



Changing of Surface Water and its Influence on Human Beings in the Barind Region

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ABSTRACT

Bangladesh is one of the biggest deltas of the world standing on the "Tropic of Cancer". Various rivers such as the Padma, the Meghna, the Jamuna flow over this country. The north western part of Bangladesh is of distinctive characteristic which is known to be the Barind tract. The Sapahar, Porsha, Niyamatpur and Patnitala Upazilas have been accepted as study area. This land is being changed every day due to the increase of population. In case of taking the future development plan of any region, it is essential for anyone to have a better concept about land use change and water resources so as an under developed and in advanced region. The remotely sensed information has been used in this research in determining land use and water resources. It is possible to evaluate land use change easily and within a short time by remotely sensed information due to repetition. Land use identification and change have been displayed in 1997 and 2006 by Landsat TM satellite image collected from "SPARRSO". The total quantity of surface water of the study area is 1832 hectares which is 1.38% in 1997 of the total area. The total area of surface water of study area is 1096 hectares which is 0.84% in 2006 of the total study area. The real development of the Barind region will happen by taking the proper future development plan evaluating land use change and contribute to the economy of the country which is essential for the country.

Keywords: Water, Land use, Barind region, Human, Satellite.

Introduction

There are many beels, ponds, dighis and streams flowing on the study area. The main source of water is the beel region of the basin of the Ponorbhoba and Tagoon to the west-northern border, the biggest 'Jobai beel'. The area of the surface water is more at Sapahar. The total area of the water body is 1456 hectares which is 79.48% of the surface water are under Sapahar (1997). Most of the water bodies are located at the union parishad of Aihai, Pathani and Goala. The total area of the surface water is about 792 hectares which is 72.26% (2006). During the rainy season rivers filled with water but they become dry in winter. In this season the Ponorbhoba river gets a large volume of water from rainfall and the rivers turns into a new artery of communication network. Sometimes the river floods the surrounding area and this time different types of fishers are found in this river. In dry season, the river becomes dry. The farmers can not get much water for irrigation during the dry season and a little portion of water is for domestic consumption. Precipitation is source of all classes of water in the surface and subsurface bodies and it maintains a cycle. The forms of precipitation are rainfall, hail, dew, fog etc. In a broad sense, the source of almost all our water is the sea. Rainfall is the most significant source of surface water in the study area. Rainfall in Bangladesh originates from three sources. The western depressions of winter which account for 5% of the total and 80% comes from the monsoon in May-June generally associated with tropical depression in the Bay of Bengal and Indian ocean. July is the wettest month. From August to May it experiences a dry season particularly in the west but a secondary monsoon rain fall peak may occur in September. From November to April, it experiences a rainfall of less than 100 mm some times it contains up to May. The difference in nature of land use is manifested from one place to other in the course of time and due to necessity. Apparently land and water are not properly used in Bangladesh. Otherwise it may be possible to meet food demand for more people comparing the present time. Land is the fundamental element of natural resources and is used in various ways. Land is also being changed owing to their pressure inflicted upon it. Activities on the surface water, either natural or man-made, may be reflected in water and land use pattern. In the truest sense the term, human activity upon land which is directly related to land is called land use (Clawson and Stewart, 1965). In order to accept the future development plan of any region, the proper concept about land use change and water resource of that region is very important.

Objective

The Barind region has been out of attention for long and is important to evaluate the water land use of this region to utilize this potentiality. In traditional survey system, determination of water and land use is expensive. A faster system is needed for the faster development plan. Remote sensing device is very effective in such case. This research has been conducted for determining the water land use of four Upazilas of the Barind Upland region using Landsat TM satellite image of various time phases.

This study aims to focus on the following aspects to a considerable extent,

- (i) To explore the water distribution in barind tract.
- (ii) The change of water resource in between 1997 and 2006.
- (iii) To evaluate the water resource and its influence on human adaptation.

Data materials and research methodology

It is possible to study with necessary and accurate materials. Materials might be of primary or from secondary sources. Here Landsat TM FCC 1997 Band 2, 3, 4 and Landsat TM FCC 2006 Band 3, 4, 5 have been used as the secondary information. These are satellite image frame is 149-043 (WRS) of two time phases and was collected from SPARRSO. Besides this further accessory secondary information has been used in this research. Many difficulties were faced while gathering these data and information, such as high price, reliability, exact time/real-time data etc. Effort was paid to make a research as much accurate as possible. The pressure of human activity on surface and ground water results in land use and land use change was interpreted using these images of 1997 and 2006. The union Geo-code of 2003 collected from Bangla Pediea was used. Each and every research is conducted by a following well-fixed system. Mainly the effort of acquiring detailed knowledge about any topic through scientific analysis is called research. The satellite image that has been used in present research has also been analyzed into a few levels and a map has been prepared. Although satellite image is called the secondary information in terms of methodology, here it is used as primary information. Because there is no difference between satellite image and land use class achieved by direct survey.

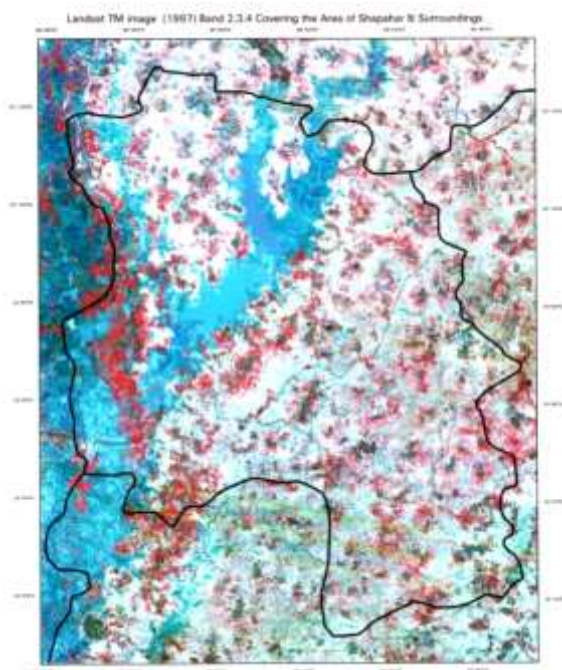


Figure 1: Landsat TM image (1997) Band, 2, 3, 4.

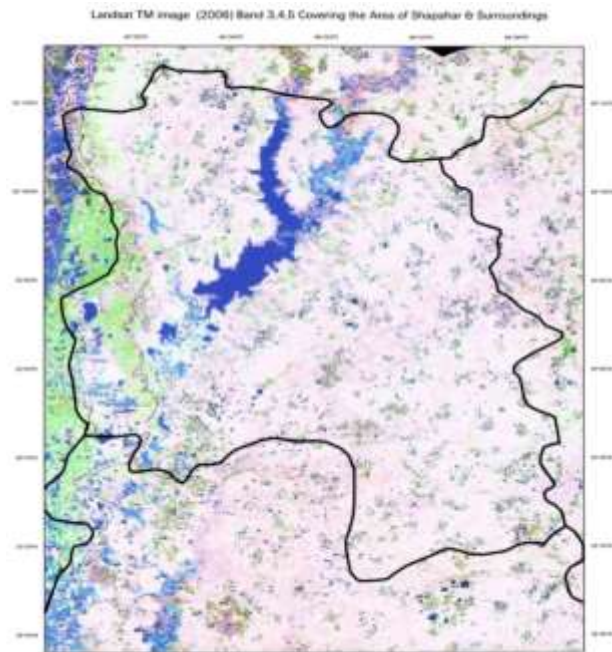


Figure 2: Landsat TM image (2006) Band, 3, 4, 5.

Each and every research is conducted by a following well-fixed system. Mainly the effort of acquiring detailed knowledge about any topic through scientific analysis is called research. The satellite image that has been used in present research has also been analyzed into a few levels and a map has been prepared. Although satellite image is called the secondary information in terms of methodology, here it is used as primary information. Because there is no difference between satellite image and land use class achieved by direct survey. The area of each and every land uses has been determined individually marked in the miler paper. Graph method has been used in determining this area. Graph paper has also been used. According to the scale of map, the biggest that is the area of one square centimeter room is 100 hector and the smallest, that is the area of every 0.04 square centimeter room is to represent 4 hector. Thus various areas based on the smallest and the biggest ones have been determined.

Results and Discussion

❖ The distribution of surface water of 1997

Though there remains one-third water in the whole world paucity of water is seen in many places. There may be various sources of water such as pond, big pond, dighi, beel, canal, river etc. It is possible to find out the location of water though Landsat TM FCC image. The basin of the Ponorbhoba and Tanguon and beel are the main sources of water. The biggest beel of this region is Jobai beel which is 996.24 acres (approximately). There is enough

dryness in the Barind region and rainfall is negligible. The degree of rainfall is more at Sapahar. Its percentage is 79.48% out of 1456 hectares (Table-1). Though Sapahar is high from other Upazilas, there are various beels such as Jobai beel, Maheel beel and others.

Table-1

Distribution of surface water according to Upazila(1997)

Thana	Area of surface water (hector)	Percentage (%)
Sapahar	1456	79.48
Porsha	188	10.26
Niyamatpur	28	1.53
Patnitola	160	8.73
Total	1832	100.00

Source: Landsat TM image 1997

The surface water varies from thana to thana. It is very little at Porsha. The surface water of 188 hectares is at Nitpur. There is no notable source of water at Niyamatpur. There are many big and small ponds in this thana which have not been easy to identify from the satellite images.

Table-2

Monthly high and low water level of the Ponorbhoba river (meter)-2009

Level	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	16.07	15.96	15.87	15.83	16.02	16.05	17.65	18.80	18.75	17.25	14.72	14.71
Low	15.17	15.89	15.82	15.75	15.73	15.88	15.78	17.68	17.27	14.85	14.61	14.49

Source: Bangladesh water development board 2009.

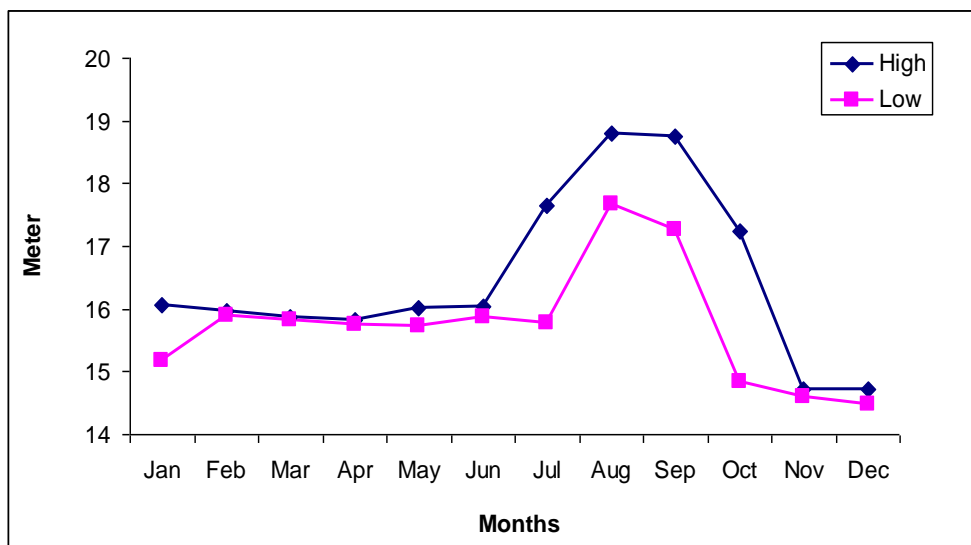


Figure 3: monthly high and low water level of the study area.

❖ The distribution of surface water of 2006

It is easily possible to see the characteristics of color of shallow and deep sources of water by using Landsat TM FCC Band 3, 4, 5 satellite image. The Barind is a dry region of the sources of surface water is very little. Beels and dighis are the main sources of water of this region. There are many rivers and ponds here.

Table- 3

Distribution of surface water according to Upazila (2006)

Thana	Area of surface water (hector)	Percentage (%)
Sapahar	792	72.26
Porsha	92	8.39
Niyamatpur	32	2.92

Patnitola	180	16.43
Total	1096	100.00

Source: Landsat TM image 2006

The total area of surface water of study area is 1096 hectares which is 0.84% of the total study area. The sources of flowing surface water of this regions are the Attrai and Ponorbhoba. Besides there are many other ponds, canals and dighis. The total area of ponds in Sapahar was about 669.26 hectares.

According to the report of 2003 number of the total ponds was 2999 out of which 1210 was usable. According to the survey of 2006 the total number of ponds at Sapahar was 3172 which is comparatively less at Porsha but more at Niyamatpur. In 2006 there were 92 hectares of surface water at Porsha which is 8.39% of the total surface water (Table-3). In Niyamatpur area surface water surface water was found less. It contains 32 hectares of surface water which is 2.29% of the total surface water (Table-3). The river of Attrai is important source of surface water at Patnitola. There is a big dighi called Dibor dighi which is a historical place. The water of this marshes are used in irrigation which play an important role for the economic development of the region. In this area the total area of surface water was 180 hectares which is 16.43% of the total surface water (Table-3). The amount of marshy land at Patnitola is more. Patnitola stands after Sapahar. Though the river of Attrai is the main source of water here, there are also many kinds of ponds, Dighis, canals etc.

The change of surface water in the study area (1997-2006)

Surface water means the water on the ground. Generally river, canal, beel, pond and dighi belong to this category. The surface water has decreased to a large extent during the observed ten years. Here water has decreased due to agricultural irrigation, household use and draught. About 736 hectares of surface water has decreased from 1997 to 2006. The marshes of all types have been clubbed in one category in this research. The big marshes and ponds have been considered but small marshes and ponds have been ignored. A lot of marshy lands are seen at Patnitola. Here the reduction of marshy land is seen. Its area was about 1812 hectares in 2006 which was about 2284 hectares in 1997. As a result of draught, the marshy lands have been modified into crop land. The quantity of marshy land is comparatively less at Niyamatpur. There are more marshy lands in the thana of Porsha of the study area. The marshy lands of Sapahar are located at the union of Pathari and Aihai. Its total area was about 2404 hectares in 1997 and became about 1992 hectares in 2006. Here the marshy lands have decreased by 17.14% in the study area.

Table- 4

The change of surface water according to Upazila (1997-2006)

Name of Thana	1997		2006		1997-2006
	Area (Hector)	Percent (%)	Area (Hector)	Percent (%)	Change (%)
Sapahar	1456	5.95	792	3.24	-45.60
Porsha	188	0.74	92	6.36	-51.06
Niyamatpur	28	0.06	32	0.07	+ 14.29
Patnitola	160	0.42	180	0.48	+ 12.50

Source: The Percentage of surface water in ratio to the land uses of Upazila (Table 1 and 3)

Though irrigation is supposed to be the main reason draught plays an important role for water reduction. Water table rises up and falls down for rainfall and draught. About 10 or 15 years ago there were a few sources of water like canal water etc. But at present tube-well has been established in those localities. As a result surface water has changed considerably. The amount of surface water is more at Sapahar. There are many big beels here. Among hem Jobai beel and Maheel beel are famous. These two beels belong to Aihai and Pathari which are the main sources of water. In rainy season these beels are full and becomes impossible to produce crop and after rainy season they dry up. In the study area the amount of surface water was 1456 hectares which becomes 792 hectares in 2006. This time the reduction rate of surface water is 45.60%. This difference is also seen at Porsha. This difference is seen to the south of Nitpur too. Here water is less in comparison with Sapahar. This difference is seen to be about 96 hectares within those ten years. This time the reduction rate is 51.06%(Table-4). Only one source of surface water at Niyamatpur is pond. The area of surface water in 1997 was 28 hectares which become 32 hectares in 2006. Here the growth rate is 14.29% many new ponds have been dug here. As a result surface water has increased at Patnitola. Many ponds along with the Attrai are the main sources of water. There are many big ponds here. Some of the big ponds and dighis are described below. The Balta dighi which is located at Patnitola is about 27 acres in 1990. Another dighi called Bonogram which is about 23 acres in 1990 is located at Dibor union. But the quantity of water has decreased in this dighi for settlement.

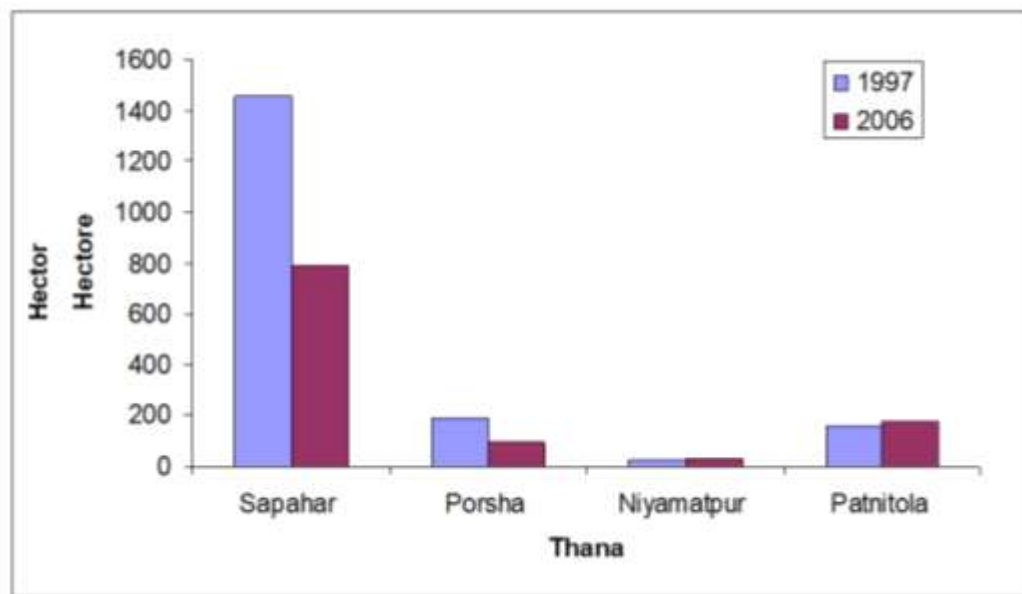


Figure 4: The change of surface water according to thanas (1997-2006)

Only source of surface water at Niyamatpur is pond. In 1997 the area of surface water was 28 hectares which become 32 hectares in 2006. This growth rate is 14.29%. The main reason of this growth is “Moja” pond which was difficult to identify. The area of surface water increased in Patritola. In 1997, the quantity of surface water at Patritola was 160 hectares and increased to 180 hectares in 2006. Here the growth rate is 12.50% (Table-4). The river Attrai flow over this Upazila doesn't show the difference of water.

Influence of water on human

Land is being changed due to land use in the study area and influencing the surface water and marshy land. Agricultural land is decreasing for settlement and infra-structural development. On the other hand, a great pressure is being laid upon agricultural land to meet the demand of ever increasing people. As a result crop is produced three or four times in this agricultural land in a year. As a result of over production, surface and ground water are being highly pressurized. Though forest has increased in the study area, built is yet a half as per requirement for our balance of environment. Besides, man uproots the forest for necessity or unnecessary as a result of which rainfall has come down and surface water also decreases. For more production, the use of surface water increases to a large extent. On the other hand, rainfall happens to a small extent. Considering these, surface water comes down largely in comparison with the past. There are many sources of small and big dighis, ponds, rivers, Jobai beel and Maheel beel. In spite of being these sources, the Barind authority has introduced deep tube-well for irrigation. With the help of deep tube-well, ground water is being uplifted from the ground. As a result of uplifting the ground water again and again, the ground water is going down rapidly consequently the co-ordination between surface water and ground is being damaged. As a result of it, imbalance is being created in our environment. Both man and environment will fall into a great danger if water is uplifted in such a way.

Ponds or water bodies are important land use. In the past there were many ponds in the surveyed area. But these types of land use pattern are decreasing day by day for various purposes. According to Landsat TM FCC image, the total area of water bodies of the study area was 1832 hectares in 1997 which covered almost 1.38% of total area whereas it changed to 1096 hectares in 2006(.84% of total area). During this period the amount of water bodies was reduction rate 40.17% of the total area of the study region. Land value is increasing bit by bit as a result the use of land becoming diversified. 33% respondents supported that land value change was strongly responsible for different kinds of land use change. According to the field study, a new thing has come out as a cause of land use change and that is family problem. Hence, 1.25 percent of respondent perceived that the separation from joint family was also responsible for land use change.

Finding

There are many Dighisin the study area such as Thakral dighi, Korol dighi, Hat dighi, Noira dighi etc. The most important dighi of the study area is “Dibor dighi” which is located at Dibor union. Its area was 101 acres at past. But water area is decreased significantly now. There is a big pillar in the middle of this dighi as the ancient relics. Another important characteristic of this dighi is that there are 101 ponds around this dighi. The quantity of surface water has decreased in 1997 in comparison with 2006. The quantity of surface water was about 1832 hectares in 1997 and it decreased to about 1096 hectares in 2006. The quantity of this decrease is about 40.17% . More surface water exists at Sapahar. The “Jobai” and “Maheel” beel are the sources of water. The quantity of surface water was about 1456 hectares in 1997 and it decreased to 792 hectares in 2006. The reduction rate of surface water is 45.60% (Table-4). More surface water has decreased at Porsha in 1997. There were 188 hectares of surface water where it became 92 hectares in 2006. The reduction rate of surface water is 51.06% (Table-4).

Recommendation

- ❖ The amount of water available in Barind region is decreasing day by day due to which common people including farmers are facing various bid problems so everyone should be aware about the proper use of water and the government should take strict action in this regard.
- ❖ Apart from surface water and ground water, flood water is also used by the farmers. Irrigation by this flood water causes serious damage to crops, so farmers should be well aware of this and use improved irrigation methods properly.
- ❖ The use of conservation of rain water for crop product, face water storehouse for irrigation and groundwater recharge for depleting water tables. Raise mindfulness among growers about the damages of the wild flooding system of irrigation and use bettered face irrigation practices like the border system, crest and crinkle system, and sprinkler and drip styles.
- ❖ In the addition mindfulness among growers about suitable inter-cropping for sugarcane and other crops. Effective treatment of manufactories' waste water to use treated water for irrigation, recovery of main conduit seepage water logged area through inventions developed by Central Soil Salinity Research Centre.
- ❖ For the purpose of sustainable production, provision of sufficient water, production of organic fertilizers, use of green manures and various steps should be taken to increase organic carbon deficit.
- ❖ Rain water should be conserved for improved and good crop production, surface water should be properly used for irrigation, only then the quality of life of farmers and the development of the country would be possible.

Conclusion

Although the area is facing severe water crisis but after establishing the BMDA project irrigation facilities, cropping intensity have been increased remarkably from 1997-2006. However, 10.25% of respondents suppose that irrigation facilities and 9% respondents' opined, cropping intensity are liable for land use change. Decrease in water bodies is an essential factor of changes in land use. 5.5% respondents in the study area mention that decrease in water bodies is accountable for different kinds of land use changes. Per capita income is increasing in the study area day by day as well as expenditure capability. So, many respondents converted fishing due to higher income in the selected area. Besides, agricultural land conversion in the study area has been increased remarkably due to more income opportunity and expenditure competency. Besides, due to employment opportunity, transport development, market improvement, communication facilities are also the causes of water body changes which has changed the aspect of human perception in the study area.

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