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Impact of Tanda Dam on Agriculture Land use and Cropping Pattern: (A Case Study of Mouza Kalochanna District Kohat)

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Abstract

The present paper deals with the impact of Tanda Dam located inKohat District on Agriculture land use and cropping pattern in Mouza Kalochanna. The study is based on two sets of data (2005-06 and 2011-12) collected from Revenue Office Kohat district. The data of 2005-06 were selected because the Dam was closed and the water was not available for irrigation in 2005-06, while in 2011-12 it was reopened for irrigation. Data was collected and analyzed to determine the trends and dynamics of agriculture land use and cropping pattern. The findings reveal that most of the cultivated land was current fallow in both cropping seasons in2005-06, while in 2011-12 the cultivated land increased than the current fallow in both cropping seasons. This shows the impacts of Tanda Dam on agriculture land use and cropping pattern.

Keywords: Agriculture; land use; cropping pattern; Tanda Dam

Introduction

Cropping patterns of a region are closely influenced by the geo-climate, socioeconomic, historical and political factors. Pattern of crop land use of a region are manifestation of combined influence of physical and human environment. Differences in attitude towards the rural land in the level of prosperity and technology have produced changes in emphasis. This effects on both landscape and land use is studies are likely to be far reaching (Sujatha et al., 2011).

In this paper, land use change dynamics were investigated by the combined use of satellite remote sensing, geographic information systems (GIS). The result indicated that there has been a notable and uneven urban growth and a tremendous loss in cropland between 1989 and 1997. The land use change process has shown no sign of becoming stable. The study demonstrates that the integration of satellite remote sensing and GIS was effective approach for analyzing the direction, rate, and spatial pattern of land use change. The further integration of these two technologies with Markov modeling was found to be beneficial in describing and analyzing land use change process (Qihao Weng, et al., 2001).

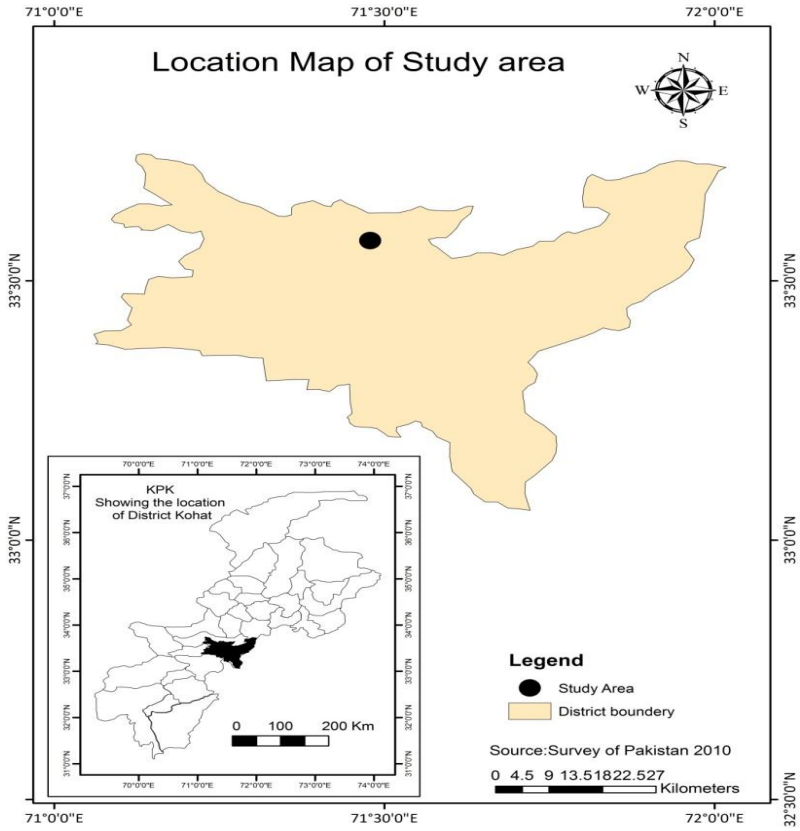
Agriculture land-use means land under net sown area, fallow land and uncultivable agriculture land. In short agriculture land-use means a cropping pattern. Cropping pattern means the proportion of area under various crops at a point of time or yearly sequence and spatial arrangement of crops and fallow on a given area. Cropping pattern is a dynamic concept as it changes over space and time. The cropping pattern of a region is closely influenced by the geo-climatic, socio-cultural, economic, historical and political factors. The agriculture land use is the result of the direct application of effort applied is related to decisions made by farmers regarding to the actual use of land. These decisions are based on his appreciation of the available land resources, his response to these resources as conditioned by the knowledge passed from generation to generation and his appreciation of demand for various agriculture commodities in the market. The cumulative effect of farmer's decisions regarding the choice of crops, the method of tillage and his appreciation of the land resources as reflected in the spatial as well as temporal variations in agriculture land use (Todkari G.U. Suryawanshi S.P.Suryawanshi M.V. and Patil B.D, et al., 2010).

New tools and techniques, of ten based on the synergetic use of disciplinary theory and knowledge, have increased our ability to monitor and explore changes in land use and land cover. Advances in remote sensing and land inventory techniques enable land scientists to make an assessment of current land resources, identify ongoing land cover change processes and identify hot-spots of change (Herold, et al., 2006).

Land use and cover change have been identified one of the prime determinations of global change with major impacts on ecosystems, global biogeochemistry, climate change and human vulnerability (Foley, et al., 2005).up to 1190s land use and land cover change were manly studied from a disciplinary perspective. The need for interdisciplinary approaches to fully understand the interactions within the land system has, more recently, led to the emergence of the new interdisciplinary field of land change science (Rindfuss, et al., 2004; GLP, 2005; Turner, et al., 2007).

The Study Area

Tanda Dam is located 10 km away in the Southwest of Kohat city. Construction of Tanda dam canal system was started in 1962-1963 and was completed in September 1967 at a cost of 66.3 million. The project was originally investigated and executed by WAPDA and later on transferred to irrigation department in September1968.The project consist of a diversion barrage on Kohat*toi* to direct the flood water in the feeder canal terminating in to a t unnel servicing as an inlet to the reservoir. The total canal system length is 54.7miles. Irrigation from the scheme was commenced since *Rabi* 1967-68. The beautiful view of Tanda Dam makes an interesting picnic spot (GoKP, 2012). The MouzaKalochanna (Study area) is located in the East of Kohat city. The absolute location is $71^0 27'39''$ to $71^0 29'31''$ E longitudes and $33^0 34'13''$ to $33^0 35'15''$ N latitudes. Its irrigation takes place through Tanda dam canal irrigation system. Various types of food and cash crops are produces in this mouza.



Materials and Methods

The study was based on irrigation and agriculture (Revenue) data. The data was collected from the following departments.

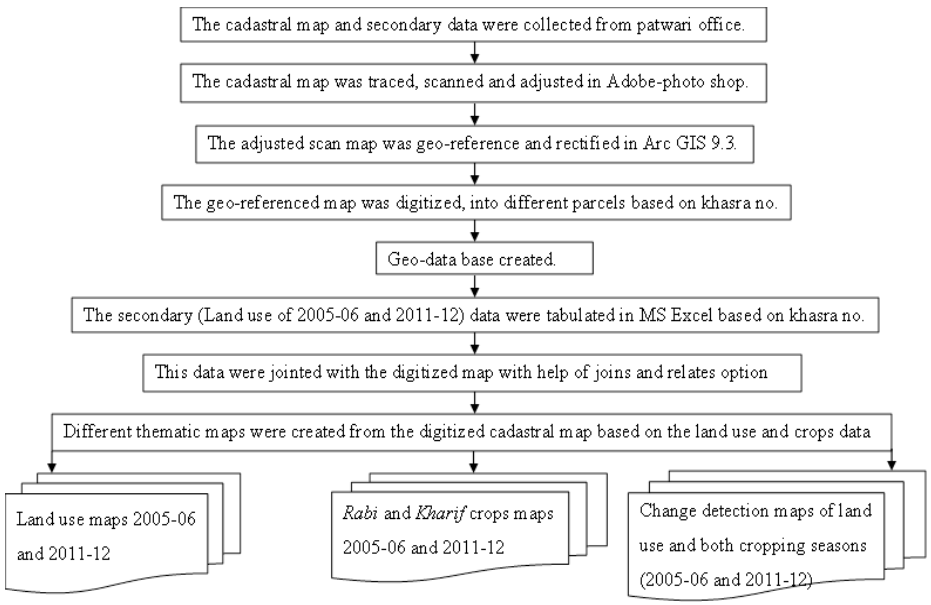
1. Irrigation Department Kohat district (Data about Tanda dam).
2. Revenue Department Kohat district (Agriculture land use and crops data)

These departments provided the noted secondary data sources.

a) *Shajra Kishtwar* (a large scale cadastral map called *Lattah*).
b) *Khasra Girdawari* (Ownership, Cultivators and cropping record).
c) *Lal Kitab* (Land use record).

Cadastral map of MouzaKalochanna was obtained from *Patwari* Office. It was traced, scanned and after adjusting it in Adobe Photoshop thecadastralmapwas georeferenced and then the georeference map was digitized in ArcGIS 9.3. Total area and area under different crops was calculated through histogram generation and tabulation. Based on the data various maps were created, which shows the spatial distribution of different crops types. The methodology is explained with the help of flow diagram Figure 1.

Figure 1: Methodology adopted for the study



Water for Agriculture Uses

Agriculture is the major user of fresh water, with a world's average of 71% of the water use. There are large regional variations in the use of water for agriculture, from 88% in Africa to less 50% in Europe (Stockle, 2001). It is estimated that meeting the projected crop demands for 2025 could require an additional 192 cubic miles of water, a volume nearly equivalent to the 10 times annual flow of the Nile (Hussain, 2004; Khan, et al., 2006). No one yet knows how to supply that additional water in way that protects supplies for future use and minimizes environmental impacts. Severe water scarcity presents the single biggest threat to future food production. Even now, many fresh water sources (underground aquifers and rivers) are stressed beyond their limits (Stockle, 2001). As much as 8% of foods crops grow on farms that use ground water faster than the aquifers are replenished, and many large rivers are so heavily diverted that they don't reach the sea for much of the year.

Results and Discussions

Agriculture land use

In the Mouza Kalochanna the share of cultivated land in 2005-06 and 2011-12 are 65% and 66% respectively, out of the total land. The remaining 35% are divided into different land use categories, i.e. uncultivated land (culturable waste (Banjarland), non-farm (settlements, etc.) and not available for cultivation). In 2005-06 the net sown land was 163.96 acres 49% of the cultivated land in both cropping seasons (*Rabi and kharif*), and it increases to 309.75 acres 92% of the cultivated land. The current fallow land in 2005-06 was 172.28 acres (51%) while in 2011-12 it decreases to 27.51 acres (8%) of the total cultivated land (Table 1).

Cropping pattern of Mouza Kalochanna

According to the revenue record the overall increase in cultivated land and decrease in uncultivated land is 1.02 acres. Wheat is the main crop of *Rabi* season while in *Kharif* season the orchards are followed by vegetables and maize. The land under wheat in 2005-06 was 108.11 acres which increase to 255.08 acres in 2011-12 the change detected was 146.97 acres. Land under vegetables increased by 0.79 acres in 2011-12. In *kharif* season 2005 and 2011 the change detected in land under maize, vegetables and fodder was 22.81, 20.84 and 13.61 acres respectively, while the land under orchards experience no change in both seasons. Banjarqadeem land decreases from 51.94 acres in 2005-06 to 47.06 acres in 2011-12. Tanda dam was closed in 2005-06 and water was not available for irrigation, thus it reflects the impacts of Tanda dam canal irrigation system on the agriculture land use and

cropping pattern. The 4.34 acres decrease in banjarqadeem was achieved through converting it into culturable waste land, here our concerned is agriculture land use, and it is studied in detail. The net sown land increased in 2011-12 to 309 acres from 163.96 acres in 2005-06 the change detection was 145.79 acres, and the current fallow land decreases from 172.28 acres in 2005-06 to 27.51 acres in 2011-12, and change detected in the current fallow land is 144.8 acres. The increase in net sown land in 2011-12 reflects the availability of water for irrigation. In 2005-06 most of the cultivated land was current fallow and decreased in 2011-12 reveals the impacts of on the agriculture land use.

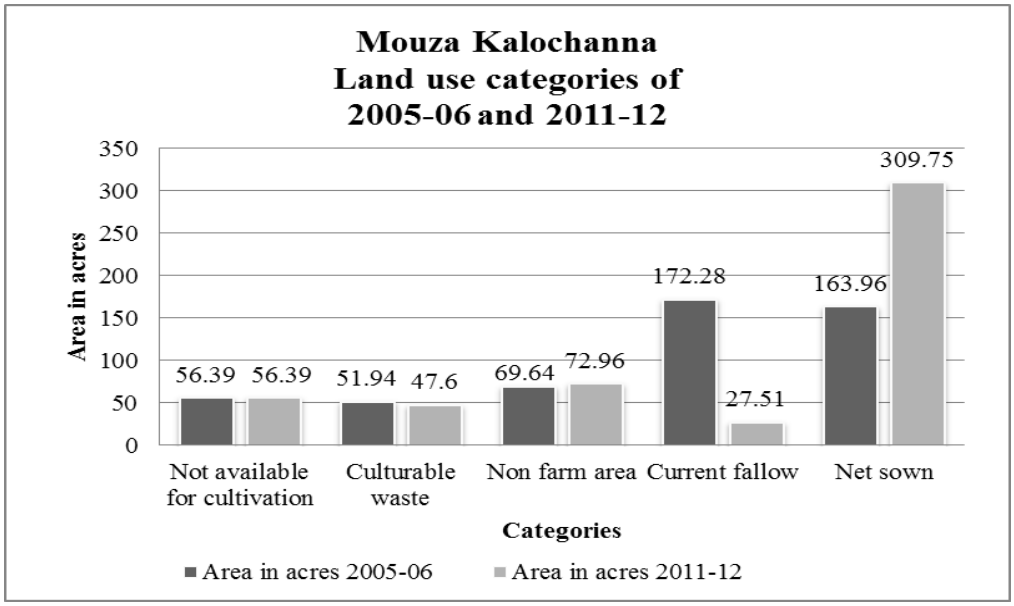
This decrease in the current fallow land and increase in the net sown land actually suggest the impacts of Tanda on the agriculture land use, because the dam was closed and water were not available for irrigation in 2005-06 and most of the cultivated land was vacant in this year, while the water was available from Tanda dam for irrigational purposes and almost whole of the cultivated land was cropped in 2011-12.

Table-1: MouzaKalochanna: Land Use Categories with Area in Acres (2005-06 and 2011-12)

Land use categories	Area in acres 2005-06	Area in acres 2011-12
Not available for cultivation	56.39	56.39
Culturable waste	51.94	47.6
Non-farm area	69.64	72.96
Current fallow	172.28	27.51
Net sown	163.96	309.75
Total	514.21	514.21

Change detection

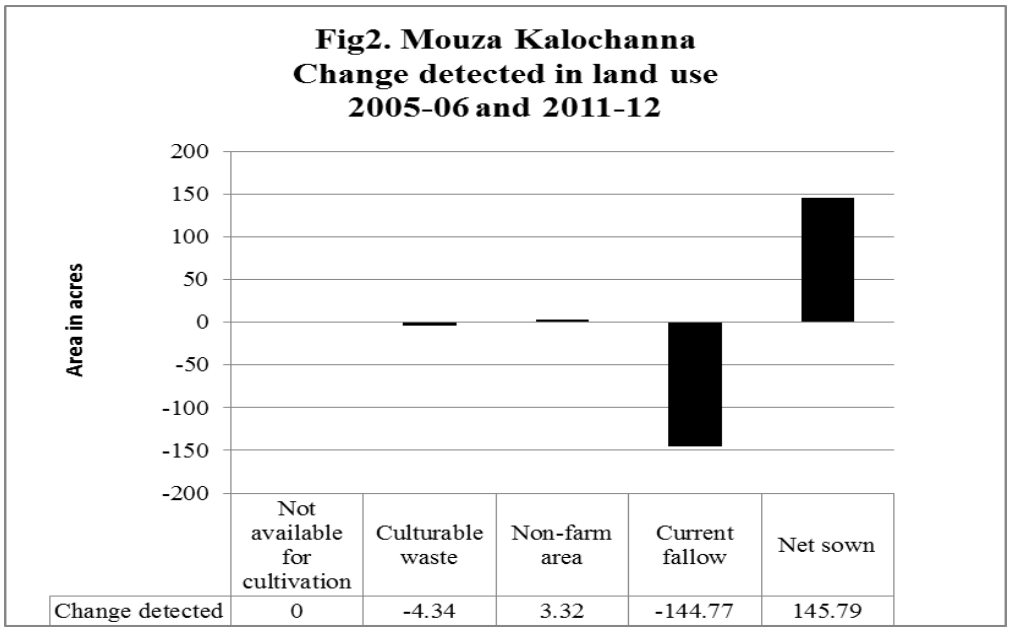
Change detection is theme of the study, because we can conclude the impacts of Tanda dam on the agriculture land and cropping pattern by calculating change. The change detected in the land use categories are enlisted in table 2. The table shows that the area under physical feature (torrent) records no change. The notable change calculated is in current fallow and in net sown area. The current fallow area decrease in 2011-12 by 144.77 acres on the other hand the net sown area increased by 145.79 acres in the same year.



Graph 1: Land use categories in 2005-06 and 2011-1

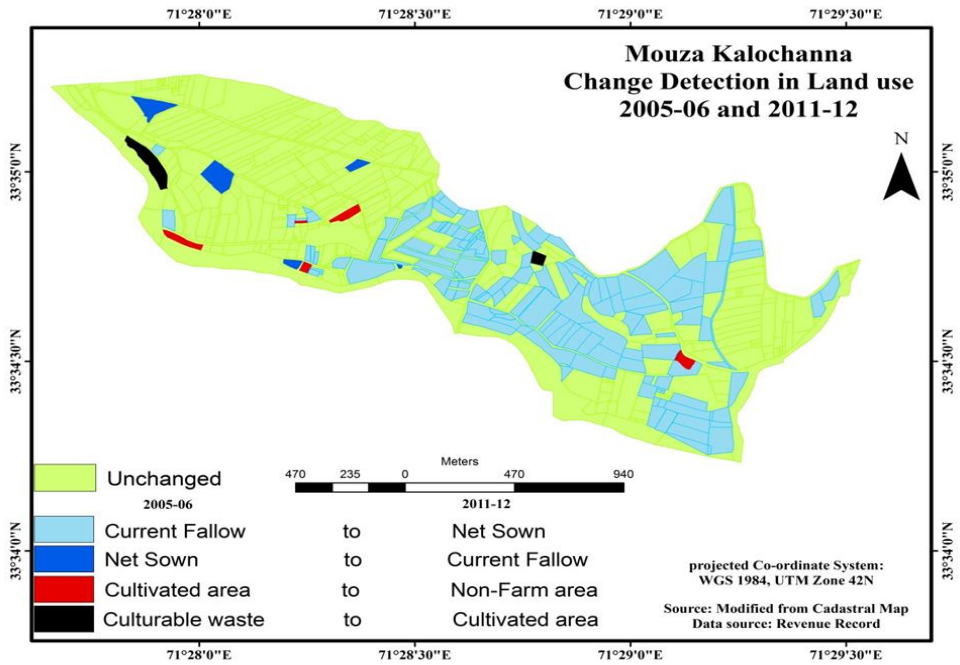
Table-2: Change detection in Land use categories in 2005-06 and 2011-12

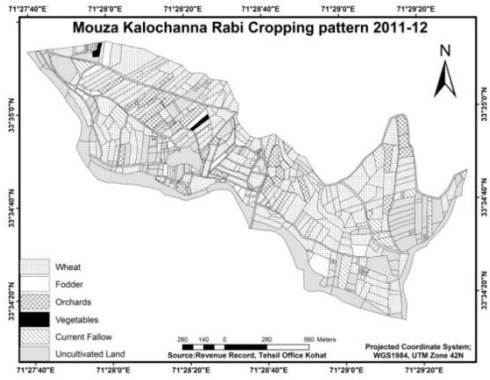
Land use categories	Area in acres 2011-12	Area in acres 2005-06	Change detected
Not available for cultivation	56.39	56.39	0
Culturable waste	47.6	51.94	-4.34
Non-farm area	72.96	69.64	3.32
Current fallow	27.51	172.28	-144.77
Net sown	309.75	163.96	145.79
Total	514.21	514.21	0

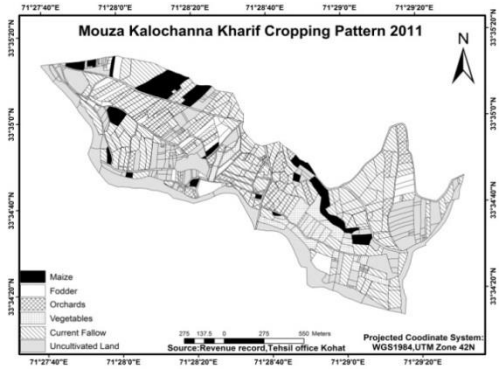


Graph 2: Change detection in Land use categories

Map-1: Mouza Kalochanna: Change Detection in Land use 2005-06 & 2011-12

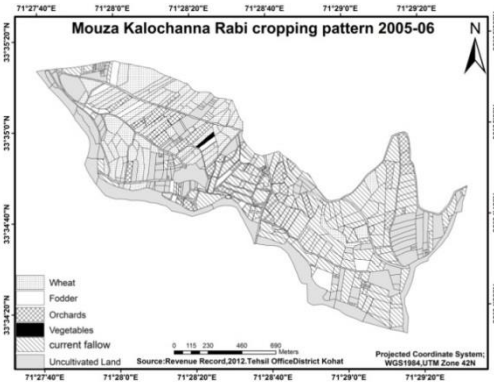






Map-1 shows the change in the land use of Mouza Kalochanna in 2005-06 and 2011-12 in the different categories. The parcels which records change are represented with different colours on this map, while the light green colour represents the unchanged parcels. The black colour on the map shows that some of the culturable waste land (banjarqadeem) is changed into the cultivated land and some of the cultivated land changed into the culturable waste land (settlement) represented by red colour, but these changes are not too much large in term of acreage. The extraordinary decreased was noticed in the vacant land (current fallow) changed into the net sown land represented by the light blue colour on the map.

The changes mentioned above shows the impacts of Tanda dam on the agriculture land of Kohat district. The change was detected in such a way that the area under specific land use categories decreased or increased in 2011-12.



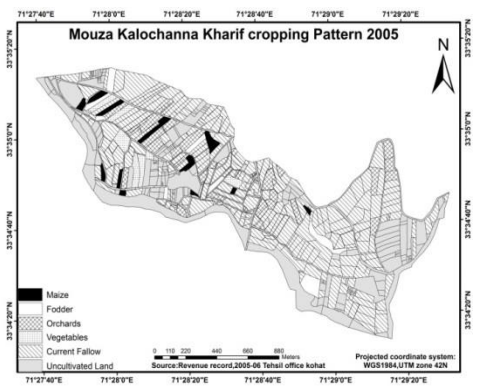
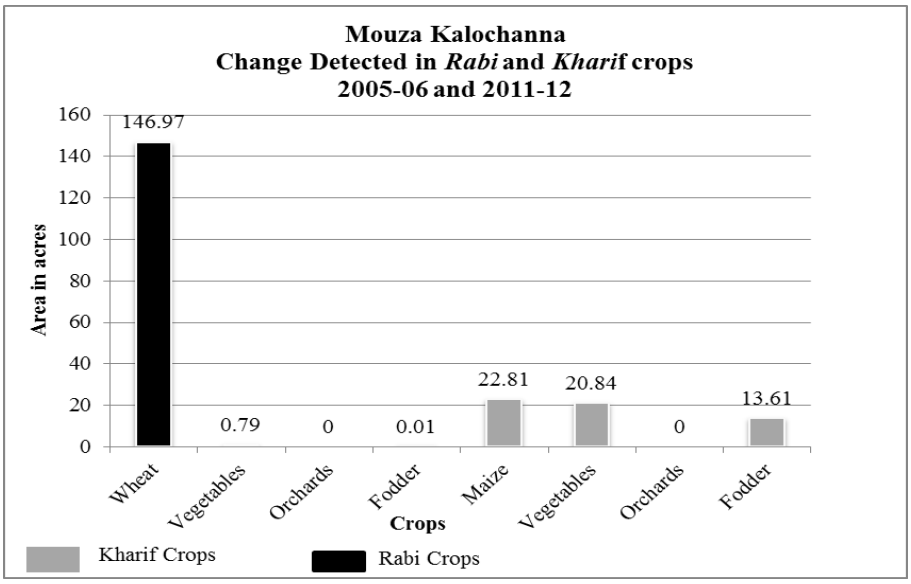


Table 3 shows area under different crops of both cropping seasons (*Rabi* and *Kharif*) in 2005-06 and 2011-12, and also shows the change occur in the crops in 2011-12. In *Rabi* crops the wheat increased more than every crop, as we know that wheat is food crop, its cultivation is practices in every part of our country and it is a water loving crop thus with the availability of irrigation water the area under wheat increased. On the other hand the area under maize increased in *kharif* but less as compare to wheat.

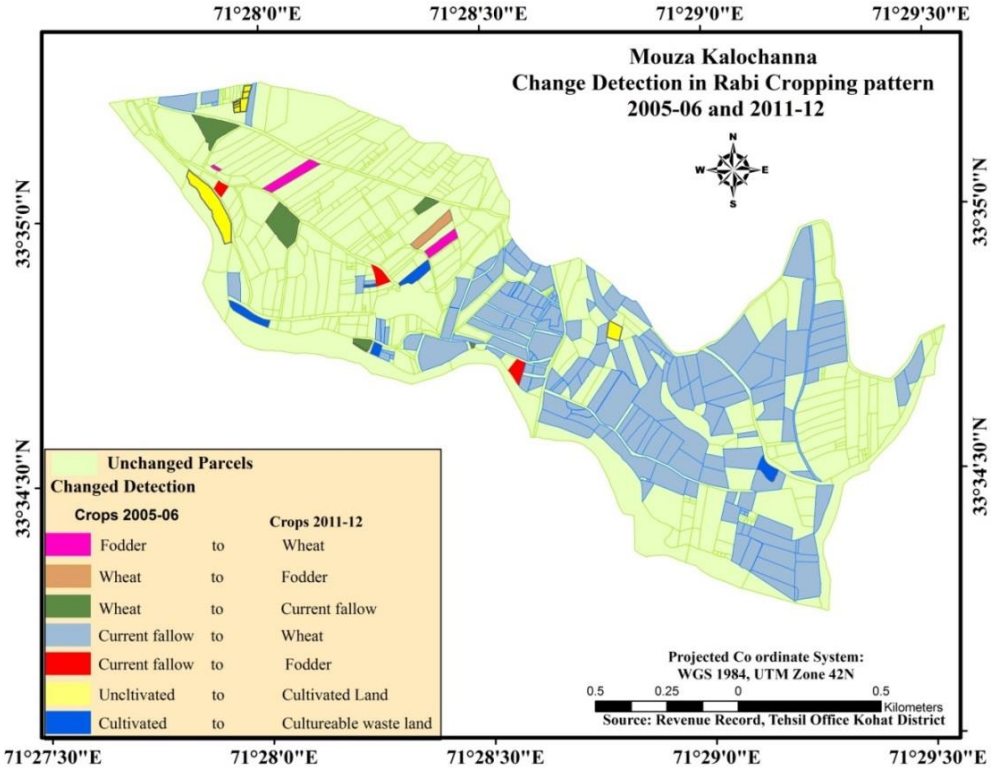
Table 3: Land under *Rabi* and *Kharif* crops and Change Detection in land in acres 2005-06 and 2011-12

***Rabi* Crops and Change**				***Kharif* Crops and change**			
Rabi Cops	area in acres 2005-06	area in acres 2011-12	Change detection In acres	*Kharif* crops	Area in acres 2005-06	Area in acres 2011-12	Change detection in acres
Wheat	108.11	255.08	146.97	Maize	10.72	33.53	22.81
Vegetables	0.89	1.68	0.79	Vegetables	13.94	34.78	20.84
Orchards	36.51	36.51	0	Orchards	36.51	36.51	0
Fodder	16.33	16.34	0.01	Fodder	14.5	28.11	13.61
Total area	161.84	309.61	147.77	Total	75.67	132.93	57.26



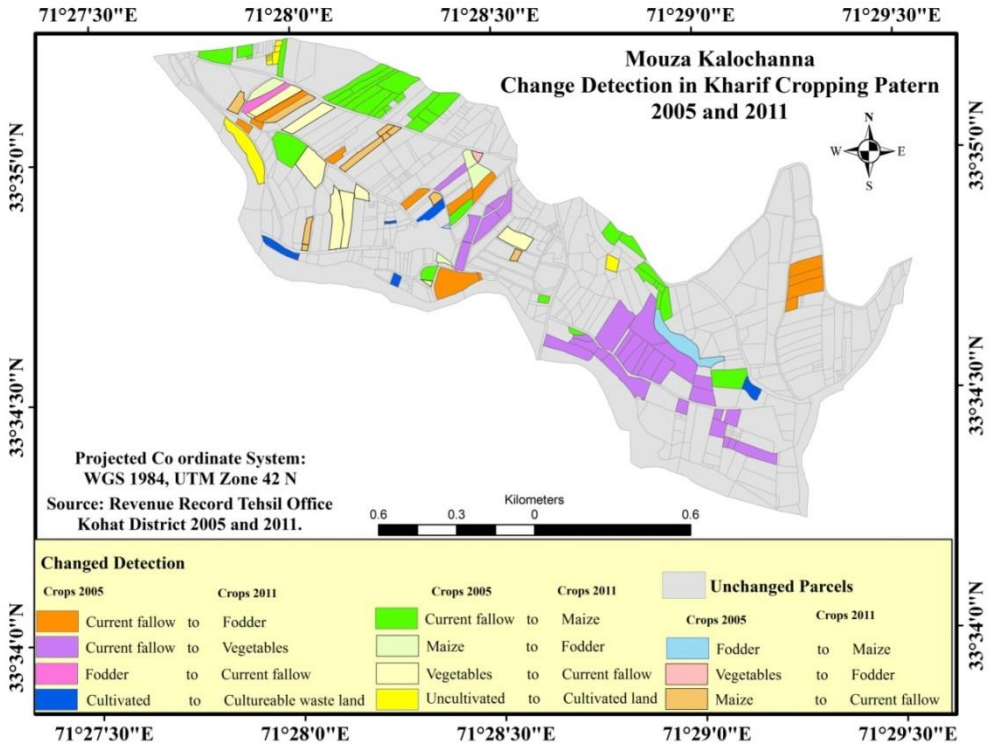
Graph 3: Change Detection in *Rabi* and *Kharif* crops 2005-05 and 2011-12

Map-8: Mouza Kalochanna: Change Detection in *Rabi* Cropping Pattern 2005-06 and 2011-12



The above map (5. 10) reveals the change in the *Rabi* cropping pattern of the mouza between year 2005-06 and 2011-12. The different colour on this map tells that these parcels records change in 2011-12. It is clear from the map that on most of the current fallow land wheat is cropped in 2011-12. In *Rabi* 2005-06 most of the land was current fallow due to the unavailability of irrigational water from Tanda dam, and 2011-12 the water from Tanda dam for irrigation was available which change the current fallow land into net sown land. This map helps in understanding the change in *Rabi* cropping pattern, the pink colour on the map shows that this piece of the cultivated land in *Rabi* 2005-06 was under fodder, which changed in 2011-12 into land under wheat. Some of the parcels also converted from uncultivated to cultivated land represented by the yellow colour on the map.

Map-9: Mouza Kalochanna: Change Detection in *Kharif* Cropping pattern 2005 and 2011



Map-9 shows the change detection in *Kharif* cropping pattern in 2005 and 2011. The light dark colour is used in the map to show the unchanged parcels, while the variety of colours is used to show the change detection in other crops and land use categories. The green colour representing the vacant land in 2005 converted into land under maize, while the purple colour show the vacant land converted into land under vegetables. These changes suggest that most of the land was vacant in *Kharif* 2005 which changed to net sown in *Kharif* 2011. The prominent reason was that Tanda dam was not in operation and the water from Tanda dam was not available for irrigation in 2005 *Kharif* season, therefore in *Kharif* 2005 most of the land was vacant, while in 2011 Tanda dam was in operation and the vacant land changed to net sown land. Besides from these changes with the availability of water intercropping pattern change was also detected in 2011 *Kharif* season. These may be due to the fact that some crops are more water loving then the others.

Major Issues

The water deficiency in the dam is one of the major issues. During the construction of the dam an agreement was signed in 1962 between local people and the government. According to this agreement less than 45 cusecs water will not allowed into the dam. Due to this agreement flood water will be allowed in the dam, the Kohat*toi* is flooded only in the days of monsoon rainy season and this flood water also brings a lot of sediments which deposits in the dam and decreasing the storage capacity of the dam. The cleaning and repairing of the canal system is also a problem, which causes blockage and seepage of water. The main canal is running through the city, the solid waste block the water flow and the toxic liquid flowing from factories to the canal causes pollution of the water, which is harmful for the crops. The estimated life of the dam is fifty years which is going to be complete its life in 2017.

Conclusion

It is concluded from the above discussion that Tanda Dam is playing a leading role in the agriculture of Kohat District. Because most of the agriculture land was vacant in both *Rabi* and *Kharif*cropping seasons in 2005-06 due to the unavailability of water for irrigation from Tanda Dam, The Tanda dam was closed down in 2005-06 for reconstruction purposes and the water was not available for irrigation. In 2011-12 the net sown area increased two fold in both the seasons. A tremendous increase is noticed in each type of crop in 2011-12 in both cropping seasons*(Rabi* and *Kharif*).

So it is concluded that Tanda Dam has huge Impacts on the agriculture land use of Kohat district, because Kohat is having semi-arid conditions, rainfall is not evenly distributed and its agriculture is dependent on irrigation.

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