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IMPACTS OF THE CHASHMA RIGHT BANK CANAL ON LAND USE AND CROPPING PATTERN IN D.I.KHAN DISTRICT (PAKISTAN)

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ABSTRACT This paper attempts to determine the ex post impact of Chashma Right Bank Canal (CRBC) on the land use and cropping pattern of D.I.Khan district. CRBC commands 250,000 ha and spread over two provinces. The CRBC project was completed in three stages. Stage I was commissioned in 1987-1988, whereas stage II and III in 1989 and 2001, respectively. CRBC brought radical changes in the land use and cropping pattern of D.I.Khan district. For this study, three variables were selected including land use, cropping pattern and land values. To determine these changes at micro-level, five sample villages were randomly selected, four from within the CRBC command area and one off the command area. The analysis found that after commissioning of CRBC, prime cultivable land was brought under non-agricultural use. The area under net sown was also enhanced. The dry farming crops were replaced by water intensive cash crops, which in effect caused the twin problem of waterlogging and salinity, particularly in stage I. Likewise, the land values increased considerably. This study is a sort of ex post evaluation of CRBC and provides policy guidelines for decision makers not to repeat the weaknesses of Chashma Right Bank Irrigation Project. The guidelines will be valuable for the proposed Chashma Right Bank 1st Lift Irrigation Project

Keywords: Land use, Cropping Pattern, Impacts

INTRODUCTION. D.I.Khan is the southern most district of North West Frontier Province (NWFP) in Pakistan. Geographically, D.I.Khan district stretches between 31^0 15' to 32^0 32' North latitude and 70^0 11' to 71^0 20' East longitude (Map 1). Here, water is one of the most valuable natural resources and there is a great potential for water resource development in general and irrigation in particular. Nevertheless, very little progress has been made in this respect. Likewise, in D.I.Khan uncertain physical factors also become barriers in the development process, including arid to semi-arid climatic condition. *Barani* (rainfed) farming dominates the land use, but erratic rainfall largely results in crop failure before ripening. Therefore the yields are very low. Irrigation has the potential to bring transformation in land use and sustainable agriculture, and to achieve self-sufficiency (Ali *et al.*, 2004). It was a very large effort to bring water through canal systems for irrigation. Nevertheless, optimum utilization of land and water resources is essential for a successful land use and cropping pattern.

In D.I.Khan, dry conditions were the major limiting factor in changing land use and cropping pattern. Therefore, an intervention was made in the form of the Chashma Right Bank Canal (CRBC) during 1987. The source of CRBC is the Indus River, from which water has been diverted at Chashma Barrage. Prior to this, the Paharpur canal irrigated parts of the project area in the North. Paharpur canal was originally an inundation canal built in 1902 and upgraded to become perennial in 1930s (Ahmad, 1993). The Chashma Right Bank Irrigation Scheme is a large irrigation system spread over the two provinces of Pakistan. The total canal command area is 250,000 ha, of which 61% in NWFP and 39% in Punjab. The ultimate goal of the CRBC was to increase agricultural productivity, employment opportunities and strengthen institutional support in the agriculture sector. All these goals were aimed to alleviate poverty in the area. Availability of water through CRBC has played a major role in changing the ecology of this area. Large-scale surface irrigation in this arid tract has brought revolutionary changes in the socio-economic and physio-ecological environment. In the CRBC command area, the economy of the inhabitants largely depends on agricultural production. Therefore, the benefits of irrigation are evident.

To analyse various land uses, land areas were classified into cultivated and uncultivated land. The cultivated land was sub-divided into net sown and current fallow, whereas uncultivated land was classified into cultivable wasteland, uncultivated land and area under forest. The analysis found that the land use is a dynamic factor in the district and hence varies from year to year. The analysis also reveals that in the CRBC command area, large-scale cultivable wasteland has been brought under cultivation. The land use pattern was also analysed at micro-level. It was found that after CRBC, there is a constant increase in the area under cultivation, a gradual decline of area under cultivable waste land (mainly due to the conversion of cultivable waste land into cultivated) and an increase in uncultivated area in the CRBC command area. Extensive prime agricultural land has rapidly been converted into non-agricultural use, mainly because of physical development of new settlements, industries, construction of roads, canals, etc. This is an irreversible negative impact on local area of this canal-irrigated region. After commissioning of CRBC, dry farming has been replaced by water intensive crops. This has adversely affected the underground water resources and has caused the twin problem of waterlogging and soil salinity, particularly in stage I. Likewise, during post CRBC, land values largely increased, but the prices of residential areas comparatively increased more than the other categories.

This paper is divided into four sections. The first section deals with the detailed introduction of the study. The second section highlights the material and methods used for conducting this study, whereas the third section explains the analysis and discussion. Findings and conclusion are given in the final section.

METHODS AND MATERIALS. The aim of the present study was, to determine the environmental impacts of CRBC on the land use and agricultural resources of D.I.Khan district. For the collection of data and information, both primary and secondary sources were used. To achieve the mandated task, three indicators were selected including land use pattern, cropping pattern and land value. Preliminary data were required to find the condition prior and after the availability of canal water. Primary data were collected through questionnaire survey, field observation and interviews with the key stakeholders including local respondents, Focused Group Discussion and officials of the line agencies.

A random sampling method was applied and five villages were selected namely Jarra, Gomal, Buchari, Chera and Khudaka. Amongst the sample villages, the first four are under the command of CRBC and one (Khudaka) off the command, in order to get a clear picture of CRBC impacts on the land use and cropping pattern of D.I.Khan district.

As far as secondary data are concerned, They were obtained from the related line agencies, NGO's, reports, journals, maps and electronic data base searches, etc. The collected data were then analysed, using checklisting technique. Finally, the data were presented in the form of maps, tables and description.

ANALYSIS AND DISCUSSION. Land is an important resource as humans live on it and obtain most of their needs from the land (Swami *et al.*, 2004). Total area remains constant in time and space (Atta-ur-Rahman, 2003). Owing to increase in population pressure and ever-growing demand of food and raw materials, there is dire need to utilize every piece of land properly. This need calls scientists to use the land resources rationally and economically without disturbing the socio-economic and physio-ecological environment. Land utilization particularly deals with the study of problems arising in the process of deciding between the alternative types of land use and translating into action the optimum use of limited land resources. The land use pattern includes three inter-related factors:physical, economical and behavioural. Thus, the changes in the land use pattern of an area depict the interaction among all these three factors and may be affected by the availability of irrigation.

Almost all small and large-scale irrigation projects with passage of time after commissioning show impacts on their respective ecosystem (United Nations, 1985; World Bank, 2000). After commissioning of CRBC, a complete anthropogenic reconstruction of the environment has been made (WAPDA, 2002). In the D.I.Khan district, most of the changes in land use and cropping pattern are attributed to the advent of CRBC. These changes are positive, negative or both, if judged on various parameters. As far as the rate of changes is concerned, it depends on the level of involving the project components. The major environmental impacts on important components like land use and cropping pattern are being analyzed in detail (Table I).

In D.I.Khan region, prior to inception of canal irrigation, Rod Kohi (Hill torrent irrigation locally known as Rod Kohi) and rainfed farming as well as animal rearing were practised (WAPDA, 2002). This arid region was sparsely populated and most often little part of land was used for agriculture mainly due to uncertain physical factors (Said, 1971). Scarcity of water was a common feature in this region. There has been a considerable change in the land use and cropping pattern after the availability of water in the form of the CRBC. This has resulted in overall decrease in degenerated land and subsequent increase in land under built-up area, irrigated area, cultivable area and net sown area (Government of NWFP 1975; 1980; 1991; 2000 and 2004). After the inception of canal irrigation in this slice of earth both positive and negative impacts emerged. The CRBC impacts identification and evaluation were carried out at micro level by selecting five sample villages both from the CRBC command area and off the command area namely: Jarra, Gomal, Buchari, Chera and Khudaka. Following are the detailed impact evaluation of CRBC on the land use and cropping pattern.

<u>Impacts on cultivated land and cultivable waste land.</u> In the D.I.Khan district, after the

introduction of canal irrigation, the agricultural landscape of a majority of the sample villages has been changed significantly. Because of irrigation facilities, nearly all the cultivable wasteland of the sample villages was brought under CRBC command and more than 90% of the cultivable wasteland brought under cultivation. Likewise, after the inception of canal irrigation, the net sown area has increased considerably. Increase in cultivated area was noted both for Kharif and Rabi season. After comparing the pre and post CRBC share of cultivable land, the share of Kharif crops improved from 10 to 80% and that of Rabi from 15 to 91% (WAPDA, 2002). The CRBC has also caused changes in the area under current fallow. Before inception of canal irrigation, current fallow was higher compared to post CRBC. Detailed analysis reveals that the fallow lands both in Rabi and Kharif seasons showed several fold changes.

The analysis further reveals that the impacts of CRBC on the cultivated land are significant. There is constant increase in the cultivated area, since after inception of CRBC. The respondents were asked about *the impacts of CRBC on the cultivated and cultivable wasteland?* Hence, a predominant majority of the respondents were of the view that after CRBC their cultivated area significantly increased. In Chera more than two-thirds of the respondents replied that their cultivated area increased and none of the respondents mentioned a decrease in their cultivated land. They brought extensive cultivable wasteland under cultivation. However, nearly one-third of the respondents replied that no change occurred in their cultivated area. In Jarra, half of the respondents replied that their cultivated land is the same as it was prior to CRBC. This is mainly due to the fact that prior to CRBC the village was under the command of the old Paharpur canal. In Jarra and Gomal the higher proportion of unchanged (same) cultivated area is due to the fact that before CRBC the cultivated land in the sample villages was either rainfed, Rod Kohi or well irrigated and the same land was brought under the command of CRBC. No changes were reported from Khudaka, as the cultivated land remained same both pre and post of CRBC. As far as the cultivable wasteland is concerned, none of the respondents mentioned an increase in their cultivable wasteland.

Negative impacts. In D.I.Khan, after the introduction of canal irrigation the land use pattern has greatly changed. The long-term adverse impacts were identified. Extensive cultivable land has rapidly been brought under non-agricultural use, mainly because of physical development of new settlements, industries, construction of roads, canals etc. With extension of irrigation facilities in the study area, rapid physical development started in response to more opportunities. But in the majority of cases this development has not been according to land suitability. Prime agricultural land has been converted to settlements and other physical developments. This is an irreversible negative impact on local area of this canal-irrigated region. Consequently, it has significant adverse impact on the land use of this canal region. The problem can be minimized if the people switch over to use cultivable wasteland for physical development. Likewise, cultivable land in CRBC stage I was also affected by waterlogging and salinity. This is a short-term impact of CRBC on the local area, but reversible after applying mitigation measures (Table I). Surprisingly, it has significant to moderate impacts on the land use of D.I.Khan district. In advanced stage of waterlogging, the agricultural land goes out of any productive use.

Positive impacts. The long-term and significant positive impact on the local area is the increase in cultivated land that has taken place (Table I). This is mainly due to conversion of barren and cultivable wasteland into cultivated land after the availability of canal

water. The statistical analysis revealed that almost 90% cultivable wasteland was brought under farming. As a positive impact of irrigation facility, area under current fallow has declined in the CRBC command area and area under net sown is rising. Another positive impact has been the development of more settlements and infrastructure in the area. Prior to CRBC, the area was not suitable for luxuriant human habitation as means of sustenance was very little. But after completion of CRBC, the means of sustenance increased and large number of people started to live here.

Impact on land prices. Majority of the sample villages were primarily under the command of the traditional Rod Kohi irrigation system. The analysis reveals that in almost all the sample villages, the residential land prices were found higher than the rest of the land types. It is mainly because of the compact settlement pattern, security and location of residential areas at higher altitude. According to revenue record, during the pre-construction phase of CRBC, the land prices were not very high, though the land prices differ from one category to the other. Per unit cultivable wasteland is the lowest as compared to that of land for residential or agricultural use, which is considered as more valuable.

Field survey along with the revenue record indicates that the land value has considerably increased. There are several reasons behind this rapid rise of land prices. Primarily, due to the inception of canal irrigation income level of the people improved particularly of those who had large holdings and secondly due to high return from land. The economically well-off people both inside and outside the command area purchased land at inflated market rate and hence the prices have gone up. Secondly, despite of large land holdings in the area, they want to maintain their hold mainly due to socio-political reasons. Thirdly, the population of D.I.Khan is increasing at an alarming rate, which puts tremendous pressure on the land resources and in effect, the land prices have gone beyond the reach of low-income families.

Prior to CRBC, village Jarra was under the command of the old Paharpur canal for almost 88 years. Waterlogging and salinity adversely affected this village in the initial stage of CRBC, but with the introduction of Paharpur SCARP, the area was reclaimed. Amongst the sample villages, Jarra has agriculturally more productive lands, as mixed type of farming (crops and orchards) is practised, here. Table II shows that the residential land prices increased from Rs[1] 336,000 per ha pre CRBC to present residential land price of Rs 2,372,300 per ha, whereas the cultivated land increased from Rs 79,000 pre project to Rs 790,700 per ha and cultivable waste land from Rs 19,800 to Rs 296,500 per ha in last sixteen years.

Gomal has quite different land prices, pre and post CRBC. Being part of CRBC stage II and irrigation through CRBC started from 1990-1991. Prior to CRBC, the village was partially under the command of lift irrigation scheme i.e. Government and private tube wells. Currently, CRBC passes through the north-western part of the village. On average, the price of cultivated land increased from pre CRBC price of Rs 158,152 per ha to post CRBC Rs 691,915 per ha and that of cultivable waste land from worth Rs 39,500 to Rs 296,500 per ha, whereas residential land prices increased from Rs 494,225 per ha pre-

[1] Rs = Pakistan Rupee, 60 Rs = 1 US$ (price level 2006)

project to Rs 2,174,600 per ha post project (Table II). This indicates the direct impact of CRBC on the land prices. Some part of Gomal lies outside the CRBC command area, where the land prices are comparatively low. Likewise, area under CRBC lift scheme is less than the direct command area.

In Buchari, irrigation was started in 1993, after commissioning of stage II of CRBC. According to revenue record, the land prices have significantly increased. The price of cultivable wasteland was only Rs 59,300 per ha pre-project, which increased to Rs 395,400 per ha. Likewise, the price of cultivated land increased from Rs 98,845 pre-project to Rs 1,581,620 per ha. As far as residential land price is concerned, it was Rs 197,690 per ha prior to CRBC and presently, it is about Rs 1,976,900 per ha (Table II). Luni Nala divided the settlement into two halves. Old Buchari is located on the right bank of Luni, whereas new Buchari is on the left. The land prices are higher in new Buchari than the old one, mainly because of the accessibility and nearness to the main link road.

Chera is located in stage III of CRBC and commissioned in 1998-1999. This is one of the CRBC command villages, where extensive cultivable wasteland (hillocks of Aeolian material were levelled) brought under the command of CRBC. The land is very productive and fertile, therefore the land prices have remarkably increased. The agriculture land price increased from Rs 39,538 to Rs 296,535 per ha, cultivable waste land from Rs 29,600 to Rs 237,000 per ha and residential area from Rs 197,690 to Rs 1,186,140 per ha in only seven years (Table II). Out of five sample sites, the land prices in Chera increased comparatively at a rapid pace.

Khudaka is one of the sample villages that lies outside the command of CRBC. Here, cultivation is entirely dependent on the traditional Rod Kohi irrigation system. Underground water is saline and not fit for drinking and irrigation purposes. Therefore, a slight increase occurred in land prices. The agricultural land increased from Rs 19,769 to Rs 59,300 per ha, cultivable waste land from Rs 15,800 to Rs 59,300 per ha and land for residential purpose from Rs 29,653 to Rs 395,380 per ha in last twenty years (Table II).

Positive impacts. The change in the land prices has both negative and positive impacts. For landowners, rise in the land prices has a positive impact, as their land becomes more valuable because presently they are getting higher production compared to the pre CRBC situation. The beneficial impacts are long-term and significant in the CRBC command area.

Negative impacts. For landless and tenant cultivators buying a piece of land for housing on high price is a negative impact. The higher production from this fertile land encouraged well-of people from the surrounding districts to purchase land in the CRBC command area. This has caused socio-economic problems and became a negative impact of CRBC. The adverse consequences are long-term but reversible (Table I). Furthermore, these negative impacts are moderate over the local area.

Impact on cropping pattern. Cropping pattern means the proportion of area under various crops during census period (Government of Pakistan, 2004). Generally, the cropping pattern depends on several factors such as water availability, land fertility, topography, climate, land productivity, agricultural technology and farm size, etc. but water has been a major limiting factor for the cropping pattern particularly in the desert ecosystem. In

D.I.Khan, the cropping pattern in the CRBC command area was different during pre CRBC as compared to post CRBC. Prior to CRBC, rainfed and Rod Kohi crops were grown for domestic consumption only but after CRBC cultivation of more productive and water-loving crops were started. Whenever, there was rainfall over the catchment area, the runoff of hill torrents was diverted into fields to achieve soil humidity. Contrary to this, lack of precipitation resulted in absence of net sown area, which means that the cropped area was limited by the physical environment. Prior to the inception of canal irrigation, a small area was under Rabi crops and main Kharif crops were millet, guara (fodder), sorghum etc. and that of Rabi dominantly include wheat, barley and gram.

In CRBC command area, rainfed and Rod Kohi farming has been replaced by irrigated farming, after availability of canal water. Total cropped area in both Kharif and Rabi cropping season in CRBC command area has increased. Through canal irrigation rainfed crops have been replaced by cash crops such as sugarcane, cotton and rice in Kharif, whereas in Rabi wheat and oilseeds. The previous uncertainty in the physical conditions was changed by a more secure cropping pattern. Wheat is cultivated as an assured and important food grain crop for domestic consumption as well as the surplus is exchanged outside the CRBC command area. In the CRBC command area, land under wheat has increased. Most of the increase has taken place at the expense of the poor production of barley and gram. The cropped area under millet has reduced substantially and this area is allocated to cash crops. However, intensive irrigation and trend towards the cash crops has caused the environmental problem of waterlogging and salinity. Contrary to this, in stage I and II the groundwater table is rapidly inclining. In waterlogged areas, crops like rice and sugarcane are gaining importance in the present cropping system.

Negative impact. The Chashma Right Bank Canal has brought several changes in the cropping pattern. The rainfed and Rod Kohi was modified by the perennial canal irrigation. This has certain adverse consequences on the local area. The farmers switched over to more profitable cash crops that need plenty of water, which ultimately caused a twin problem of waterlogging and salinity. However, this is a long-term but reversible local impact on the land and crops of the study area. Severity varies from significant to moderate.

Positive impact. The canal irrigation in the D.I.Khan region positively affected the CRBC command villages. Due to the availability of water, the cropping pattern changed and food deficiency was modified by self-sufficiency and even the entire household needs were fulfilled from exchanging the crop production. The choices of crops had increased and physical barriers were modified. This is a long-term positive impact of CRBC that significantly benefited the study area.

FINDINGS AND CONCLUSIONS. The study revealed that the impacts of CRBC on the land use and cropping pattern were great, as the Chashma Right Bank Irrigation Scheme has brought a large number of changes. The inception of canal irrigation in the form of CRBC has increased the area under cultivation. Almost all the households cited that the availability of more water has increased the area under cultivation, high yield as well as cropping intensity. This is mainly due to the conversion of wasteland under the command of CRBC. As a positive impact, net sown area largely increased in the CRBC command area. One of the long-term negative impacts of CRBC was the conversion of prime cultivable land to non-agriculture use, which is not according to land suitability.

This can be considered as an irreversible negative impact on the local area.

Field study of the selected areas suggests that the cropping pattern of the study area has been changed after inception of canal irrigation. Before canal irrigation, rainfed and Rod Kohi farming was practiced in the study area. The main crops of rainfed farming were replaced by cash crops like sugarcane, rice, cotton, wheat, oilseeds, gram etc. and secured the leading position in the crops. This intensive irrigation and trend towards cash crops has caused environmental problems like waterlogging and salinity. On the other hand, it has positively affected the production leading to overall improvement in the food security and allowed the farmers to switch over to cash crops requiring plenty of water.

In D.I.Khan, land and water are scarce natural resources and their proper management is a prerequisite for sustainable development. For preservation and conservation of water resources in D.I.Khan and increasing life span of irrigated agriculture, intensive or over irrigation needs to be controlled. Better water management strategies including adoption of drip and sprinkler irrigation systems. Though costly, they are useful to economise the available limited resources. The possibilities of expansion in agricultural activities in the study area exhibit potential for further growth in population.

REFERENCES

Abdullah K. 2003. Handbook of production technology. Agricultural Research Institute, D.I.Khan, Pakistan.

Ahmad N. 1993. Water resources of Pakistan. Shahzad Nazir publisher, Lahore, Pakistan.

Ali A, Singhvi SL, Swami SK. 2004. Canal irrigation in the desert ecosystem: An environmental impact analysis of the selected areas of I.G.N.P. command (stage-I). In Khan, M. Z. A. and Agarwal, S. K. (eds) Environmental Geography, APH publishing corporation, New Delhi, Pp.17-57.

Atta-ur-Rahman. 2003. Land use and agricultural resources: a case of NWFP. Journal of Pakistan Geographical Review. Pp. 18-31.

Government of NWFP. 1975. Crops statistics of D.I.Khan Division, 1969-70 to 1974-75. Bureau of statistics, planning and development department, Government of NWFP, Peshawar.

Government of NWFP. 1980. Development statistics of NWFP. Bureau of statistics, planning and development department, Government of NWFP, Peshawar.

Government of NWFP. 1991. NWFP Development statistics. Bureau of statistics, planning and development department, Government of NWFP, Peshawar.

Government of NWFP. 2000. Agricultural Statistics, NWFP for 1999-2000. Agriculture statistics wing, Agriculture Department, Peshawar. P.144.

Government of NWFP. 2004. Agriculture statistics, D.I.Khan district. Agriculture statistics wing, EDAO office, D.I.Khan.

Government of Pakistan. 2004. Pakistan statistical yearbook, 2004. Govt. of Pakistan, Statistics division, federal bureau of statistics, Islamabad.

Said M. 1971. Land and agriculture resources of D.I.Khan. Board of economic enquiry, NWFP. University of Peshawar, Peshawar.

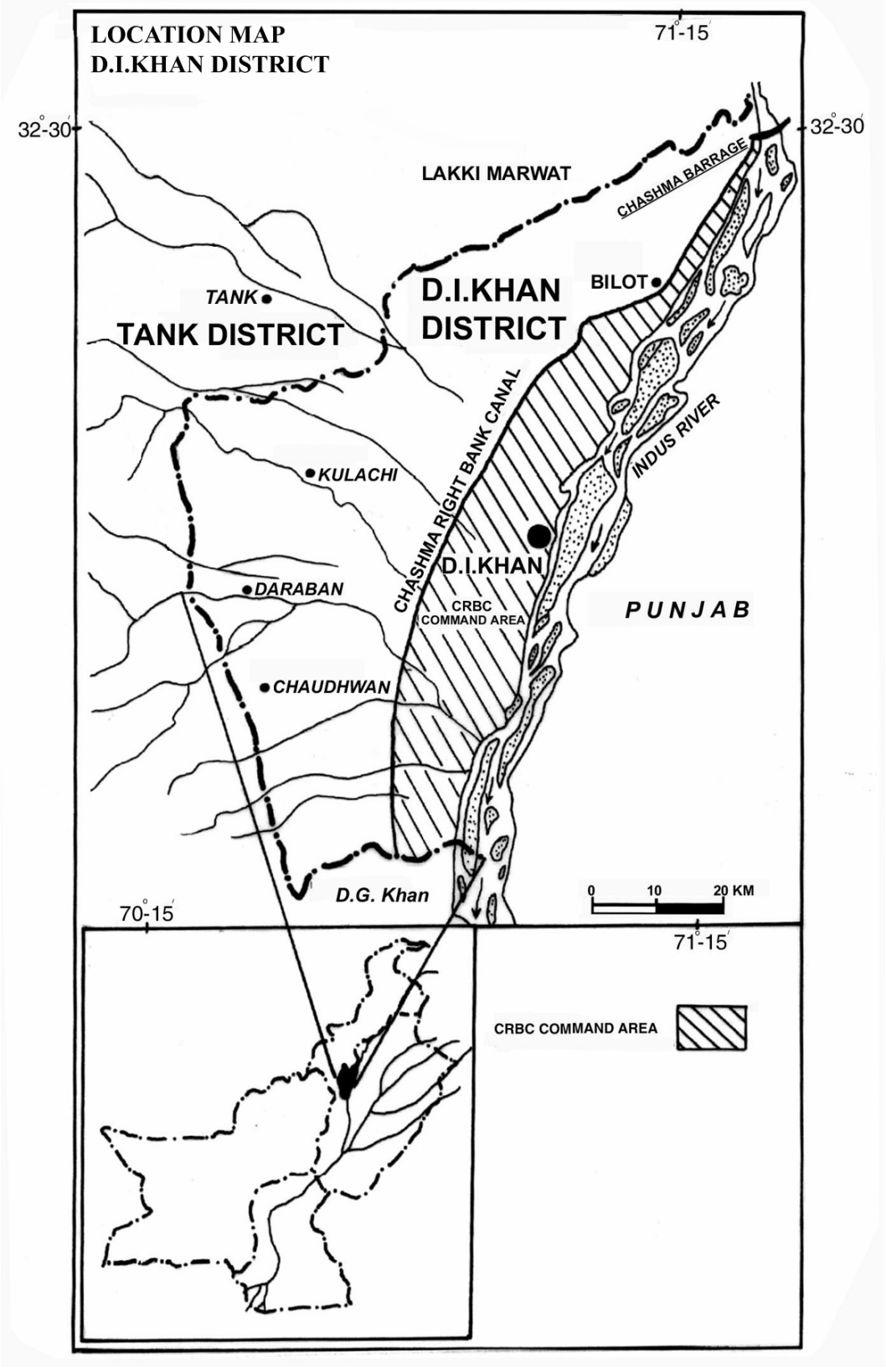
Swami SK, Ali A, Singhvi SL. 2004. Change in land use and cropping pattern: A case study of Suratgarh tehsil of Ganganagar District. In Khan, M. Z. A. and Agarwal, S. K. (eds) Environmental Geography, APH publishing corporation, New Delhi, Pp.74-95.

United Nations (UN). 1985. Environmental Impact Assessment: Guidelines for planners and decision makers. ESCAP- Environment and Development Series, Bangkok, Thailand.

WAPDA. 2002. Final report PIME studies, Phase II, Benchmark stage III of Chashma Right Bank Irrigation Project. Main report Vol. I. P. 337.

World Bank. 2000. Evaluating the Impact of Development Projects on Poverty: A Handbook for Practitioners. The World Bank, Washington, D.C.

World Commission on Land Use Survey. 1958. Reconnaissance survey of landforms, soil and land use of the Indus plain: Colombo plan. Photographic survey corporation, Toronto.



Map 1. Location of the study area

Table-1, Checklisting for the assessment of CRBC impacts

Parameters	No Impact	Nature of impacts														
		Adverse Impacts									Beneficial Impacts					
		ST	LT	R	IR	L	W	SI	M	N	ST	LT	L	W	SI	M	N
Land use			X	X	X	X		X	X		X	X	X		X	X	
i. Cultivated area				X		X			X			X	X		X		
ii. Cultivable waste												X	X		X		
iii. Uncultivated area			X		X	X		X			X		X			X	
Land Values			X	X		X			X			X	X		X		
Cropping pattern			X	X		X			X			X	X		X		

Legend

ST	Short Term	IR	Irreversible	SI	Significant
LT	Long Term	L	Local	M	Moderate
R	Reversible	W	Wide	N	Normal or Negligible

Table-2, Changes in the land prices pre and post CRBC (price is in Pak Rupees)

Sample villages	*Residential land price per ha*		*Agricultural land price per ha*		*Cultivable waste price per ha*	
	Pre-project	*Post project*	*Pre-project*	*Post project*	*Pre-project*	*Post project*
Jarra	336,000	2,372,300	79,000	790,700	19,800	296,500
Gomal	494,225	2,174,600	158,152	691,915	39,500	296,500
Buchari	197,690	1,976,900	98,845	1,581,620	59,300	395,400
Chera	197,690	1,186,140	39,538	296,535	29,600	237,000
Khudaka	29,653	395,380	19,769	59,300	15,800	59,300

Source: Revenue Record, 1985 to 2005 and own survey April 2005