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ENVIRONMENTAL IMPACTS OF CHASHMA RIGHT BANK CANAL ON THE LAND USE AND AGRICULTURAL RESOURCES OF DERA ISMAIL KHAN DISTRICT, PAKISTAN

Doctoral Dissertation Abstract (2008)

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This study attempts to evaluate the environmental impacts of Chashma Right Bank Canal (CRBC) on the land use and agricultural resources of Dera Ismail Khan (D.I.Khan) district, Pakistan. It is the southern most district of North West Frontier Province (NWFP) and stretches between 31 15' to 32 32' North latitude and 70 11' to 71 20' East longitude. D.I.Khan district is bounded on the north by Marwat, Bhittani and Shirani hills, while Suliman Mountain lies in its west. The Indus River and Vehowa stream form the natural boundary to the East and South, respectively. The climate of D.I.Khan is characterized by long hot summer and short cool winter.

D.I.Khan district has a total reported area of 730,575 hectare (ha), out of which 236,371 ha was cultivated, 3,908 ha under forest, 132,487 ha uncultivated and large share of about 357,809 ha was cultivable waste, during 2003-2004. Primarily, the main form of agriculture was *Barani* (rainfed) followed by *Rod Kohi* (hill torrent irrigatted). Although, small areas around western tributaries such as Tank Zam, Gomal Zam, Sheikh Haider Zam, Chowdwan Zam and Daraban Zam have surface irrigation. Canal irrigation to a greater extent became possible after the inception of CRBC.

Work on the Chashma Right Bank Irrigation Project (CRBIP) started in 1984 and was subsequently completed in three stages during 2003. The ultimate goal of CRBIP was to enhance agricultural productivity, employment opportunities and alleviate poverty. CRBC is 272 Km long canal, traversing over the two provinces i.e. 170 Km in NWFP and 102 Km in Punjab. The CRBC commands 250,000 ha, out of this 61 per cent lies in D.I.Khan district of NWFP and remaining 39 per cent in Dera Ghazi Khan (D.G. Khan) district of Punjab Province. The CRBIP was completed in three stages i.e. stage I, II and stage III. Stage I, II and a part of stage III falls in D.I.Khan district and remaining part of stage III falls in D.G. Khan District. The CRBC commands only left bank area as the slope is from west to east.

This study is a sort of ex - post impact evaluation of CRBIP. It attempts to answer the question that what are the environmental impacts of CRBC on the land use and agricultural resources of D.I.Khan district. The major objectives of the study were firstly, to find out the socio-economic and physical environment of D.I.Khan district; secondly, to analyse the land utilization and irrigation pattern before and after commissioning of

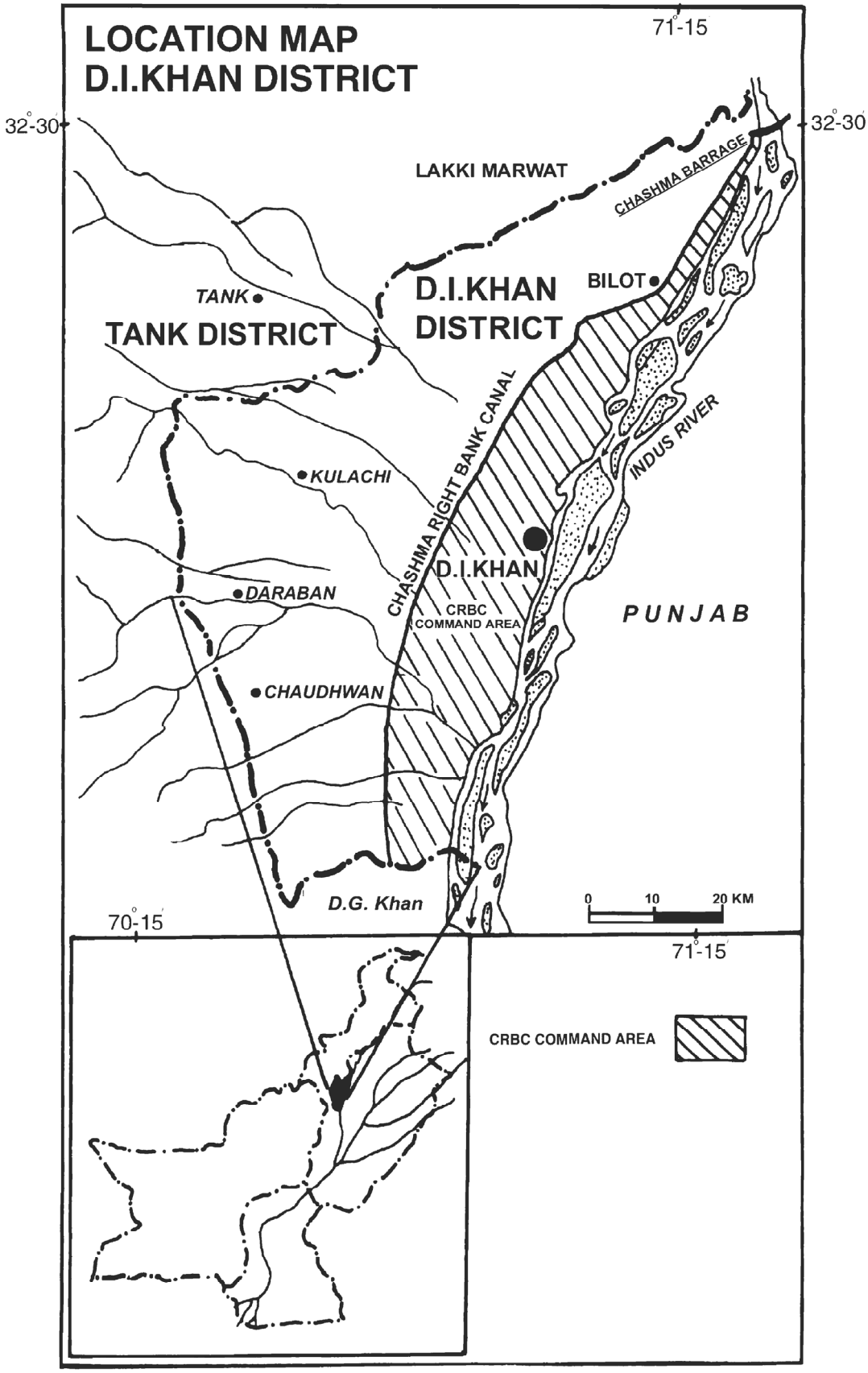
CRBC; thirdly, to compare changes in the cropping pattern and cropping intensity pre and post CRBC; fourthly, to find out the environmental impacts of CRBC on the agricultural production, land values, mechanization, fertilizer and water-table; finally, to suggest recommendations for mitigating the adverse impacts of CRBC on the land use and agricultural resources.

To carry out this study, nine indicators which included land use, cropping pattern, cropping intensity, land value, agricultural production, irrigation, mechanization of agriculture, application of fertilizer and ground water-table were selected. To achieve the objectives of the study the data were collected both from primary and secondary sources. Data pertaining to selected variables for pre and post CRBC period were collected for all 384 villages, which covered the whole district. However, to conduct more intensive analysis, five sample villages, four from CRBC command area i.e. Jarra, Gomal, Buchariand and Chera and one off the CRBC command area i.e. Khudaka were randomly selected to get clear picture of CRBC impacts at micro-level. The collected data were analysed using computer based statistical techniques, and Geographical Information System (GIS). The data were finally presented in the form of maps, statistical diagrams and tables for analysis.

The analysis reveals that there had been widespread anthropogenic reconstruction of the environment, with the advent of large-scale intensive canal irrigation in the arid tract of D.I.Khan district. These changes were both positive and negative and vary from short to long-term on local and regional level. The study found that after CRBC cultivated land had increased particularly in the CRBC command area. Similarly, in the CRBC command area, extensive cultivable waste land has been brought under cultivation, but no significant impacts reported from outside the CRBC command area. The analysis also indicates that cultivable land has also been brought under non-agricultural uses, mainly because of physical expansion of settlements, emergence of new settlements, industries, construction of roads, canals etc. which are not according to the land suitability. This is an irreversible change of the land use in this canal-irrigated region.

The analysis further revealed that area under irrigation gradually increased, after 1969-70. Comparison of pre and post CRBC conditions of canal irrigated area also reveals a net positive change of 10.77 per cent of the total reported area. This large-scale increase in the canal-irrigated area is attributed to the inception of CRBC. Likewise, the micro level analysis showed that after CRBC a positive change has been occurred in the canal irrigated acreage of Gomal, Buchari and Chera villages. Contrary to this, in sample village Khudaka no significant impact of CRBC on the irrigation pattern was detected. It indicates that in the CRBC command area there has been considerable enhancement in the canal irrigation, after the inception of CRBC project.

After the advent of CRBC, acreage under both *Kharif* and *Rabi* crops has improved. The analysis revealed that positive changes have occurred in *Kharif* crops like rice, sugarcane, pulses, orchards and vegetables. Contrary to this, negative changes were registered in sorghum, millet, oilseed, barley and maize. Similarly, prior to the inception of CRBC, wheat, barley, pulses and fruits were the dominant crops grown in the district. However, after CRBC a positive change was recorded in wheat, pulses and fruit, whereas negative changes occurred in barley and oilseed. This indicates that in the CRBC command area, farmer mostly switched over to more productive and water loving crops such as rice, sugarcane and orchard. It is evident that in the


LOCATION MAP
D.I.KHAN DISTRICT
71°-15
32°-30
32°-30
LAKKI MARWAT
CHASHMA BARRAGE
BILOT
TANK
TANK DISTRICT
D.I.KHAN
DISTRICT
CHASHMA RIGHT BANK CANAL
INDUS RIVER
KULACHI
D.I.KHAN
DARABAN
CRBC
COMMAND AREA
PUNJAB
CHAUDHWAN
D.G. Khan
0 10 20 KM
70°-15
71°-15
CRBC COMMAND AREA

present cropping system new water loving crops have been introduced as a result of CRBC.

The analysis further revealed that after the advent of CRBC, the cropping intensity was also gradually increased in the CRBC command area. It was found from the micro-level analysis that the rate of cropping intensity has been rapid in stage III as compared to that of stages I and II of CRBC project. It was also found that with the inception of CRBC, there had not only been gradual increase in the cultivated area, but per hectare yield also improved to a greater extent. All these developments have improved the socio-economic situation particularly in the CRBC command area. Moreover, the land values in the CRBC command villages were increased at a rapid pace, whereas outside the CRBC command area impact on the land value was found insignificant. The study also found that besides all these beneficial impacts, the introduction of canal irrigation has raised the ground water-table particularly in the CRBC command area.

The study found that engulfing of prime agricultural land by the built up area, lack of proper crop selection, absence of sub-surface drainage, irrational irrigation practices and the rapid rise in the water-table particularly in the canal irrigated tract were causing the environmental degradation. In the CRBC command area, such environmental changes were occurring and would continue to occur in the large area. This situation if not taken care of well in time might pose serious threat to the environment in the near future.This study, however, provides policy guidelines for ameliorating the negative consequences of CRBIP. It may help the decision-makers to avoid repeating the weaknesses of CRBIP in the proposed and future irrigation schemes.