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Indigenous Knowledge System and Sustainable Management of Rural Resources in a Floodplain Village of the Brahmaputra Valley, Assam

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Sourav Saha, Indigenous Knowledge System and Sustainable Management of Rural Resources in a Floodplain Village of the Brahmaputra Valley, Assam- Palarch's Journal Of Archaeology Of Egypt/Egyptology 17(9). ISSN 1567-214x, Key words: Natural resource, utility pattern, management systems, Indigenous knowledge, village environment, ecosystem people.

Abstract

The villages of the State Assam are endowed with diverse natural resources which fulfill the household needs of the villagers and also feed even the landless people. The life and livelihoods of the villagers are intrinsically and intimately related to the ecological settings, and as such villagers can be considered as the ecosystem people. These ecosystem people have been utilizing the resources without causing harm to the village ecological settings. They have also developed some kinds of peculiar resource management systems through their traditional knowledge and belief systems (TKBS) which can be thought, in the present context, as economically affordable to rural poor on the one hand and environmentally adaptive to the rural landscapes on the other. Thus, this study can be considered as significant as the use and management practices of natural resources done by the rural people help the rural development planners and policy makers in order to formulate sustainable resource utilization and management strategies. The present study is, therefore, an attempt to investigate the status, diversity, utility and management systems of natural resources of a village, called Jatiabhangra in Kamrup district, Assam. The study is solely based on the primary data and information obtained through household questionnaire survey, field observation and oral interviews among the aged people of the village.

1. Introduction

The indigenous rural communities in different environment across the world have developed diverse systems of resource utility and management based on their traditional knowledge and skills (Gadgil and Berkes 1991; Juanwen *et al.* 2012). Their life and livelihoods are intrinsically and intimately related to the local ecological settings of the area, and thus they have been utilizing the rural resources without causing harm to the village ecological settings. But most of the traditional knowledge and resource management practices are still remained undocumented (Nehal *et al.* 1999). Recently, the significance of indigenous knowledge system of resource management practices in the context of sustainable development have been realised by the researchers, ecologist, social scientists and planners (Farooquee *et al.* 2004). However, many researchers and ecologist are now beginning to appreciate the folk ecological knowledge and traditional resource management systems.

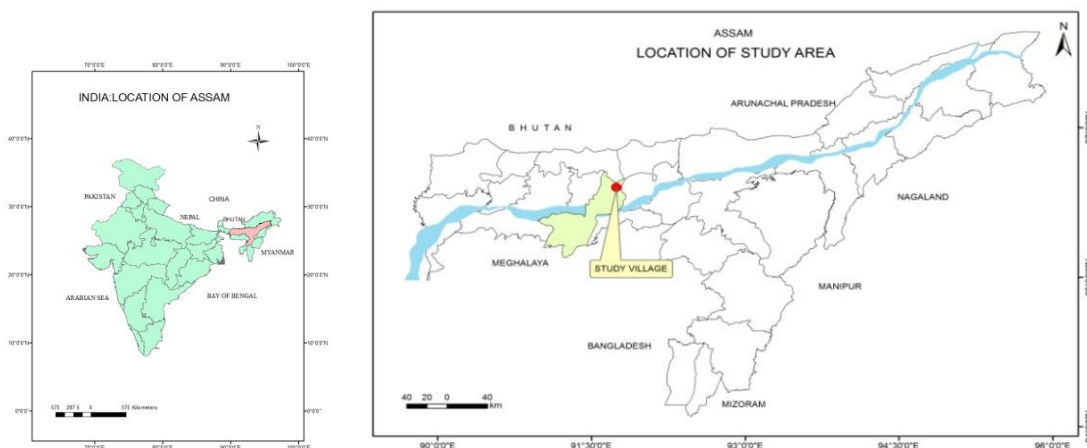
The villages of the State Assam, India are endowed with diverse natural resources which fulfill the household needs of the villagers and also feed even the landless people (Bhagabati and Deka, 2017). The interaction of different social groups with natural environment of the villages has evolved characteristic resource management system. However, in recent years, the growing pressure of population on agricultural lands, increasing demand for foods and residential lands, rural-urban migration and changing socio-economic conditions have caused remarkable changes in the rural resource management practices (Deka and Bhagabati, 2010). Thus, the villages of the State have been facing tremendous challenges regarding the gradual declination of rural self-sufficiency and sustainability, biophysical productivity, ecological diversity and food security (Saha and Deka, 2017). As the indigenous resource management systems are economically affordable and environmentally adaptive, therefore, a detail study on the traditional resource management practices can help the rural development planners and policy makers in order to make sustainable resource utilization and management systems. Therefore, the present stud has been carried out in order to investigate and document the indigenous knowledge systems related to natural resources management of the village and to examine the changes in resource management practices and utility pattern of the study village over time caused by different internal and external factors.

2. The village

In order to know the diversity, utility, and management practices of natural resources of villages in Assam, a detailed study has been carried out in a typical Assamese village, called Jatiabhangra. The village is confined within $26^{\circ}25' 45.90''$ N and $26^{\circ} 27' 18.4''$ N latitude and

91°44' 0.33"E and 91°42' 38.67"E longitude (Figure 1). The village is administratively located under Kamrup revenue circle in Kamrup district, Assam and physiographically situated in northern floodplain of the lower Brahmaputra valley. The village is at a distance of about 35 km north from Guwahati city and 45 km south from Bhutan Himalayan foothill. It covers a geographical area of 5.76 sq. km with a population of 3,086 persons. The total number of household of the village is 666 in its 14 different *chuburis* hamlets). It is the highly populated village of *Patidarang Mouza*. The people belong to different castes, like Brahmin, *Kalita*, *Keot*, *Koch*, *Bodo-Kochari*, etc. The population density is 536 persons per square kilometer. Sex ratio is 996 female per 1000 male. Out of total population 51.94 % is male and 48.6% is female.

Figure 1: Location of study area



3. Database and Methodology

The study is solely based on personal field experience, primary data collected through a previously designed questionnaire and schedule during 2015-16. Relevant secondary data from various government sources, like the Directorate of Census and Kamalpur Revenue Office, Govt. of Assam have been collected. The resource base within the village was intensively mapped through plot (*dag*) survey. Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) were applied to typify and map the village resources, land use patterns and their seasonal variations. The agricultural lands of different types and the cropping pattern were also identified by asking the owners of each *dag*. A detailed agricultural landuse map and maps of agricultural fields in summer and winter seasons were prepared. Some selected

homesteads have been intensively surveyed and mapped to get a very micro picture of the homestead resource management systems. Some focus groups (FG) among different age groups and different occupations have also been made to get information and perception towards the changes in resource management practices and its effects on rural livelihoods and ecology. Some meaningful cartographic and quantitative techniques and soft wares ((like Arc GIS 9.3, MS Excel etc.) were applied both for processing and representing the data so obtained in the form of tables, maps and diagrams.

4. Resource base

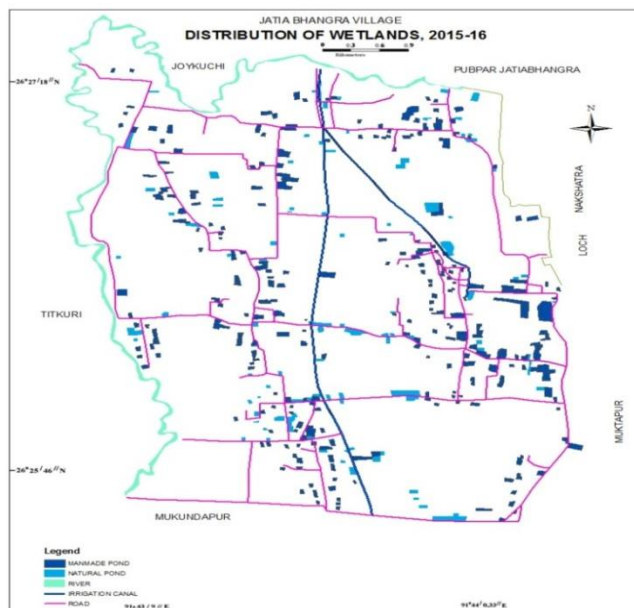
4.1. Land resources

As majority of the people of the Brahmaputra Valley depends on agriculture, agricultural lands is the most precise natural resource base in the rural areas of the Valley. Gentle topography with no perceptible relief variation, the village bears all the characteristics of floodplain physiognomy. However, there are some micro-variations in elevation within the village and the villagers defined high land as *okha mati*, moderately highland as *madhyam mati* and low land as *da mati*. Every year, during the monsoon season most of the *madhyam mati* and *da mati* are inundated by flood water, and as such fresh alluvium gets deposited on them which helps in luxuriant growth of crops and other vegetation. Although, the major soil types of the village is alluvial one, but the soils of the village as perceived by the villagers are sub-divided as *palakhuwa mati* (alluvial soil), *kachamati* (loamy alluvial), *bokamati* (clayey soil), and *balimati* (sandy soil). The people of this village have been developed their indigenous cropping patterns and other landuse practices on the basis of micro-variation in elevation, flood levels and soil types.

4.2 Rivers and wetlands

The entire north and western boundary of the village is covered by a small tributary river called *Sessanoi*. The river joins *the Puthimari* River before falling into the Brahmaputra. The length of the river bordering the village is 5.7 km. Every year, during the monsoon season the village surface is inundated with flood water by this river. The village is also endowed with a large number of small and medium natural as well as manmade wetlands. These wetlands have been providing the habited for large number of aquatic plants and animals. Based on the size, nature of origin, aquatic characteristics and uses the villagers locally classify the wetlands as *khal*, *phukhuri*, *beel*, *pitoni*, *jan* etc. There are as many as 302 man-made ponds, 86 naturally occurred ponds, and 25 *pitonis* in the village (Figure 2).

Figure 2: Distribution of wetlands in the study village



The man-made ponds (*phukhuri*) are usually located near the homesteads, some of which are seen either in front or back side of home gardens. Generally such ponds are dug by the people during the time of construction of house, to raise their homesteads, home gardens and kitchen gardens at different times. As flood is a major problem, therefore the villagers used to raise homesteads, home gardens and kitchen gardens to get rid from the flood water. Sometime, people make the pond few years later from the establishment of house for the consumption of fish. The villagers use to rear fish in *phukhuris* for consumption, sometime certain amounts are also sold in markets when the owners need of cash. The banks of the ponds are planted by different types of plants, such as banana, coconut, bamboo, different types of fire wood trees, etc. As compared to natural pond diversity of aquatic plants and animals are comparatively less. Besides the pisciculture, these ponds are used for various purposes, such as bathing, washing of cloths and utensils, supplying water kitchen garden, soaking seeds, woods, bamboos, etc, (Deka, 2012; Saha, 2016). Some plants like pumpkins, gourds are planted on the banks of the pond let them climb on the bamboo roof established the pond. In this way, the rural people are getting double benefits from the same land area. Some ponds are getting dried up during the winter season due lack of water.

4.3. Natural vegetation

The soils of the village landscapes is so fertile and saturated that many plants naturally grow which make the landscape green. The sub-tropical humid climate and variation in climatic

seasons along with the soil variety have contributed the rich and diverse ecological base to the village ecology. The village is endowed mainly with deciduous and evergreen vegetation. Apart from the tall wood and fuel wood trees many grass species and creepers have also enrich the vegetation cover of the village. The geo-environmental conditions of the village support luxuriant growth of bamboos. Different species of bamboos are found in this village. The vegetations of the village belong to wood trees, fruit trees, fuel wood trees, grass, creeper, medicinal trees, flower trees and religious trees. The rich and diverse vegetation of the village have provided habitat for animal, birds and insects. The small wild animals found mainly in the jungle patches and home gardens are monkey, squirrel (*kerketua*), fox, *hepa*, *jahamalla*, *biral*, *rabit*, *hagagenda*, rat, *neoul* etc. Different types of snakes found in the village are *sakarifeti*, *mugafeti*, *kalafeti*, *hulaberia*, *kankhala*, *gala*, *bakraj*, *bamunia*, *dona*, *dhora* etc. The important birds seen in the village are *kauri*, *salika*, *kapou*, *moina*, *dahikatara*, *keteki*, *bogoli*, *hargila*, *sarali*, *dauk*, *ghansirika*, *soka*, *masroka*, *pani kauri*, *silani*, *baj*, *sagun*, *sekseki*, *haitha*, *hudu*, *fesa*, *bulbuli*, *moupia*, *baduli*, etc. In this way the plants and animals form the base of rich ecosystem in the village landscape.

4.4. Grassland

These are comparatively elevated lands with the dominance of sandy soil which support for the growth of various grass species or thatch locally known as *kher*. Because of sandy nature of soil, water retaining capacity of these lands is low. These grasslands provide the habitat of various small animals and birds. The grasslands located on the river banks are considered as community land, but some time individual farmer also keep some portion of grassland for the growth of *kher* to use for making thatched roof house (*kherighar*). These lands are the important source of fodder and thatch. But recently, under the influence of modernization in housing, the number of *kherighar* has been gradually decreasing. Therefore, number and areas of *khertoli* are declining very significantly.

5. Traditional resources management

5.1. Agroforestry

Homestead agro-forestry is an age-old resource management practice in the rural areas of the Brahmaputra Valley where diverse trees, herbs, medicinal plants, vegetables, fruits and other crops are grown very intensively in and around the dwelling premises, primarily for household consumption (Deka et al. 2011; Deka and Bhagabati, 2018). Traditionally, along with the houses they develop some micro productive units like home garden, pond, kitchen garden,

bamboo patches, etc. These provide homes for a large variety of flora and fauna which contribute remarkably towards sustenance of the concerned households. Traditional homegardens also perform certain social and aesthetic functions and thus serve as an indicator of family status (Deka 2012). Homegardens are commonly found in the backyard of almost all the households of the villages of the Brahmaputra valley (Deka and Bhagabati 2011). The homegardens have a variety of plant species providing fruits, building materials, cash crops, fire woods, medicinal plants, and some plants of cultural or religious importance. The total number of homegardens in the village under study (Jatiabhangra village) is 460. Sometimes home gardens may tell the history of a settlement which can be found out by the age and height of planted trees. Small plots of land in the front/back side of the homesteads are put to kitchen gardening to grow a variety of vegetables. The villagers grow different types of vegetables in their kitchen gardens during the year mainly for home consumption.

5.2. Cropping pattern and practices

The farmers of the Brahmaputra floodplains have been developing a characteristic agricultural land use pattern based on traditional knowledge about the micro ecological settings of the valley over a long period of time. The agricultural land use patterns of the village reflect the indigenous methods of agriculture land management practices with its ecological settings. It also includes the recent influence of increasing population, modern agricultural inputs and implements. Based on the slight variation in height of land surface, soil quality, flood level, the farmers have developed a different field pattern for cultivating different types of rice. Thus, the agricultural practices of the village form some micro agricultural land use within the broad agricultural landscape, such as seedling bed (*kothiatoli*) winter paddy field (*salitoli*), autumn paddy field (*ahutoli*) (Figure 3).

Seedling bed (*kothiatoli*)

Seedling beds are very significant component of the village landscape of floodplain areas, which are generally developed in slightly elevated lands near some water sources, such as pond, *khal* etc. The land is chosen near the source of water so that required water for seed beds preparation can easily be obtained. Some time few numbers of trees are also seen around the seedling beds. The average size of seedling beds ranges from 0.05 ha to 0.10 ha. Seedling beds are prepared during the May to June month, rest of the year remain fallow and used for

Sometimes people cultivate mustard in these lands during winter season. As the elevation of this land is comparatively higher therefore, people prefer the *ahutoli* for establishing of the settlements. If one farmer needs to construct new house for his son but he has not enough land in his nearby homestead, then he will prefer the autumn rice field. But he does not prefer the winter rice field for construction of settlement, as the productivity of winter rice field is higher than the autumn rice field and flood level also quite high in winter rice fields than autumn rice ones.

Winter rice field (*salitoli*)

The most significant and valuable property of the people of this village is the *salitoli*. Among all the agricultural lands the winter rice fields are the low lying ones. The winter paddy fields are the major suppliers of rice. These fields are enriched with natural fertility by clayey alluvial soils which are recharged every year by flood. The average flood water level of these fields is 3.5 feet. Previously the farmer used to cultivate indigenous *sali* rice varieties, such as *Jaha*, *Bonni*, *Bordhan*, *Gajia*, *boka*, *moinagiri*, etc. but recently the indigenous *sali* varieties are gradually replaced by HYV rice. Due the low productivity of local varieties, the farmers recently started growing HYV rice, such as *Aijong*, *Ranjit*, *Bahadur*, etc. The indigenous rice varieties not only provide food, but these are closely related to the culture and traditions of the villagers. Therefore, unlike the autumn rice variety the indigenous *Sali* varieties have not been completely replaced. The farmers still cultivate the local *sali* rice varieties although the area of *Sali* rice decreases very significantly. At present the farmers of the village cultivate *Sali rice* for making traditional snacks during different festivals and for the use of it in various ceremonies. During winter season most of the *sali* rice fields land remain fallow and some portions of lands are used for cultivation of mustard, lentil, coriander etc.

6. Changing scenario

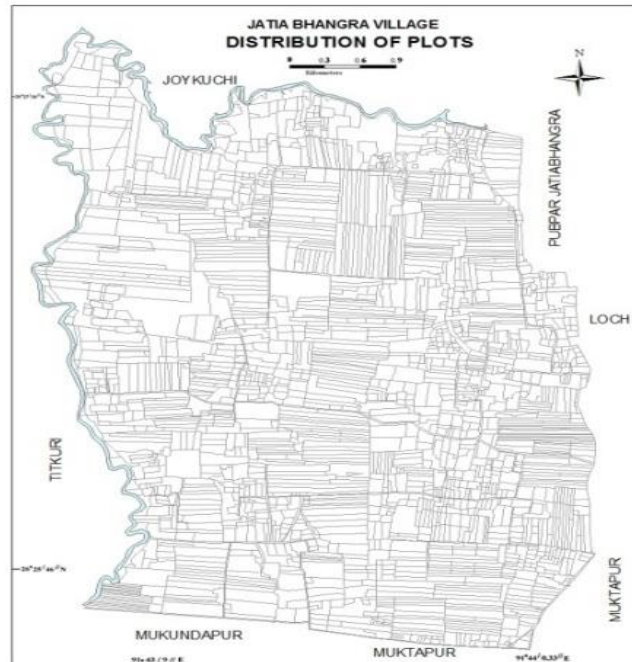
Since the time of human habitation, the natural resources of the village have been utilizing and transformed gradually by the people according to their growing need and aspirations. Very recently, the influence of modernization, urbanization of Guwahati city, and changing perception and behavior of people, etc. accelerated the rate of change. The present rate of change has caused adverse effects on the sustainability of the village landscape leading to the occurrence of various problems. Traditionally the villagers conserve the winter paddy fields because it is very much productive one. But, due to high pressure of population, increasing number of nuclear family and lack of available land, some households are developed in the

productive winter rice fields. It has been observed that during 1800 and 1900 only 65 households were developed in the village. The growth rate of households from 1910 to 1950 was very slow. Only 67 new households were settled within this long 40 years. Within the period of 1950 to 1980, 125 households were setup in the village. After 1980 the numbers of households started increasing rapidly. In between 1980 to 2010 the total number of newly developed dwellings in the village was 315.

The traditional agricultural systems started changing to modern agriculture under the influence of modernization and technological development. The agricultural landscape of the village has been changing both structurally and functionally. Agricultural plots are getting fragmented into smaller ones over the period of time (Figure 4). Functionally the agricultural system has also been experiencing remarkable changes. Traditionally the farmers used to cultivate the land by bullock driven wooden plough which has gradually been replaced by tractors and power tillers. Similarly the many indigenous agricultural tools, inputs, crops and other agricultural practices have been disappearing with the appearance of mechanized agriculture. Previously the farmers cultivated different types of crops, such as *musur*, *mah*, *mati mah*, (pulses), *morapat* (jute) etc, and rice throughout the whole year. Although the crop productivity was less in traditional agricultural system but crop diversity was very high. Agricultural lands were fully covered with crops throughout the whole year. Presently most of the lands are remain fallow after the cultivation of rice except some amount of land for mustard cultivation (Figure 5). Although the modern method of agriculture (mono cropping methods) increase the rice productivity and sustainability but other crops sustainability decrease dramatically (Table 1).

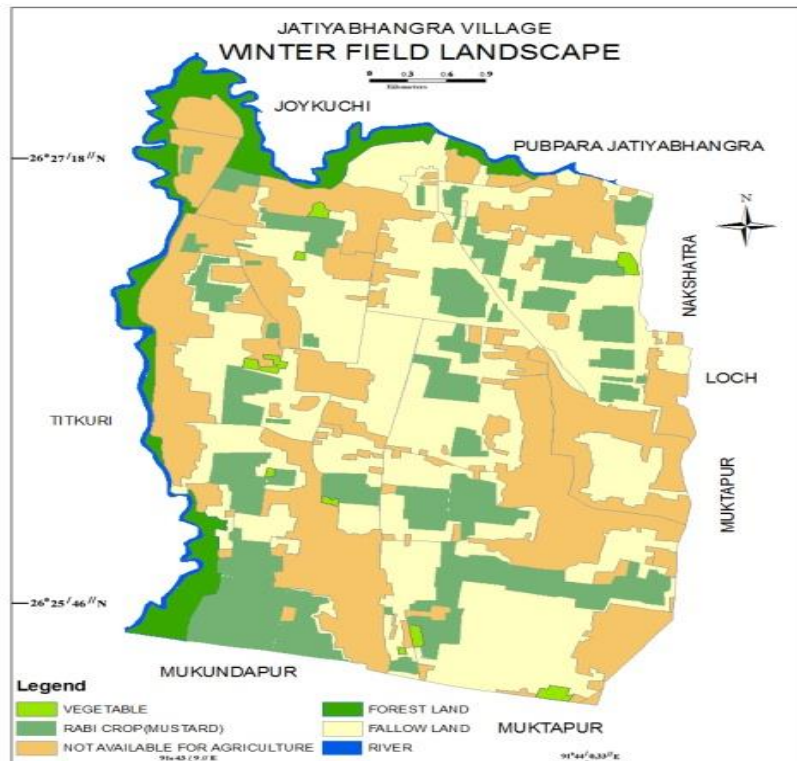
Similarly the sustainability of traditional crop diversity is also degraded. The introduction of exotic crops species are destroyed the traditional agro ecosystem of the village which was ecologically adaptive and sustainable. The production from home gardens has been declining due to the constant attract of squirrel, monkey and other insect. The traditional trees of the home gardens are now getting replaced by many economically valuable wood trees

Figure 4: Distribution of plots



The grazing land is one of the significant components of landscape of the village which provide the natural grass for rearing cattle. The nature and structure of grazing landscape of the village has been experiencing constant change during the last few years because of modernization in agriculture. The application of power tiller significantly reduced the importance of wooden plough and cattle population. As a result of which the numbers of cattle populations are reducing day by day. The expansion of agricultural fields and settlement areas caused large scale destruction of forest patches which has adversely affected the biodiversity of the village. Large numbers of birds and animals are now getting endangered and become extinct from the village.

Figure 5: Winter field landscape



Previously the physical landscape of the village was the habitat of diverse animals and birds. Natural wetlands (*khal, beel, pitoni*) were endowed with various species of aquatic fauna and flora which thus become the feeding grounds of many birds, such as *bogoli, panikaouri, hargila, machroka, baduli*, etc. But due to the degradation of natural wetlands and aquatic species such as frog, snail, different types of fish, etc, these bird species are adversely affected. The food chain of these bird species starts deteriorating for which large numbers of aquatic fauna depended birds on them have gradually been getting extinct from the village landscape.

Table 1: Change in area, production and productivity of crops

Year	Change in Area, Production and productivity of different crops																				
	Rice			Oilseed			Black gram			Lentil			<i>Khechari</i>			Sugarcane			Jute		
	Area (ha)	Production (in tone)	Yield	Area (ha)	Production (in tone)	Yield	Area (ha)	Production (in tone)	Yield	Area (ha)	Production (in tone)	Yield	Area (ha)	Production (in tone)	Yield	Area (ha)	Production (in <i>kari</i>)	Yield	Area (ha)	Production (in tone)	Yield
1995	124.15	356	320	17.55	14.4	80	22.1	15.4	100	15.27	12.8	80	8.77	6	100	5.52	315	7	1.3	2	160
2015	80.6	368.8	480	23.4	20.3	120	0	0	-	0	0	-	0	0	-	0	0	-	0	0	-
% Change	-35.07	+3.59	+50	+33.33	+40.97	+50	-100	-100	-	-100	-100	-	-100	-100	-	-100	-100	-	-100	-100	-

Source: Field survey, 2015-16, based on 50 household sample survey, Note: 1 *bigha*= 0.13 hectare land area, *kari* is a big size pot for measuring sugarcane sap, i.e. 1 *kari*= approximately 100 liters; Yield in kg / bigha

The application of chemical fertilizers and insecticides on the paddy fields are the main cause for the loss of aquatic flora and fauna. The birds, like *hargila*, *shagun*, *chiloni*, etc were extinct from the village due to the large scale destruction of big and tall trees. Many birds make nest in the big wood trees after making hole in the plants. Most of the big trees of the village are almost cleared, therefore many birds species loss their habitats. Moreover the application of chemical fertilizers, insecticides, etc in agricultural fields affects their food. The modern methods of harvesting also affect the foods for these birds. Similarly many animals, such as fox, *Johamalla*, *Hapa*, *Sohapohu*, *Neoul*, are also almost extinct from the village landscape. Thus the changes in utility pattern and management systems also adversely affect on the rural ecology and biodiversity.

7. Conclusion

The micro-level land use pattern of the village depicts the diversity of resource base and their intrinsic relationship with the rural life and livelihoods. Based on the micro-ecological settings and resource base of the village people have developed different types of traditional utility patterns and management practices for sustainable rural livelihoods. However, under the influence of the rapid population growth, agricultural modernization and urbanization, the natural resources base of the village have been experiencing remarkable changes in biophysical productivity and sustainability. Therefore it has been now realized that the existence of traditional resource base and their management practices bear immense importance from the view point of rural ecology and economy of the Brahmaputra Valley, and therefore these should be continued to some extent for the sustainable livelihood of the villagers.

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