

## LANDUSE CHANGE IN KHAGERI WATERSHED, CHITWAN

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### Abstract

*This paper is an attempt to analyze land use pattern and its changes between 1978/79 and 1999 in Khageri watershed located in Central Development Region, Nepal. This watershed has mainly been covered with forest followed by agricultural land. The proportion of other land use categories like grazing land, sandy area, barren land and water bodies is limited. The pattern of land use has been changing in this area. Resettlement program after eradication of malaria and migration of population from other parts of the country are the main causes of this change. The resettlement in the watershed of population from Padampur VDC further accelerated the change. The most remarkable change was from forest to agricultural land. The sandy area has also been increased due to lateral cutting and floods of the Khageri River and deforestation.*

**Key Words:** Land use, catchment, cultivated land, forest, grazing land, barren land, sandy area, protected forest, resettlement, topo-sheet.

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### Introduction

Nepal is a mountainous country with 83 percent of the national territory with rugged topography. The country is covered by several watersheds and thousands of sub watersheds. A watershed, often called a catchment area, is a topographically delineated area drained by a river system and differentiated from another river basin. A watershed is a hydrological unit that has been described and used as a physical as well as socio-economic or political unit for management of natural resources (FAO 1990: 3).

Land use is an important aspect in geographical studies. Land use in an area is the cumulative outcome of historical events, the interaction of economic forces with the natural environment. Land use pattern is an arrangement of different types of uses of land (cultivated land, forestland, grazing land, sandy area, water body etc). Land use is the result of different cause. Some are directly related to the nature and quality of land resources and cultural, socio-economic condition of the past and their development trends from history.

The area of Khageri watershed is used for various purposes. The dominant land use types are forest and cultivated land. Grazing land, sandy area, barren land, and water body are other categories of land use in this watershed. Land use type signifies the competition among use types for the land. Before 1950, most of the

land was covered by forest. Later on people from mid hills of the country migrated to this watershed. Government's resettlement program of Padampur VDC has accelerated the migration. The increase in population demanded more cultivated land. The population growth leads to high competition on limited resources. In the process man first brings the marginal land of different uses into agriculture. On the newly acquired land, human activities are environmentally less adaptable than the portion of land already in use. The major problem of this watershed are land use change, erosion, landslide, deforestation and sedimentation. In this context, the main objective of this study is to examine the present land use pattern and its changes between 1978/79 and 1999 and associated reasons for this change. The study is mainly based on available maps and field verification. The study is confined within the Khageri watershed area in Chitwan district.

### Materials and Methods

Land use map represent the distribution pattern of land use and their spatial relationship. The information for this study was primarily taken from different maps. The land use type data of 1978/79 were taken from land utilization map of LRMP (1978/79) at the scale 1:50000 prepared by topographic survey branch and Kenting Earth Science Limited of Ottawa Canada. Likewise, the land use data of 1999 were taken from

topographic map of 1994/95 at the scale of 1:25000 prepared by topographic survey branch and FINNIDA. Land use pattern and its change was verified extensively from the field visit and updated in 1999.

The land use type 1978/79 has been categorized into seven groups i.e. slopping terrace cultivation, valley cultivation, protected forest, forest with crown density more than 70 percent, forest with crown density 40 to 70 percent, sandy area and grazing land. Similarly, the land use type of 1999 has been categorized into six categories i.e. cultivated land, forest land, sandy area, grazing

with crown density represent 40-70 percent and forest with crown density more than 70 percent. Apart from these forests, there is also protected forest in this watershed. The cultivated land has been divided into slopping terrace and valley cultivation. The pattern of present land use is shown in Table 1.

Table 1 shows that the forestland has covered 80.7 percent (120.03sq km) area of the watershed. It is the most dominant land use type. The protected forest, forest with crown density more than 70 percent and forest with crown density 40-70 percent occupied 10.5 percent (15.53 sq

**Table 1: Land Use Pattern of Khageri Watershed (1978/79)**

Land use type		Area (sq km)	Percent
Agriculture	Slopping terrace cultivation	0.3	0.2
	Valley cultivation	14.74	9.9
Forest	Protected forest	15.53	10.5
	Forest with crown density 40-70 percent	103.0	69.2
	Forest with crown density >70 percent	1.5	1.0
Grazing land		12.51	8.4
Sandy area		1.07	0.71
Total		148.65	100

Source: LRMP 1978/79

land, waste land, and water body. These two data layers were prepared using geographical information system (GIS) software.

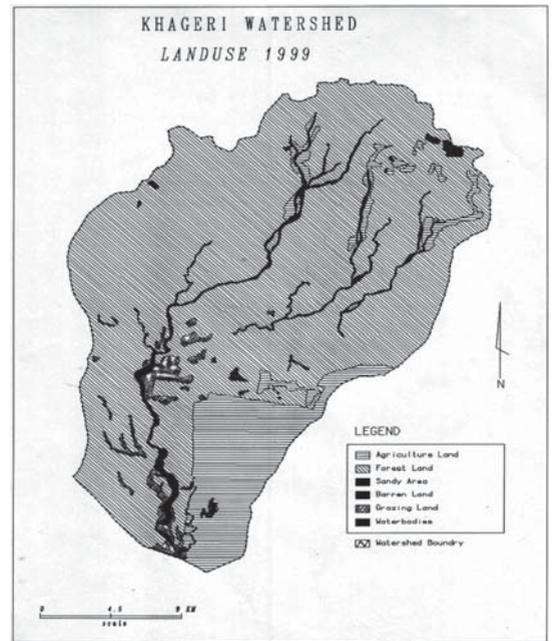
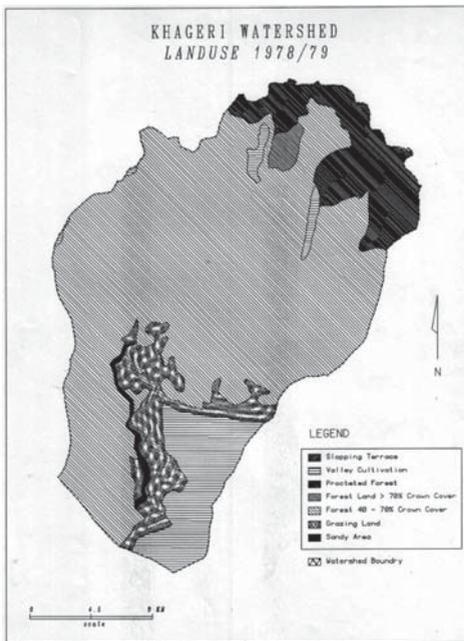
The two coverage of land use (1978/79 and 1999) had been overlaid in GIS program to analyze the change in land use pattern. Four categories of land use of 1978/79 had been compared into six categories of 1999. The land use change has been interpret and analyzed with the help of GIS software.

### Land Use Pattern in 1978/79

The land use pattern of Khageri watershed in 1978/79 has been studied based on the land utilization map published by Topographical survey Branch. Mainly there are four categories of land use in this area. These are forest land, cultivated land, grazing land and sandy area. Depending upon crown density, the forest has been classified into two categories. The forest

km), 69.2 percent (103.0 sq km) and 1 percent (1.50 sq km) area of this watershed respectively.

Agriculture is the second most dominant land use type in this watershed. It covers 10.1 percent (15.04 sq km) area. It has been further classified as valley cultivation and sloping terrace cultivation. The valley cultivation occupies nearly 10 percent (14.74 sq km) area and sloping terrace cultivation occupies only 0.2 percent (0.3 sq km) area of the watershed. Grazing land covers 8.4 percent (12.51 sq km) area. Only 0.71 percent (1.07 sq km) area of the watershed is covered by sandy area. Figure 1 clearly shows the land use pattern of Khageri watershed of 1978/79.



### Land Use Pattern in 1999

The land use pattern of 1999 has been analyzed based on the topographic map 1994/95 published by the Topographical Survey Branch and field verification in 1999. Six major categories of the land use have been identified i.e. agriculture land, forestland, grazing land, sandy area, water body and barren land (Table 2). Table 2 shows that forestland is the dominant land use type. It has covered 74.52 percent (110.78 sq km) area of the watershed. Agriculture is the second dominant land use type, which covers 19.48 percent (28.96 sq km) area. Sandy area is the third dominant land use type. It covers 2.6 percent (3.90 sq km) area. Grazing land covers 2.4 percent (3.57 sq km) area of the watershed.

The water body covers only 0.31 percent (0.47 sq km) area of the watershed. Figure 2 also shows the land use pattern of Khageri watershed of 1999.

### Land Use Change Between 1978/79 and 1999

After the eradication of malaria and resettlement program in Chitwan, people migrated there. After immigration, the land use pattern has been changed. Other causes for land use change are the construction of east west highway and population growth. The resettlement program from Padampur VDC to this area is another cause for land use change. During the period of 1978/79 and 1999 the land use pattern of Khageri watershed has been changed significantly.

**Table 2: Land Use Pattern of Khageri Watershed (1999)**

Land use type	Area (sq km)	Percent
Cultivated land	28.96	19.48
Forest land	110.78	74.52
Grazing land	3.57	2.40
Sandy area	3.90	2.62
Barren land	0.94	0.63
Water body	0.47	0.31
Total	148.65	100

Source: Toposheet 1994/95 and field verification in 1999.

Agricultural land has been increased and forestland has been decreased during this period. Grazing land has been also decreased. Table 3 shows the changing land use pattern of the watershed. The total cultivated land was 10.1 percent in 1978/79 that increased to 19.48 percent in 1999. During this period, cultivated land has changed by 92.55 percent. But the

Padampur village development committee. The coverage of sandy area has also been increased in this area in this period. The total sandy area was 0.71 percent (1.07sq km) in 1978/79 and reached 2.60 percent (3.9sq km) in 1999. This area has been increased by 264 percent. The forest area in riverside is changed into sandy area within the period by the lateral cutting of

**Table 3: Land Use Change Between 1978/79 and 1999**

Land use type	Year				Change Percent
	1978/79		1999		
	Area (sq. km.)	Percent	Area (sq. km)	Percent	
Cultivated land	15.04	10.10	28.96	19.48	92.55
Forest land	120.03	80.70	110.78	74.52	-7.70
Grazing land	12.51	8.40	3.57	2.40	-71.46
Sandy area	1.07	0.71	3.90	2.6	264.48
Barren land	-	-	0.94	0.63	-
Water body	-	-	0.47	0.31	-
Total	148.65	100	148.65	100	-

Source: Toposheet 1994/95 and field verification in 1999

forestland has decreased. There was 80.7 percent (120.03 sq km) forest area in 1978/79 but it decreased by 74.52 percent (110.78 sq km) in 1999. Within this period, it has been decreased by 7.70 percent. The forests are has been used for fodder, fuel wood, and timber and litter collection by local people. The main cause of decreasing forest is population pressure. The forest land has mainly been converted into agricultural land. Grazing land has also been decreased rapidly within this period. In 1978/79 it covered 8.40 percent (12.51 sq km) but in 1999 this area has decreased to 2.40 percent (3.57 sq km). It has decreased by 71.46 percent. The main cause of decreasing grazing land is the resettlement program in this area from

the river. The barren land and the water body were not found in land utilization map of 1978/79. In 1999, these two categories together covered 0.94 percent (1.41 sq km) area. Barren land covered 0.63 percent (0.94 sq km.) area and water body covered 0.31 percent (0.47 sq km.) in 1999. Figure 3 clearly indicates the change.

#### **Detail Land Use Change between 1978/79 and 1999**

The detailed land use change between 1978/79 and 1999 has been analyzed. Mainly there were 6 categories of land use in 1999 while it was categorised into 4 groups in 1978/79. For detailed comparison slopping terrace cultivation & valley cultivation kept in cultivation land. Pro-

**Table 4: Detail Land Use change of Khageri Watershed (1978/79 and 1999)**

From	To					
	Agriculture	Forest	Sandy area	Barren land	Grazing land	Water bodies
Agriculture	12.91	1.11	0.28	0.18	0.44	-
Forest	12.56	102.41	2.92	0.76	1.30	0.25
Sandy area	-	0.62	0.19	-	0.12	0.11
Grazing land	3.49	6.64	0.55	-	1.64	0.22

Source: Toposheet 1994/95 and field verification in 1999.

tected forest, forest with crown density more than 70%, and forest with crown density 40-70% are kept in forestland. Table 4 shows the detailed land use change between the periods. It also shows the detail land use change of the Khageri watershed area between 1978/79 and 1999. The largest area of change has been observed from forest to agriculture land. It has been changed by 8.47percent (12.56 sq km.). The second largest change has been observed from grazing land to forest (4.46 percent) in the same period. Similarly, grazing to agriculture land and forest to sandy area has been changed by 2.34 percent (3.49 sq km.) and 1.96 percent (2.92sq km.) respectively. Agricultural land to forested land has been changed by 0.74 percent (1.11 sq km.).

Land use change in the hilly area is related with deforestation. Forestland is changed into agriculture land and grazing land destructing the area of forest lands. The process of land use change of Khageri watershed area follow the same process of other hilly area of Nepal. The forestland has directly been changed into agriculture land, sandy area and grazing land. The grazing land of 1978/79 changed into agriculture and forestland. The agriculture land also changed into forestland.

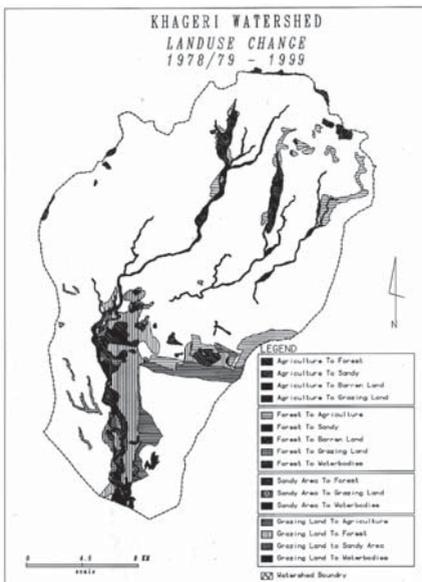
The study indicates that the agriculture land is expanding at the cost of forest and grazing land. The forestland either directly changed into

agriculture land or changed into grazing land and further converted into agriculture land. Grazing land also changed into forestland by afforestation.

## Conclusions

Present paper was an attempt to deal with the changing pattern of land use in Khageri watershed area, Chitwan. Land is a pattern is a changing subject and change takes place overtime. The land is pattern of the Khageri watershed area has been observed before and after resettlement programme from Padampur VDC. In this watershed, forest land and grazing has been decreased and agricultural land has been increased rapidly during 20 years period. The mejour cause of land use change in Khageri watershed due to resettlement programme from Padampur VDC. Population growth accelerate the pressure in forest area and grazing area of the watershed, The other causes of land use change are the migration from midhills of the country to this area , natural growth of population, construction of east-west highway and Khageri irrigation channel.

To reduce the drastic land use change in this watershed, forest land should be protected and grazing land should be properly managed and afforestation programme should be started. The settlement in high hazard zone should be shifted to the safer palce. The other way of managing watershed is the adoption of scientific method of cultivation and icreasing the public awareness on land use change pattern and it's effects in future life.



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