SECTION-II

From the dawn of civilization components of physical environment from a strong physical base for socio-economic activities which pass through simplicity to complexity with the passage of time. Culture and cultural environment play a decisive role in the transformation of freely available physical environmental components into functional commodities. Ultimate resourcisation of fundamental components takes place within a behavioral environment where concepts and ideas on different facets of socio-economic, technological, politico-administrative environments become significant. Resourcisation is place specific within a broader spatial framework. Resourcisation has positive and negative impacts both on space and society.
4.1 Laterite

4.1.1 Introduction

Laterite is a rock, therefore it is a fundamental component of geological environment but lateritic soil comes under pedologic environment.

4.1.1.1 Problematic definition of laterite

To define laterite is extremely difficult. Pedologists, geomorphologists, geologists and geographers gave different definitions of laterite. The earliest descriptive definition failed and it was replaced by definitions which are based on chemical contents or ratios of these components. The evolution of different concepts creates some problems on genesis of laterite as a whole and it suggests that laterite is a zonal soil that is formed on the variation in morphology related to different geomorphic environment.

Based on the physical properties, hardness and color, Buchanan (1807) defines laterite as material which was initially soft enough to be cut into blocks by an iron instrument but becomes as hard rock as bricks on exposure to air. For this reason it is suitable for making bricks. That’s why Buchanan chooses the name laterite (later-bricks). Hardness is one of the main physical properties to define laterite.

Color is another physical property, which is more consistent and meaningful criterion to define laterite. Buchanan noted causes behind the hardness of laterite. It contains a very large quantity of iron in the form of red and yellow ocher. Newbold states it as purplish or brick red ferrous rock. Chemical definition is based on chemical property i.e., different mineral contents of laterite. The minerals generally found in laterite are Iron and Alumina.

There is another definition and classification of laterite.

4.1.1.2 Primary laterite and Secondary laterite.

Primary laterites are in situ laterites that are formed by lateral movement of ground water with iron. Primary laterites have been associated with summit features.
Secondary laterites on the other hand are seemed to have derived from the primary laterites. These are the result of denudation, reclamation and recementation of primary laterite fragments.

The presence of detritus material in well-developed laterite sheets forming plateaux and mesas indicates that not all these materials are free from transported fragments (Lamotte and Rougerie, 1962 sited in Thomas, ). On the one hand it does not appear justifiable that all lower slope laterites are a result of the recementation of older duricrust fragments and in the case of nodular deposits it is not always easy to distinguish in-situ from recemented occurrences as noted by De Swardt and Trendall (1969) in Uganda.

Generally primary laterites are associated with one major period commonly thought to be during middle Tertiary when laterites form as more or less continuous sheets over wide surfaces.

4.1.1.3 Laterite formation processes:

There are three models of laterite formation; namely Marine Origins, Volcanic Origins and Termite Activity.

The former two enjoyed little popularity and were dismissed by Oldham 1893 and the third one has gained a little support.

Generally two concepts were given for the formation of laterite

i. Laterite as a residuum.

ii. Laterite as a precipitate.

Primary laterite is developed on pediment in association with detrital accumulations. With parallel slope retreat primary laterite developed with in the profile of a pediment is incorporated into the surface detrital layers.
4.1.1.4 Spatial distribution of laterite

It is difficult to present a clear picture of world distribution of laterite formation. Prescott and Pandelton presented certain areas of distribution of laterite such as Africa and Australia. According to Magnien (1966) the laterite forms in Guinea & Sierra Leone depending on high precipitations (3000 mm). Laterization associated with forest or woodland environments in this area. Periodic drying out of the soil to permit the immobilization of iron within the laterite layer is necessary for formation of laterite. This kind of formation can be found in some areas of Malaysia.

Lower rainfall and distinct dry and wet season i.e. savanna type climate caused exposure of laterite and on the other hand with in the forest region with high organic matter content and high humidity of the surface soil helps organic complexion and mobilization of iron near surface. It supports the formation of laterite horizon to migrate downwards. Degradation of forest helps the exposure of laterite horizon and immobilization of iron makes the horizon hard and forming duricrust.

Laterite formation is generally absent in the desert and equatorial and rain forest. Most of the laterite formations were held at least in Pliocene age and some may form in early tertiary. These lateriate get a long
period. Change in local climate may also affect laterite formation. So laterite formation may found in the areas of savanna plain land of the tropics and may persist into the desert margins or in higher rainfall zones but lack of forest cover areas.

In India laterite cover may be found in the plateaus of Malwa, Madhya Pradesh, Central India, Bihar, Orissa, Tamilnadu, Eastern and Western Ghats, Assam, West Bengal and Hyderabad covering a total area about 2,48,000 Sq Km.

In West Bengal laterite cover found in Purulia, Western part of Bankura, West Meidinipur, Birbhum and in the western part of Barddhaman district.

4.1.2 Objectives

Objective of this chapter is to review the resource potential of laterites and lateritic soils in the study area. This objective is further divided into

i. Physical and chemical properties of laterite in the study area.
ii. To review the changing uses of laterites and to trace its place in different environments.
iii. To identify the areas of laterite quarrying and its effect on space from resource hazard perspectives.

4.1.3 Methods

Nomothetic method has been adopted to analyze the physical characteristics i.e. formation, chemical composition etc. Laterite is a freely available physical component. The very notion on the usability of laterite makes it a resource. Concept of laterite as a resource is changing over time and space. Ideographic method therefore has been applied to analyze the role of laterite and lateritic soils in resourcisation process.

4.1.4 Techniques and data base

Distribution of laterite in the study area has been analyzed from SOI and GSI maps. Hydro-geological maps and soil maps from SWID and Panchet Soil Conservation Division are also taken. Field survey technique is adopted to assess the concept on the utilization of laterite as a resource. Perception survey technique is also adopted when discussing resourcisation of laterite. Dependence on SOI maps is due to
unavailability of air photographs. IRS Geocoded imagery is used to detect the sand quarrying areas and distribution of brick kilns in the study area.

To examine the resource potentiality of laterite active data have been collected from different temples by field survey. Data from ASI has been used in this chapter. Ornamentation and structures of temples are analyzed through active data and data collected from different books, information brochure.

4.1.5 Discussion

Laterite interspersed with associated rocks of sand and gravel forms the characteristic geological feature of the district. There is true laterite in land massive beds and blocks and laterite gravel which have the appearance of being the result of decomposition and rearrangement of the more massive laterite. The ferrogenous gravels in some places seem to pass by almost imperceptible changes into the solid laterite in a few instances have become reentered into a mass not easily distinguished from the rock. On the other hand they pass by equally insensible gradations into coarse sandy clay. Containing only a few ferrogenous nodules of laterite, which are barely sufficient to give a red tint. The calcareous nodules known as ghuting are associated with this. It is extending up to Sonamukhi. (Malley,1908).

4.1.5.1 Laterite profile in the study area

In the study area laterite and lateritic type of soil covers 45% of the total area in Bishnupur and 42% in Sonamukhi. In Bishnupur police station 169.39 Sq. Km. of land is covered by laterite and lateritic soil out of 379.4 Sq. Km. geographical areas and in Sonamukhi police station 160.72 Sq. Km. land is covered by this type of soil out of 380 Sq. Km. of total area (SWID Bankura,2003). Rest of the study area is covered by old alluvial soil.

4.1.5.2 Characteristics of laterite in the study area

Laterite is predominant process of soil formation giving rise to red to brown laterite to laterite type of soil as it falls under tropical area. At the top there is a deep red ferrogenous zone(photo 4.1). Bellow it with a transitional passage, is a mottled zone of white kaolin material with red patches. Downward the ferrogenous mottlings become more scattered until some times by gradations of the soil pass into a layer without mottling in which often the form of original rock is little changed. This material is bleached because of the removal of much if not all of the iron. Rather than use the term leached or bleached white
house prefer the name pallid. This pallid zone is not always present. Some time the mottled zone is the first true soil horizon above the parent rock. A silicified material some times forms a basal horizon frequently however there is silicified regions in the three other zones (due to periodic flooding in an arid environment) (Fig.4.1)

Soils are lighter in texture, slope 1-3% well drained, acidic and are mostly eroded. Depth and width of the layers of laterite varies greatly.

Chemical Analysis Report of laterite and laterite soil.

<table>
<thead>
<tr>
<th>PH</th>
<th>Organic carbon (%)</th>
<th>Electrical conductivity milimhos/cm 1:2</th>
<th>C.E.C mg/100gm</th>
<th>T.E.B mg/100gm</th>
<th>Base saturation (%)</th>
<th>Av. K2O Kg per Hectare</th>
<th>P2O5 Kg per Hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.6</td>
<td>0.35 L</td>
<td>0.04 N</td>
<td>12.35</td>
<td>3.11</td>
<td>47.2</td>
<td>25 VL</td>
<td>190 ML</td>
</tr>
</tbody>
</table>

(Source: SWID, Bankura, 2003)

Fig 4.2

The laterite of the study area is lighter in texture slope 1 – 3% are well drained acidic and are mostly eroded. The chemical analysis states that percentage of organic carbon is 0.35% which is very low. Electrical conductivity, carbon exchange capacity and total exchangeable bases are low. Available K2O and P2O5 also low (Fig.4.2). That means the laterite of the study area is of low fertility from agricultural perspective. It is not suitable for crop cultivation. But the iron content may help tea plantation with proper irrigation facility.

4.1.5.3 Concepts and ideas on laterite

Throughout the study area it is found that laterite has been quarried to a large extent for construction of roads and buildings. At the time of mining it is soft but exposure to air makes it strong. Another property that made the utilization of laterite rock popular, that it is less affected by weathering. It is perhaps not so strong like gneiss but it certainly possesses sufficient strength for all ordinary purposes. It has been largely used in the old temples. The looser and gravelly form of laterite is used for construction of road all over the study area (Fig.4.5).

All over the world rock is used for its durability. The ideas and concepts on laterite are-duricrasts are durable. Under weathering the rate of erosion is low. It is massive and weather resistant. This leads to utilization of laterite as a construction material in plinth step. All over the world it is seen that marble, granite, sand stone are widely used for construction of buildings, temples, mosques, church etc. Tajmahal, the
Bahai temples of Delhi are made of marbles, pyramids of Egypt are made of sandstone, Kabba at Macca made of granite. Compared to marble and sandstone or polished granite the people's perception about laterite is that it has not so appreciable look or it does not have aristocrat look. So it is covered with white finial (pankha) or ornamented by terracotta tablets (photo. 4.4, 4.6). From the referred figure 4.5 it appears that laterite is a part of Geological environment and component of the physical landscape. It is a natural resource because it is formed by physical laws, process and practices. But concepts on it make it a resource.

4.1.5.4 Terracotta in the resource process

Terracotta a Latin word means backed earth (terra means soil or earth and cotta means baking). In sculpture it is a kind of art. In Mahenjodaro civilization polished laterites were widely used. It was practiced in China, India, Egypt, Crete, Sumerio, Babilon, Grece, Italy and South America. Evidence of terracotta work was found in Greece and Italy in 42 century B.C. In 15th century Della Robbia introduced glazed tiles of terracotta in Florence. Later it spread to France, Spain and entire Europe. Evidence is also found in Sindhu Civilization, Mathura (Gandhar Art), Taxsila, Patna. In Mourya era utilization of terracotta goods also reveals that terracotta Art was also known to them also. 2nd & 3rd century of Kushan era also presents several abstract statues made of terracotta. In Nagarjun konda of Madhya Pradesh, Surat Garh of Rajhasthan several terracotta tiles proves its existence. But in Bengal it is popular art (Tusnes, 1996). According to age the terracotta of Bengal may be classified into three stages – Ancient, internal and contemporary period. Ancient type of terracotta culture is seen indifferent type of statues (mother), birds and animals and motif of Gods and Goddess, story of Aesop's. These are made by Molds (extra attachment of clay) (Chakroborty, 1995). The ancient terracotta is found in many places like Berachampa, Harinarayana pur, Tamluk, Aatghara, Boral, Mongalkot and Deolpata of West Bengal and Moynamoti, Paharpur of East Bengal (Bangladesh). Among the inter stage terracotta work, Bishnupur, Medinipur, Haora, 24 Parganas (both North & South), Birbhum, temples are famous. These expresses the story of Ramayana, story of Shiva – Kali, Krishna lila and life style of different local and foreign people, plant, animal and geometric designs. The contemporary terracotta work includes different toys, Gods and Goddess, folk art (McCutchion, 1971). In these stages utilization of Brass color and perfect structure can be seen.
4.1.5.5 Laterite in the resource process in the study area

Temple structure and terracotta ornamentation in the study area

Bankura district is famous for its terracotta works. After Turki conquest in Bengal the impact of terracotta became lesser. But in 1400 to 1600 century reintroduction of terracotta is seen. The Bengal style temple (village hut) was introduced in 16th century on which Muslim impact is clear. Terracotta tiles are stacked on temple walls to create different types of pictures. Decline of this art is seen from 18th century and it is near extinction in the 19th century.

The temples of Bishnupur are the product of cultural environment. The kings constructed them as a religious symbol. Mixture of tangible resources or natural resources and intangible resources i.e. religious and beliefs makes temple a part of cultural environment, which becomes resources for tourism.

The temples of Bishnupur and surrounding areas were constructed in 16th or 17th century. There is a great impact of Orissa. Mughal and South Indian style of temple can also be found (Santra, 1998) because there was a relationship between and among these cultures to Bishnupur. Bishnupur comes under Karna suvarna. It is shown as an ancient place on a map in the books of Cunningham (Cunningham, 1871).

Commercial route to Kalinga run through Kanksa - Sonamukhi - Abantika - Bishnupur - Dandabhuki. So it may be said that diffusion of culture from north to south India happened through this route. The modern Review (March 1933, Page 348) say that Bishnupur lies on the highway to Puri from north India. Advancement of concept and cultural advancement and thus stagnation was avoided. Although there is a deep impact of Tribeni, Gour and Pandua's temple architecture on the temple structure of Bishnupur. The more prominent is a suitable Hindu culture as well. It followed the Mughal architecture in Khilan (Pillar), Volt Trikhilan doors (Piers and pillar) terracotta ornamentation, Kiosk (A light open pavilion) and for Ratna (Pinnacle) temples it followed the lineated and the Pira temple structure of Orissa style (Mc.Cutchion, 1964 & Santra, 1998). The Malla Kings of Bishnupur had great interest in the promotion of Ratna or Pinnacle temples. The lineated or Rekha temples, which are marked as a memento of 10th - 11th Century and were abolished, renovated in 17th century. In these temples we can mark even the Jagmohan which was introduced later (Sri Sri Shyam Chand Mandir of Hazrapara in Bishnupur) (Bandopadhyay, 1975).
The Mughal, Parsic, Indoparsic, classics, and the mythological influences are prominent in terracotta ornamentation. Beside that the influence of Portugeese architecture is prominent (Dasgupta, 1980).

Chaitanyadeva, the great icon of Vaisnavism who had influenced Bengal in late 16th and early 17th century, had also influenced terracotta ornamentation of Bishnupur temples. Mallaking Bir Hambir was indoctrinated in vaisnavism and influence of vaisnavism is prominent on the temples, which were constructed later.

We have said that the mythological influence is prominent in the ornamentation of terracotta temples of Bishnupur, for example Uma-maheswar, Ram-Sita, Radhakrishnha, Vishnu-lakshmi, Ramayana, Mahabharata and Srimad Bhagbat Gita are familiar. Besides, figures in terracotta also depict influence of Buddhism, Jainism and British culture on some temples of Sonamukhi.

**The Mughal influence:**

Depiction of Mughal turban, shoes, clothings (jama - pajama) and Jahangiri crown are prominent. Hawk hunters, king with bird in hand, Political events like Portugeese war is found on Jorbangla temple which was held in the reign of Sahajahana. Besides tobacco smoking is seen on Shyamrai temple (1643). If we minutely analyse the history of Mughal era we find that in between 1600 – 1650, the farmers of India started cultivation tobacco among which the Ambari tobacco of Bishnupur was very famous. As in folk rhymes we can see then evidence. For e.g “Guli Khili Motichur, Tin nie Bishnupur (Tobacco, bittle and Matichur (sweets) - these three are important in Bishnupur)

The temple structure of Bishnupur itself is influenced by Mushlim culture. The brick temples of post Mughal era at Bishnupur also followed Mughal architecture e.g. Squint type of design on octangular/ circular wall set domical base. The temples formed a pinnacle structure with the help of circular wall, which were constructed by bricks step by step. In some cases vault is noticeable e.g Khar Bangla Temple. Fire weapons, miniature painting, and military forces, protect the Malla capital from enemies by construction of Garh surrounding the Kila and stone made special door reveals the impact of Mughal culture on Bishnupur. Besides this construction of Dalmadal Canon following the famous canon Kale Khan and Jahan Kasan of Murshidabad also shows a Mughal impact (Dasgupta, 1980).

The Malla kings however gave emphasis on Pinnacle structure, rekha and pira temple structure.
The Portuguese influence:

With the spreading of Portuguese rule, the Portuguese culture also influenced Indian Culture. The artisans of Bishnupur temple included Portuguese culture. The Dagon with a guitar and Portuguese war ship are the evidence of that.

*Parsee Influence*

The dragon sketches in terracotta temple are the result of Indo-parsic influence because Mughal previously influences the Parsic. The kings are found wearing dragon printed dresses. This motivates the artisans of Bishnupur to create such designs on terracotta. Besides, the foreigners with varieties of dresses and turban are found, e.g. Sridhar temple (25 pinnacles) of Sonamukhi. Pillow, hand fan, Otto-pot, veil, women-trousers is common on Jorbangla temple which depicts Persian culture.

*Influence of Ramayana and Mahabharata*

On the western wall of Jorbanglo temple stories of Rama, Laxman, Bharata, and Satrughana are seen. Bhismma lying on arrows are another sculpture on the temple wall.

*Vaisnav Influence*

Great Malla King Bir Hambir converted to rationalism in end of 16th century. The Bishnupur followed the miniature painting of 'Pata' centering the Vaisnavism. Story of *Srimad Bhagbat Gita* and *Gitagovinda* can be found on terracotta sculpture. Picture of Lord Krishna sucking milk from cow is found on the southern side of upper floor of octagonal pinnacle which is at the center of Shyamrai temple. Lord Krishna playing flute is seen on the southern veranda of Jorbanglo temple. Radha Krishna is seen on the south east corner of Jorbanglo temple. Kaliya Daman(Lord Krishna killing a snake named Kaliya), Jalakeli(Lord Krishna playing with with friends of Radha in a pool), Vastra Haran(Lord Krishna saving Draupadi when her saree was being taken away by Dussawasan), Nouka lila(Lord Krishna in a boat with friends of Radha) also depicts the influence of Vaisnav culture.

The picture of conquering of Srinivasa Vaisnabite on *Malla Sava* is clearly drawn on the Sothern wall of Madan mohan temple. On the front side of the temple picture of Srinivas at learning a 'puthi' is depicted on the base of the temple.
Influence of ten incarnation of Lord Vishnu

I chitra is also depicted on temple wall. It is also says about the vaisnav culture. Matsya, Kurma, Varaha, Varmana, Ram, Balaram, Parasuram, Buddha, Kalki are the ten avatars or incarnation of God. But in Bishnupur Jagannatha is seen in place of Buddha. It is an influence of Orissa. The temple which were established before 18th century those were shown statue of Buddha inspite of Jagannatha. This is a vaisnav influence comes from Orissa (e.g. Sridhar mandir where Jagannath is the 9th incarnation inspite of Buddha established on 18th to 19th century).

Importance of Place

In some cases place also take an important role for the ornamentation of temple walls. Impacts of Gujarat, Rajasthan are seen in picture of milk sucking by Krishna. Impact of Rajasthan is also seen through description of horoscope. Imprint of Orissa is seen in Shyamrai temple. The rekh and pira type of temples are formed following the Orissa type which was transformed into ratna temple in Bishnupur. Parcy Brown stated ‘Some comparison with brick in Bengal spring to the mind. A number of those have been discovered some well published but hardly any go back to a period earlier than 17th and 18th century.’ Parcy Brown has already drawn attention to an 18th Century brick temple with curvilinear roof at Bishnupur (in his Indian architecture, vol. - I page 188) but which differs rather conspicuously from our Rasika Roy in the surface decoration full of Bankura’s skilled work.

Jain Influence

Jainism comes in the study area following the commercial routes from North India to Kalinga and from Kalinga to Rarh (J.D. Beglar, 1978 Report of a tour through Bengal provinces) on temples of study area. The influences of Jainism are more than any other religion. The word Rarh may have come from the Sanskrit word Roorha, meaning rough or uneven. In the ancient Jain Sutra Rarh refers to that part of Bengal, limited by the Bhagirathi River. Rarh stated an isolated forest covered area. 6th B.C. Jain samanu(monk)were come to Rarh for perching their religion. Rarh was situated on the caravan route from Banga to Magadh(Singha,1951). In Buddhist books Rarh was known as ‘Sumbha’. A statue of Tirthamkar Risava(Jain monk) is found on the Sanreswar temple of Dihar which is now worshipped as Siva. In Dharapat village statue of naked Shyamchand which worshipped with Narayan statue, is actually a Jain statue (5ft / 3ft). Beside this temple the expanded hood of a serpent originally a Jain sculpture, now converted to Manasa.
statue (goddess of Snake). This temple was formed in 1323 sakabda. Residual beside this temple is thought to be a prayer hall of Jains.

Locally available laterite is widely used for construction of temples. In some cases stone is also used as building materials. Beside that baked earth (terracotta) is also used for the ornamentation of temples (Bandopadhyay, 1971) (photo. 4.8, 4.5). Based on the structure, materials used the temples of the study area classified as (Fig.4.3)

<table>
<thead>
<tr>
<th>Name of temple</th>
<th>Location</th>
<th>Material used</th>
<th>Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malleswar (1622)</td>
<td>Bishnupur, Bhattacharya Para</td>
<td>laterite rock</td>
<td>Deul</td>
</tr>
<tr>
<td>Krishna &amp; Balaram (end of 18th century) (British influence)</td>
<td>North west of stone darwaja</td>
<td>brick</td>
<td>Rekha Deul</td>
</tr>
<tr>
<td>Keshabray &amp; Kunja Bihari (2nd half of 18th century) (British influence)</td>
<td>Inside the fort area</td>
<td>terracota covered with</td>
<td>Rekha Deul</td>
</tr>
<tr>
<td>Kalachand (1656)</td>
<td>Near Lalbandh</td>
<td>laterite rock</td>
<td>Ekratna (single pinnacle)</td>
</tr>
<tr>
<td>Madan Gopal (1665)</td>
<td>Near Lalbandh</td>
<td>laterite rock</td>
<td>Pancharanta (five pinnacles)</td>
</tr>
<tr>
<td>Radha Govinda</td>
<td>Near Lalbandh</td>
<td>laterite rock</td>
<td>Ekratna (single pinnacle)</td>
</tr>
<tr>
<td>Radha Madhab</td>
<td>West of Kalachand</td>
<td>laterite rock</td>
<td>Two storyed building</td>
</tr>
<tr>
<td>Lalji &amp; Radha-Shyam (1658 / 1758)</td>
<td>Near fort</td>
<td>laterite rock</td>
<td>Ekratna (single pinnacle)</td>
</tr>
<tr>
<td>Madan Mohan (1694)</td>
<td>Within municipal area</td>
<td>laterite brick</td>
<td>one pinnacles</td>
</tr>
<tr>
<td>Shyamrai temple (1643)</td>
<td>Near Gardarwaja</td>
<td>laterite brick</td>
<td>Five pinnacles</td>
</tr>
<tr>
<td>Rashmancha (1600)</td>
<td>Within Bishnupur town</td>
<td>laterite rock</td>
<td>Pyramid</td>
</tr>
</tbody>
</table>
| Jorbangla (1655)                | Inside the fort area            | laterite Rock with terracotta brick | Do-chala
<table>
<thead>
<tr>
<th>Name of temple</th>
<th>Location</th>
<th>Material used</th>
<th>Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siddheswar &amp; Sonat Pal</td>
<td>On the bank of river Darakeswar</td>
<td>brick</td>
<td>Deul</td>
</tr>
<tr>
<td>Sridhar Temple (1845)</td>
<td>Sonamukhi market area</td>
<td>brick</td>
<td>25 Pinnacle</td>
</tr>
<tr>
<td>Temple of Elati (17th century)</td>
<td>On the bank of the river Darakeswar</td>
<td>brick</td>
<td>Deul</td>
</tr>
<tr>
<td>Sanreswar Sailieswar (1335)</td>
<td>Dihar</td>
<td>brick</td>
<td>Deul</td>
</tr>
</tbody>
</table>

Fig.4.3

Description of ornamentation according to temples (Fig.4.4)

Shyamrai temple or Pancharatna Temple

i. Raslila, Krishna at dancing poses - Both side of the eastern entrance.

ii. Gaja Kachap Chitra - Western Barandah

iii. Frendship - southern Varanda - Krishna at giving fruit to his friend.

iv. Collection of Parijat (Exotic flower) -

v. Ceremonial washing of Ram -

vi. Gujrat style hand fan in the hand of a dancing garl, Orissa type dress

vii. Rash Mondal motif following the Konarak of Orissa in the interior of the temple.

viii. Jain Tirthankar on the way towards interior of the temple.

ix. Picture of Lord Jagannath on the southern barandha

x. Vishnu at (eternal lying equilibrium state) - Ananta Sayan

xi. Makar rath - a mythological aquatic animal

xii. Dragan motif - on the southern varanda beside false door.

xiii. Five faced Shiva and valiant man (myth)

xiv. Uma-maheswar, Kartikeya, Radha Krishna, Sita Ram on the central top floor.

xv. To smoke a hookah

xvi. Dancing Krishna, Playing flute, picture of Krishna Balaram

xvii. Different ethnic groups wearing various kinds of dresses on the central top Pinnancle.

xviii. Ram - Ravana at war at the eastern entrance.

xix. Mallah warriors, Dagan, Ganesh, Dasavatar, Buddha, wearing peculiar dress, wrestling

Jorbangla

i. Krishna and Balaram at boyish sport, killing of Baka rakshas, Taraka on the front side.
ii. Ram, Laxman, Bharat & Satrughna in the mother’s womb in the front side.

iii. Picture of Krishna, Radhika, Barai, Sri Krishna Kirtana, nouka lila (activities of Krishna on Boat)

iv. Musical instruments. A Gandharba (Dame god) with a tambura, on the front varanda

v. Prists at worship of god – front Degetati

vi. Visma lying on arrows – on the south west challa (thatch)

vii. Killing of tiger. The sight of the hunters resembles with Mahenjodaro civilization on the front chala (thatch)

viii. A man with a book, may be picture of Srinivasa – famous Vaisnavites of the North east corner of the back chala (thatch)

ix. Killing of Kangsa, picture of different animals and birds, Degetati with fly wing (mythological animal) on the eastern wall of first chala (thatch)

Khar Bangla

Two women are reading books – North Eastern corner.

Madan Mohan Temple

Paintings like swan, conquering of Malla residence by Srinivasa – on South East corner.

Temple ornamentation at a glance (photo 4.5, 4.6, 4.20, 4.21, 4.22, 4.23)

<table>
<thead>
<tr>
<th>Ramayana</th>
<th>Sculpture of Rama, Laxmana, Bharata and Satrughna, Rama &amp; Ravana at war.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mahabharata</td>
<td>Bhisma is lying on arrows.</td>
</tr>
<tr>
<td>Social event</td>
<td>Smoke a Hookaa, friendship, man in reading book, killing of tiger</td>
</tr>
<tr>
<td>Historical events</td>
<td>Mallah warior, Buddha, Srinivasa, Conquest of Mallah residency by Srinivasa.</td>
</tr>
<tr>
<td>Flora</td>
<td>Creeper, lotus.</td>
</tr>
<tr>
<td>Fauna</td>
<td>Pig, horse, elephant, camel, deer, snake, ox, swan, birds, Tiger, fish, goose etc.</td>
</tr>
<tr>
<td>Mode of transport</td>
<td>Makarrath, chariot, country boat, elephant, horse.</td>
</tr>
<tr>
<td>Weapon</td>
<td>Hand missile, sword, bow &amp; arrow.</td>
</tr>
<tr>
<td>Dress</td>
<td>Ethnic dress, wrestling, classical dancing dress</td>
</tr>
</tbody>
</table>
Abstract
Design
Ornaments
Mythological character

Octagonal shape, paisley, circle, trellis
Bangle, necklace, crown
Uma Maheshwar, Kartikeya, Ganesha, Lord Jagannatha, Kali etc

Fig. 4.4

In short the temples include the picture of figures of Royals, monks, common people, fictitious creatures, animals, fish, tree, historical events, royal events, common mode of transport, social life etc.

Bishnupur and Sonamukhi Hindu dominated area and temples are religious symbol of Hindus. In case of Malda, Murshidabad, Barddhaman the Muslim dominated culture expressed by different kinds of Mosques, Dargas etc. But the study area has a background of Hinduism. Prior to the rise of Malla Kingdom it was dominated by Hindu culture. So the temples of the study area have been taken. All over the Bengal terracotta temples are found but the most famous are the temples of Bankura especially the temples of Bishnupur. Who are the artisans of making these temples? History is silent about these questions. There is no authentic data about these questions. In this research work we delimited our analysis only on the structure and ornamentation of the temples of the study area. How the structure and the ornamentation of the temples has changed with the changing culture. Impact of changing culture is clearly been seen on the temple walls. Our discussion delimited the role of human behavior and meaning in understanding people’s relationship with environments, places and the impact of culture on landscapes.

Temple a religious symbol must survive or time resistant. It is used as raw material in temples. Compare to marble or to sand stone or polished granite it is less attractive. The people’s perception about it was not appreciable. It does not have attractive look. So it is covered with finial.

Temple is a component of historical environment. These temples were made for religious purpose. According to the religion of the king the ornamentation structure of temple become changed with changing concept of religion. Now most of the temples lost its religious significance. These temples are part of cultural environment but ultimately they become a cultural resource for tourism (photo.4.9, 4.10). Column of laterite has a visual attraction or appeal. But due to lack of proper awareness often makes treat our rich heritage casually (The Sunday Statesman, Impression, 1998). For this reason it is often seen that the temple wall is often used for inscribe the name of the tourists. Many terracotta tablets were stolen or damaged. The temples were not properly maintained.
Recently World Heritage Centre decided to announce Bishnupur as world heritage site. Indian National Trust for Art & Cultural Heritage (INTACH) formulated and design documentation and preservation work on Bishnupur Temples (The Statesman, 2005). Ultimately it is a resource of the cultural and economic environment. At present these temples become the symbol of tourism attraction and are highlighted through several articles, books and news papers(The Statesman, 2002). Laterite is a tangible resource forms under certain temperature, rainfall; vegetation characteristics, used as raw material for temple building. Temple is a religious symbol, part of cultural expression on natural landscape. Temple is an intangible resource as it is a symbol of religion. Mixture of tangible and intangible resource is found on the temple of the study area. Emphasis is given more on the ornamentation of the temple rather than the structure of the temple because culture has its imprint on the ornamentation of temples. The temple which was constructed pre Muslim era is mainly brick temples (11th & 12th century, Bahulara temple) and are of deul type. Later on the structure changed. Muslim imprint on the structure of post Muslim temples are prominent. The trikhilan, column, inclined chala pattern are based on Muslim culture. The famous hut pattern of Bengal has also emphasized temple structure. The ornamentation i.e. geometric pattern, picture of Nawab, sultan also depicts about Muslim culture. The Muslim has no direct influence on Malla Kings till it has influenced the design in passive ways. After the conversion of Malla Kings to Vaisnavism the ornamentation includes the story of Radha Krishna, Rasmomdal, activities of Krishna etc. After 18th century the terracotta works has lost its significance in temple ornamentation. But the pottery maker borrowed the concept of terracotta from the temple wall and started to create terracotta tablets. These tablets are used in interior decoration in different metropolitan cities including several towns. The terracotta tablets are used for decorating their pendals. Using the terracotta concepts the artisans are creating other terracotta items for decorating houses like decorated horse (Bankura horse), elephant, pen stand, dinner plates, and calendar etc. Not only this terracotta ornaments are very famous now a days. A village near Bishnupur named Panchmura (18 Km. from Bishnupur) is famous for terracotta works. The products of this village are marketed through Bishnupur and Bankura. The tourists used to collect terracotta goods from Bishnupur when they come to visit the temple town. Sonamukhi horses (made by terracotta method) are also popular for their unique designs. Local people used to sacrifice abstract terracotta horses, elephants to god and goddess temple than to fulfill their demand.

The silk weavers of Bishnupur mainly the Baluchari weavers borrowed the design from the temple and put the design into their saris. The unique Baluchari sari used to express different designs from temples and the temple itself became a design in their creative Baluchari sari and other silk materials.
LATERITE IN RESOURCISATION

LATERITE (PHYSICAL COMPONENT) → THEORIES ON LATERITE → CONCEPT ON LATERITE → ENGINEERING ENVIRONMENT → RELIGIOUS ENVIRONMENT

GULLY-RILL-BADLAND TROPOGRAPHY → PALLID ZONE USED IN POTTARY & PAINTING

EDUCATION BASED SOFT ECOTOURISM → CHANGE IN CONCEPT → ECONOMIC ENVIRONMENT

Fig. 4.5
Once terracotta, which is used for ornamentation of temple, brings a new concept to the porter and weavers and the concept become a resource base for the artisans. Not only this the conch shell and bell metal artisans also accept the design on their works. The unique Bishnupur Lanterns are based on the temple structure of the study area.

Thus a tangible material laterite creates resource base for temple building once the temple has religious significance. But with changing culture it losses its religious significance and become a part of cultural and economic environment and attract tourists. Simultaneously it gives some concept to the artisans and it becomes a resource for them. Thus mixture of tangible and intangible resource is found on the temples of the study area.

4.2 Sand and clay as an environmental resource base and related hazard issues

4.2.1 Introduction

Sand and clay are the end products of tropical weathering. They are reworked and redeposited by geomorphic agents like glacier, river, sea waves and wind. They are classified according to these agents- glacial sand and clay, riverine sand and clay, marine sand and clay and Aeolian sand and clay. To these may be added lacustrine sand and clay.

Sand is an element of physical environment. It is minor mineral resource. In resource classification it falls under renewable resource type. According to Zimmerman's definition about resource, the workability or utility of a thing makes it a resource. With the advancement of human civilization, house type, settlement type evaluated and the material for making their houses also changes with time. At present sand is a good building material for concrete houses. So its utility makes it a resource (Fig.4.6).

There are four main rivers in Bishnupur and Sonamukhi police stations. These are Damodar, Darakeswar, Sali and Berai. These rivers are all tropical seasonal rivers and bed materials mainly consist of sand. Fresh flood deposits are also sandy. On the contrary old alluvium is clay. These rivers are the main source of sand and clay quarrying.

4.2.2 Objective

Objective of this chapter is to focus on river bed sand quarrying and their impact on socioeconomic environment on the one hand and on place and society on the other. The primary objective will be segregated to
SAND & CLAY QUARRYING AS RESOURCE BASE, RESOURCISATION & CONSEQUENT PLACE - SOCIETY SPECIFIC HAZARDS

**SAND & CLAY**
Geological - Pedological component controlled by physical laws, processes and factors.

- **PHYSICAL & CHEMICAL PROPERTIES**
  - Sand - porous - less water holding capacity.
  - Seasonal tropical rivers - sandy bed load.
  - Fresh riverine sand is free from salt.
  - Clay impervious, more water holding capacity.

- **Notions on physical & chemical properties**
  - Porous sand help better air circulation.
  - Younger alluvium is fertile.
  - Old alluvium is good for pottery.
  - Fresh sand is good for construction.

- **Antisocial activities in brick fields and sand quarrying areas also hazardous.**
  - Illegal quarrying on river bed increases destabilization of river bed and caused river bank erosion.
  - Flood borne fresh sand affect adversely on pottery and artisans.
  - Sand & Clay quarrying defaces surface and impact on space.

- **Fig. No. 4.6**
i. To make an observation on the spatiotemporal distribution of sand and clay.
ii. To analyze resource potentialities of alluvial clay and sand in a rural background.
iii. To survey the objectives behind sand and clay quarrying.
iv. To trace the use of sand and clay to fulfill socioeconomic needs.
v. To study the consequences of place specific sand and clay quarrying on space and society.

Sand and clay have multiple uses. In the present chapter however sand has been assessed as a resource in construction sector and clay has been assessed from (a) agricultural perspectives and (b) its use in pottery and making idols.

4.2.3 Method

Nomothetic method has been adopted to analyze the physical characteristics i.e. formation, chemical composition etc. sand and clay are freely available physical component. The very notion on the usability of sand and clay in construction and pottery make it a resource. Therefore ideographic method has been applied to analyze the role of sand and clay in resourcisation process.

4.2.4 Technique

Technique is field survey technique. Topographical maps 73M/8, 73M/2, SOI maps and satellite imageries are taken as a tool to analyze the resource potentiality of sand and clay.

4.2.5 Data base

Secondary data has been collected from Settlement office, SDLRO, Bishnupur, Bishnupur Block office, Sonamukhi Block Office and District Census Handbook, Bankura 1981 &1991 for discussion. Primary data has been collected by field survey in the riverine villages and in Sonamukhi municipality. Door to door survey has been done in word no. 9, 10 and 11 to generate data about pottery.

4.2.6 Discussion

Damodar, Darakeswar, Sali and Birai are all characterized by the characteristics of tropical seasonal rivers. These rivers have highly fluctuating river regime though there is no recorded data on
fluctuation but sediments and sedimentation characteristics of the rivers strongly show that they are all wet and dry tropical seasonal rivers. Damodar and Darakeswar somehow maintain their thalweg during dry seasons but Sali and Birai dry up completely. Bed load of all above mentioned rivers are pure sand in most of the places. In fact Birai and Sali look like a continuous stretch of sand during dry season. Damodar near Sonamukhi and Darakeswar near Bishnupur do not look different. These rivers often flood surrounding areas during monsoon. Way back in 1978 extensive areas in Sonamukhi block were flooded. This is the most devastating flood in the district in the last century. The flood history of Bankura also gives an idea of the episodic floods in the area. Away from the river the soil changes from sand to clay. Below the superficial sandy layer clay is found. The data supplied by SWID, Bankura, give an idea of the vertical distribution of sand and clay. Sands in the river beds are reworked by the river and are redeposited during floods. The conclusion is that both sand and clay are geological, pedological and geomorphological components freely available in the physical environment. Their spatial distribution, physical and chemical properties are governed by physical laws and properties.

Sand particle of rock of a size intermediate between silt and gravel; internationally defined as particles with diameters ranging from 0.06 to 2.00 mm. Fine sand ranges up to 0.2 mm. medium sand up to 0.6 mm and coarse sand up to 2.00 mm. Sands are mainly particularly immune from physical weathering and although it may be significant that quartz has a lower limit for mechanical breaking at 0.02 (below that size most stresses can be accommodated by elastic strain). By the process of different weathering agents sand formation occurs at the end stage of weathering.

Sand & clay as a resource and consequences

Sub Divisional Land and Revenue Officer looks after this resource in Bishnupur and Sonamukhi police stations. According to their information Darakeswar is very resourceful for sand quarrying (photo.4.11). They use to give permission for sand quarrying. They issue three types of mining permit here. These are

i. Short term quarry permit (for 13 days)
ii. Long term mining lease (for five years)
iii. High court orders.

At present 200 persons are engaged in short term quarry permit, 21 persons are engaged in long term mining lease and 23 persons are under High Court order type (photo.4.12).
The demand for Darakeswar sand is higher than that of Damodar sand because of its quality. Darakeswar sand is fresh, white, washed but in case of Damodar river sand, it is polluted by industrial effluents coming from mining and industrial areas in the upstream sector. Besides this Darakeswar sand is coarser than Damodar sand and coarse sand has more temperament than fine sand. So, most of the mining units are located both sides of Darakeswar River in the study area. Another problem to quarry sand from Damodar in the study area is lack of transport facility, which is very poor. The sands of Berai (tributary of Darakeswar) are also of low quality because this river raises in lateritic soil areas. Black kankar (nodules) are mixed with the sand which creates problem at the time of plastering. Darakeswar sand is free from salt and fresh. The sallow river bed also increases its resource potentialities. Because high depth increases accumulation of ferrous and clay within it and it attracts salt weathering. There is another river called Sali which is a tributary of Damodar River. Quality of sand of Sali River is very poor of mixing of polluted material from river Darakeswar. That's why Darakeswar become the only river that can increase the supply of sand in Bankura district and in other areas and it is the most resourceful river in Bankura from the sand supplying perspective.

Rates
Rs. 787.00 for 100 cft. of Sand to which Government royalty of Rs. 63 and quarry permit of Rs. 15.00 per 100 cft. of sand are to be added. Per day sand quarrying from Darakeswar is 1068376 cft or 267 trucks of 400 cft. each. One tractor can carry 100 cft of sand.

The price of 400 cft. of sand in Kolkata ranges from Rs. 5200 to 6000 and this is Rs 800 in local market. The price of 100 cft of sand in local market is Rs. 360.00(SDLRO,Bishnupur,2004). Therefore the quarry owner prefer to send sands to Kolkata.

Royalty collection
Rs 2,42,35,800/- was collected on 31.03.2004. If royalty was not given, then punishment of Rs. 10000/- to Rs 25000/- can be collected.

Sand quarrying areas are situated on both side of Darakeswar River. Mines are generally quarried 20 m. away from river bank. It is a Government order. But during field survey it is seen that sand is unscientifically quarried from the river bed. It cause severe bank erosion and also changes the channel behavior.

Demand for Darekeswar sand is mainly coming from Kolkata, Haldia, North 24 parganas, South 24 parganas and Barddhaman. Local
brick kiln has a demand for *Dhash* sand (fine sand found just on the river bank). Beside this there is also special demand for *stag* sand. Sand which is quarried from deep water has great demand because of its freshness.

The owners are mainly local people in case of short term quarry permit and High Court order but in case of mining lease people from outside areas are more in number. Last year SDLRO, Bishnupur's income was Rs. 3 crores from sand quarrying only.

Thus sand a physical element becomes a valuable resource base for Bishnupur and Sonamujkhi Police Station. Quarrying is space specific but through supply it becomes a part of spatial network.

Sand quarrying is often practiced without government approval. Sands are not quarried scientifically and caused disequilibrium in channel behavior. Bank collapse is the resultant fact. Fresh sand deposited in the paddy field reduces the productivity of soil. During 1978 floods this fresh sand, deposited in the paddy field adversely affected pottery. What is a resource for brick manufacturers is as a hazard for pottery industry because in pottery clay is the main resource and this clay is collected from paddy fields.

The study area is characterized by rural population. House types are also rural in character. Clay is the main raw material for construction of rural houses. From census data it is found that agriculture is the main economic activity in the study area. For paddy and other agricultural production fresh alluvial is the resource base. Emphasis has been given on utilization of clay in brick kilns (photo.4.15), pottery, idol making and painting.

Sand, clay and water are the main raw materials for brick kiln industry (photo.4.14). During empirical studies it is seen that most of the brick kilns are situated on the river banks (Fig.4.7 & 4.8). Brick kiln industry needs *Dhash* sand which is brought from river bank (photo.4.13). Young alluvium soil is another required raw material which is taken from the agricultural fields. Water is directly collected from river. There are three types of brick factories found in the study area. These are bangla chimney, fixed chimney and temporary chimney. Most of the bangla and temporary chimneys were formed illegally. These are often caused air pollution in local areas. A brick kiln in Chakdaha village on Berai river bank is a point source of air pollution in the village and neighboring villages. The students of Chakdaha primary school are facing problem by the polluted air, dust and fly ash of neighboring brick field (Roy, 2004). Besides, unscientific quarrying of sands from river bank changes the channel characteristics. Brick fields are also
Distribution of brick kiln in Bishnupur police station with underlying geology

LEGEND
- Brick kiln type
  - Fixed Chimney
  - Temporary Chimney
  - Bangla Chimney
- Geology type
  - Younger Alluvium
  - Older Alluvium
  - Darakeswar River
  - Bishnupur Municipality

Area shows:
22° 57' 15" N to 23° 12' 32" N
87° 31' 46" E to 87° 24' 11" E

Scale: 2 0 2 Km
Distribution of brickkiln in Sonamukhi police station with underlying geology

LEGEND

Brickkiln type
- Fixed Chimney
- Temporary Chimney
- Bangla Chimney

Geology type
- Younger Alluvium
- Older Alluvium

Sonamukhi Municipality
Damodar River
Sand bar

Area shows-
23° 05' 59" N to 23° 29' 00" N
87° 18' 45" E to 87° 31' 28" E

SCALE
2 0 2 Km

Fig. 4.8
centers of anti social activities. Here we may refer the cinema Ashani Sanket of Satyajit Roy.

Sonamukhi is noted for its unique Sonamukhi horse and painted pottery. These are mainly used for social and religious purposes. Sonamukhi horse is totally different form Panchmura horse which a stylized forms of the original. It can be separated in different parts which is easy to carry. It is mainly used for interior decoration. The Sonamukhi horse followed the original design and structure of horse. It is in compact form because, belief that separated horse is a broken horse and it can not be offered to the God. Besides horse the potters make different type of pitcher, pot which are used in social functions. The potters of Sonamukhi are mainly leave in Sonamukhi municipal area (ward no 9 and 10).There are merely 50 families who are at present doing this work. The potters of Sonamukhi mainly produce different types of painted pots which are mainly used in social rituals of Hindus. Beside this they also make horses and elephants which are mainly offered to gods and goddesses. Old alluvium soil is mainly used for making these earthen materials. The potters used to collect soil from riverside beds of the Sali River. To increase the temper of soil they mix sand and ash with the soil, the pottery horses and Manasa bari or chali are hand made. They don't use any mould. Besides old alluvium they use pallid and mottled clay for coloring (photo.4.2&4.3). This pallid and mottled clay are collected from Kaolin quarring field near Dhansimla of Sonamukhi Block. A thin layer of mottled and pallid clay is applied on unburned earthen pots. After baking this clay coating comes into red ocher or flesh like tint. According to tint Banak (local name of pallid and mottled clay)is classified into ranga (dark red), majer (medium red) and gad (light ocher ). Banak is mixed with rain water for a month and sieved until the clay totally mixed with water. This mixture of soil and rain water is used for coloring. Here we may refer to Jamini Roy, who used these earth colors in his painting. Hingul, Haritaki, Kakkhari, lamp black, chalk, lime stone and Giri Mati are some of Indian earth colours (Appasamy 1995).

The making processes are

i. Collection of raw material from riverside bed
ii. Drying and sieving of soil
iii. Mixing of sand and clay to increase the strength of the soil at the time of heating
iv. Putting the prepared soil on wheel and making of wanted material. In case of making horses, all parts have made separately then joined together before heating.
v. Sun dried and colors it with pallid and mottled clay
vi. Put it to furnace
vii. After burning the pots are colored with primary earth colors
viii. Ready for marketing.

Old alluvium is used in pottery. Unscientific utilization of river bank soil by the brick field owners creates unwanted situation to the potter because it caused flood situation which suppress the old alluvium soil. The brick field owners acquiring the river side land and they can not get their raw material. Restriction by forest protection committee under Joint Forest Management Project also creates problem. FPC does not allow collecting fallen leaves from forest so they are not getting fuel to burn the pottery items.
Major findings

1. Laterite is a fundamental geological component and Lateritic soil is a component of Pedological environment. Laterite enters cultural environment as many temples are formed of Laterite.
2. Laterite is considered to be inferior to marble, granite or sandstone when appearance is concerned. Therefore it is masked with finial or terracotta work.
3. Temple structure has been influenced by Orrisa, South India, Mughal and Bengal chala.
4. Terracotta tiles has show the influence of Mughal, Parsee, Jain, Hindu especially Vaisnab culture. Vaisnab culture is obverting in almost all temples and other temple like structure.
5. Finial works mostly show creepers, flowers and small fruits.
6. Temples have lost their religious significance. They are now become components of commercial tourism.
7. Quarried lateritic area has become prone to soil erosion.
8. Roads covered with lateritic soil creates dust hazard during dry season.
9. Sand is widely used in brick kiln which provide job opportunity.
10. Unscientific sand quarrying have created imbalance in the river system.
11. Alluvial clay, mottled clay and pallid are used in pottery and idol making. Mottled and pallid clay are used for coloring in pottery.
CHAPTER - 5

Forest resource as a freely available environmental commodity, commoditization and consequences.

5.1 Introduction

5.1.1 Definitions of forest

a) Natural vegetation is a freely available environmental component under natural conditions i.e. it is controlled by physical laws, physical processes and physical factors. From ecological point of view forest refers to the development of forest vegetation, the actions, co-actions and reaction of trees and other organisms to the complex whole of the environment (Puri, 1954).

b) Forest according to common people is defined as gathering of trees only.

c) The word forest is derived from Latin word foris meaning out of doors. Etymologically it is the large uncultivated tract of land covered with trees and wood (Chamber, 1923 cited in Puri, 1954). Wills stated that the forest is a close assemblage of trees allowing no break in the overhead canopy; homogeneous of one species or diversified. (Wills, 1951 cited in Puri, 1954)

d) A forest is a community of trees and associated organization covering a considerable area utilizing air, water and minerals to attend maturity and to reproduce it; and capable of furnishing mankind with indispensable products and services. In short forests are close association of trees growing together at any place (Allen & Sharp). FAO’s Global Forest Resource Assessment 2000 has given a common definition of the forested lands as those areas having an extent of at least 0.50 hectare with tree grown cover of more than 10% (FAO, 2001).

e) There are complex inter relationship among these various forms of life, some provide food for others or shelter and in numerous cases they exhibit a state of constant warfare, as between the insects which attacks trees and the trees which defend themselves by manufacturing different chemicals. Forest utilize their energy received from the sun but forests also depend upon water and in many situations availability of water limit trees and other plant growth as much as energy supply. In addition to this competition for light and water, there are numerous
and complex nutrient flows within the forest, a nitrogen cycle, phosphorus cycle etc. (Clawson, 1974).

f) From the legal and administrative point of view the forests are classified into (a) protected forest (b) reserve forest and (c) unclassed forest. Protected and reserve forests are those forests which are maintained for the steady supply of timber and other produce for domestic reason. Mostly these are under Government supervision (Mamoria, 1977).

g) According to floristic composition the forest is classified as (a) coniferous forest (b) broadly tropical forest (c) deciduous forest (d) evergreen forest etc. Emphasis is given on the floristic composition or on trees (Koromondy, 1996).

h) According to Spur (1964) the virgin forest or an unharmed forest simply does not exist. So the concept of natural forest lost its significance.

Elaborately it can be said that a forest is a dynamic complex eco-system with many and highly varied characteristics. The natural appearance of the forest is trees but other plant species such as shrubs, grasses and weeds, various animals, birds, insects, reptiles and over all numerous micro biological life also inhabit in the forest.

5.1.2 Mythology and forest

(a) Non-Hindu

The forest God Leshy of Salvonic mythology protects from evils and gives shelter. Another Latin divinity of forest is Sivanus who is worshiped by frightened people. Existence of Goddess Flora named all plants, creepers, climbers and cereals which also prove the importance of forest God in Latin Mythology (Graves, 1994).

(b) Hindu & Folk

There are myriad of concepts having different activity and occupation about forests. It is a resource for tourists as forest is the resting place at a certain period of time. From the time immemorial forest plays a great role in human societies. Concept that a divinity was supposed to reside among the branches of tree lead to worship trees (Ferguson, 1873 cited at Dwivedi et al 1987). People used to go to forest for education which is known as Brahmacharya and at the end of their life when they become old again they used to go to forest for resting which as known as Banprastha and Sannyas.
In Rig Veda there are striking hymn to the Gods and Goddess of forest. *Manusamhita* (the ancient Hindu law code) regarded the destruction of tree as a serious offence and prescribed a heavy penalty for it. The *Agnipurana* (a Hindu scripture) goes so far as to say that man who plants trees for the welfare of the public obtains absolute bliss (Dwivedi & Tiwari, 1987). Our *Vedas*, *Upanishadas* and *Aranyakas* were composed in the forests. Hindus used to worship trees. Some trees like Ashoka, Kadam, Padma, Pipal, Tulsi and Banyan Trees are given a very high place in Hindu religion (Dwivedi & Tiwari, 1987). People of Sundarban worship forest as a deity *Banabibi*. Trees are also symbol of fertility (The people of Indus valley civilization regarded tree as benevolent devas. On the seals of Harapa a women is represented with a plant coming out of her womb is symbolizing fertility concept (Agrawala, 1965).

5.1.3 Forest as economic resource

Forest is regarded as a resource to a Botanist or to an Ayurvedic doctor. It is resource in Botanical or medicinal sense. Beauticians are interested in goods collected from forest for beauty therapy. It is also resourceful for an eco tourist, an adventure tourist or a naturalist. It is resource base to those people of forest fringe areas who have to depend on forest for their livelihood. Ecotourism is a new concept in tourism. Ecotourism is ecology based tourism. The main focus of ecotourism is on natural or cultural resources such as a scenic beauty, caves, and jungles, places of archaeological and historical interest or wildlife particularly endangered or rare species. Objective of ecotourism in India are (a) to create job for jobless people, (b) for nature conservation (c) to improve forest based economy (d) growing interest among tourists, NGOs (e) to develop resource base for tribal in forested areas etc (Cunningham, 1999).

5.1.4 Forest as a negative resource

But there are also negative values attached to forests. To the anti social it is the hiding place or a place for shelter. The agriculturists are often eagerly clearing the forest for expansion of agriculture. The wild animals can destroy the agricultural fields. So it is not a resource base for them.

5.1.5 Conceptual evolution of forest in resourcisation process.

From hunting gathering stage to the era of information technology forest is actively or passively related to human civilization. In the first seral stage of hunting or gathering, forest was treated as resource base
as people collected food from forest and take shelter on trees or by using raw materials from forests. In the next stage of domestication of plants and animals people gather the knowledge of agriculture and they cut forest land for agricultural advancement. After agricultural revolution, destruction of forest increased in an accelerated rate. For construction of bridges, railways, roads and settlements, forest was drastically cleared and the forest cover became thin. After that, industrialization began especially in the developed nations.

With the invention of agriculture the concept that forested tract is a wasteland motivated people to cut forest. But excessive destruction of forest creates hazardous consequences. Efforts have been to conserve forest through various programs.

5.1.6 Forest as a social resource

The life cycle of tribes are intricately related to forest. Many social customs like Law mahal system is centered on forest (Kisku, 2001). Annual sikara or sandra (hunting) festival is also related to forest. Every tribal man used to take his wives bangle before going to forest for sikara. Baha, another folk festival is also forest based festival. During this festival they worship trees, flowers etc. This festival is observed among Bhumij, Munda tribes. Due to deforestation and decrease of wild animal, rituals like sikara has become formal festival (Fig.5.11 & 5.12).

5.1.7 Forest as a problem of law and order

From previous time to the present, forest is a problem of law and order. Jungle mahal was constructed in the study area to control law and order situation of this area. Forest is a hiding place for antisocial activist. Here we may refer to Virappan, the famous sandal wood trader in south India. Wild animals from forest some times create hazardous situation.

5.1.8 Classification of forest

(a) Forest is widely distributed all over the world. About 40% of the total land area is covered by forest. With the advancement of human civilization forest has been cleared drastically. Over 40% of the original forest has been cleared with the advancement of civilization especially after introduction of agriculture (Roy, 1997). There is a relationship among climate, natural vegetation and soil. Owing to these factors the floristic biomes of the world are distributed as - tundra biome, boreal or coniferous, temperate deciduous and rain forest, temperate grass land, chaparral, desert, tropical rain forest, tropical deciduous forest,
The relation between tribal population & forested area of Bishnupur Block, 1991

LEGEND

Tribal population density/hectare
- Less than 20
- 20 - 45
- 45.1 - 71
- More than 71
- Absence of tribal population

Forest Density/hectare
- Less than 0.20
- 0.20 - 0.45
- 0.46 - 0.71
- More than 0.71
- Nonforest area

Scale:
- 22° 57' 15" N to 23° 12' 32" N
- 87° 31' 46" E to 87° 24' 11" E
- 2 Km

Fig. 5.11
The relation between tribal population & forested area of Sonamukhi Block, 1991

LEGEND

Tribal population density/hec
- Less than 20
- 20 - 45
- 45.1 - 71
- More than 71
- Absence of tribal population

Forest Density/hec
- Less than 0.20
- 0.20 - 0.45
- 0.46 - 0.71
- More than 0.71

Nonforest area

Riverine deposition

Sonamukhi Municipality

Area shows:
23° 05' 59" N to 23° 29' 00" N
87° 18' 45" E to 87° 31' 28" E

Fig. 5.12
tropical scrub forest, tropical grass land and savanna and mountains
(Koromondy, 1996). It is seen that the forest of the tropical and
temperate region are cleared more than the forest of equatorial region.
It is because of more accessibility and fertile agricultural lands. For the
advancement of agriculture, construction of road, cities and towns a
large quantity of forest has been cleared in tropical and temperate
region.

(b) India is very rich with forest resource base. There are about 15000
known and described species of flowering plants in India (Puri, 1961).
There are almost 150 species which provide timber and wood. Indian
forest is rich both with teak and sal, rose wood and deodar, sandal and
sisoo, haldu, gurgun, mahogany, laurel, oak and pine. There are
bamboos, canes, palms, acacias also in Indian forests.

(c) The Northern part of West Bengal is covered by tropical moist
deciduous forests, coniferous forests and the southern part is covered
by tropical dry deciduous forests, palm and mangroves. Maximum
forest cover of the southern Bengal has decreased due to illegal
deforestation and agriculture. Main species of dry deciduous forest are
Sal, Segun, Palas, Mohua, Aam, jam, Asan, Sidha, Soara, Kul, Palm, Babla
etc. In riverine areas grasses and other sandy vegetation are found. In
the state of West Bengal both moist and dry deciduous forests are
found.

### 5.1.9 Distribution of forest in Bankura district

Bankura district is physiographically divided into two. The eastern
portion is lying under rice plane and the rest of the district is higher
undulating land. Total district is more or less covered by shrubberies of
semi-spontaneous shrubs, small trees. The main species are pipal,
benyan, figs, mango, jiyal, sij, various creepers, sal, siddha, asan, arjun.
There is a brief account of most common trees and plants of economic
use found in the district. Alkushi (Mucuna pruriens) is a leguminous
creeper; the amaltas (Cassia fistula) is one of the common trees in the
district. Asan (Terminalia tomentosa) yielding good wood and the leaves
used as food for tasar silk worms, babul (Acacia arabica) are very
common in the district. Flowers and seeds are used for medicine,
fodder; boir (zizyphus jujube) is an astringent fruit; bel (Aegle marmelos)
grows freely in Bankura; bag varenda (Jatropha eurcas) grows every
where in the district and used as poultices; bichuti (Tragia involucrate)
used for paralyzed limbs to exotic sensibility; bahera (Terminalia bekerja)
used as astringent (Malley 1908)

Other common plants are dhatura (Datura stramonium), dhuman tree
(Cordial macleodii), gab (Diospyros embrioptecis), harra (Terminalia chebula),
imli (Tamarindus indica), kuchila (Strychnos nux-vomica), mohua (Bassia lalifolia), palas (Butea frondosa), sajina (Meringa pterygosperma), kend (Diaspyros melanxylon), date palm, nim (Malley 1908).

5.2 Objective

Objective of this chapter is to analyze the resource potentiality of natural, modified and extended forest of the study area and probable hazards accrued on due to over or under utilization of plants and their effects on space and society. Objectives of this chapter are numbered below.

i. To analyze the contemporary forest as an environmental economic and socio cultural resource.

ii. The role of changing concept of resource on forest

iii. The effect of this change or consequences on space and society.

iv. Corollary objective is to trace the importance of medicinal plants in the study area and abroad.

v. The changing floristic combination and interaction to other inhabitants of forest.

5.3 Method

Both nomothetic and ideographic methods are used in this chapter.

5.4 Technique

To analyze distribution and density of forest cover data from District Census Handbook are taken. These data are analyzed through statistical technique. Satellite images are also used in this chapter. Field survey technique has been adopted to generate data for medicinal plants. To measure Hazard situations perception survey technique has been adopted.

5.5 Database

Primary data generated through field survey. Secondary data collected from census handbooks, statistical handbooks, DFO Bankura North Division, Panchet Soil Conservation Division, and Sonamukhi Forest Office. Data has been collected from different information brochure supplied by the forest department. Media published data has also been used to prove hazardous situation in the study area.

5.6 Discussion

In modified classification of forest, study area comes under tropical dry deciduous forest and dry peninsular sal forest (photo.5.3). It is based on
the temperature and soil characteristics mainly. The area is mainly covered by coppiced Sal and its associates (*peasal, mahua, kend baheya, asan, arjun, haldu and haritaki*) or a mixture of *Acasia* and *Eucaliptus* (photo.5.5).

### 5.6.1 Species variation

Total forest cover is 1404 Sq. Km. in all or 20.4% of the total area of the district. The shape and size of the forest is depending on topography and soil. Total floristic composition can be divided into two main parts i.e plants of alluvial soil and plant of lateritic soil and elaborately plants are classified as:

i. Plants of the alluvial soil
ii. Plants of lateritic region
iii. Plants growing on hills and their vicinity
iv. Plants growing on wet sandy beds of rivers
v. Hydrophytes
vi. Epyphytes and parasites
vii. Rice field flora (Sannyal, 1994).

The forest of the study area includes plants of lateritic soil, plants of alluvial soil and plants growing on sandy beds of the rivers.

In this chapter natural as well as man made vegetation is interpreted of taken as an environmental resource because plant is an important component of bio-sphere (Fig.5.1).

### 5.6.2 Jungal Mahal district

Bishnupur and surrounding areas were known as *Jungle Mahal*. After Santhal rebellion in 1805 the the then Government decided to form a separate district named *Jungle Mahal* (Regulation no. 18). Six parganas of Medinipore and Bishnupur were included in Jungle Mahal (Choudhury, 1987). Existence of Jungle Mahal is also found in 1813-14 by Bayley (1813-1814) in Bengal District Gazetteers (Peterson, 1997). From the very name Jungle Mahal it is clear that there is a dense natural forest cover in this area. Entire area was covered by deep jungle mainly of sal trees (Malley, 1908).

### 5.6.3 Social Significance

8.16% of the total tribal population of West Bengal is living in Bankura district (Kisku, 2001). In this district there are five types of tribal group namely Santhal, Bhumij, Mahali, Kheria/ sbar and Munda. Among them Santhal stands a major portion. Study area also has a large percentage of Santhal population. From the census report it is seen that
## Common species found in the study area

<table>
<thead>
<tr>
<th>Local Name</th>
<th>Latin Name</th>
<th>Local Name</th>
<th>Latin Name</th>
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<td>Butea frondosa</td>
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<td>Piayl</td>
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<td>Sajina</td>
<td>Moringa pterigosperma</td>
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<td>Ficus religiosa</td>
<td>Sajina</td>
<td>Moringa pterigosperma</td>
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<td>Bahera</td>
<td>Terminalia bellirica</td>
<td>Sheora</td>
<td>Streblus asper</td>
</tr>
<tr>
<td>Bat</td>
<td>Ficus benghalensis</td>
<td>Simul or Semal</td>
<td>Bombox malabaricum</td>
</tr>
<tr>
<td>Bel</td>
<td>Aegle marmelos</td>
<td>Siris</td>
<td>Albizia lebbek</td>
</tr>
<tr>
<td>Cashew(Kaju)</td>
<td>Anacardium occidentale</td>
<td>Sonajhuri</td>
<td>Acacia auriculiformis</td>
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<tr>
<td>Kathal</td>
<td>Artocarpus heterophyllus Linn</td>
<td>Segun</td>
<td>Tectona grandis</td>
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<td>Chapot siris</td>
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<td>Calotropis gigantea</td>
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<td>Alstonia scholaris</td>
<td>Bagnokh</td>
<td>Martynia diandra</td>
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<td>Ocimum canum</td>
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<td>Haldu</td>
<td>Adina cordifolia</td>
<td>Dhutura</td>
<td>Datura stramonium</td>
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<td>Kath bel</td>
<td>Feronia elephantum</td>
<td>Girikali</td>
<td>Glycine hispida</td>
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<td>Kend</td>
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<td>Kaliakera</td>
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<td>Karamcha</td>
<td>Carissa spinarum</td>
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<td>Kul</td>
<td>Zizyphus xylopyra</td>
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<tr>
<td>Minjiri</td>
<td>Cassia siamea</td>
<td>Kurchi</td>
<td>Holarrhenna antidysenterica</td>
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<td>Neem</td>
<td>Azadirachta indica</td>
<td>Nagkeshor</td>
<td>Opuntia Dillenii</td>
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<tr>
<td>Palash</td>
<td>Butea Frondosa</td>
<td>Nishinda</td>
<td>Vitex negundo</td>
</tr>
<tr>
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<td>Pterocarpus marsupium</td>
<td>Shialkanta</td>
<td>Mimosa rybicaulis</td>
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<tr>
<td>Piayl</td>
<td>Buchanania latifolia</td>
<td>Bherenda</td>
<td>Jatropha curcas</td>
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<td>Sajina</td>
<td>Moringa pterigosperma</td>
<td>Bhurur</td>
<td>Gardenia resinifera</td>
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<td>Sal</td>
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<td>Bichuti</td>
<td>Tragia involucrate</td>
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<td>Clerodendrum infortunatum</td>
<td>Shialkanta</td>
<td>Argemona mexicana</td>
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</tbody>
</table>

Fig. 5.1
total percentage of tribal population in this district has increased. The forest density and composition of species also changed. The social, economic, cultural and philosophical lives are centered on forest. They used to collect fruits, roots, hunting game birds and other animals from forest. Advancement of agriculture retards hunting activity but till the rituals continues. Bageswar is the God of forest among Kora tribes. Giring or Thakur is forest God among Kheria tribes. Before going to forest they used to worship their God to get rid of any mishap. Sal (Shoria robusta) is a sacred tree among Santhals. In every social custom and ceremony worship of Sal is a must. Mahua (Madhuka indica) is another sacred tree. They believe that Jaherera and Gosainera live under this tree. The main festivals Baha, Saharai or Sahrul and Karam are nothing but forest festival (Hansda, 2002).

The study area also has a great percentage of scheduled caste population who also spend their livelihood on forest. A ritual cum festival is 'Ekhan parab' (festival). In the month of January (when the animals are not pregnant) the Chatri, Bhuj, Bagdi, Bauri, Dom etc went to forest for hunting. It is related to the hunting festival of kings. But due to deforestation number of animal has decreased. The wild life protection acts are also one of the main reasons for extinction of these festivals. But the ritual continues by eating meat on the day of Ekhan (first day of Bengali month Magha or January).

Another important festival related to the forest is worship of snake Goddess Manasa (discussed in separate chapter) and Jhapan festival.

5.6.4 Economic Significance

Social forestry project in 1981 and West Bengal forestry project in 1992 helped forest personnel to interact closely with fringe population and panchayats in the study area (photo.5.2).

Joint Forest Management was launched in the study area since 1990-91. The district was converted into five territorial ranges. These are Bishnupur, Bankadaha, Onda, Jaypur and Taldangra. These five territorial ranges including Bishnupur (one of my study areas) come under Panchet Soil Conservation Division in 1995. Sonamukhi comes under Bankura North Division. At present there are 46 FPCs of 5016 members in Sonamukhi range and 72 FPCs of 4741 members in Radhanagar range of Bishnupur Police Station (DFO, Bankura, 2001). Under Panchet Soil Conservation Division there are 224 number of FPCs of 25781 members of which a large proportion of member coming from Bishnupur Police Station (PSCD, Bishnupur, 2001). In Joint Forest Management Program 25% of produce for restoration of degraded Sal, coppicing and multiple shoot cutting goes free of cost to the FPC
members and 75% is being sold at Government approved rate to the villagers. The members are also entitled to collect fallen twigs, grasses, seeds and leaves etc completely free of cost. Sal seeds and Kendu leaves are collected by the FPC members and deposited to West Bengal Tribal Development Co-operative through LAMPS. After felling, 25% of the net sale proceeds were given to the FPC members. Thus it creates marketable benefits through commercial timbering and household uses (Murthy et al, 1999).

To strengthen the Joint Forest Management Programme in the study area Ramkrishna Mission Loksiksha Parisad is assisting the forest department of Government of West Bengal. They deal with FPC member only to make them stable, capable, self reliant so that they can undertake and sustain the process of development. The objective if fulfilled through ‘community fund building’ and this fund named as ‘Musty Sanchay’ (fistful rice collection). It is a slow but certain and with community effort. However the fund may be replenished by contribution from joint income generating activities and give strength to JFM (Das: 1997) (Fig.5.4).

5.6.5 Forest as a source of energy

Forest is a source of energy not only for the people of forest fringe areas but outside the forest areas also. Most of the forest of the study area is covered by tropical deciduous forest. It is to be noted that the forest of the study area are not natural forest but are rehabilitation of degraded forest mainly to check soil erosion. From satellite image it is noticed that the forest cover is increasing in the study area. To check soil erosion priority is given on the fast growing plants. Eucaliptas came to India in 1960’s to check soil erosion in degraded barren lands and open areas. Forest department has taken the decision to plant eucalyptus, acacia, Amlaki, am, Kanthal, Krishnochura, Karanj, Gamar, Gharanim, Chatim, Jarul, Jacaranda, Jhau, Tentul, Debbaru, Pakur, Babla etc. Among these plants eucalyptus and acacia are mainly used for energy plantation. These two are fast growing plants. After the introduction of JFM forest protection committee get a certain percentage of forest products from forest as fuel for domestic purposes. Local artisans, potter used to collect leaves from forest to burn the earthen materials. Besides eucalyptus coppiced Sal (a fast growing plant) is also planted for energy production and as timber (photo.5.1&5.4).

5.6.6 Forest and Eco-tourism

Forests on the vicinity of urban settlements or any other places may be a place of attraction for picnic. The study comes under rolling and
FLORA & FAUNA

ELEPHANT ENCROACHMENT

UNWANTED SITUATION

NATURAL SAL SHEGUN

COPPICED SAL

EUCALIPTUS / ACASIA

MEDICINAL PLANT

AURVEDIC & COSMETIC VALUE

POTTARY

FOREST AS WASTE LAND

PROTECTION

SOCIAL FORESTRY

JOINT FOREST MANAGEMENT

FOREST PRODUCT

ECONOMIC ENVIRONMENT

Fig. 5.4
undulating landscapes with dense Sal forests combination of red lateritic soil and green natural vegetation attracts tourists. Chenchuria, Sutan, Jhilimili and Beharinath are the places of eco tourism in the district. Attempts have been made to create new eco tourism spot in the study area. Beldanga of Bankura North Division has been selected as a spot for eco-tourism. These all steps were taken to generate resource base. The main objective of eco tourism is to develop resource base for tribals in forested areas, to improve forest base economy and job opportunity (Cunninghum, 1999).

5.6.7 Changing concept on forest in the study area

In India deforestation activity was done mainly in British period by the East India Company. After the transfer of authority from East India Company to British Crown a change was observed. Emphasis was given on long term benefits in place of immediate gain. Due to excessive timbering and collection of fire wood compelled the Government to pay attention to that. In the year 1863 and 1884 some resolutions were taken by the Inspector General of Forest

a. Forest should be maintained for general wellbeing of the country.

b. It should be maintained for preservation of climate and physical condition of the country.

c. To supply and fulfill the needs of the people for fuel and industries

So the concept was to preserve the forest.

In the year 1952 a new forest policy was taken by the Government and steps were taken to preserve forest by

a. Beneficial practices
b. Increasing the efficiency of forest administration
c. Improve in forest research and forest product utilization
d. Controlling grazing and the needs for promoting welfare of the people

Several forest development programs have been taken such as Vana Mahotsava. Special plans have been taken under five year plans by the Government (Mamoria, 1984). The third plan emphasizes on protective and productive role of forest in the Indian Economy and suggests loan term objective. In the fourth plan emphasis was given on forest products for industrial and fuel products. The schemes were undertaken for quick growing species and programmes for rehabilitation for degraded forests. Under fifth plan
measures have taken for increasing forest products for industrial sector and to develop firm forestry. In the sixth five year plan also emphasis was given on conservation of forest. In 1981 program for social forestry was adopted. In this program attempts have been taken to satisfy those social demands which farm forestry is inadequate to meet (Mamoria, 1984). In 78-83 planning period concept of social forestry came into existence.

Objective of social forestry were

a. Supply fuel wood to the rural population
b. Small timber supply
c. Fodder supply
d. Protection of agricultural field against wild animal.
e. Recreational needs.

The study area was previously known as jungle mahal. Forest of different shape and sizes covers the whole district interspersed with agricultural land, waste land and habitation. After the abolition of Zamindari system in 1953, the forests of Bankura district came under the control of forest department. At the time of acquisition by the Government during 1954-1955, forests were in an advanced stage of degradation. After that the forest was taken under scientific management but till there are problems in the forest fringe areas due to growing unemployment and lack of resources in those areas.

In the year 1972 there was an upliftment for those people of forest fringe areas through the socio economic research project for fringe population at ‘Arabari’ Midnapore. After that the West Bengal Social Forestry Project came in 1981. In 1992 another project, West Bengal Forestry Project helped the forest personnel to interact closely with the fringe population and panchayats. Based on this platform another project Joint Forest Management was introduced in the nineties in southern West Bengal (Government of West Bengal’s order no. 5962 for D/15-16/88 Dated 27.07.90). Through this project degradation of forest was checked by Forest Protection Committees in Bankura district along with the study area.

5.6.8 Forest as a medicinal resource

In Rigveda one entire hymn devoted to trees especially to praise the healing property of trees (Rigveda, 10.97 cited at Dwivedi et al, 1987). In recent times ayurvedic medicines are very popular because of having no side effects. For this reason forest department has taken the decision of raising medicinal plants in the study area. List of some of the medicinal plants are given in Fig.5.2 and Fig.5.3.
# CHART OF MEDICINAL PLANTS

<table>
<thead>
<tr>
<th>LOCAL NAME</th>
<th>BOTANICAL NAME</th>
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Fig. 5.2
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<th>LOCAL NAME</th>
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<th>FRUIT</th>
<th>ROOT</th>
<th>FLOWER</th>
<th>BARK</th>
<th>SEED</th>
<th>STEM</th>
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<td>Tulsi</td>
<td>Asimun sanctum</td>
<td>√</td>
<td></td>
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<td>Zizyphus xylopoera</td>
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<td>Vite negundo</td>
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<tr>
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<tr>
<td>Kalmegh</td>
<td>Andrographic pariculata</td>
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<td>Marsilea miluta</td>
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<td>Chhatim</td>
<td>Alstonia scholaris</td>
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<tr>
<td>Bahera</td>
<td>Terminalia balarica</td>
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</tr>
</tbody>
</table>

Fig. 5.3
5.6.9 Forest as hazard

With the advancement of human civilization demand for agricultural land is increasing. Forested land is cleared for agricultural purposes. After Permanent Settlement Act deforestation became hazardous. In the study area also deforestation is a problem.

The very decision of the Government to plant fast growing species to check soil erosion (photo.4.2&4.3) and easy supply of fuel wood is also a problem. Mono species culture affects bio-diversity and ecological balance as well. Eucalyptus plantation in lateritic belt may cause lowering of water level (Siva, 2002) (photo.4.2). In the article, Siva cited example from Australia where eucalyptus plantation results lowering of ground water.

The old district gazetteers had recorded about the movement of a large number of wild animals including elephants, wolves and wild boars etc. Extension of agricultural fields due to increased population pressure is one of the main causes of shrinkage of forest cover in the study area. Forest became decimated and fragmented and wild animals lost the large part of their habitat. At the time of transfer of private forest to the forest department in 1955 there were least animals including no resident herd of elephant was found in the study area. After the successful launch of joint forest management program in the study area, vast areas under degraded Sal forest become regenerated. They often savour the crops in the villages and provided nutrition at minimum efforts. During December 1987 a migratory herd of 40 wild elephants first migrated in the study area from Dalma sanctuary in Jharkhand (DFO, Bankura, 2004). The elephants moved eastward, crossed Kangsabati River and entered Lalgarih of Midnapur (Fig.5.10). Fragmented forests of the study area had grown very fast during JFM project in the last 10 years. The disjointed forest patches were surrounded by thick population and agricultural fields. The elephants used the forest as day time shelter and destroyed the paddy field from dusk to midnight. Since 1988 they ventured in to Bishnupur forests after crossing the Silabati River. Since 1995 they have been crossing the Darakeswar river and moving to Sonamukhi of Bankura North Division (DFO, Bankura 2004). The are advancing their date of arriving from Jharkhand state and delaying departure unless pushed back by determining drives by the forest department. It is a matter of concern that the hard is advancing their arrival and delaying returns, deliver young calves during their stay at south West Bengal. The elephants caused human causality, injury including rendering permanently disabled; property damage and crop loss is increasing with the expansion of their territory.
Elephant encroachment from different parts of India in the study area

Source: IRS, LISS-III (107_56 & 107_55)
It is seen from census data analysis that the density of forest cover increases in the study area (fig no. 5.5 & 5.6). Animals especially elephants are migrating from neighboring deforested areas. Dalma pahar and forested tracts of Jharkhand and Bihar mention worthy. These elephants bring huge loss both to life and property which can be seen from the following table (Fig. 5.7, 5.8 & 5.9). Among other wild animals other than elephants is wild boar which is also hazardous. Wild boar often caused damage to the field crop in April 2002 and one person is killed by wild boar. The problem is increasing (PSC, Bishnupur, 2003). Besides these spotted deer released by forest department increasing their population by breeding, regularly raid forest fringe agricultural fields in Jaypur range.

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1 No of person killed</td>
<td>4</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>2 No of person permanently disabled</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3 No of persons injured</td>
<td>3</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>4 No. of hut damaged</td>
<td>10</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>5 No. of livestock killed</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6 Case of crop raiding</td>
<td>791</td>
<td>4075</td>
<td>3550</td>
</tr>
<tr>
<td>7 Total area affected by crop raiding (ha)</td>
<td>120</td>
<td>593.036</td>
<td>341</td>
</tr>
</tbody>
</table>

Fig.5.7
Source: DFO, Bankura North Division.

<table>
<thead>
<tr>
<th>year</th>
<th>No. of human beings killed</th>
<th>Responsible for killing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999-00</td>
<td>04</td>
<td>Wild elephants(resident)</td>
</tr>
<tr>
<td>2000-01</td>
<td>06</td>
<td>Wild elephants(resident)</td>
</tr>
<tr>
<td>2001-02</td>
<td>nil</td>
<td>nil</td>
</tr>
<tr>
<td>2002-03</td>
<td>01</td>
<td>Wild boar</td>
</tr>
</tbody>
</table>

Fig.5.8
Source: Panchet Soil Conservation Division, Bishnupur

People have to spend many sleepless nights to protect themselves from sudden attack of elephants. Some times it is seen that they try to suicide losing their crops and houses. It is also hazardous (Anandabazar Patrika, 2006). Wild animals creates hazardous situation by affecting agricultural fields and human lives on the one hand. On the other hand wild lives are also affected by illegal killing or accident which affects the forest
Forest density map of Bisnupur Police Station, 1981 and 1991

LEGEND

Forest density per hectare

- Less than 0.20
- 0.20 - 0.45
- 0.46 - 0.71
- More than 0.71

- Nonforest area
- Darakeswar River
- Bisnupur Municipality

Area shows:
22° 57' 15" N to 23° 12' 32" N
87° 31' 46" E to 87° 24' 11" E

SCALE

2 0 2 Km

Fig. 5.5
Forest density map of Sonamukhi Police Station, 1981 and 1991

Area shows:
23° 05’ 59” N to 23° 29’ 00” N
87° 18’ 45” E to 87° 31’ 28” E

Legend:
- Less than 0.20
- 0.20 - 0.45
- 0.46 - 0.71
- More than 0.71
- Nonforest area
- Damodar River
- Riverine deposition
- Sonamukhi Municipality

Fig 5.6
ecology negatively. This is also undesirable. The following table gives a picture about killing and accidental death of animals.

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of wild animals died</th>
<th>Killing/Accidental</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999-00</td>
<td>01 wild elephant, male</td>
<td>Accidental</td>
</tr>
<tr>
<td>2000-01</td>
<td>01 wild elephant, male</td>
<td>Killing, declared rogue</td>
</tr>
<tr>
<td>2001-02</td>
<td>Nil</td>
<td>nil</td>
</tr>
<tr>
<td>2002-03</td>
<td>01 wolf, 04 deer (02 male + 02 female)</td>
<td>Accidental</td>
</tr>
</tbody>
</table>

Fig. 5.9
Source: Panchet Soil Conservation Division, Bishnupur, 2004

Besides loss of life and or property people also suffer from some unwanted situations. People have to depend on fallen leaves, twigs often restricted by the members of the forest protection committee. The pottery makers of Sonamukhi previously collect fallen leaves to burn earthen products. Low heat generated from burning of Sal and eucalyptus is suitable for their industry. But the restriction by FPC creates unwanted situation and they have to buy saw dust for this purpose. A bag of saw dust costs Rs. 10-12. It increases the production cost. In a situation when the use of earthen material has already decreased this increased price drastically affect the potter community.
Major findings

1. Ecologically forest is a component of botanical and zoological environment controlled by physical laws, processes and factors.
2. Forest was a resource base for tribal community in the study area.
3. It has now become an industrial resource base.
4. Domesticated forest now become center for tourist attraction.
5. Due to changes in concepts on socio-economic demands on forest the composition of domesticated forest has changed.
6. Energy plantation is the characteristic of forest policy.
7. Increased density of domesticated forest has checked soil erosion particularly in the lateritic terrain.
8. Increased density of forest has enhanced encroachment of elephants from the degraded and deforested neighboring districts and states.
9. Loss of life and property is the observed socio-economic and spatial effect of this encroachment.
10. Prohibitive orders on the entry to the forest have deprived potters from collecting dry leaves free of cost.
11. Potters have been negatively affected by this prohibitive order.
12. Culture of medicinal plant has increased.
CHAPTER - 6

Water resource, socio-economic environment and agriculture, the main socio-economic activity

6.1. Water, a component of humanized hydrological cycle, resourcisation of water and its positive and negative consequences on space and society.

6.1.1 Introduction

Water is found in 3 states such as atmospheric, surface and ground water in global hydrological cycle, basin and local hydrological cycle. It covers 70% of the earth's surface. It has entered into the resource process from ancient times. Atmospheric water comes to earth through precipitation in form of solid, liquid or water vapor. The main sources of surface water are ocean, sea, rivers, lakes and rainfall.

6.1.1.1 Hydrological Cycle

Water on earth exists in a space called hydrosphere which extends about 15 km. up into the atmosphere and about 1 km down into the lithosphere. On the crust of the earth water is a component of physical environment. Water circulates through a cycle called hydrological cycle. The cycle has no beginning or end and many processes occur continuously. Water evaporates from the ocean and land surfaces to become a part of the atmosphere, water vapor is transported and lifted in the atmosphere until it condenses and precipitates on the land or the ocean; precipitated water may be intercepted by vegetation, became over land flow over the ground surface, infiltrate into the ground, flow through the soil as subsurface flow and discharges into streams as surface run off, returns to the atmosphere through evaporation. The infiltrated water may percolate deeper to recharge ground water. Later emerging in spring or seeping into streams to form surface run-off and finally following out to the sea or evaporating into the atmosphere as the hydrological cycle continues (Feeter, 1988). This is a physical environmental process. On the other hand water is culturally defined as a resource as it fulfills human needs and satisfying their wants. Culturally it can be said that water is a mobile resource as it transformed into different forms at different and places by human beings to satisfy their wants. Water is used in industrial, municipal, domestic and irrigation sectors. It is mainly used for drinking purpose. Significance of water is culturally defined.

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6.1.1.2 Historical evidence of utilization of water

There is no boundary in natural distribution of water. It is a freely available natural or physical environmental component. Through human activities the movement and distribution of water restricted to some extent. River basin water systems, ocean water systems are restricted by human made political boundaries. Concepts on the utilization of water make it a resource. Emphasis has been given on surface and ground water in this dissertation. Water enters into the resourcisation process through times immemorial. It is a subject of investigation from the early stage of civilization. About 4000 BC, the Nile was dammed to improve agricultural productivity in barren lands of Egypt. Harappa Mahenjodaro, Indus valley civilization Mesopotamia was situated between the major rivers Tigris and Euphrates (Wikipedia, 2006).

6.1.1.3 Religious significance of water

Almost in all religious water occupies a significant place. Shintoism a religion of 500 BC is about the nature worship. The term formed after Shin-Tao (way of good).During the worship of Kanis they used to purify themselves with water. Waterfall is a sacred symbol of Shinto’s (Wikipedia, 2006).

The existence of a pool, fountain is common in Dargas (Muslim place of worship) because these are symbol of purity. One can purify through ghusl or bath before prayer. They used to wudu or do normal purification before 5 time’s daily prayer or Namaz on friday. Koran recognizes water as important and valuable as the inevitable component of agriculture (Wikipedia, 2006).

In Buddhism water is a means of spiritual enlightenment. Buddhists used to place a bowl in front of a dead body (Wikipedia, 2006). Buddha got Mahanirvana on the bank of river NairanJana.

Christians also believe water as a medium for purification. Baptism is a ritual related purification by water. Jordon is a sacred river to them because Jesus baptized by this river. In holy Bible creation of water and classification of water are described in Genesis no.2 & 7 respectively. In Judaism, Torah states about purity of water. They believe that living water such as sea, spring, and river are pure. They used to wash hand or whole body for purification. Mikah, a ritual related to the purification of body after connection with a dead or after menstruation. Red sea is sacred to them. They believe that it was parting by Mosses when Israelites escape from Egyptian army (Wikipedia, 2006).
In Hinduism water plays an important role. The Ganges is personified as a Goddess. There are many sacred rivers in India and these are called *Punyataa* (meaning sacred water). These are Bhagirathi, Saraswati, Yamuna, Krishna, Kaveri, and Brahmaputra, Godabari, Narmada and many others. In India social relation indicated through water named as 'jalchal.' Rabindranath Tagore’s dance drama ‘Chandalika’ is based on this very theme (Tagore, 1980). The very concept that river water is pure is because it is flowing. Anything will be washed with water because it is flowing. The Hindus immerse their idols in the water. Water is one of the five elements or ‘Pancha tatvas’ in Hindu religion (Dwivedi, 1987). Indus used to worship their ancestors standing on water. Water is believed to have spiritual power and the adjectives like holy water, amrita (nectar) are attached to water. Not only the rivers but the wells, another source of water are also sacred or auspicious like Zamzam well.

Ponds are also sacred to many religions. Manas sarovar, Bhimtal, Rakhashal, Puskar are some of the sacred water bodies in Hinduism. Water is widely used in many other social rituals and customs.

### 6.1.1.4 Use of water in different purposes

Water is a freely available physical component. After entering into the resource process it becomes resource for human beings. Besides drinking water it is also used as a solvent, as a thermal transfer agent. It is a base for recreation activity, for industrial purposes and for generation of hydral power. In agriculture water is the main factor. For human intake 2.7 liter for men and 3.7 liter for women water is required daily (Santra, 2001). It is also used for domestic purposes. Water is also used for cooking.

Based on water many sports and recreation centers have developed for swimming, water surfing, boating, fishing, diving etc. Natural aquarium is another mode of recreation. It is used as jet cutters and blasting. For dying it is also important.

### 6.1.1.5 Water dispute

Basin water system controlled by physical, environmental laws. Due to mass increase of population, per capita water reserve decreases day by day. Now a day, it becomes a strategic resource and centering water many political conflicts are increasing. UNESCO’s World Water Development Report (WWDR, 2003) from its World Water Assessment Program indicates that, in the next 20 years, the quantity of water available to everyone is predicted to decrease by 30%. At present some of the countries have insufficient water supply. All over the world
there are millions of examples about water conflict. Control of Jordan River by Israel creates conflict between Jordan and Israel. Conflict between Iraq and Syria about Ataturk dam is another example. The Nile is shared by nine countries. Creation of 3 Gorges dam on Yangtze River creates social and environmental problem. Dispute between India and Bangladesh about river Ganges is another political issue. Though these two countries sign an agreement but till issues going on for the quality of water. Another inter state conflict is between Karnataka and Tamilnadu about Kaveri water. Conflict for water among four countries of South America (Argentina, Brazil, Bolivia and Paraguay) is seen for the Guarani aquifer. Privatization on source of water some times create problem (wikipedia, 2006). Spatial distribution and place specificity show that these civilization developed in the areas where there was a scarcity of atmospheric moisture and rivers are of fluctuating regime. Civilization flourished by judicial using of atmospheric moisture and river water like Tigris in history. Pond and canals were excavated as supplement of atmospheric and riverine water. With the increased population and increased demand on food, agricultural area were extended and surface water bodies were extended through canals due to notions on increased demand of water to meet agricultural needs. Green revolution (1960's) has been a threshold in agriculture in the south Asian countries. Selected varieties of rice, wheat, maize were raised with high inputs of fertilizer and water (Jackson, 1996). This revolution initiated the introduction of high yielding varieties with shorter gestation period. Water requirement of this HYV species is higher than that of previous one. Therefore this is the phase when ground water irrigation was enhanced to meet water demand in agriculture. At present every where there is conjunctive use of atmospheric, surface and ground water is seen.

Above discussion shows that through the history water in different forms have been perceived as an important component of physical, socio cultural and politico economic base all over the world and according to its utilization has taken place in different sectors at different places and at different times.

6.1.2 Objective

Objective of this chapter is to assess the role of atmospheric rain water, surface rivers, canals, tanks and ground water as a major physical base in agricultural development of the study area. Objectives in detail are:

i. To make an observation on rainfall pattern in the study area to survey inherited and extended surface water; flowing or bounded.

ii. To evaluate ground water situation
iii. To assess resource potentiality of water mentioned above from agricultural perspective as agriculture is the most important socioeconomic activity of the study area.

6.1.3 Methodology

Both nomothetic and ideographic methods have been applied in this chapter.

6.1.4 Technique

Distribution of water is analyzed from SOI maps collected from SWID. Field survey technique is adopted to access the concept on utilization of water resource in the study area. Due to unavailability of satellite imageries researchers have to depend on topographical maps. Distribution of agriculture is analyzed from PAO data collected from PAO, Bishnupur. Field survey technique is adapted to access the concept on agricultural change in the study area. Due to unavailability of satellite imageries researchers have to depend on topographical maps. Irrigation data used here, collected from Agri-irrigation Department, Bishnupur and District Census Handbook, Bankura district. Data for Physical hazard has been collected from District Relief Office, Bankura.

6.1.5 Discussion

Water in three states atmospheric, surface and ground water in global basin are used in the study area. It enters into the resource process from ancient time. Surface water mainly river is widely used in the places of scarcity in atmospheric rainfall. Ground water is the latest entrant in this rail. The main features of utilization are described below.

6.1.5.1 Atmospheric Water

Bankura district is under subtropical climate. The average rainfall is lower than tropical or equatorial climate. It has scanty atmospheric rainfall. Economy is dependent on agriculture. Monsoon plays a significant role in agricultural production. In rainy season most of the crops are raised with the help of rain water. Naturally rainfall is the most important physical environmental resource. The rainfall and temperature characteristics of the district are as follows (Fig.6.1, 6.2 & 6.3)

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<td>January</td>
<td>21.0</td>
<td>31.9</td>
<td>36.6</td>
<td>12.6</td>
<td>90.2</td>
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<td>5.5</td>
<td>0.0</td>
<td>29.0</td>
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<td>February</td>
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<td>14.2</td>
<td>18.0</td>
<td>17.6</td>
<td>79.9</td>
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<td>58.0</td>
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<td>April</td>
<td>60.3</td>
<td>4.2</td>
<td>9.8</td>
<td>70.1</td>
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<td>361.6</td>
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<td>355.2</td>
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<td>135.1</td>
<td>205.7</td>
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<td>268.3</td>
<td>362.6</td>
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<td>313.0</td>
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<td>239.8</td>
<td>365.8</td>
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<td>90.8</td>
<td>38.8</td>
<td>45.0</td>
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<td>113.6</td>
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<td>31.6</td>
<td>11.8</td>
<td>11.6</td>
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<td>11.0</td>
<td>14.0</td>
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<td>18.6</td>
<td>0.0</td>
<td>50.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
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<tr>
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<td>1490.7</td>
<td>1481.7</td>
<td>1315.6</td>
<td>1571.4</td>
<td>1326.8</td>
<td>1876.8</td>
<td>950.7</td>
<td>1323.0</td>
<td>1437.0</td>
<td>1317.0</td>
<td>1409.0</td>
</tr>
</tbody>
</table>

Source: Data (1994-2000): Principal Agricultural Officer, Bankura
Data (2001-2003): Meteorological Department, Government of India

Fig. 6.1


<table>
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<tr>
<th>Month</th>
<th>Maximum°C</th>
<th>Minimum°C</th>
<th>Maximum°C</th>
<th>Minimum°C</th>
</tr>
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<td>January</td>
<td>29</td>
<td>8</td>
<td>29</td>
<td>6</td>
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<td>February</td>
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<td>37</td>
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<td>42</td>
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<td>June</td>
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<td>July</td>
<td>39</td>
<td>26</td>
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<td>25</td>
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<tr>
<td>August</td>
<td>35</td>
<td>24</td>
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<td>September</td>
<td>35</td>
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<tr>
<td>October</td>
<td>34</td>
<td>18</td>
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<tr>
<td>November</td>
<td>31</td>
<td>15</td>
<td>33</td>
<td>13</td>
</tr>
<tr>
<td>December</td>
<td>31</td>
<td>10</td>
<td>28</td>
<td>11</td>
</tr>
</tbody>
</table>

Source: Meteorology Department, Government of India
The above diagram shows the rainfall characteristics of ten years (1994-2003). Though in last ten years the rainfall is more or less normal but the exception found in the years 1994 and 1999 when the total rainfall is much higher than average. In the year 2000 the total rainfall was much lower than the average. Due to uncertainty of monsoon rainfall farmers mostly depend on surface water and ground water. This uncertainty of rainfall has entered people's notion and has influenced cultivators to take decision on the use of other sources of water within the behavioral environment.

In this district two types of agro climatic zones are found (a) Undulating red and lateritic in Sonamukhi, Joypur, Bishnupur, Radhanagar, Gangajalghati, Barjora, Saltora, Onda, Taldangra, Simplapal, Mejhia, Raipur, Sarenga, Chhatna, Indpur, Khatra, Hirbandh, Bankura I and Bankura II。(b) Vindhyan alluvial zone in Patrasayer, Indus, Kotalpur blocks. First zone comes under dry sub humid type of climate. Rainfall varies from 1100 mm to 1400 mm, maximum temperature is 45°C and minimum temperature is 10°C. From the rainfall data of the year 1994, 1995, 1996, 1997, 1998, 1999, 2000 it is seen that average rainfall is 1329.2 mm approx. During April -May a few spells of nor'wester shower rush in. Rainfall in the month of June-Sept constitutes 78% of the annual rainfall. Though the rainfall is enough but uneven distribution creates problem. For that reason crop
failure is a common problem which results agricultural drought in this
district.

6.1.5.2 Surface water

Surface water of the study area is further classified into rivers, ponds,
reservoirs, canals etc. River flow is governed by physical laws and
processes. Owing to the slope the rivers of the study area flows from
north-west to south-east. All the rivers are non perennial, rises from
Chhotonagpur plateau and are rain fed hill streams. Depending on the
climatic characteristics (mainly temperature and rainfall) the level of
water fluctuates with seasonal variation. River beds are sandy and
dried up in summer months. The main rivers are Damodar,
Dwarakeshw?r (photo 6.1), Birai and Shali.

Damodar takes its rise in the hill of Chhotonagpur and touches
Bankura district just after it receives water of Barakar and flows in the
south-eastern direction. It is a natural boundary between Bardhaman
and Bankura. Total width is 1484 m. It is full of sand banks. From the
middle of July to October it causes flood because of over sedimentation
of the river bed. It is navigable in the rainy season. In its lower course
the size of the channel becomes much lesser which fail to retain whole
volume of water and this causes flood. The chief tributary of Damodar
is Sali which covers almost the northern portion of the study area.

Man controlled the flood propensity of Damodar by constructing
different transverse embankment on it. Use of water in DVC and
agricultural purposes it is no longer a natural phenomenon. Men also
quarried sand from the river bed for construction and other purposes.

Dwarakeswar or Dhalkishor is another important river of the study
area. This river takes its rise near the Tilabuni hills in the northern part
of Hura P.S. of Purulia district and enters Bankura near damuda
village of Chatna P.S. Shilabati, Birai, Arkusa, Gandeshwari are the
main tributaries. Birai is important river of the study area regarding
agriculture. During monsoon rainfall flash flood is a common incident
of Birai.
Sali is another chief tributary of Damodar. Sali rises at Kora hills and
joined Damodar near Indus block. This river covers most part of
Sonamukhi. During rainy season flash flood occurs in Sali River
also. Many wards of Sonamukhi municipality and surrounding
villages.

Name of the flood prone Gram Panchayets and name of the village

i. Uliara - Santipur colony, Chhilimpur, Basantapur and Ptokas.
Besides rivers there are many tanks in the study area especially in Bishnupur. These tanks were excavated by Malla kings to meet water demands during dry months. Beside drinking water these ponds are used for agriculture, fishing and domestic purposes. Besides the tanks excavated by Malla Kings there are many tanks in the study area. Small rivulets in the lateritic terrain have been transformed into dams or tanks by constructing cross dams of rudimentary structure. These are locally known as *jorbandh* (photo.6.2).

Revisional Settlement (1953) and Land Revenue of West Bengal (1955) gives some information about the tanks of Bishnupur. (Fig.6.4)

The study area comes under Kangasabati command area. Southern part of Bishnupur mainly areas of Dhangasol, Basudevpur, Kharikasuli, Bangele, Gobrindapur, Kalabani and Balidoba are fed by Kangasabati river canal. In Sonamukhi Police Station another canal locally known as Subhankari Khal also used for irrigation.

<table>
<thead>
<tr>
<th>Sl no.</th>
<th>Name of tank</th>
<th>Location with respect to Bishnupur</th>
<th>R.S. Record Dag</th>
<th>Total area in acre</th>
<th>Excavated by Raghunath Malladev</th>
<th>Dag</th>
<th>Total area in acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chougan</td>
<td>South east corner</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td></td>
<td>Nil</td>
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<tr>
<td>2</td>
<td>Lalbandh</td>
<td>East corner</td>
<td>14176</td>
<td>74.78</td>
<td>83057</td>
<td>51.70</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Shyambandh</td>
<td>East</td>
<td>12791</td>
<td>18.5</td>
<td>21853</td>
<td>18.15</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Krishna Bandh</td>
<td>Heart of the town</td>
<td>9005</td>
<td>16.62</td>
<td>11568</td>
<td>9.46</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Jamunabandh</td>
<td>West</td>
<td>1169</td>
<td>107.35</td>
<td>5502</td>
<td>39.10</td>
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<tr>
<td>6</td>
<td>Kalindi Bandh</td>
<td>West</td>
<td>1156</td>
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<td>8959</td>
<td>30.60</td>
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<tr>
<td>7</td>
<td>Gantait Bandh</td>
<td>North west</td>
<td>5691</td>
<td>10.46</td>
<td>Not known</td>
<td>144</td>
<td>10.46</td>
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</table>

Fig.6.4
N.B: Chougan and Kajulia were totally silted. There is no record of these two tanks in R.S record and L.R record. At present Krishna Bandh is undertaken by Government of West Bengal as Krishna Bandh Fishery Project.

6.1.5.3 Ground Water

Bankura district shows various hydro geological characters. It is generally divided into three hydro geological zones. (a) Hard rock area in the west; (b) Hard rock fringe area of the middle and (c) Alluvial area of the east.

a. South-western part of the district is covered by hard crystalline rock of Achaean period. Some places by sedimentary rocks of Gondwana groups. Due to presence of hard crystalline rock limited ground water occurs in the joint cracks and in fissures. Average ground water depth is between 5 m and 10 m in summer. Ground water exploited by dug wells.

b. The second zone i.e., the hard rock fringe area extends between hard rock and unconsolidated aluminum in the east. This area is covered by laterite capping followed by sand, clay and kankars (nodules). Unconfined to semi unconfined aquifers host ground water in this region.

c. In the eastern alluvial plains the depth of the groundwater occurs between 10 m and 30 m. The study area lies in this zone.

It has been observed from LANDSAT imageries that in the flood plain areas valley fill occurs within the basement rock which is covered by recent alluvium. Beside this the north-eastern part is covered by recent sedimentary deposits (Fig.6.5).

GROUND WATER LEVEL DATA 2001-2002 (Depth in m)

<table>
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</thead>
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<td>Sonamukhi Girls High School</td>
<td>0</td>
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<td>3.85</td>
<td>4.48</td>
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<td>Dhulia primary high school</td>
<td>5.52</td>
<td>2.60</td>
<td>4.19</td>
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<tr>
<td></td>
<td>Patharmara primary school</td>
<td>5.01</td>
<td>0.90</td>
<td>1.45</td>
<td>5.07</td>
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<tr>
<td></td>
<td>Dhansimla level crossing</td>
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<td>1.58</td>
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<td>1.82</td>
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<td>Bishnupur</td>
<td>Hereparbat</td>
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<td>----------</td>
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<td>----------</td>
</tr>
<tr>
<td>Siddheswari Kali</td>
<td>Mandir</td>
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<td>0.60</td>
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<td>Radhanagar Police Station</td>
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<td>Sericulture farm</td>
<td>Kharikasuli</td>
<td>8.65</td>
<td>0.44</td>
<td>5.18</td>
<td>7.70</td>
</tr>
</tbody>
</table>

Source: SWID Bankura, 2003

Fig. 6.5

From the above table it is seen that ground water level fluctuates with the seasonal variation. Uneven distribution of rainfall affects the ground water level. Water level condition during April 1999 and April 2000 are different due to variation in rainfall regime.

Stock value, availability, buffer value and option value (Becker et al, 2001) increases the dependency on ground water utilization in the study area.

In the year 2000-2001 total 7022 shallow tube wells, 628 tanks, 113 dug wells, 34 mini deep tube well, 28 deep tube well, 18 RLI and 8 auto flow are used for irrigation. Beside this Sonamukhi enjoys irrigation from DVC canals.

6.1.6 Consequences of utilization of water resource

With the increasing population, demand for food also increases. But agricultural field is limited. To meet the increasing demand in limited agricultural field, high yielding seeds are used. These require more water. For this reason surface water bodies were extended through canals to meet agricultural demand (Fig. 6.6, 6.7, 6.8 & 6.9). In the year 1981 various irrigation sources are used for irrigation in the study area. Most places are using tank, tube well and ground canal for irrigation. The places like Saluka, Dharampur, Harinagar, Bhara, Bhagarara, Patalpur, Hingjuri, Gobardhanpur, Banskopa, Prakash, Birra, Narayanpur, Joykrishnapur, Abantika, Belthya and Dwarika are previously depend on Tank and Tube well for irrigation. Beside tank and tube well ground canal is another source of irrigation in Bishnupur block. Villages like Chougan, Kuralbari, Siromanipur Moyrapukur, Dhenga pathar, Basudevpur, Tribanka, Belsulia, Dumohoni, Bandhgaba, Khanabari, Chandabila, Dharasol, Marar, Benachpra, Ghugimura, Jharia, Sankarlayekerdanga, Amdahara, Chhotobankadaha, Chanchar, Kadamdiha Agunkumari, Astasol, Dhansol and many other villages had to depend on ground canal...
Map showing source of irrigation type of Bishnupur Police Station, 1981

LEGEND

Source of irrigation
- W
- TK
- TWE
- Gc
- TK, TWK
- Gc, TK
- Gc, TWE, TK
- TK, R
- Pc
- Gc, W
- Gc, R, Pc
- TW, W
- TW, EW
- TK, W
- R
- Gc, TK, W
- TKE
- TKE, TK
- TKE, R
- No source of irrigation (Mostly Uninhabited)
- Darakeswar River
- Bishnupur Municipality

Area shows:
22° 57' 15" N to 23° 12' 32" N
87° 31' 46" E to 87° 24' 11" E

SCALE 2 0 2 Km

Fig. 6.6
Map showing source of irrigation type of Bisnupur Police Station, 1991

Legend:
- **Source of irrigation**
  - W
  - TW
  - Gc
  - Rc
  - No source of irrigation (Mostly Uninhabited)
  - Darakeswar River
  - Bishnupur Municipality

Area shows:
- 22° 57' 15'' N to 23° 12' 32'' N
- 87° 31' 46'' E to 87° 24' 11'' E

Scale:
- 2 Km

Fig. 6.7
Map showing source of irrigation type of Sonamukhi Police Station, 1991

LEGEND
Source of irrigation
- TK
- Gc
- Gc, TK
- Gc, TK, TW
- TK, GC, O
- GC, W
- TK, GC, W
- TK, O, TWE
- TK, TWE
- TK, O
- TK, GC
- GC, TW
- GC, TW, O
- TK, TW, TWE, GC
- TK, TWE, GC
- TW
- TK, TW, TWE

Sonamukhi Municipality
Damodar River
Sand bar
No source of irrigation
(Mostly Uninhabited)

Area shows:
23° 05' 59" N to 23° 29' 00" N
87° 18' 45" E to 87° 31' 28" E

SCALE
0 2
2 Km

Fig.6.8
Map showing source of irrigation type of Sonamukhi Police Station, 1981

LEGEND
Source of irrigation
- Gc
- TWE
- Sonamukhi Municipality
- Damodar River
- Sand bar
- No source of irrigation
  (Mostly Uninhabited)

Area shows:
23° 05' 59" N to 23° 29' 00" N
87° 18' 45" E to 87° 31' 28" E

Fig. 6.9
irrigation. In 1981, utilization of well for irrigation are comparatively low in Bishnupur block. The crops raised were mainly indigenous. Atmospheric water and surface water were sufficient for agriculture. After Green Revolution use of HYV seeds increased with increasing demand for food. Farmers prefer HYV seeds which require more water. Uncertainty of monsoonal rainfall leads the farmer towards utilization of ground water. The census report of 1991 shows this fact that irrigation system changed from the previous decade. Tank, ground canal are mainly used along with tube well in some places. Various other sources of irrigation like river lift, personal canal are also used. But main thrust was on surface irrigation. In 1991 it is seen that dug well and tube well are given priority for irrigation. Ground canal also servers a large area of Bishnupur block. The southern part of Bishnupur block uses ground canal. Water from Kangasabati canal is utilized through different ground canals. Kangasabati canal is extended from Benabadi (south west of Bishnupur block) to Natungram and Tribanka (the south east of Bishnupur). This canal is divided into two sub canal near Basudevpur. The southern parts of the canal are irrigated by canal water and the northern parts are irrigated through tanks or tube wells. In 1981 irrigation system mainly depends on ground canal. Percentage of different types of irrigation system are tank irrigation 42%, ground canal 31%, tube well 9.7%, well 13%, river 2.6% and electrified tank 0.65%. The areas which were previously used electrified tube well and tank for irrigation are transferred to dug well irrigation in the north and ground canal in the south of Bishnupur block. To decrease the excessive pressure on ground water measures have been taken to supply surface water through Kangasabati canal. Excessive utilization of ground water, through electrified tube well makes lowering of ground water in the lateritic belt. To check irrational use of ground water policies have been taken at Government level. Lowering of ground water is observed in dug wells. It is ease to measure ground water fluctuation. Several ground canals were connected to Kangasabati canal to serve the areas in the southern part of the study area. 37.88% of the total irrigated source is done by ground canals. Dug well holds 52.79%. Besides these two main sources, tube well and river lift irrigation are 8.69% and 0.62% respectively.

Unavailability and uncertainty of atmospheric and surface water forced the farmers to depend on ground water. Therefore this is the phase when ground water irrigation was enhanced to meet water demand in agriculture. But excessive use of ground water may cause lowering of ground water table in future. It will be dangerous (Fig. 6.13).
6.2 Agriculture, the main Socio-economic activity

6.2.1 Introduction

In locational understanding of agricultural characteristics of physical base are prioritize climate, soil, topography and water are decisive factors in selection and areas extension of crops particularly in the developing countries. Of these physical factors climate is of prime importance because it influences soil and water availability in a particular area. For these there are books like tropical agriculture (Jarrett, 1977; Hartshorne and Alexander, 1988). The components mentioned above are freely available environmental components which enhance or restrict the agricultural potential to a great extent but ultimately it is the social environment which decides, what crop is to be grown in the environment and it is the economic environment which helps in taking decision how much to grow a particular crop. In a nutshell physical environmental characteristics are very important in the understanding of agricultural environment. Then the socio economic characteristic has come for ultimate analysis of agriculture in a particular area. If we make an observation on the different definitions given by different authors we may come to a statement that the very definition is based on specific concept on agriculture at a specific time, space, culture juncture.

6.2.1.1 Definition on agriculture

Anderson (1970) has classified world agriculture into ecological, subsistence, commercial and collective agricultural systems. In the primitive stage human beings used to collect food and it was known as hunting and gathering stage.

According to Watson’s Longman Modern English Dictionary, 1976, agriculture is a science or the art or the practice of large scale soil cultivation in order to produce crops. In a broader sense agriculture means soil cultivation with reference to natural environment and human characteristics. That time emphasis is given on physical factors.

According to agriculturalist agriculture means both cropping and grazing. With the changing man-environment relationship, the concept on agriculture has changed. Still agriculture is one of the primary economic activities. Characteristics of agriculture are changing with changing seral stages.
6.2.1.2 Classification of agriculture

Jerrett (1977) classified agriculture as shifting agriculture, wet land cultivation, plantation livestock etc on the basis of changing economic environment. Any economic activity is determined by the very politico-economic environment of that country. Maksakovosky (1979) has divided world into socialistic, capitalist and developing countries.

In the first stage human beings utilize plants and animals in native forms. This level is known as ecological or near ecological level. At the subsistence level, agricultural products were mainly used for domestic or home purpose. This is further subdivided into primitive and intensive subsistence type. At the commercial level the agricultural produce is mainly for sale and a little portion is used for domestic consumption. At the commercial level both agriculture and livestock raised. Another type compiling commercial and collective agriculture is also seen. It is known as cash cropping agricultural system. (Singh, Dhillon, 1998).

According to Whittlesey the word agriculture can be classified as following.

i. Ecological or near ecological system
ii. Subsistence system
iii. Commercial system
iv. Collective system
v. Cash cropping system

6.2.1.3 Changing concept on agriculture

The primitive agriculture (as referred by Alexander, 1988) refers to a primitive socio economic environment. Under this type of environment, shifting agriculture comes under this type of environment. With the changing socio-economic condition this type ultimately changes in form of collective agriculture (in a society which is accessible to modern and technical devices). Agriculture becomes less dependant on physical environment and more on economic base (Fertilizer, modern technology, transport facility, storage facility etc). It is a socio-economic activity and still controlled or influenced by physical environmental characteristics. Better the level of economy lesser the influence of physical factor but physical environmental actors remain significant in all over the world, both in developing countries and highly developed countries.

In this connection we may refer to the great economic depression in 1930. Americans were forced to extend agricultural activities in dry
areas. In India with the extension of irrigation facilities economic environment changes and more and more areas are brought under irrigation.

6.2.1.4 Controlling factors

Agriculture is still a land oriented economic activity in a developing country like India. Of all physical environmental requirements climate and water play an observable role on agriculture and agricultural environment. On the other hand agriculture can not be isolated from social demands, availability and accessibility of economic facilities. Agriculture is thus a land oriented economic activity strongly influenced by socio economic environment at a time and space juncture.

i. Climatic and water resource base for agriculture to other components of physical base, soil and topography.

ii. Food habits and social demands of crops.

iii. Economic environment with special reference to irrigation environment.

6.2.1.5 Distribution

In China, India, Pakistan, Burma, Malaysia about 75% of total population are engaged in agricultural activity. Indian agriculture is under subsistence system. There are two types of subsistence agriculture are found in these countries. They are intensive subsistence agriculture with paddy dominance and intensive subsistence tillage without paddy dominance. The characteristics of this type of agriculture are small agricultural holding, traditional agricultural implements, intensive subsistence in place of commercial agriculture, absence of livestock with agricultural activity, emphasis is given on the staple foods rather than commercial farming, disguised labor etc. As agriculture is the main source of income, pressure on land is high in terms of number of crops per year. Soil erosion is a problem (Singh, Dhillon, 1998). In tropical monsoon type of climate two or three crop cultivation are favorable in a year. Most of the rice farming countries are situated in this type of climate namely the Kwanltn in China, the Tonkin Delta in North Vietnam, the Mekong flood plane in Cambodia, the Mekong Delta in South Vietnam, the Menam in Thailand, the Irrawaddy in Myanmar, the Ganga -Brahmaputra delta and coastal place of Orissa in India. These regions are called rice bowls of world. Beside these countries parts of Korea, Japan, Taiwan, India, Srilanka, Malaysia, Java, Philippines rice production is dominant. The food habit of people of these regions is rice from land and fish from fresh water.
The areas having lack of moisture and some unfavorable conditions for paddy production produce low value, low yielding food grains. This type of agricultural system developed mainly because of scanty rainfall. The main agricultural products for staple food grain are barley, sorghum, bulrush, millet, wheat etc. Beside this tobacco, sugar cane, vegetables, various oil seeds like rapeseed, mustard, linseed and some legumes like peas, beans, gram or chick peas are produced. Rearing of drought animals is also a practice with agriculture due to high population. They provide milk, meat and manure for agriculture. The main characteristics of this type of agriculture are intensity of man power, traditional primitive instruments, multiple cropping. Due to uncertainty of rainfall crop failure is a common problem. Physical hazards like draught, flood are also caused by erratic rainfall. Dry farming technique has been adopted to fight this situation. The agriculture of dry India and cold China are under this type of agricultural system. In some places management measure has been taken to cope with this situation.

India is controlled by monsoon type of climate. Depending on the available rainfall humid, sub-humid, dry sub-humid and dry agricultural zones are found in India. Besides climate socio-cultural setup is also an important factor in agricultural classification.

West Bengal stands in the first position among 17 states of India. West Bengal produces 16% of the total paddy products of India. Almost every district more or less produce paddy in West Bengal. The concentration of production found in the fertilized Gangetic alluvial region.

In West Bengal 65% of the net sown area is under rice cultivation. The reasons are divided into physical and non-physical. The physical factors are vast futile alluvial plains, abundant rainfall. Among non-physical factors culture especially food habits support the cultivation of rice and the age old expertise favored the rice cultivation in West Bengal. Multicropping is a common feature, even three times cropping are not uncommon in fertile alluvial plains of West Bengal. Three types of rice i.e. Aus, Aman and Boro are cropped in the state. Among them aus and aman are important. Aus are sown at the end of rainy season and harvested at the end of winter. Aman is sown just before the onset of monsoon and harvested at the end of rainy season. Boro is sown in marshy lands. It is of inferior quality than Aus and Aman.

The leading districts with respect to rice production are Burdwan, Hooghly, North and South Dinajpur, North and South 24 Paraganas, East and West Midnapore.
6.2.2 Discussion

District Bankura lies between the Chhotonagpur plateau and rice producing alluvial planes in the lower Gangetic delta. Broadly the district is sub divided into hilly tracts of the west undulating tracts of the middle and the level alluvial planes to the east. The third part covers the entire sub-division of Bishnupur and some of the eastern police stations of Bankura Sadar sub-division (Bankura District Census, 1981). Agriculture is controlled by several physical factors. Among them rainfall, temperature and humidity are important. Another important factor is altitude which is accompanied by various complex land form, hydrology, soil combination etc. All these physical factors are influencing the farming system of Bankura district.

The economy of the district of Bankura is predominantly rural in nature. It is the principal source of income for livelihood. Here is a brief historical background about agriculture (Fig.6.14).

1757 East India Company gets the power to control Bengal, Bihar and Orissa
1765 East India Company got ‘Dewani’ of the forest of south-west part of Bengal and they oppressed the farmers and artisans to leave that place
1770 Famine of 1770’s. 1/3 people died
1772 Announce Panchasala system
1792 Dassala system
1793 Permanent settlement. Attempt has been taken to take all the holdings of farmers by British.
1805 Chuar Rebellion in south west Bengal
1813-1932 Several rebellions against British rule.
1937-1940 Famine in Bengal(Famine of 50’s)
1943 Bankura took leading role in famine elevation.
1947 Independent India. Slogan ‘Langal jar jami tar’ (whose plough his field) movement started in Bankura district. Movement for proper wage started in Patrasayer, Bishnupur, Bankura, Onda, Joypur.
1956-57 Kangsabati Reservoir project
1971 CPI(M) leads in assembly election
1973 Formation of Panchayat in West Bengal including Bankura district.
1977 Implementation of operation Barga and distribution of lands among landless labours.

Fig.6.14
Implementation of three land reform law up to the year 1997 total 106325.86 hectare land distributed among 621016 peasants (Bose, 2002).

Rice, wheat, oil seeds and vegetables are the principal crop of this district. Both Rabi and kharif crops raised in the district. (P.A.O, Bankura 2001)

Owing to the climatic characteristics the district agriculture is controlled

Bishnupur and Sonamukhi blocks are under Bishnupur sub division. Total geographical area of these two blocks is 725.7sq.km. 330.11 sq. km land is covered by laterite or lateritic soils i.e.; about 45.49% of total land is covered by laterite and lateritic soils. Soil texture used to include sandy plain, sandy loam, clay, clay loam and laterite .In this area high land, medium land and low land all are used in agriculture. Most of the holdings are small in size. So the use of instrument is limited in these areas.

Source of irrigation used for cultivation are lift irrigation , deep tube well, mini deep tube well, shallow tube well, tank, dug-well auto flow, Kangsabati and DVC canals(Fig. 6.10,6.11 & 6.12).

In the year 2000-2001 total 7022 shallow tube wells,628 tanks , 113 dug wells , 34 mini deep tube well, 28 deep tube well , 18 RLI and 8 auto flow are used for irrigation. Beside this Sonamukhi enjoys irrigation from DVC canals

**SOURCES OF GROUND WATER IRRIGATION & CROPPED AREA (in ha), 2000**

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Source</th>
<th>Installation</th>
<th>Kharif</th>
<th>Rabi</th>
<th>Summer</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Lift irrigation</td>
<td>216</td>
<td>3536</td>
<td>2662</td>
<td>1605</td>
</tr>
<tr>
<td>2</td>
<td>Deep tube well</td>
<td>104</td>
<td>1496</td>
<td>1092</td>
<td>875</td>
</tr>
<tr>
<td>3</td>
<td>Mini deep tube well</td>
<td>818</td>
<td>5815</td>
<td>5721</td>
<td>4297</td>
</tr>
<tr>
<td>4</td>
<td>Shallow tube well</td>
<td>24033</td>
<td>40790</td>
<td>32047</td>
<td>25063</td>
</tr>
<tr>
<td>5</td>
<td>Dug well</td>
<td>8852</td>
<td>2253</td>
<td>1431</td>
<td>557</td>
</tr>
<tr>
<td>6</td>
<td>Auto flow</td>
<td>159</td>
<td>217</td>
<td>141</td>
<td>105</td>
</tr>
<tr>
<td>7</td>
<td>Tank</td>
<td>21351</td>
<td>25143</td>
<td>11337</td>
<td>3007</td>
</tr>
<tr>
<td>8</td>
<td>Kangsabati canal</td>
<td>0</td>
<td>61551</td>
<td>5000</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>DVC</td>
<td>0</td>
<td>30341</td>
<td>0</td>
<td>2500</td>
</tr>
<tr>
<td>10</td>
<td>Others</td>
<td>0</td>
<td>6427</td>
<td>3746</td>
<td>2701</td>
</tr>
<tr>
<td>11</td>
<td>Bishnupur (total)</td>
<td>14436</td>
<td>5780</td>
<td>5606</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Sonamukhi (total)</td>
<td>13748</td>
<td>8784</td>
<td>3512</td>
<td></td>
</tr>
</tbody>
</table>

Fig.6.10 Source: PAO, Bankura
COMMAND AREA OF DIFFERENT GROUND WATER IRRIGATION BISHNUPUR, 2000

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Village</th>
<th>JI no.</th>
<th>Plot no.</th>
<th>Type</th>
<th>Power in hp</th>
<th>Distribution chamber</th>
<th>Command area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Radhanagar</td>
<td>43</td>
<td>324</td>
<td>DTW</td>
<td>18-25 hp</td>
<td>12</td>
<td>100 acre</td>
</tr>
<tr>
<td>2</td>
<td>Damodarpur</td>
<td>105</td>
<td>427</td>
<td>DTW</td>
<td>18-25 hp</td>
<td>12</td>
<td>100 acre</td>
</tr>
<tr>
<td>3</td>
<td>Bhagarara</td>
<td>159</td>
<td>565</td>
<td>DTW</td>
<td>18-25 hp</td>
<td>12</td>
<td>100 acre</td>
</tr>
<tr>
<td>4</td>
<td>Dharampur</td>
<td>22</td>
<td></td>
<td>DTW</td>
<td>18-25 hp</td>
<td>12</td>
<td>100 acre</td>
</tr>
<tr>
<td>5</td>
<td>Birra</td>
<td>50</td>
<td>798</td>
<td>DTW</td>
<td>18-25 hp</td>
<td>12</td>
<td>100 acre</td>
</tr>
<tr>
<td>6</td>
<td>Saluka</td>
<td>21</td>
<td></td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>7</td>
<td>Benachapra</td>
<td>41</td>
<td>79</td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>8</td>
<td>Chougan</td>
<td>102</td>
<td>192</td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>9</td>
<td>Radhanagar</td>
<td>43</td>
<td></td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>10</td>
<td>Turki ornitampedur</td>
<td>100</td>
<td></td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>11</td>
<td>Amral</td>
<td>47</td>
<td></td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>12</td>
<td>Ratanpur</td>
<td>131</td>
<td>4930</td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>13</td>
<td>Joyrampur</td>
<td>42</td>
<td>3498</td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>14</td>
<td>Chumasina</td>
<td>131</td>
<td>1000</td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>15</td>
<td>Arjunpur1</td>
<td>127</td>
<td>3</td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>16</td>
<td>Layer</td>
<td>84</td>
<td>503</td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>17</td>
<td>Patlapur</td>
<td>173</td>
<td>852</td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>18</td>
<td>Agunkumari</td>
<td>159</td>
<td>49</td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>19</td>
<td>Layekbandh</td>
<td>13</td>
<td>82</td>
<td>MDTW</td>
<td>12.5-15 hp</td>
<td>8</td>
<td>50 acre</td>
</tr>
</tbody>
</table>

Source: Agri-irrigation Department, Bishnupur

Fig.6.11

COMMAND AREA OF DIFFERENT GROUND WATER IRRIGATION SONAMUKHI, 2000

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Village</th>
<th>JI no.</th>
<th>Plot no.</th>
<th>Type</th>
<th>Power in hp</th>
<th>Distribution chamber</th>
<th>Command area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rafatgang</td>
<td>55</td>
<td></td>
<td>DTW</td>
<td>18-25</td>
<td>12</td>
<td>100 acre</td>
</tr>
<tr>
<td>2</td>
<td>Maheshpur</td>
<td>174</td>
<td>2</td>
<td>DTW</td>
<td>18-25</td>
<td>12</td>
<td>100 acre</td>
</tr>
<tr>
<td>3</td>
<td>Chhalchaturia</td>
<td>59</td>
<td>175</td>
<td>DTW</td>
<td>18-25</td>
<td>12</td>
<td>100 acre</td>
</tr>
<tr>
<td>4</td>
<td>Manikbazar</td>
<td>27</td>
<td>348</td>
<td>DTW</td>
<td>18-25</td>
<td>12</td>
<td>100 acre</td>
</tr>
<tr>
<td>5</td>
<td>Amraladalanga</td>
<td>79</td>
<td>781</td>
<td>DTW</td>
<td>18-25</td>
<td>12</td>
<td>100 acre</td>
</tr>
<tr>
<td>6</td>
<td>Bahulia</td>
<td>58</td>
<td>326</td>
<td>MDTW</td>
<td>12.5-15</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>7</td>
<td>Balarampur</td>
<td>95</td>
<td>160</td>
<td>MDTW</td>
<td>12.5-15</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>8</td>
<td>Jaypur</td>
<td>45</td>
<td>249</td>
<td>MDTW</td>
<td>12.5-15</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>9</td>
<td>Gopinathpur</td>
<td>180</td>
<td>575</td>
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<td>12.5-15</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>10</td>
<td>Dhansimla</td>
<td>11</td>
<td>178</td>
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<td>12.5-15</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>11</td>
<td>Kundapuskarini</td>
<td>147</td>
<td>273</td>
<td>MDTW</td>
<td>12.5-15</td>
<td>8</td>
<td>50 acre</td>
</tr>
<tr>
<td>12</td>
<td>Bhaluka</td>
<td>116</td>
<td>1121</td>
<td>MDTW</td>
<td>12.5-15</td>
<td>8</td>
<td>50 acre</td>
</tr>
</tbody>
</table>

Source: Agri-irrigation Department, Bishnupur

Fig.6.12

Beside ground water irrigation, tank is another mode of irrigation. There are many natural and man made tanks among which the tanks
Fig. 6.13
dug by the Malla kings are important. The Malla kings dug these tanks for drinking water and irrigation in agricultural fields. Lalbandh, Jamunabandh, Kalindibandh, Pokabandh and Gantaitbandh are mention worthy. (Discussed in detail in Chapter 6.1) These tanks are also used for fishing. After rice fish is the favorite dish of the Bengalees.

The climatic and soil characteristics are favorable for coarse grain crops like maize, sorghum, finger millet, gram, barley, bulrush, millet. But the very food habit of the people is rice. Like other district of Bengal the people of the study area also take rice and fish as their main food. Due to even and optimum receipt of rainfall and irrigation facilities the study area fetches a good harvest during 1999-2000.

Main crops raised in this area are aus, aman and boro. Following these wheat, potato, mustard, til and vegetables are also raised. In Bishnupur and Sonamukhi 39262 ha. land is irrigated out of 42629 ha net cultivable area. HYV crops also rose with the help of irrigation water. In kharif season aus, both HYV and local, aman, both HYV ad local, maize, jute, mesta, kharif til, kharif ground nut, sugar cane, chilly, soyabean, arhar, kolai, mung kultha and other pulses produced. In Rabi season winter vegetables, wheat, potato, winter til, mustard, linseed, gram, lentil, pea, mung, keshari chilly raised. During summer, summer rice, summer vegetable, summer til, summer mung are raised.
Major findings

i. Rice eating Bengali community decides the food habit of the study area.

ii. Agriculture is the main socio economic activity.

iii. Climate is sub tropical monsoon with seasonal rainfall.

iv. Major river are seasonal and fluctuating river regime.

v. Ground water level is also fluctuating with rainfall fluctuation.

vi. Scarcity of atmospheric rainfall lead to excavation of tanks under Malla reign.

vii. Importance of tank irrigation has decreased as these are used for fishing.

viii. Tank irrigation has gained importance in Sonamukhi after 1981.

ix. After the construction of DVC and Kangsabati project canal irrigation facilities have been extended in the study area.

x. Noteworthy feature is almost absence of river lift irrigation

xi. Rivulets in lateritic terrain are being dammed to supply water in the near by fields.

xii. The emphasis has been shifted to ground water irrigation due to increased water demand with changing agricultural environment.

xiii. A striking characteristic is shifting of tube wells by dug wells. Point specific dug wells are more important feature in the agricultural field.

xiv. To much emphasis on ground water irrigation may lead to the lowering of ground water in future but the study is yet to face that problem.