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Future of agricultural production in the perspective of declining area under wetlands----A case study on Krishnagar-ii Block, Nadia, West Bengal, India

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Present study focuses on an agro based region which is within Krishnagar-ii Block of Nadia District in West Bengal, India with an area of about 124.37 sq km. The study area is within the moribund part of the Gangetic Delta and presence of river Bhagirathi and Jalangi along with their palaeo channels contribute significantly the fertile alluvial deposited land to continue agricultural practice with a huge prospect. This research runs with the objective to highlight:

- *Loss of wetlands as part of land-use land-cover change*
- *Impact of wetland loss on irrigation system and its long term effect on agriculture. Methodologies applied for the present work are:*
    - *LANDSAT image analysis at the interval of two decades.*
    - *Quantitative analysis of collected information.*

Keywords: Wetland, agriculture, irrigation, land-use land-cover change.

Introduction:

All economic activities of human beings and all the basic demands of them are directly controlled as well as fulfilled by the natural environment. Agriculture is such a prime economic activity which is directly related to food production and food supply as per human demand. Proper quality of land, soil fertility, climate, ground water is such natural elements which directly impact on agriculture. For present research work a fertile land area with high prospect in agricultural production is been chosen. Continuous and smooth agricultural practice for such an area is facing challenges day by day. Here one of the important natural resource i.e. wetlands, their decaying nature and impact of such situation on agriculture is been discussed.

About the study area:

From administrative point the study area covers Krishnagar-ii Community Development Block, it is within the Krishnagar Sadar Subdivision of Nadia District in West Bengal, India. It covers an area of 124.37sq km with the latitudinal and longitudinal extension of 23°26'38"N, 88°25'29"E to 23°32'10''N, 88°29'20"E.

From Geomorphic point it is within the moribund portion of Gangetic delta and presence of meandered streams, palaeo channels, alluvial deposits, presence of variety of flora and fauna

give the region a speciality. Eastern to south-western part of this administrative unit is marked by the river Jalangi, while river Bhagirathi with its south ward flow demarcates the western most boundary of the study area. Major wetlands found within the region are Hansadanga Bil, Nowpara Bil,Sartola Bil along with innumerable ponds and channels.

Objective of the study:

This research runs with the objective to highlight:

- Loss of wetlands as part of land-use land-cover change
- Impact of wetland loss on irrigation system and its long term effect on agriculture.

Methodology:

- LANDSAT image analysis at the interval of two decades done by Image classification using ARC-GIS 10.2 in a hybrid processing where both unsupervised classification based on previous source and use of GCP been done. .
- Quantitative analysis of collected information based on:
  - i. Crop concentration analysis after Majid Hossain (1996).
  - ii. Measuring crop combination with the application of Weaver's (1954) method.
  - iii. Percentage wise study on major quantitative information.

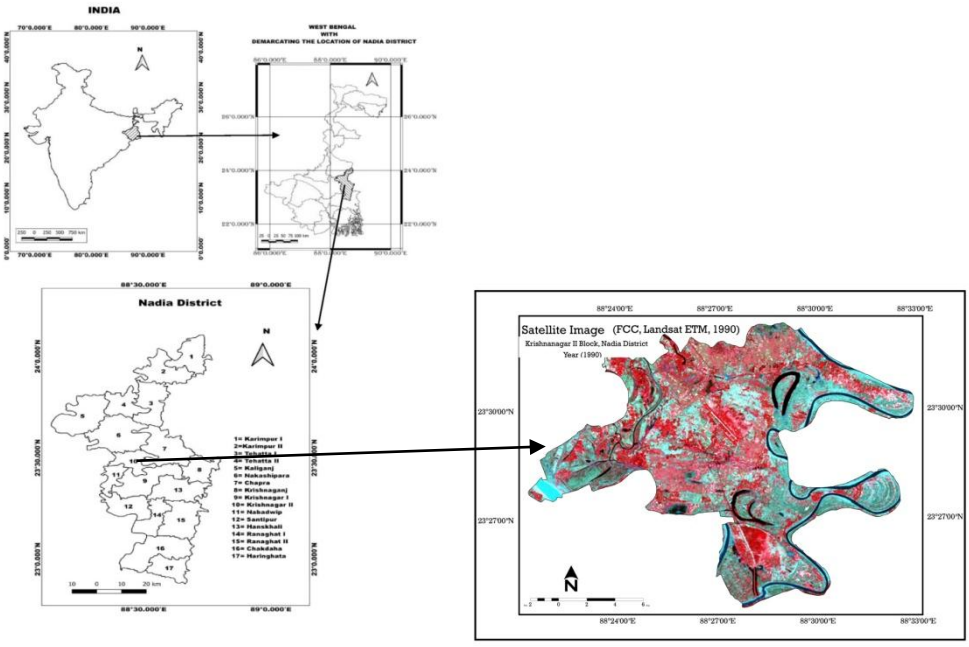


Fig. 1: The study area

Discussion:

- **Changes in area under wetland:**

LANDSAT image analysis of the study area at an interval of twenty five years shows the following figure:

Base map for Land-use Land cover map of Krishnagar-ii Block in 1990

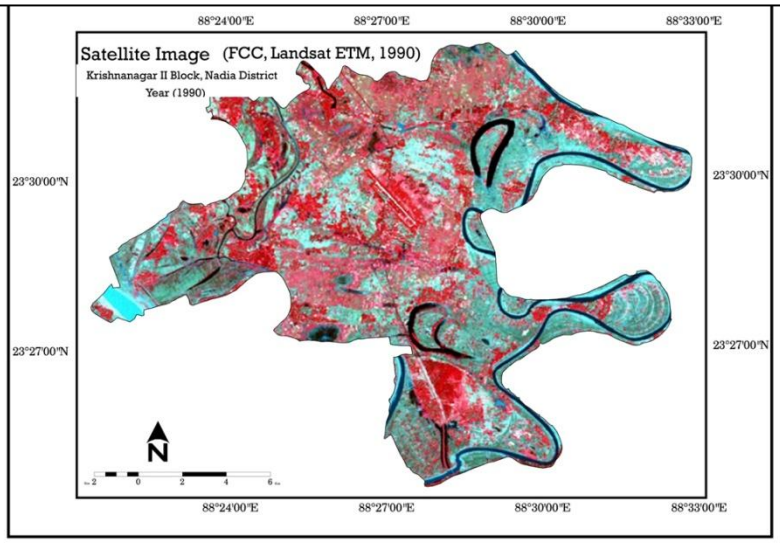
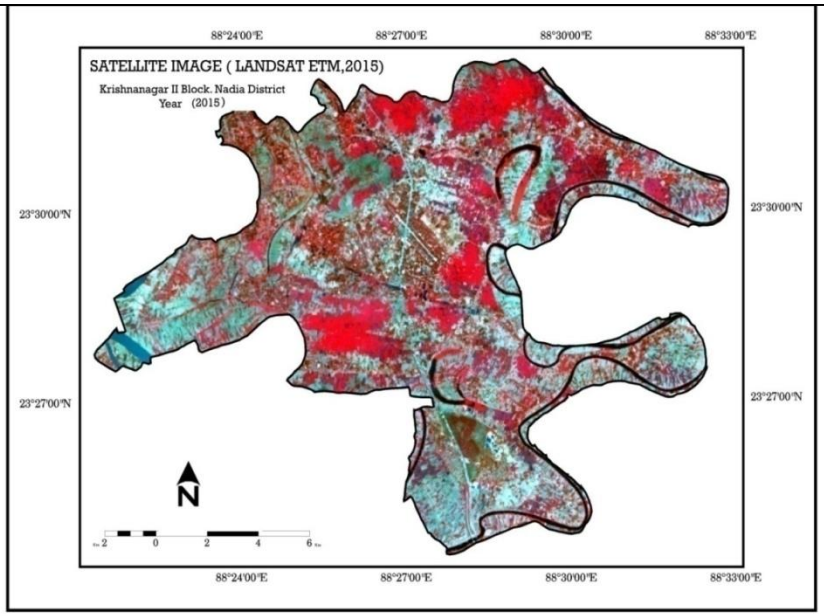


Fig.2

Base map for Land-use Land cover map of Krishnagar-ii Block in 2015



Land-use Land cover map of Krishnagar-ii Block in 1990
1990

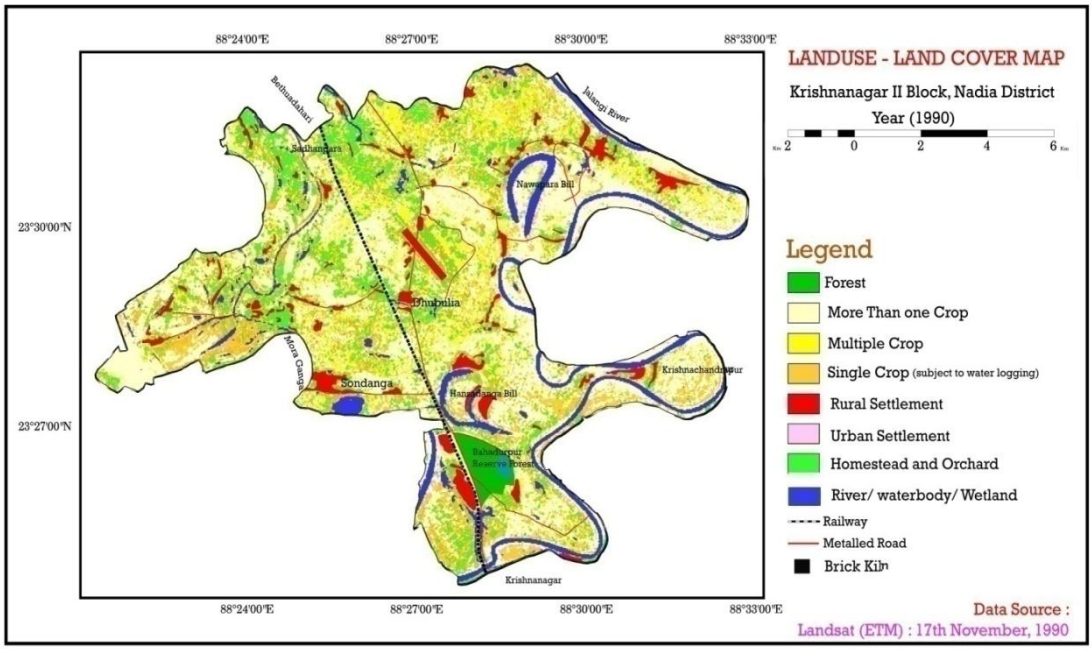


Fig.4

Land-use Land cover map of Krishnagar-ii Block in 2015

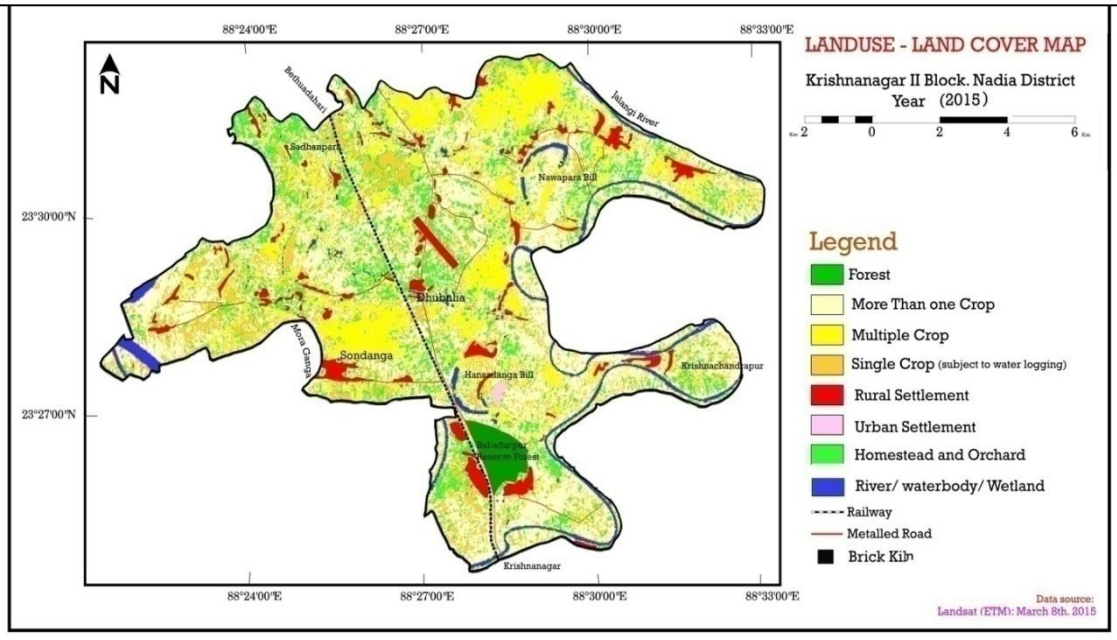


Fig.5

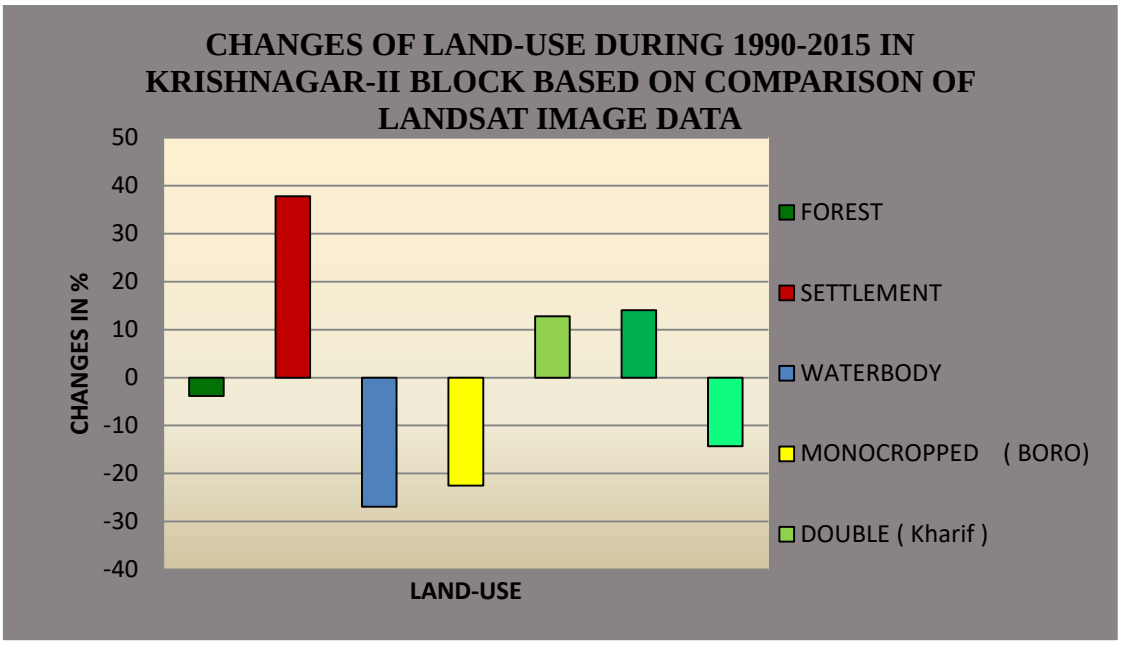


Fig.6

Table-1:Temporal changes in land-use, land-cover in Krishnagar-ii block

Years	**In 1990 based on LANDSAT ETM data**		**In 2015 based on LANDSAT ETM data**		**Change of area in %**
Land-use, Land-cover types	**Area in hectare**	**% to total area**	**Area in hectare**	**% to total area**	
FOREST	198.43	1.56	190.23	1.50	-3.85
SETTLEMENT	798.86	6.30	1101.01	8.68	+37.82
WATERBODY	**1524.87**	**12.02**	**1114.87**	**8.79**	**-26.90**
MONOCROPPED (BORO)	1796.22	14.16	1392.27	10.98	-22.49
DOUBLE (Kharif)	4697.65	37.03	5297.65	41.76	-12.77
MULTIPLE	1568.96	12.38	1788.96	14.10	+14.02
HORTICULTURE AND ORCHARDS	2099.97	16.55	1799.97	14.19	-14.29
TOTAL	12684.96	100	12684.96	100	

Data source: Image classification by technical support from RSGIS, Kolkata and computation made by the researchers on the basis of image classification.

- **Changes in agricultural practice:**

From the point of crop concentration:

Crop concentration means the variations in the density of any crop in an area/ region at a given point of time (Majid Hussain, 1996). This method is useful to identify any region from the point of view of crop specialization. To identify crop concentration location quotient method is used. The index is calculated using the following formula:

(Area of x crop in the component areal unit ÷ Area of all crops in component areal unit) ÷

(Area of x crop in the entire region or country ÷ Area of all crops in the entire region / country)

The formula is used here to represent crop concentration of crops occupying at least 10% of total cultivated land of the selected blocks in twenty years interval:

Table-2: Temporal Changes In Crop Concentration for Krishnagar-ii Block

Block	Major crop	Index value	
		1993-94	2013-14
Krishnagar-ii	Aus	2.0267	1.2437
	Jute	0.9153	0.7964
	Aman	0.3819	0.8101
	Mastard	6.9293	1.3335
	Boro	0.6518	0.7945

Data source: District Statistical Hand Book of Nadia 1995, 2014 Published by The Bureau of Applied Economics and Statistics, Govt. of West Bengal and the computation is done by the researcher.

- **Changes in irrigation system:**

Table-3: Temporal Changes In irrigation system for Krishnagar-ii Block

Year	Irrigation systems							
	Shallow tube well		Deep tube well		River lift irrigation		Other sources	Total
	Number	Area in hectare	Number	Area in hectare	Number	Area in hectare	Area in hectare	Area in hectare
2004-05	5335	5490	24	380	19	682	264	6816
2013-14	48	7	17	300	21	764	NA	10710

Data source: District Statistical Hand Book of Nadia 1995, 2014 Published by the Bureau of Applied Economics and Statistics, Govt. of West Bengal; the computation been done by the researcher.

Findings from the study:

The above mentioned events point towards the following issues:

- Land-use land-cover changes of the study area with a prominent indication towards loss of wetlands and water bodies.
- Rise in built-up zone which might be in exchange of cultivable lands as well as wetlands.
- More and more concentration towards multiple crop production using a single piece of land, for such a region which is dominated by Monsoon climate, crop production throughout the year mostly depends upon irrigation.

- A trend of increase in production for rabi (winter season) crops instead of kharif (monsoon season) crops, again points towards dependence on irrigation, more and more use of ground water.
- Loss of wetland, prolonged dependence on ground water to continue agricultural practice is a threat to ground water quality and quantity, at the same time initiating a big question against sustained agriculture for the present study area.

Conclusion:

Wetlands are the key places to balance the eco-system and at the same time their importance to support agricultural practices in unavoidable. So to sustain the agricultural practice for present study area conservation of wetlands, garbage free and pollution free surroundings for wetlands could support the natural environment and continue agricultural works as economic back bone for the area.

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