

Traditional water management systems - An overview of *Ahar-pyne* system in South Bihar plains of India and need for its revival

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The traditional water harvesting system that existed decades ago in various Indian states is as relevant today as it was then and perhaps even more. Present day India is no stranger to nature's fury like floods, drought, famine and hurricanes, and it would be well to learn from the old but true wisdom of traditional customs of water harvesting. There is also need to provide qualitative and quantitative irrigation to various agriculture fields to enhance the production of food grains and improve the livelihood of people in India. *Ahar-pyne* system is an indigenous irrigation technology of South Bihar which continues to irrigate substantial areas even today. In the present study, it has been tried to review the present status looking into the Institutional and Management issues, assess the reasons for its decline and explore the possibility of revival of the system in India in convergence with the various Government programmes, funding agencies and the local community.

Keywords: Traditional water management, *Ahar-pyne* system, South Bihar plain

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In recent years, there has been growing attention to local management of common property resources, and recognition of the potential of farmer-managed irrigation systems. Many indigenous irrigation systems provide good examples of farmer management and are therefore, being studied for learning principles of management. Behind the existing indigenous systems of irrigation there are thousands of years of tradition. The development of irrigation systems received a great impetus after the discovery of iron and extensive use of it from around 3000 yrs before present. However, these traditional water management systems are increasingly being replaced by the other faster means of groundwater extraction systems, which are less labour intensive for the farmers in the shorter run. But, if long term sustainability of water as well as providing water at crunch times for irrigation has to be looked upon, the traditional systems do fare better than the so called modern systems.

***Ahar Pyne* - Traditional water harvesting system**

Ahar-pyne system is an indigenous irrigation technology, which continues to irrigate substantial

areas even today in South Bihar plains of India (Fig. 1). This system has evolved from an understanding of the particular agroclimatic conditions of the region. An *Ahar* is rectangular embankment type water harvesting structures, i.e. a catchment basin embanked on three sides, the fourth side being the natural gradient of the land itself. *Ahar* beds were also used to grow a *Rabi* (winter)¹ (Fig. 2) crop after draining out the excess water that remained after *Kharif* (summer) cultivation. *Ahars* differ from the regular tanks in that the bed of an *ahar* is not dug and usual tanks do not have the raised embankment of an *ahar*. While *ahars* irrigating more than 400 ha are not rare, the average area irrigated by an *ahar* during early 20th century was said to be 57 ha². Water supply for an *ahar* comes either from natural drainage after rainfall (rainfed *ahars*) or through *pynes* where

¹Indian sub-continent, which is one of the major irrigated regions of the world, has three major agriculture cropping seasons, namely *Kharif* (June-September), *Rabi* (October-February) and Summer (March-May). But it is very difficult to have a clear cut distinction between *Kharif* and *Rabi* seasons as the *Rabi* sowings of different crops start in the month of September in some areas while it extends upto November ending in some other areas.

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necessary diversion works are carried out. Water for irrigation is drawn out by opening outlets made at different heights in the embankment. *Pyne*s are artificial channels constructed to utilise river water in agricultural fields. It is this system that made paddy cultivation possible in South Bihar, which is otherwise unsuited for this crop. In particular, it helped farmers meet the crucial water requirement for paddy during *hathia*², i.e. the grainfilling stage³.

Overview of the region

On the basis of its physical features, the Bihar state of India can be divided into 3 regions – the North Bihar plains, the South Bihar plains (the area North and South of Ganges, respectively) and the Bihar plateau also known as Chotanagpur plateau. South Bihar is characterized by (a) scanty to medium rainfall; and (b) stiff clayey or highly sandy soils, both of which have very poor water retention capacity are highly retentive of runoff water. This region has a marked slope from South to North towards the Gangetic valley and is comparatively rapid, the average fall North wards being about 1.13-0.76 m/km. that causes rainwater to flow rapidly towards the North, causing floods. All these factors make floodwater harvesting the best option here, to which this system is admirably suited.

The rainfall is conditioned by two constraints. First, there is a shortfall in the rains almost every third year. Second, there is an urgent requirement of water for paddy during the crucial period of *hathia* in case the rain fails. Bounded by the Bihar plateau in the South and the Gangetic valley in the North, a number of rivers debouch from the southern hills and intersect the region as they flow across it from South to North. Since these rivers are rainfed, following the incidence of rainfall in their catchment basins, the rivers swell up into rushing torrents and discharge the rain water very quickly within hours through their sloping beds. As a result, the water is either rapidly carried through the area (in case the soil is stiff clay) or it percolates down through the land (in case the soil is sandy). On casual examination, the area would seem utterly unsuited for rice cultivation, both from the nature of the surface and the comparative scantiness of the

²*Hathia* refers to period of the post monsoon rains (approximately between last week of September and first week of October) when water is absolutely essential to fill out the ripening paddy grain.

rainfall. But both difficulties have been overcome by the ingenuity and industry of its inhabitants, who have devised a system by which the natural drainage is blocked and the water impounded for use and have also brought rivers into their services by diverting the water they bring down.

Present status of *Ahar-Pyne* system

Ahar-pyne system of indigenous irrigation is historically the most important source of irrigation in South Bihar and even today provides a shining example of participatory irrigation management. *Ahars*, with sides that are more than a km long, irrigating more than 400 ha are not rare, though smaller ones are more common. According to O'Malley⁴, this indigenous system is the outcome of the natural conditions and physical configuration of the country, and has been evolved to meet the obstacles which they place in the way of cultivation. Area irrigated by *ahar-pynes* is on the decline, accounting for only about 12% of the total irrigated area in Bihar (Table 1).

Table 1—Area irrigated by *ahar-pyne* system

Year	Area irrigated (mha)	Region covered
1930	0.94	South Bihar
1971	0.64	South Bihar
1976	0.55	South Bihar
1997	0.53	Whole of Bihar

Source: Pant, 2004 (2)

Ahar-pyne system of irrigation was overwhelmingly more important in South Bihar, where it was irrigating about 35% of 2.5 mha of cropped land during the first two decades of twentieth century. Compared to it, the irrigation in North Bihar was a mere 3% of 3 mha cropped area². During this period, of the 0.98 mha area irrigated by *ahar-pyne*, 0.88 mha area was irrigated in South Bihar, while only 0.1 mha was irrigated in North Bihar. The area irrigated by this indigenous source has witnessed a constant decline. The extent of decline can be gauged by the fact from 0.94 mha in 1930s in South Bihar, the area declined to 0.64 mha in 1971 and to 0.55 mha by 1975-76. As per the Government figures, the area irrigated by *ahar-pyne* system in whole of Bihar came down to about 0.53 mha constituting about 12% of all irrigated sources in the year 1997 compared to about 18% in South and North Bihar alone during the first two decades of twentieth century.

Reasons for success of *Ahar-Pyne* system in the past

The major factors that led to the traditional *ahar-pyne* being so much prevalent in the region are furnished below:

1. Fragmented land holdings and equity in water distribution: An interesting pattern noticeable in each of the *ahar-pyne* areas and in general the whole of South Bihar and adjoining areas is that the land holdings of the farmers in general are small, fragmented and scattered. As a result, every landholder in the command of a *pyne* had some land at the head, some in the middle and some at the tail of the irrigation channel. So, all farmers have their plots both in advantageous as well as disadvantageous locations - head, middle and tail. Therefore, to optimize their irrigation, they would have to take active participation in all kinds of situations.

2. Cheap source of irrigation: In the past, *ahar-pyne* used to be the cheapest and easiest source of irrigation in the region which only needed a collective effort from the villagers. In case of *ahar-pyne*, all major repairs are done by the Government and farmers do not have to pay any water charges. Hence, cultivators do not mind working collectively for small maintenance or to meet emergencies like breach in *pyne* or embankment, etc.

3. Uniformity in cropping: All farmers grow the same crop (paddy) all over the irrigation command around the same dates. As a result, agricultural operations undertaken by all cultivators are similar throughout the irrigation command. Since, *ahars* and *pynes* have to be used collectively, all farmers have to synchronize their operations.

4. Collective action: Communal action for irrigation operation and maintenance referred to as *goam* consists of large groups. *Ahar-pynes* have been constructed by the extraordinary concerted effort of the human beings against the oddities of nature. Although in South Bihar also, like rest of India, a rigid caste hierarchy obtains, this does not deter different caste groups, including scheduled castes to come together for a common good and a common concern. All cultivators, who take water from the same *pyne* or the same *ahar*, irrespective of the location of their villages and irrespective of their castes, come together for collective action whenever their irrigation is affected or is likely to be affected.

Institutional and management issues

Such a large system of irrigation which would sometime be spread over many villages could not have existed with a strong institutional mechanisms and proper management. These were:

1. Equity in allocation and distribution of water: *Ahar-pyne* system had well worked-out institutional mechanisms for sharing of water between farmers. Synchronization of the agricultural operations over the year was achieved by earmarking each 14 days period on the lunar cycle for each agricultural operation (Table 2). Buchanan⁵ noted that landlords appointed proper persons to divide the water among the tenantry. According to O'Malley⁴, the *Parabandi* system was used to distribute water among the villages from a common source (usually a *pyne*). *Parabandi* derived from the term *para* (turn) and *bandi* (fixation) meant fixation of turn. Each village had its fixed turns of so many days and hours to avail the water. These turns were assigned by mutual agreements or ancient customs. A detailed register called *lal bahi* (red register) maintained in some systems specified the irrigation rights of each village. The reliability and timeliness of *ahar* irrigation is ensured because water is stored in the reservoir and is utilized when *pynes* do not have any water left and rains are not forthcoming. This is the likely scenario during the *hathia* period, when water is critically needed by paddy².

Equity in water allocation was not a granted right but it was in-built in the system. The total landholding of each individual in a command was highly fragmented. In consequence, every major landholder who could influence the allocation had interests both at the head and the tail regions of the distributary⁷.

Table 2—Timing of agricultural operations in *ahar-pyne* system

Period	Operation
1 June 20 to July 5	Seed bed sowing
2 July 18 to August 15	Transplanting
3 September 12 to September 25	Field water drained out
4 September 26 to October 7	Fields filled again
5 October 8 to October 20	Standing water in fields
6 October 21 to November 3	Field water drained out
7 November 4 to November 15	Harvesting

Source: Aggarwal & Narain, 1997 (6)

2. Community participation and distribution of responsibilities: In the past community participation was extensive in traditional irrigation management. Community labour for repair, called *kudimarammath* in South India and *goam* in Bihar was an established custom. *Ahar-pynes* work, particularly the one relating to maintenance and overseeing of water distribution was looked after by 3 functionaries. These were headman, *Barahill* (supervisor) and *Gudait* (watchman). A unique feature of *ahar-pyne* management system in was that some posts were associated with particular castes. For instance job of the watchman, the drum-call for *goam* (Collective physical action) used to be made by beating of drums and the drum beatings used to be done by *dafalis* ².

3. Repair and maintenance: The repair and upkeep of the most *ahar* and its water conveyance system is of two types. The one involves major repairs and the other deals with the minor routine upkeep to make the system work. The responsibility of *ahar-pyne* construction as well as major repairs was of landlords^{4, 5}. The amount spent by the estate was later realised from the farmers under the *Gilandazi* (improvement of irrigation works). The routine upkeep work involves cleaning and desilting of *ahar* and *pyne* and maintaining the water conveyance network, while the system is in operation. As a result, ordinary maintenance such as the periodic clearance of silt, the repair of small branches of the *ahars* and field channels is done by the cultivators themselves under *goam* system and it starts before the onset of monsoon. Apart from the routine activities, an important task is to keep constant vigil, particularly during monsoon against sudden damage of protective works which may occur due to natural cause or due to man-made reasons.

4. Central control: Steward⁸ and Wittfogel⁹ opine that irrigation management requires a high degree of discipline and that in turn implied central control and an all powerful bureaucracy. In the *ahar-pynes* of South Bihar, it is found that a centralised authority in the form of the landlord played an important role in respect of construction of *ahar-pynes*, their major repairs and allocation of water to different villages.

Reasons for decline

There has been a gradual decline in the area irrigated by the *ahars* because of the following reasons:

1. Abolition of the *Zamindari* system³: One of the reasons cited for the decline of *ahar-pynes* is the abolition of the *Zamindari* system. *Zamindars* (Landlords) regularly organized maintenance and desilting of *ahar-pynes* before independence. Till the abolition of *Zamindari* system the *Zamindars* used to maintain these systems because they had the capital resources and had a vested interest in doing so. Tenants were required to pay *Gilandazi* (improvement of irrigation works) charges. After the *zamindari* abolition there are no regular budgeted funds for the repair of these systems.

2. Development of new irrigation sources: Development of new irrigation sources, notably canals and tube wells leading to easy availability of water made people lose interest in *ahar-pynes*, which needed community effort for upkeep and maintenance. This has been aided by high doses of government subsidies in case of private tube wells. Even in 1970-71, the area irrigated by tube wells in Bihar was about 17%, this reached above 48% in 1994-95 (Government of Bihar^{10, 11}).

3. Lack of convergence between old systems and new schemes: Non-integration of the indigenous systems in the new diversion schemes undertaken by the Irrigation Department was also a major reason for the decline. Converting *pynes* to *toads* (Fig. 4) used by villagers and poor maintenance of old *pynes* (Fig. 5) has led to their decline.

Need for going back to indigenous systems

Even if the area irrigated by traditional methods is on a decline and it has been mostly replaced by various modern techniques of surface and groundwater harvesting systems, it is essential that we revive the old systems. The major reasons for the same are furnished below:

1. Delays in major and medium irrigation projects: Pant¹² reported that the technical evaluation cell of Planning Commission approved 529 projects (106 major and 423 medium) between 1971 and 1981, with an original outlay of Rs.6820 crore. The cost of all these schemes, according to latest estimates, compiled by ministry of irrigation has gone up by a staggering Rs. 3828-10648 crore. This indicated an overall increase of 56.13 % during the last 10 yrs. Statistics also reveal that 60 schemes, including 4 major ones, were completed in 9 states, bringing the success ratio to only 11.34 %. One of the major

reasons for the inadequate growth of the irrigation sector is the long time that it takes to commission major and medium irrigation projects. Instead of pumping in huge amount of money in schemes that are marred by technical, political and social glitches, it is time that we need to look into the already practiced systems at the grassroot level.

2. Easy maintenance, cost and quality: The cost of *ahar-pyne* maintenance is quite low compared to canal maintenance which comes to about Rs. 5000 per ha. In case of *ahar-pyne*, it varies between Rs. 500-1000/ ha, depending on the extent to which *goam* is utilized. Further, the quality of construction is quite good because those who get engaged in the repairs are themselves the beneficiaries. Pant noted that use of *mozar* which is obtained by mixing the wet mud with paddy straw quite effective in the repairs of embankment, including in raising its height².

3. Sustainability in the longer run: The sustainability of *ahar-pyne* system can be judged by the fact that these modes of irrigation are in existence for centuries. All the *ahar-pyne* systems that exist today are at least nearly 100 yrs old. The main reason of the sustainability of these indigenous systems is that the advantages emanating from them are two fold. First, these systems utilize water which otherwise would be wasted. Second, these systems, particularly in the past, saved the plains of South Bihar from the recurrent floods which otherwise would have devastated the countryside regularly. Lastly, if these indigenous systems are properly integrated with the recent canal irrigation schemes, the sustainability of both types of irrigation systems will enhance manifold². There are other systems of providing irrigation used by the local people (Fig. 3), which along with other income generating livelihood activities like lac tree plantation (Fig. 6) along *Ahar* bunds can be a very successful model.

Attempts for revival

Some villages in Bihar have taken up the initiative to rebuild and reuse the system. One such village is Dihra. It is a small village 28 km Southwest of Patna city. In 1995, some village youths realised that they could impound the waters of the Pachuhuan (a seasonal stream passing through the village that falls into the nearby river Punpun) and use its bed as a reservoir to meet the village's irrigation needs. Essentially, this meant creating an *ahar-pyne* system.

After many doubts, the village powers that be gave the go ahead. Money was collected and work began in May 1995. After a month of *shramdaan* (voluntary labour) the villagers completed their work mid-June. Their efforts have borne fruit. By 2000 AD, the *ahar* was irrigating 80 ha of land. The people grow two cereal crops and one crop of vegetables every year. The returns from the sale of what they produce are good and the village is no longer a poor one.

Future strategy

Revival of this traditional irrigation system could be one of the major activities for livelihood security. According to a report by Ministry of Rural development³ revival of this system and ensuring their proper maintenance through community action should be a major plank of watershed projects in South Bihar.

For revival of traditional water harvesting systems, the most critical thing which needs to be done is the integration between new and old schemes. In the decade of 1950's, particularly during the first and the second 5 yrs plans, a number of diversion schemes were undertaken in South Bihar. In most of the cases, the area brought under the command of these schemes had very elaborate system of indigenous irrigation network through *ahars* and *pynes*, particularly in the upper reaches. The planners realizing the valuable contribution of this indigenous system in subsidiary storage and water distribution; dovetailed it in their plan and thereby increased the capability of the run-of-the-river scheme on a rainfed river proposed to serve an area subject to fitful monsoon. They relied on the contribution of the existing *ahars* so much that they planned about two-third of the command was to be irrigated during the critical *hathia* period through the *ahars* which were to be filled up from canal networks by drawing maximum possible water during favourable period of river flow. However, the envisaged integration of *ahar-pynes* with the new schemes could not be done in a large number of cases and this indigenous system was made to languish over time. A recent study shows that the number of *ahars* in the command of Upper Mohar Irrigation Project covering the districts of Gaya and Aurangabad had dwindled to 44 in post project period from 109 in preproject period¹³, consequently affecting the irrigation in an adverse manner. Had due attention been given to proper maintenance of these indigenous systems and integrated management of new canal



Fig. 1-6—1, A large *Ahar* in Patan block of Palamu; 2, *Ahar* bed used for cultivating Rabi crop; 3, Poor maintenance of *Pyne*; 4, An old *Pyne* converted into road; 5, *Lath-Kudi* irrigation system for vegetable cultivation; and 6, Trees on *Ahar* bund

networks and old *ahar-pynes* was devised, all these new diversion schemes would have been grand success stories².

Presently, the possible avenues of repair and revival are: hard manual labour during drought period, NREGA (National Rural Employment Guarantee Act), some relief schemes, food for work programme and also Minor Irrigation department which can spend some planned funds in the name of renovation of these systems.

Knowledge of water management handed over from generation to generation is extensive. One way to use it is to undertake extensive studies by the experts and then reflect it in their works. The other is to channelise it through peoples' participation in the projects themselves¹. Collective action is essential for the repair and maintenance of the system. For that, Olson¹⁴ argues that collective action is likely to be more feasible (I) The smaller the groups, (II) the more homogenous the origin of the group (III), the longer the members of the group have been associated with one another or the group has been in existence, (IV) the closer the social and physical proximity among group members, (V) the more differentiated (in a complementary way) the goals of different

members of subgroups, (VI) the greater the sensitivity of the group to a threatened loss due to inaction and (VII) the more unequal the distribution of wealth and power among members.

Keeping in mind the points discussed above, it is essential that concrete measures are taken at the earliest as the rate at which the traditional systems are declining; it would not be long that they would be left only for academic and historical importance.

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