CHAPTER-4

PRESENT SCENARIO OF THE
TRADITIONAL SYSTEMS OF
WATER HARVESTING
CHAPTER 4

PRESENT SCENARIO OF THE TRADITIONAL SYSTEMS OF WATER HARVESTING

Water harvesting in North East India is a century old traditional system which is still in vogue for various cultivation processes and are well synchronised with the environment. Different cultural groups of people under different environmental conditions have developed various agricultural practices which utilize different ecological niches. This study covers three important systems of traditional water harvesting practiced in Ziro valley of Arunachal Pradesh, Kikruma village of Nagaland and in the plains of different parts of Brahmaputra valley of Assam.

4.1. WET RICE CUM FISH CULTIVATION OF ZIRO VALLEY OF ARUNACHAL PRADESH

4.1.1 DESCRIPTION OF THE PROCESS

In this system of farming both rice and fish are cultivated together in the same field. Millets are also cultivated on the bunds. So it is an integrated farming where farmers get triple benefit from a single plot. Integrated rice-fish farming is practiced in many parts of the world which supports a huge portion of rural population in Asia and West Africa. Integrated rice-fish farming is in practice in Bangladesh, Cambodia, China (1.2 million), Egypt (173000 ha), Indonesia (1,38,000 ha), Replubic of Korea, Madagaskar (13,000 ha), Thailand (3 million ha) and Vietnam (40,000 ha) (Halwart, 1998). Though integrated rice cum fish cultivation is practiced in many parts of the world, but these require very high input cost. So it is not a profitable practice. But
Apatanis are the pioneers in this field to make possible the rice cum fish cultivation in a profitable way (Saikia and Das, 2008).

Field preparation starts in the month of January-February with the bund formations and repairing. Once the bunds are formed it sustains for four to five years. But these have to repair annually. They burn the fields after harvesting and dump the kitchen wastes in the field. Wastes from piggeries are also released to the fields. Weeding is started in the month of February. Weeds are dumped in the fields to decompose. Ploughing is not done. So the fields are kept water logged to make the land soft depending on the land. The fields are of three types depending on the water retained capacity—Jebi which is endowed with clayey soil with high water retention capacity than Ditor/Pitang which is sandy (Saikia and Das, 2004). Jebi is kept without water in the fallow period whereas Ditong is kept under water for three months in the fallow period. Miding i.e nurseries are the most fertile land of the threes. In Jebi ie soft field only 'pyapin' is grown and lesser no of fishes are stocked as there is a risk to damage the paddy by the fishes. On the other hand in hard field like Ditor/Pitang two batches of fishes are stocked of which the first batch is stocked in March/April and harvested in June while the second batch of fish is stocked in July and harvested in September. Seedlings are grown in nurseries in February. Paddy varieties are of two types—early and late. Early variety is harvested in July whereas late variety is harvested in October. The fields are levelled in March-April. Healthy seedlings are planted at a distance of 10cm from one another. Weeding is done again in the first half of April. In the second half seedlings are transferred from the nurseries to the field. Fingerlings of size 10-20mm are released to the field in the month of March-April at the rate of 2000 per ha.
Millets are sowed along the sides of the bunds in April- May. Weeding is done for four to five times manually (Plate 4.1-4.12).

Trenches are dug along the fields which are three to four in numbers. The depth of each trench is about one feet depth and of one feet breadth. Each trench is connected with two pipes, one inlet pipe and one outlet pipe. In summer when the water dries in the field then fishes can take shelter in the trenches. No additional foods are added for the fishes. The fishes eat a periphytoplankton that originates in the lower portion of the stems of paddy. Two other phytoplankton lemina minor and azolla are also eaten by the fish. Azolla fixes nitrogen in the field and thus acts as a bio fertilizer. The fishes also feed on the pest like grasshooper and thus act as an excellent controller of the pest. Sometimes cowdung is used at a rate of 1500kg per ha. Bunds in the upper elevations are of the height of 3-4 feet while that in the lower elevation the bunds are of the height of 50 -70 cm. Water intakes in the upper elevations is low and hence the terraces are connected with bamboo pipes of low circumferences like 15-20 cm while intake of water in the lower elevation is high and hence are connected with pipes of large circumferences made of pine tree. Fields are of size varies from 250- 2900 sq.m in size. Inlet pipes are fitted above 20-25 cm above the ground. To prevent soil erosion bio-fencing is done with bamboo and woods of Pine and Castanopsis tree. Weeding of Houtyonia cordata is not done as it has the soil binding capacity and thus stabilizes the bunds (Dollo, 2008 ). First fish harvesting is done in the month of June when the fishes attain a size of 100-250gm. Second harvesting is done in August and final harvesting is done in the month of September when the fishes attain the weight of up to 1kg. Bunds are wider in the upper elevation while that of lower elevation are narrower. At the time of harvesting of fishes outlet pipes are opened so that water from the fields are
completely drained out and then the fishes can be caught easily. The Apatanis wet rice cum fish cultivation is presented in Fig 4.1.

4.1.2 WATER MANAGEMENT

Streams from the mountains are diverted to a large main canal using pine logs. This primary channel is divided into a numbers of secondary and tertiary channels so that every field gets the water supply. Every plot is provided with inlet-outlet pipes made of bamboo and are called hubur. The trenches of the fields are perpendicular to each other and connected with inlet-outlet pipes. The bottom outlets are for complete dewatering which is done at the time of fish harvesting. The top outlets are for levelling the water in the plots. The distribution system is supervised by a farmer community called Bogo agoh. The outlets are guarded by split bamboo network to prevent escape of fishes from one plot to another. Violation of any rule of distribution of water is punished by an institution called Buliyang. Every year the main canal is repaired by the people by providing labour and thus the system is community oriented. Stream water leaches decomposed forest products to the fields and thus adds humus to the soil. All the outlets finally drain out to the river Kille which flows through the heart of the valley.

4.1.3 VARIETIES OF CROPS AND FISHES

Apatanis use local variety of paddy, millets and fishes for cultivation. The paddy and millet varieties are early and late varieties. Early varieties are harvested in the month of June-July and late varieties are harvested in September-October. The
Common carp fish species is used for fish cultivation. Varieties of crops are shown in table 4.1


Fig 4.1 Pictorial presentation of structure of Apatani’s wet paddy field
Table 4.1 Variety of paddy and millets cultivated in Ziro valley

<table>
<thead>
<tr>
<th>Paddy Type</th>
<th>Variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emo</td>
<td></td>
</tr>
<tr>
<td>1. Empo RA</td>
<td>Early variety</td>
</tr>
<tr>
<td>2. Elang</td>
<td>Late variety</td>
</tr>
<tr>
<td>3. Empo hatte</td>
<td>Late variety</td>
</tr>
<tr>
<td>4. Radhe emo</td>
<td>Late variety</td>
</tr>
<tr>
<td>Mipya</td>
<td></td>
</tr>
<tr>
<td>1. Pyat mipya</td>
<td>Early variety</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Millet type</th>
<th>Variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Supru latta</td>
<td>Late variety</td>
</tr>
<tr>
<td>2. Supru ahar</td>
<td>Early variety</td>
</tr>
</tbody>
</table>

Varieties of fishes are as follows—

Tali ngiyi (Channa sp) and Aji ngiyi (Punitus sp) are naturally available in the field. Other varieties stocked are aji ngiyi i.e Common carp viz *Cyprinus carpio*, *Cyprinus carpio* var. *communis* (Scale carp), *Cyprinus carpio* var. *specularis* (Mirror carp), *Cyprinus carpio* var. *nudus* (Leather carp) and *Ctenopharyngodon idella* (grass carp).

Fishes are distributed by the fish farms at Tarin established in the year 1983-84 which covers an area of 7 ha of which water body covers an area of 3 ha. There are different ponds in the fish farm for rearing of fishes for different stages. Ponds are nursery pond, rearing pond and stocking pond. Fingerlings from these ponds are distributed among the farmers at a rate of 50 paisa per fingerling. Mustard oil cake and rice polishes are provided as food for fishes in the fish farm. About 300-350 kg of fishes are produced by...
the farmers in wet rice cum fish cultivation per ha per year and rice is produced at a rate of 3-4 ton per ha per year. Fish seed distributed by the Government fish farm in the last few years are shown in table 4.2

Table 4.2 Year and no. of fingerlings distributed in Ziro valley

<table>
<thead>
<tr>
<th>Year</th>
<th>No of fingerling</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011-12</td>
<td>8,10,867</td>
</tr>
<tr>
<td>2012-13</td>
<td>5,10,000</td>
</tr>
<tr>
<td>2013-14</td>
<td>5,58,900</td>
</tr>
</tbody>
</table>

The Apatanis rice cum fish cultivation system was first introduced by a fishery officer in the year 1965 in about 23 plots on an experiment basis. At that time the area was 10 acre and the production of fish was 150kg per ha per year. At present time integrated fish farming covers an area of about 497 ha and the production of fish is 300-350 kg per ha per year. About 22 million fish seeds are required to meet the demand of farmers. But the fish seed production rate is still low. If the required amount of fish seed is supplied by the Government then Ziro valley can create blue revolution in Arunachal Pradesh.

4.1.4 MAINTENANCE OF SOIL FERTILITY

Apatanis do not use any chemical fertilizers and pesticides for wet rice cum fish cultivation. After harvesting they burn the paddy fields so that the ashes can mix in the soil. Till the next cultivation after harvesting, they dump the kitchen wastes in the field and allowed to decompose. Weeding is done manually four to five times per season and the weeds are also dumped in the field to decompose. Various phytoplanktons like
aulosoria, anabaena etc are present in the wet paddy fields that can fix nitrogen in the soil. Sometimes cowdung is used at the rate of 1000kg/ha. Waste materials from piggery are also released to the field which is not only an organic manure but also an excellent food for fishes. The movement of fishes helps the aeration of the soil and also helps the roots to absorb more nutrients. Decomposed organic material increases the nutrient and improves the biological activity of the soil. It provides a supplemental amount of slow release nutrients and helps to balance the soil p$^H$.

### 4.1.5 ECONOMIC FEASIBILITY OF WET RICE CUM FISH CULTIVATION

The economic feasibility of integrated paddy cum fish cultivation in Ziro valley is discussed in table 4.3 on the basis of a case study for one hectare sample area.

Table 4.3 ECONOMIC FEASIBILITY FOR ONE HECTARE AREA OF PADDY FIELD OF ZIRO VALLEY FOR INTEGRATED FISH CULTURE:

1 ha= 10,000 sq. m

<table>
<thead>
<tr>
<th>INVESTMENT</th>
<th>RATE</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. FIXED CAPITAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earthen work for development of paddy plot</td>
<td>Rs 8/sq m</td>
<td>Rs 80,000</td>
</tr>
<tr>
<td>(Raising and widening of dykes, excavation of pits, loosening and levelling of soil, provision for hubur with bamboofencing etc)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **B. RECURRING COST** |      |        |
| a. Cultivation of paddy | Rs 200/labor | Rs 15,000 |
| (From sowing to harvesting including labor) |      |        |
| b. Cultivation of fish |      |        |
i. Cost of fish seeds Rs 1/fingerling for 4000 fingerling Rs 4000

ii. Packaging charge of fish seeds including the container Rs 45/tin for 30 tins Rs 1350

c. Cultivation of millet Rs 4000

(From sowing to harvesting)

C. MISCELLANEOUS COST

Including transport etc Rs 5,600

Total annual cost = A + B + C = Rs (80,000+15,000+4000+1350+4,000+5,600) = Rs 1,09,950

Contd.

2. INCOME

a. Sale of 4 ton of rice @ Rs 22/ kg Rs 88,000

b. Sale of minimum 500 kg of fish @ Rs 150/kg Rs 75,000

c. Sale of 2 q of millet @ Rs 20 / kg Rs 4,000

Total income a+ b+ c = Rs (88,000+75,000 + 4,000) = Rs 1, 67, 000

Net profit in the first year= Total income – Total cost = Rs 1, 67, 000 – 1, 09, 950

= Rs 57,050

Net profit in the second year= Total income-Recurring expenditure (as no fixed capital)

=Rs 1, 67, 000- 15,000+4000+1350+4,000+5,600

= Rs 1, 67, 000- Rs 29, 950

= Rs 1, 64, 050

Source (Angkita and Goswami, 2015)
In the second year, profit increases due to absence of fixed capital. Of the total capital a large portion is spent in the bund preparation. So once the bunds are prepared it sustains for four to five years and thus in the second year costing is reduced. Recurring expenditure includes labour charge, fingerlings costing and packaging charge. No expenditure on fertilizers, pesticides and herbicides. Use of locally available material also reduces extra burden of cost. Through this integrated farming the farmers get more profit simultaneously than mono culture of rice.

4.1.6 ROLE IN POVERTY ALLEVIATION

Pisciculture plays an important role in rural economy. Integrated paddy cum fish cultivation is very beneficial for the farmers as it reduces the burden of fertilizers, pesticides and weedicides. Also the productivity in this integrated farming is higher than monoculture. The fish species common carp can sustain both in low and high temperature. China, where rice fish production have moved from very low levels in the early 1980s, has reached over 1.2 million ha in recent years only through integrating fish polyculture with poultry, livestock as the integrated use of manure, grass and other crop as natural feed and fertilizer (Saikia and Das, 2008). The Apatani Plateau is one of the fertile areas in Arunachal Pradesh from where rice production was estimated as 4000kg per ha per year (Annon., 2006). Though Apatanis are practicing integrated paddy cum fish cultivation in a profitable way but the income received by farmers in Apatani plateau is still low (Saikia and Das, 2004). Economic subsidy in the form of bank loan with low rate of interest and other incentives and judicious mixture of modern technology with traditional knowledge can boost the production to a large extent.
Plate 4.1 TRENCHES IN PADDY FIELD OF ZIRO VALLEY OF ARUNACHAL PRADESH

Plate 4.2 CLOSE VIEW OF A TRENCH FILLED WITH PHYTOPLANKTONS
Plate 4.3: DYKES IN THE APATANI FIELD OF ZIRO VALLEY OF ARUNACHAL PRADESH

Plate 4.4: WEEDING IN THE PADDY FIELD OF ZIRO VALLEY OF ARUNACHAL PRADESH
Plate 4.5: SECONDARY WATER CANAL IN PADDY FIELD OF ZIRO VALLEY

Plate 4.6: THE GOVT FISH FARM AT TARIN IN ZIRO, ARUNACHAL PRADESH
Plate 4.7: NURSERY POND AT THE TARIN FISH FARM, ZIRO, ARUNACHAL PRADESH

Plate 4.8: A NURSERY OF A PADDY FIELD OF ZIRO VALLEY, ARUNACHAL PRADESH
Plate 4.9: TRANSPANTATION FROM NURSERY TO THE PADDY FIELD IN ZIRO

Plate 4.10: BAMBOO FENCING TO PREVENT SOIL EROSION IN ZIRO, ARUNACHAL PRADESH
Plate 4.11: A LOCAL DEVICE OF AGRICULTURE IN ZIRO VALLEY, ARUNACHAL PRADESH

Plate 4.12: SEEDS OF MYPIA IN ZIRO VALLEY, ARUNACHAL PRADESH
4.2 ZABO CULTIVATION OF KIKRUMA VILLAGE OF NAGALAND

4.2.1 DESCRIPTION OF THE PROCESS

The village Kikruma is located at the hill top where except rain water no other source of water is available for irrigation. All the streams lie below the level of the village and hence the villagers evolved the system of harvesting rain water which is in vogue since the time of their ancestors. Initially the system of harvesting water was called ‘Ruza’ system but latter it is named as ‘Zabo’. Zabo means impounding of rain water in ponds in Chakhesang dialect and according to the name of these ponds the system of cultivation is called ‘Zabo’. Zabo is a complete package of forestey, agriculture, horticulture, animal husbandry and well management of soil and water resources. The Chakhesang people have evolved this system so skilfully that even modern technology seems to have no match for it (Sharma and Sharma, 2003). As zabo cultivation controls soil erosion, maintains soil fertility and manages water and land resources, it is a feasible practice for management of natural resources and maintenance of ecological balance.

Forest land

The forest of the hill top is conserved which acts as a catchment area to receive rainfall. The slope of the area is hundred percent. Soil erosion does not take place as the area is covered with vegetation. The pictorial representation of the zabo cultivation is shown in Fig 4.2.
Desiltation tank

Water harvesting ponds are of two types – siltation tank and main storage tank. The siltation tanks are dug in the forest area to retain silts. Water enters in these tanks before entering the main storage tank. All these are earthen tanks. The main storage tank is called ‘Zabo’ the average size of which is 25mx10mx10m. The sides are plastered with mud and chopped paddy straw and the bottom of the tanks are rammed and compacted to avoid water loss due to seepage (Sharma and Sharma, 2003). Water from the pond is carried either through the open channels or through the bamboo pipes.

Cattle enclosures

Cattle enclosures are located below the water harvesting ponds and made with woods and bamboo. Generally buffaloes and pigs are kept in these individual enclosures on rotation basis. About 30-40 animals are kept per enclosure for ten to fifteen days. Then these are shifted to another enclosure. Water from the storage tanks when flows through these enclosures wash away the urine and dung to the paddy fields located in the lower elevations. This serves as good manure for the crops.
Paddy fields

In Zabo cultivation paddy fields are located in the lower elevations so that water from the storage tanks flowing through the enclosures reaches the paddy fields due to natural slope of the area. The plots vary in size from .5 ha to 1.5 ha. Normally 10 to 15 cm depth of water is maintained in the field. Seedlings are transplanted in June and July at about 10cmx10cmx15cm spacing (Singh et al, 2013). During normal monsoon sufficient water is available in the paddy fields. But in poor monsoon irrigation is supplied from the zabo. Water depth maintained in the field is about 15cm. No chemical fertilizers and pesticides are added to the field. Indigenous variety of paddy is
cultivated. Fishes are also reared with paddy. A large pit is dug at the centre for shelter of fishes. Fish variety is mainly common carp. Other local varieties are also cultivated. Production of rice is about 3-4 ton per ha whereas production of fish is about 70-80kg per ha. Fingerlings are released in the paddy fields after transplantation of rice seedlings. The fish and paddy are harvested in September-October. At that time water is drained out from the terraces. Different snaps of field structure of Kikruma is shown in Plate 4.13-4.22

4.2.2 Variety of rice and fish

Local variety of rice is used for zabo cultivation. Local varieties are – Thiivuri, Chide tanyi, Kiimonyo, Ribolii, Tanye kimiga, Tanyi kimere, Zecho munyo, Nyodo and Nyogo. Of these Tanyekimiga is cultivated mostly which is a late variety. Common carp variety of fish is cultivated with the paddy. Local fish variety includes Fukha, Thugo, Tumphrefu, Mude and Fupru.

4.2.3 Water management in Kikruma

Harvested water is shared between different families through mutual understanding. An earthen channel is dug along the slope of the hills and the channel is compacted with stones to prevent gully erosion. Several parallel gradual contour trenches are constructed in series on both sides of the channel that collect runoff water from the catchment area and drain into the irrigation channel that again carries the water to zabo (NEPED and IIRR, 1999). Silt retention tanks are dug at several points before the runoff enters the zabo so that the silts can accumulate in these tanks. Silt retention tanks are cleaned annually. In poor monsoon period when water is required in the field then water is released from the Zabo by cutting a small hole in the bund. When the need is fulfilled,
the opening is again plugged with soil so that water can accumulate in it. A pond of 3m x 2m x 2m size is able to irrigate terraces that yield 600kg of rice (Ibid, 1999). Zabo also acts as a source of drinking water for domestic animals. Water harvesting ponds dries up in March-April month and at that time these ponds are repaired. The accumulated organic materials are dumped in the paddy field which acts as fertilizer. Even the NH 150 is also used as catchment area and the speed breakers on the road divert the runoff water to the water channels. The channels that carry the water from zabo to the field are compacted by hammering its base so that water leakage is avoided.

4.2.4 Maintenance of fertility of soil and horticultural practices

The water carries the waste materials from the animal enclosures to the paddy field. Also the leaves and branches of Alder tree are added to the field to decompose. Alder tree is planted along the side of the fields. The roots of Alder tree can fix nitrogen in the soil. Nitrogen fixation takes place by a fungus Actinomycetes of the genus Frankia. Symbiotic Frankia are located in nodules along the root system of Alder tree. The amount of nitrogen fixation varies between 48.3 kg / ha to 184.8 kg / ha. Besides N₂ fixation, the added litter also provide P, K, Ca and other nutrients to the soil (Sharma and Singh, 1994). Deep root system of Alder plant stabilizes landslide area. It can grow very fast even in low fertile area. Leaf and twigs of Alder tree may produce 3-6 tonnes litter per ha annually that contain nitrogen- 3.4-3.7gm, phosphorous- 0.08-0.1 gm and calcium of 0.2 gm per 100 gm dry matter (ICAR, 2013). Chakhesangs have been using this agro forestry since last few decades. On the other hand the de silted materials from the water harvesting ponds are dumped in the fields which add humus to the soil. No inorganic fertilizers are used. Thus the farming is totally organic.
Horticulture

Vegetables like squash, pumpkin, cucumber, tomatoes, citrus, chillies, maize, beans, pea, garlic, potato, ginger, colocassia, tapioca, chowchow, turmeric, tree tomato, leafy vegetables, cowpea, arhar and nagadal etc are cultivated on the bank of the ponds and also just below the animal enclosures. The required water is taken from the ponds. The water that flows through the animal enclosures carries the necessary nutrient both to the vegetables and to the paddy. The average production of vegetables is about 500-600 kg per ha.

The zabo cultivation is a combination of forestry at the hill top, animal husbandry in the middle elevations, horticulture on the bunds and paddy cum fish culture in the lower elevations. It is a well based conservation system to control soil erosion and maintain soil fertility. As it controls soil erosion it is an effective method to control flood. Due to its role in management of natural resources and maintenance of ecological balance, this century old system is still sustaining today.
Plate 4.13: TERRACE CULTIVATION IN KIKRUMA, NAGALAND

Plate 4.14: ZABO CULTIVATION IN KIKRUMA OF NAGALAND
Plate 4.15: A ZABO IN KIKRUMA VILLAGE, NAGALAND

Plate 4.16: PADDY FIELD OF ZABO CULTIVATION IN KIKRUMA VILLAGE OF NAGALAND
Plate 4.17: AN OUTLET OF A PADDY FIELD IN KIKRUMA, NAGALAND

Plate 4.18: A CATTLE ENCLOSURE IN KIKRUMA, NAGALAND
Plate 4.19: A SPAD USED IN ZABO CULTIVATION IN KIKRUMA

Plate 4.20: A LOCAL DEVICE USED FOR AGRICULTURE IN KIKRUMA, NAGALAND
Plate 4.21: PHUZUTU WILDLIFE SANCTUARY IN KIKRUMA, NAGALAND

Plate 4.22: HORTICULTURE PRACTICE IN KIKRUMA, NAGALAND
4.3 DONG PRACTICES IN THE PLAINS OF ASSAM

4.3.1 DESCRIPTION OF THE PROCESS

Dongs are water channels that carry water to the paddy field either from the streams or by diverting water from the river. These are man made structures to divert water from local water resources like small rivers, perennial swamps, lakes, streams etc. On an average dongs can have a breadth of 7-15 feet which gradually increases over the course of its flow from the source till the feeding point. Dongs generally dry out at the end of its course or merge in large river or beels. Generally the length of the dongs is 2-5 km. The longest dong is reported to be of 10 km. On the other hand ‘Jamphoi’ are small canals of 2-5 feet breadth or more which carry water from dongs to the field. Jumphois are dug along the length of the embankments to carry water to the paddy field.

This century old system was evolved by the indigenous people of Assam for irrigation purposes. The dong irrigation system is traditionally prevalent among the Bodo people in Assam and North Bengal to make provision of irrigation for paddy cultivation. These systems were evolved to solve the problem of water scarcity as a result of poor rainfall, higher altitude or soil with low water holding capacity. The significance of dong irrigation is the sustainable use of available surface water resources, community involvement and regulation by traditional community based norms. Dong water is used not only for irrigating the paddy fields but also for other day to day activity. The word ‘dong’ has its origin in Bodo language though it is also called ‘dwaisa’ in bodo language. The exact time of origin of dong can not be ascertained. But some of the dongs of Kokrajhar district are in vogue since the time of British regime. Two of such dongs are Phatakata and Bailari in the district of Kokrajhar which are in operation for hundred years. The rivers and streams that originate in the hills of Bhutan
are the sources of dongs of Kokrajhar, Baksa and Nalbari districts. Besides, perennial lakes, swamps and springs also serve as sources of dongs of these regions. At present, Kokrajhar has the highest numbers of functioning dongs of all the districts of BTAD. A rough estimation shows that cultivation in 60%-70% of the total geographic area of the district is irrigated by dongs.

Water in the field is accumulated in a pond like structure from where water is lifted and taken into the necessary portion by an instrument called “lahoni”. Another structure called “koon” is also used to harvest water from pond to the field. Koon is a wooden boat like structure handled with leg. With the help of Koon about 25L of water is harvested per time. This is sufficient to irrigate a plot of land of 4-5 beegha in one day. With Lahoni about 10L of water can be harvested per time and a plot of 2 beegha can be irrigated in a day. Traditionally an earthen bund made of bamboo is put at the source of the dong and at different interval across the length of the dong to maintain the desired level of water. During rainy season the bunds are cut at some places to control the flow of water depending on the intensity of the flow. The bunds are usually constructed at the point of diversion of water between two or three villages. If the source of the dong is a river, then the outlet of the dong is curved out at 90° to 60° to the main course of the river. Most of the dongs are perennial. Some of the existing dongs are Bordong, Salana dong, Lungsoom dong of Dimoria block, Suti doisa, Nepalpara to Narabari doisa, Jumfoi-Bima dong, Jorakia-Buri dong, Kungreb doisa of Kokrajhar district, Ohopa –oronga dong, Polashguri dong, bhopara dong of Baksa district etc. Most of the villages through which these dongs are passing are populated with SC, ST, ex tea garden labours and also general caste people. Though the dong irrigation system originated in Bodo populated area, people of all caste use dong
irrigation in their cultivation at present. In some villages like Guwabari of Baksa district, the dong 'Akhal donga Barnadi Aranga Asoma' is not only the source of irrigation for the cultivation but also for all the day to day activities. A minimum fare is donated to the dong committee for membership. The dong committee decide the distribution of water and ascertain that every household receives irrigation. The sources of this dong are one lake and one river. The lake is located in the North East side of the village named Okaldonga. Another source of the dong is river Barnadi. The village Guwabari is the gift of this dong. The people of this village work hard to maintain the flow of the dong. But sometimes their hard works go wastage due to another problem called 'man-elephant conflict'. The elephants from the Bhutan hills use this village as corridor and destroy all the paddy fields. So the livelihood of the people of this village is very tough. Photographic representation of tools used in dong irrigation is presented in Plates 4.23 and 4.24.
Plate 4.23: A LAHONI USED IN DONG IRRIGATION IN DIMORIA, KAMRUP

Plate 4.24: A FARMER HARVESTING WATER WITH KOON IN KHETRI, KAMRUP
4.3.2 Some of the dongs, modified by the Department of Irrigation of Government, Assam are as described below-

1. Salana and Bordong –

Salana dong irrigation canal is located at village Salana about 45 km away from the Guwahati city. Both Bordong and Salana dong are perennial streams and originated from the hill known as Dhoimara. Though the streams are perennial, the discharge is very scanty in winter season ie about 2 cusec in Salana dong and about 10 cusecs approximately in Bordong. So a submerged weir is constructed across the Bordong to feed 7 cusec water to Salana dong through a feeder channel constructed parallel to NH - 37. Design discharge of Head work for Salana is 200 cusec. Reservoir level of Head work is 54.95 m. Net irrigated area of Salana dong is 348 ha and that for Bordong is 175 ha. These dongs provide irrigation for cultivation of kharif crops like Regular Ahu, Jute and Sali paddy.

2. Khoirani irrigation canal -

The Khoirani irrigation scheme is located at village Chowki under Baganpara development block in the district of Baksa. The head work is proposed to be constructed over river Pagladiya which is a perennial river originating from the Royal hills of Bhutan. The dong of this scheme is known as Jopa dong which provides irrigation in many villages like Nayabasti, Chaulkara, Sundaripara, Milanpur, Jopa, Digpur etc. The villagers belong to S.C and S.T community for whom cultivation is the main source of livelihood. It was very difficult for the villagers to divert the water because in monsoon when the discharge increases, the earthen dams made by the villagers breach. So the irrigation department has constructed the Head work at Chowki where the two rivers
Pagla and Diya have united to form Pagladiya. Design discharge of jopa dong is 650 cumec. Net irrigated area is about 1950ha. Crops cultivated are Ahu(local), Sali (H.Y.V), Ahu regular, oil seeds and pulses.

3. Alengmari flow irrigation scheme

The flow irrigation canal is located at village Alengmari which is situated under Dotoma block in Kokrajhar district. The Head work is constructed across a perennial river called Jorakia- Buridong. The hard working villagers irrigate their fields by providing an obstruction by means of tree branches, bushes and bamboo every year as their collective efforts go in vain as flood washes away the obstruction. Villagers like Alengmari, Sonapur, Umanagar, North sanyasipara etc will get benefit from this project. Discharge at the head work site is 60 cumec. Lean period discharge is 3.28 cumec. Minimum discharge observed during lean period in case of deficit rainfall is 2.25 cumec. Net irrigated area is 350 ha. Name of the crops irrigated are Kharif—traditional Sali, Rabi—oil seeds, sugarcane, pulses, tobacco etc. Pre kharif—regular Ahu, Bao paddy and jute.

4. Sahjharang flow irrigation scheme

The river Sahjharang is the source of irrigation for Sahjharang dong. The villagers from the villages like Taraibari, Shyamthaibari, Dwigwdai and Hunturpara get irrigation from this dong. The maximum discharge of the river at head work site is 204 cumec and lean period discharge is 5.66 cumecs. The maximum required discharge for both the head regulator is only 2.68 cumec. Hence the irrigation is possible throughout the whole year.
Net irrigated area is 565 ha. Crops cultivated are - Kharif - traditional Sali, Rabi - oilseeds, sugarcane, pulses, tobacco, pre kharif - regular Ahu, Bao paddy, and Jute.

5. Suti doisa flow irrigation

The river Suti doisa is a perennial river located at Hegurmari near Shyamthaibari in Chirang district. The beneficiaries belong to the villages like Hegurmari, Pratgaon, southMojabari, Jolaibari, Deolguri, Nimagaon, Chotapathar gaon etc. Th maximum flood discharge is 80 cumec which allow providing a total length of 35 m of the head work. Net irrigated area is 300 ha. Cultivated crops are Kharif - traditional Sali, Rabi - oil seeds, pulses, pre kharif - regular Ahu and Jute.

6. Jumfoi - bima flow irrigation

Jumfoi - bima is a perennial stream located at Kokrajhar district. The Head work of the stream is situated at village Batabari. The stream carries maximum flood discharge of 20 cumec and a lean period discharge of about 2 cumec. As the river carries sufficient water throughout the whole year hence it can provide irrigation water for both Rabi and Kharif crops. The beneficiaries belong to five villages namely Batari, Bonshigaon, Sikargaon, Bhalukmari, and Anthibil. Net irrigated area is 220 ha. Crops irrigated are - Kharif - Ahu, Rabi - oil seeds, pulses, pre kharif - regular Ahu, Jute.

7. Naturbil flow irrigation canal

Naturbill is a perennial stream that flows through the villages Sialmari no 1, Sialmari no 2, Lungsung and Baladonga. The people living in the command area are mostly economically backward and Naturbill is a blessing to them. Naturbill carries maximum flood discharge of 19 cumec and a lean period discharge of about 2.09 cumec. Due to its sufficient discharge Naturbill can provide irrigation both for Rabi and Kharif crops.

8. Nepalpara to Narabari canal

The head work of Nepalpara to Narabari canal system is situated at village Hazarika at about 4 km. towards North of Serfanguri under Dotoma development block in Kokrajhar district. The poor cultivators of about six villages who are solely dependent on cultivation constructed this canal by their own effort. They used to harvest rain water by constructing a pond at the northern side of the village Hazarika and the rain water so accumulated is distributed to the vast agricultural area of the six villages. But after heavy rainfall a huge runoff enters the canal and breach it. Hence the irrigation department has constructed a head regulator to regulate the discharge entering into the canal along with necessary guide and afflux bund as well as to improve the canal system so that uninterrupted supply of irrigation water can be maintained during kharif crops. The discharge of the canal is 2.37cumec in the lean period. Net irrigated area is 200 ha.

The dongs described above are natural streams that are used traditionally by the villagers for seasonal cultivation. Villagers made the earthen bunds to divert the water to the paddy fields. But these bunds breach every year due to high monsoonal discharge. The Irrigation Department of Government have constructed the Head work of diversion and now the villagers are relieved from this problem. The distribution of water is supervised by the local dong committee. Photographic representation of selected dongs is shown in Plates 4.25 &4.26.
Plate 4.25: A DONG IN BAKSA DISTRICT OF ASSAM

Plate 4.26: A DONG IN BAGAMATI, BAKSA DISTRICT, ASSAM
Gramya Vikash Mancha is an NGO based at Nalbari working on rural development since the year 2011. Gvm is working mainly on rejuvenation of dongs in Kamrup, Baksa and Nalbari district. In the western side of Assam the indigenous people have been using the dongs for irrigation purposes since the time immemorial. These dongs are the gifts of nature to these people as in some of the places no other source of irrigation is there. The villages like Guwabari, Bagarisuti, Mahendranagar etc are situated on the bank of a dong called ‘Akhaldonga- Barnadi- Aranga- Asoma’dong’ which supply water to these villages for all kinds of activities. Local dong committees supervise the supply of water. The dong committees are composed of representatives of each of the benefitted villages. The people pay Rs 10-20 per household to the dong committee. When necessity arises all beneficiaries work for the dongs. Thus the dongs are community oriented and labour intensive. There are ‘constitutions’ for each dong committee where rules and regulations to supply dong water are described in written. Violation of these norms leads to social and monetary punishment. So everyone is bound to abide by the rules and regulations of dong committees.

GVM has implemented a number of projects funded by Jamsedji Tata Trust. Some of the activities of GVM on dongs during 2013-14 are as follows-

- Total 95.3 kms of natural water bodies have been restored through cleaning and dredging work by community. The restoration work has benefitted total 12,296 farmers and fisherman families and 27,812 Bigha (9,029.87 Acre) of agricultural land.
Total 3599.5 person days contributed (In amount Rs. 5, 47,124.00) by the community by doing shramdaan in almost each and every restoration work implemented. This is achieved by community mobilization and through community decision prior to the restoration work of the water bodies where the Canal management committees, Dong Bund Committees, Village Dev. Committees or other village level community institutions, farmers clubs have taken a responsive role.

Approximately a total of 16,283 bigha (5286.68 acre) of agricultural land covering 2255 household of 28 villages have benefited by the construction of the Irrigation Based Structures (4 Nos.) and Earthen Krishi Bund (5 Nos.). Total 2170 person days will be saved every year by the completion of the Irrigation Based Structures which otherwise would have been consumed in repairing and construction of kutcha bund during the cultivation time of the farmers.

Another major work initiated is the formation of the Central Canal Management Committee of Ghogra Jan (Canal) by nominating members from each of the Branch Canal Management Committees formed in the villages linked to Ghogra Jaan.

The project is presently undertaken in different areas of Nalbari, Kamrup (Rural) and Baksa districts of Assam. The entire area of Uttar Kamrup is situated in the northern
plains of the Brahmaputra Valley. A numbers of tributaries of mighty river Brahmaputra pass through the area. Besides these main tributaries, there are large networks of natural canal, creeks and wetlands. The natural canals and creeks are locally known as jan, dong suti and dwara and wetlands are known as beels. Almost all farmers and fisherman of both the districts are solely dependent upon these natural networks of water bodies. Most of these water bodies are originated in neighbouring country of Bhutan and merged into river Brahmaputra through its tributaries. These networks of water bodies have been used as the main source for irrigation, drinking water and natural fishing by local community since time immemorial. Thus, each canal, creek or wetlands of these areas have direct or indirect relation with life and livelihood of common people. These wetlands can be termed as the lifeline of the people of the region. But unfortunately, the entire system has been obliterated due to several causes as a result of which another set of social problems are emerged. Consequently, life and livelihood of people mainly from the backward communities has been affected and is now under threats. There is an immediate need to reverse the situation. To address such issues, GVM appealed at Jamsedji Tata Trust for support to implement the project entitled “Promotion of Diversion Based Irrigation in Baska and Nalbari districts of Assam” and it was subsequently approved.

The project is implemented in eight clusters each cluster carrying about 20-25 villages. Of these clusters, four clusters are located in Nalbari district, two in Baksia district and two in Kamrup district. Details of jans/ dongs in Nalbari, Baksia and Kamrup districts are shown in table 4.4, table 4.5 and table 4.6.
<table>
<thead>
<tr>
<th>Sl</th>
<th>Name of canal/ creek</th>
<th>Block</th>
<th>Revenue circle</th>
<th>Approximate Length(Km)</th>
<th>Starting From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Garakhiya jan</td>
<td>1. Pachim Nalbari and 2. Barkshetri</td>
<td>Nalbari</td>
<td>15 Km</td>
<td>Jagara Village, Saul Khowa River</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Beldow Jan</td>
<td>1. Pachim Nalbari and 2. Barkshetri</td>
<td>Nalbari</td>
<td>20 Km</td>
<td>Village Kakaya, Baira reserve</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Simalua Jan</td>
<td>Barbhag</td>
<td>Barbhag</td>
<td>2.5 Km</td>
<td>Barbukia, Barsimalua</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Jaha jan</td>
<td>Pub Nalbari development block</td>
<td>Nalbari</td>
<td>22 Km</td>
<td>Khudra Sankara, Makal doba wetland, Deharkalakuchi</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Dokoha Jan</td>
<td>Barbhag</td>
<td>Barbhag</td>
<td>1.5 KM</td>
<td>Dokoda Milan Lp school, Silarjor</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Bala Jan</td>
<td>Barbhag</td>
<td>Barbhag</td>
<td>2 Km</td>
<td>Bala, Kowarpur</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Sijuajan</td>
<td>Barbhag</td>
<td>Barbhag</td>
<td>1.5 Km</td>
<td>Sijuw wetlad, Satha channel</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ghograjan</td>
<td>Barigog Barbhag and Barbhag</td>
<td>Ghograp ar and Barbhag</td>
<td>65 Km</td>
<td>Nagrijuli, Dokoha</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Maranadi</td>
<td>Pub Nalbari, Barbhag and Barigog Barbhag</td>
<td>Barbhag, Ghograp ar and Nalbari</td>
<td>40 Km</td>
<td>Village Nilpur, Khudrakulhati</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Ahta Bakribakuchi</td>
<td>Pachim Nalbari</td>
<td>Pachim Nalbari</td>
<td>28 KM</td>
<td>Kumarakata, Banmaja</td>
<td></td>
</tr>
</tbody>
</table>
### Table 4.5 Dongs in Baksa district of Assam

<table>
<thead>
<tr>
<th>SI</th>
<th>Name of canal/creek</th>
<th>Block</th>
<th>Revenue circle</th>
<th>Approximately Length(Km)</th>
<th>Starting From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Balakata dong</td>
<td>Baska</td>
<td>Baska</td>
<td>10 Km</td>
<td>Bhutan</td>
<td>Diring river</td>
</tr>
<tr>
<td>2</td>
<td>Trisankar</td>
<td>Baska</td>
<td>Baska</td>
<td>10 Km</td>
<td>Bhutan</td>
<td>Diring river</td>
</tr>
<tr>
<td>3</td>
<td>Amarpur</td>
<td>Baska</td>
<td>Baska</td>
<td>15 Km</td>
<td>Bhutan</td>
<td>Diring river</td>
</tr>
<tr>
<td>4</td>
<td>Ghoga Dong</td>
<td>Tamulpur</td>
<td>Tamulpur</td>
<td>10 Km</td>
<td>Dighe-lipar</td>
<td></td>
</tr>
</tbody>
</table>

Source: GYM, 2013

### Table 4.6 Dongs of Kamrup district of Assam

<table>
<thead>
<tr>
<th>SI</th>
<th>Name of canal/creek</th>
<th>Block</th>
<th>Revenue circle</th>
<th>Approximately Length(Km)</th>
<th>Starting From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Raharpar</td>
<td>Hajo</td>
<td>Hajo</td>
<td>7</td>
<td>Dakshin-sinra</td>
<td>Akadi</td>
</tr>
<tr>
<td>2</td>
<td>Bhairatola</td>
<td>Rangia</td>
<td>Rangia</td>
<td>11</td>
<td>Dobak</td>
<td>Chanmaguri</td>
</tr>
<tr>
<td>3</td>
<td>Dimu-Japia</td>
<td>Rangia, Hajo</td>
<td>Rangia, Hajo</td>
<td>13</td>
<td>No.1 Dimu</td>
<td>Bhoillabori</td>
</tr>
<tr>
<td>4</td>
<td>Maihati</td>
<td>Kamalpur</td>
<td>Kamalpur</td>
<td>9</td>
<td>Kendukonan</td>
<td>Panikhati Wetland</td>
</tr>
<tr>
<td>5</td>
<td>Bhoma</td>
<td>Hajo</td>
<td>Hajo</td>
<td>5</td>
<td>Garjan Wetland</td>
<td>Satdala Wetland</td>
</tr>
<tr>
<td>6</td>
<td>Bhaira</td>
<td>Rangia</td>
<td>Rangia</td>
<td>4</td>
<td>Kekenikuchi</td>
<td>Kanikuchi</td>
</tr>
<tr>
<td>7</td>
<td>Barshil</td>
<td>Rangia</td>
<td>Rangia</td>
<td>2</td>
<td>Barshil</td>
<td>Kakenikhola wetland</td>
</tr>
<tr>
<td>8</td>
<td>Bodna</td>
<td>Rangia</td>
<td>Rangia</td>
<td>15</td>
<td>Dhuhi</td>
<td>Bordol</td>
</tr>
</tbody>
</table>

Source: GVM, 2013
Details of length of dongs restored and number of villages benefitted in Nalbari, Baksa and Kamrup districts are shown in table 4.7, table 4.8 and table 4.9. Various photographs showing different dongs are presented in Plates 4.27-4.34.

Table 4.7 Dongs to be restored in Nalbari district

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name of main canal/creek</th>
<th>Approximate length (Km)</th>
<th>Area need restoration</th>
<th>Numbers of villages to be benefitted</th>
<th>Approximate persons to be benefited directly (farmers and fisherman)</th>
<th>Approximate agricultural land to be benefited (in Hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nameri Jan</td>
<td>20</td>
<td>11</td>
<td>32</td>
<td>28500</td>
<td>15000</td>
</tr>
<tr>
<td>2</td>
<td>Garakhiya Jan</td>
<td>15</td>
<td>5</td>
<td>21</td>
<td>13989</td>
<td>11300</td>
</tr>
<tr>
<td>3</td>
<td>Beldow Jan</td>
<td>20</td>
<td>10</td>
<td>14</td>
<td>1760</td>
<td>9200</td>
</tr>
<tr>
<td>4</td>
<td>Simalua Jan</td>
<td>2.5</td>
<td>2.5</td>
<td>9</td>
<td>1040</td>
<td>1100</td>
</tr>
<tr>
<td>5</td>
<td>Jaha Jan</td>
<td>22</td>
<td>9</td>
<td>32</td>
<td>29874</td>
<td>23000</td>
</tr>
<tr>
<td>6</td>
<td>Dokoha Jan</td>
<td>1.5</td>
<td>1.5</td>
<td>6</td>
<td>1400</td>
<td>1200</td>
</tr>
<tr>
<td>7</td>
<td>Bala Jan</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>364</td>
<td>900</td>
</tr>
<tr>
<td>8</td>
<td>Sijuajan</td>
<td>1.5</td>
<td>1.5</td>
<td>6</td>
<td>540</td>
<td>6700</td>
</tr>
<tr>
<td>9</td>
<td>Ghograjan</td>
<td>65</td>
<td>13</td>
<td>65</td>
<td>42354</td>
<td>17500</td>
</tr>
<tr>
<td>10</td>
<td>Maranadi</td>
<td>40</td>
<td>17</td>
<td>62</td>
<td>65000</td>
<td>12900</td>
</tr>
<tr>
<td>11</td>
<td>Ahata Bakrikuchi</td>
<td>28</td>
<td>7</td>
<td>30</td>
<td>19250</td>
<td>5320</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>217.5</td>
<td>79.5</td>
<td>281</td>
<td>204071</td>
<td>104120</td>
</tr>
</tbody>
</table>

Source: GVM, 2013
Table 4.8 Dongs restored in Baksa district of Assam

<table>
<thead>
<tr>
<th>No</th>
<th>Name of main canal/creek</th>
<th>Approximate length (Km)</th>
<th>Area need restoration</th>
<th>Numbers of villages to be benefited</th>
<th>Approximate persons to be benefited directly (farmers and fisherman)</th>
<th>Approximate agricultural land to be benefited (in Hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Balakata</td>
<td>10 Km</td>
<td>7 Km</td>
<td>9</td>
<td>9200</td>
<td>2300</td>
</tr>
<tr>
<td>2</td>
<td>Trisankar</td>
<td>10 Km</td>
<td>3 Km</td>
<td>7</td>
<td>7500</td>
<td>2700</td>
</tr>
<tr>
<td>3</td>
<td>Amarpur</td>
<td>15 Km</td>
<td>4 Km</td>
<td>12</td>
<td>13500</td>
<td>3200</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>35 Km</td>
<td>14Km</td>
<td>28</td>
<td>40200</td>
<td>8200</td>
</tr>
</tbody>
</table>

Source GVM, 2013

Table 4.9 Dongs restored in Kamrup district of Assam

<table>
<thead>
<tr>
<th>No</th>
<th>Name of main canal/creek</th>
<th>Approximate length (Km)</th>
<th>Area need restoration</th>
<th>Numbers of villages to be benefited</th>
<th>Approximate persons to be benefited directly (farmers and fisherman)</th>
<th>Approximate agricultural land to be benefited (in Hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Raharpar</td>
<td>7</td>
<td>4 Km</td>
<td>7</td>
<td>2500</td>
<td>3700</td>
</tr>
<tr>
<td>2</td>
<td>Bhairatola</td>
<td>11</td>
<td>7 Km</td>
<td>5</td>
<td>4200</td>
<td>2500</td>
</tr>
<tr>
<td>3</td>
<td>Dimu Japia</td>
<td>13</td>
<td>9 Km</td>
<td>11</td>
<td>12400</td>
<td>4000</td>
</tr>
<tr>
<td>4</td>
<td>Maihati</td>
<td>9</td>
<td>5 Km</td>
<td>4</td>
<td>3000</td>
<td>5500</td>
</tr>
<tr>
<td>5</td>
<td>Bahoma</td>
<td>5</td>
<td>3 Km</td>
<td>4</td>
<td>1200</td>
<td>2000</td>
</tr>
<tr>
<td>6</td>
<td>Bhaira</td>
<td>4</td>
<td>3 Km</td>
<td>5</td>
<td>3200</td>
<td>1500</td>
</tr>
<tr>
<td>7</td>
<td>Barshil</td>
<td>2</td>
<td>2 Km</td>
<td>3</td>
<td>2000</td>
<td>500</td>
</tr>
<tr>
<td>8</td>
<td>Bodna</td>
<td>15</td>
<td>7 Km</td>
<td>20</td>
<td>8000</td>
<td>5000</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>51</td>
<td>33</td>
<td>39</td>
<td>27500</td>
<td>19300</td>
</tr>
</tbody>
</table>

Source GVM, 2013
Plate 4.27: Cleaning of dong in Pagladiya cluster, Nalbari district, Assam

Plate 4.28: Cleaning of dong in Jaha cluster of Nalbari, Assam
Plate 4.29: Restoration of a dong in Baralia cluster, Nalbari district, Assam

Plate 4.30: The dong after restoration in Baralia cluster of Nalbari district, Assam
Plate 4.31: A dong in Diring cluster that originated from a spring, Baksa district

Plate 4.32 Restoration of the spring originated dong in Diring cluster, Baksa district
Plate 4.33: A structure called ‘Naodhara’ to divert dong water over an low lying area in Nagrijuli, Baksa, Assam

Plate 4.34: Front view of the ‘Naodhara’ of a dong in Baksa district, Assam
The major problem of the farmers is the loss of working days due to damage of the kutcha canal every year. The farmers have to repair the canal every year and so the working days reduce. Average 50 numbers of farmers work for 20 days each year to repair the canals. After the request from the farmers and the Dong committee, GVM constructed the concrete canal that solved the problem and has saved about 1000 person days per year of the farmers (Plate 4.37- 4.38).

The people of the villages like Palasi, Bhogpara and other villages use vermicompost as fertilizers. Vermicompost is prepared by the farmers themselves. For this a concrete container is taken. Then the bottom portion is filled with a layer of sand of 10cm thickness. This layer is covered with a layer of coconut husk of 4cm thickness. This layer is covered with a layer of decomposed farm products and cowdung. Soil near the root portion of the Peepal tree is added to vermicompost unit as it contains a fungus useful for vermicomposting. Then the layer is kept wet for two days. After that two dozen earthworms are added. Worm species like *Eudrillus engenial*, *Eisenia foetida* and *Peronyx excavates* are used. After two weeks the waste materials are converted to compost. A container of size 6feet X 4feet X 2feet can produce compost of 150-200 kg four to five times per year. The input cost is also minimum which is about Rs 2000 per year. Vermicompost is very beneficial for the plants as all necessary elements for plants are present in it. It is also free from harmful chemicals. Photographs of vermicomposting and SRI method of cultivation are shown in Plates 4.35-4.36.

In addition to construction of dongs, Gramya Vikash Mancha also trains rural people for organic farming and woman empowerment. Capacity Enhancement
programmes of farmers, fisherman, women groups and youths is one of the major components carried out under the projects of GVM. Farmers who have low land areas have been mobilized to do SRI cultivation in the time of Boro paddy cultivation (starting from December-February) in the clusters like Jaha, Baralia, Satdola and some parts of Pagaldia. A capacity enhancement programme on organic pesticide preparation was held to provide the farmers with skill required for preparation of organic pesticide and encourage them to use the same in their crops instead of chemical pesticide.

In addition to construction of dongs, Gramya Vikash Mancha also trains rural people for organic farming and woman empowerment. Capacity Enhancement programmes of farmers, fisherman, women groups and youths is one of the major components carried out under the projects of GVM. Farmers who have low land areas have been mobilized to do SRI cultivation in the time of Boro paddy cultivation (starting from December-February) in the clusters like Jaha, Baralia, Satdola and some parts of Pagaldia. A capacity enhancement programme on organic pesticide preparation was held to provide the farmers with skill required for preparation of organic pesticide and encourage them to use the same in their crops instead of chemical pesticide.
Plate 4.35: A unit of vermicomposting in Baksa district of Assam

Plate 4.36: Farmers are using SRI technique in Baksa district, Assam
Plate 4.37: A diversion of Uttar Diringapur dong, Nagrijuli, Baksa

Plate 4.38: Sluice gate installed at Balakata dong, Baksa, Assam
4.3.4 SeSTA: A Bongaigaon based NGO

SeSTA started its work in Dhaknabari village in the year 2011. Dhaknabari is a village situated in Boitamari Block of Bongaigaon district, 2 Kms from the NH-31. In the year 2011, during the summer paddy season 11 farmers cultivated through the SRI methods of paddy cultivation. During the summer season SeSTA could get closer to the farmer of the village due to frequent field visits of SeSTA staff to establish SRI (System of Rice Intensification) among small and marginal farmers. During one of the field visits, few villager requested SeSTA staff to do something about the damaged “Shankar Jhora” canal coming from the Bhairab Pahar, near the village; for protection of kharif crop during dry spells. Visiting the whole patch with the enthusiastic farmers, SeSTA found that, the damaged canal can be repaired and utilised for Khariff as well as rabi crops covering a huge patch of 400 Bighas benefitting approximately 150 farming families. All water coming through the damaged canal was wasted and going out of the paddy field through the village road making it difficult to walk during rainy season. After analysing the whole patch, SeSTA found that new canal need to be constructed for nearly 200 meter and old canal need to be repaired for 850 meter. Photographs of Shankar Jhora are shown in Plates 4.39 and 4.40.
The 11 interested farmers conveyed a village meeting, attended by over 80 men and women after 3 days. All the farmers agreed to spare a continuous patch of 4-5 feet wide land for construction of a new canal and renovation of the damaged canal. They also agreed to arrange a huge pipe from nearby hamlet to use the canal for passage of livestock and farmers to the paddy fields. Within 10 Days, villagers completed the renovation of old damaged canal, dug the new 200 m canal and completed all the sub canals to individual plots. After completing the renovation work in the Dhaknabari, 100 farmers adopted SRI method due to assured irrigation from the dong and improved their productivity from 8-12 Mound per bigha to 18-24 mound per bigha. Now many farmers in the village adopted maize as cash crop in the summer season using water from the “Shankar Jhora”. After harvesting paddy in December 2011, farmers of Dhaknabari villagers took initiative to organise a Kisan Mela and Harvesting Festival to mark their success in enhancing productivity of paddy through adoption of SRI method using water from the Shankar Jhora.
4.4 ENVIRONMENTAL SUITABILITY OF THE TRADITIONAL SYSTEMS OF WATER HARVESTING

The traditional systems of water harvesting are evolved by the indigenous people of an area according to their need and are based on local environment. They have the ability to adapt with the environment. Their ecofriendly attitude and excellent skill is utilised so wisely in the management of water that modern methodology can’t touch their level.

The environmental suitability of the traditional systems of water harvesting are discussed here-
WET RICE CUM FISH CULTIVATION SYSTEM

1. People cultivate rice, fish and millet together in the same plot which provide triple benefit simultaneously. In case of mono cultivation it is not possible. Thus they are utilizing their resources in optimum level.

2. Apatanis are the pioneer to make it possible to practice wet rice cum fish cultivation in a low input and with high output. Even marginal and poor farmers can bear the cost.

3. Avoidance of agrochemicals has made this system more ecofriendly. No chemical fertilizers, pesticides and weedicides are used. So the farming is totally an organic farming.

4. Fishes in the field are excellent controller of pests as they feed on these pests. No additional food is used for fishes. They feed on a peri phytoplankton that originates in the lower stem portion of paddy plant which remains under water. Diverse communities of planktons are present in the rice field which play important role in the growth of fish.

5. Optimum utilization of aquatic resources which prevent loss of nutrient from the field.

6. Phytoplanktons like lehma minor, azolla, anabaena etc fix nitrogen in the field. The decomposed weeds, house hold wastes and the waste materials of fish act as a manure to the field.
CHAKHESANGS ZABO CULTIVATION, NAGALAND

1. It is a combination of forestry, agriculture, horticulture, animal husbandry and soil and water management.

2. It is an excellent method to control soil erosion.

3. Paddy cum fish cultivation is also practiced in the field.

4. Productive use of farm resources by recycling the animal wastes as manure and food for fishes in the paddy field.

5. Excellent method of large scale rain water harvesting and preventive method of wastage of runoff.


8. Providing year round employment to the farming family and benefit to the community at large by supplying essential commodities throughout the year.

9. Maximum return per unit area per time in terms of produce and money.

10. Totally an organic farming.

DONGS IRRIGATION IN THE PLAINS OF ASSAM

1. Optimum utilization of available surface water resources.

2. Use of SRI method can minimise the seed cost as only 5-6 kg / ha seeds are required. Following are the benefits of SRI method-

   A. Cost of production is reduced as chemical fertilizers and pesticides are used in minimum amount.
B. Pest population and rate of disease is reduced as the soil is allowed to dry intermittently.

C. SRI leads to 39% increase in yield due to profuse tillering, increased panicle length and weight.

D. Saves 30%-40% of water as less water is required.

E. Crops mature early and thus facilitates early sowing of succeeding rabi crops (Das et al, 2012).

3. Vermicompost used in cultivation are rich in several microflora like Azospirillium, actinomycetes, phosphobacillus etc which multiply fast through digestive system of earthworms.

4. Plant hormones like auxin and gibberellin which are not present in the soil are present in the earthworms.

5. Moisture retention capacity of the soil is increased by earthworms.

6. Due to buffering action, soil $pH$ is maintained and trace minerals and trace elements become available for crops.

7. Earthworm arrests soil erosion, prevents soil degradation and enhances soil fertility.

8. When FYM is not available then earthworms can easily convert farm and biodegradable garbage into useful compost.

Thus the traditional farming systems which use traditional methods of water harvesting provide better opportunity for implementation of traditional knowledge. The problems like displacement and resettlement are not associated with the traditional systems. Rather it involves the whole community in practicing of these systems. These
systems are labour intensive and the beauty lies in the use of locally available materials. These systems reduce the dependence on ground water resources. Water is the indispensible natural resource upon which the present and future generation is depended. It is very necessary to understand the importance of available water resources and use of these resources in efficient, equitable and sustainable manner and traditional systems are the excellent methods to use the water resources in a productive way.