Traditional Water Management System: A Case Study of *Ahar Pyne* System in Angra Village of Palamu District of Jharkhand

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Abstract

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 wisdom of traditional customs of water harvesting. The traditional irrigation systems developed through indigenous knowledge find the maximum potential to be revived and enhance the irrigation potential. Ahar-Pyne system is one such indigenous irrigation technology of South Bihar and Jharkhand States of India, which continue to irrigate substantial areas even today, but has been in bad shape in recent years due to manifold reasons. In the present study, it has been tried to review the present status of Ahar-pyne by taking example of Angra, a small village in the Palamu district looking into the institutional and management issues attempting to assess the reasons for its decline and explore the possibility of revival of the system.

Key words: *Traditional Water harvesting, Ahar-pyne*

Introduction

Palamu district in Jharkhand state is normally characterised by drought leading to considerable loss of agricultural production and livestock wealth, besides causing misery to people inhabiting the area. Ecological degradation on account of denudation of forests and excessive grazing has resulted in soil erosion and decline in the productivity of the land. Palamu is considered as one of the districts under Drought-Prone Areas Programme (DPAP) launched by the Central Government in 1973-74 to tackle the special problems faced by those fragile areas, which are constantly affected by severe drought conditions. Rainfall in the district is either deficient or unevenly distributed. Palamu gets as much as 1200-1300 mm of rain in normal year but in its worst year (2009) it received around 600 mm[3] of rainfall. Several districts in Jharkhand including Palamu were crippled by drought in 2009 for two consecutive years. In Palamu, the distance between drought and famine or near famine conditions seems to be much shorter. Palamu is the region of enormous

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potential and presently not equipped to conserve the water it receives as compared to the past (Sainath, 1996).

Figure 1: Barka Ahar of Village Angra

Traditional water harvesting systems have met both the domestic and irrigation needs of the people over years. *Ahar-Pyne* is one of such traditional rainwater and floodwater harvesting system, which is indigenous to South-Bihar and parts of Jharkhand. The *Ahar-Pyne* system of irrigation in Bihar was probably in use during the time of the Jatakas (tales of Buddha in his previous birth). In Kautilya's Arthashastra there is a reference to *Ahar* yodaka–setu as a method used for irrigation. Megasthenes, an ancient Greek traveller who visited India during the reign of Chandragupta Maurya (340-293 BC) mentioned the existence of closed canals in Bihar. The concept of Ahar in Palamu was used during the reign of King Medni in the 15th century A.D., then come the Britishers who by their technical and managerial skills strengthened the Ahar-Pyne system of irrigation suiting the physiology and geography of the area. In Palamu, Ahar is not one structure rather it is a channel system. An *Ahar* resembled a rectangular catchment basin with embankments on three sides, the fourth side being the natural gradient of the land itself. *Ahar* beds were also used to grow a Rabi crop (sown in winter and harvested in summer. e.g. wheat) after draining out the excess water that remained after Kharif (sown in monsoon and harvested in autumn. e.g. paddy) 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 ha (Sengupta, 1993; Pant, 2004). Water supply for an *ahar* comes either from natural drainage after rainfall (rainfed *ahars*) or through *pynes* where necessary diversion works are carried out. *Pynes* are artificial channels constructed to utilise river water in agricultural fields. Apart from irrigating agriculture fields, system of *Ahar-Pyne* is used to control torrential floodwater and thus was a tool to mitigate flood. According to O'Malley (1919), 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. However, with the passage of time, the collective institutions of management of the *Ahar-Pyne* system have declined (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)

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 20th century. In Palamu district of Jharkhand, rice cultivation was and is still mainly dependent on small bunds called *Ahars*. The irrigated area varied from less than a hectare up to 40 hectares, depending upon the size of the Ahars (Agarwal & Narain, 1997). These were made by constructing embankments across drainage hollows or across the natural slope of the fields, so as to intercept or impound a stream. They had several outlets called *bhaos,* consisting of cylinders or tubes of baked earth. As a rule, the outlets were kept closed during the rainy season and water thus accumulated in the bed of *Ahar*. The *bhaos* were opened when water was required, for instance, when rains failed in August, when transplantation was in full swing or at the close of monsoon. After the rains and after the irrigation of the paddy was completed, the remaining water left in the bund was drained off and the bed of the reservoir was cultivated with wheat, barley and other winter crops (Singh, 2013).

Irrigation was also done through dug wells at few locations where water table is shallow. Vegetables were grown in small plots adjoining the village homesteads and were watered by permanent wells. For the cultivation of sugarcane, temporary wells were generally used. The water was raised from the wells using a *latha* or lever, a long beam resting on an upright forked post with a *kunri* (bucket) at one end and a stone or a mass of dried mud at the other end. As wells were limited only to small part of the district, artificial irrigation was almost entirely confined to the Ahars and Pynes. The district depended almost entirely on bunds or reservoirs for the success or failure of the winter rice crops. Thus, these water harvesting structures played a crucial role in the economic stability of the district, especially during the years of deficient and unequally distributed rainfall.

Overview of the study area

Palamu district is situated 165 km away from Ranchi, the capital city of Jharkhand State. The district lies within the 23° 50’ and 24° 8’ north latitudes and 83° 55’ and 84°

30' east longitudes covering an area of 4606 sq km. District has a total population of around 15 lakh among which 93% is rural and dispersed in around 2000 villages in 12 Blocks (2001 census).

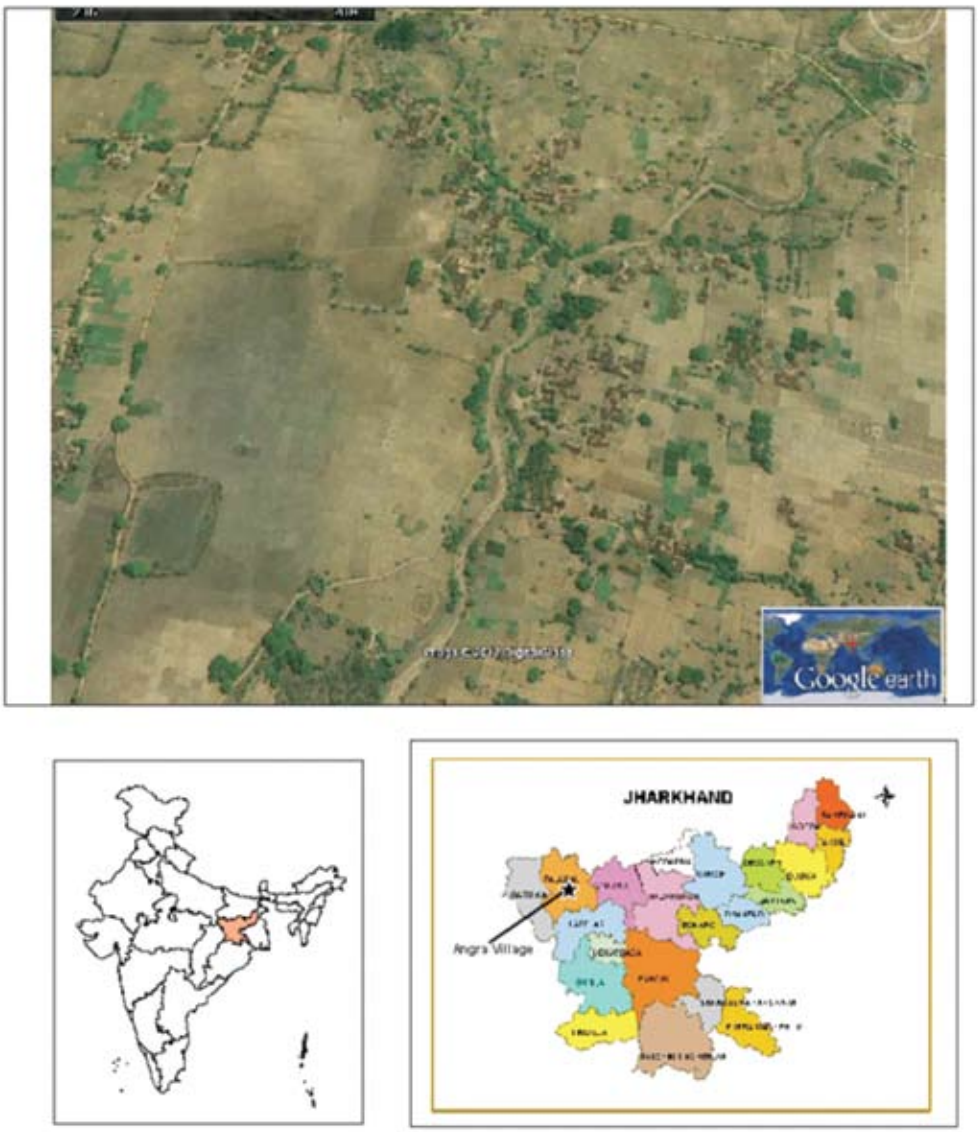

Figure 2: Map showing the study area.

The district has a population density around 240 per sq km (population density in the state is 338 and India 325), which is lower than the state. Palamu district is characterised by a series of parallel ranges of hills through which the Koel river passes. The most valuable arable land in the district is found in the valleys and on the banks of Koel and Son. Otherwise the district consists of hilly broken country covered with low-growth jungle and dissected by deep cuts caused by numerous streams and torrents which dry up in summer and come in spate during the monsoons. Unfortunately, rainfall in the district is either deficient or unfavourably distributed. Hence, agriculture is dependent on artificial irrigation. Both Rabi and Kharif crops suffer due to uncertain rainfall and the rapidity with which water

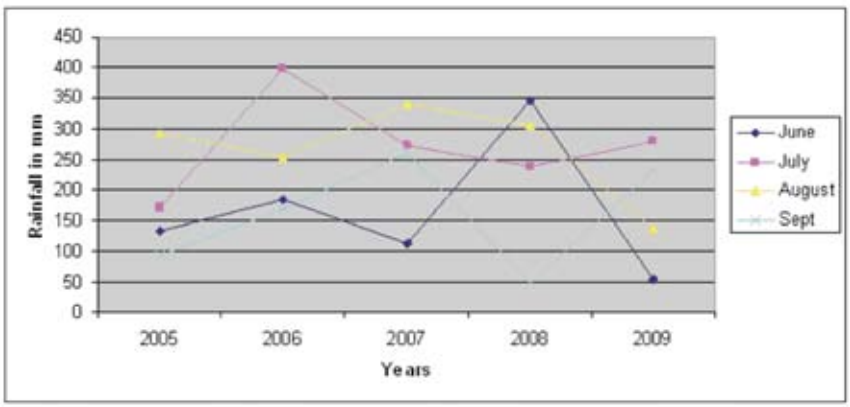

Figure 3: Monsoon rainfall during 2005-09 period (Source: imd.gov.in).

flows down to the main streams. The fate of rice crop is equally precarious, unless a means for storing water to irrigate the fields is devised. The district remained as one of the most backward region of the state and in the country (http://planningcommission.nic.in/reports/publications/tsk_idw.pdf) on around almost all development indicators. It is normally associated with droughts, large SC/ST population, large forest cover and recently increased naxalite activity. Palamu district is characterised by a series of parallel ranges of hills through which the Koel river passes. The rainfall in the district is both erratic and skewed, with annual average rainfall of about 700 mm.

The graph above shows how erratic the rainfall is even within the best four monsoon months. So kharif agriculture also suffers due to erratic rain. Even within a good month of rain, dry spell prolongs for 15 to 20 days which proves very fatal for the standing crops.

Hence agriculture is dependent on secondary sources of irrigation. The government data reveals that 19% of total cultivable land is irrigated but the actual percentage should be well below that according to the local people. Village Angra comes under Patan block, Kishunpur Panchayat of Palamu district which is dominated by tribals mainly belonging to Oraon tribe. Angra is *Khasmahal*[13] village which is endowed with rich forest resources and trees like *Sorea robusta* (Sal), *Madhuca indica* (Mahua), *Butea monosperma* (Palash), are dominant species. Total households in the village are 194, with population of 1033 and are dominated by scheduled tribes (70%) followed by schedule caste (30%). Map showing the study area is given Figure 2.

Research Methodology

Research design selected for the study was exploratory survey and evaluation. Purposive sampling at Ahar level was done and transect walk was done to get the overview and clarity of the structure. At farmer's level, detailed survey was done randomly and sampling size was 10% of the total households. Thus a total of 72 farmers were selected out of 708 for the study. Participatory Rural Appraisal techniques were adopted and mapping was done in order to get a fair idea about the state of the resources, social setup of the villages as well as the location and suitability of the structures. Focused Group Discussion helped to understand the historical perspective of the *Ahar-pynes*, socio-economic status of the farmers and to know from them how the system can be improved.

Research Findings

The total geographical area of this village is 732.90 acres with maximum percentage of upland (65.44%) followed by middle (19.91%) and lowland (14.65%). Once it was bestowed with rich forest resources but with increasing population this natural resource is dwindling very fast. Today forest cover is just 19.9% of the total geographical area.

Table 2: Land Type of Village Angra

Land Type	Area in acre
Total geographical area	732.90
Forest area	145.87
Irrigated land	107.4
Non irrigated	401.47

Major Sources of Livelihood

Agriculture: Angra is a rainfed village where agriculture depends on monsoon. The major Kharif crops of this village are paddy and maize. The average land holding is 3.34 acres per farmer with standard deviation (SD) ± 2.38. The SD is high because most of the respondents were small and marginal farmers. About 49.12% of total cultivable land is under paddy cultivation (this includes irrigated and non-irrigated land both). Maize occupies only 4.91% of the total cultivable land and source of irrigation is monsoon. The average production of paddy is 6.75 q/a and that of maize is 2.40 q/a. Because of lack of irrigation and other facilities like hybrid seeds, manures, new technology etc. the production is low as compared to the national average. Apart from paddy and maize, other crops grown are wheat, barley and *Cajanas cajan* (arhar). The major sources of livelihood of Angra are agriculture followed by labour work. Almost 100% of households practice agriculture in their own land for around four months which is mostly consumed by themselves only.

Labour: Nearly half the village is into non-agriculture labour for about six months in a year, which is just after the harvest of Kharif crops. Average per family income from labour was found to be Rs. 13,425 per annum with SD of Rs. 1153.

Sale of Non-Timber Forest Produce: Apart from agriculture and labour, the other source of income is selling of forest produce like flowers of *Madhuca indica (*Mahua) and leaves of *Diospyros melanoxylon (*Tendu*)*. They depend on these forest products for approximately 45 days. Each household collects around one to two quintals of Mahua. Most of them are consumed by themselves in the form of liquor and left over is sold in the market @ Rs.18/kg. villagers also collect kendu leaves and sell in the market @ Rs.47-50/*sekra* (1 sekra = 100 pola, 1 pola = 50 leaves) they sell around 10-15 sekra of kendu leaves. Some of the households also collect fruit of *Shorea robusta* called *sarai* in local language. They exchange *sarai* with salt. Average annual income from the sale of forest produce was found to be Rs.1090 with SD of Rs.115.

Overall these livelihood sources all together provide only about Rs.10,267/annum for each household. The economy is very poor and households basically have to depend on multiple sources in which agriculture to a large extent takes the primary role.

Migration Status: Inadequate irrigation facilities and limited agronomic inputs have resulted into poor productivity in the area and the agriculture production is mostly of subsistence level. The villagers are forced to migrate outside as there is scarcity of food for nearly half the year. The study shows that at least one member from every household migrates and the duration of migration varies from three to eight months. The general trend observed was that after paddy cultivation in October, villagers migrate in search of labour work. Around 72% of the households

migrate as far as to Punjab, Dihri, Sasaram, Karnataka and Ranchi and remaining 28% remain in the vicinity of the area. Those who migrate outside live very miserable life and are forced to work in hostile condition and earn only on an average Rs.1,800 with SD of Rs. 254.

Village institutions: Except for four Self Help Groups, no village level institution was found to be functioning here. *Van Suraksha Samiti* was formed by the villagers who used to look after the forest, but at present it is dysfunctional.

Sources of irrigation: At present the irrigation facility is inadequate in the village. Due to the lack of irrigation facilities second season crops are grown on very small patch of land and most of the land is left fallow.

Table 2: Irrigation facilities in Angra village

Sources	Numbers	Area irrigated (acres)	Crops grown
Tube wells	9	0	Nil
Dug wells	28	10	Wheat, vegetables
Ahars	5	153	Paddy
Ponds	2	0	Nil
Check dam	1	0	Nil

Among different sources of irrigation maximum area is irrigated by *Ahars* even today. There are nine tube wells in the village out of which three are out of order. The remaining ones are used for drinking water purpose. Most of the dug wells get dry by the end of the winter season. Though there are 28 wells but most of them are *kuchha* wells and in total they irrigate approximately 10.34 acres of land. Government schemes are also visible in the form of two ponds and one check dam but they do not irrigate any land. The State Government has recently built a check dam in the year 2005 under minor irrigation scheme on stream that originates from the Angra Mountain but it has been unable to help in irrigating the land due to technical problems.

Rice cultivation is mainly dependent on *ahars* even today. Since the topography of the region is undulating; *ahars* were made in almost every depression to store the rainwater. The total *Ahars* in village are five but the most important and biggest *Ahar* of this village is *Barka Ahar* (which in local language means big or huge). It is considered as the life line of the village and was built in the year 1912 by the British. It is more or less rectangular in shape facing north-south direction with three sides closed and one side open to receive runoff water. It occupies around 36 acres of land (catchment area) which is 5% of the total geographical area of the village. At

present it irrigates approximately 150 acres of land and if revived it has a potential of irrigating around 412 acres of land approximately. It means that there will be net increase in command area of 262 acres. Along with paddy cultivation, Rabi crops particularly wheat can also be irrigated with the water in the *Ahar*. Its revival will not only benefit farmers of Angra but will also benefit four more villages namely Arredana, Loinga, Sutha and Barwadih respectively.

Reasons for the decline of Ahars

1. Abolition of Zamindari (during the British period all cultivated lands belonged to Zamindars i.e. feudal landlords, who paid a fixed revenue to the British Government. After independence in 1952 this system was abolished and the land was distributed among the erstwhile tenants) system: Though zamindari system was never considered good for common people but its abolition has in real sense affected the ahar-pyne system of irrigation. Zamindars used to collect tax under the name of *Malgujari* which was a type of land excise. Taxes were either collected in the form of money or in the form of produce which was called produce rent according to the local people. If any damage occurred to the structure it was repaired by them from the money which they collected. Farmers were not charged separately for its repair though initial tax was high.
2. Apathy of Government towards *Ahar-pyne* system is the major reason why the old system is dying a silent death. The Government put lot of emphasis upon various irrigation projects in the District with no concrete result. The final nail in the coffin for the *Ahar-pyne* system was the implementation of Jawahar Rozgar Yojana around 1989 in the area where many of the *pynes* and raised embankments were converted to roads.
3. Large scale land encroachment and also selling of plots of lands by Zamindars was a factor for decline of the system. At present we can witness almost all types of constructions and activities on the old *Ahars* and *Pynes*. Converting the reservoir into full-fledged agriculture plots also slowly led to reduction in efficiency of the structure.
4. Siltation of the *Ahars* due to inadequate soil checks has led to decrease in water storage capacity and in some places; the *Ahar* beds are nearly reaching the ground level in absence of any desiltation activity.
5. After the Zamindars stopped having the centralised authority over the management of *Ahar-pynes*, the villagers or other authorities have not taken any

concrete steps for their management. There are no institutional management systems and the people became disinterested towards the traditional system. The farmers do not want to spend time for collective action and are focused on individual plots to benefit their own agricultural fields. Also, gradually they lost interest in agriculture and the current production is mostly subsistence level only. The local contractors and middlemen also discourage the local farmers for doing collective efforts towards repair and maintenance of the system.

Future strategy

This study tried to find alternatives of improving the irrigation status and income of farmers in Palamu and came to the conclusion that it was very critical to work towards revival of traditional *Ahar-pyne* system at the earliest as more delay would lead to a state where revival is impossible. Emphasis has to be laid upon people's participation and farmer-based system where the *Ahars* and *Pynes* would be collectively owned and managed. Study revealed that this was the only way to solve the problem of persistent drought and floods in the area. The following strategy is suggested:

1. Increasing the capacity of *Ahar*: The *Barka Ahar* has the total catchment area of 36 acres and has earthen embankment in three of its sides. The storage capacity can be increased either by deepening the bed or raising the height of the embankment or at times exercising both the options.
2. Desilting and lining the *pyne*: The *pyne* feeding water to the *Barka Ahar* is silted with around two to three feet depth of sand and the side embankments are broken at many sections. This has led to loss of water in the pyne and less storage in the *Ahar*. Desilting the *pyne*, strengthening its embankments and lining it, can feed more water to the *Ahar* and increase its storage.
3. Structural Rehabilitation of Barka *Ahar* for better operation: The *Ahar* has pipe spillway called *kanwa* to drain the surplus water and it goes below the village road. The pipe spillway is to be repaired and on the top of that a wider spillway can be provided for safety of the earthen embankments of the *Ahar*. When the surplus water is less in quantity it can be discharged through the existing pipe spillway and the new one would provide path to the flood water when it is in more quantity. The outlets have become weak and are made up of mud. These can be repaired and replaced to have better utility.
4. Institution Building for Operation, Maintenance of the Structures, Equitable Water Distribution and Agricultural Development: Irrigation through *Ahar pyne* system requires regular maintenance of the structures and every time government or other agencies cannot step in to rehabilitate the structure. So a Water User's Group (WUG) of the farmers to be benefited would be formed for

operation and maintenance of the structure and regulate water distribution in the command area. The systems of the institution should be designed adequately to collect the water charge and effectively take up the maintenance work when required. The WUG would ensure equitable distribution of the water and resolve any conflict arising during shortage of water. With maturity, the WUG can assist in agricultural production and marketing.

5. Collaboration with the Government Schemes: Since revival of Ahar-pyne is basically earthwork it can be dovetailed with Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA). This will also help in getting employments and reducing stressed migration.

Acknowledgement

This research paper is an outcome of M.Phil dissertation from Indian Institute of Forest Management, Bhopal under the guidance of Prof. Amitabh Pandey. The author is thankful to Collectives for Integrated Livelihood Initiatives (CInI) in Jamshedpur (www.cinicell.org) for sponsoring and Sampoorna Gramin Vikas Kendra (SGVK) in Palamau for supporting the research.

References

Agarwal, A, & Narain, S. (1997). *Dying Wisdom: Rise, fall and potential of India's Traditional Water Harvesting Systems*. State of India's Environment a Citizen's Report No.4., Centre for Science and Environment, New Delhi.

Hanumantha Rao Committee Report (1994). Retrieved from http://www.dolr.nic.in/TechCommittee-Report1994/P04-09Ch2_HistoricalBackground.pdf.

O'Malley, L.S.S. (1919). Bengal District Gazetters - Gaya Superintendent, Government Printing, Bihar and Orissa, Calcutta, p.146-147.

Pant, N. (1982). Major and medium irrigation projects: Analysis of cost escalation and delay in completion. *Economic and Political Weekly,* A34-A43.

Pant, N. (2004). Indigenous Irrigation in South Bihar: A Case of Congruence of Boundaries. Retrieved from http://www.indiana.edu/~iascp/Final/pant.pdf.

Report of the Task Force (2003). Identification of districts for wage and self employment programmes, Planning Commission. Retrieved from http://planningcommission.nic.in/reports/publications/tsk_idw.pdf.

Sainath.P, (1996). *Everybody Loves Good Drought: Stories from India's Poorest Districts.* P.367-368. New York: Penguin Books.

Sengupta, N. (1985). Irrigation: Traditional vs. Modern. *Economic and Political Weekly*, *20* (45- 47),1919-1938.

Sengupta, N. (1993). Land records and irrigation rights. In B. N. Yugandhar and K. Gopal Iyer (eds) *Land reforms in India, Volume 1, Bihar-institutional constraints*,. New Delhi: Sage Publications.

Singh, S. (2008). Traditional Water Management System: Study of Ahar Pyne system of Palamu, Jharkhand. Unpublished M Phil Thesis, Indian Institute of Forest Management, Bhopal.