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Deforestation Drivers in Tehsil Barawal, Dir Upper, Pakistan

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Abstract. The study area Tehsil Barawal, district Dir (U) of forest has facing serious problems of deforestation. The forest of the study area is ever green forest trees like (*Cedras deodar, Abies pindrow, Pinus roxbergii, Picea smithiana* and *Pinus wallichiana*) are dominate trees. The focus of the study area was to explore the various drivers of the deforestation. The study was based on field survey and GIS and remote sensing techniques. The results of field survey revealed that there are seven drivers of deforestation, source of income from forest, fuel forest collection, illiteracy rate, agriculture expansion, forest fire, illegal cutting/harvesting and encroachment. The field survey shows that 40% people agreed that the major driver of deforestation in the area is agriculture. Study was based on the GIS and remote sensing techniques to explore the various drivers of the deforestation from year 2000 and 2012. In this study the images of 2000 and 2012 were downloaded from landsat 5 satellite. Five key classes such as forest, agriculture, barren land, snow and water were acknowledged. The result showed that the study area Tehsil Barawal, District Dir (U) of forest, barren land, agriculture, water and snow in year 2000 was 49.54, 43.38, 5.19, 1.40 and 0.49%, and the area in 2012 was 37.17, 41.36, 12.69, 5.05 and 3.72%, respectively. After data analysis it was cleared that 2.02% decrease in barren land, 12.37% decrease in forest and 7.5% increase in agriculture land was identified. Therefore, from field as well as from GIS and RS results it was cleared that agriculture is the key driver of the deforestation study area.

Keywords: sensing techniques, deforestation, harvesting, Upper Dir.

Introduction

Forests area of Pakistan is 4.8 million hectare (GOP, 2005; Lubna, 2001). Pakistan forests resources comprise one of the most established and second biggest Juniper forests on the planet. These are for the most part evergreen characteristic forests of conifers, developing between rises of 1500-9000 meters above ocean level in the northern sloping areas of Pakistan. Pakistan has distinctive sorts of forests such as slope pine forests is clean ragged or foot slope forests, watered manors, Riverside and mangroves forest in the delta of Indus River (Qazi, 1994). The northern part of the nation is ruled from the evergreen forests (42% in Khyber Pakhtunkhwa and 16.6% in Gilgit Baltistan and 7.7% in Azad Kashmir). These forests to a great extent arranged in Khyber Pakhtunkhwa and spread over the mountains of Hindukush, Himalayas and Korakoram and brushy and coniferous forests are for the most part begun from the upper slants of area Swat, Dir, Mansehra and Chitral, while the high and sub snowcapped fields are found on the edge of the mountains (Khan, 2009) Globally, six million hectare forest lands are changed because of logging,horticultural, mining and other human exercises (Verburg *et al*., 2006). The United Nations Framework Convention on Climate Change (UNFCCC) reported that the agribusiness was the key reason for deforestation. 48% of deforestation is agriculture subsistence cultivating, 32% of deforestation is dependable fuelforest, 14% logging is in charge of deforestation and 5% of forest accumulation is capable of deforestation (UNFCCC, 2007). As indicated by Siddiqui *et al*. (2006), Pakistan is the second most astounding deforestation nation in world where yearly deforestation rate is 4.6%. Verburg *et al*. (2006) reported that overall six million hectare forest terrains are modified because of agriculture, logging, mining and other human practices. Khan and Naqvi (2000) reported that in Khyber Pakhtunkhwa trees and forest assets have a key part in the rustic vocation. The greater part of people rely upon forests for timber, for houses and fuel. What's more, forest individuals gather different non-timber forests items for use at the family unit level and for money wage. As per the United Nations Framework Convention on Climate Change (UNFCCC)

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48% agriculture practices was the significant reason for deforestation while 32% of deforestation is responsible for business agriculture, logging is in control 14% for deforestation and 5% of fuel forest gathering is accountable for deforestation (UNFCCC, 2007).

There are two primary drivers of deforestation immediate and backhanded (Helmut *et al*., 2002). Direct drivers are those causes specifically prompting forest decrease. For instance, forests into horticultural area exorbitant logging. The characterise aberrant drivers are an unpredictable association of financial, administration, innovative, and demographic (Rademakers *et al*., 2010). As per Boakye *et al*. (2008), because of human initiates the vegetation spread happened changes (development of populace) and natural impacts likely variability in atmosphere. The human exercises, for example, horticultural works on, mining, infrastructural and other anthropogenic exercises are the real reasons for ecological debasement (Yang, 2001) and as indicated by FAO (2006). Forest spreads are quickly corrupted because of social, monetary and multi social factors. GIS and Remote detecting has been proficiently and broadly utilised much as a part of single topical examination for example, land utilise and arrive spread change mapping (Lambing, 1997), forests screen (Rogan *et al*., 2002), watershed administration and forest fire administration (Kachmar and Sánchez-Azofeifa, 2003) and forest approach evaluation (Nagendra *et al*., 2005). Remote detecting the flying photography thinks about demonstrate that in Khyber Pakhtunkhwa the rate of deforestation is tremendous and inside 30 year entire forest will vanish. Real advance has been made in tree ranch on farmland however it can't adjust the loss of regular forest (Shahbaz *et al*., 2006). Therefore the motivation behind the study was to recognize diverse drivers of deforestation in study territory Tehsil Barawal, district Dir (Upper), Pakistan.

Materials and Methods

Study area. Tehsil Barawal is one of the Tehsils of Dir Upper which is dominated from various forests. The range found north of the territory lays Chitral, Afghanistan on west, Dir Upper forests on east and district Lower Dir in south part of the Tehsil Barawal. All out house hold of the region are 350 according to region censes report of Upper Dir 1998 (Upper Dir, 1998). The height of the region begins from 4200 m to 6700 m. Tehsil Barawal is ruled by assorted sort of forests i.e., deodar (*Cedras deodar*) and spruce blended fir (*Abies pindrow*) and (*Pinus roxbergii*) forests, (*Picea smithiana*) blue pine (*Pinus wallichiana*), forests and diverse natural products trees.

Methodology. A definitive reason of the field overview was behaviour to a mass subjective and quantitative data to better perceive the drivers of deforestation in the area. The primary study was completed on August and September, 2013 between 08:00 am and 16:00 pm which is the most vital time of individual's exercises. The aggregate populace of the study territory is 61674. Study area covers three Union councils i.e., Barawal Bandi, Darkand and Shahikot. The house hold of the area are around 350. The 75 questioners were gathered from three union committees. Neither the survey was lost nor returned fragmented along these lines having 100% reaction rate. For drivers of deforestation additionally includes arrangement and amendment each remotely detected image. After the image grouping recognizably, thought about the subsequent maps on a pixel-by-pixel premise utilizing a change discovery grid. The streaming strides was done in strategy of image handling; (1) Data accumulation, (2) Data readiness, (3) Supervised image arrangement, (4) Analysis and (5) Preparation of progress location maps. These applications were done utilising ERDAS envision 9.2 and Arc GIS 10 programming.

Data collection. The 200 and 2012 images were downloaded for exploration information from the landsat 5 satellite of the United State of Geological Survey site.

Analysis. Subsequent to finishing handle review, every one of the information were gone into statistical package for social sciences (SPSS) form 19. The entered informations were cross checked and blunders were corrected by the key examiner. In the wake of cleaning the information, investigation was done through SPSS for every one of the variables. GIS and remote detecting information are orchestrated from ARIC GIS 10 and Eradas programming.

Results and Discussion

Field survey data. A field survey was conducted in the study area to find out the main cause of deforestation and agriculture development.

Respondents level of education in the study area Barawal, Dir Upper. Table 1 depicts that majority of respondent were illiterate (60%), followed by 24% metric and 12% are undergraduate, while very few 4% of them have attained post graduate qualification.

Table 1. Assessment of education level in the study area of Barawal, Dir Upper

Education	Frequency	Percentage
Illiterate	45	60
Metric	18	24
Undergraduate	9	12
Postgraduate	3	4
Total	75	100

Respondents source of income in the study area Barawal, Dir Upper. Table 2 shows the respondents source of income. The data indicated that economically 44% respondent are dependent on forest whereas 34.67% of respondent depend on agriculture. Similarly, 12% are dependent on livestock, 6.66% Govt. services and 4% have their own businesses.

Respondents land use classes in study area Barawal, Dir Upper. From Table 3 it was clear that 44% respondents have forest land while 26% of respondents have agriculture land. The reaming 6% respondents have range lands whereas the remaining 10% respon-dents have barren lands. There are only14% respondents that have mixed land.

Respondents fuelforest collection per day amount in Barawal, Dir Upper. Table 4 shows the respondent fuel forest collection from 1 to 30 kg per day is 86% and 31 to 60 kg fuel forest collection per day is 6% while 61 to 90 kg fuel forest collection is 5%. The minimum number of respondent used more than 90 kg is 3%.

Respondents view about causes of deforestation in the study area Barawal, Dir Upper. Table 5 shows that 40% respondents agreed that agricultural practices are the main cause of deforestation while 24% agreed that fuel forest collection caused deforestation in the study area. The 19% respondents' view that it is illegal cutting/harvesting while 9% agreed that encroachment caused deforestation. According to 8% of respondents forest fire is also one of the causes of deforestation.

Table 2. Respondent's source of income in the study area Barawal, Dir Upper

Income source	Frequency	Percentage
Forest	33	44
Agriculture	25	34.67
Livestock	9	12
Govt. servant	5	6.66
Business	3	4
Total	75	100

Table 3. Respondent's land use classes in study area

Land type	Frequency	Percentage
Forest	28	44
Agriculture	16	26
Range land	4	6
Barren	6	10
Mixed land	9	14
Total	63	100

Table 4. Respondent's fuel forest collection per day amount in study area Barawal, Dir Upper

Fuel forest collection in kg (one day)	Frequency	Percentage
1 to 30 kg	54	86
31 to 60 kg	4	6
61 to 90 kg	3	5
More than 90 kg	2	3
Total	63	100

Table 5. Respondent's view about causes of deforestation in the study area Barawal, Dir Upper

Deforestation cause	Frequency	Percentage
Agriculture	30	40
Fuel forest	18	24
Illegal cutting/harvesting	14	19
Encroachment	7	9
Forest fire	6	8
Total	75	100

Image classification of the year 2000. The satellite image of the year 2000 was arranged into five fundamental classes. The results demonstrate that the area of forest, barren land, agriculture, water and snow was 19349, 16995, 2028,549 and 188 hectares (Table 6). The Fig. 1 demonstrated that the forest areas is present in south-east and south west of the study territory while the agriculture is generally packed in the north-west of the study region. Where the north-east parts have low agriculture land. The barren area is for the most part

begun in the focal parts and in the north-east parts. In the northern side peaks of mountain snow was also originating.

Image classification of the year 2012. The satellite image of the year 2012 was divided into 5 classes like that of 2000. The result showed that the region of forest, barren area, agriculture, snow and water was 14522, 16156, 4958, 1450 and 1973 hectares (Table 7 and Fig. 2) showed that the agriculture headways has been started in forest districts which was determined in the south-east and south-west part in 2000, as an outcome of the which forests area has decreased in such area. Correspondingly the agriculture area has been further urbanized and elevates in the north-west side of the study range while the north-east side has moreover genuine agribusiness changes.

Changes in land use and land cover from 2000 to 2012. The Table 8 and Fig. 3 show the assessment that the amount of measure of changes has been happened from 2000 to 2012. The results showed that the forests range has been reduced up to 4826 hectare which makes up around 12.37% from that of image 2000. So likewise the agriculture area has extended around 2930 hectares which make up around 7.5% extension.

The present study was based on satellite image and field survey to identify the drivers of deforestation in the study area.

Drivers of deforestion. The greater part of residents in study area Barawal, Dir Upper are unaware and people did not understand the significance of trees. Due to this reason people doing deforestation in the area. Forest spread diminished in study territory Barawal, Dir Upper because of fuel forest gathering the (Table 4) demonstrated the fuel forest accumulation per family unit every day i.e., gathering of 1-30 kg fuel forest for each family unit every day since forest has a noteworthy part to play in meeting the household

Table 6. Classification results of the image 2000

Class name	Area of the year 2000 hec	Percentage
Forest	19349	49.54
Barren	16945	43.38
Agriculture	2028	5.19
Water	549	1.40
Snow	188	0.49
Total	39059	100

Table 7. Classification results of the image 2012

Class name	Area of the year 2012 hec	Percentage
Barren	16156	41.36
Forest	14522	37.17
Agriculture	4958	12.69
Water	1973	5.05
Snow	1450	3.72
Total	39059	100

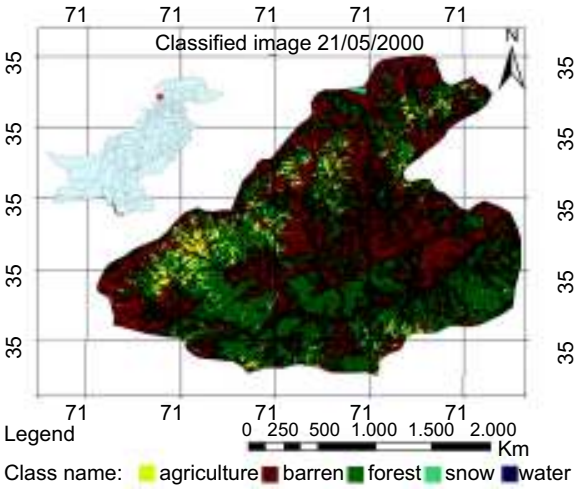

Fig. 1. Classified image of the year 2000.

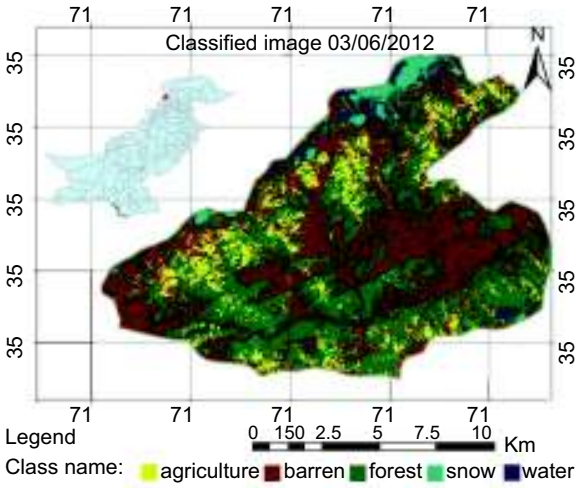

Fig. 2. Classified image of the year 2012.

Table 8. Land use land cover changes from 2000 to 2012

Class name	Area 2012	Area 2000	Difference
Agriculture	12.69	5.19	7.5
Barren	41.36	43.38	-2.02
Forest	37.17	49.54	-12.37
Snow	3.72	0.49	3.23
Water	5.05	1.4	3.65
Total	100	100	

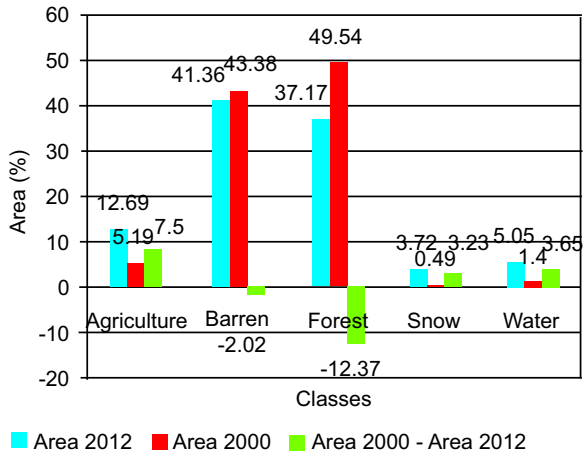

Fig. 3. Land use land cover changes from 2000 to 2012.

vitality pre-requisites. There is no other current office like gases, power and lamp fuel oil accessible, so individuals just gathered the fuel forest for cooking and warming (Table 4). As indicated by Bekure (1996) fuel forest gathering and infringement are the key reasons of forest spread change in Ethiopia and Shackleton (2004) reported that 80% of country families in South Africa use fuel forest for vitality purposes. The forest is likewise utilized for development purposes and assembling furniture and so on. Distinctive studies have communicated that the forest area is changed to farming (Gibbs *et al*., 2010; Fombed, 2009) and it is likewise accepted that the interest of sustenance will be expanded to 70% by 2050 (FAO, 2009). The study range has been confronting difficult issues of timber mafia so 19% of the respondents were of the perspective that illicit cutting and collecting is the reason for deforestation, while 9% accounted that infringement brought about deforestation.

To get quantitative data about forest in Barawal valley from 2000 to 2012, a forest spread change identification was done utilizing remote detecting and GIS methods. A post-order procedure as utilized by Coppin *et al*. (2004) was connected for grouping and quantitative information examination on both satellite images of 2000 and 2012.

From 2000 to 2012 the forest area is diminished by 12% and agriculture area is expanded by 7%. These outcomes are like a study directed on forests spread change evaluation in Swat and Shangla which demonstrates that there was around 13% diminishing in forests in Swat and 11% in Shangla (WWF, 2009).

Conclusion

The forest spread is reduced as a result of the seven drivers of deforestation. These fuses (i) wellspring of pay from forest (ii) fuel forest accumulation (iii) absence of education rate (iv) agriculture (v) fuel forest (vi) Illegal cutting/collecting (vii) infringement. The greater part of inhabitants in study range Barawal, Dir Upper is unskilled and individuals do not understand the significance of trees. Instruction assumes huge part in spreading information and getting creative contemplations to grow family profit through differing hotspots for feasible business. It is likewise cleared that 40% of the respondents established that rural practices were the primary driver of deforestation in study region Barawal, Dir Upper. So also the forest spread diminished in the study region because of fuel forest gathering per family unit every day i.e., gathering of 1-30 kg fuel forest for each family unit per day. The characterisation after effect of satellite image of the year 2000 demonstrated that the percent range of forest, farming, desolate land, snow and water bodies were 49.54, 5.19, 43.38, 0.49 and 1.4% individually. Similarly the grouping after effect of satellite image of the year 2012 demonstrated that the forest, agriculture, barren area, snow and water bodies were 37.17, 12.69, 41.36, 3.73 and 5.05%, separately. From 2000 to 2012 the forest area is diminished by 12% and farming range is expanded by 7%. Due to high deforestation rate and expanded rural exercises it is prescribed that mindfulness battle ought to be propelled in the study area to shield and ration this forest from further deforestation.

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