Traditional Water Harvesting Structures and Knowledge Systems for Coping with the Water Situation in Coastal Orissa[1]

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Introduction

The state of Orissa has a coast line of 480 km with the Bay of Bengal. The coastal plains of Orissa suffer perennially from water logging, frequent floods and saline water ingress. The lack of proper irrigation facilities exacerbates the problem. In this context its useful to study the ways by which the farmers of the region have been able adapt to the situation through their traditional water harvesting mechanisms, cropping patterns and knowledge systems and been successful in surviving in this harsh environment. The paper focuses on the coping mechanisms adopted by the farmers of the Kendrapada district which is the worst affected by the ravages of saline ingress, water logging and floods.

Water and Crops

The pattern of water availability is the most significant determinant of the Cropping pattern followed in any given region. The magnitude and seasonality of water availability determine agricultural practices, land use, water management practices and other use of water. In Kendrapada the old management practices for obtaining a degree of control over varying water conditions and local traditional knowledge system to cope with the existing water availability regime have evolved over a long period of time and are still greatly in use. But recently, there is a perceived threat to these traditional mechanisms and knowledge systems. There is a increasing trend towards adoption of alien models of agriculture and water management. Traditional management practices and modes of water harvesting and are gradually being replaced and this process is encouraged and facilitated by the faulty water management initiatives of the state Government. The following discussion is seeks to argue out a case for the maintenance and strengthening of the age old water harvesting practices and knowledge systems that can still provide the most dependable, economical and sustainable management of agriculture in the area.

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[1] *This paper is based on the findings from the research done by Vasundhara in The Kendrapada district of Orissa during August-November 1997. The research work formed part of the National Level Study on "Status of Fresh Water in India" taken up by the World Wide Fund for Nature(WWF)-India. The Research Team included Ms Pritichhanda Mohanty, Sri Ashok Kumar Nayak and Sri Prateep Kumar Nayak*

I. Traditional Water Harvesting Structures and Management Practices

The Overall Water Situation

The study area contains a large number and variety of water bodies. The major water bodies found in the area are rivers, branch rivers, nala or canals, creeks, jores and ponds. There are more than one river or *nala* passing through or along every village. There is a large number of creeks, an essential feature of all mangrove ecosystems, a number of narrow and long water bodies called jores which probably owe their origin to gradual filling up of creek mouths and a profusion of small private ponds. The water bodies affect the lives and livelihoods of the people in various ways. Over the past few centuries people have experimented with a number of water harvesting and management techniques at local level to improve their primarily subsistence oriented agriculture. Over the seasons the area passes through periods of severe floods and water logging, saline water ingress and acute scarcity of freshwater for irrigation and domestic use. The water situations depend on the monsoons, the flow of water in the rivers and the strength & pattern of tidal flows.

Land Varieties

Varying magnitude, seasonality and nature of water availability have led to a multiplicity of land varieties. During the field research in three villages of Kendrapada district it was found that land and agriculture is basically classified on the overall water situation. Four major land varieties (as per local classification) have been recorded in the area, viz., Bheda, Dhoiya, Luna and Madhura land.

Bheda/Bandhua Land (Semi-Water Logged Area)

Bheda/Bandhua lands are separated from the rivers and major surface water bodies by large bunds. They are not directly affected by floods in the rivers. The bunds have sluice gates for irrigating the fields from the rivers / other water bodies during water scarcity and drainage to the rivers / other water bodies during water logging. The possibility of irrigation and draining depend, of course, on the level of water in the river. Water logging takes place due to excess rain and when the river is full it is not possible to drain water in to the river and hence occasionally the Bheda land stays waterlogged.

The entire region is still highly dependent on traditional paddy varieties. Bheda land is no exception. But Bheda land is more suitable for HYV and Hybrid varieties than the other kinds of land. The traditional varieties are of late maturing types which can withstand between 10 to 15 days of water logging. Depending upon availability of water a second crop can also be grown.

Dhoiya/Juaria Land (Water Logging area)

Dhoiya land is situated on the river side and often flooded by river water as it has no protective embankments. This is water logged for long periods and water logging resistant paddy varieties are grown here. Water situation in *Dhoiya* land is mostly dependent on the flow of water in the river and is not much affected by local rainfall as water gets continuously drained through the rivers and canals to the sea. Much damage is, however, caused to the crop when the river is in spate.

Practice of multi-cropping is followed in these land varieties which includes pulses and vegetables. Traditional varieties of paddy with highest water logging resistant value are

cultivated in these lands. Due to prolonged water logging paddy is not transplanted here and sowing/broadcasting is practiced. There are not many paddy varieties which can be cultivated in these lands. *Potia*, one of the traditional varieties of paddy, is used in this land. This paddy has the highest water logging resistant value.

Luna land (Saline land)

Luna is Oriya for salt. Luna land is saline water ingress area. These lands are situated by the rivers and creeks in the salinity or tide prone area and remain flooded by saline water for about 4-6 months in a year, i.e. during the summer. With the onset of monsoon there is movement of fresh water on these lands replacing saline water. The flow of fresh water prepares the land for cultivation and a single crop is possible here.

Salinity resistant paddy is the only crop grown in these lands. Application of chemical fertilizers, pesticides and medicines are not required as it receives enough silt during the flow of fresh water on it. In addition, saline water not only provides nutrients but also enriches the soil to combat pests and diseases.

Madhura Land (Reclaimed Saline Land)

These are lands in the tidal zone but which are not affected by tides due to their physical features. Prior to 1972 most of these lands were saline land. After the construction of the saline embankment the land has changed to non saline rainfed land. During summer these lands mostly remain uncultivated due to water scarcity. A single crop of paddy is possible in these lands. Now that they have become non saline in nature a slight increment in salinity due to chance ingress of saline water renders them uncultivable for 3 to 5 years as there is no suitable crop that can be grown under the changed salinity regime.

TWHS in different Water Situations

Taking into account the seasonality of water availability and flow various water harvesting structures/systems and related management practices have evolved over time. This involves both irrigating the water scarce land and draining the water logged land. Over time people have evolved mechanisms to deal with the diverse situations that result out of the unique environment and number of land categories. The following is a brief discussion on the water harvesting structures evolved by people for various land types and different water situations.

Water Logged Areas (Dhoiya Land)

Jantasaja (traditional water lifting machine)

Jantasaja has a dug canoe like structure and is provided with a lever at the middle. On pressing it down water enters the Jantasaja and on raising it the water flows in the opposite direction. It can be used to irrigate as well as to drain. The Jantasaja is operated manually. *Jantasaja* is very commonly used by all farming households. Each such household has more than two numbers of *Jantasaja*. The number is more in areas of constant water logging.

The area suffers from both water logging as well as water scarcity at different times of the year. *Jantasaja* as a traditional way of water harvesting work effectively in both the situations. Though the most common use of it is to provide irrigation, it is also used to drain water from the water logged areas, especially from agricultural fields. This gets preference over other methods of lifting water because of its suitability to the water situation in the area.

Semi-Water Logged Areas (Bheda Land)

Flow Irrigation

Flow irrigation has been identified as one of the most viable methods of irrigation for the local condition. A network of *nalas* (canals) connect the lands to the rivers and other minor flow sources. This is a common practice in Bheda land or semi-water logged areas where the agricultural land is at a distance from the main water source or are separated from the water sources by large bunds.

When there is a sufficient level of water in the river water flows in to the canals and then to the land with just the opening of the sluice gate at the origin of the canal. When there is less water in the river water is lifted by motor pump in to the canal from where it flows to the fields. Jantasaja is used to bring water to individual fields which do not receive a natural flow of water. People have now started using motor pumps to lift water from the small *nalas* for irrigation purpose. When one field is filled with water a breach is created in the bund to allow water to flow to nearby fields. The *nalas* are not only used for irrigation purposes, but they also work as drainage channels.

Ponds

Every village in the region has at least one village pond (1/2 to 3-4 acres in area). Most village ponds were made before independence when he area was under princely rule. They are still functional and serve as important sources of water. These ponds have huge bunds that restrict the ingress of saline water into it. Apart from the village ponds each household has a pond in its backyard.

Role of domestic ponds

Due to flood and water logging houses are required to be built on raised earthen platforms. Digging a pond in one's backyard provides earth to raise the level of the house building area as well as the backyard. This results in the common pattern of a house by the side of the main village street with a backyard behind it and a pond at the other extreme of the backyard. The typical house distribution in a village is linear, along both sides of a more or less straight main street. Thus the ponds also form a parallel line to the row of houses. Flood water is diverted to the ponds and the bunds are breached to allow free water movement between adjacent ponds. This provides a good drainage channel for flood water and protects the agricultural fields and the houses by slowing down the flow of water. During periods of water scarcity domestic ponds provide irrigation facilities, especially to the fruit and vegetable crops grown in the backyard. Coconut, banana and other fruit trees are grown on the bunds of these ponds. In a situation of regular crop failure the backyard horticulture provides a small but reliable source of income. The ponds also supply a regular supply of fish for domestic consumption and sometimes a small amount for sale as well.

Suggested measures for improving the utility of the ponds

The following measures are suggested by the villagers for revival & improvement of the ponds

- The height of the bunds around them need to be increased and the pond embanked on all sides so that the flow of flood water in to it, which damages the water quality and silts the pond, can be controlled.
- A small sluice gate should be provided in the bund for inflow and drainage of water.
- In the month of *Kartika* (October-November) the water hyacinth in the pond should be cleaned.

- During Asadha (June-July) when fresh water starts flowing, the sluice gate should be opened to get fresh water into the pond along with fishes. After a temporary opening the gate should be closed.
- Regular and timely purification measures, like bleaching and cleaning, should be carried out.

River Lift Point
Lift irrigation from the rivers is a major form of irrigation during water scarcity periods, especially in the summer. Farmers having their land just alongside the river bund directly irrigate their fields from the river. For the rest of the land water from river is first lifted to a storage tank (pond) from where it is supplied through the channels (nala). This method is applied when there is shortage of water in the river and supplying through the sluice is not possible.

Motor Pumps (Personal and hired pumps)
The use of motor pumps for irrigation purposes is not very old in the villages, except for the pumps used by the lift irrigation department. 7-8 years ago people started hiring 3 and 5 hp pumps for irrigation mainly during the Rabi season. Recently people have started purchasing personal pumps.

Lift Irrigation Point
The Government owned Lift Irrigation Corporation of Orissa has set up deep tubewell points at various places in order to provide irrigation. Each such point has an ayacut(command) area of 50 acres and can supply water only to land within this ayacut area.

Saline Water Infested Areas (Luna Land)

Creeks (Jore)
Innumerable creeks run through the area carrying saline water all through the year except rainy season. The creeks facilitate seasonal irrigation during rainy season. Creeks also provide a capture fishery for prawn.

Embankments
Saline water ingress is a common problem for a large amount of land in these areas. In order to safeguard their lands people create small embankments to check saline water ingress. After repeated demands the Government has constructed a 300 sq. km saline embankment in 1971. There are 241 sluice gates to facilitate water movement. The embankments save the land from saline ingress and also regulate the flow of water for irrigation and drainage through the sluice gates.

Traditional Systems vs. new Methods of Water harvesting
The new modes of water harvesting are not completely divorced from the existing modes. The farmers use a mix of old and new methods depending on the water situation. For example, if there is sufficient water in the ponds, nalas etc. Jantasaja is preferred because it provides cheaper irrigation. But when the level of water is low and water has to be lifted from a considerable depth motor pumps are used. This reduces the dependence on external factors that is associated with the use of pumps. On the other hand growing use of pumps is resulting in growing pressure on the existing sources of water. Motor pumps are used to lift water in to the *nalas* (small canals) to facilitate the flow water irrigation in the semi-water logged areas.

The traditional practice of creating embankments and management of creeks in saline ingress zones has ultimately led to the elaborate system of embankments and sluice gates that exist now.

II. Traditional Knowledge System for Coping with the Water Situation

Traditional Agriculture and Paddy Varieties

Agricultural land in the area is under constant threat of flood, water logging and saline ingress. Basing on the type of land different varieties of paddy are cultivated which differ mainly on the basis of their resistance to water logging and salinity.

Duration of maturity and water resistance value of a paddy variety are important factors in determining its suitability to a given type of land. The water resistance value is judged on two parameters, the number of days a variety can withstand constant water logging and the maximum level of water logging it can resist. The first is determined by the hardiness of the plant and the second by its height as well as ability to stay okay under complete submergence.
The local paddy varieties are hardier and taller than HYVs and hybrid varieties. Few of the local varieties, like Potia, can even withstand complete submergence upto one month.

The paddy crop should reach a certain period of maturity by the time water logging starts. Most of the traditional paddy varieties can withstand water logging after they are one month old. Hence sowing and transplantation work is completed one month before the onset of the water logging period. However, most of these varieties can also withstand a lower level of water logging before they are one month old. The maximum height of various paddy varieties ranges between 2.5 to 6 feet. The water resistance value of different traditional paddy varieties varies between 5-7 days before the paddy is one month old and 10-32 days when it is one month to three months old. In contrast, the hybrid varieties record negligible water resistance value and have proved to be thoroughly mismatched to the local water situation.

Use of Green Manure and Crop Rotation

In the water logged areas the practice of leaving the plant residues in the field to rot and to act as manure is very common. The water situation is such that even at the time of harvest the fields are water logged in the Dhoiya areas. Thus, it is not possible to cut the plants at ground level. A s a practice the long height paddy varieties are cut at half of their height. The remnants get decomposed in the field and act as nutrients. Sometimes people use small country boats for harvesting of paddy in a water logged condition.

Rotation of paddy and pulses, mostly black gram, facilitates retention of moisture and nutrients in the soil. Black gram is broadcast at the completion of 5th month of paddy crop, i.e. one month before the harvest.

Taller the plant greater is its water logging resistance value in terms of submergence upto a particular height and number of days. Local agricultural practices include growing tall(upto 6 feet) paddy, that can withstand from 1 to 3 feet of water logging, in comparatively low land. However taller plants also have longer maturity periods. Some of these paddy varieties can be cultivated in extreme low lands which may involve complete submergence for days at a stretch. But in spite of such coping mechanisms changes in the seasonality of water logging

often leads to complete destruction of crops. At times the farmers have to sow repeatedly for a number of times if the first sowing is washed out in the flood water. Due to the same reason, the time for various agricultural operations gets extended which results in less productivity. However, the practice of repeated sowing ensures at least some production in the year. In Dhoiya or Water logged lands people follow the practice of sowing/ broadcasting of paddy and no transplantation. Direct sowing gives lower yields than transplantation but it costs much less and in case of a crop failure due to water logging the farmer does not lose as much as he would have if he had transplanted.

A detailed list of paddy varieties with their major characteristics is given in the Annexure.

Luna (*Saline*) Land and Salinity Resistant Paddy

Agricultural lands bordering the rivers and nalas undergo constant water movement on them. The rivers swell and recede with tides and as a result of the daily tidal inflows from the sea the lands have extreme salinity during the 4-6 months period in a year from late winter till the onset of the monsoons, when the rivers carry little freshwater in them. Due to daily tidal flows the saline lands also face recurrent water logging. As saline lands pose the dual problem of long periods of water logging coupled with saline ingress, the paddy varieties for saline lands
need to be resistant to both salinity as well as water logging. On the other hand due to building of dams in the upper part of the rivers there is often little flow in the river and there is water

With the onset of monsoon fresh water flow in the rivers starts towards mid June. Fresh water movement washes away the extra alkaline and sodium chloride content and deposits silt, thus, prepares the land for cultivation. The more the flow of fresh water during this period the better it is for the land. Therefore, the farmer leaves the land uncultivated till mid of July. After this process is over the agricultural activities start. There is very little possibility of the land being inundated by saline water during rains. However, if such a thing happens there could be no crop produced in that season.

scarcity during the growing period even in the monsoons. Hence the paddy varieties for such lands should also be resistant to significant periods of water scarcity. More than half a dozen varieties possessing the above mentioned qualities have been recorded.

Changes in Saline River and Saline Land Characters in the Recent years

With the construction of dams on the upper reaches of the main rivers and consequent control of the water flow there has been marked changes in the seasonality of salinity levels in the rivers, hence in the general characteristics of the agricultural land and cultivation practices. The examples of Hirakud dam on the Mahanadi and Rengali dam on Brahmani are generally cited by the local people. The Rengali project is much more directly connected with this area because it is built on Brahmani which is the principal river of Kendrapada district with number of tributaries and connects with Hansua river at Rajnagar before draining into the sea.

If there is less water and less current in the river tidal water can travel up the river to a greater distance. This does not happen if there is heavy water flow in the river. With greater water flow during rains the rivers remain fresh. In summer, when there is insufficient water flow, the rivers become saline. After these dams were constructed, especially the Rengali dam on Brahmani in Angul district, water is released from the reservoir during the summer which

maintains the water flow in the river, thus checks the sea water ingress to a great extent. It also provides irrigation opportunity in summer. As a result, since last 3 years people have started cultivating vegetables, pulses, groundnut, mustard etc. in the areas adjacent to the river, including saline lands. However, seasonal saline rivers like Dhamara, Baruni and Kochia flow in the region which result in salinity hazard to agricultural lands.

Drinking Water Situation in the Area

When pond water was the only source of water few people purified the muddy water by adding lime while boiling it. When the water is boiled with lime all the mud and dirt settle at the bottom of the pot. However, the lime-boiled water retained some quantity of lime and this had adverse impact on the health of the people. Hence some people boiled the water without lime. But most of the people used pond water without further purification. During floods problem of drinking water becomes acute. With no other sources of drinking water the villagers even used to collect rain water in containers for drinking purposes. However, in the last decade installation of tubewells has brought marked changes in the drinking water scenario.

Irrespective of their water quality ponds have not lost their significance. Pond water is specifically important as it is used for cooking by majority of people. Pond water is most significantly used in making *pakhala* (slightly fermented water rice)[2] by each household in the village. It has been experienced by women that tubewell water is not suitable for making *pakhala* because it does not help in fermentation of the rice and, at the same time, creates a white layer on the top of the pot. Tubewell water also has a bad taste.

III. Local Practices and Impact on Water Resources

Traditional Methods of cultivation are being replaced by modern techniques along with increased use of Chemical Fertilizers, Pesticides, Medicines in the fields. As a result of this there is now a direct co-relation between the use of these components and the quantum of agricultural produce. But all this has severe adverse impact on the soil and water quality. Recently it is being observed that the unsystematic application of these components in agriculture has seriously affected the entire fresh water resources in the area. Constant water logging expedites the percolation and seepage effect through which the chemical pollutants reach various water sources. In traditional practice saline water treated the land with alkaline and sodium chloride and, subsequent flow of fresh water deposited silt in the field. With no use of any chemical components the entire system of agriculture was successfully managed

Revival of the traditional practices

The paddy varieties, which were traditionally used as most suitable for the local situation, are being replaced by HYV/Hybrid varieties of paddy which are found to be unsuitable and less profitable. In the process, some of the traditional varieties of paddy have become extinct. The traditional varieties came into use because of their suitability to the water logged and saline infested lands. Immediate attention for revival of traditional varieties is needed as the new varieties are a complete mismatch.

[2] *Pakhala* is boiled rice is put in cold water and allowed to ferment in a earthen pot. Rice is added to the fermented water everyday.

by the seasonality of the water in the area. However, in the recent years, the newly adopted practices by the local farmers have been causing serious threat to the water sources.

Use of Chemical Fertilizer

It has been observed by many villagers in the area that there is no systematic application of fertilizers in the field by the farmers. Any Nitrogen based fertilizer follows a three time application pattern. Thus the normal dose would be 15 days after sowing, at half the maturity period of the crop and before the grain sprouts. However, the general and the most usual pattern followed in application of the chemical fertilizers in the area is that the farmers mostly follow an one time application method, i.e. the entire quantum is put at a time. Further to this, the one time application is done just after ploughing - before or after sowing or just after transplantation which differs from case to case. Thus, fertilizer is put at such a time when either there is no plants in the field or the plants are not well rooted to be able to absorb nutrients from the soil.

Use of Pesticides & Insecticides in Agriculture

In the recent years the use of pesticides and insecticides in agriculture has increased manifold. However, the use / application of it suffers from various faults. In an agricultural season, for a particular crop in specific, the application of pesticides needs to be done over a number of times, depending upon the plant type, size and age. The normal application follows a sequence / rotation of low-high-low doses at the sapling-intermediary- cropping stages respectively. But, the general practice in the area indicates that the recommended sequence / rotation of application of pesticides is not often followed. If a high dose of pesticide is applied first at a time when the crop is in seedling or smaller stage then instead of the plant adequately receiving it major portion of it goes underneath the soil thus affecting it and the valuable ground water sources. And, it also gets mixed up with the surface water and causes pollution. Apart from its effect, there is loss of pesticides and medicines in the process and agriculture is affected as the crop does not get them. In many cases, the application is done during the midday as a result of which there is evaporation of these chemicals. Even when the powder and liquid is not properly mixed with water before spraying, a portion of it goes to the soil or destroys the plant because of excessive application in some parts of the field. When pesticides and medicines are applied in a concentrated form it affects the plant by burning the leaves etc..

IV. Conflicts over water and their Management

An effective management system ought to involve a sound conflict resolution mechanism to acquire sustainable character. In the management of a valuable resource like water situations of conflict have become a common phenomena. The local people have developed mechanisms to deal with conflicts in the management of traditional and newly adopted water harvesting systems. However, the success of local resource management practices largely depend on how effective they are at the micro-level resource-user groups level and what contribution they make towards managing their water resources sustainably and profitably.

Situations of Conflict

As far as the quantum of water is concerned the area has no dearth of it. But, availability of water at right time in sufficient quantity and quality becomes a general problem. Water is excess only in terms of flood. Summer is the time of water scarcity if there is not sufficient water in the rivers or canals. It is also the time when people cultivate HYV paddy which

requires timely water supply without which it is spoiled. People generally remain eager to get water because of their heavy investment in the high yielding crops. Thus, conflict for water distribution is a very common phenomena, especially during summer or scarcity periods. The following types of conflicts occur in the village situation :

Conflict between the users of Pump and Jantasaja
The conflict between the farmers who lift water by *Jantasaja* and those who use pumps is very common in the village. This is more common in the summer or scarcity period. The pump can lift more than thrice the water of *Jantasaja*. Thus, the pump users take more water. Water being limited during this period both the users enter into conflicts over the distribution of it. This type of conflict not only occurs in the village but also with the farmers of other villagers who have got land in the same area and vise-versa.

Conflicts over distribution of water from the lift point
Lift Irrigation Corporation has set up a number of river lift points in the area which provides irrigation facilities from the nearby rivers. The ayacut area of each lift point is more than 50 acres. There is varying degree of dependence on the lift point for irrigation mostly during summer. Water is lifted and flown through the *nala* or allowed to pass from one field to the other. During scarcity periods the land owners enter into conflicts over distribution of water from the point. The reason for conflict is stated as the demand to have water first. This creates a lot of conflict with regards to the management of water distribution. For water to irrigate someone's land it has to pass through some body else's land. Therefore consensus is required for effective distribution of the scarce resource. As far as water for irrigation is concerned it follows a typical trend. If it rains or there is sufficient water coming through the rivers and canals then nobody wants it and vise-versa. Therefore, water demand fluctuates between it being everybody's need or nobody's.

Conflicts over water distribution through the Sluice Gate
One of the common features of the area is that it is immediately surrounded with numerous water bodies which includes rivers, branch rivers, nalas etc.. The irrigation system for the Bheda or semi-water logged lands is done through sluice gates. Since the flow of water in the river is dependent on the release of water at the barrage on the upper head, villagers have to do night shift to open the sluice gate whenever water comes in the river. It is not all the beneficiaries who do this shift. However, when there is water coming through the canal they demand to have it first. This ultimately leads to conflict between those who opened the gate and those who did not.

Conflicts over distribution of pond water
Over the years it has been a general practice that, at the time of need, private pond owners would allow other farmers to take water from their ponds. Even water from the village pond is made free when someone's crop is dying without water. Recently, the private pond owners are unwilling to share water from their ponds because the farmer who takes water is not careful about the fishes and the bund. They do not use any sieve or net while diverting water to their ponds. As a result the pond owner loses his fish. Moreover, the farmers do not take proper care while separating the bunds thus affecting vegetable cultivation on the bunds. Consequently, the private pond owners have decided not to share water with others. This decision is creating pressure on the other sources of irrigation, especially lift point and sluice gates thus intensifying the conflicting demands over water.

Conflicts over diversion of water from the main channel

Nalas (canals) of different sizes have been carved out through the agricultural fields in order to facilitate flow water irrigation. The *nalas* pass through the fields of different farmers. With release of water to the canals farmer, through whose field it is laid, divert water without the permission and knowledge of other beneficiaries. As a result, there is shortage of water for the farmers whose lands are towards the end of the canal. Instances of such conflicts are high in the semi-water logged area.

Conflicts during the Saline Flood

During saline floods villagers generally insist that the bunds of both private and village ponds should be opened so that the water flow can be diverted into them. Most of the saline water would then enter into these ponds instead of inundating the agricultural fields and other areas. However, there are objections raised by many private pond owners and they enter into conflicts with the villagers. These conflicts are very rare and occur only when there is saline flood.

Conflict Resolution

Resolution of most conflicts cases is generally achieved through involvement of concerned parties who first try to decide a mutually acceptable distribution pattern. In some cases it is resolved within the beneficiary groups. They select one of them as their leader, who then examines the crop condition of each beneficiary and decides whose crop is in the most needy stage. Accordingly, the decision for each of them is taken. However, occasionally the conflict takes a bigger shape where the involvement of some more leaders from the village becomes necessary. In some other cases of conflict few villagers mediate between the two conflicting parties in order to bring out a solution.

Analysis

Recently the number of conflict cases concerning water is on the increase. One of the major factors is that there has been a manifold addition to the existing traditional water harvesting systems which do not adequately assimilate into the existing ones. Nor do they take adequate care for evolving mechanisms for management of conflicts even though most of these situations arise due to their incongruity with the existing systems of water harvesting. In the traditional modes of water harvesting the major dependence of each farming household was on *Jantasaja* which allowed people to operate independently. However, a whole set of new modes have brought a situation of serious competition in the area. Anyone who uses *Jantasaja* bears the risk of getting less water as compared to one who employs a motor pump. This results in forceful abandonment of the age old practices of water harvesting. The source of water being same differential use of it is not always based on a consensus. At the same time, not all the farmers are capable of using the new modes of water harvesting which are capital intensive. In spite of repeated occurrence of such conflicts no standard mechanism has yet been evolved to manage this. *What is required is not only a numerical increase in water harvesting systems. It is equally important to ensure that the new modes exist in congruence with the traditional practices.*

Conclusion

It is an established fact that over time people have evolved their own mechanisms to deal with diverse situations of water. Modern modes of water harvesting are neither complete substitutes of the traditional system. Nor are they very well suited to the unique land-water situation of the region. At best they can be used to supplement the traditional system. The newly adopted water harvesting systems focus mainly on how to supply (irrigate) water during periods of scarcity. But the farmers have to fall back upon the traditional coping

mechanisms during periods of flood and water logging. New and alien varieties of paddy and new modes of cultivation have been proved to be incompatible to the existing land-water conditions. However, given the impetus provided to the new technologies, and the utter negligence of the traditional ones, by the state Government and modern agricultural experts the old knowledge and practice systems are rapidly falling in to disuse. Traditional water harvesting mechanisms are falling in to disrepair and are not strengthened making them less effective and non-functional. It is time to realize that the revival of the traditional water harvesting structures and management practices would help people to use the available water resources in the most sustainable fashion. Their suitability is based on the fact that these are locally available, based on local technological know-how and cost effective. It is not the use pattern, management practices evolved by the people which are responsible for the undesired change. Rather the non-continuance of the traditional practices has brought about the present state of affair. The coming of the new modes and practices for harvesting water is not negative so long as they coexist with the traditional modes. Once this equation is tampered the balance is lost because In spite of numerous scientific innovations the fact remains that the law of nature cannot be thoroughly altered.