Research Article

Forest Land Cover Change from Year 2000 to 2012 of Tehsil Barawal Dir Upper Pakistan

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Abstract

In this study was based on satellite image and field survey to full fill the objective of the study. The main objective of the study was to find Forest Land Cover Change and its location from year 2000 to 2012. The primary data was taken from field survey and from land set 5 satellite images. In this study the anthropogenic actions was accounted because the actions like logging, illegal cutting, agriculture land and fuel wood collection were found the key reasons that change the forest land cover. For forest cover change and its location downloaded two images from land set satellite of the year 2000 and 2012. The land set images was classified into major five classes' forest, barren land, agriculture, water and snow. The land cover classes of forest, barren land, agriculture, water and snow of the year 2000 was 49.53%, 43.48%, and 5.29%, 1.30% and 0.48% and land cover classes of forest, barren land, agriculture, water and snow of the year in 2012 was 37.27%, 41.35%, and 12.68%, 5.06% and 3.74% respectively. The results of the study showed that from year 2000 to year 2012 forest area was decrease 12.3% while the agriculture area was increase 7.5%. Furthermore 2.02% decrease in barren land, sown decrease to 3.23% and water also increased to 3.65%.

Keywords: Forest Land Cover Change, satellite images, forest, barren land, agriculture, water and snow.

1. Introduction

Forests are a key indicator of health of the planet and they are part of a complex system that supplies us clean drinking water and cleans the air. Forest also played important roles in soil nutrient absorption and contributes to gas regulating through their functions as carbon sinks (Adnan et al., 2015). Unfortunately, when forest ecosystem changed the services may also be disturbed and its benefits also decreased (Wilson and Troy, 2005). According to (Verburg et al., 2006) that due to agriculture, mining, cutting of trees, encroachment and from forest fire six million hectare of forest worldwide changed to other land. To get food and other requirements for life human being changed

the forest land cover. In Pakistan different types of forest are present the conifer forest are situated mainly in Khyber Pukhtunkhwa (KPK) Northern Areas, northern Punjab, Balochistan and Kashmir (AJK). The Pukhtunkhwa (KPK) forests are found at altitudes 1,000 to 4,000 meters. These forests are located at Dir, Malakand, Swat, Mansehra of KPK, district of Punjab like Rawalpindi (Sheikh et al., 2012). According to (Siddiqui et al., 2006) Pakistan is the second highest deforestation country in world where annual deforestation rate is 4.6 %. The study area of Barawal Dir upper have different types of forest like kail (*Pinus wallichiana*) forests, oak (*Quercus incana*) forest,

deodar (*Cedrus deodar*) forest (Abdul, 2001). The objective of the study was to find forest Land Cover Change and its location with the help of field survey and GIS and remote sensing. The studies of GIS and Remote sensing showed that in Pakistan Khyber Pakhtunkhwa forest within 30 year will be complete disappear so therefore the forest land required tree plantation, especially on farmland, it does not pay the loss of natural forest (Suleri, 2006).Remote sensing and GIS has been powerfully and broadly used greatly in single thematic investigation such as land

use and land cover change mapping (Lambing, 1997), forest supervising (Rogan *et al.,* 2002), watershed management and forest fire supervision (Kachmar and Sánchez-Azofeifa, 2003) forest strategy assessment (Nagendra *et al.,* 2005), environmental demonstrating (Rosyadi.,2004) while yet to be minor used in determination of socioeconomic information. The

forest land cover alteration exposure can be precisely determined by means of GIS technology because of its capability to achieve spatial and temporal information magnificently (Panigrany *et al.,* 2010).

2. Materials and Methods

Study Area

The study area Barawal is one of the tehsil of district Dir upper. The area lies between north latitudes 350 37' and 360 21' and east longitude 720 30'and 710 21'. The area has ever green forest and mostly precipitation receives in the form of snow throughout winter. Dir upper Tehsil Barawal Forests has significant environmental, socioeconomic and biological role. It supports major tourism and wildlife habitats and has high potential timber production.
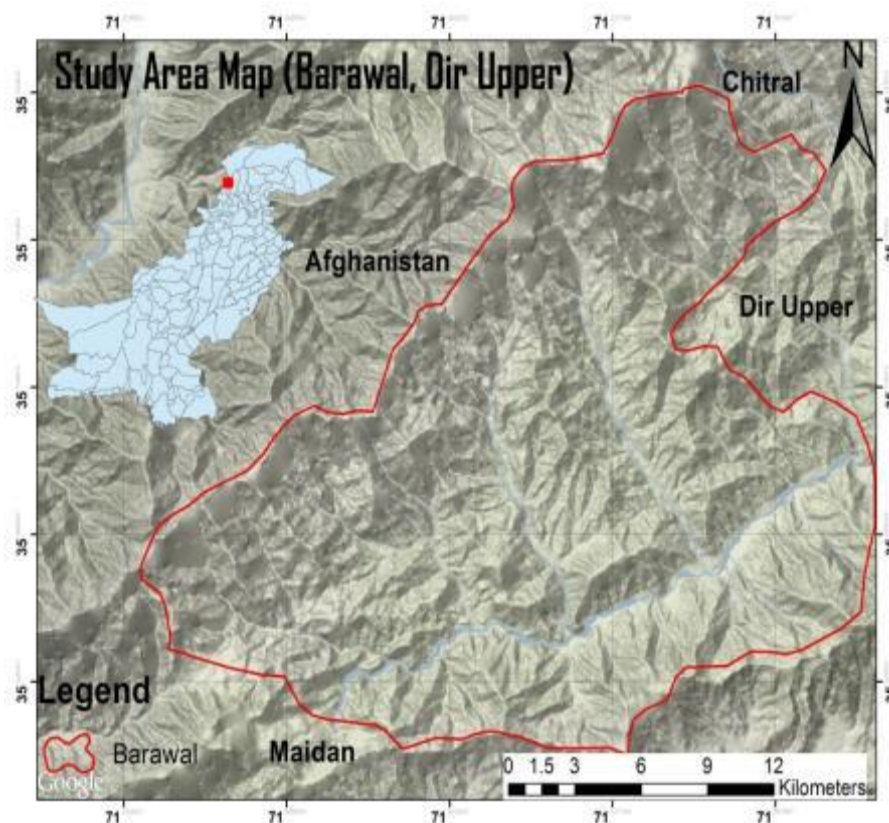
Methodology

The study based on field survey and also GIS and remote sensing to find the forest land cover change and its location that which area have face changing from year 2000 to 2012. The Field survey identifies the agents/drivers whose involve in forest cover change. The GIS and remote sensing analyze the forest cover from year 2000 to 2012 and also its location that where and how much change occurred.

Data Collection

The GIS and remote sensing data was collected from land set satellite while field survey data from questionnaire. The study area Barawal total population is 6167. The 75 questionnaires were collected from the area to collect the data about agents/drivers.

Data Preparation

The following steps are involved for data preparation.

Layer Stacking.

Layer stacking is a process in which different bands of image are stacked to make a complete image.

Sub-setting.

Sub-setting is the method of "cutting" or cropping out a portion of an image means study area for analysis with the help of Erdas Imagine software.
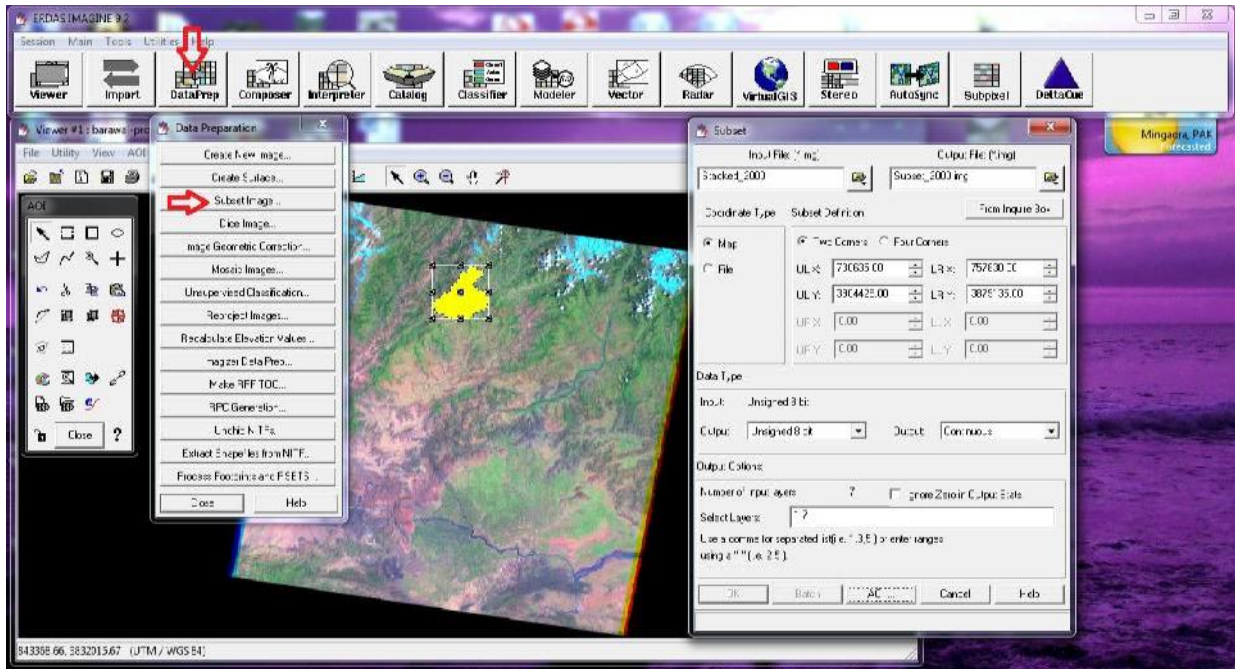

Figure: 2.2. Sub set of the study area.

Supervised Image classification

Supervised training is directly controlled by the analyst. In this method investigator choose pixels that make up patterns or land cover characteristics that investigator identify. Information of the data, and of the classes desired, was necessary before categorization.

Analysis

The field survey and GIS and remote sensing data were arranged with the help of ArcGIS 10, SPSS (Statistical Package for the Social Science) software and from Erdas Imagine software. Graphs were also prepared of all the land cover types for each year.

3. Results and Discussion

A research investigation was carried to out find forest land cover change and its location in Tehsil Barawal Dir Upper through field survey and GIS and remote sensing. A similar study was also conducted by (Pandit, 2011) through GIS and remote sensing to analyze the drivers of deforestation in Laljhadi forests, Nepal.

Land Cover Maps of Study Area Barawal of the year 2000

The study area image of the year 2000 was classified in to 5 major classes as shown in the figure 3.1. The main classes of the area were forest land, agriculture land, barren lands, water and snow in order to recognize the area covered by each class. Our study is in line with the study conducted by (Mya, 2010) on land use and land cover classification.
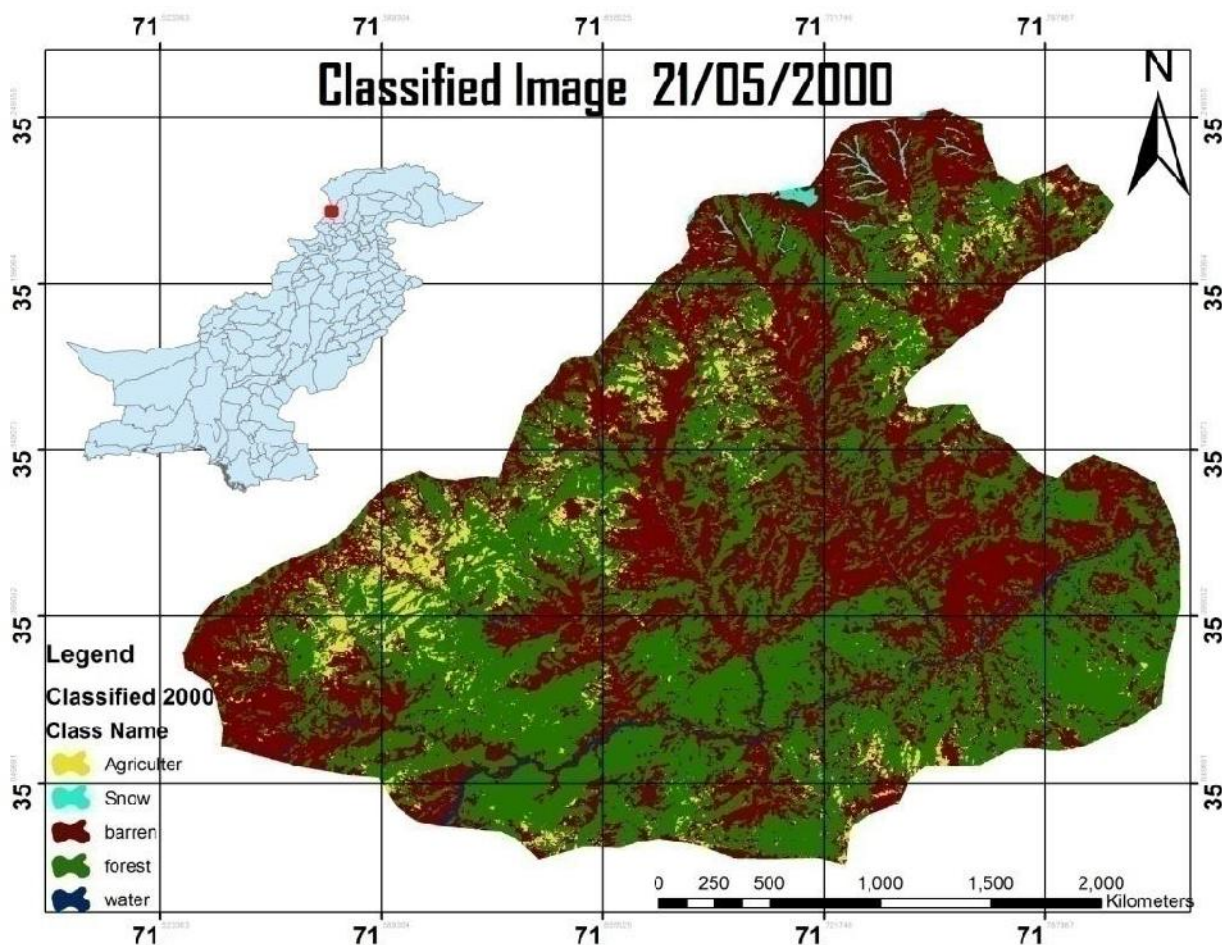
Figure: 3.1. Land Cover image of the Study Area Barawal for the year 2000

Area of the Classes in Study Area Barawal of the year 2000

The satellite classified image of the year 2000 showed that forest was 19349 hec , agriculture 2028 hec, barren land16995 hec, snow188 hec and water and 559 hectares. These classes were converted to percentage ratio 49.54%, 5.19%, 43.38%, 0.49%, and 1.40% as showed in table 3.1.

The figure 3.1 showed that the forest area in year 2000 was generally located in South West and South East while the agriculture is generally located in the West North of the study area Barawal, whereas the East-North parts have low agriculture lands. The barren land was located in the central parts and also some parts located in the North-East side. The image also showed snow in northern side in May 2000.

Table: 3.1. Classified Image of the year 2000 for Study Area Barawal

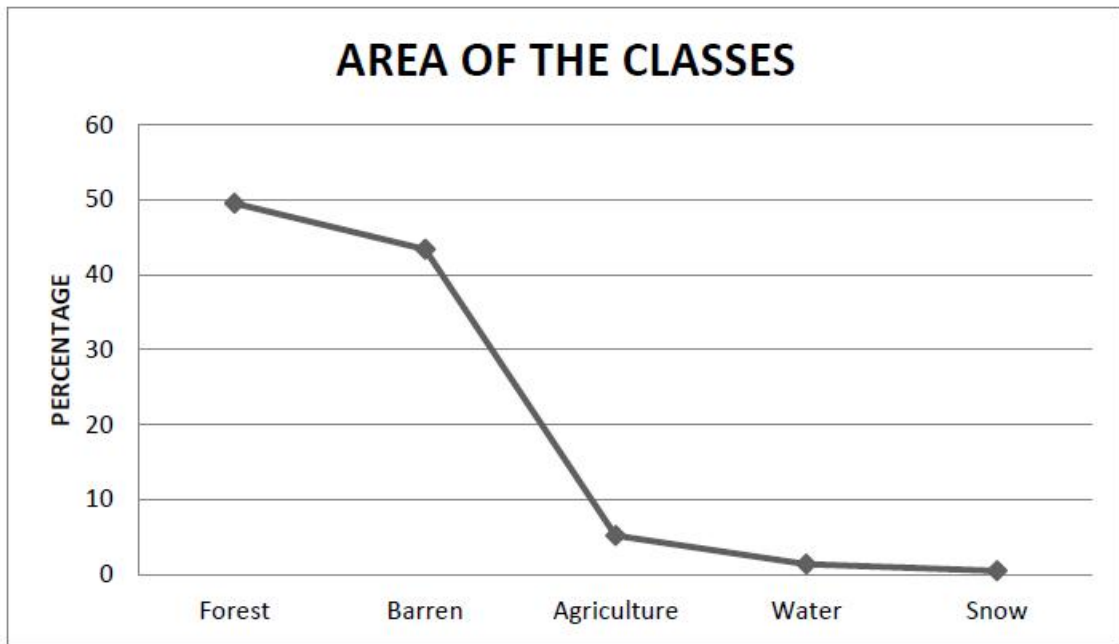| S.No	Class name	Area 2000 (ha)	% Age
1	Forest	19349	49.54
2	Barren	16945	43.38
3	Agriculture	2028	5.19
4	Water	559	1.40
5	Snow	188	0.49
	Total	39059	100

Figure: 3.2. Classified Image of the year 2000 for the Study Area Barawal

Land Cover Maps of Study Area Barawal for the year 2012

The study area image of the year 2012 was also classified in to 5 major classes as shown in the figure 3.3. The main classes of the area were forest, agriculture, barren lands, water and snow in order to recognize the area covered by each class.
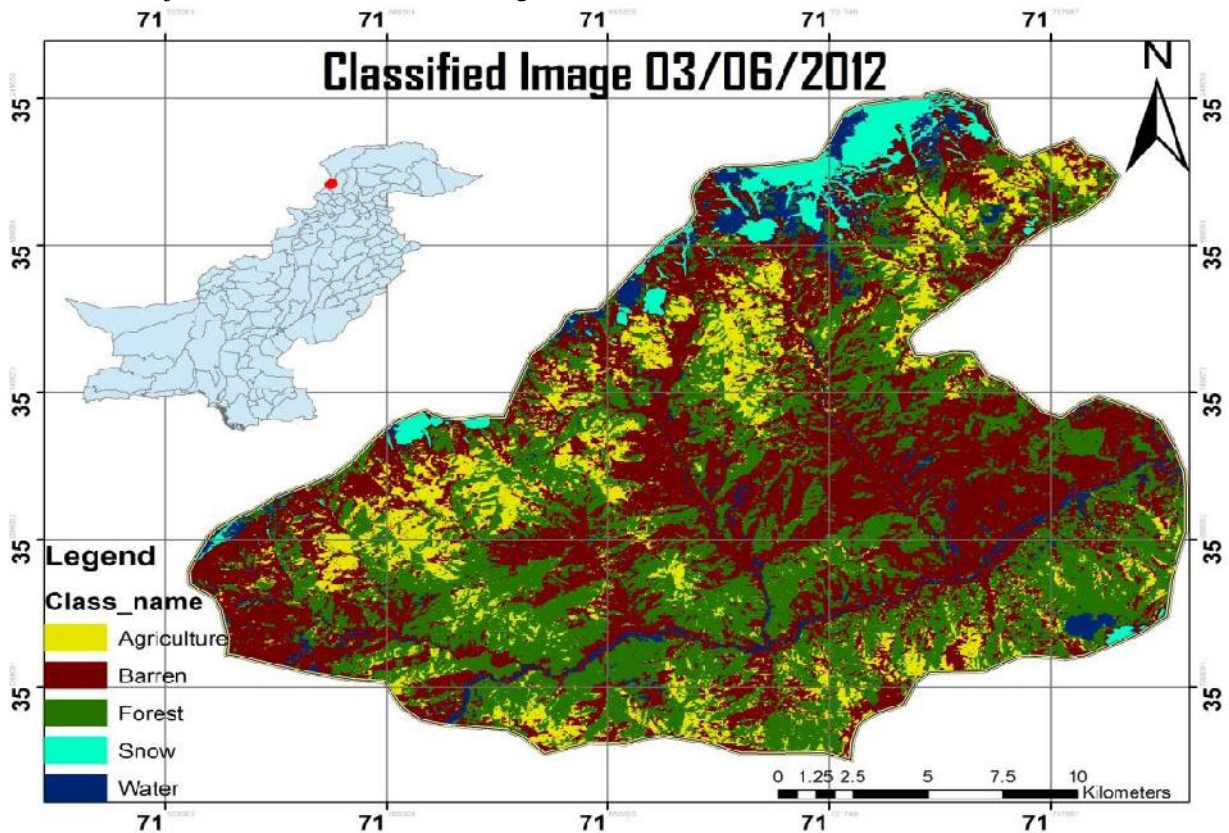

Figure: 3.3. Land Cover image of the Study Area Barawal for the year 2012

Area of the classes in study area Barawal for the year 2012

The satellite image of the year 2012 showed the land cover of the study area. The classes of the area were as forest 14522, agriculture 4958, barren land 4958, snow 1450 and water was 1974 hectares. These classes were converted to percentage ratio 37.17%, 12.69%, 41.36%, 3.72%, and 5.05% (Table 3.2).The figure 3.3 showed that the agriculture developments has been in progress in forest areas which was located in the

South-West and South-East part in the year 2000, as a consequence of which forest area have been decrease in such area of the study area. The North West side agriculture practices were stared from year 2000 to 2012. The results of which other lands specially forest land have trouble like deforestation and degradation. According to (WWF-Pakistan, 2005a) reported that in Pakistan have facing deforestation to the forest land cover and also reported that forest area are depleting to agriculture area.

Table:3.2 Classified image of the Study Area Barawal Dir Upper for the year 2012.

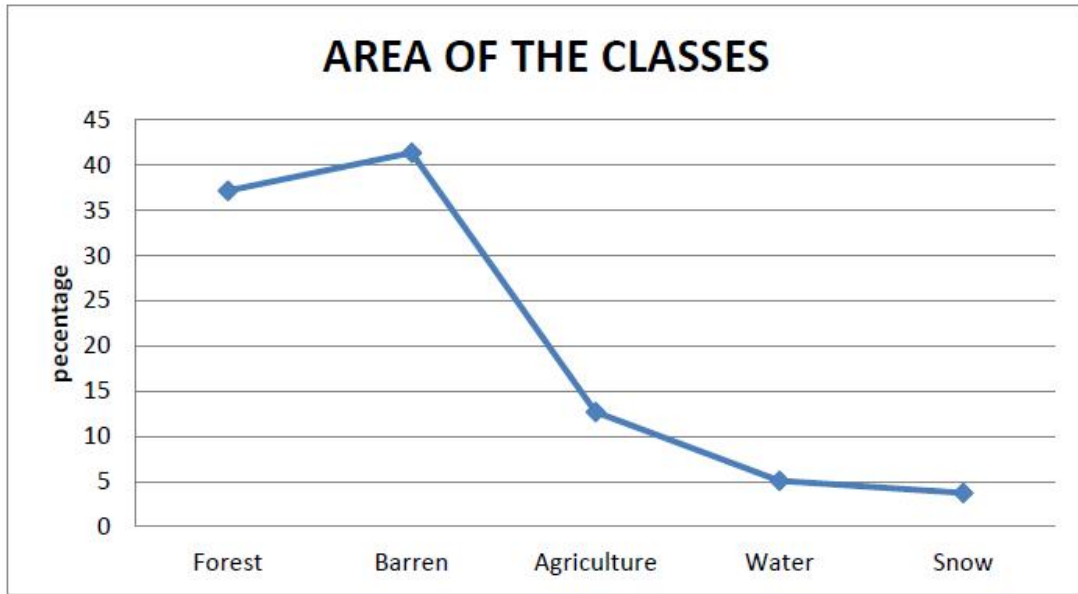| S.No	Class name	Area 2000 (ha)	% Age
1	Forest	161561	41.36
2	Barren	14522	37.17
3	Agriculture	4958	12.69
4	Water	1973	5.05
5	Snow	1450	3.72
	Total	39059	100

Figure: 3.4. Classified image of the Study Area Barawal for the year 2012

Changes in land use and land cover in study from year 2000 to year 2012

The table 3.3 showed that from the year 2000 to the year 2012 how much changed occurred in land cover. The analysis of the results showed that the forestland has been decline up to 4826 hectare which makes up about 12.37 %. Similarly the agriculture area has

increased about 2930 hectares which make up about 7.5 % increase. The barren land was decrease up to -2.02 and water and snow was also increased about 3.65% and 3.23%. according to (WWF, 2009) conducted a report on forest cover change assessment in Swat and Shangla which showed that there was about 13% decrease in forest cover in Swat and 11% in Shangla .

Table: 3.3. Changes in land use and land cover in study from year 2000 to year 2012

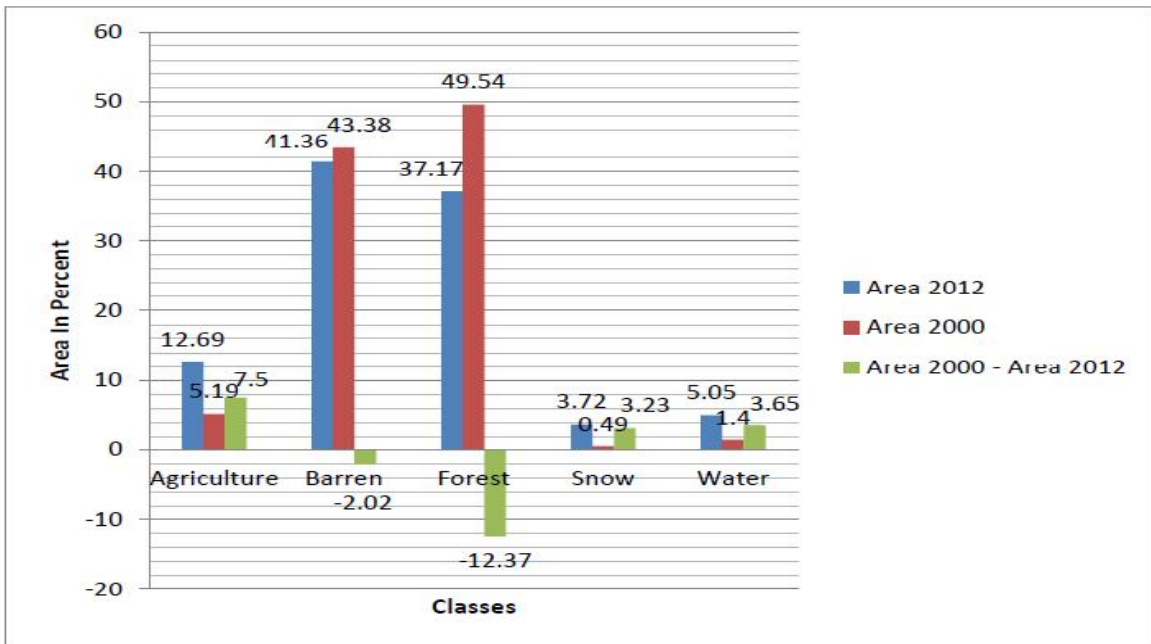| S.No	Class name	Area 2012 in percent	Area 2000 in percent	Net percent change
1	Agriculture	12.69	5.19	7.5
2	Barren	41.36	43.38	-2.02
3	Forest	37.17	49.54	-12.37
4	Snow	3.72	0.49.	3.23
5	Water	5.05	1.4	3.65
	Total	100	100	

Figure: 3.5. Changes in land use and land cover in study from year 2000 to year 2012

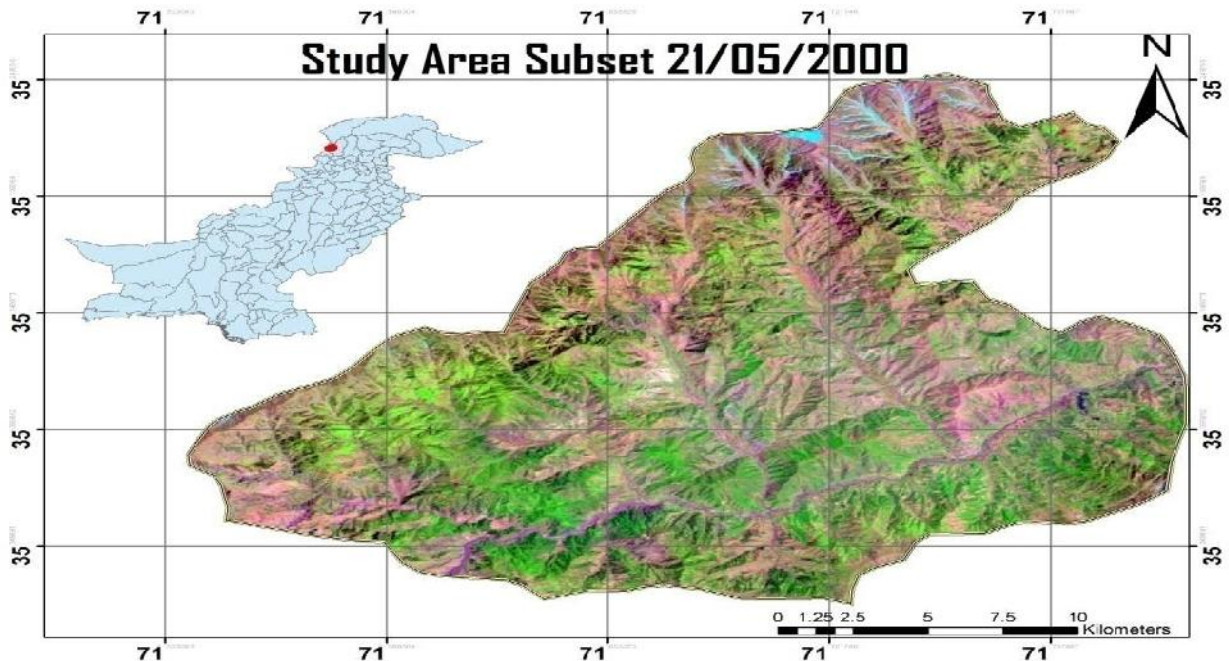**Study Area Barawal Sub Set**

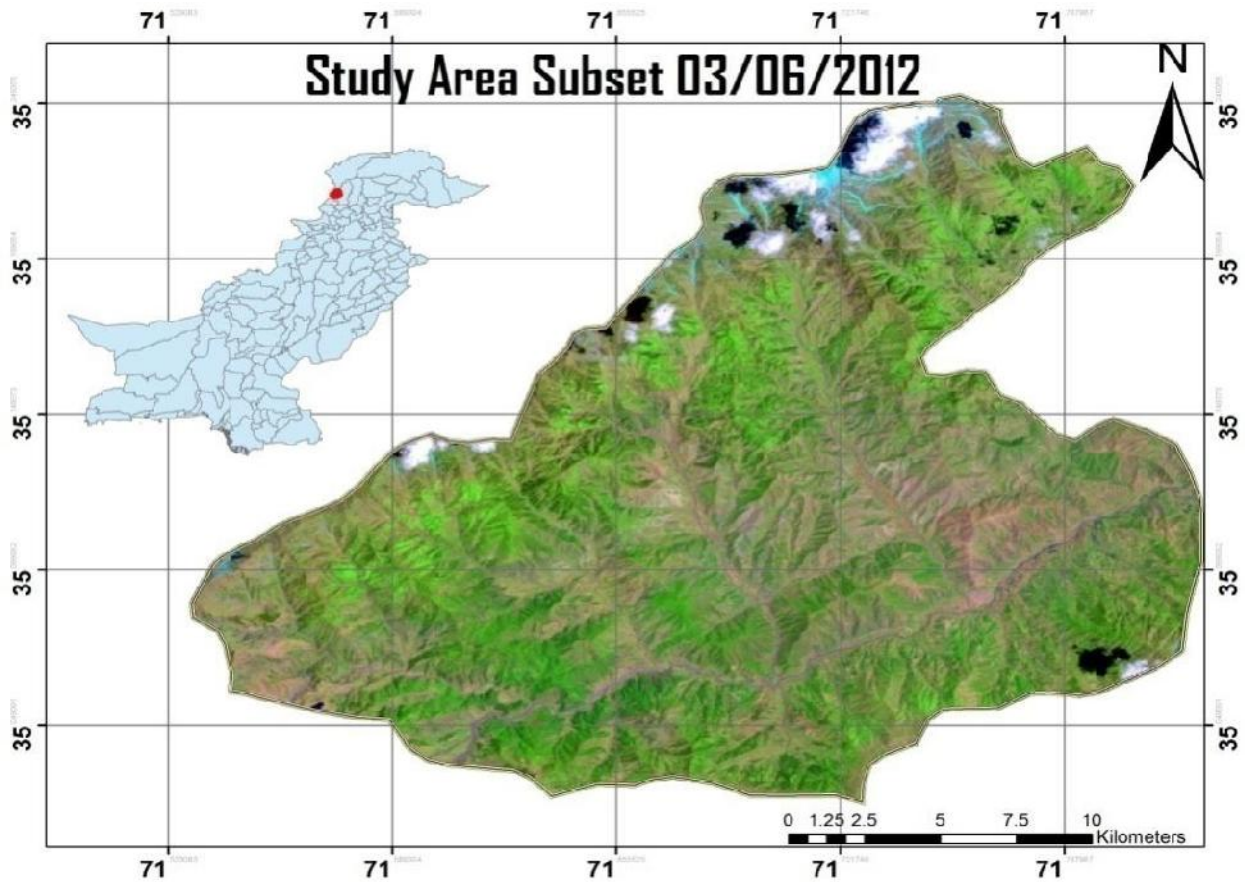Figure: 3.6. Study Area Barawal Sub Set Map of the Year 2000.

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Figure: 3.7. Study Area Barawal Sub Set Map of the Year 2012.

4. Field Survey Data

A Field survey was conducted in the study area to find out the agents involving in forest cover changing.

Respondents level of Education in the Study Area Barawal

Table 4.1 showed that 60% of the respondents were illiterate, 24% of respondents are metric level and 12%

are undergraduate while few 4% of the respondents are have attained post graduate. The majority of residents in study area Barawal are illiterate and people did not realize the importance of trees and due to unawareness the study area people changing the forest cover to other land.

Table 4.1: Assessment of Education level in the Study Area of Barawal.

S.No	Education	Frequency	% Age
1	Illiterate	45	60
2	Metric	18	24
3	Undergraduate	9	12
4	Postgraduate	3	4
	Total	75	100

Respondents land ownership of the Study Area Barawal

Table 4.2 showed that 84% of the respondents have its own forest and 16% of respondents have No forest

land according to the (Adnan et al., 2006) reported that in Pakistan majority of the rural peoples are dependent on forest resources.

Table 4.2: Status of land ownership in the Study Area of Barawal Dir Upper.

S.No	option	Frequency	% Age
1	YES	63	84
2	NO	12	16
3	TOTAL	75	100

Respondents Source of Income in the Study Area Barawal Dir Upper

The table 4.3 showed the respondent's source of income. The data indicated that economically 44% respondent are dependent on forest where as 34.67% of respondent depend on agriculture. Similarly 12% are dependent on livestock, 6.66 % Govt. services and 4% have their own businesses. Economic gains from forest have been found vital character in deforestation as people overexploited forest to build up financial incomes. (Salam and Noguchi, 1998) reported in factors influencing the last of forest cover in Bangladesh that forests are degraded due to economic growth.

Table 4.3: Respondent's source of income in Study Area Barawal.

S. No	Income source	Frequency	% Age
1	Forest	33	44
2	Agriculture	25	34.67
3	Livestock	9	12
4	Govt. servant	5	6.66
5	Business	3	4
	Total	75	100

Respondents View about Causes of Deforestation in the Study Area Barawal

Table 4.4 showed that 40% respondents agreed that agricultural practices are the main cause of deforestation while the 24% agreed that fuel wood collection caused deforestation in the study area. The 19% respondents' view that it is Illegal cutting/ harvesting and while the 9% agreed that encroachment caused deforestation. According to 8% of respondents forest fire is also one of the causes of deforestation. The rising price of fuel wood in alternate's fuels it impact on poor men's welfare and the social cost so they did not hesitate in spoiling the timber wealth for minor purposes like their home warming in winter season. Education plays significant role in spreading data and receiving inventive thoughts to expand family earnings through diverse sources for sustainable livelihood. It is very important that ruthless cutting of the trees should be stopped. It should be arrange that alternative energy resources be provided to these people so that trees are not cut down for getting fuel wood.

Table 4.4: Respondents View about causes of deforestation in the Study Area.

S.No	Deforestation cause	Frequency	% Age
1	Agriculture	30	40
2	Fuel wood	18	24
3	Illegal cutting/Harvesting	14	19
4	Encroachment	7	9
5	Forest fire	6	8
	Total	75	100

Different studies have expressed that the forest land is changed to agriculture (Fombed, 2009; Gibbs et al., 2010) and it is also assumed that the demand of food will be increased to 70% by 2050 (FAO, 2009). The study area has been facing serious problem of timber mafia so 19% of the respondents were of the view that illegal cutting and harvesting is the cause of deforestation while 9% accounted that encroachment caused deforestation. According to 8% of respondents viewed that forest fire is also one of the causes of deforestation in study area. There are numerous reasons for deforestation, such as fuel wood collection, agriculture growth, illegal cutting, and Forest fire and so on. (FAO, 2010) reported in global forest resources assessment that agriculture growth was pointed as the key reason for decreasing of forest areas.

4. Conclusion and Recommendation

The present study was based on satellite image and field survey to find the forest cover change from year 2000 to year 2012 and its location in the study area Barawal. From analysis of data 2000 to 2012 the forest land cover in the study area was decreased by 12% and agriculture cover was increased by 7%. The barren land was decrease up to -2.02 and water and snow was also increased about 3.65% and 3.23%. The local peoples of the study area are totally dependent on forest resources because forest is the major class in the study area. It is finished up from the come about that the woodland spread is diminished because of the seven drivers of deforestation. These incorporates (i) source of income from forest (ii) fuel wood collection (iii) illiteracy rate (iv) agriculture expansion (v) forest fires (vi) Illegal cutting/harvesting (vii) encroachment. The main agents of forest cover change are involved 40% agriculture and 24% fuel wood.

In view of the discussion of the results and conclusion, the following recommendations are hereby made
Due to high deforestation rate and increased agricultural activities it is recommended that awareness campaign should be launched in the study area to protect and conserve this forest from further deforestation.

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