International Journal of Geology, Earth & Environmental Sciences ISSN: 2277-2081 (Online)
An Open Access, Online International Journal Available at http://www.cibtech.org/jgee.htm
2016 Vol. 6 (2) May-August, pp. 66-75/Dey
Research Article

EFFICACY OF CANALS OF RIVER DAMODAR - CASE STUDY FROM KHANDOGHOSH, RAINA I AND RAINA II BLOCKS

***Soumen Dey**
Department of Geography, Visva Bharati, Santiniketan
**Author for Correspondence*

ABSTRACT
Damodar River flows through the region called 'Rice bowl of west Bengal'- Burdwan District. The region practices rice cultivation three times in a single year i.e. autumn and winter or Kharif season from June to October and Summer (or Rabi) from December to May. The mineral rich alluvium of river Damodar produces high quality of rice with help of adequate supply of water in growing season. The canals of Damodar Valley Corporation (DVC) was built to supply water in rice growing season, but temporal analysis show decrease in rice crop cultivation as carrying capacity of Damodar Dams decreased. The efficacy of canals of Damodar decreased as average flow of water is very low in Rabi season.

Keywords: *River Discharge, GIS, Canal Consumption*

INTRODUCTION

Rice is the single most important food crop in India that occupies 44.0 million hectares of agricultural land, which is the largest rice area in the world (IRRI, 2005).
It is grown in almost all states of India and in the state of West Bengal rice cultivation was done in 3.7 million hectares in 2006-07 (WBDR, 2010).
West Bengal is a predominantly agrarian state as more than two third of the state's population depends on agriculture.
Rice is grown in three seasons in India, autumn and winter or Kharif season from June to October and summer (or Rabi) from December to May.
The Kharif season accounts for 88 percent, and Rabi season accounts for 12 percent of total productions.
In India the rice crop is highly dependent on the southwest monsoon, which occurs over the subcontinent from June through September.
Green revolution in India (1967- 1978) brought substantial increase in production of cereals, particularly wheat and rice.
Double-cropping in existing farmland is one of three basic elements of green revolution. This encompassed to have two crop seasons per year instead of one that depend on the monsoon.
So, irrigation projects were built up to support crops with adequate water supply during the growing period.
Dams were built to store large volumes of monsoon water which were earlier being drained into rivers and sea.
DVC Dams over Damodar River in West Bengalare one of such scheme which built up in early days of independence (1957) having live storage capacity of 6,500 million m^3 and it provide irrigation potential of 3,93,768 ha during kharif and 22,258 ha during rabi season.

Study Area

For this research, parts of Damodar River command area, West Bengal, India has been chosen as study area.
It extends from $22^0$55'N to $23^0$15'N latitude and from 87^0 38'E to $87^0$58'E longitude. This area comprises three blocks namely Khandaghosh, Raina I and Raina II which are well connected with the Damodar Right Bank main and Branch canals (Figure 1). In the entire study area paddy is the Predominant crop covering 95 % of the total crop area (NRSA, 2004).
The region consists of high mineral rich alluvium of Damodar river also known as 'Rice Bowl of West Bengal'.

International Journal of Geology, Earth & Environmental Sciences ISSN: 2277-2081 (Online)
An Open Access, Online International Journal Available at http://www.cibtech.org/jgee.htm
2016 Vol. 6 (2) May-August, pp. 66-75/Dey
Research Article

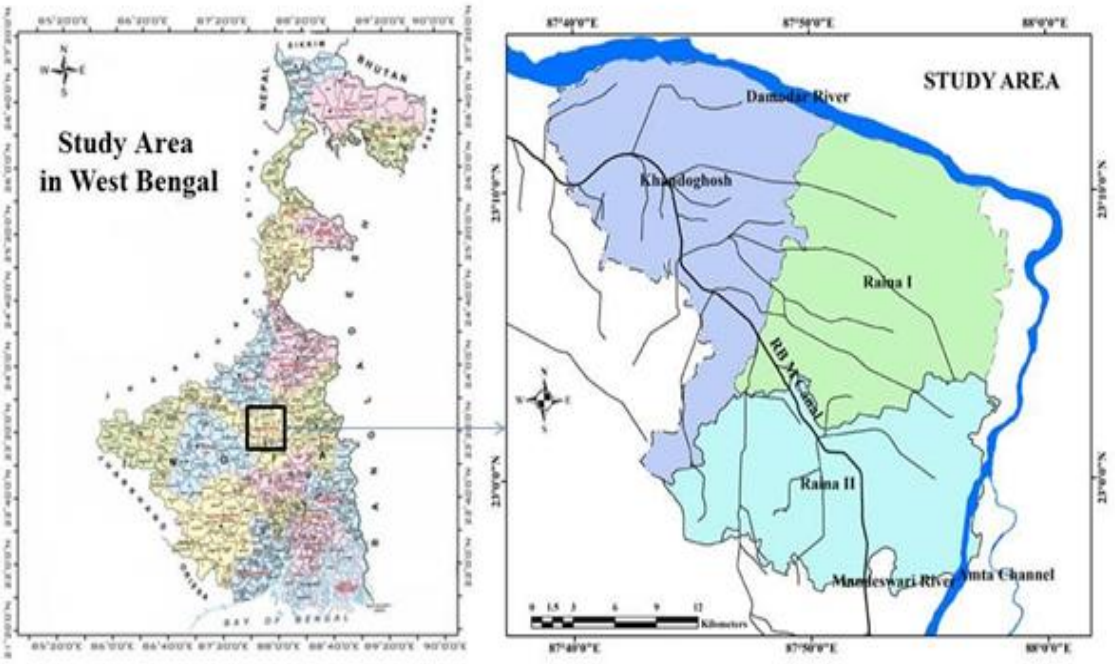

Figure 1: Study Area

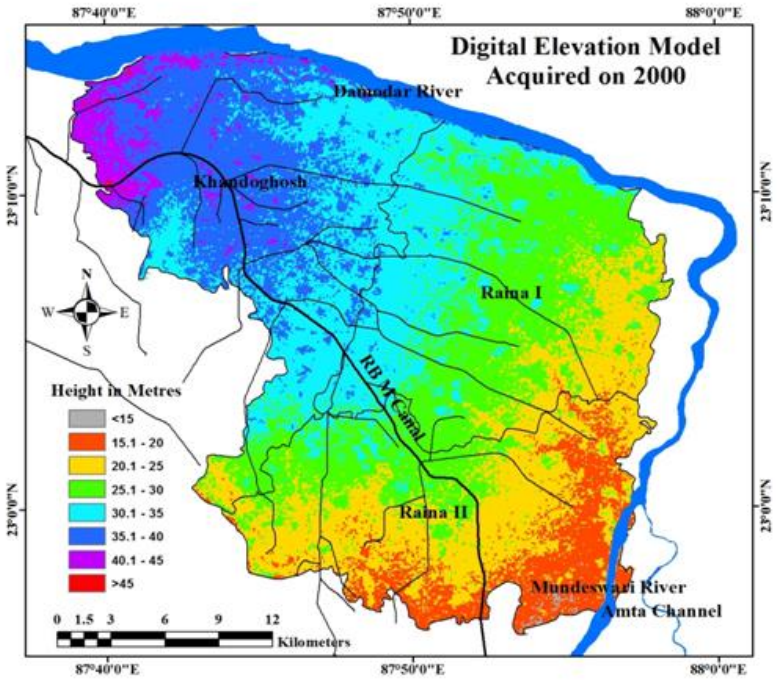

Figure 2: Height Map of the Study Area

MATERIALS AND METHODS

Various types of data are used in this study. Meteorological data collected from IMD to understand the climatic condition over the study area. Irrigation and hydrological data were collected from previous literature. Relevant agricultural data was collected from several District statistical handbook, Burdwan.

Landsat Satellite data from 1975 to 2015 were used to understand the spatio temporal variation of cropped area of the three blocks (Table 1). SRTM data (2000) of the area is used to study the height aspect of the area. Canal network is generated using Google Earth virtual GIS application. The main aim of this work is to calculate cropped area during Rabi and Kharif season which is command by River Damodar Right bank canal and branch canal using temporal data. To achieve that goal all data are converted to Universal Transverse Marcator (UTM) Projection with WGS 84 datum. For that Geomatica 10.0 software has been used and total digitization process done in the ARC GIS 10.1 software platform. Cropped area of three blocks are generated from different images using supervised classification in ERDAS imagine 14 software and GIS work done in ARC GIS 10.1 software. DEM of the area is also prepared on ARC GIS 10.1 software (Figure 2).

Table 1: Satellite Data

Satellite Images	Pre-Monsoon	Post-Monsoon
LANDSAT MSS	29-03-1975	12-10-1975
LANDSAT TM	10-03-1990	20-10-1990
LANDSAT TM	03-03-1999	13-10-1999
LANDSAT 8	15-03-2015	07-09-2015, 25-10-2015

RESULTS AND DISSUSION

Unlike the rest of Bardhaman district, which lies to the north of the Damodar River, the Khandaghosh-Raina I and Raina II area lies on the alluvial plains between the Damodar on its southern/ eastern side and the Dwarakeswar river. As a result, it has been a flood prone area. The soil of this area is very fertile as recurrence of flood every year. Paddy is the ideal crop which is almost cultivated 95 percent of the total cultivable area. But the study shows that Pre and Post monsoon difference i.e. Rabi and Kharif crop cultivation due to lack of canal water.

Climate

The climate of the area is characterized by moderate winters and hot & humid summers. Like the rest of India, the region experiences two principal seasons. In the winters from December to March there is little rain. In the summer months, June to September, the flow of air is from sea to land and the season is characterized by high humidity, clouds and rain due to South-West Monsoon which is the main season producing rains. Between these two principal seasons are the transition seasons of the hot weather months of April & May and the retreating monsoon months of October & November.

Siltation of Reservoirs and Canal Consumption

DVC was set to provide a controlled storage capacity of 6,500 million m3 but only four dams and Tenughatreservoir provide a maximum storage capacity of 3,591 million m3, only 55 % of storage capacity originally envisaged (Saha, 1979). The last two terminal dams, Maithon and Panchet, are located close to break of topographic slope in the border of Jharkhand and West Bengal. So, the upstream tributaries of Damodar and Barakar bring heavy sediment laden water to these reservoirs, and the siltation of reservoirs is emerging as a major problem to affect the downstream flood control measures (Basu, 2011). According to Lal *et al.*, (1997), the siltation rate of Maithon and Panchet reservoirs is 1310.0 and 1059.0 m3 km-2/year, respectively. A recent study shows that the sedimentation of Panchet (on the basis of Landsat TM images of 1990 and 2005) occurs approximately at a rate of 0.041–0.047 cm per year, whereas it was 0.033 to 0.034 cm per year in 1990 (Majumder *et al.*, 2012). If we consider the overall capacity (including dead zone, live zone, and flood zone), the loss of capacity of Maithon and Panchet reservoirs is 22.1 % (up to 1994) and 14.1 % (up to 1996), respectively (Rudra, 2002; Bhattacharyya, 2011). The temporal variation of flood moderation by Panchet and Maithon dams shows that there is now a declining trend of flood controlling performance till 2007 (Ghosh and Mistri, 2013). It is a reality that DVC dams cannot attain their previous capacity to accommodate flood water due to siltation. In the post-dam period when DVC dams suddenly had released excess water to save structure of dams, the floods were occurred in 1959, 1978, 1995, 1999, 2000, 2003, 2006, and 2007. Canals from Durgapur barrage

recorded highest flow in month of October (557.38 M.Cu. M) and lowest in June (33.82 M. Cu. M) (Figure 3).

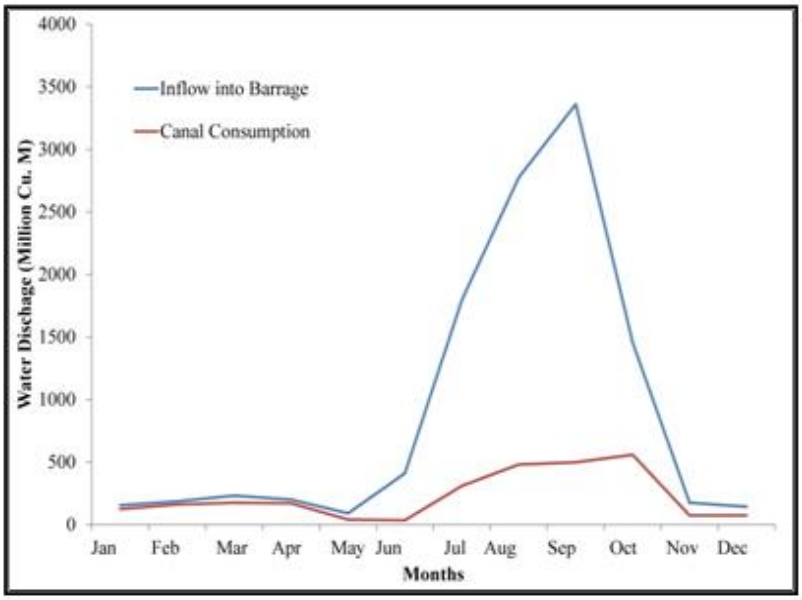

Figure 3: Average Durgapur Barrage and Canal Consumption Curve

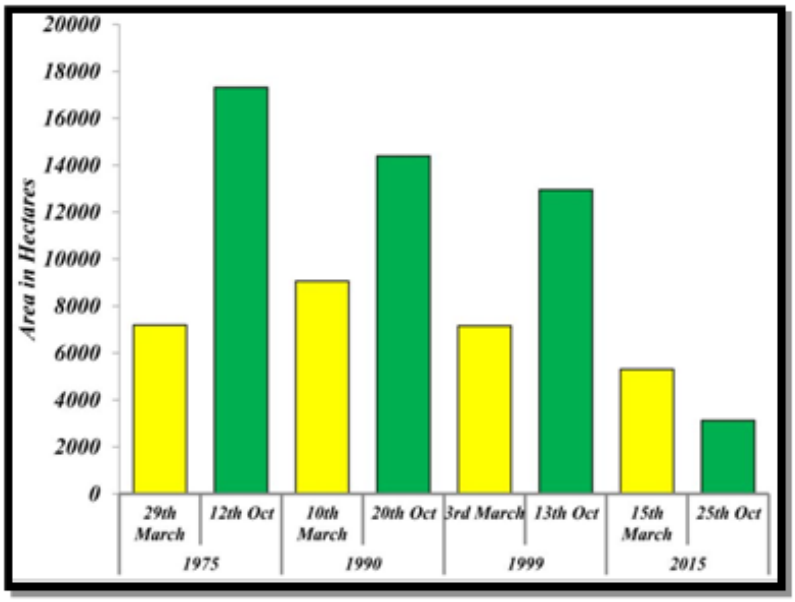

Figure 4: Cropped Area of Khandaghosh

Khandaghosh Block

Khandaghosh is an administrative division in Bardhaman Sadar South subdivision of Bardhaman district which has total area of 25635 hectare. The Gram panchayats of Khandaghosh block is Berugram, Gopalbera, Kaiyor, Khandaghosh, Lodna, Sagrai, Sankari I, Sankari II, Sasanga and Ukhrid. Study show that decreasing in total cropped area in the studied four time phase i.e. 1975, 1990, 1999 and 2015. In Rabi season the net cropped area are 7195 ha, 9054ha, 7159 and 5307 ha and in Kharif season the cropped area are 17313 ha, 14392 ha, 12956 and 8085 respectively (Figure 4, 7, 8, 9, and 10).

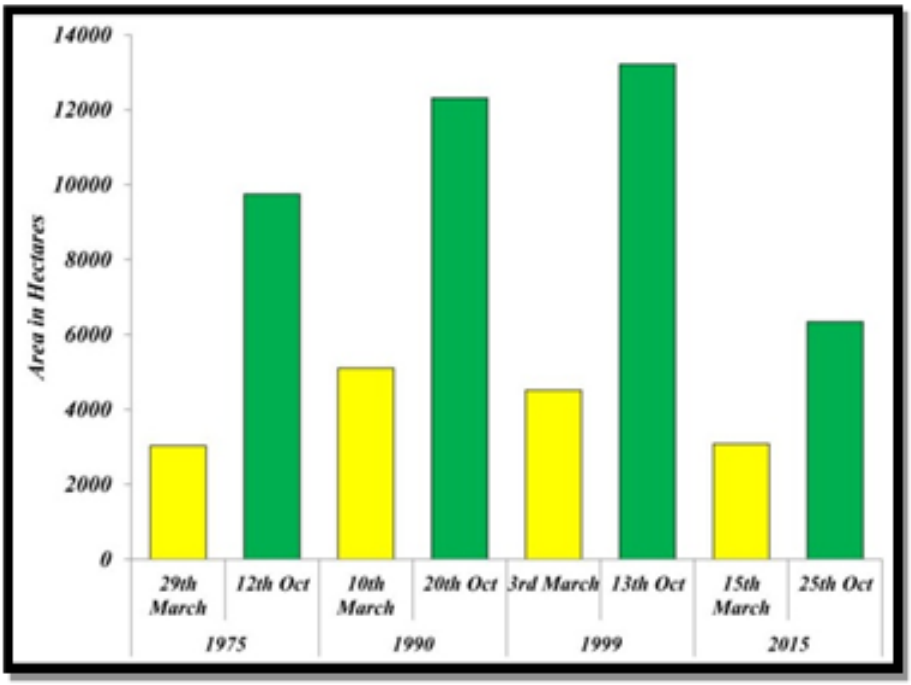

Figure 5: Cropped Area of Raina I

Raina I Block

The total area of Raina I block is 24829 ha. It is also spelled Rayna and called Rainagar which have Hijalna, Mugura, Narugram, Natu, Palasan, Raina, Sehara and Shyamsundar Gram panchayats. Study showing that in Rabi season net cropped areas are 3027 ha, 5102 ha, 4511 ha and 3079 ha, where as in Kharif season the cropped areas are 15184 ha, 15378 ha, 12578 ha and 8086 ha, in the years 1975, 1990, 1999 and 2015 respectively (Figures: 5, 7, 8, 9, and 10).

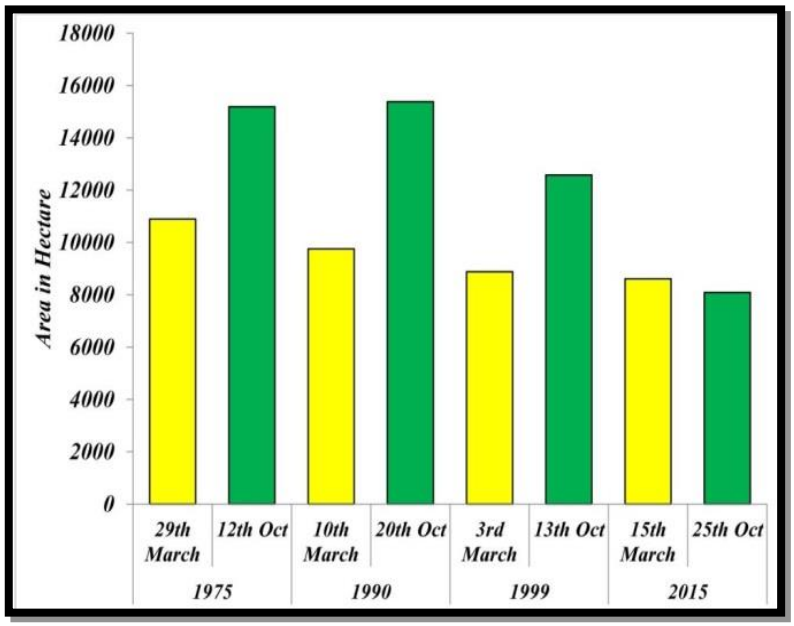

Figure 6: Cropped Area of Raina II

Raina II Block

The total area of Raina I block is 22445 ha. Gram panchayats of Raina II block are Arui, Barabainan, Gotan, Kaity, Pahalanpur, Painta I, Painta I, Painta II and Uchalan. Study shows that decreasing in total cropped area in the studied four time phase i.e. 1975, 1990, 1999 and 2015. In Rabi season the net cropped area are 3027 ha, 5102ha, 4512 and 3079 ha and in Kharif season the cropped area are 9751 ha, 12314 ha, 13215 and 6337 respectively (Fig: 6, 7, 8, 9, and 10).

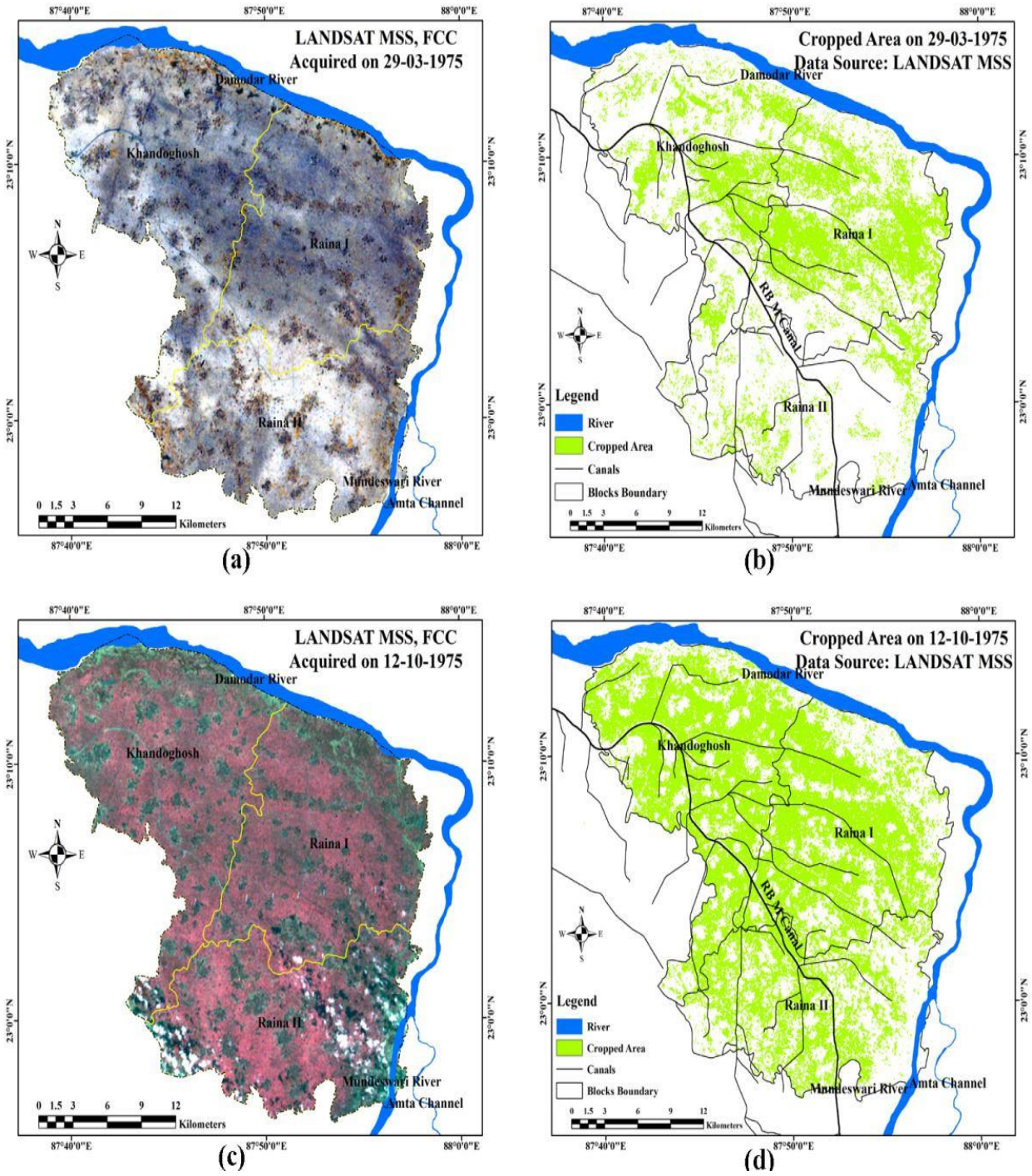

Figure 7: Pre and Post Monsoon Cropped Area (1975)

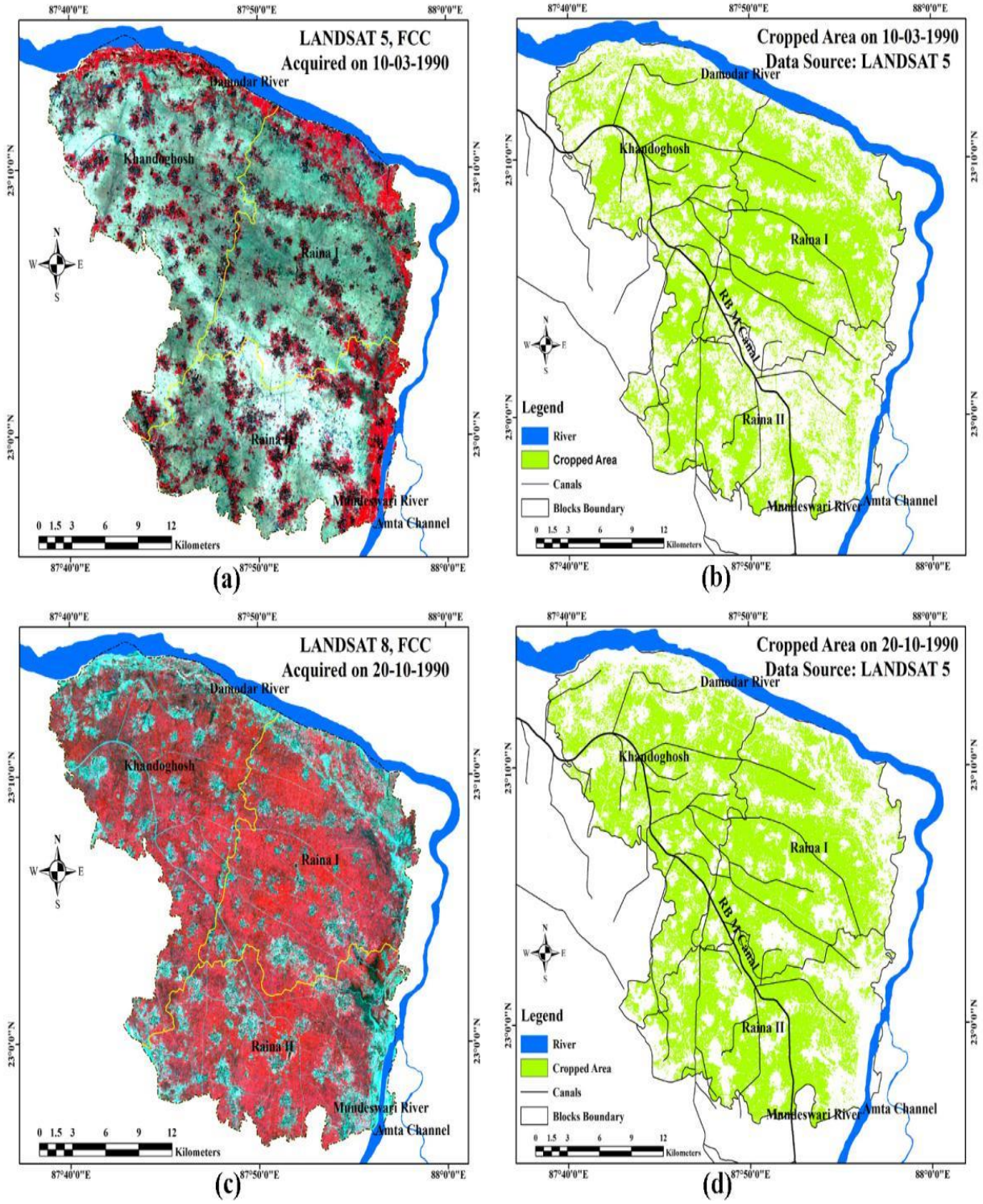

Figure 8: Pre and Post Monsoon Cropped Area (1990)

Conclusion

Results show that all three blocks has decreasing rate of net cropped area specially in the Rabi season due to lack of water supply in the right bank canals from Durgapur. It also show that the carrying capacity of dams decreasing day by day with increasing sedimentation which ultimately leads to low pond level in the

non- monsoon seasons. Recent flood map of 7th September 2015 (Figure 11) of the area show the extend of flood caused due to excess of water discharge by the canal, leading to flooding of the upper stretch of right bank canal.

It reveals that canals are supply water to the field when there is no need of water as monsoon water are already inundated the field. Where due to capital building (Hydro-electricity) water from barrage is not discharge when it is need most by the farmers. Ultimately leads to low production in Rabi and Kharif Season in recent times.

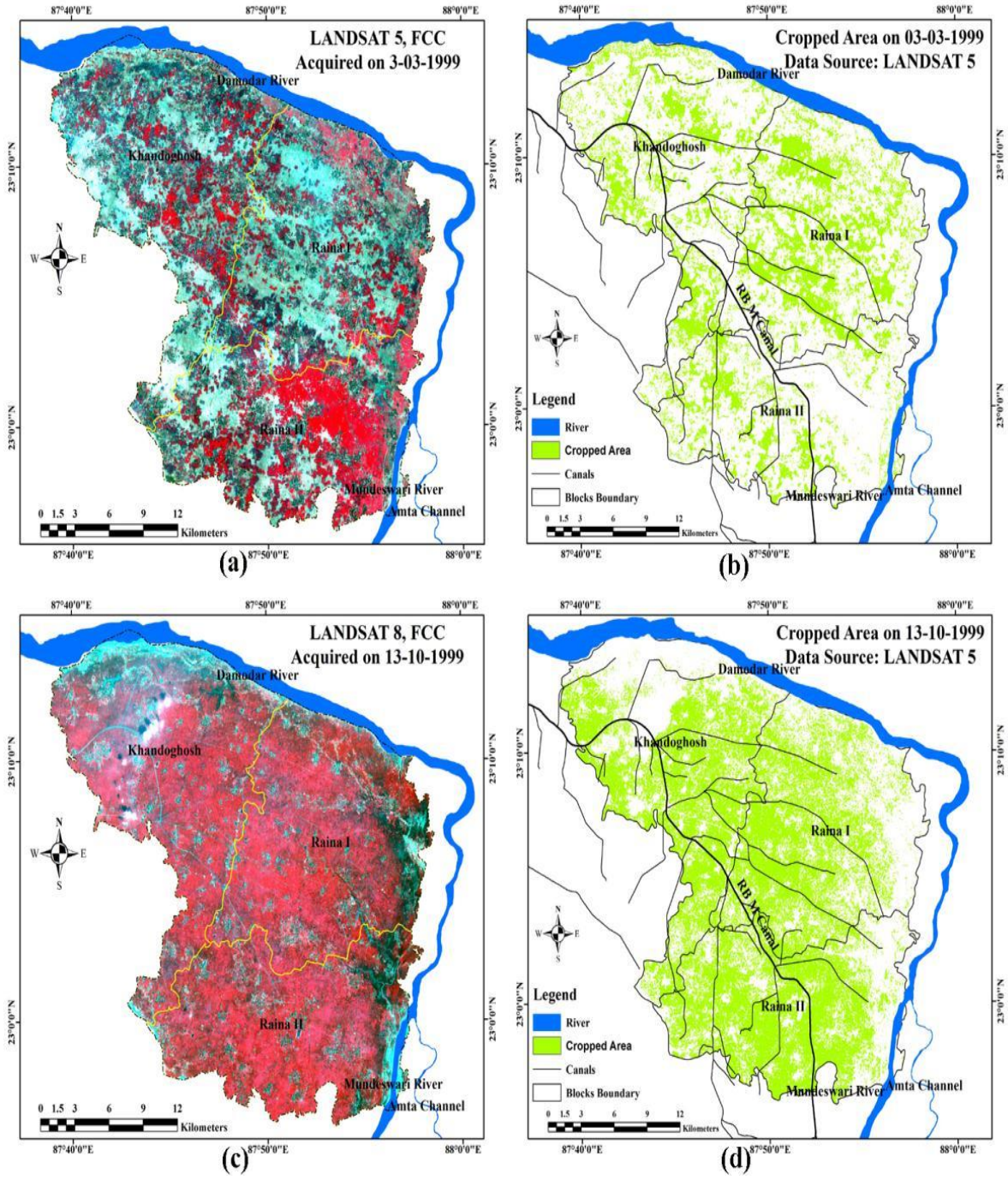

Figure 9: Pre and Post Monsoon Cropped Area (1999)

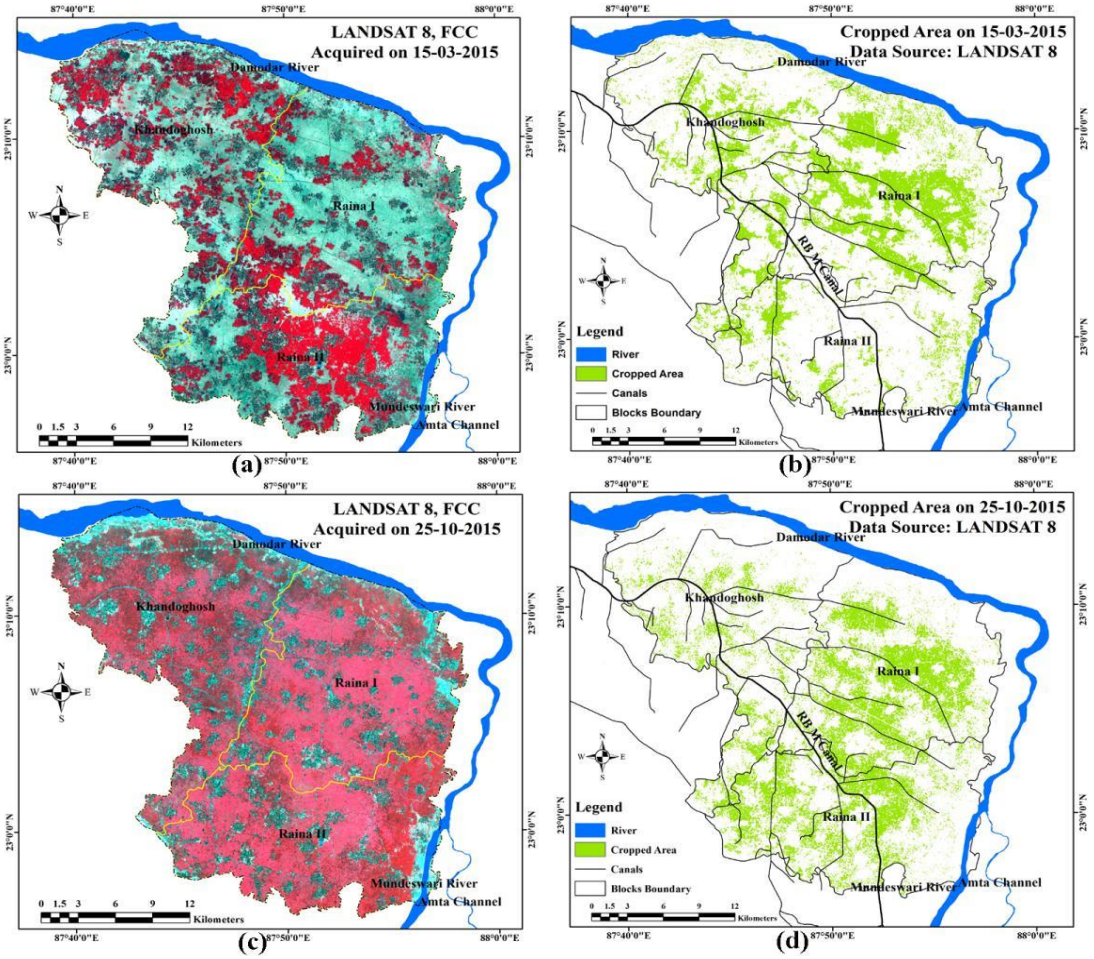

Figure 10: Pre and Post Monsoon Cropped Area (2015)

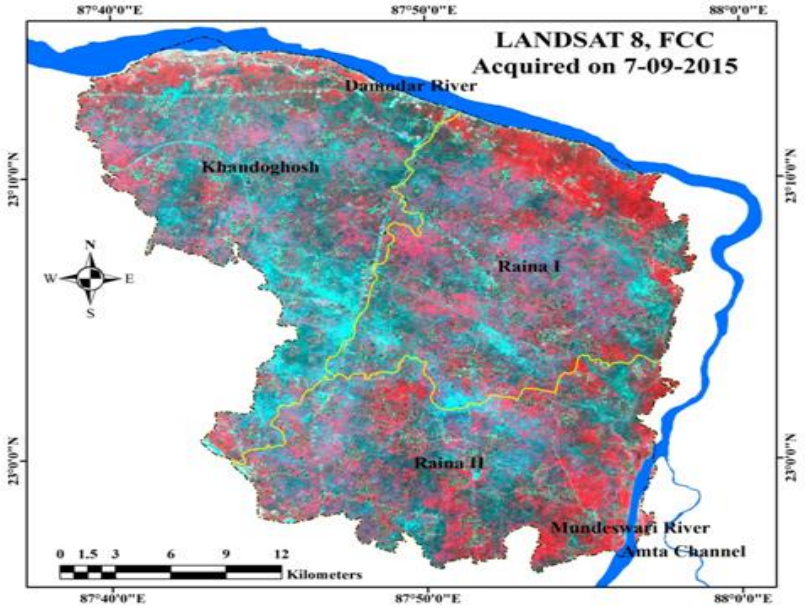

Figure 11: Flood Map on 07-09-2015

REFERENCES

Basu S (2011). *Soil Erosion and Environmental Problems*, (India, New Delhi: APH Publishing Corporation).

Bhattacharyya K (2011). *The Lower Damodar River, India: Understanding the Human Role in Changing Fluvial Environment*, (USA, New York: Springer).

Ghosh S & Mistri B (2013). Performance of DVC in flood moderation of lower Damodar River, India and emergent risk of flood. *Eastern Geographer* **19**(1) 55–66.

Lal VB, Banerji S and Narayanan J (1997). *Sediment Yield in Relation to Drainage Basin Characteristics in Some Indian River Valley Projects*. Available: www.iahs.info/redbooks/a122/iahs_122_0093.pdfon [Accessed 17th Jan, 2015].

Majumder A, Ghosh S, Dsagupta A & Seth D (2012). Analyzing reservoir sedimentation of Panchet Dam, India using remote sensing and GIS. *Panchakotessaya* **2**(3) 82–95.

Nayak AB (2006). *An Analysis Using Liss III Data for Estimating Water Demand for Rice Cropping in Parts of Hirakud Command Area, Orissa, India*, (IIRS, National Remote Sensing Agency, Department of Space, Government of India, Dehradun, India).

Planning Commission GOI (2010). West Bengal Development Report, Academic Foundation, New Delhi, India.

Rudra K (2002) Floods in West Bengal, 2000—causes and consequences. In S. Basu (edition),*Changing Environmental Scenario,* 326–347. (India, Kolkata: ACB Publications).

Saha SK (1979). River-Basin planning in the Damodar Valley of India. *Geographical Review* **69**(3) 273–287.