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Inside

India in 2050: Food Security through Water Security

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Recognizing the vital role that water security plays in securing lives and livelihoods, this article raises significant questions, which point to formulating policy and taking action that encourage small-holder farmers to contribute to food sufficiency… "Little drops of water make a mighty ocean"

India's per capita food grain availability has gone down since 1991 even though there has been a net addition of about 60 million hectares to agricultural land during the last half of the 20th century. Food production has gone up—rice production by about 350 per cent and wheat production by more than 800 per cent. The production of millets and pulses has, however, gone down to give space to wheat and rice.

With a largely rural (70 per cent) and agrarian (60 per cent) population, the state of agriculture and, more broadly, the state of the farm sector impacts the livelihoods of people hugely. The poor state of the agricultural sector is the main cause of rural poverty in India. Three-fourths of the rural poor depend on mono-cropped 'rain-fed' farming, a highly uncertain enterprise.

The productivity as well as the value of farm output in rain-fed regions is well below the sustainable potential and the national average although over half the region is sub-humid with over 900 mm of rainfall. Beyond some pockets, farming in rain-fed areas is mostly at subsistence levels. A very small fraction of the farmers produce enough to feed their families. Table 1 captures the trends of availability of food in the country.

Table 1: Per Capita Food Grain Availability

(Grams/Capita/Day)						
Year	Rice	Wheat	Other Cereals	Cereals	Pulses	Food Grains
1971	192.6	103.6	121.4	417.6	51.2	468.8
1981	197.8	129.6	89.9	417.3	37.5	454.8
1991	221.7	166.8	80.0	468.5	41.6	510.1
2001	190.5	135.8	56.2	386.2	30.0	416.2
2002	228.7	166.6	63.4	458.7	35.4	494.1
2005	177.3	154.3	59.4	390.9	31.5	422.4
2007	194.0	157.8	55.5	407.4	35.5	442.8

Source: http://agricoop.nic.in/statatglance

"The per capita availability of food grains and pulses has increased from 436 gm per day in 2008 to about 463 gm per day in 2011. As per the provisions of the National Food Security Bill, introduced in the Lok Sabha on 22nd December 2011, the annual requirement of food grains for targeted Public Distribution System and other food-based welfare schemes is estimated at 60.74 million tonnes. The food subsidy is to touch Rs 924.93 billion during the FY13." (India Infoline News Service 17:43, Aug 14, 2012)

In the past, food grain production could be increased by bringing more land under cultivation as well as by introducing high yielding varieties. There is no longer a possibility of bringing more land under cultivation. In fact, the competition for control over land is increasing, with industries and human settlements demanding more land. The per capita availability of agricultural land has continued to go down with the increase in population. The rate of decrease has been faster since the 1980s.

Table 2: Total Gross Cropped Area (in Million Hectares)

1950 – 51	1970 – 71	1990 – 91	2000 – 01
131.89	165.79	185.74	190.76

Table 3: Per Capita Agricultural Land Availability (in Million Hectares)

Year	Net Sown Area	Population (in Millions)	Net Sown Area Per Capita
1951	119	361	0.33
1971	140	548	0.26
1991	143	84	1.70
2001	142	1027	0.14
2051*	137	1600	0.085

(*The 2051 figures are projected. This is the year when India's population is expected to stabilize.)

The projected figure of the average per capita net sown area will actually vary from state to state. The more populous the state/area, for example, in West Bengal or Bihar, the less per capita (about 0.04 ha) net sown area it will have (1950 figure). The national projected per capita average of 0.085 ha means that each Indian will have just about 850 sq m of land to meet all the food and nutritional demands.

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In addition, there are some other biomass needs, for example, cotton and, in rural areas, fuel and fodder, which need to be taken care of from the same land. Assuming that (in 2050) 50 per cent of Indians will be engaged in farming and the rest will find engagements in the service and manufacturing industries, the actual farming population will have a per capita net sown area in the range of 0.08 ha (in high population density areas) and 0.16 ha (in low population density areas).

Depending upon the carrying capacity of different agro-climatic zones and sub-zones, this range will vary. For example, in arid zones and undulating terrains, the agrarian population density is lower, with a consequently higher availability of per capita net sown area, and in the Indo-Gangetic plains, in coastal areas and in pockets where big dam- and canal-based irrigation infrastructure has been developed, the agrarian population density is much higher.

Thus, as of now, the difference in per capita makes very little sense in terms of any economic benefit to the owner. A family that has 2 ha of land in an arid or undulating terrain could actually be poorer and economically worse and more vulnerable than a family that has 1 ha of land in the Gangetic plain or in the coastal belt.

The big question is, "Does the nation see and recognize the 160 million marginal/small-holders, who have a farm size in the range of 4,000 sq m (presuming a family would have five members, in high density areas) and 8,000 sq m (in low density areas), as a viable enterprise?"

Some social leaders and national planners in India have lost faith in small-hold farming as a model of development. They have more faith in industry and the service sector. Often, there is an argument for the consolidation of land into bigger holdings and for farming to be carried out by a smaller percentage of the population (as it is in developed countries).

Combining these two aspects, we need to think about: "Can these millions of small-holders take the responsibility and challenge of meeting the food grain demand for the growing population?"

The small-holders' viability depends upon the vision of the planners, policy makers, political parties and society at large. If they are left to themselves and the market is allowed to decide their future, there is little chance that they will be able to gear up their production systems to meet such a huge national challenge.

This gives rise to a bigger question. "What kind of a society do we want to see in India? Should we work towards a society where fewer entrepreneurs/'big-holders' (say 1.6 million, each owning about 100 ha of land) will be given the responsibility to manage most of the natural resources (ecosystems), with an understanding and belief that they will honestly shoulder the responsibility and feed a nation of 1,600 million people, or should we work to create a facilitating environment, in

which millions (160 million, each with less than one ha of land) of small-holder communities take the responsibility of not only feeding themselves but also ensuring supplies to another 160 million families, who are working in industry and the service sector?"

India in 2050 will not be relying on a few 'Punjabs' to meet the food grain and other bio-mass needs of the entire country. Food grain (and other crops) needs to be produced in all available cultivable lands

The question about meeting the food grain demand is purely a technical one. It can be broken down to the elemental level of the demand on land and water and the technologies of production. Assuming that the population distribution (net number of persons demanding food from a defined geographical area) across the regions/states is not going to change much (even if migration increases), there will be a need to augment the yield of food grain everywhere.

Unlike today, India in 2050 will not be relying on a few 'Punjabs' to meet the food grain and other bio-mass needs of the entire country. Food grain (and other crops) needs to be produced in all available cultivable lands. We have to work out farming practices on the presumption that each Indian will have 800 sq m of farm land to meet all food grain, vegetable, fruit and oil seed demands (either as direct pulses or fodder/feed converted into animal protein). And today, with the widespread experience of high yielding crops, this is theoretically possible.

For the sake of calculation, let us use the case of the food grain demand at present. Let us assume that 50 per cent of the per capita available land is used for food grain, leaving the rest of the area for other crops. With the available technologies, each hectare could produce 5,000 to 10,000 kg of grain (rice/wheat). Thus, 400 sq m can produce 200 to 400 kg of food grain in four to five months (either in the *kharif* or in the *rabi* seasons). This is more than adequate to meet one person's annual requirement. Even if we were to assume that there will be a bad monsoon every three years, two years' harvest could meet the demand of three years.

Assuming that 50 per cent of the population (thereby 50 per cent of the families) will not be engaged in farming, their land will be available to the farming community. This raises the average farm family's holding size to 4,000 sq m. Thus, each farm family will have the capacity to produce enough to meet their family's demand and to supply to the market enough to meet another family's demand—the family that is not engaged in farming (but engaged either in industry or the service sector).

Thus, theoretically, it could be claimed that 160 million farm families can feed the entire country even in 2050. India need not depend on the import of any food grain. Similarly, it will be possible to meet the other demands for vegetables, oil seeds, etc. However, this will require a change in cultivation practices in the irrigated areas and more comprehensive natural husbandry practices in rain-fed regions. The challenge is to intensify crop production in every piece of available land under farming, which will be possible only when adequate water is available.

This leads us to a fourth set of associated questions: "Is there enough water? Can we, as a nation, meet the water demand of 2050?"

The situation is tough but not impossible. "... The average per capita availability of water, estimated at 1,600 cu m per year, is expected to fall to around 1,000 cu m per year by 2050, based on the current population projections.

The effects of climate change on the availability of future water resources are uncertain, but it is expected that the frequency of extreme events (floods and droughts) will increase." ('Water Security Challenges in India', Kapil Narula and Upmanu Lall, Columbia Water Center, Earth Institute, Columbia University)

With some prudent planning and application in the field, India can meet its food demand with its own production in 2050 for 1,600 million people, provided it commits to working on water security now

"What is the per capita water requirement of a farming family against this 5,000 (1000* 5) cu m of availability in 2050?"

One such rough estimation that requires an on-field reality testing across different agro-climatic zones is:

> Assuming that the most practised irrigation water use efficiency in Indian conditions—1 kg of wheat production would require 500 litres (or half a cubic metre) of water (Assumption: Yield 5000 kg/ha; irrigation: 4 times with 5 cm each). This means, if a person from the farming community consumes 500 gm of grain per day (182.5 kg/year), the annual per capita water demand for food grain production will be 91.25 or say 100 cu m. In the case of rice, the water demand would be at least double, say, 200 cu m. (This is a very conservative estimate because for rice, it could go as high as 3,000 litres/kg of rice; but as most rice in our country is grown in the rainy season, a minimum provisioning will help to have a higher predictable production by saving the crop from intermittent dry spells during the crop growing period). The corresponding land demand will be 365 sq m or, say, 400 sq m. As wheat is cultivated in winter, the losses will be higher because water received in the rainy season will need to be stored for a longer time. Let us assume that both rice and wheat have the same water productivity, requiring 1,000 litres of water per kilogram of grain. Thus, the per capita demand comes to 200 cu m, irrespective of the primary food crops. If the same person aspires to earn Rs 10,000 through vegetable cultivation, she/he will need to grow vegetables in about 10 cents/decimals (one decimal is about 40 sq m), or 400 sq m of land. This will require another 200 cu m of water (assumptions: 10 times irrigation @ 5 cm each).
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> In addition to this, let us add another 100 cu m of water for household use, including the water required to feed a couple of domestic animals, which are an integral part of the farming system. Thus, the per capita annual water demand for assured food and income comes to about 500 cu m. This does not provide for other losses (due to conveyance through open mud channel or percolation losses, depending upon what kind of harvesting structures are adopted). Assuming 50 per cent average efficiency of such a structure, each person will require 1,000 cu m of water storage, that is, 5,000 cu m for a family of five members.

With some prudent planning and application in the field, India can meet its food demand with its own production in 2050 for 1,600 million people, provided it commits to working on water security now.

One can look at India's performance vis-à-vis two other countries, in terms of the average per capita water storage created (ibid.):

- United States: 1,960 cu m
- China: 1,100 cu m
- India: 200 cu m

This shows that India's planned effort to ensure water availability is much below the requirement. Further, when we consider millions of small-holders in rain-fed areas, it seems a herculean task to think and commit the required water security to all the small-holders.

When the per capita water availability at the national level is expected to reduce further because of further growth in every sector, the cross-sectoral competition for access to and control over water will also be accentuated, giving rise to a condition where the weaker sections of society (for example, the poor small-holder farming communities, tribal and other socially and politically marginalized) will face extreme difficulties to access water from common water resources.

This will warrant a much more pro-active stance on the part of the government to ensure that small-holders have access to minimum water requirements and help them realize the potential of their farms. Unless the government (planners/policy makers) works with a clear vision of seeing millions of small-holders succeed as food growers for the nation and are accordingly supported with assured water resources, this will not happen. When farmers are left to deal with the vagaries of nature year after year and often generation after generation, they too lose hope. The new generation of farmer children, who own a hectare of land, will not aspire to be accomplished farmers. They would rather opt for menial jobs as migrant or casual labourers.

It is theoretically possible to meet India's future food grain and other bio-mass consumption demand through careful support to small farming communities. The government/society must recognize the value of investing time and resources to meeting these future needs

When it is theoretically possible to meet India's future food grain and other bio-mass consumption demand through careful support to small farming communities, the government/society must recognize the value of investing time and resources to meeting these future needs.

In the past (during the first few Five Year Plan periods), the government and society decided to adopt big industries as a model of growth and enhance the country's economy, pushing almost all cottage industries to perish. The national policy to promote industry has thrown out millions of small entrepreneurs (weavers, potters, blacksmiths and others) from their traditional livelihoods and most of the displaced craftsmen have crowded into the agriculture sector.

There is no doubt that industrial growth has created jobs; however, only a small fraction of the class of people, who were thrown out of their hereditary (self-employed) cottage industry based livelihoods, were absorbed in big industry and, over time, a new set of urban population replaced the rural artisan class. Industrial growth, urban growth and the associated consumerism have grown hand-in-hand and have caused irreparable damage to nature. Today, it is time to think of and not neglect small-holders in the farm sector.

Before proposing any particular stance to be adopted, it might make sense to refer to some of the Policies/Acts framed by the Government in the recent past. In the MGNREGA, the Food Security Act, the Forest

Rights Act, etc., the message is clear that, as a nation, we are committed to the safety and security of our weaker communities. At the same time, one can also see that there is no systematic and focussed approach to make a direct investment in the small-holders' farming system. The gap is particularly conspicuous in the case of water. The Food Security Act commits a definite quantity of food, the Employment Guarantee assures the availability of a certain number of days of employment, the Community Forest Rights Act gives some definite land resources that the community can access. But our government is yet to come up with a commitment to ensure access to a definite amount of water to the people.

However, it is worth mentioning here that the draft National Water Policy (NWP) talks about priority in allocating water for food security when it states, Water, after meeting the pre-emptive needs for safe drinking water and sanitation, achieving food security, supporting poor people dependent on agriculture for their livelihood and high priority allocation for minimum eco-system needs, be treated as an economic good so as to promote its conservation and efficient use." (Press Information Bureau, Government of India). The draft policy also mentions several principles that have guided the formulation of the draft.

Two basic principles that govern the draft NWP are that "Principle of equity and social justice must inform use and allocation of water… Water needs to be managed as a common pool community resource held, by the state, under public trust doctrine to achieve food security, support livelihood, and ensure equitable and sustainable development for all..." (Draft National Water Policy, 2012)

However, unlike other national policies such as food security and employment guarantee policies, there is no 'quantified provision' assured under this policy. At the same time, the concept of equity is subject to varied/ conflicting interpretations, depending upon the interest of the stakeholders. The task of implementing such a policy will become even more difficult if there were no policy statement to ensure some provision that is quantified (for example, XY cu m of water/capita, as it is done for food security or employment guarantee), to create an impact on the lives and livelihoods of the poor, as visualized by policy makers.

In the absence of any policy or Act on water security, a farmer/community, interested in creating water resources, is expected to mobilize MGNREGA, Integrated Watershed Management Programme (IWMP) or some such scheme. Why can't we have a water security policy that ensures that each small-holder family (of five members) will be provided 2,500 to 5,000 cu m of water (the actual feasible volume being worked out with a detailed agro-climatic analysis, depending upon a local feasibility analysis)?

The farmers, in turn, can commit to produce enough food grain to feed their own family and one more family. This approach to rural development through water security could actually help our country with sustainable food security and employment guarantee.

If we were to visualize the large number of small-holders (160 million by 2050) as food producers for the nation, the spirit of equity and social justice will have meaning, which will not be if we were to visualize an inefficient, below subsistence farmer. Thus, it is very important how the policy

makers and planners engage with the issues of water and visualize the future of farming communities and the Indian society of 2050.

How could we create such a broad-based water security? Approaches to such equitable water sharing at the local and the national level will need special care in designing the water resources. The challenge is not just in creating water bodies. At the national policy level, we need to know how much water should be ensured to our citizens. Also, the urban population will require less water to meet daily household demands than the rural faming population that needs water for household needs as well as for farming—to grow food for self and for sale in the market, thereby contributing to the national food security.

Approaches to such equitable water sharing at the local and the national level will need special care in designing the water resources. The challenge is not just creating water bodies

Even within the farming population, what should be the principles and norms for water resource creation and distribution? There are segments of the farming population, which are already in a position to produce marketable surpluses, based on the irrigation support and extension of other technological services sponsored by the government.

There is some awareness that more water should be made available to them because they are 'exporting virtual water' from their area/land/state to feed the population outside their area/state. And there is large farming community that is struggling to produce adequate food grain to feed its own families round the year.

The national policy needs to make clearer statements about the level of food security—local level (family level, village level, panchayat level), state level and national level. Planning for the national level or the state level food security may not take into account the needs of the farming community's food security. There might not be enough allocation and investment in the resources required to create water sources that will ensure supply of water at the farming household level.

Household-level food security demands a much more decentralized resource creation and investment policy, aimed at meeting the needs of the many agro-climatic and geo-physical conditions across the country. Widespread poverty in the farming communities, (particularly those considered to be rain-fed farmers, in spite of their presence in much higher rainfall areas than many irrigated areas) across the country today is the result of the lack of political will rather than technology.

The NWP needs to be sensitive to the influence and the impact it has on the large number of small-holders in the so-called rain-fed farming population, across different agro-climatic zones, particularly if we recognize them as potential food growers for the nation.

Depending upon the agro-climatic areas in which the farmers produce their crop, each family requires a definite volume (a range, based on how efficiently the water is used)

of water to meet the per capita food grain requirement. Each unit mass of grain/biomass production demands a specific amount of water to pass through the plant bodies for transpiration and associated evaporation from the field. A family will, therefore, require a definite volume of water to meet its own consumption requirements and more to produce the marketable surpluses, to earn cash to buy other necessary services or goods. There is need to assess this volume, and the National Policy should work to ensuring this.

Unequal access to water across geographies is often rooted in the evolution of civilization and the historical movement of the human race but local inequalities are often rooted in and determined by social and political power distribution

Geographical distribution and topographical locations of communities and their resources (habitats and lands in particular) give people a natural access to water. There are variations across geographies as well as within the same agro-climatic conditions. Unequal access to water across geographies is often rooted in the evolution of civilization and the historical movement of the human race but local inequalities are often rooted in and determined by social and political power distribution.

Even within democratic governance, inequalities are created by decisions made by national planners in the choice of technology and the allocation of resources. The discrimination in setting cost norms across the imaginary theoretical division of farmlands into 'rain-fed' and 'irrigated' is a distinct example of how national decisions have deprived some citizens of certain basic services that threaten their lives and livelihoods, and their aspiration to be respected farmers.

Policies to ensure an equitable share of water resources need the right emphasis on research, development and the application of the right kinds of technologies. A big dam downstream of a river would certainly deprive the people situated upstream, especially if they are not helped to harvest their water, where they receive it as rain.

As per *The Times of India* July 8, 2012 report: the construction cost of the irrigation projects in Maharashtra is among the highest in the country. The cost of irrigation per hectare incurred by the state is Rs 9.81 lakhs compared to the Rs 1.5 lakhs to Rs 2.5 lakhs limit mandated by the Central Water Commission. Whereas the cost of land treatment for land labelled 'rain-fed' is allocated at Rs 12,000 (Source: Outcome budget 2009–10; Department of Land Resources; IWMP). Such discrimination is made in policies with no clear scientific reasons. If we remove the artificial discrimination line between the rain-fed and the irrigated land, and Rs 1 to 1.5 lakh are made available on a per hectare basis, 80 per cent of the farmers of the rain-fed lands would enjoy the benefit of irrigation, achieve sustainable water and livelihood security, and realize the vision of 'equity and social justice' as reflected in NWP.

RELEVANCE AND SIGNIFICANCE OF THE APPROACH

Without any well-established standards, there can be no reference to verify how equitable the distribution and the use of

water is across various stakeholders/strata of society. In the past, there have been big river valley projects, to support agriculture in our country. Smaller water harvesting projects help smaller farmers. If the runoff water from the upstream areas is arrested in a dam before it reaches downstream, and is then guided though canals, it will irrigate farmlands and also feed industries downstream.

For instance, a woman has been harvesting a rice crop since 2005 in Pogro village, Purulia district, India. Every year, the crop has been failing because the runoff water from her land flows down to a dam through a river, to irrigate the land of another district downstream. When we asked her why she was continuing to harvest that crop every year even though it was failing, her brief response was that her husband had told her to do so.

This illustrates the desperate situation that small-holder rain-fed farmers, particularly women, face in India. When the rains fail, the farmers lose their crop and people migrate to urban centres in search of jobs. Sometimes, only the able-bodied male members migrate, leaving the farming to the aged and the women who, out of desperation, engage themselves in meaningless/non-remunerative activities. They often have no food to eat.

There is peculiar upstream-downstream dynamics being played out in this part of the world, which may be prevalent in other poverty areas as well.

Upstream Areas/Plateaus
Features: ◆ Undulating topography ◆ Rainwater runoff ◆ Soil erosion ◆ Low uncertain crop production ◆ Weak local economy ◆ Distressed migration ◆ Price of lands low ◆ Politically weak ◆ Pressure from states/MNCs to grab lands for mining, industry ◆ Yield water to fill big reservoirs made to benefit downstream

Downstream Areas/Plains
Features: ◆ Plain lands ◆ Receive runoff water and good soil from upstream ◆ Good and assured crop ◆ Vibrant local economy ◆ Get cheaper labour from upstream migration ◆ Price of lands high ◆ Politically organized and influences policy ◆ Use canal water to irrigate their lands

If one follows the rivers that originate in the central or the eastern Indian plateau and flow down either to the plains of the Ganga basin in North India or the coastal plains, one observes that the plateau (hilly and undulating terrain) is yielding its water and fertile top soil to the plains. This phenomenon leaves the farming system of the area poorer, impacting the local economy, making it weaker. People also migrate to find jobs in the plains. Thus, the plains not only receive the productive soil and water but also cheaper labour from the plateau, boosting their farm productivity. The government and the industry sector then find it easy to negotiate with the farmers on the plateau, to occupy those lands for mining and setting up factories.

However, if one takes a closer look at the rainfall data, it shows that the area never received less than 600 mm of rainfall between the months of June and October, and the average annual rainfall is 1,200 mm. About 50 per cent of this rainfall flows out as runoff. Millions of such small-holder farmers in rain-fed areas are forced to live miserable lives.

Such inhuman suffering is perpetuated because the society/state does not invest in improving farming conditions. There is a pattern; the state invests in areas where people are organized and politically strong; isolated tribal communities in remote areas and other weaker sections are left out for generations. As if there is no technology to improve their conditions! Even a small water harvesting structure to help each family preserve 1,000 cu m of water, of the 5,000 to 10,000 cu m of water each family receives in their own land, can help change reality.

This article was earlier published in Yojana*, a development monthly, in its December 2013 Special Issue.*

Scaling Up Sustainable Agriculture in Balaghat

ARJUN PANDIT AND CHANDAN SARMA

Describing the sustainable agriculture practices being promoted by the Balaghat team, this article captures the processes employed for promoting sustainable agriculture with more than 3,500 farmers, the challenges faced and the major insights gained

INTRODUCTION

In our earlier article called 'Organic Farming in Balaghat: Power to the Community, Power to the Farmer!' (NewsReach May-June 2013; Vol. 13), we said that the team had begun its intervention by extensively promoting chemical-based agriculture in both paddy and vegetable cultivation from 2008 onwards. Based on experiential learning in the first few years, from 2009 to 2011, in pockets of more than 20 villages where agriculture was promoted through organic and integrated approaches, a change in perspective took place and the team began to believe that an alternative and a more sustainable agriculture practice promotion, which may be more compatible with the cultural practices of the community in the area, was possible.

The community had always practised farming, based on natural organic inputs such as cow dung, organic matter and the use of medicinal leaves such as *neem* and *laltain*. These experiments also helped dispel our notion that productivity would be compromised once the approach were to shift from chemical-based farming to organic farming. The professionals in the team were oriented, through various exposure visits and training programmes, particularly with Center for Sustainable Agriculture and Chetna Organic (both Hyderabad-based organizations). Additionally, the community was taken on exposure visits to organic farms in Maharashtra, and organic *melas* were organized in several villages by SHGs, with the support of the PRADAN team, to make the community aware of sustainable farming. Rigorous on-field, as well as class-room, training was provided to the support staff in all villages, to help disseminate knowledge about sustainable agriculture.

In the early part of 2013, more than 400 women farmers from 25 Clusters were taken for an exposure visit to the farm of Subhash Sharma in Yawatmal district of Maharashtra. Mr. Sharma is a pioneer in natural farming in the area. This experience, along with visits to the organic *melas* at three different places, helped build momentum for the intervention during the *kharif* season. Awareness building among the community was followed up with intensive training of agriculture Service Providers (SPs) in the philosophy and the technical nitty-gritties of organic farming.

A timeline was set; the professionals and the Community Service Providers (CSPs) divided the villages in the area so that the first phase of concept-sharing was done well in advance of the monsoon. The main focus was to bring about a complete transition from integrated (mixture of organic and chemical practices) to organic practices in vegetable cultivation, and more intensive organic practices in paddy, to lower dependency on chemical fertilizers and pesticides, and to use high-yield, improved variety of seeds, and indigenous seeds.

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Interestingly, the indigenous paddy promoted last year through improved practices by about a hundred farmers also yielded exciting and eye-opening results, with a huge potential of looking at the whole picture of agriculture in a more holistic way.

INTERVENTIONS DURING *KHARIF* 2013

Deep ploughing and green manure: Subsidized deep ploughing and green manure promotion was encouraged under the MKSP project. Over 2,000 farmers were covered under both (union and intersection) interventions. Deep ploughing helps eradicate larvae and harmful worms of the previous agriculture cycle by exposing the soil to the summer heat. There was, however, very little success on the green manuring front because the rains came very early (15 days before the

The Balaghat team of PRADAN was started in 2008. The team is currently working in two blocks, namely, Paraswada and Balaghat Sadar, with the Schedule Tribe (ST) Gonds, the Particularly Vulnerable Tribal Groups (PVTG) Baigas and Other Backward Castes (OBC) Pawar, Marhar and Ahir communities. The outreach is 7,000 families in 165 villages. The area has about 60 per cent forest cover, with undulating terrain. Low accessibility and widespread poverty is the characteristic feature of the villages that PRADAN is engaged with. The PRADAN team has been the implementing agency for the Mahila Kisan Sashaktikaran Pariyojana (MKSP) in these two blocks. The focus of the project is on the concept of the *mahila kisan*, or the woman farmer, helping her build skills and introducing her to sustainable agriculture. At the core of organic agriculture is sustainability vis-a-vis economic profitability and social equity (farming independency), which has also been the guiding principle of the team. As such, the project was very much in tune with the approach of the team.

expected date). The farmers had to prepare their fields when the plants were in their inception stage.

Seed management: Seed treatment involves treating the seeds with organically prepared *beez amrit*, commercially available tricoderma or simply treating the seeds with turmeric, *chuna*, and soil from termite mounds mixed with cow urine. The separation of low-quality seeds from better ones through the salt-egg approach was followed for paddy. SRI practices (both paddy and vegetable), and SRI-allied practices such as reduced sapling rates (paddy) in traditional practice and regular weeding were adopted.

Soil management: In organic practice, the soil is treated as a living entity with high microbial activity. Interventions such as vermi-compost, improved composting, *jeev amrit* and *matka khad* are taken up with farmers. The application of *jeev amrit* when preparing the field for paddy, just before transplantation, was initiated last year. The farmers were given hundred litre capacity drums to prepare *jeev amrit* (for 2,500 farmers) under the MKSP project. *Matka* (earthen pots) were used widely in the preparation of the *matka khad*, which is now extensively used in vegetable cultivation in the area. The optimum nutrient requirement in a patch of half an acre entails four to five doses of *jeev amrit* application (100 litres) beginning from the day of transplantation and followed up every 12–15 days. It takes five to six days to prepare *jeev amrit*, and the manure can be used in both the paddy and the vegetable patches. In paddy fields that have sufficient stagnant water, it can be used directly; in vegetable fields and up-land paddy fields that have negligible water retention in the fields, it needs to be mixed with four portions of water before using.

- **Pest management:** Pheromone traps (under the MKSP project), *neem kada* as the initial pest preventive measure, *agni astra* as the intermediary pest control and commercially available *neem* oil as the final pest control measure have been introduced.
- ***Neem kada* as a preventive pest spray:** One kilogram of neem leaves is boiled with four litres of water. The solution is boiled until it is reduced to one litre. The leaves are removed and the *neem kada* is added to 10 litres of water and can be used in a 10 decimal vegetable patch. This solution needs to be sprayed five times during the cropping, beginning about 10 days after transplantation with an interval of 10–15 days.

Table 1: *Agni Astra* Preparation

No.	Particulars	Purpose of components	Quantity
1.	Water	Base	10.0-15.0 litres
2.	*Neem* leaves	Pesticide value	1.0 kg
3.	*Dhatura* leaves	Pesticide value	1.0 kg
4.	*Besaram* leaves	Pesticide value	1.0 kg
5.	*Laltain* leaves	Pesticide value	1.0 kg
6.	Chilli	Pesticide value	0.25 kg
7.	Garlic	Pesticide value	0.25 kg

In paddy cultivation of one acre, nine litres of *neem kada* are mixed with 90 litres of water and the solution is sprayed three or four times, beginning 15 days after transplantation, and then at an interval of 15 days.

More than 3,500 farmers adopted organic practices in agriculture in the last kharif *season. In several villages, no expenditure was incurred on the purchase of chemical manure or on pest management*

- ***Agni astra* as pest control**

  The above mixture is boiled until three-fourths of it evaporates. The remaining solution is then cleansed of the solid leaves and used. *Agni astra* is used when pests start appearing in the farm plot. For an acre of paddy, approximately 5 litres of *agni astra* mixed in 90 litres of water is used. The solution is sprayed at an interval of 10–15 days, based on the presence of pests in the crops. In vegetable crops, in an area of 10 decimals, half a litre of *agni astra* solution mixed in 10 litres of water is used as a pest control measure.

- ***Neem* oil as final control measure:** A five per cent solution of *neem* oil can be used as pest control in both paddy and vegetable cultivation. The quantity of the mixture is similar to that of the *agni astra*.

THE SUSTAINABLE CHANGE

More than 3,500 farmers adopted organic practices in agriculture in the last *kharif* season. In several villages, no expenditure was incurred on the purchase of chemical manure or on pest management. In about five per cent of the 150 villages where this intervention was introduced, there has been a complete shift from chemical and integrated practices to the organic approach. Villages such as Salghat, Sawarjhodi, Bhikewada and Madanpur have completely shifted to organic farming, both in vegetable as well as in paddy cultivation. In other villages, the use of urea and DAP has declined considerably, ranging from 30 per cent to 70 per cent, based on a random sampling by SHGs. A more integrated approach is being used by the community.

The average production in places where farmers have adopted the integrated approach, encompassing both organic inputs and limited chemical inputs, remains comparable to the chemical fertilizer-driven production and, in some cases, has gone up when compared to the previous years. Farmers have been able to get optimum production from their land. The last *kharif* crop saw planning and intervention not only in farms where SRI, or the improved variety, was adopted, but in all plots.

Table 2: Thumb Rule for Pest Management

Type	Purpose	Solution Percentage	Per Acre Need
Neem kada	Preventive	10%	90 litre water solution
Agni astra	First line of attack on pests	5%	90 litre water solution
Neem oil	Final line of pest attack	5%	90 litre water solution

Table 3: Analysis of Production Yield of 10 farmers in Balaghat in Paddy Cultivation

No.	Name of Village	Name of Farmer	Type of Irrigation	Area under SRI (Acres)	Name of Paddy Variety	Orgainc or Integrated Practice	5 m x 5 m, Production (in Kg)	Production (Quintal/ Acre as Per 5 m x 5 m Measurement)	Traditional Practices Production (in Quintals)	Actual Per Acre Production (in Quintals)
1.	Batwa	Savanbai/ Rupchand	Unirrigated	0.5	IR-64	Organic	9.3	37.2	6.0	15.0
2.	Batwa	Sushila/Rulal	Unirrigated	0.5	IR-64	Organic	8.4	33.6	6.0	14.0
3.	Amoli	Satula/Gariba	Unirrigated	2.0	MTU-1010	Organic	10.5	42.0	6.0	14.0
4.	Amoli	Rukhamini/ Tarrachand	Unirrigated	1.0	MTU-1010	Organic	10.0	40.0	7.0	12.0
5.	Amoli	Sadhana/ Devsingh	Unirrigated	1.0	IR-36	Organic	9.4	37.6	6.0	13.0
6.	Takabrra	Hiran/ Vimalesh	Unirrigated	1.0	MTU-1010	Integrated	12.0	48.0	8.0	19.0
7.	Kewa tola	Kapoora/ Uikey	Unirrigated	1.0	Kuber	Integrated	-	-	7.0	16.0
8.	Jheeriya	Rashmi/ Chetnsingh	Unirrigated	0.5	Safari (indigenous seed)	Organic	5.5	22.0	6.0	11.0
9.	Korja	Mantura/ Chainsingh	Unirrigated	0.7	Pililuchai (indigenous seed)	Organic	-	-	6.0	13.0
10.	Badgaw	Doliya/ Sumansingh	Unirrigated	0.5	Pililuchai (indigenous seed)	Organic	12.0	48.0	8.0	16.0

Organic farming opens the door for intervention in each and every type of crop, irrespective of the technique adopted for nursery raising or transplantation.

An yield estimation under agriculture intervention (both completely organic and integrated practice) was carried out with 200 farmers, with the support of the District Agriculture Department. Agriculture Development Officers and other officials of the Agriculture Department visited the villages, interacted with the farmers and captured the crop production, using statistical methods. Table 3 gives a detailed analysis of the production yield of 10 farmers.

This intervention has been very successful with vegetable crops—several varieties of indigenous brinjal, chili, beans, tomato, barbati, bottle gourd, etc., which were on the brink of extinction in the area are now recognized by the community and the larger market as viable replacements for the hybrid variety

INDIGENOUS SEEDS: A NEW DAWN?

As reported in the last article, indigenous seeds, which are highly resistant to disease and are capable of high yields, are now being promoted actively across the villages. This intervention has been very successful with vegetable crops—several varieties of indigenous brinjal, chili, beans, tomato, *barbati*, bottle gourd, etc., which were on the brink of extinction in the area are now recognized by the community and the larger market as viable replacements for the hybrid variety.

Indigenous vegetables, cultivated through the organic SRI method, are now a reliable alternative to hybrid vegetables in the area. Whereas hybrid vegetable seeds still have viability, in terms of catching the early market (one of the lessons from the last *kharif* season), there is tremendous scope for the high yielding indigenous vegetable varieties because they are disease resistant and can survive long into the winter.

Hybrid vegetables bear fruit early as compared to indigenous vegetables, and by the time the fruiting of the latter starts, there is already saturation in the market. Our own intervention in indigenous seeds has been based on the experiences at the field level in the villages. In the village of Dhutti, where the community is extensively involved in vegetable cultivation in the *rabi* season, indigenous seeds in brinjal and tomato are used with very good commercial results, with high productive output, lower cases of pest attack and a slightly higher rate of return per kilogram in the market.

The community in Balaghat had already been traditionally practising organic farming; the PRADAN team's intervention of increasing the sapling rate, the use of *jeev amrit* and bio extracts encouraged the community to adopt vegetable extension on an average of 0.1 to 0.5 acre of land.

A particular instance in Tikaria village, Paraswada block, two years earlier was an eye-opener for the team. An SHG member had planted both hybrid and its traditional variety in equal patches by adopting the same technique of raised nursery, single plant transplantation and maintaining sufficient distance between the plants. To our surprise, both the patches ended up yielding comparable production by the end of November. However, in the traditional variety, the cases of pest attack such as shoot borer and fruit borer were low; the produce fetched a slightly higher market rate and was tastier.

The woman, thereafter, began to focus on the indigenous variety because it fetched her better rates and also tasted better. Concurrently, some farmers of Madanpur village of the same block also adopted improved practices with traditional paddy seeds with very encouraging results, and achieved yields comparable to the improved variety of seeds.

Based on our learning from the previous year, we realized that indigenous seeds could be a major intervention for farmers who were not able to get linked to the market for various reasons. More than 70 extremely vulnerable farmers were covered for the very first time under this intervention for vegetables. Also, since food and nutrition security is a very critical aspect in our area of intervention and calls for wider diversification of food, indigenous vegetables play a crucial role. With high instances of anaemia, stunted growth and malnourishment among the rural communities in India, there is a clear cut need for crop diversification, to help mitigate some of these dangers.

The use of hybrid seeds across the world is based on the principle of mono-cropping and market linkages for the excess produce. In India, when addressing some the issues of poverty alleviation, we fail to take into consideration the nutrition requirement of the producer, leading to a detrimental effect on the health of women. Hybrid seeds are expensive, often require group purchasing and, as such, are not a convenient approach for many ultra-poor families in India.

Unfortunately, much of the crop produced using indigenous variety (along with hybrid) was washed away last year due to unprecedented rainfall. However, the indigenous brinjal, beans and bottle gourd were moderately successful. The most exciting result from the intervention last year was from the indigenous paddy. Twelve different varieties of paddy were promoted with 102 farmers last year—from the paddy for the barren uplands to the seeping (leaking) low-lands. It was quite a challenge to find indigenous paddy seeds in the area. After much searching and very moderate output in terms of seed collection, we decided to venture farther into the interiors of Birsa and Baihar blocks of the district. We managed to collect two quintals of indigenous seeds of 12 different varieties. Patches from 0.3 to 1 acre were selected by the farmers for sowing. The analysis of the various varieties based on the production and feedback from the community is depicted in Table 4.

Table 4: Indigenous Paddy Seed Analysis

No.	Name of Paddy	Land Type	Crop Duration (in Days)	Height of Standing Crop (in Feet)	Production (in Quintal) Per Acre				Crop Type/ Weight of Paddy	Rate in Rupees per Quintal	Advantage	Disadvantage	Remarks
					Broad casting	Traditional Transplantation	Improved Practice	SRI Practice					
1.	Satiya	Upland/ Light soil	75–80	4.0	5.0	-	-	-	Heavy	1,100	Less water, manure needed, pest resistant	Prone to wilting in excessive rain	Ideal for uplands with no bund, high undulation and broadcasting
2.	Chipra	Light soil	90–100	4.0	-	7.0	11.0	-	Heavy	1,200	Less water, manure needed, pest resistant	-	-
3.	Lal Dhan	Light soil	90–100	4.0	4.0	6.0	10.0	-	Heavy	1,200	Less water, manure needed, pest resistant, good yield of hay fodder	Susceptible to falling down during the end stage of harvest	Ideal if distance is maintained, with lower sapling rate
4.	Kakeri	Light soil	90–100	4.5–5.0	-	11.0	15.0	18.0	Heavy	1,200	Less water, manure needed, pest resistant, good yield of hay fodder	-	Has the potential for replication

Table 5: Indigenous Paddy Seed Analysis

No.	Name of Paddy	Land Type	Crop Duration (in Days)	Height of Standing Crop (in Feet)	Production (in Quintal) Per Acre				Crop Type/ Weight of Paddy	Rate in Rupees per Quintal	Advantage	Disadvantage	Remarks
					Broad casting	Traditional Transplantation	Improved Practice	SRI Practice					
5.	Badal Phool	Light soil/ Medium uplands	90–100	4.0–4.5	-	-	14.0	-	Small size, medium weight	1,200	Less water, manure needed, pest resistant	-	Has the potential for replication
6.	Chindi Kapoor	Light soil/ Medium uplands	100–110	5.0	5.0	7.0	12.0	-	Heavy	1,200	Less water, manure needed, pest resistant, good yield of hay fodder	-	-
7.	Pili Luchai	Medium land	120–130	4.5–5.0	-	8.0	14.0	-	Medium Heavy	1,200	Less water, manure needed, pest resistant, good yield of hay fodder	-	Very high potential for large-scale replication.
8.	Udai Butta	Medium land	120–130	3.0–4.0	-	8.0	14.0	16.0	Heavy	1,200	Less water, manure needed, pest resistant	-	Only one weeding is possible as the plant spreads from the bottom; potential for replication high

Table 5: Indigenous Paddy Seed Analysis

No.	Name of Paddy	Land Type	Crop Duration (in Days)	Height of Standing Crop (in Feet)	Production (in Quintal) Per Acre				Crop Type/ Weight of Paddy	Rate in Rupees per Quintal	Advantage	Disadvantage	Remarks
					Broad casting	Traditional Transplantation	Improved Practice	SRI Practice					
9.	Pandri	Medium land	120–130	3.0	-	8.0	-	-	Medium Heavy	1,200	-	-	SRI/Improved variety has the potential of enhanced production
10.	Culture	Medium land	120–130	3.0	-	9.0	12.0	-	Heavy	1,200	Less water, manure needed, pest resistant	-	SRI/Improved variety has the potential of enhanced production
11.	Safri	Low-lands	140–145	4.5–5.0	-	9.0	14.0	15.0	Heavy	1,300	High quality paddy, excellent to eat, yields good rate in the market	Prone to pest attack, susceptible to falling before harvest	Has the potential for large-scale replication
12.	Jeera Shankar	Low-lands	140–145	4.5–5.0	-	5.0	8.0	9.0	Small size, light weight	3,000	High quality paddy, excellent to eat, yields good rate in the market	Scented rice, prone to pest attack, shoot borer common	Has the potential for replication provided pest attack is controlled

The results of the indigenous paddy experiment were shared in the Federation meeting, attended by village-level representatives. Word of the success spread. Indigenous paddy seeds, which were on the brink of extinction, in the area were back in demand. In the current *kharif* crop, about 30 quintals of seeds of 17 varieties have been collected and distributed in villages and more than a thousand farmers have taken up the activity. In Chaktola hamlet (comprising 22 families) of Dorli village, Doliya Bai experimented with the indigenous paddy seed, Pilli Luchai, for the very first time. Based on her experience, nine other SHG members approached her for paddy seeds immediately after the harvest. In this *kharif* season, ten farmers are experimenting with indigenous paddy.

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If the success of last year can be replicated in this season, the paddy practice of the entire area will undergo a massive change. Seeds in the area are available for every type of land, unlike the hybrid seeds available in the market, which are uniform for all types of land. Farmers, rather than companies, will have more control over the process of farming if they are to switch to indigenous practices. Farmers will not be so alienated from the practice of farming if their seeds provide a viable and productive alternative to the seeds available in the market.

CHALLENGES

Unlike in chemical agriculture, there is no quick-fix process in organic farming. One has to live along with the crop, treat the soil as a living entity and holistically take care of both the crop and the soil. To revitalize the soil, nourishing it with regular doses of *jeev amrit* is critical. One paddy cycle requires five doses of *jeev amrit,* starting from the day of transplantation and then after every 12–15 days. A 100-litre dose suffices for a half an acre plot for a single time. For a family owning a larger plot of land, greater engagement in terms of manure preparation is required during the *kharif* season.

In the uplands, it is not feasible to apply the third or the fourth dose directly because there is very little water left in the field by that time. So, the solid part of the *jeev amrit* needs to be sieved out and the liquid part has to be sprayed in the field, which can be a little cumbersome. The community is usually content after the third dose, even in the lowlands, and it will take some more time and effort to convince farmers of the importance of the additional two doses. At present, every family owns at least one or two bovines, sufficient for producing enough organic manure for their farms.

Preventive pest control is critical for the success of organic farming. This means the recurrent use of preventive pest control measures such as *neem kada* after every ten days from the day of transplantation. For some families, this simple but repetitive procedure, which requires focus throughout the season, is cumbersome and acts as a deterrent.

Another issue of struggle has been the widespread use of urea and Diammonium phosphate (DAP), along with pesticides, in

the OBC community in the area. This will require gradual cutting down on the chemical input every year and increasing the organic input progressively so that in about three to four years' time, the community can shift to a completely sustainable processes. Last year, in certain villages, there were cases of excessive pest attacks, particularly shoot borer in paddy due to the incessant rainfall. These attacks exacerbated in the case of hybrid paddy, which requires supplementary and regular doses of chemical fertilizers and pesticides.

Some of the adverse impacts of the chemical use in the hybrid plot can spill over to the organic plot. So, it is critical that organic cultivation be viewed from the prism of entire patches rather than small individual plots. It will take a few more years for families in the area, where extensive chemical farming and hybrid seeds have been used, to get completely oriented with the organic process.

THE NEW APPROACH

The promotion of large-scale organic agriculture continues this season with the community in Balaghat. However, the approach to agriculture has undergone some drastic yet pertinent changes. Instead of focusing directly on technology and practices, a need was felt to highlight the gender-based discrimination in livelihoods, particularly in agriculture at the community level and the role women play in agriculture. The perception in society is that agriculture is an activity associated with men. Although women share in the work and even bear a large chunk of the drudgery in farming (except ploughing), their contribution to the activity is rarely acknowledged. Their own perception is that they are not farmers because the land in not their name. There is urgent need to challenge this perception and to bring about radical change in the perception of the Self of the women farmers and in how society views them. This is the core philosophy adopted for this year's intervention.

AJEEVIKA SATHIS (LIVELIHOOD FRIENDS)

The idea behind initiating the Ajeevika Sathi process is to transfer the planning and implementation of livelihood interventions into the hands of members of the SHG Federation in the not very distant future. This is in line with the vision of the team and the new stance of PRADAN, where the community will take charge of all the processes, with PRADAN acting as a facilitator. One Ajeevika Sathi was selected from each SHG. In all, 470 Ajeevika Sathis have been selected this year. Village-level meetings of SHGs were held to select Ajeevika Sathis from each SHG.

A two-day central training was held for the Sathis. The theme of the training was the skewed work division between genders and the insufficient inclusion of the women in decision-making in the household. It was meant to create awareness of the role of women as earners and their identity as farmers. Based on sub-group activities in the group, on the first day of the training, the following were the takeaways for the women attending the training:

- Women work all year round without a single day's respite, both inside the household and outside it.
- Women take the major load of work to run the household.
- Women have very little say in decision-making in their homes or in society.
- Women contribute 50 per cent or more to the overall earning in a family.

Whereas internalizing and understanding the concept of gender-based discrimination is a gradual process, the stark discrimination in the work load and in decision-making was recognized very easily by women participants. There was also the realization that they contribute to the systematic bias by their own entrenched beliefs and values, especially in the case of their treatment of the girl child vis-à-vis a boy.

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On the second day of the training, the focus was on women's role in agriculture. The concept of a farmer and a woman's identity or the lack of it was discussed. Interestingly, most women find it difficult to articulate their identity as farmers, despite contributing 70 to 80 per cent of the total effort in crop production. The lack of land in their name, the social taboo associated with women ploughing, the lack of societal recognition of women as farmers and the knowledge gap in the entire crop cycle are cited as some of the reasons for this identity crisis.

At the end of the training, each Ajeevika Sathi is asked to introduce herself as a farmer. Dates are set for the first round of their technical training. The idea of an Ajeevika Sathi is to have a woman in each SHG, who is fully trained in agriculture and is capable of supporting and helping other members of her group in agriculture. She will also start the discussion on the discrimination faced by women in livelihoods and in general, and as a group start taking very small but crucial steps towards change.

TECHNICAL TRAINING OF AJEEVIKA SATHIS AND EXTENSION METHODOLOGY

The technical training of the Ajeevika Sathis is held at a central location in the village, where Sathis from nearby villages also attend the four-hour process. The discussion begins with the agricultural practices followed in the previous year and the community's learning from it. A detailed discussion is held on all aspects of agriculture.

This is followed by a demonstration of how to prepare *jeev amrit/matka khad* and how to prepare the nursery for vegetable cultivation. The focus is on all the crops and all types of land, irrespective of the method used in sowing. The training helps farmers understand simple seed treatment technology for every crop, proper handling of saplings during transplantation with minimum damage to the root zone, how to maintain resilient and pest-free nurseries, how to lower seed rates, how to use *jeev amrit* in all stages of the crop cycle, and preventive pest management.

An additional intervention this year is the use of *Ghan jeev amrit* at the nursery stage. For this, six days before the preparation of the nursery bed, *jeev amrit* is made in a drum or earthen pot (100 litres). After four days, the *jeev amrit* is mixed with ten *tokni* (about 20 kg) Farm Yard Manure (FYM), kept in the shade for two days and regularly watered. The mixture is then used in the preparation of the nursery for an acre of land under SRI, or improved variety of paddy cultivation. This

leads to the growth of strong saplings at the nursery stage. One diluted dose of *neem kada* is recommended after three to four days when the seeds are at the germination stage.

A booklet made by the team on organic agriculture was distributed in the training. Each Ajeevika Sathi was given a planning sheet to be used by them to plan their cultivation process with the SHGs. Ajeevika Sathis were taken for an exposure visit to a farm in the Bagarmarra village in Kirnapur block of Balaghat district. SPs are the field staff employed by PRADAN on task basis, to support the interventions in the field of livelihood. The SPs for agriculture support the Ajeevika Sathis in all the technical spheres of agriculture and help them fine-tune their expertise.

Video shows are held in villages on organic agriculture and on the advantages of adopting the SRI method for all crops. Ajeevika Sathis next discuss the many kinds of seeds that the community used earlier as compared to what it does at present. Farmers are made aware of the fact that if they were to completely lose control of the indigenous variety of seeds and become dependent on the market for fertilizers, they would lose their farming sovereignty.

The conversation in these meetings usually drifts to the issue of production. Experiential sharing of the last few seasons, where farmers have used traditional seeds in a scientific way, using the SRI method and improved practices, with great results allays some of their fears. Many in the community are today willing to experiment, albeit in small patches. This has given great hope and as more people in the community take up this intervention, and learn and grow, there will be wider replication in the coming times.

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CONCLUSION

The awareness about sustainable processes in agriculture has increased greatly with these interventions and the demand for indigenous paddy has also spiked tremendously. Unfortunately, a major part of the vegetable intervention was washed away last year. This year calls for a focused approach to sustain the *kharif* vegetable intervention. This is a critical year of intervention in sustainable agriculture for the team.

Women in the community are far more confident today about their skills in agriculture. The core area of gender-based discrimination, both in terms of work and decision-making, needs to be addressed and Ajeevika Sathis can take a lead to initiate this discussion in the community.

Lastly, there is the question of replicability of the process in other poverty pockets. Our experience in Balaghat and the experience of other people in several interior pockets of the country have shown that farming distress can be mitigated by a more holistic approach to agriculture. No doubt this approach should be well scrutinized by all the stakeholders, weighing all the pros and cons. The farmers of this country, particularly the marginalized ones, have been crying for a change for a long time now, and sustainable farming could well be the harbinger of the required change

Lighting up the Hills—Ballimusti

ASHISA KUMAR RATH

Bringing electricity to the remote and difficult terrain of Ballimusti village by creating micro hydro projects using the available water resources in the area has transformed the darkness in the lives of the villagers and liberated them from depending on the meagre supply of kerosene to light their lamps.

Kandheri Mallika is in a hurry. She is rushing through her household chores to watch a new movie on the television with her friends. Life is not the same for Kandheri, who lives with her husband and children in a two-room house in Ballimusti, a small forest-fringe village, which is set amid the beautiful landscape of streams and trees. There was a time, not very long ago, when this scenic tranquillity would be enveloped in shadows when it started to get dark in the evenings. Life would come to a halt and the only light in the homes would be from the kerosene lamps, and that too for an hour or so while the children studied; then there would be complete darkness.

Kandheri talks about how her life was so dependent on kerosene, "I would walk 12 km to get a litre of kerosene from the market and that would take me the whole day. I had a BPL card, which entitled me to subsidized 5 litres of kerosene that lit up my home in the night. I used to spend Rs 150–200 per month only on kerosene. My children would study in the evening so they needed the light but then we would remain in darkness throughout the night to save oil and expenses.

"Now, we have electricity in the village. The scenario has changed. We can light up our houses the whole night almost for free and there is no need to buy kerosene. I can now use the money I save on my children—for their education and to buy them clothes. Recently, the school teacher in the village, Mrs. Priyatama Pradhan, started giving evening tuitions and my children go there to study.

"Having electricity in my house has also helped me do all my chores easily and quickly. After I complete my work and have my dinner, the other women in the village and I watch television. It is so joyous to watch television with everyone. Our village seems crowded even at night only because we have electricity. We hold important meetings in the night because everyone is free at that time to leave their homes. We no longer fear the night and move freely from one hamlet to another because the street lights are on through the night. These lights have not only lit up our village but have also lit up our lives."

Our village seems crowded even at night only because we have electricity. We hold important meetings in the night because everyone is free at that time to leave their homes

THE INITIATIVE

In 2011, the PRADAN team received an invitation from Odisha Tribal Empowerment and Livelihood Programme (OTELP) to initiate a hydro-water project in Balliguda block, where the team was already working. The proposal was to electrify remote villages in the operational area, where there was no electricity and also no chance of electrification in the near future, due to the remoteness of the villages and the difficult terrain.

A micro hydro project (Pico Hydro Water) for generating electricity was possible because there was perennial flow of water in the streams and rivers of the area. This was a new initiative for PRADAN and because OTELP was supporting it, the PRADAN team accepted the proposal.

OTELP then invited Practical Action, an international organization that works alongside communities to find practical solutions to the challenges they face by developing appropriate technologies in renewable energy, food production, agro-processing, sustainable transport, water, sanitation, small enterprise development, building and shelter, climate change adaptation and disaster risk reduction. Officials and engineers of the organization visited the field for a feasibility study. Engineers from Sri Lanka and Bhubaneshwar also came to Balliguda, to explore and discuss possibilities.

The terms and conditions for selecting the site were:

- A perennial source of water flow with a velocity of 100 litres per second
- A vertical drop of 100 m within a horizontal distance of 1,000 m
- There must be no electricity provision before the implementation of the Total Energy Access (TEA) and not even an opportunity for electricity supply from the government agencies in the near future.
- The community must agree to contribute their labour and locally available material so that they have a stake in the programme.
- The community must agree to implement and take care of the project for sustainability.

It was difficult to find a village that would meet all these requirements. Ballimusti, which is situated almost 30 km in the interior south-west of Balliguda, seemed to be the ideal spot. Looking at the terrain, the officials figured that they could install a small-scale Pico or Micro Hydro project as well as set up other energy saving or generating activities from renewable sources here, under the TEA programme.

Thus, PRADAN, Practical Action and OTELP agreed to collaborate on this venture.

PRADAN facilitated a meeting of the villagers, OTELP and Practical Action officials. Discussions were held about whether the villagers needed electricity for their village and for each home in the village;and would the villagers be willing to support such a project, in which power would be generated from the natural resources of their own village.

Pico Hydro is hydro power with a maximum electrical output of 5 KW. Hydro-power systems of this size benefit small communities because of the low cost and simplicity of installation

The villagers spoke of the difficulties they faced due to the lack of power in their village and how it affected their lives. They shared how they lived in complete darkness at night when there was no power and no light. The availability of kerosene oil (from the PDS) was also very limited. The monthly entitlement was barely enough to light their rooms in the evening for an hour or so. Purchasing kerosene from the open market was very costly and, sometimes, it was not available. The village was surrounded by the forest and there was fear of wild animals attacking after dark. Sometimes, they used firewood to light their village and houses for security, but that was very dangerous because it could cause a fire. The community found the idea of generating electricity interesting and was eager to work on it.

What is Pico Hydro?

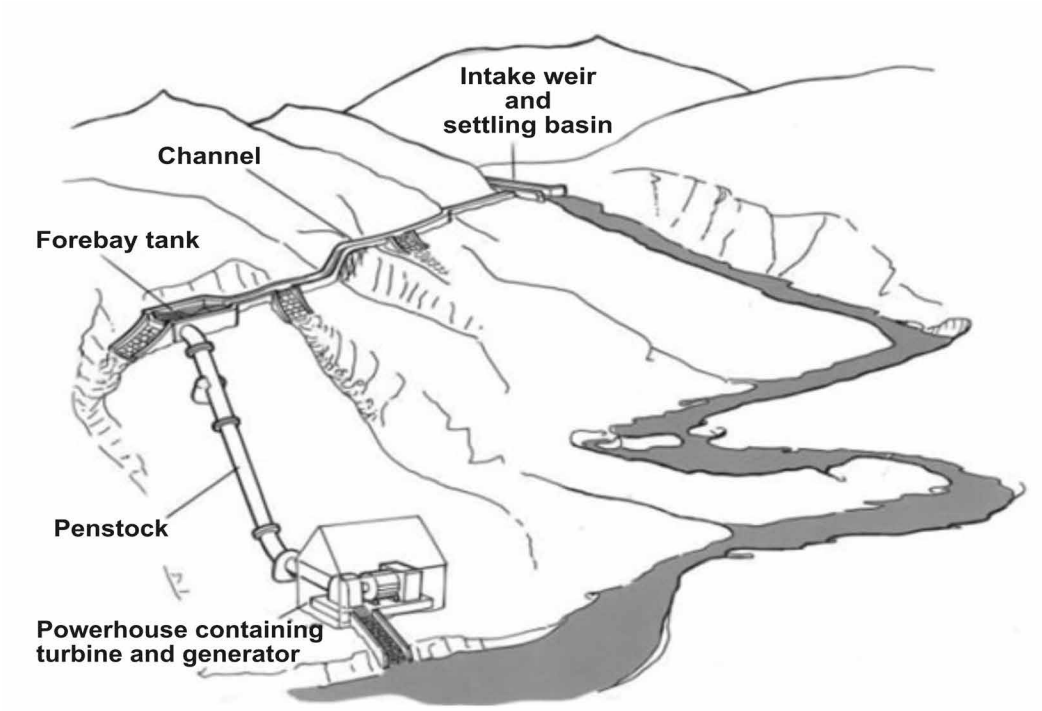
Pico Hydro is hydro power with a maximum electrical output of 5 KW. Hydro-power systems of this size benefit small communities because of the low cost and simplicity of installation. They are different in design, planning and installation than the larger hydro-power projects. Recent innovations in Pico Hydro technology have made it an economically viable source of power in some of the world's poorest and most inaccessible places. It is also a versatile power source. The AC electricity can be produced enabling standard electrical appliances to be used and the electricity can be distributed to a whole village. Common examples of devices that can be powered by Pico Hydro are light bulbs, radios, televisions, refrigerators and food processors. Mechanical power can be utilized with some changes to the design. This is useful for driving of machinery such as workshop tools, grain mills and other agro-processing equipment.

Principle of Pico Hydro

Pico Hydro works on the principle of generating electricity from the force of water flowing down a slope. The water from the source is diverted down a pipe, called the penstock, to fall through a vertical height, or head, in order to gather energy. The lower end of the penstock is attached to a turbine that is turned by the energy of the falling water. The diagram shows a typical hydro water scheme. The water from the stream or river is chanelled to a tank and then released downhill through a pipe, or penstock. The pressure of the flowing water on the turbine blades causes the shaft to rotate. The shaft is connected to a motor. As the turbine and the shaft rotate, the motor rotates automatically, resulting in the generation of power/electricity. The amount of energy available is directly related to the volume of water flowing down the penstock and the height from which it falls. The greater the volume of water the height, the more energy harnessed.

A Pico Hydro can be installed if there is a perennial water flow (with a minimum flow of 20 litres per second or more) in a gradient or slope with a minimum drop of 20 m and within a maximum distance of 500 m.

Figure 1: Pico Hydro Power System



THE SURVEY

When the PRADAN and Practical Action teams reached Ballimusti for the survey, the community showed us the *luddu* (the mountain stream/a small waterfall) with great excitement. We used GPS (Global Positioning System) navigation to survey the site and assess its suitability. GPS is a navigation tool by which we can find the longitude and latitude of a point on Earth and also its altitude to calculate the slope and elevation difference).

As per the findings from the survey, the vertical difference between the upper and the lower points of the water stream was 30 m. Also, the water flow was calculated at 50 litres per second (lps). The problem, however, was that to achieve a 30 m head difference, we needed to cover a distance of around 580 m. This increased the cost (pipes, fittings, plumber, labour, etc.), which the community was to contribute. When we shared this with the villagers, they at once agreed to contribute their labour and do the work. So the project was considered feasible with minimum allocation.

Calculating the Hydro Power

The amount of power that can be provided by the stream depends on two factors called the head and the flow.

1. The head, measured in metres, is the vertical drop/difference in height from the top of the penstock to the bottom. The greater this drop, the greater the power and the higher the speed of the turbine.
2. The flow measured is the amount of water flowing in litres per second (lps)

The power is calculated by multiplying the head and the flow by the force of gravity.

Hydro Power = Head x Flow x Gravity

As per the survey

Head = 30 m

Water flow = 50 lps

Hydro Power = 30 x 50 x 9.81

= 14,715 watt

= 14.7 KW

Considering the turbine efficiency (≈ 0.54), the available power may be

Power = 14.7 x 0.54 = 7.94 KW

After deducting the dissipation loss of 10 per cent, the net available power calculated was 6 KW.

Installing the Pico Hydro System

After the survey and feasibility report, the operational guidelines for the implementation were finalized.

PRADAN was to be the facilitating NGO (FNGO) with the major role of mobilizing the community and capacity building of the village-level institution—the Alok Path Jala Vidyut Committee.

Practical Action was to provide the technical assistance during the implementation and was to be one of the major funding agencies.

OTELP was a support institution that would bear a part of the project implementation cost and would provide the administrative support to FNGO.

For a better understanding of the work involved, we organized an exposure visit for the villagers to Karnibel in Kalahandi, where Practical Action, in association with Gram Vikas, had already implemented such a project, with the financial support from OTELP. The exposure visit was significant in terms of building confidence among the community. The villagers were convinced that such an initiative was possible and they also observed how the community in Kanibel had carried out the task.

After the exposure visit, a meeting was held in the village. Discussions and meetings were subsequently conducted on a regular basis for the quick and smooth implementation of the micro hydro project. The villagers agreed to form a new committee to monitor the project and maintain financial records. The committee was named Alok Path Jal Vidyut Committee (APJVC), Ballimusti. A bank account was opened in the name of the committee.

The committee comprised 13 Board Members, selected during the village meeting. The provision of the funds was to be from OTELP, Practical Action and some contribution from the community itself. The total project cost was estimated at Rs 13 lakhs, which included raw material for the construction of the super structures, the turbine, motor, pipes, electric fittings, wires, household-level electrical appliances, mason, plumber, mechanic cost, a part of the labour cost, transportation, etc. The community contributed Rs 2.85 lakhs in terms of labour and in supplying the locally available raw material for the construction. They collected sand and stone, and made bricks and metal chips in the village.

The committee took the responsibility for the timely completion of the project and for complying with day-to-day issues during the implementation of the project. The committee

also took charge of mobilizing and facilitating the community. It met fortnightly to take decisions regarding implementation, payment and other project-related issues. The programme was totally managed by the community and its members, wherein they took charge of the implementation, decision-making, future governance system and of the smooth distribution of power.

People took charge of their respective tasks. There were rocks in the springs, which were a hurdle and also affected the flow of water. The committee took the responsibility of cutting the rock, to allow the water to flow in a maintained slope from the forebay tank to the powerhouse through the penstock. Women, as usual, took the maximum responsibility, collecting sand from the river bed, breaking stones and metal into chips and placing these on the side of the fountain, luddu.

Gradually, the work began with the construction of a diversion check dam, fore-bay tank, penstock line, the laying of PVC pipes, construction of the power house, etc. The turbine was made at Bhawanipatna by a local designer, under the guidance of Practical Action professionals. The programme took almost 18 months to complete. However, every day brought a new challenge. There was no road to the village; the villagers carried the material from Baulimaha, a nearby hamlet, where the lorry would unload the material, to their village—a big task. All material such as cement, rods, pipes, electric fittings and appliances was carried by the villagers to the workplace, which was about 3–4 km from the unloading point.

All the hard work was worth it when the turbine started to rotate around the shaft by the force and pressure of the water

The villagers then decided to make a track from the village to the powerhouse so the material could be unloaded at the site itself. The length of the road constructed was approximately 1 km. The construction of the road was a big relief and reduced the distance of the dissipation line.

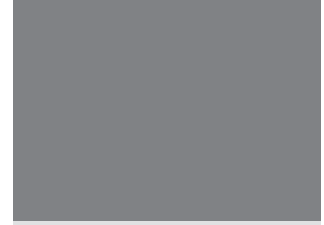
Along with the turbine, all other electrical fittings were purchased and installed by the community with support from the experts. To reduce the cost, wooden poles were made from the community managed forest.

All the hard work was worth it when the turbine started to rotate around the shaft by the force and pressure of the water, which rushed through the nozzle and caused the motor to run. It showed its signal strength with red, orange and green coloured lights. The village was illuminated. It was a joy to see the whole village dancing and playing drums. This was their victory over darkness and it was a well-deserved celebration.

Training on the construction of the structures, canals, pipe-line laying, electric wire-laying at the house-hold level and operating the turbine was conducted by Practical Action professionals and PRADAN jointly.

THE OPERATING SYSTEM

The community now manages the operating system. Two persons were identified during the implementation stage and trained in the basic operation of the hydro project. The task of the person involves opening the valve for water flow to the turbine and to close the valve to stop the motor form working. The system is managed by the APJVC.



The village was illuminated. It was a joy to see the whole village dancing and playing drums. This was their victory over darkness and it was a well-deserved celebration

The committee decided to collect a monthly electricity charge from the community and keep the amount in the APJVC bank account. The corpus would be utilized for maintenance purposes.

The village has 27 households, and the nearby hamlet, Kadamahal has 25 households. All together now 52 households are electrified for 24 x 7 x 365 through the Pico Hydro project. For even distribution to each household, there is an individual and central control system that automatically cuts off the power if any one household consumes more than the desired load. The load per household has been calculated as per the net power availability after deduction of the dissipation losses.

Level of Power Consumption	Particulars	Approximate Load Required	Utility
Household level	2 lights x 14 Watts 1 light x 9 Watts 1 charging point	45 Watts per HH x 52 hh = 2,340 Watts or 2.3 KW	Lighting the houses, including the kitchen and the verandah in the evening. Charging of mobile phones and small charge torchlights.
Village level	7 street lights x 23 Watts	161 Watts per village	Lighting the village street
Community level (well-being and livelihood prospectus)	2 leaf plate pressing machines x 1,500 Watts 1 rice huller machine x 1,500 Watts	4,500 Watts or 4.5 KW	Production of value-added buffet plates made of siali leaves. De-husking of rice
Community level (well-being only)	1 television with DTH	200 Watts	For entertainment and information

Tola Sabha–A Model for Community Development

TARAK NATH DAS, MADHAVESH KUMAR AND VINAY KUMAR RANA

Mobilizing and empowering people for a shared developmental goal and inculcating in them a sense of ownership are paramount for the effective implementation of development programmes. Setting up a community governance mechanism, bringing transparency and accountability in the implementation of programmes and transferring power to the villagers are some of the much-deliberated and critical issues with which development projects across the nation are grappling

The essence of the Gandhian philosophy of Gram Swaraj lies in governance, not by a hierarchical government but through self-governance by individuals and the community. This rhetoric has been further reinforced by the Government of India's commitment, reflected through the 73rd Amendment Act of 1992, in which the *gram sabha* has been envisaged as the foundation of the Panchayati Raj System.

Empowerment of the *gram sabha* is the key to strengthen Panchayati Raj institutions (PRIs). Mobilizing and empowering people for a shared developmental goal and inculcating in them a sense of ownership are paramount for the effective implementation of development programmes. Setting up of a community governance mechanism, bringing transparency and accountability in the implementation of programmes and transferring power to the villagers are some of the much-deliberated and critical issues with which development projects across the nation are grappling.

The MoRD (Ministry of Rural Development), Government of Jharkhand, through its Special SGSY project, has taken definitive steps to implement Integrated Natural Resource Management (INRM)-based livelihood programmes. It has kept the village community at the epicentre of its projects and all major project functions are carried out by the community.

PRADAN, the project implementing agency (PIA), recognized the developmental paradigm and the potential of the *gram sabha*, or the people's body. Taking a calculated step, in accordance with the overall spirit of the functioning of a *gram sabha* in which the community is in the driver's seat, PRADAN seeded the concept of working through *tola sabhas* (hamlet associations). Hamlets, or *tolas*, are small, socio-economically homogeneous, natural and historical settlements in a village. People within a hamlet enjoy far greater affinity and societal affiliations with each other than with inhabitants of other settlements. Many of the *tolas* in rural India are based on caste lines. Even nomenclatures such as Adivasi *tola*, Santhal *tola* and Ghatwari *tola* of settlements reflect the clan. Usually, communities in one *tola* share similar resource endowments and, hence, are also characterized by a similar set of social and resource constraints. Keeping the household as a unit of planning, the *tola sabha* is the basic platform for planning, execution and monitoring of INRM projects.

PRADAN seeded the concept of working through tola sabhas *(hamlet associations). Hamlets, or tolas, are small, socio-economically homogeneous, natural and historical settlements in a village*

The implementation of INRM projects requires comprehensive planning for an entire patch of land. All adult residents of the *tola* are members of the *tola sabha*. The small size of the *tola sabha*, usually comprising 50 to 60 households, ensures inclusiveness in the planning process. Because of the undulating topography of the state, at times, *tolas* are spread over large distances; the socio-cultural homogeneity of the *tola sabhas* thus provides the much-required emotional and social bond essential for the active participation of all members. The members of a *tola sabha* not only get an opportunity and space to share their views but are also able to access appropriate, adequate and timely information about all project-related work.

Usually, hamlets that have a reasonable level of social mobilization and the presence of a high number of SHGs are selected for the formation of a *tola sabha*. This helps in building essential trust and confidence among community members. The work starts with concept seeding in the hamlet, in which the emphasis is on building an understanding of the basic objectives of the project, its implementation process, and opportunities for all-round development of the families as well as the hamlet. After the consent of the villagers is obtained, the planning process is initiated by using participative rural appraisal (PRA) tools and techniques.

Tola sabha members are trained in various tools, techniques and processes of INRM and participatory planning. Members become familiar in the use of PRA tools such as resource mapping, ownership mapping and chapati diagram. Subsequently, each *tola sabha* prepares its own comprehensive INRM plan through a participatory approach. With the objective of assessing and analyzing the current situation vis-à-vis the dormant potential, information regarding land-use patterns, cropping, water availability, animal husbandry practices, forests resources etc., are mapped in detail.

As part of the process, detailed wealth-ranking exercises are conducted to identify and prioritize the poor and marginalized families. Adequate care is taken to ensure that the needs and aspirations of the most

marginalized are integrated in the overall plan. For the wealth-ranking, the villagers assess themselves on four categories, namely, the poorest of the poor, the poor, the relatively well-off and the well-off, based on criteria such as food-sufficiency, income, land-holding, family size and belongings such as motorcycle and warm clothes. Special livelihood provisions are made for the landless and asset-less families. Usually, the landless and the asset-less families are provided with farm and allied activities such as poultry farming and vermi-compost making, the two most rewarding enterprises for the impoverished, developed by PRADAN, specific to the region.

The villagers start planning around their resources in a three-day exclusive *tola sabha* resource management and planning meeting, to prepare a detailed implementation plan (DIP). The process starts with a sharing of the INRM concept and approach. It promotes the sustainable use of various natural resources such as land, forest, water, animal and human, by logically integrating them. The villagers then identify their existing resources and map them in the revenue map; they also identify the existing resource use and their problems, and follow it by generating options for action. After this, the villagers go for a transact walk in every field to decide on the plan of action, according to the problems identified and the technical suitability. The action plan usually comprises the construction of civil structures such as small farm ponds, seepage tanks, irrigation wells, micro-lift irrigation, earthen check dams and storage units, as well as organizing land husbandry, horticulture and off-farm activities such as vermi-composting, poultry-rearing and goat-rearing.

The core of the programme is discussed and deliberated upon by the members every fortnight, thus making it truly dynamic and practical. Both the physical and the financial progress are regularly tracked in these meetings.

The process of creating an action plan, and especially its depiction on a map, provides an understanding about the type of resources available, the current situation and the visualized state after the completion of the project.

A DIP, thus formulated, vividly encapsulates the aspirations of the community. The DIP, the core of the programme, is discussed and deliberated upon by the members every fortnight, thus making it truly dynamic and practical. Both the physical and the financial progress are regularly tracked in these meetings. Any anomaly in the plan is thoroughly discussed, the cause and effect relationships analyzed and remedial actions suggested.

Women remain at the centre of all programme interventions. For day-to-day co-ordination of project activities, a seven- to ten-member Project Execution Committee (PEC) is constituted. The PEC actually finalizes the plan, gives work orders, monitors the physical and financial progress, makes payments to the beneficiaries and suppliers and, in case of default, penalizes the concerned individual. In the selection of the PEC, women are preferred over men. Today, most of the posts in a PEC are occupied by women. This system has empowered and inspired rural women enormously to take on leadership roles.

The implementation of the work starts with the layout of the activities by the PEC members and a pool of local resource persons. The villagers in their *tola sabha* meeting decide on the availability of labour, the plan for their engagement and other related issues such as whether labour from other villages should

be required and permitted to work. It is mandatory for the *swarozgari* (the owner of the asset) or a member of her family to contribute 10 per cent of the total cost. This often comes in the form of labour.

All works are closely monitored by the *tola sabha* and the PEC. PEC members ensure both the quantity and the quality of the work done. They themselves carry out on-field measurement of each and every activity and ensure that the quality of the work is maintained during the project implementation and even after that. For example, they ensure that mango orchards are being well-managed; that inter-culture and inter-cropping is being done; that pruning and watering takes place as per schedule; and that they engage early in planning for marketing the fruit.

All works are closely monitored by the tola sabha *and the PEC. PEC members ensure both the quantity and the quality of the work done. They themselves carry out on-field measurement of each and every activity and ensure that the quality of the work is maintained during the project implementation*

The PEC furnishes a status report to the *tola sabha* in its monthly meeting. This ensures timely and adequate dissemination of information about the progress in implementation of the project to all the villagers. Some members of the PEC are specifically nominated to monitor the quality of the programme implementation and are better known as being part of the Nigrani Samiti (Management Committee).

The monitoring of the project is, however, not confined to the boundaries of the hamlet. The members of the Cluster also discuss and examine the project implementation progress in their monthly meetings. In times of crisis, Cluster members from nearby hamlets support the implementation of the project. The support is in the form of maintenance of accounts, training for layout, and providing labour. Similarly, the block-level Federation, the apex institution of the SHGs, in many places, keeps an eye on the progress of the project.

A plan becomes an instrument of action only when the financial provisions stipulated in it are also made available for use at the appropriate time. The *tola sabhas* maintain their own bank accounts into which the project fund is directly transferred by the Jharkhand State Livelihood Promotion Society (JSLPS), the nodal agency for the implementation of livelihood programmes, including that of NRLM in the state. The project fund from MoRD is routed through JSLPS. Usually, a woman member of the *tola sabha* or a local youth is trained to maintain the minutes book, the muster roll, the cash book, the ledger book, the stock register, the bank book and the pass book. All the three signatories in the *tola sabhas*, responsible for financial transactions and transactions with banks, are women. Handling large-scale mainstream funds has further helped build the confidence of the women.

One copy of the books is kept with the *tola sabha* and another is submitted to the PRADAN office, which in turn, has them audited by the District Rural Development Agency (DRDA). As mandated in the project, the *tola sabha* also ensures that each and every beneficiary contributes a minimum of 10 per cent of the cost.

All bills and signatures are validated by the three signatories. As soon as the *tola sabha* achieves 60 per cent fund utilization, a fresh request for funds is raised.

Breaking tradition and eons of inhibitions, the women from these *tolas*, mostly belonging to the Scheduled Castes, Scheduled Tribes, Other Backward Categories, and the minority communities, can now be seen actively interacting, persuading and negotiating with banks, government officials and market players. The increased mobility has infused the women with a higher sense of confidence and has developed amongst them a 'can do' attitude. Women in the *tola sabha* are empathetically engaged in demonstration and scaling up of models of livelihood, community mobilization, empowerment and natural resource management, thus contributing to the overall well-being of women and their families.

The tola sabhas *have also contributed in further scaling up social mobilization. Due to the distinguishable impact of the work done by the* tola sabha*, households that had been left out of the ambit of the SHGs are now attracted to it.*

The members' direct involvement in the planning process has resulted in enhanced project ownership, further encouraging them to complete the project well within the stipulated budget and timelines. Instances of default or dropouts are resolved through peer engagement of members. Starting from the measurement to labour payment, everything is done in front of the PEC and the *tola sabha*, thus making every activity transparent.

The *tola sabhas* have also contributed in further scaling up social mobilization. Due to the distinguishable impact of the work done by the *tola sabha,* households that had been left out of the ambit of the SHGs are now attracted to it. One of the unintended benefits visible is the significant contribution of the *tola sabha* in strengthening *gram sabhas*. The *tola sabha* members now feel far more confident and empowered to not only raise relevant questions in the *gram sabha* but even actively steer the process of decision-making at the village level. Issues related to rights and entitlements, which were earlier taboo, are now articulated in the village decision-making forum. Villagers in the *gram sabha,* today, are demanding more meaningful assets such as a grading house, lift irrigation or mango orchards that will immediately contribute to their livelihoods. Demands by the community, to initiate the formation of *tola sabhas* in the remaining hamlets and villages are in itself testimony to the success of the institution. A *tola sabha* is now a conduit between the people and the *gram sabha*. The *tola*-wise plan, if created, by all *tolas* in a village, can then effectively contribute to strengthening the plans of the *gram sabha*.

The supportive role of PRADAN professionals at the grass roots has been extremely noteworthy. Concerted efforts have been made in the capacity building efforts of the community. Structured, as well as on-the-job-training, is imparted to villagers, in order to equip them with the required technical and managerial skill-sets. In order to raise the aspiration level of the community, visioning exercises are conducted for SHG members, *tola sabha* members and PEC members. Exposure visits to see the fruits of the INRM projects have significantly helped in winning the much-required trust, confidence and belief of the farmers.

The process of project implementation through *tola sabhas* has generated opportunities and sparked the interest of local youth in land and water development activities such as digging pits and constructing water harvesting structures.

The success of the *tola sabha*-based planning process is evident from the fact that activities undertaken in the project continue to be utilized. For example, in Khunti district, more than 100 ha of high yielding varieties of mango plantation have been completed with more than 90 per cent survivability, even after five years of implementation of the project. Similarly, the use of irrigation structures has changed the project villages of the district from mono-seasonal cropping to multi-seasonal cropping. A few villages such as Saridkel in the Khunti block and Chandarpur in the Torpa block have become leading producers of watermelon in the district. Damray village of Murhu block of the district has earned its identity as a vegetable producing village round the year. The project has witnessed multi-fold increase in the coverage of families for livelihood activities for both *rabi* and summer agriculture.

INRM: Transforming the Lives and Livelihoods of the Rural Poor

BINOD DAHAL, ARUNAVA GHOSHAL, SURYAKANT SAHOO AND MD KAMRAN

Undaunted by the challenges of poor irrigation, poor service delivery, low rate of literacy, poor health facilities, degraded land, under-developed agriculture, and lack of basic services in Godda, PRADAN's initiation of INRM, is slowly transforming the land, the women and the villages, bringing hope of economic self-sufficiency.

BACKGROUND

Godda is located in the north-eastern part of Jharkhand, and is an area that falls in the agro-climatic Zone VII. Two-thirds of the total geographical area of the district is cultivable. It is also fairly densely forested, covering about a tenth of the district (Source: DRDA, Godda), especially two of the tribal dominated blocks of Sundarpaharai and Boarijore. Although the district receives around 1,200 mm of precipitation, inadequate water harvesting mechanisms limit the scope of expansion of an agriculture-based economy in the area.

The district is low on most indices of development and has poor infrastructure—very little irrigated area (15.5 per cent of the cultivable land); poor service delivery; low rate of literacy (overall 57.68 per cent and female literacy 44.9 per cent); poor health facilities (institutional delivery is 22.63 per cent); degraded land; under-developed agriculture with low productivity per unit of area (909 kg of paddy per ha); and lack of basic services.

There is little understanding, among the local people, regarding these issues, which contributes to the sluggish development in the area. In spite of the best efforts of the government to ensure last mile delivery of its services, there has been a colossal gap in the implementation of welfare schemes. Low awareness in the community and lack of dedicated manpower to effectively implement and monitor the schemes within a stipulated time-frame lead to the slow development of the region.

Land-based, livelihoods-promotion activities faced major challenges because the area has low irrigation coverage (ranging from 4.6 per cent in Boarijore to 21.1 per cent of the cultivable land in Pathargama) and, therefore, rain-fed farming is the only choice for the predominantly rural populace. The rain in the region, however, is quite erratic. In 1996, the precipitation was 893 mm whereas, in 1999, it was 2,454 mm (www.jharkhand.gov.in). But even figures of high precipitation are, at times, illusory because even a good monsoon year may be marked by long, dry spells between two downpours. The long gaps between rains gravely affect plant flowering and fruiting, and eventually translate into substantially low yield of crop. Further, a significant high proportion of rainfall, estimated to be around 50 per cent, drains out to small tributaries, leading to poor in-situ conservation. This seriously compromises the carrying capacity of the land, for both the *kharif* and post *kharif* crops, thus further pushing farmers into the vicious cycle of poverty and perpetual indebtedness.

Despite having an average of one hectare of land-holding per family, the return from agriculture is abysmally low, mostly owing to poor agriculture management practices

Despite having an average of one hectare of land-holding per family, the return from agriculture is abysmally low, mostly owing to poor agriculture management practices. The average productivity of common crops during the baseline assessment is depicted below:

Table 1: Average Productivity of Common Crops

No.	Crop	Productivity (Quintal/Acre)
1.	Paddy	11.3
2.	Maize	2.3
3.	Wheat	1.4
4.	Rapeseed	5.6

People usually fear investing in alternative ventures such as horticulture and vegetable cultivation because of the lack of reliable irrigation facilities and because they lack awareness and confidence. Factors such as free grazing practices, poor storage and transportation facilities, the lack of exposure or linkages to markets constrain the farmers from venturing into non-traditional and multi-cropping. Most of the cultivable land, therefore, has remained fallow for years.

Gradually, the farmers have become content with less risky crops such as paddy, maize and potato, and have inadvertently compromised on the nutritional security of the household, especially that of the women and the children. Field experience in Sundarpahari and the results of the analysis of the data collected show that around 50–55 per cent of the children are malnourished, with 23 per cent of them severely so whereas more than 75 per cent of the women are anaemic.

The lack of awareness about government programmes and procedures contributes to the low and impassive involvement of the community in owning, monitoring and implementing of these programmes. This has seriously jeopardized the effectiveness of state-sponsored programmes. Instances of poorly maintained and sub-optimally utilized community infrastructure are not an uncommon sight.

The only certainty in the above scenario has been the seasonal distress migration. The project's baseline sample survey conducted in Sunderpahari block revealed one or more members of a family migrating from the village in 62 per cent of the households. The lack of round-the-year reliable livelihood

avenues contributes to the high incidences of poverty and creates a flourishing ground for moneylenders who lend money at exorbitantly high rates of interest, sometimes as high as 120 per cent per annum. Due to indebtedness, people are often compelled to mortgage their productive land for a paltry amount. There are instances of farmers, who have mortgaged their land at the rate of Rs 350 for five years, to meet credit exigencies. A significant number of people migrate for a short term, to make around Rs 5,000. Data indicate that even a little augmentation in income would cover the gap and lead to a momentous reduction in migration.

The unrestrained run-off and erosion of the top soil year after year has led to the deterioration of the quality of the land. A major portion of the humus has got deposited in the lowlands, making it fertile whereas the uplands have gradually lost their productivity. The community is despondent, unaware of how to restore the wasted uplands. Even if there were the will for restoration, the lack of access to the required capital has hampered the translation of this desire into action.

The community is experienced in handling funds of a few thousands in their SHGs; however, helping the members to handle large amounts and teaching them account-keeping were the major challenges for the team.

INITIATION OF INRM

In order to bring considerable and enduring change in the lives of impoverished families, the PRADAN team decided to promote at least three different livelihood avenues for each beleaguered family. Taking the average landholding of a family as one hectare, an ambitious target was set of providing Rs 40,000 annually to them, to ensure round-the-year food security, through optimum utilization of land and water resources.

The mammoth target called for building strong institutions and required systematic investment in building the capacities of people. There was also a need to demonstrate apt models of livelihood and create a support structure, both, at the community and at PRADAN's professional level. In order to ensure sustainability, the community was central to all programme interventions.

PRADAN initiated INRM, with support from the Special SGSY Project. The main focus of the programme was the large-scale capacity building of poor families, to facilitate the adoption of improved technologies and practices, to attain rapid growth in farm and farm-allied sectors, and to enable villagers to access mainstream markets for economic gain.

PRADAN had already promoted strong women's collectives through SHGs and the associative tiers, namely, Clusters and Federations. The concept of undertaking holistic, integrated and inclusive development gave rise to other institutions such as the *tola sabha* (hamlet-level association). Unlike SHGs and Clusters, where participation is restricted to women, the *tola sabhas* include both men and women. The new institution also gave the women the opportunity to participate in local matters and take the lead in the relatively macro-spheres such as land and water planning and development.

From its inception and gradual progression, the involvement of the *tola sabha* in the implementation of projects is as follows.

- **Village Selection:** Villages were primarily selected on two factors—the availability of functional SHGs in sizeable numbers

(around 40 members) per hamlet and a high incidence of poverty (70 per cent below the poverty lines, BPL, families)

- **Concept Seeding:** Before the inception of the project, all the *tola sabha* members participated in reflection and realization exercises about their current state of being. For smooth and transparent implementation of the project, two special committees were formed in each *tola sabha.* The Project Execution Committee (PEC) comprised seven women members from different SHGs, and an Advisory Committee of two or three selected male members for techno-managerial support. One accountant was also hosted by the community for book-keeping. All adult members (both male and female) were members of the *tola sabha* and acted as a watch group.
- **Pre-Planning Preparations:** Before formulating a detailed implementation plan (DIP), the members of the *tola sabha* were trained on the following participatory rural appraisal (PRA) tools.
  - **Wealth ranking** (socio-economic profiling of each family undertaken)
  - **Resource mapping** (all kinds of land, forest, water, habitation resources, etc. mapped on the revenue map)
  - **Land-use mapping** (pre-project use of every patch of land plotted) and
  - **Ownership mapping** (who's where, including the status on livelihood opportunities for the landless mapped)

The entire process of this INRM-based Special Project, from initiation to implementation, led to the step-by-step empowerment of villagers, especially women, who were then able to manage large multi-dimensional projects

- Planning Process: During the finalization of the DIP and the budgeting, the following points were intensively deliberated upon by the community.
  - Would the poorest sections of the community under the *tola sabha* benefit from the very first year?
  - Would the implementation in the initial year generate some benefits to most of the beneficiaries?
  - Which month would be appropriate for the execution/creation of the structures/assets?
  - Would the water harvesting structure get priority over ground-water using structures?
  - Which part of the plan would be converged with government schemes such as MGNREGA?

The entire process of this INRM-based Special Project, from initiation to implementation, led to the step-by-step empowerment of villagers, especially women, who were then able to manage large multi-dimensional projects. Concept seeding was conducted on issues of soil and water conservation techniques, for example, project elements included the 30 x 40 model (a method of in-situ soil and water conservation by dividing the un-bunded and un-terraced uplands that have 3–8 per cent slope into small plots of 30 ft along the slope by 40 ft across the slope) and the five per cent model (an in-situ rainwater harvesting method, suitable for medium up-lands. This is so designed that each plot has its own water body, the 5 per cent area of this plot would be sufficient to hold the rainwater, which otherwise would flow out of the plot as run-

off). Other elements that were considered were upland and lowland wells, lift irrigation, seepage tanks, vermi tanks, etc., as well as land treatment, horticulture and timber plantation, land husbandry, staggered trench with semialata plantation.

An understanding about the physical status of resources, their positioning and inter-relation was reached by focussing on groundwater recharge through various tools such as visual-based integrated learning system and the transact walk. An analysis of current trends on the use of every patch of land and the constraints identified were taken into account, to address the gap of the aspired state of inter-relation among resources as well as future utilization. The probable solutions to overcome these constraints were also framed. The *tola sabha* members were provided the techno-managerial training and exposure to INRM. The community made the layout and executed it under the technical guidance of a specialist from PRADAN. Consensus and clarity were arrived at about the division of roles, especially those to be played by various people, including who would monitor the project.

During the implementation of the INRM programme, the *tola sabha* reviewed the physical and the financial status in detail in their monthly meetings, and any deviation from the initial plan was thoroughly discussed. Appropriate modifications and alterations were made with the consent of the members of the PEC, the community and the *tola sabha*.

CHALLENGES

1) The community had a deep inclination for traditional water structures such as wells and large sized ponds and resisted other structures.
2) Convincing the community about creating water harvesting and ground water recharge mechanisms as a long-term strategy proved to be challenging. The demonstration held for a few farmers in the first year helped in overcoming the inhibition of other farmers.
3) The efforts to integrate fallow land through horticulture met with resistance from the community, mainly due to the social constraints such as grazing and theft of plants.
4) The people who were accustomed to the casual implementation of schemes such as MGNREGA were averse to the stringent quality norms of the project. However, the enforcement of quality and economic efficiency was non-negotiable and posed a major challenge in the beginning. Unskilled labourers, who earlier executed earth work with ease, without adhering to stringent quality norms, found a lot of difference in the expected work quality. This mismatch in work culture, led to a labour scarcity initially.
5) During the implementation, there were numerous instances when the perceptions of the people regarding the utility of the uplands or fallow lands underwent a paradigm shift when the apparently unproductive land yielded an abundant produce of vegetables such as tomato and chili within horticulture plots through inter-cropping. However, large-scale coverage and replication has still been difficult to achieve.

STIMULATING FACTORS

1) The rapport and trust developed between the PRADAN professionals and the community, gained mostly during previous programmes of the Ministry of

Rural Development helped mobilize the community.

2) The project also capitalized on the previous familiarization of the community with INRM in the district. Hence, a few farmers who had been earlier exposed to the concept, helped in influencing the community from the second year onwards.
3) The transparent system promoted for financial transactions at all levels kept all the stakeholders duly informed about each development.
4) As a result of the organizational training and the exposure programmes on similar INRM models in other PRADAN operational states, the Godda team already had a rudimentary knowledge of the nuances of the INRM programme. This gave a head start to the project.
5) The availability of good prototypes of the INRM work, across different states under PRADAN's operation, facilitated easy and effective vision building exercises of the community through exposure training programmes.
6) The significant focus on capacity building of the *tola sabha* members shifted the responsibility of programme execution from PRADAN and empowered the community.
7) The agility in the programme structure, for autonomous decisions of the *tola sabha* regarding time and labour management, further propelled the project.
8) The demonstration of success by the immediate beneficiaries, regarding the utilization of assets/resources created in the first year, helped in scaling up of interventions within the stipulated mandate.

KADAMPUR VILLAGE: A CHANGED PICTURE

PRADAN intervened in Kadampur village of Sunderpahari block in 2008 and promoted two SHGs (covering 27.65 per cent of the households) in one hamlet. Three more SHGs were promoted in other hamlets of the village. There are currently 59 households under five SHGs, which constitute about 57.5 per cent of the total households in the village.

'Kadampur Gram Vikash Samiti', the *tola sabha* of Kadampur, comprising 36 SHG members and their male counterparts, has executed work worth Rs 16 lakhs between 2012 and 2014. Around Rs 6.71 lakhs was invested in land and water conservation and tree-based activities; Rs 7.51 lakhs in creating a micro-irrigation system; and Rs 1.74 lakhs for agricultural development.

Most of the land water and agriculture work was undertaken in 2012–13 and 2013–14. The estimated change in productivity varies from 5 tonnes per ha to 6.5 tonnes per ha, over the baseline productivity of 4.5 tonnes per ha. Paddy, for instance, used to be highly vulnerable, both during the transplantation and during the flowering season. However, after the creation of assets, mainly of water-related infrastructure, productivity has increased by 1–2 tonnes per ha.

In addition to the 2 tonnes per ha average additional increment in production, which contributes an additional three months of food security for a family, the cash income per family from other cash crops such as vegetables in *kharif* and *rabi* has been around Rs 6,500 per family from six decimals of land. The creepers are the major vegetables cultivated by the farmers in this village. The range of income from five decimals is Rs 5,500 to 8,300. This earning from one season convinced many

families in the village to take up this crop. Hence, now 22 families are participating in this intensive agriculture in the village and other members are expected to follow in the coming season.

The change in perception of the farmers and the farm scenario is reflected in the following:

1) After the execution of INRM, the members of the *tola sabha* now have a better understanding of the innate potential of their natural resources, terrain pattern, inter-relationship between resources, water holding capacity of various patches of land, present use of resources as well as the future plan around the resources.
2) People have demonstrated their commitment to tapping the run-off. An average 80 decimals of land per family has been treated under the 5 per cent model, which is enough to generate seven months of food security per family, even during dry spells.
3) Almost half the families have benefitted from horticulture intervention done over 1.73 ha of land, with a potential to fetch Rs 7,000 per family from 2017 onwards.
4) Another 80 decimals of land per family has been brought under assured irrigation through the installation of a micro-irrigation system. This is enough to generate five months of food security along with a minimum Rs 10,000 of cash income per family.
5) Around 24 people have willingly participated in the organic method of agriculture. Around 17 vermi-tanks have been created, of which five belong to the families from the poorest strata, as identified through wealth ranking.
6) People have now begun to identify and articulate the social constraints that make them reluctant to transcend to optimum utilization of the created resources and have begun mass mobilization of people against the tradition of free-grazing.
7) Some marginal/landless families from the poorest section are still reluctant to synchronize with the new practices. The *tola sabha* is making concerted and sincere attempts to bring them into the mainstream by making special provisions for crop demonstration and training.

MGNREGA: Investment in Soil Systems Asset Creation

NORMAN UPHOFF AND PRATYAY JAGANNATH

Preserving and enriching soil and associated natural resources within the framework of MGNREGA and employment generation is a way of ensuring and enhancing individual and national productivity in the future

Apart from its people, the asset that has most fundamentally nurtured the productivity and sustainability of Indian civilization over the millennia has been its soil and associated natural resources. The abundance and diversity of India's flora and fauna (both macro and micro) and the adequacy of its hydrological cycles all depend, as do humans, upon the fertility and functions of the soil. All sectors of the economy rest directly or indirectly upon the food and material produced, and the employment and income created by agricultural pursuits. These cannot succeed without well-functioning soil systems that make other factors of production efficient and productive.

The soil systems of India are, thus, the most basic material asset of the country, and yet they have been tragically depleted and diminished over centuries of use and misuse. The most salient parameter for evaluating this is the loss of soil organic matter (SOM), which provides the essential source of energy for the myriad soil organisms that make inert mineral material into dynamic and productive soil systems. SOM has the advantage of making soil more absorptive and retentive of water, an increasingly scarce and crucial resource as a result of the changing climate. Water absorption and retention have the added benefits of reducing soil erosion and abating the damages from flooding. So more robust and better-functioning soil systems not only create value by increasing agricultural productivity but also protect values and assets, which would otherwise be lost, and diminish costs imposed by natural disasters.

MGNREGA serves the dual objectives of creating employment and income opportunities for Indian men and women living below the poverty line, who direly need enhanced income streams to lead acceptable lives, and of creating assets that put their labour to good use that enhances individual and national productivity in the future, making India as well as its citizens more productive and secure.

This proposal is to recognize and support the development and restoration of soil systems as a focus for MGNREGA employment and asset creation. This can be done quite simply and reliably by the collection, processing and application of decomposed biomass, vegetative and/or animal, to soils that are deficient in SOM.

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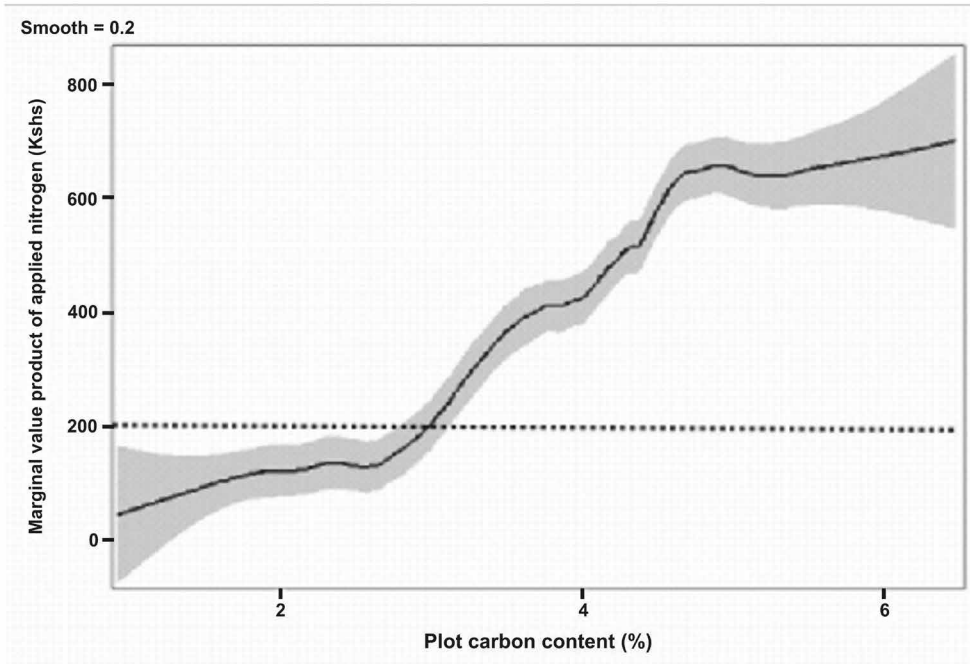
Indian soils, cultivated for centuries and sometimes millennia, and in recent years less resupplied with organic matter and plied with inorganic nutrients that further diminish SOM and nutrient reserves, have some of the lowest levels of SOM in Asia. Whereas a normal range would be 2 to 6 per cent, many soils in this country have less than 1 per cent SOM.

When SOM levels are so low, there is little economic response to the application of inorganic nitrogen fertilizers. The increase in production obtainable from such fertilizers is less than their cost. A study done in Western Kenya (P.P. Marenya and C.B. Barrett, Agricultural Economics, 2009) found that until the levels of soil organic carbon, a main component of SOM, were at least 3–4 per cent, the marginal economic return from applying nitrogen fertilizer on small-holder plots was negative. One reason subsidization to lower fertilizer prices is necessary to promote its use is that applying fertilizer is not actually profitable on soils that are deficient in SOM. Sufficient stocks of SOM are needed for chemical fertilizers to be productive; it cannot, by itself,

Figure 1: Estimated Marginal Value Product of Nitrogen Fertilizer (Kshs/kg N) Conditional on Plot Soil Nitrogen Content



Source: Marenya and Barrett, Agricultural Economics, 2009

be a substitute for the soil's endowments of SOM.

How do we build stocks of SOM? Whereas animal manure is a source of higher quality organic matter for soil enrichment, vegetation biomass that is well-decomposed can support the multiplication of soil organisms that are needed for fertile soil systems. These organisms mobilize and cycle nutrients within soil systems whereas compost restores the micronutrient supplies that are essential for the metabolism of plants.

Most non-arable areas have a good supply of biomass, a renewable resource, which can be collected and processed, along with crop residues from arable areas, to manufacture compost. In many situations, the supply of biomass (grasses, shrubs, weeds, tree branches, etc.) can be augmented by the growing of appropriate plant species on non-arable areas (wastelands), benefiting from the solar energy and rainfall that would otherwise not be utilized. Planting fast-growing leguminous trees and shrubs is beneficial because these have the advantage of nitrogen content in their vegetation and also of nitrogen-fixation in the soil.

For rapid and effective decomposition, one critical step in the process is the shredding of the vegetative biomass into small pieces, breaking the protective surfaces that plants have on their leaves, stems and roots, so that microorganisms can more quickly break down the organic matter into its constituent tissues and molecules. Appropriate implements and tools, possibly some of them motorized, will make labour much more efficient and can reduce the drudgery; efficient wagons, wheelbarrows or other simple vehicles will be helpful, for cutting, transporting, shredding, decomposing and applying material on a large scale. It is difficult to 'overdose' soils, especially deficient ones, on organic matter.

Work can be denominated and compensated in terms of the volume of material collected and processed into compost for soil enrichment. The objective, however, is not just to apply material to the soil but to build up soil organic matter, a measurable quantity. Soil testing could establish pretty simply a baseline level for a particular field (needing sampling within the field because there can be considerable variability). To the extent that reliable measurements and validation can be done, this activity could demonstrate carbon sequestration, which has value for mitigating climate change, a growing concern.

Agronomists who work on soil evaluation could advise on the methods of measurement and validation necessary to determine the amount of work done in collecting, processing and applying compost and to document soil fertility improvements as a result of compost applications. To the extent that the MGNREGA participants are compensated for improving the fertility of land that they own or rent, there will be incentive to do this work effectively.

The Villagers of Ballimusti in Kandhamal district, Odisha at a Pico hydro meeting

Recent innovations in Pico hydro technology have made it an economically viable source of power in some of the world's poorest and most inaccessible places. Pico hydro works on the principle of generating electricity from the force of water flowing down a slope. The forest fringe village of Ballimusti with an abundance of perennial water bodies is now electrified through the use of this technology.

PRADAN

PRADAN is a voluntary organization registered in Delhi under the Societies Registration Act. PRADAN works through small teams of professionals in selected villages across eight states. The focus of PRADAN's work is to promote and strengthen livelihoods for the rural poor. It involves organizing the poor, enhancing their capabilities, introducing ways to improve their income and linking them to banks, markets and other economic services. The professionals work directly with the poor, using their knowledge and skills to help remove poverty. *NewsReach,* PRADAN's bimonthly journal, is a forum for sharing the thoughts and experiences of these professionals working in remote and far-flung areas in the field. *NewsReach* helps them to reach out and connect with each other, the development fraternity and the outside world.

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