

HAPA: Dreaming with small pond

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Abstract

According to an estimate, rainwater harvesting could benefit from nearly 400,000 to over 600,000 farming households in rural West Bengal. The introduction of small rainwater harvesting reservoirs has resulted in benefits, including cultivation of fallow land and higher crop intensity due to cropping in the dry season. Small ponds on individual farms can store rainwater for the dry season, allowing households to diversify crops, produce fish, increase livestock numbers and have more water for domestic use. In dry districts like Bankura, collecting rainwater for use in the dry season has major implications for agriculture and livelihoods. In 2008, a program, funded by the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), was initiated by the NGO, PRADAN, to experiment with reservoirs to store rainwater. Known locally as hapas, these storage ponds were initially designed to cover 5% of a farmer's land to provide supplementary irrigation for paddy. They were highly successful and farmers have modified them, by making them larger and deeper, so that they can be used for multiple purposes. Earlier studies have shown that hapas have a substantial impact on the livelihoods of rural people as well as environmental impacts like soil and moisture conservation of the watershed area. This paper is based on a field study conducted on the beneficiaries (treatment group) and non-beneficiaries (control group) of hapas in three villages of Hirbandh block in Bankura district. The study assesses the present status of the hapas and benefits drawn from the same and finds a somewhat mixed picture of Hapa use. As the hapas have lost some utility due to siltation in their bed thereby reducing water retention capacity, some of the hapa owners have lost much of their interests in using hapas and some become reluctant even to abandon its use, while some hapa owners are still reaping significant benefits from the use of it. The paper strongly suggests that steps need to be taken to urgently renovate the hapas to make them more beneficial to the most marginal farmers owning the same.

Keywords: Hapa, Hapa-owners, Non-hapa owners, Undulating topography, Lateritic soil, Runoff, Retention, Moisture absorption, Treatment group, Control group, Siltation, Soil erosion, Defunct, Cropping intensity, Fallow land, Cultivable land, Crop diversification, Yield, Drudgery, Migration, Ecological benefit, Mono-crop, Multi-crop, Loamy.

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Introduction

Irrigation is the lifeline of agriculture. The western parts of West Bengal, including the district Bankura, lack adequate irrigation facilities as it forms an intermediate tract lying between the rice-producing alluvial plains of Bengal to the east and the Chotonagpur plateau on the west. Agro-ecologically and socio-economically Bankura falls in the most impoverished region in West Bengal. (IAP, 2010). Agriculture in most of Bankura suffer due to undulating topography and lateritic soil conditions with high runoff leading to low water retention and moisture absorption in the soil.

Our study area- Hirbandh block, has only 27 per cent of its cultivable area irrigated principally by surface flow irrigation (HDR, 2007), which is seasonal and unreliable. The impoverished farmers of this block, belonging mostly to the SC-ST communities (both constituting around 54 per cent of the population), survives mainly on paddy cultivation depending on rainfall and some amount of mustard and vegetable cultivation in the rabi season. While area under paddy cultivation in this block is around 8000 hectares, area under mustard and sesame has been 322 and 144 hectares (District Handbook, 2014) showing the extent of dependence on mono-crop of the farmers in this block.

In this context the importance of creation of water harvesting structures, locally known as Hapa, needs to be assessed. The development agency PRADAN with the help of block administration began to implement hapa since 2007-08 that became popular among the small and marginal farmers of this block after initial apprehension of further reduction in their small land-holdings with construction of hapa. Individual Beneficiary Scheme (IBS) was conceptualised to facilitate the construction of Hapa on individual farmers' land and transmitted to the state government. The then secretary of the Panchayat and Rural Development department of West Bengal government personally visited Hirbandh to acquaint with the ground reality and accepted the idea. IBS was included in MGNREGS and the initiative for hapa was launched.

The ideal size of hapa is assumed to be 5% of the land-size of a farmer, but in practice the size varies according to the requirement of the farmer (in our study the length varies from 30-60 ft. and the breadth from 20-50 ft. while the depth varies between 10 to 12 feet). The typical shape of hapa going down almost vertically from the surface (sometimes with a few steps) gives it sufficient water retention capacity in comparison to village tanks that generally have wider open area with lesser depth causing quicker evaporation and the resultant drying up of the tanks long before the summer season.

Field-level researches have earlier observed that the multiple use of water services improve health, free the women in particular from drudgery, increase food intake and income generation considerably, more effectively and sustainably than conventional single-use of water services (Koppen et al, 2009). Previous study reports on hapa found that construction of Hapa had a substantial impact on the livelihood of rural people as well as on environmental aspects like soil and moisture conservation of the watershed area (Jana, 2011, Banerjee 2012).

These earlier studies were undertaken just after the construction of hapas. The relevance of this study is to assess the extent of benefits derived from the hapas after a period post construction of these water harvesting structures.

Objectives of the study

The present study is intended to capture the benefits derived by the beneficiaries of Hapa from its multiple uses, assess the agricultural, economic and ecological impacts of Hapa, and identify the problems presently faced by the farmers in using the hapas. It tries to estimate to the extent possible the benefits derived from the use of Hapas regarding income generation, increase in cropping intensity, diversification of crops, reduction in drudgery of women, livestock rearing and increase in nutritional level. The study also intends to capture the perception of the farmers regarding increase in the groundwater level and soil fertility.

Study methods

For conducting the study three villages of Hirbandh block, namely in the villages of Damodarpur, Biradi and Bamni, were selected. These villages were among the pioneers where a good number of hapas were constructed since 2008.

The study method is principally quantitative and based on structured questionnaires. Two sets of questionnaires are formulated: one set for the beneficiaries of hapa, the treatment group, and the other set for non-beneficiaries, i.e. people not having hapa, the control group. These questionnaires were administered to randomly selected hapa-owners, and non-hapa owners, in these three villages. In total 50 hapa owners and 31 non-hapa owners were interviewed. The following numbers of hapa owners and non-hapa owners from the respective villages were interviewed.

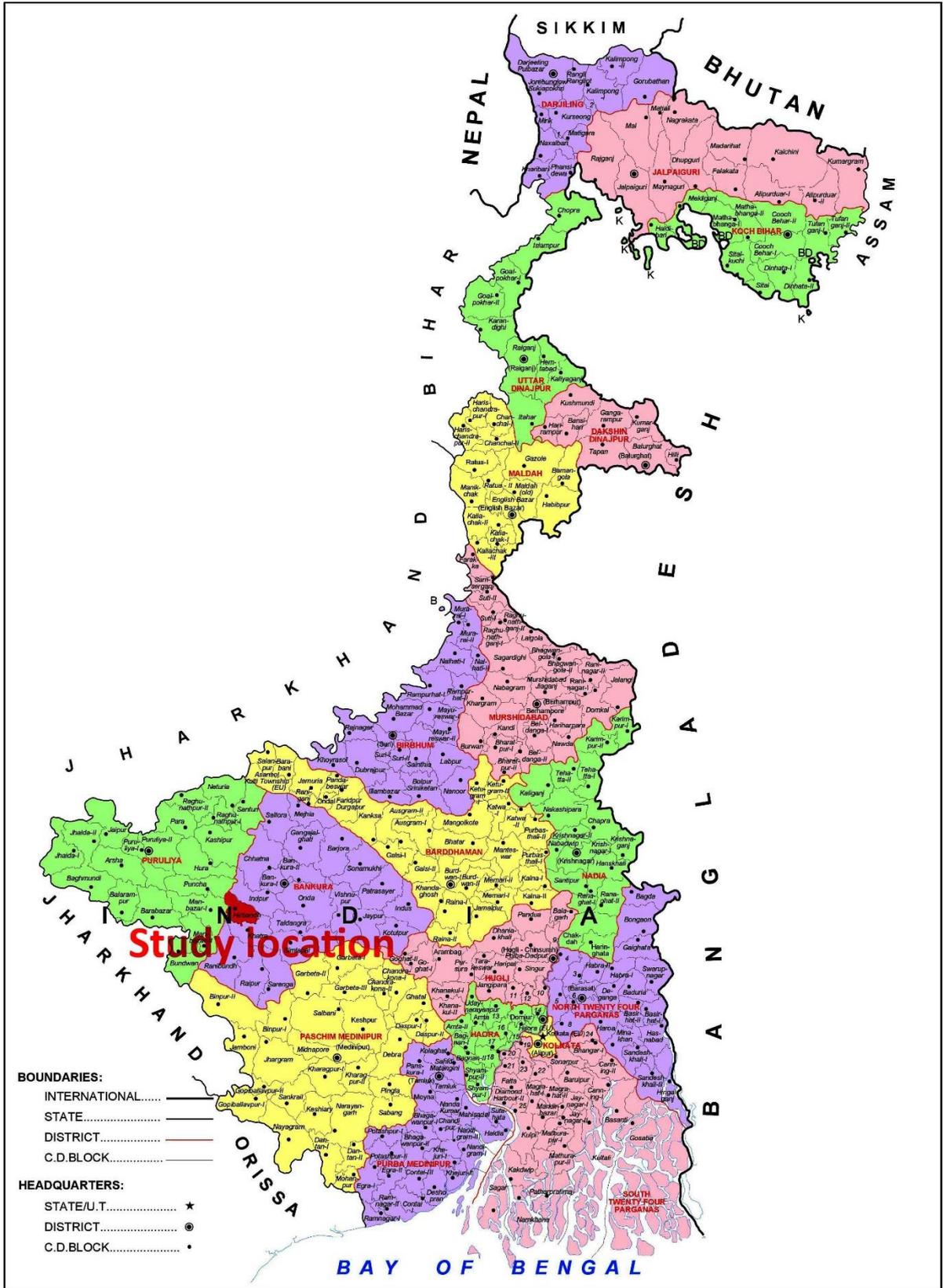
Village name	Hapa owners	Non-hapa owners
Bamni	13	9
Biradi	23	9
Damodarpur	14	13

The questionnaires are designed to have two kinds of comparisons essentially:

- 1) Change in livelihood practices of the hapa-owning farmers by assessing the benefits derived by them in the post-hapa period (after treatment) in comparison to what they used to derive during pre-hapa period (before treatment).
- 2) Comparing the benefits of the hapa owning families derived by using hapa water with that of non-hapa owners cultivating land without a water harvesting structure.

Apart from the primary data collection, government literature and some previous research materials are also studied to gather relevant data and knowledge necessary for our study.

The study area is located in the West Bengal map below.



Findings of the survey:

1) Socio-economic status of the respondents

Now let us summarise the findings of the data collected from individual hapa owners and non-hapa owner-farmers. The caste composition of the respondent farmers shows that most of them belong to the Scheduled Caste, Scheduled Tribe and Other Backward Caste (OBC) communities.

Status of the respondents	Scheduled Caste	Scheduled tribe	OBC	General caste	TOTAL
Hapa-owners	24	16	8	2	50
Non Hapa-owners	24	2	4	1	31

Apart from their caste backwardness, a majority of the respondents, 38 (76%) of the hapa-owners and 24 (77%) of the non-hapa owners, belong to the BPL (below poverty line) group.

2) The conditions of hapas in the study villages

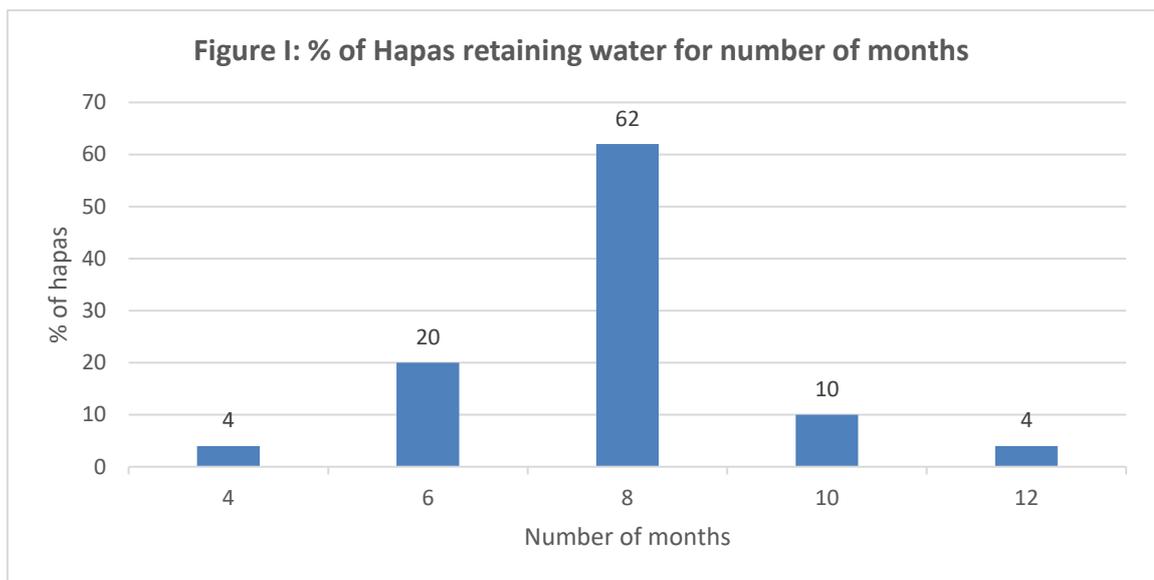
The utility of hapa largely depends on its physical conditions, particularly on its depth that determines its water retention capacity. As the run-off water brings soil with it, the hapas become silted with time. Almost all the hapas in our study villages have been affected by siltation and soil erosion. The table below reveals the general status of the hapas in the respective villages.

	Biradi	Bamni	Damodarpur
Number of households	55	90	32
Number of Total Hapa	76	30	15
Number of defunct hapa	-	-	4
Hapa used for irrigation (number)	76	30	11
Fish cultivation in Hapa (Number)	76	6	7
Average reduction of hapa depth (Feet)	3 to 4	4	1 to 1.5

Two things need to be noticed from the above table. One, the village Biradi (or Biradihi) has more number of hapas than their household number, and two, everywhere the depth of hapas

has reduced considerably. In Biradi, every household has one or more hapas and the farmers here seem to be using hapa water more efficiently and are still enthusiastic in using hapa for growing different kinds of vegetables and thereby earning right amount of profit.

However, the hapa scenario in the other villages appeared not so hopeful since many of the hapa owners of these villages seem to have become disenchanted with the decline in hapa utility. The following chart reveals the percentage of hapas retaining water for number of months.



Nonetheless, our study along with visits to the hapa sites reveals that reduction of depth of the hapas is a real problem, which needs to be addressed at the earliest to keep the hapas functioning and useful.

3) Ownership and locations of the hapas

Among the 50 hapa-owners in our study, 11 are found to possess more than one hapa, mostly in the village Biradi. Benefits derived from all these hapas were taken into account in the present study.

Among all these hapas, 39 were constructed between 2008 and 2010, while the rest were constructed after 2010.

Most of the hapas are located in high or medium high lands that show that the hapa owners in general have selected the land for hapa construction in such a fashion that would ensure the benefit of seepage to the low lands.

4) Pump ownership

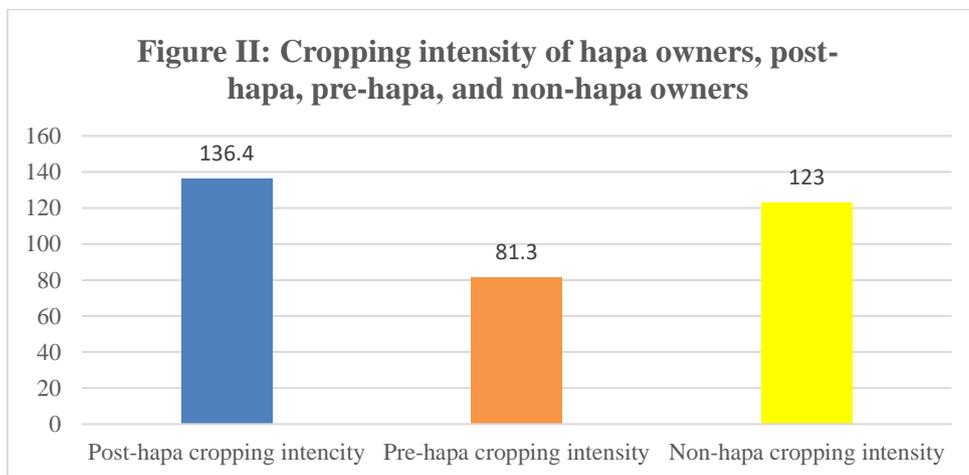
32 of the hapa-owners (64%) use their own pump sets, all run by diesel or kerosene, to lift hapa water, while the rest of them hire pump sets from others. The rent of pump sets varies between Rs.100-120 per hour. That means that 36% of the hapa-owners are still incapable to have a pump-set of their own, the ownership of which would cut down the cost of cultivation. In 2011, more than 60% of the hapa owners lacked ownership of pumps (Banerjee, 2012). The proportion of pump ownership has significantly increased during the last seven years reflecting a kind of capacity development of the hapa owners.

Benefits derived from use of hapa in agriculture

1) Increase in cropping intensity

Average agricultural land possessed by the hapa-owners in our study is 3.76 bigha (1.25 acre). Average cropping intensity for the hapa owners during the last cropping season was 136.4 per cent, while at the pre-hapa stage the same farmers had average cropping intensity of 81.3 per cent only. It shows that in the pre-hapa period, these farmers could not cultivate the whole land even for a single crop. After construction of the hapas, the cropping intensity has increased substantially.

Average land possessed by non-hapa-owners taken for this study is 2.14 bigha (0.71 acre), while their cropping intensity is found to be 123.



2) Conversion of fallow land into cultivable land

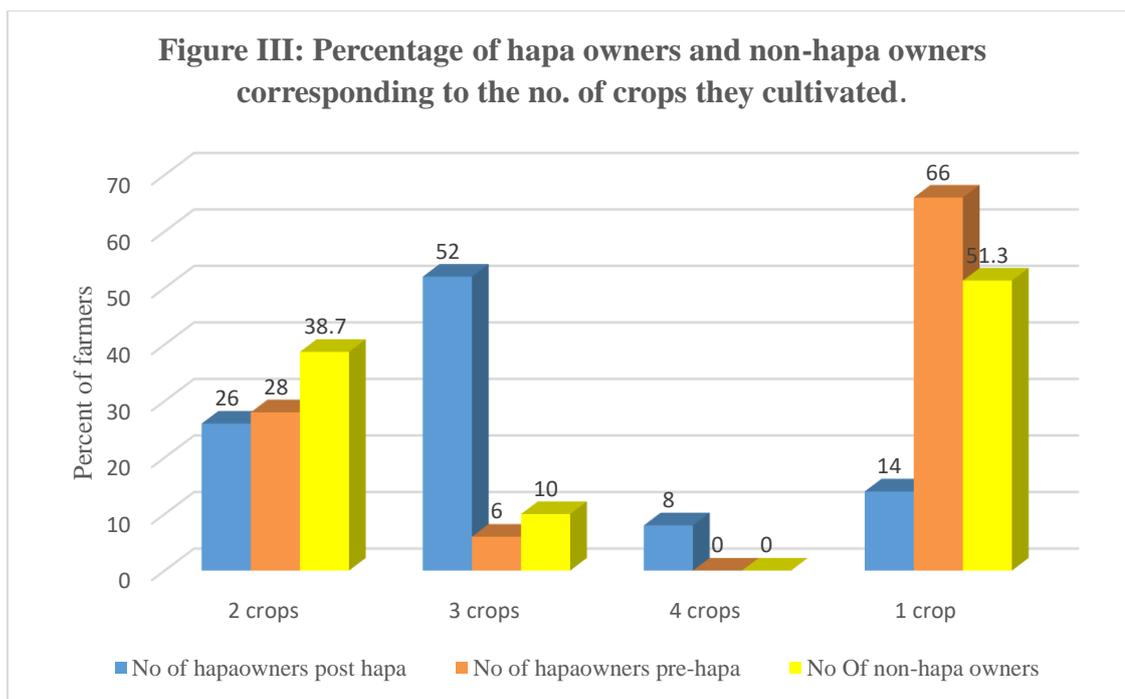
Among the 50 hapa-owners, 26 (52%) have increased their agricultural land on an average by 1.38 bigha (0.46 acre) after the construction of hapa. This increase has been possible by using hapa in two ways: a) by providing irrigation from hapa to plots so far lying fallow; and b) by levelling certain portion of sloppy land with the mud extracted from hapa excavation and making them cultivable. Such levelled land on the bank of the hapa proved to be fertile and particularly suitable for growing different kinds of vegetables, with easy access to irrigation water.

No conversion of fallow land by the non-hapa owners are reported.

3) Crop diversification

During the year 2017-18, out of the 50 hapa owners, 43 (86%) cultivate two or more crops--- among them 13 (26%) cultivate two crops, 26 (52%) cultivate three crops and four farmers (8%) cultivate four crops. Principally maize, mustard and different kinds of vegetables have been added in the cropping pattern in the post-hapa period. In the pre-hapa period, only 14 (28%) farmers among them used to cultivate two or more crops. Among the 31 non-hapa owners respondents, only 12 (38%) cultivate a second crop while only 3 cultivate a third crop.

The following chart shows the number of crops grown by percentage of hapa owners, pre and post-hapa, and the non-hapa owners.



4) Increase in yield

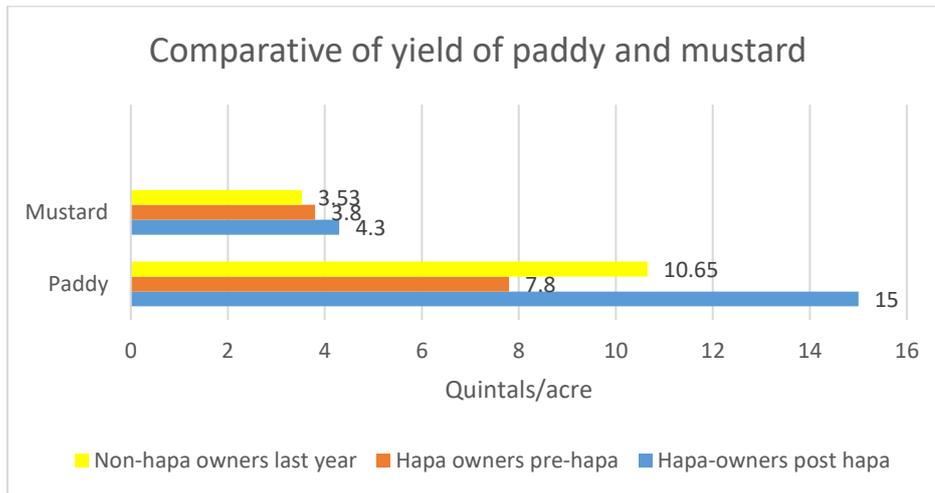
The increase in the yields of major crops cultivated by hapa owners have been significant in the post hapa period. The most common crop of this area, Aman paddy during the last kharif season, has been harvested with an average yield of 15 quintal/acre, which is almost double than the yield of 7.8 quintal/acre received by the same farmers at the pre-hapa period. For the non-hapa owners, paddy yield have been 10.65 quintal/acre in the last year.

The second most important crops are various kinds of vegetables that include cabbage, radish, brinjal, cucumber, pumpkin, ladies finger, tomato and other vegetables apart from potato. This part of Bankura does not belong to the potato belt of Bengal. Among our sample farmers, potato is cultivated by only 6 of the 50 hapa-owners, average yield of which is around 75 quintal/acre. None of the Hapa-owners reported to have cultivated potato in the pre-hapa stage, while only one non-hapa owner cultivated potato last year. So the scope of comparison of yield of potato does not arise.

Yields for other vegetables cannot be compared as the variety is numerous and their yields not comparable with each other. However, mustard is the most commonly produced crop during the rabi season, yield of which is marginally better in the post-hapa period in comparison to pre-hapa period and non-hapa owners. Noticeably, while in the pre-hapa period, the farmers of this area could not produce enough crops to fulfil their family needs

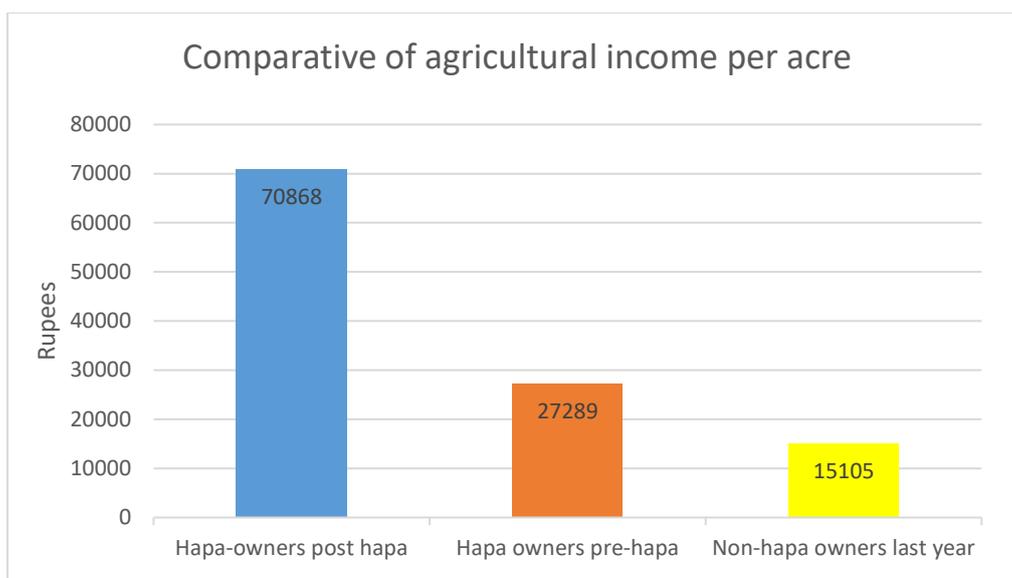
throughout the year, presently many of them are earning right amount of money by selling crops, especially vegetables in the market.

The following chart provides a comparison of yield of paddy and mustard between the hapa-owners, post and pre-treatment and the non-hapa-owners.



5) Significant increase in gross income of the hapa-owners

The construction of hapas has enabled most of the hapa-owning farmers to increase their income from crop production to a great extent. To calculate the benefits derived from crop production amount of crops used for both family consumption and sale in the market have been taken into account and converted to money value. The gross incomes thus calculated by value of all the crops produced during the last cropping year (May 2017- June 2018) reveals that 6 of the hapa owning farmers had incurred loss for various reasons, while the rest 44 farmers had earned an average income of Rs.70,865 per acre. In the pre-hapa period, average income of the same farmers from cultivation, excluding those who incurred loss, had been Rs.27, 289 per acre. The non-hapa owners interviewed in the present study are found to have earned average income of only Rs.15, 105 per acre. The chart below shows the differences of agricultural incomes of hapa-owners, post and pre-hapa periods and non-hapa owners in the last cropping year.



6) Increase in livestock:

Rearing of livestock is a crucial livelihood practice in this region. As found in the study, the amount of livestock has marginally increased for the hapa-owners in comparison to the pre-hapa period. The table below shows the percentage of livestock-owning farmers in different categories and average number of livestock in their households.

Number of livestock	Hapa-owners Pre-hapa		Hapa-owners post-hapa		Non-hapa owners	
	% of farmers	Av. Number	% of farmers	Av. number	% of farmers	Av. Number
Cow	28	3	32	4	35	2
Goat	34	5	50	3	26	3.4
Bullock	56	2	50	2	19	2
Hens & ducks	28	7	50	5	23	8

It is also revealed from the above table that more hapa-owners possess livestock both in comparison to their pre-hapa stage and to the non-hapa owners at present. That more number of hapa-owners possess livestock in the post-hapa period may not be directly related to the existence of hapa, as in most cases water required for the livestock is collected from hand

pumps, which are close to the households and more reliable for water availability throughout the year. Still it might be seen as a sign of their overall economic prosperity that more hapa owners are now rearing livestock. The livestock principally used to supply nutrition to their family members while cash earnings from sale of their products are not significant.

7) Benefit from fish cultivation in hapa

In the 2011 study it was found that all the hapa-owner respondents except one used to cultivate fish in their hapas. Initially, the block office supplied fish-seeds to the hapa-owners. Subsequently, they are investing in fish cultivation, reaping good return from the practice. However, the present conditions of many of the hapas have deteriorated due to reduced depth caused by siltation or soil erosion that results in quick drying of the hapas making many of those unsuitable for fish cultivation. Hence the number of hapas used for fish cultivation has reduced considerably.

In the present study, 58 per cent of the hapa owners reported to have cultivated fish in their hapas and collected on an average 42 kgs of fish in the last year, most of which (33 kgs) were used for family consumption. As most of the hapa-owners did not sell fish during the last year, the benefit could not be estimated in money term.

8) Increase in nutritional level

With substantial increase in crop production supplemented by marginal increase in livestock production and availability of fish for some period, the nutritional level for most of the hapa owners' families has certainly increased. Among the respondent hapa owners, 72 per cent have reported that their food intake has improved in the post-hapa period. The improvement of food intake has been classified as moderate to better by 36%, much improved with added nutrition by 32% and marginal by 4% respondents. Asked about food security gained from use of hapa, 83 per cent of the Hapa-owners responded positively, reporting to have gained on an average nine months' food security.

9) Impact on women members

As the hapas were not renovated since its construction causing reduction in their depth, their capacities to contain water have much reduced as revealed in this study. Hence, in most cases

hapa water is not being used by women for domestic purposes. Only a few women of hapa owning households presently use hapa water for bathing and other domestic uses. As most of the households here do not have toilets inside their house premises and women have to go in the field for defecation, hapa water is used by some, even from non-hapa owner families, for cleaning after toilet. Anyhow, increased income of the hapa-owners in the post-hapa period has had positive impact on the women of hapa-owner families in improving nutritional standard and reducing drudgery in domestic works.

10) Reduction in migration

Seasonal migration in search of work had been rampant before the advent of hapa as farmers used to go in the summer season to agriculturally developed districts of the state to work as agricultural labourers. That kind of migration has considerably reduced in the post hapa period. Presently migration is taking place, but its pattern has changed. Now mainly the youth having some education are migrating to cities and towns for better income facilities. 20 of the respondent hapa owners and ten non-hapa owners said that migration has reduced in their villages. Reduction of such kind of migration that usually happen due to non-availability of work particularly during the summer might be construed as a positive sign.

11) Ecological benefit

Creation of water harvesting structures in large numbers have positive impacts on the ecology of the treated area. Moreover, since these are constructed in such undulating terrain, their importance for ecology becomes all the more critical. Firstly, these structures helped to increase the greenery of the area by enabling the hapa owners to cultivate more crops; secondly, increase discharge of groundwater by water retention in hapas, and thirdly, improve the moisture content in the soil, thereby improving fertility.

Among the hapa owners, 58 per cent have reported about rising groundwater table in the area, while 60 per cent stated their perceptions that fertility in their agricultural fields has improved over the years.

Discussion

The present study reveals that hapas have been beneficial to the farmers in a multiple way, e.g., securing and enhancing agricultural production, transforming mono-crop land to multi-crop land and fallow land to cultivable land and creating new livelihood practice like fishery.

However, much of the utility of hapas in the study area seems to have lost as these hapas were not renovated or de-silted since their construction, leading to much reduction in depth of the same. As a consequence, some of the hapas have been abandoned, while others are working with lesser capacity of water retention.

However, the practice of hapa owners in Biradi village provides the silver lining as they have been known in the whole block for cultivating and supplying excellent quality vegetables round the year. These farmers seem to have learnt to utilise the hapa water in their best interests despite facing the same problems of siltation and earn substantial profits by selling the vegetables and other crops in the market. Moreover, that is why while many hapa owners have lost much enthusiasm over hapa-based cultivation, the Biradi hapa-owners shows that hapas can still be used to bring prosperity to the farmers' households.

The study confirms that cultivation may be more beneficial with the multiple impacts of hapas on agricultural outputs. Income from agricultural production for hapa-owners has significantly enhanced by expansion of the area of cultivation, increase in the cropping intensity and yield of crops and finally by changing the cropping pattern.

So it can be said that introduction of Hapas in this region has changed the basis of cultivation at least to a certain extent from farming for bare subsistence (that too was not fulfilled and people had to migrate to feed their families) to farming for family maintenance combined with producing commercial crops intended for the market. Although the practice of fish cultivation has reduced considerably with reduction in the depth of the hapas, some hapa owners are still cultivating small amounts of fish and being the most relished and nutritious food for the Bengali people and generally out of reach for poorer sections due to high prices, availability of it even for a few months is considered to be of great value and prestige to these people. Further it provides the much-needed nutrition to their families and increases their social standing. The hapa owners cultivating fish relished the fact that they could now entertain their guests by preparing fish dishes caught from their tanks.

With increase in water retention capacity and moisture content, soil in this area have become more agriculture-friendly boosting agricultural production notably in villages like Biradi, where hapas are being used optimally. An earlier study on hapa in the same area observes that the soil in this area has been changing colour (from red to yellow) and turning more loamy (Jana 2011). The far-reaching impact of hapa might be achieved by creating more number of new hapas and re-excavating the old ones, thus turning this drought-prone area

into a vibrant agricultural area that would bring substantial change in the lives of the local people.

Conclusions and way forward

Our study of hapa in the undulated terrain of Bankura district corroborates the effectiveness of the multiple use strategy of water harvesting structures. The hapa-owners in the study area have increased their yield, cropping intensity, number of crops in a year and overall income from cultivation in the post-hapa period in comparison to what they had derived in the pre-hapa period and what the non-hapa-owners are deriving at present. The hapa-owners have also gained in the post-hapa period regarding fostering more livestock, cultivating fish in some cases and thereby getting better food and nutrition and reduction in women's drudgery.

However, the experience of construction of hapas has been mixed in this region. While some of the hapa-owner farmers have turned into entrepreneur farmers, planning and cultivating crops with an eye to the market, a few of them seem to have become reluctant to use hapa water due to deteriorating water retention capacity of the same. Hence, it is strongly suggested that immediate intervention by way of re-excavation of the existing hapas should be undertaken to enhance their water retention capacity that might redeem the hope of greater socio-economic changes by construction of water harvesting structures even on small landholdings.

Farmers in the water-scarce regions with abundance of rain-fall can easily replicate the Hapa model to receive similar benefits. Our study shows that hapas not only bring substantial changes in the livelihood of the hapa-owners, it might also bring changes in their attitude to life.

References:

Banerjee, ParthaSarathi (2012), *Impact Study of Hapa and Its Multiple Uses in Bankura District*, AGWater Solutions Project Case Study, retrieved from <http://awmsolutions.iwmi.org/home-page.aspx>.

B. Van Koppen, S Smits, P Moriarty and F Penning de Vries, M. Mikhail, E. Boelee (2009), *Climbing the Water Ladder: Multiple-use water services for Poverty Reduction*, IRC International Water and Sanitation Centre, The Hague, The Netherlands.

District Statistical Handbook (DSH), Bankura, (2014), Bureau of Applied Economics and Statistics, Govt. of West Bengal.

District Human Development Report (HDR): Bankura (2007), Development and Planning Department, Government of West Bengal, Kolkata.

IAP (Integrated Action Plan), Bankura, Irrigation and Flood Control, (2010), retrieved from bankura.gov.in/Schemes/IAP_Irrigation.pdf.

Jana Sebak Kumar, (2011), *Sustainable Small-scale irrigation experiment in the dry zone: A case study of Hapa model in the state of West Bengal*, retrieved from <https://mpra.ub.uni-muenchen.de/29553>.

Pant Nirajan and R. K. Verma (2010), *Tanks in Eastern India: A Study in Exploration*, IWMI-Tata Research Policy Programme, Hyderabad.