Ethno-botanical Studies and Vulnerability Assessment of Forest Resources in District Shangla, Khyber Pakhtunkhwa, Pakistan

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DEDICATION

I hereby dedicate this research work to all of my respected teachers, Beloved parents and friends who sanctified me with an inspiration that made all of my ways lighten at every stage of this research.

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ABSTRACT

Since old human history, forest resources are among the vital necessities for all the living organisms. Besides their economic and ecological role, they ensure the balance of atmospheric gases especially oxygen and carbon dioxide, regulating vital natural processes. But unfortunately due to the over exploitation, unsustainable use and management issues, the forests around the world are under pressure and are depleting. The forest resources in Pakistan are also under stress. Considering the importance of forest this study was designed to emphasize the importance of their medicinally and ethno-botanically important resources and their vulnerability in District Shangla, KP, Pakistan. The area is rich in biodiversity including wild flora especially ethno-botanically valued species. About 40 species of the area were found to have marked medicinal value. Out of these, 7 species were reported to be used for their diuretic properties, 5 were used as stomachic and laxative. While 4 species each were reported to be used as Aanthelminthic, 3 carminative, 3 antiseptic, 2 expectorant, 1 astringent and 1 purgative respectively, the remaining species have also one or more than one medicinal use in the local community. Overall appearance & state of the forest cover, previous reports of intactness of the forest are encouraging, but visible reduction in the forest cover has been reported by various sources in study area, while change detection from 2000-2016 also revealed the same. This change is attributed to absence of alternate fuel resource and lack of cheap fuel resources. 95.5%of the deforestation is due to wood extraction by the local respondents because of their dependence on fuel wood. While 54% believe that collected fuel wood absolutely comes from the local forest, while 86%believe that the road infrastructure extended in the mid of the forest is responsible for the forest degradation. The extension of road network into the forest was found to be accelerating the deforestation by providing easy access and simultaneously making possible the timer transportation in difficult terrine.

Chapter 1

INTRODUCTION

The interaction and relationship of the human populations with their surrounding natural resources has been an ancient and vibrant survival strategy of these communities on earth. Among these natural resources, the forests provide major resources base, hence making the lifeline for the mankind since centuries Qasim *et al.* (2014). Till day there are thousands of industrial and domestic needs based on the forest products (Martin, 1995). In general the main forest products are wood based, and their utilizations are specified upon wood/timber, for the manufacturing of numerous useful products. Hence mainly the forests are known for the timber and tree based products, with less consideration of the shrubby and herbaceous species abundantly found in the forests and rangelands. Though timber has been very important, mainly for shelter, the non-timber products have long served mankind for food, forage, medicine, insulation and countless other uses. Therefore, non-timber forest products are also amongst important forest product (Malmsheimer*et al.*, 2011) and these provide the key source of food and medicine for the neighboring human communities. This dependence of the human populations, especially those living in the vicinity of the forests is studied under ethno-botany, and is the topic of increasing interest for the environmental biologists, botanists, anthropologists and ecologists (Martin, 1995).

Around the world the forests cover was recorded around 4 billion hectares in 2005, which is about 30% of the land, while out of these forests 36% are classified as primary forests. Over two third of known land-based species originate from forests, with the shrinking forest lands a number of these species are under the serious threat of extinction (IUCN/UNEP, 1999). More than 9000 tree species are on the verge of extinction, making about 9% of the total number of the world's tree biodiversity (Liaison, 2012). When a forested land is converted to a non-forest land which is incapable for agricultural activities, urban development and grazing this process is known as deforestation that results in huge emissions of CO_2 which is an active agent of global warming and climate change. Anthropogenic pressure on resources and

consumption of the natural resources by the increasing population plays a vital role in climatic variations and global warming. With the increase in demand of energy the earth is going beyond the production capacity of the fossil fuel facilities, and the reserves are depleting around the world. The renewable energy generation is still too low; hence the things are now going beyond the carrying capacity of the natural eco-systems(Liaison, 2012) and the assimilative potential of the natural systems. As stated about the global warming and climate change relation to deforestation, forests have been regularly cleared around the world to acquire agricultural lands. While the advances agricultural methods are derived for more production out of crop lands, including production of paddy and other such crops resulting in increasing emission of greenhouse gases like CO_2 and CH_4. These anthropogenic activities and aptitudes of mankind have increased the quantity of GHGs, which are the main elements of global warming. These greenhouse gases are responsible for the absorption of huge amount of heat and causing climatic variations and global atmospheric warming, hence disturbing the existing forests. The consequences of these changes extreme climatic events include floods, melting of glaciers, and loss of biodiversity etc. With this background, since 2000 to 2005 the estimated rate of deforestation is 13 million hac/year, according to another estimate during 1990s deforestation has caused 20% of emissions (Locatelli et al., 2008). Pakistan is a developing country situated in south Asia, on the border of Arabian Sea in south, Iran and Afghanistan in west, India to the east and China, which is vulnerable to the influence of climatic variations or climate changes.

Pakistan starches from 60° 55'to 75° 30' E, longitude and from 23° 45' to 36° 50' N, latitude, which covers an area of 796096 square kilometers. Pakistan keeps a highly variable terrain with virtually flat Indus plains, comprising deserts in the east, high mountains in the north and northwest. The west is predominantly covered by Baluchistan plateau. The surface slopes ranges from 0 m above sea level up to the Mount K_2 which is 8611m. While there is only 27.88% arable land available in the country. The cultivated area of Pakistan is about 24% of the total, out of which 80% is irrigated, 4% is covered by grazing lands, pastures and forests, about 2% is under cover and 31% is unfit for agricultural purposes (Qamar-uz-Zaman *et al.*, 2009). Pakistan's climate has variations and its tropical features ranges from mountains in the north to south where it has coastal plains. There are four major climatic categories

Khan Khwar and the feasibility reports has been completed for the other on Khan Khwarh at Karora.River Indus passes through Shangla at Besham.

Figure 1 Map showing Location of District Shangla in KP Province, Pakistan

There are many famous streams in Shangla like Khan Khwar, Chakesar stream, Karora stream, LewanayKhwar and Lilonai Stream.

1.2 OBJECTIVES:

- To document vulnerability of the forests in Shangla region with emphasis on local forest condition and consideration of contemporary challenges.
- To identify and report the important ethno-botanical and medicinal species in the local forests.

Chapter 2

REVIEW OF LITERATURE

The literature review of this thesis explains the related studies reported by various researchers and scientists in Pakistan from the year 2002-2014.

Iqbal *et al.* (2014) studied the vegetation of pine forests of Shangla District of Khyber Pakhtunkhwa Province of Pakistan is described. Thirty stands at different locations were selected in this study. In each stand gymnospermic species were widely distributed and dominated. Sampling was mostly performed by Point Centered Quarter Method (PCQ). *Pinus wallichiana* exhibited higher density 409 ha-1 with 132.1 m2 ha-1 basal area occurring in 26 stands. *Abies pindrow* occurred in 7 stands with density of 384 ha-1 and 145.3 m2 ha-1 basal area, while *Picea smithiana* attained low frequency, recorded from 2 different sites. It is shown that populations represented from the younger stands exhibited higher density.

Qasim *et al.* (2014) stated that the Swat region (including Shangla) is part of the high mountain Hindu-Kush Himalayan region of Pakistan, with diverse biophysical and socioeconomic characteristics. The region is endowed with many fragile and fragmented ecosystems but land use and land cover changes have accelerated processes with irreversible effects on ecosystems. This paper aims to provide evidences of deforestation in the context of very disparate accounts on the state of forest resources in Pakistan, and suggests realigning property rights, education and community participation. The temporal analysis of forest cover between 1968 and 2007 showed a drastic change in forest cover. In lowlands forest cover decreased by 36 % and in high elevations by 69%. Annual deforestation rates observed were 1.86% (scrub forest zone), 1.28% (agro-forest zone) and 0.80% (pine forest zone) in the respective areas of district Swat. This change in forest cover leads to destruction of ecosystems and associated livelihoods. Results of household surveys and expert interviews showed that due to lack of education / environmental awareness, and lack of alternative income sources in district Swat have been mainly linked with the health and status of the overall forest ecosystems. Another important problem is the ambiguity in ownership of forest as well as rangelands and weak enforcement of

statutory rules in the district. A multi-sectoral approach is required which needs to work alternative income sources and enhancing agricultural productivity based on the conservation of traditional crop diversity and value addition to agric-products, education and environmental awareness, efficient and effective implementation of the state rules/laws governing the forest use and protection and to solve the property rights issues in the region.

Murad *et al.*, (2012) conducted a study to collect information on traditional uses of plant resources of Hazar Nao forest, Malakand. About 90 vascular plant species, belonging to 56 families were collected and utilized by the local people for various indigenous uses. Out of these 90 plants, 72 were used as medicinal, 50 as fuel wood species, 32 as fodder plants species, 22 as edible fruit, 29 species for attraction of honey bees, 10 species utilized in agricultural tools, 11 species for fencing, eight species as timber, eight species reported as ornamental, eight species used for thatching and sheltering, seven species as vegetable and pot herb, six species were reported poisonous, four species important for veterinary medicines and 20 plant species had miscellaneous uses such as making of ropes, wooden spoons, kites, fans and brooms. Field observations showed that deforestation, over grazing, agricultural expansion and unsustainable harvesting/collection, processing and preservation of natural vegetation are the major threats in the investigated area.

Shahbaz *et al.* (2012) studied the paradigm shift in forest governance from top-down bureaucratic to participatory approach in many developing countries was made during the nineties in response to the high deforestation and inefficiency of state institutions for sustainable forest governance. In the mountainous region of Khyber Pakhtunkhwa province of Pakistan (previously known as North West Frontier Province, NWFP) the process of institutional changes in forestry sector was also started in the mid-nineties and now participation to local stakeholders has become a significant feature of the forest policy of the province. To confer practical look to the participatory forestry, village level institutions were established in the selected villages for the management of forests and carrying out developmental activities. In this background, this study attempts to assess the net correlation between participation in forest management and livelihood assets of the forest dwellers by using sustainable livelihoods framework. The results showed that there was positive relationship (net correlation) between

participation and the access of the respondents to social and natural assets, but other livelihood assets (financial, human and physical) remained unchanged. It is recommended that sustainable management of forest resources necessitates that the forest conservation initiatives should be coupled with the enhancement of financial and human capital of the communities living in or around forest areas.

Plant resource evaluation project was carried out by Shah *et al.* (2012) to investigate conservation status of some important medicinal plants of Chakesar Valley, District Shangla. Conservation status of 127 plant species was evaluated through the IUCN (1994-2001) criterion. Among these species 47 (37%) were endangered (E), 32 (25%) vulnerable (VU), 36 (28%) rare (R) and 12 (9%) species were infrequent (IF). The area had no nursery to grow the critically endangered species. The study confirmed that the area possessed great potential for cultivation and harvesting of economically important plant resources. It is been concluded that establishment of nurseries and botanical garden may be the best ex-situ conservation for sustainable utilization of plant resources of the area. While local community awareness and involvement to protect these national assets will be the best in-situ conservation measure.

Khan (2010) addressed the forest management systems and resource rights in three different geographical zones of Swat District, Furthermore; the study analyzes three peculiar historical regimes with regard to their management mechanisms, resource rights, and the transition from one regime to another. It is argued that the interplay between geography and management schemes drive the use of forest resources in the Swat District The paper makes some comparisons between informal (community) management and management by formal (state institutions) and finds that inclusion or exclusion criteria regarding resource rights laid down by a particular management system create situations that lead either to a sense of ownership or deprivation among stakeholders.

Another finding is that the management of forests in the Swat District changed from community to formal institutions which could not maintain the balance between the customary and statutory resource rights arrangements. As a result, conflicting interests created an opaque resource rights situation that prompted predatory attitudes among

the various stakeholders (Khan, 2010). The paper recommends renegotiating the resource rights regime coupled with changes in the role of the Forest Department (a state institution) from a command and control approach to that of a facilitator in the process of forest management. Developing alternative energy sources, particularly in the forested areas, may also help to conserve forest resources.

Lubna *et al.* (2009) conducted the study analyses the institutional set-up of forest management in Pakistan, focusing on the North West Frontier Province, which houses 40 percent of the total forested lands. These areas have faced significant deforestation in the past. It is feared that if nothing is done to check this process, these forests will soon disappear. The study argues for the Property Rights School of thought that the roots of environmental problems are to be traced to inadequate and could not clearly define property institutions. The study develops a normative criterion, describing the conditions that are essential for optimal utilization and conservation of a resource, to be used in assessing the present situation. The analysis indicates that there are problems in the ownership structure, in the enforcement of property rules, as well as in the current management system. This was further concluded that the present institutional set-up is inappropriate to achieve the objective of forest conservation, and changes in this set-up are suggested. The study puts forward 'collective management' as an alternative institutional set-up.

Udo *et al.* (2009) stated that the plant species producing economically valuable non-timber forest products were enumerated in the entire sample plots. Species diversity and dominance concentration indices of the different life-forms were determined using Shannon-wiener diversity and Simpson's dominance conc. functions. Apart from *Baphianitida* 46 species comprising of sixteen tree species, seventeen shrub, eight herb and five climber species were encountered. Pentaclethra macrophylla, Brachystegia eurycoma, Lasianthera Africana, Alchornea cordifolia, Palisota hirsute, Urena lobata, Plukenetia conophora etc were some of the main trees, herbs and shrubs. All of these tree species were having different populations and different growth frequency rate, which was the reason of the degradation of the forest. Enrichment planting activities, using native rainforest tree species of multiple values could help restore and sustain its natural ecological integrity.

Zia *et al.* (2009) studied the fast growing deciduous Paulownia species. A trial comprising 4 species were collected and then the study conducted at Pakistan forest institute Peshawar to access the genetic variability based on its growth parameters. Those parameters were size, height and diameter. The specie was top ranking differences in the tested traits among the 4 species. The phenotypic and genotypic variations were higher. Based on findings it is concluded that *P. catalpifolia* and *P. tomentosa* may be more appropriate in species improvement program and for further field cultivation.

Babar *et al.* (2009) conducted a study on Agro forestry to fulfill/overcome the scarcity of fuel wood and timber of rural communities in arid and semi-arid mountainous areas of Bunji, a small village of Gilgit-Baltistan, Pakistan. Due to high rate of deforestation land fragmentation of 1.3 per capita had been occurred during the past 15 years, so a remarkable change had occurred in land use pattern. Land for cultivated had been reduced to 2.3% per year. The annual domestic energy consumption in Bunji was about 5234 Kg per year. About 98% fuel wood users were there and a small community used other resources like LPG and kerosene oil etc. Hence he conducted this study on some plant species i.e, Poplus specie to grow in that specific area just to overcome all these hurdles and scarcities.

Ghulam *et al.* (2009) studied *Acacia sp.* along with its basic data for the assessment of its various technological properties. He took samples of the specie as its cross, radical and tangential sections were prepared in lab. *Acaciaampliceps* wood, the fibers are medium in length and reasonably thick-walled. The wood rays are higher in frequency and a bit larger in size. The wood can be used in different products. Preservative treatment of wood before utilization may be required to increase the service life. However, the process of preservation and seasoning of wood may be slow.

Nafees *et al.* (2009) conducted a study on Tara-Gat mountains which is situated in lower region of swat for social aspects and to give some guidance for future afforestation activities. Focused group discussions and structured questionnaires were arranged and some interviews were also taken form different walks of life. This area was afforested in 2002 and was then banned by the forest department for wood cutting for 5 years after consultation with local people. Due to the ban the locals having adjacent livelihood with the forest area made some newly areas as their personal

property, so a conflict arose. Consequently the other communal owners started cutting the trees in the restricted area which results in heavy deforestation that continued till the mountain became barren again. It was concluded from the study that to avoid such happenings there should be emphasis on social context. Furthermore interests of all the stakeholders must be addressed by providing corresponding legislative coverage.

Tanveer *et al.* (2009) accomplished a study on the phytosociological analysis of the state of existing vegetation in reserved forest of Margalla hills national park, basically aimed at vegetation cover, stood 78%, shrubs and grass cover in total 79 vegetative species, however unidentified forage productivity remained 1160 kg/ha. Pressure and threats to the park and specific areas are directly and indirectly increasing day by day. Some of the pressure is anthropogenic, population increase, overgrazing and some environmental pollution like water contamination and forest fires. Forest fire occurred 1-2 times per year. All these factors showed that vegetation is declining day by day in the study area.

Muslim *et al.* (2009) conducted a research on medicinal plants in order to allocate different alternative resources to increase demands of population who were dependable upon forests and other non-renewable resources. Nigella sativa is a well-know medicinal plant which is also used in treating different diseases. This study was conducted to increase the production of this specific specie by applying different fertilizers and especially the optimum amount of NP fertilizer which increase the yield of this specie and thus give maximum benefit to the farmers in an easy way. The study revealed that the specie shows maximum yield on the application of 275 Kg/Ha of NP fertilizer.

Gideon *et al.* (2008) studied deforestation in the North western part of Pakistan is a long standing problem. The Forestry Department, as formal managers of the forest resources, has been undergoing along reform process aimed at improving its performance. This reform process has not resulted in less deforestation. From the policy perspective this has been leading to stated intentions to further reform the Forestry Department, the question is whether organizational reform is the answer. We think there are more limiting bottlenecks to sustainable forest management in Pakistan. De facto property rights are not as simple as denoted by statutory law. In this article we explore the mechanisms behind the try to uncover mechanisms to

reverse the process. Although our conclusions are not very optimistic, we provide a framework for determining the bottlenecks in the management of common resources from the perspective of institutions. We show that in circumstances where institutional change is necessary we are faced with a trade-off between the transaction costs related to the enforcement of "improved" institutional arrangements and the transaction costs improving enforceable institutional arrangements. Incurring these transaction costs only makes sense if the benefits from improved institutional arrangements outweigh them and the transition costs. When we relate this dilemma to the management regime of the forest in Northwest Pakistan, we identify at the one end of the spectrum the ideal forest management system; at the other end we see the spontaneous evolution of self-organization. The current situation is an intermediate form with an incoherent set of external interventions and strategic reactions by different agents in the local communities. The emergent system of management is the one producing the present dismal outcome Gideon *et al.* (2008).

Sarfraz *et al.* (2008) conducted research work in Dera Ismail Khan District, KP, Province (Pakistan) during 2005 - 2006. The study was focused for documentation of traditional knowledge of local people about use of native medicinal plants as ethnomedicines. The method followed for documentation of indigenous knowledge was based on questionnaire. The interviews were held in local community, to investigate local people and knowledgeable persons, who are the main user of medicinal plants. The ethno-medicinal data of 35 plant species, belonging to 29 genera of 23 Angiospermic families, were recorded during field trips of the area. Among them the 4 families belong to monocot and 19 families are of Dicot. These indigenous plants were used as traditional phytotherapies for the control and treatment of various diseases. About 51 traditional phytotherapies were investigated from the inhabitants of the area.

Ibrar *et al.* (2007) conducted a study in the Shangla region targeted the ethnobotanical parameters of the pastures. Data was collected on 97 plant species from Ranyal Hills District Shangla, Pakistan. These plants were classified for their traditional medicinal and economic uses. Many of these plants have more than one local use. There were 37 fuel species, 37 forage/fodder species, 31 medicinal species, 18 edible species, 12 species used for making shelter, 10 vegetables species, 9poisonous species, 7

ornamental species, 6 timber wood species, 4 furniture wood species, 4 species used for fencing, 4 honey bee plants, 3 species for agricultural tools, 2 species used as flavoring agents,2 species for making mats and baskets, 2 species used with religious belief , 2 species for cleaning teeth, 1 species as tea substitute,1 fiber yielding species, 1 species as adhesive, 1 irritant species and 1species for making pens, used mainly to write on the wooden boards, as an ancient method.

Another study related with the development in the past for which traditional historic approach has always been proved a suitable methodology. So this approach has been followed while working for the present study. Besides, the descriptive/analytical method has been used in the present study to provide the readers with an analysis and evaluation of the developments in respect of forests in the areas comprising the ex-Princely State of Swat and Kalam so as to reach to some valuable conclusion. Being a scientific study, emphasis is given on the archival record within the North-West Frontier Province. Most of the primary and secondary sources are available in published and unpublished state in the District Record Room, at Gulkada, Swat; Directorate of Archives and Libraries, Peshawar; Tribal Affairs Research Cell, Peshawar; Library of the Pakistan Forest Institute, Peshawar; and the Author's Personal Collection, which have been liberally consulted. A number of personnel and functionaries of Swat State, who served in different capacities and important posts and other persons have also been interviewed. Hailing from the soil, the personal knowledge since early life, gained through personal observations, discussions and other means, have also given an insight to the understanding and the judgment of various dimensions of the management plan, conservancy and exploitation of the forests during the pre- and State eras (Sultan-i-Rome, 2005).

Suleri *et al.* (2002) discuss the overall condition and current status of forests in Pakistan using the Pressure-State Response framework (PSR). This framework links pressures on the forestry sector-as a result of human activities-, with changes in the state (condition) of the forests. In this connection different pressures and their impacts on forestry sector are discussed. The responses of society to mitigate the pressure or to improve the conditions of forestry sector by instituting environmental and economic programmers and policies are analyzed. The main finding is that the present responses are insufficient as well as poorly implemented. Legal/institutional/ and

policy reforms alone are not the answer to the pressure being faced by our forestry sector today. Good laws and policies are useless without a political and administrative will to break the status quo. Further it should be realized that community participation is a must for sustainable forest management. They suggested that this would make forestry an instrument of the policy rather than its objective, thus leading to achieve the sustainable livelihood and reducing the pressure on forestry sector.

Babar *et al.* (2010) Farming in the mountain areas has always been a challenge for agri. extension workers and researchers. The mountainous areas of most of the countries are usually among least developed regions and the mountain communities largely depend on farming for their subsistence. At the same time harsh weather, remoteness, scattered population, underdeveloped infrastructure etc. are some of the key factors hampering the better agricultural productivity in such areas. In this perspective the main objective of this paper is to underline some of the factors hindering the agricultural productivity and effective agri. extension services in the mountainous areas of Khyber Pakhtunkhwa province of Pakistan. Both qualitative and quantitative methods were used for the purpose of data collection. Key informants as well as focus group interviews and participant observations were included to acquire qualitative data. Quantitative data were collected through a well-structured questionnaire. The revealed that small land holding, lack of access to bank loans, lack of female extension workers and subsistence farming are found to be some of the key challenges for effective agri. extension service in the area.

Hussain (2009) carried out this study to find the effects of weather and climate on protected and unprotected wood samples of four low value wood species i.e, *Ailanthussp.*, *Sapindus mukorossi*, *Cedrela toona* and *Ficuspalmate* collected at various locations from Azad Kashmir. Different sizes of these species were prepared from each species and partitioned into two portions i.e, coated and uncoated. This process of coating was done with commonly used five finishes in woodworking. Wooden plates were kept for one year in outdoor natural climatic conditions and data of climatic factors and wood weathering was recorded. Results revealed that all the finishes gave a good protection to wood species against natural weathering when compared with uncoated area. The maximum natural and induced weathering resistance was observed in *Cedrela toona* and *Ficuspalmate*.

Chapter 3

MATERIALS AND METHODS

3.3.1 Description of Study Area

Shangla is an administrative district of Khyber Pakhtunkhwa province of Pakistan. Shangla is a mountainous region, located amongst the foothills of the Hindukush mountain range. Most of the Shangla region's eastern slopes drain into Khan Khwar River which is a tributary of the Indus River, making the boundary of the district with Mansehra District. The surface area is mostly undulating with thick forests, high alpine meadows and infrequent flat plains in the middle of the valleys. Shangla is located in the moist temperate zone, where the climate is highly influenced by various factors including latitude, altitude and in July and August by the Monsoon. While in the winter the western disturbances and cyclonic currents arising from the Mediterranean region influence the precipitation and overall climate of the area.

Some high altitude areas of the Shangla district are under thick forest cover, while previously most of the area was reported to have forest cover even at the lower altitudes. This information is retrieved from the forest records and maps of the study area. The average annual precipitation in district Shangla ranges from 1000mm to 1200mm per year, distributed among three rain-bearing seasons winter rains, spring rains, summer rains. The average elevation of the district is 2000 to 3000 meters above sea level. The highest point (3,440 m) is near KuzGanrshal in the north of the district. The cultivated area is 423.6 sq km (104,700 ha) out of which only 30.75 sq km (7,600 ha) is irrigated and the remaining 392.85 sq km (97.080 ha) is rain fed. The Shangla is known for diversity of natural resources that are water, forest, medicinal plants, minerals and wildlife all based on its forests.The total forest area is approximately 32% according to the forest department's record. The most forest cover is represented by Fir/Spruce, Deodar and Blue chair pine. The forest covers at the area of 98468 ha. Earthquake damaged the forest sector in 2005 and about 46.6% is affected. About 83.3% of irrigation systems were directly damaged.

3.3.2 Area:

The total area of the district is 1586 kilometers square.

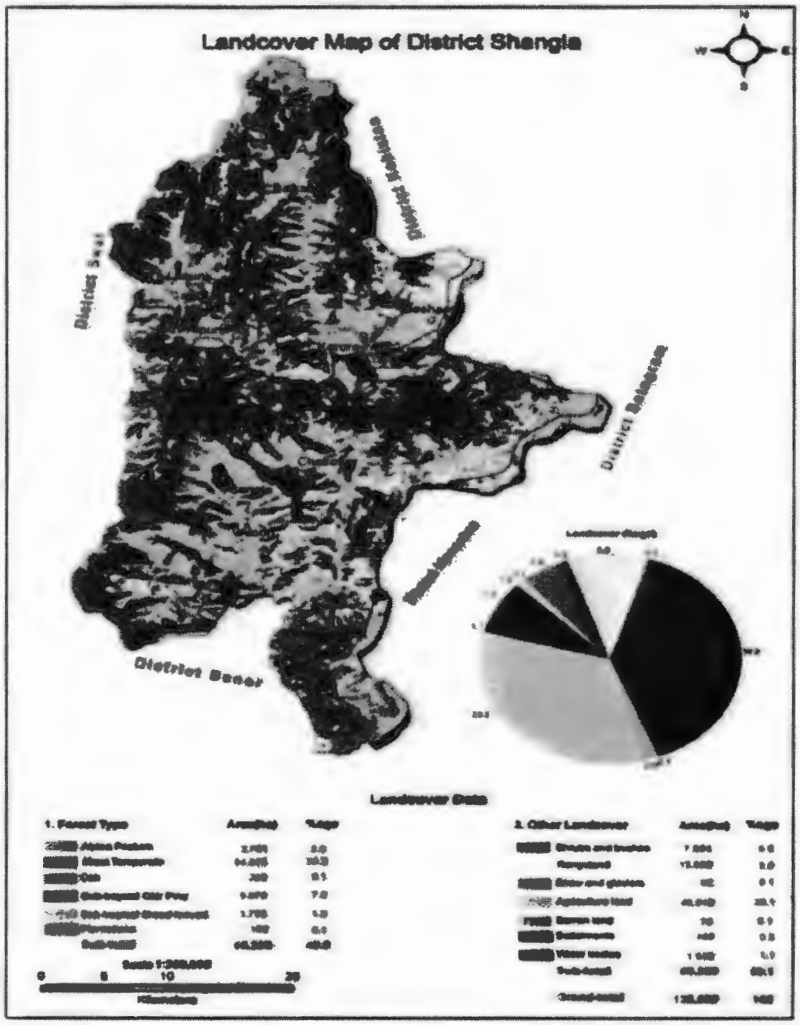


Figure 2Map showing Land Cover (land distribution) in District Shangla. Pakistan Forest Institute (PFI)

3.3.3 Physical Features:

District Shangla has very unique situations having hill rocks and high mountains where some parts are having a little bit forests as forests are a great source of income for the livelihood of the residents.

3.3.4 Topography:

The topography of Shangla is dominated by high mountains and narrow valleys. Elevation of district Shangla above the sea level is about 2000-3000 meters. Kuz Ganrshal is the highest point about 3440 meters. Forest covers mountain slopes and elevations and there are narrow valleys which allow a little bit agriculture activities.

3.3.5 Geology, Elevation and Soils:

The main ridge of the mountains forming the watershed between the swat and the Indus rivers runs from north-east to south-west. A number of spurs jutting out of this main ridge run mostly from west to east, ending at the River Indus. The elevation vary from about 468 meters near AkhunbaabaZiarat in the south-east of Martung forests to 4,464 meters Kata kandao in the northern part of kana.The peaks having great values are kicharGhar 4,465 meters, TaakhGhar, 4332 meters, YaakhGhar, 4179 meters, DobandiGhar, 4063, KopraSar 3278 meters and lilownighar 3181 utilized for agricultural purposes. The forests are found mainly between elevations 1828 meters and 3049 meters in the Kaiil (PinusWillichiana) and silver fir (AbiesPindrow) zone in the Alpuri forest division .the lower limit comes down to about 762 meters in the Chir forest. Moderate to more steepy slopes are a common feature of the district. At many places the cliffs culminate in sharp precipices. The surface configuration is generally rocky and uneven. Snow slides occur commonly in the higher parts of the Alpuri forest Division. At sheltered places in the upper reaches of Kana and lilownaiKhuwars, snow does not melt completely and is found all the year round.

3.3.6 Climate:

The climate varies from subtropical to sub humid temperate and alpine. Various components of the climate are discussed as under:

3.3.7 Humidity:

The average monthly humidity percentage collected at saidu sharif observatory is reproduced as below:

Table 1: Average monthly humidity percentage at Saidu Sharif.

Month	Humidity % at		Month	Humidity % at	
	3a.m	1200 noon		3 a.m	1200 noon
January	83	68	July	85	53
February	77	61	August	90	62
March	75	64	September	90	66
April	84	70	October	89	62
May	75	60	November	88	58
June	75	54	December	88	55

3.3.8 Temperature:

Temperature variations are different in every month of the year and also during the same months observed at different stations of the district. It is observed that from January onwards the temperature rises steadily up to June where it declines gradually with onset of monsoon rains till-September to January, mean minimum temperature during the cold December and mean maximum temperature during the hot June recorded at Meteorological station Saidu Sharif is 11.7°c and 37.7°c respectively.

3.3.9 Precipitation:

Precipitation may occurs both in the form of rain, snow and hail depending upon the temperature. There is no meteorological station in Shangla, therefore, the data of temperature, precipitation and relative humidity recorded at the nearest station Saidu Sharif are given below:

Table 2: Averages monthly rainfall recorded at Meteorological observatory at Saidu sharif for the year 2015.

Months	Rainfall		Months	Rainfall	
	Mean total mm	Heaviest fall in 24 hrs mm	Months	Mean total mm	Heaviest fall in 24 hrs mm

January	40.1	26.7	July	82.0	30.5
February	42.1	70.6	August	14.39	54.0
March	118.3	20.8	September	28.6	10.5
April	230.1	42.1	October	59.2	13.3
May	119.3	49.9	November	49.5	27.0
June	78.3	21.1	December	14.7	7.9
			Total	**876.59**	

3.3.10 Drainage:

The entire area of the Alpuri Forest Division drains out directly to Indus River The most important among these drain out areas is the Khana-Ghurbandkhwar which drains Khana, Alpuri, Lilunai, Pagorai, Kormang, Upal and part of the Shang areas. Next in the importance is the Itaikhwar which drains Puran, part of the Martung and the northern part of Chagharzai of Buner District. The rest of the area, viz, Besham, Chakesar and Martung area directly drained by the river Indus. All these tributaries being fed by snow and springs are perennial.None of these Khwars is fit for floating of logs or sleepers. Wet slides can, however, be constructed in the main tributaries of the Kana-Ghurband, i.e, Kana and GhurbandKhwars.

3.3.11 Agriculture and related sectors:

Most of the local people of the area relay on agriculture. The agricultural area is very fertile but people holding very small area as compared to the owners. Many types of crop are grown in different parts of the district like Maize, Rice and Wheat, these crops are grown by the majority of the inhabitants. Barley and sugarcane are also grown but very rarely. Vegetables like lady-finger, spinach, bean, potato, radish, turnip and peas are grown for domestic consumption. Desi ghee and honey are also a great source of income of the locals.

3.3.12 Horticulture:

The main fruits grown in the district are apple, walnut, plum, pear, Amlook, mangoes, guava and apricot. Furthermore, a great quantity of goojee (an expensive mushroom) is exported to foreign countries.

3.3.13 Livestock:

The major sources of milk production are Cow, buffalo and goat. Sheep is of more importance because wool has been consumed locally in manufacturing of blankets and other goods.

3.3.14 Flora:

There are a number of timber and non-timber species existing in the area, while the main forest type is coniferous forest, dominated by the Chir Pine. Along with the large sized forest tree species some smaller shrubs of economic value are found to exist in the area, mostly these shrubs are used as fuel wood. Among non-timber forest products there are some herbs and shrub species with great economic and medicinal value e.g. root of *Barberis* is used locally in several medicinal preparations, while bark of Chir and Oak is used in the curing of skin ailments.

Table 3: List of plants having economic and medicinal value found in District Shangla

Local Name	Family Name	Botanical name	Uses
MusliSufaid	Liliaceae	*Aspargus sp.*	Treating liver disorders
Afsantheen	Asteraceae	*Artemisia sp.*	sweetening agents
MoshkiBala	Valeriancaea	*Valeriana sp.*	*Curing Insomnia*
Banaffsha	Violaceae	*Viola serpens*	*Used in Tincture*
Khatmi	Malvaceae	*Althaea officinalis*	Anti-inflammatory
Unaab	Rhamnaceae	*Elaegnus sp.*	*Prevent malaria*
Sarba Zailay	Ranunculaceae	*Aconitum heterophyllum*	*Used as a Tonic*
Sumbal	Adiantaceae	*Adiantum incisum* Forsk.	*Used in Asthma*
Tarwa pana	Polygonaceae	*Bistorta Bistorta*	*Remove worms*

Ghoz/ Akhrot	Juglandaceae	*Juglans regia*	Flavouring agents
Nazar pana	Rutaceae	*Skimmia laureola*	*Perfume industry*
Gujae	Halveliaceae	*Morchella esculenta*	*Antibiotics*
Kakora	Podophyllaceae	*Podophyllum hexandrum*	*Anti-fungal*
Jabai	Plantaginaceae	*Plantago lanceolata*	*Cure dysentery*
Ghata jabai	Plantaginaceae	*Plantago major*	*Used to stop bleeding*
Nor-e-Alam	Liliaceae	*Polygonatum*	*Cure epilepsy*
Ghra Chai	Lamiaceae	*Thymus linearis*	*Stomach disorders*
Sra zela	Geraniaceae	*Geranium wallichianum*	*Cure diarrhea*
Prewathe	Araliaceae	*Hedera nepalensis*	*Used as a best tonic*
Asli Mamera	Primulaceae	*Primula denticulata*	*Antiviral*
Ghra Gulab	Rosaceae	*Rosa webbiana*	*Used in sleeping pills*
Shalkhey	Polygonaceae	*Rumex dentatus* L.	*Anti-tumor*
Inzar	Moraceae	*Ficus carica* L.	*Cure diarrhea*

Source: Working Plan of Alpuri Forest Div 2007-08

3.3.15 Fauna/Animals:

The important wildlife species include some of the large ungulates, Cats and Bear species representing a typical Hindukush-Himalayan biodiversity.

Table 4 List of Fauna in District Shangla

List of Fauna in District Shangla	
Local Name	**Scientific Name**
Leopard	*Pantherapardus*
Wolf	*Canis lupus pallipes*
Bear	*Lepus nigricollis*
Rhesus monkey	*Maacamulatta*
Blue pigeon	*Columba Livia*
Spotted dove	*Streptopeliachinensis*
Chakkor	*Alectorischukar*
Himalayan snowcock	*Tetracollushimalayayensis*

Monnal pheasants	*Lphororusimpejanus*
Kocklas pheasants	*Pucrasis macro*
Kalij pheasants	*Lophuraleucomelana*
Stray tragopan	*Tragopansatyra*
Hoopoe	*Lupupaepops*
White breasted king fisher	*Haleyonsmyrensis*
Indian robin	*Saxicloidesfullicota*

Source: Working Plan of Alpuri Forest Div 2007-08

3.3.16 Irrigation/Civil water courses:

Canal system is not the prominent one in the entire district, although irrigation of the lands has been done through small civil water courses which flow from various streams and as such the water for irrigation is supplied through these small water courses.

3.3.17 Forestry:

The area is very rich in forests. The forests are situated mainly between elevations 1829 to 3048 meters above the sea level in Kail (pinus-wallichina) and silver fir zone in the Alpuri forest division. The lower limits come down 762 meters in the Chir forests. All the forest is looked after by the forest department. The total area of the forests is about 98,000 acres. These forests are subjected to injuries by climatic factors like snow, wind, light, drought, erosion and biotic factors such as grazing, browsing lopping and grass cutting. Torch wood extraction, illicit filling, encroachment, fires and smugglings are also dangerous factors. Some injuries are caused by wild animals, insects and fungi.

3.3.18 Fuel Used:

Fuel wood is one of the main forest resource utilization in the study area, its use is increasing day by day with the increasing population, harsher weathers and changing lifestyle influencing the resource utilization pattern and rate.

3.3.19 Rights and Concessions:

Although the Pakistan forest act, 1927 has been extended to the area yet it could not be implemented in letter and spirit for political and economic reasons.

The privileges enjoyed by the local population are as follows:

1. Free grazing of domestic animals.
2. Free collection of brush-wood and fire wood.
3. Free grant of constructional timber to the concessioners.
4. The land owners realize a fee from Gujar nomads for in response to use their lands for agricultural activities grazing their Cattles, called Qalang.
5. Land owners are entitled to receive 60% share from the sale produced from the forests which are near to their lands in the adjoining valleys.

3.2 Data collection:

Data was collected through primary and secondary sources.

3.2.1 Primary data collection:

i. On site reporting of Medicinal plants:

Selected sites with degraded forest lands and sites with recent degradation of the forest or new forest trails/road construction sites were visited in district Shangla in order to observe and assess the main reasons for forest density reduction in different parts of the study area. Medicinal and economically important species were also recorded in these study sites, along with their uses as described by the local people and herbalists. The data was recorded on the field notes, compiled and the medicinal and other economical uses of these species were recorded. Verified by expert recorded consultation with the known local Hebraists and Hakims, detail method is as follows:

ii. Vegetation survey:

Frequent filed surveys were conducted during June, 2015 to May, 2016, with a frequency of three to four visits per month. All the data was gathered by direct observation and replication of field visits of the selected forest sites. The native flora

was recorded by visiting field sites and information was recorded. In some parts where the diversity was high line intercept method was utilized to record diversity of the herbaceous species. However, most of the sampling was confined to the large forest tree species/trees making most of the cover. In addition to the above mentioned sampling, the data was also collection regarding different ethno-botanical aspects. Data and plant samples/specimens were gathered from different selected sites by arranging meetings, interviews, dialogues and discussions with rural people, hakims and shepherds, e.g. local name; parts used and categories of individual species. About85 individuals were interviewed belonging to different age groups. Plants were classified on the basis of their economic value, medicinal, fodder, fuel, ornamental. The plant specimens were collected, pressed, dried and mounted on herbarium sheets and identified with the help of floristic literature (Nasir & Ali, 1970-1989; Ali &Nasir,1990-1992; Ali & Qaiser, 1992-2009). The correctly identified specimens were placed in the herbarium of Pakistan Museum of Natural History (PMNH)

iii. Household survey:

Household surveys were conducted to obtain the socio-economic characteristics, perceptions on the forest use and the reason for its degradation and its impacts on the environment and climate variability and seasonal weather patterns of the district and the adjacent areas. Based on the sample frame, a total of 200 households were sampled from the communities to participate in the survey using structured questionnaire.

iv. Focus group discussions (FGDs):

In order to get qualitative information which could not be effectively captured by the survey instrument/s (questionnaire), participatory approach was employed. Such approach gives an insight into the local socioeconomic conditions, dependability on forest resource and other related parameters. The research scholar being part of the same community had the advantage of a better understating of the prevailing conditions, leading to a better assessment of the overall vulnerability assessment of the local forest resource.

v. Key informant's interviews:

The interviews were conducted from the community leaders and with the wildlife officials. The interviews were consists of structured questions regarding deforestation, impacts of deforestation on the locals and other natural resources.

One component of the ethno-botanical study also included medicinal and economically important plant species survey from herbalists/Hakeems etc.

3.3 Secondary Data Collection:

The Forest office of District Shangla and forest Subdivision of Alpuri were visited. Forest department's afforestation drives/plans, and available records for the selective logging, clearing of forest for the road infrastructural development, and other such forest records were gone through, to have an idea of the resource base of the forest and to assess an overall conservation status and current situation of the forest.

Image Classification:

Satellite images were thoroughly checked for cloud free data and downloaded from United States Geological Survey (USGS) website (http://www.usgs.gov). Pre-processing steps like Layer stacking and radiometric calibration were done. Layer stacking was performed using ERDAS 2014 to produce a single multispectral image file that combines separate image bands into a single image. To analyze spatiotemporal Land Use Land Cover (LULC) change, Landsat imagery of 15, May 2000 and 13, June 2016 were selected. These datasets were processed using supervised classification technique in ERDAS (2014).The selected images were processed and differentiated into classes. The classes were Dense Conifer, Mix Broadleav-Conifer, Mix Broadleav/Scrub/Shrubs, Grasses/Shrubs, Agriculture Land, Soil/Rocks, Snow/Glacier, Water, and Clouds/Shadow

The indexes, Normalized difference water index (NDWI) and Normalized difference vegetation Index (NDVI) were specified.

The Classified LULC maps were generated after the classification using ArcGIS 10.1 and analyzed by change detection method. The accuracy of change in classified maps is dependent upon the individual classification (Dewan and Yamaguchi, 2009). Lastly, the change detections maps were generated.

3.4 LULC Classification of Shangla valley:

Spatial distribution of Land use / Land cover information and its change is desirable for any planning, management and monitoring programmers at local, regional and national levels. The methodology involves the supervised classification with the help of ERDAS Imagine 10.0 software. All satellite data used were Landsat Thematic Mapper images that were downloaded from http://glovis.usgs.gov/. Processing was done using all reflective bands. The satellite imagery was handled with the softwareERDAS Image 2011. Further data processing was handled in ArcMap. Data processing took the following steps:

I. Georeferencing and collecting ground truth data
II. Classification of the current state
III. Classification of the former state
IV. Accuracy assessment
V. Results

Chapter 4

RESULTS AND DISCUSSION

District Shangla is known for its thick forests and rich biodiversity; few decades ago the district was very much known for several endemic species and biodiversity hotspots common all around the area, with species richness for forest and wildlife. The major cause of damage to the forest is reported as the timber and fuel wood harvesting at a medium to large scale level in past, but now this activity is at its peak for the last several years, while the medicinal plant extraction was also practiced by local herbalists and collectors at local level, damaging the forest land cover, and undergrowth, essential for the soil binding and keeping the forest soil healthy and intact (Razaq et al., 2010). Use of the natural resources has been an ancient practice in all human societies; especially the resources from the forests and range lands are one of the prime dependence of the mankind. Forest can be taken as a land with a canopy cover more than 10%, an area extended across greater than 0.5 hectors, consists of trees with stature above 5m. Forests rendered various tangible and intangible services like food, shelter, timber for construction and as fuel, clean water, recreation, medicines, wildlife habitat and the regulation of hydrological cycles (Malmsheimer*et al.*., 2011). Forest plays an important role by giving employment to about 60 million people across the world, similarly the human populations in our study are dependent on forest (Razaq *et al.,* 2010). According to a survey report estimation that over 1.6 billion inhabitants across the globe depend directly on forests for their livelihoods. Currently almost three billion people extract fuel for heating and cooking from the forests, while in our study area the local population is completely dependent on the forests for the same (Kruseman and Pellegrini, 2008).

The questionnaire based survey in this study about ethno-botanical and ethno medicinal parameters showed that majority of the local people (97%) were with a belief to use medicinal plants as shown in **figure 3**.

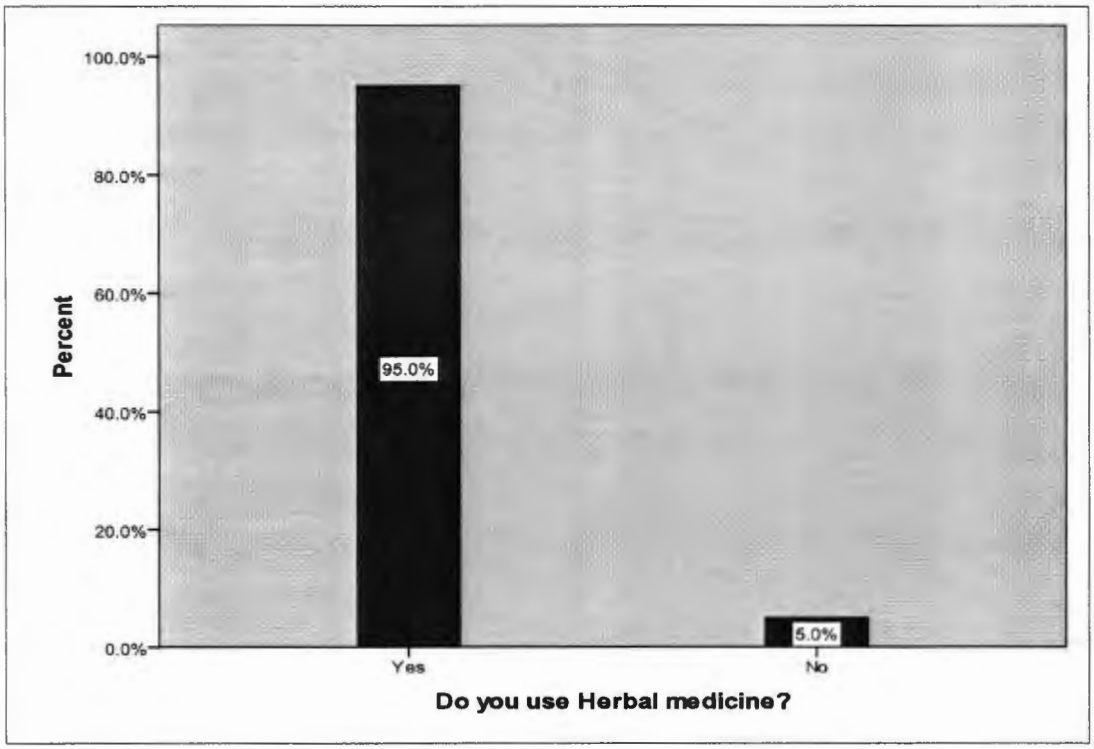


Figure 3: Percentage response about use of herbal medicine by local populations in District Shangla.

According to World Health Organization report (2002), 70% of the world population use medicinal plants for curing diseases through their traditional practitioners. In sub-continent, plant oriented drugs are used extensively and from a very long time. According to a survey conducted by W.H.O., traditional healers treat 65% patients in Srilanka, 60% in Indonesia, 75% in Nepal, 85% in Mayanmar, 80% in India and 90% in Bangladesh. In Pakistan, 60% of the population, especially in villages is getting health care by traditional practitioners (Hakims), who prescribe herbal preparations (Haq, 1983).The survey also revealed that most of the people about 55% living in District Shangla mainly use the herbal medicine on their own experience or as directed by the elders in the family (ref), without consulting a Hakeem or herbalist while 45% preferred to consult Hakeem for prescription as shown in **figure 4.**

The survey results showed that the local people about 43% use medicinal plants for a number of reasons in different health problems of low severity. Out of these people some were also found to visit doctor/hospital in extreme ailment cases like surgery, accidents, births etc shown in **figure 5.**

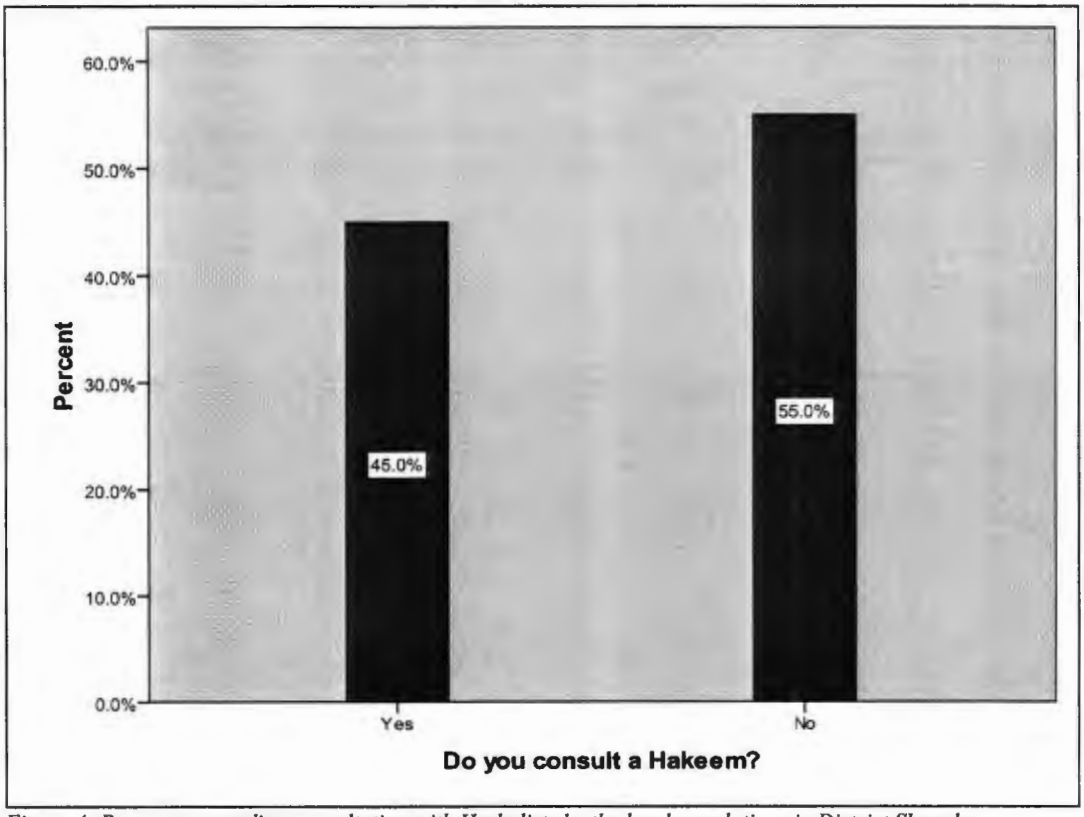


Figure 4: Reponses regarding consultation with Herbalists by the local populations in District Shangla.

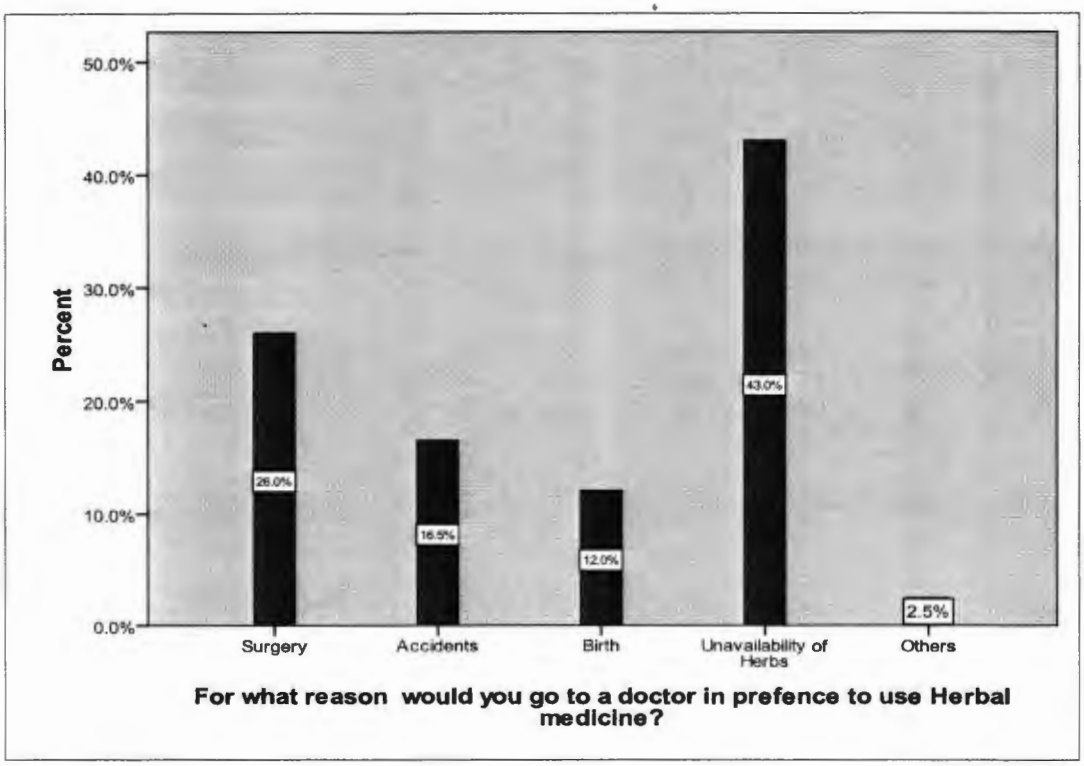


Figure 5: Response % of respondents reasons for deviation from the herbal medicinal system in District Shangla.

Instead of the vital role of women in the household responsibilities they usually help in medicinal plants collection but due cultural values in District Shangla It was found in the survey that for herbal collection mainly men use to go to forest and collect the medicinal and economically important plants according to the need and seasoning as shown in **figure 6.**

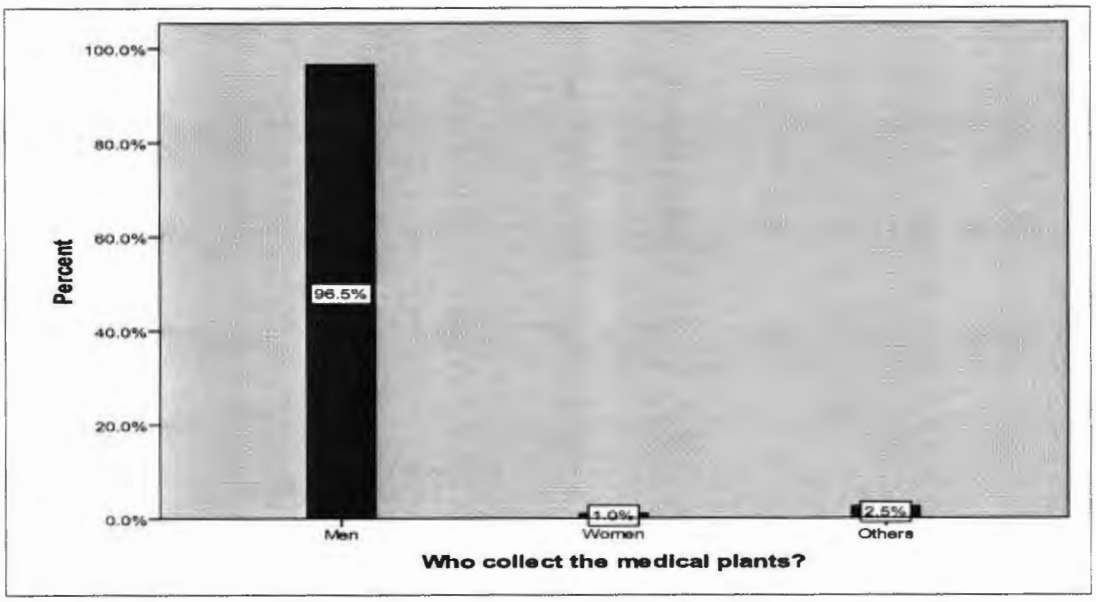


Figure 6: response about collectors of the medicinal plant materials in District Shangla.

The information regarding medicinal use of plant species also indicated that the native people of the area were aware of the most facts about collection and origin of medicinal species and it was found that 72% of the medicinal plants are obtained from wild sources while only 27% seemed to be cultivated as shown in **figure** 7.

The results also showed that Most of people also knew the flowering and maturity season of these plants. And reported about 82% of the medicinal plants comes to flowering in spring season. Based on the increasing population, lack of health facilities and demand of the medicinal plants, there is an increasing trend for the cultivation of the medicinal species in the local fields, yet over 70% of the medicinal plants used locally were yield from the forest resources (fig.8).

The results revealed that People of District Shangla were having a sound indigenous knowledge about the preparation and use of medicinal plants for certain ailments and reported that leaves and fruits are commonly used followed by stem roots ètc as shown in **figure 9**.

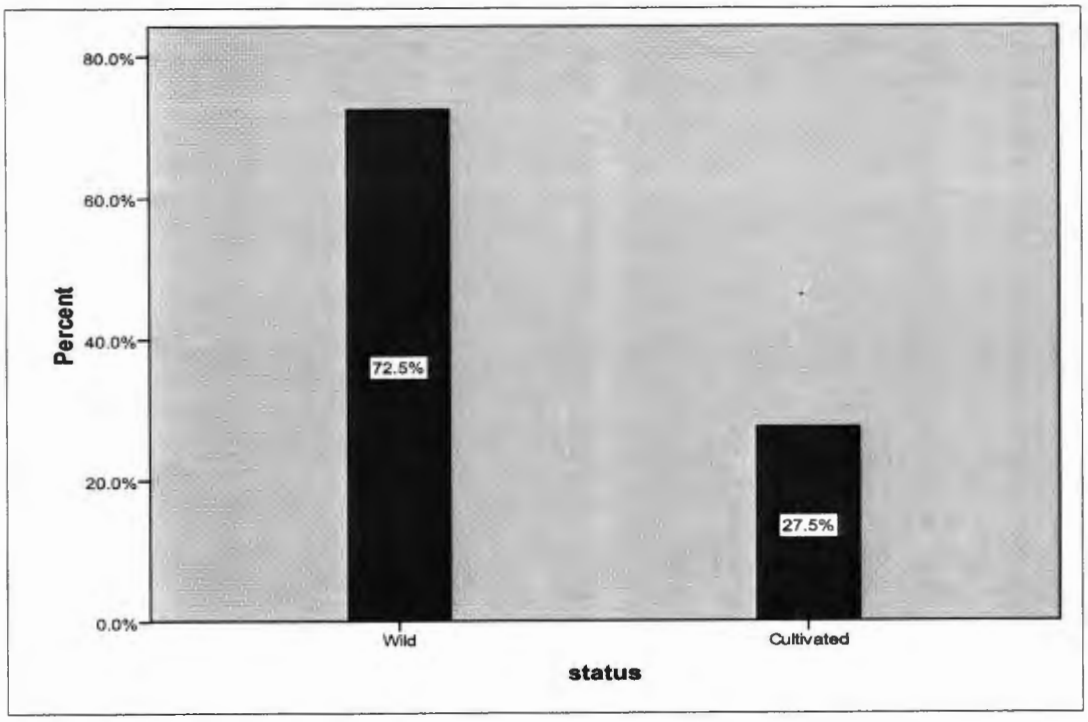


Figure 7: Response % of respondents about medicinal plant sources and cultivation status in District Shangla.

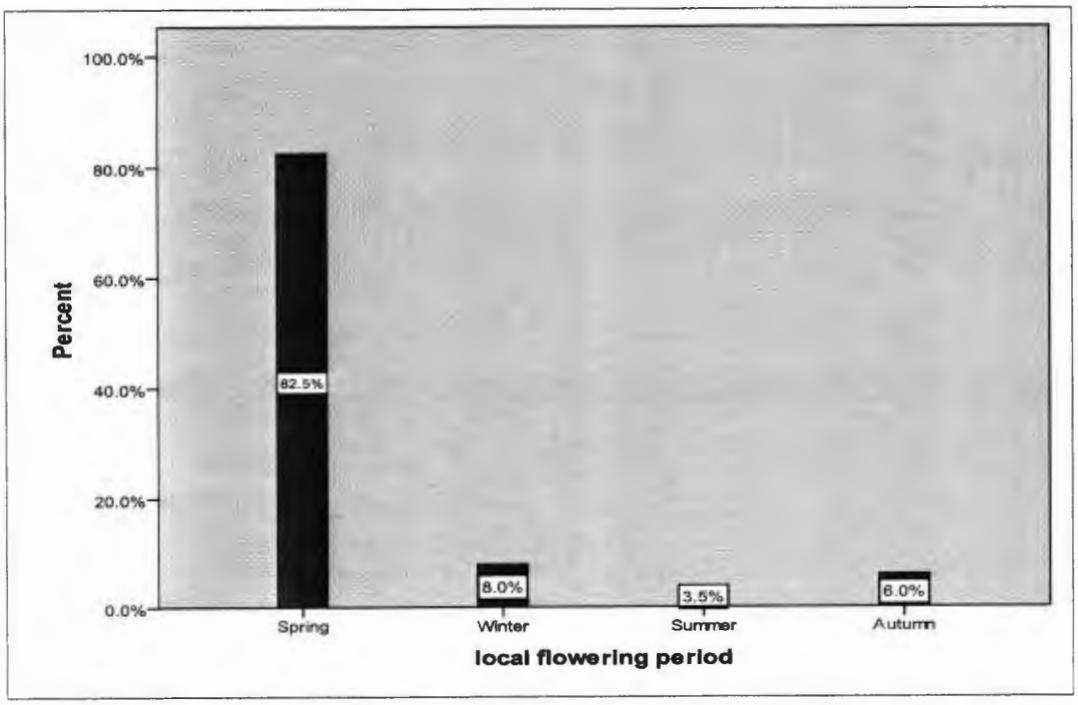


Figure 8: Respondents perception about medicinal plant collection and Flowering season in District Shangla.

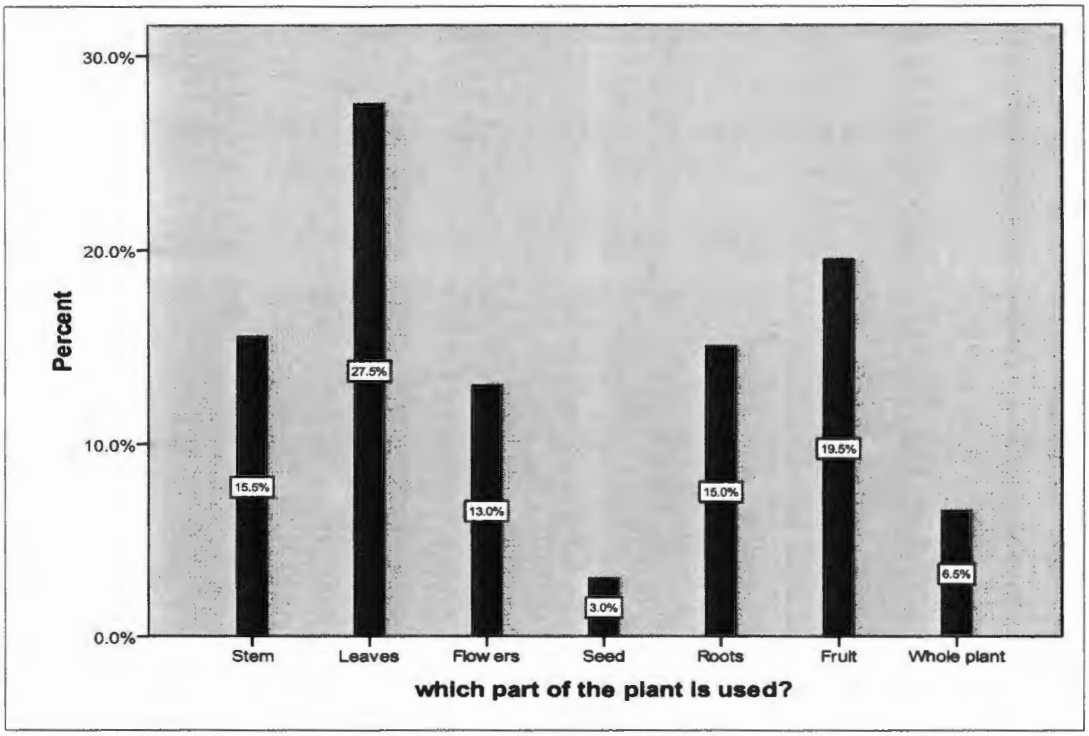


Figure 9: Respondents information of plant parts used in local medicine in District Shangla.

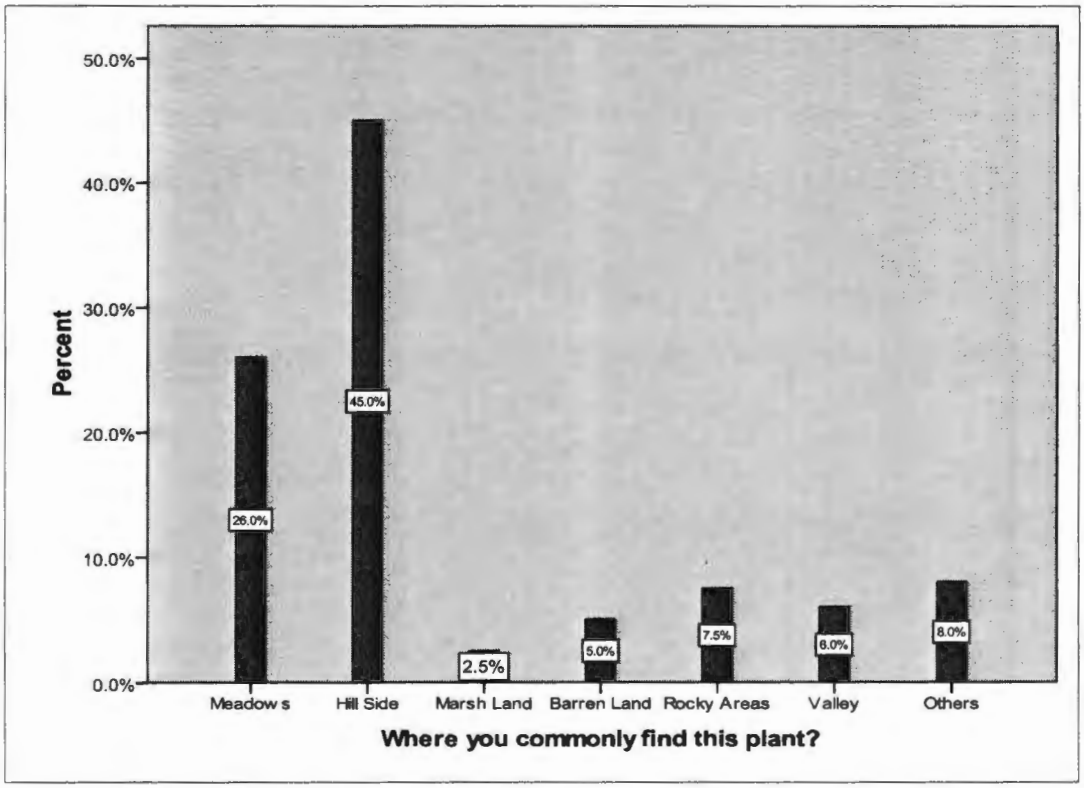


Figure 10: Information about collection sites for the medicinal and ethno-botanical species in District Shangla.

Pakistan has an arid climate and is rich in medicinal herb, scattered over a large area. There are about 600 plant species identified as having medicinal values (Shinwari,1996).The survey indicated that the medicinal plants are commonly found in hill sides and meadows in District Shangla shown in **figure 10.** Where they can be collected easily for different purposes and hence shows the importance of forests and meadows in medicinal plants production in wild.

The collection of medicinal plants in a sustainable manner is an integrated process with potential for development and conservation (Hall & Bawa. 1993).The results showed that Like in other parts of the country medicinal plants collection is at peak in summer and spring seasons in District Shangla followed by winter and late summer as shown in the **figure 11.**

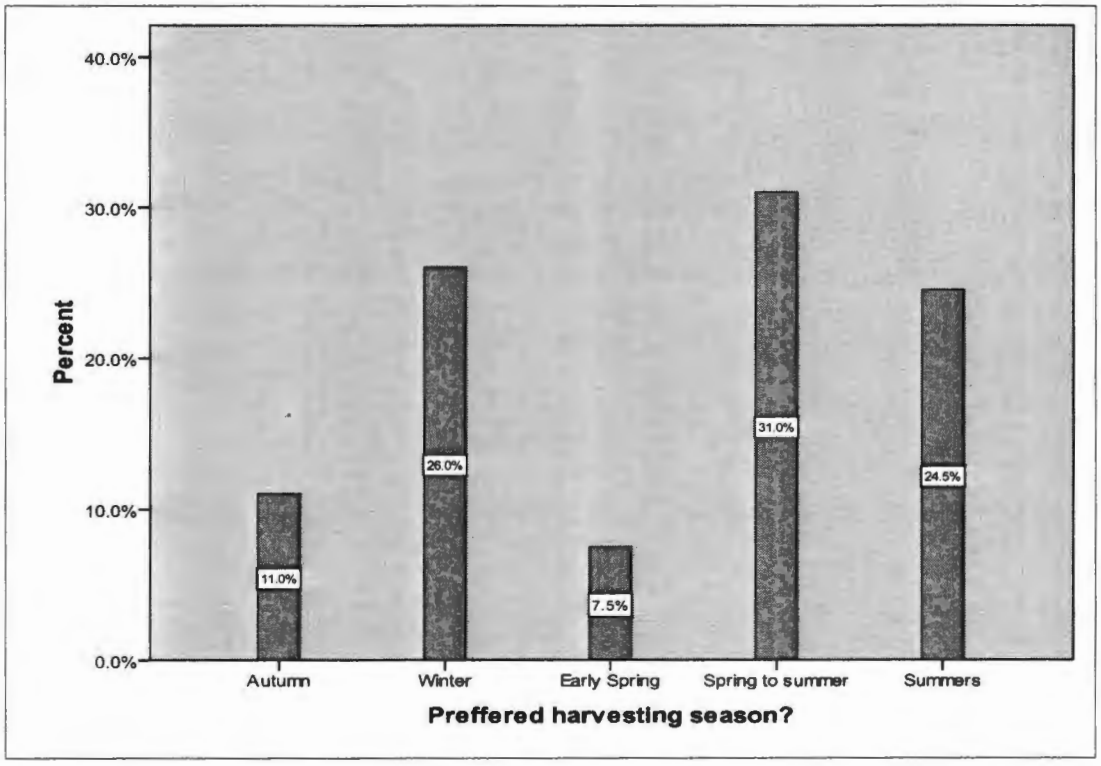


Figure 11: Information about % of plant collection in different Season species in District Shangla.

In Pakistan medicinal plants are chiefly used by Tibbia Dawakhana (herbal medical centers of indigenous physicians known as hakims). In Ayurvedic system of herbal treatment pharmaceutical industries are being commercially exploited for the extraction of various ingredients (Mahmood *et al.*, 2003).The local people were

observed having sufficient knowledge about the presence of plant in specific areas like, meadows, marshlands, barren lands, valleys, riverine etc. and also having ideas about the preferred harvesting seasons and method of preservation according to the medicinal use and season. The study also reveals that people have knowledge for various preparations of the medicinal plants. Different types of uses are done on different grounds, and reasons e.g. most of the medicinal plants are used in dried form and a few in the fresh form as shown in **figure 12**.

The survey indicated that the medicinal preparations are variable according to use e.g. in the form of Infusions, Decoction, Tea, Syrup, and others as Oil, Poultice, Lotion, Creams etc as shown in **figure 13**.

The information retrieved from the survey shows that the plant materials of the specimen to be stored, it is interesting that people know how long the plant could be stored like days, Months and even years (fig.14).

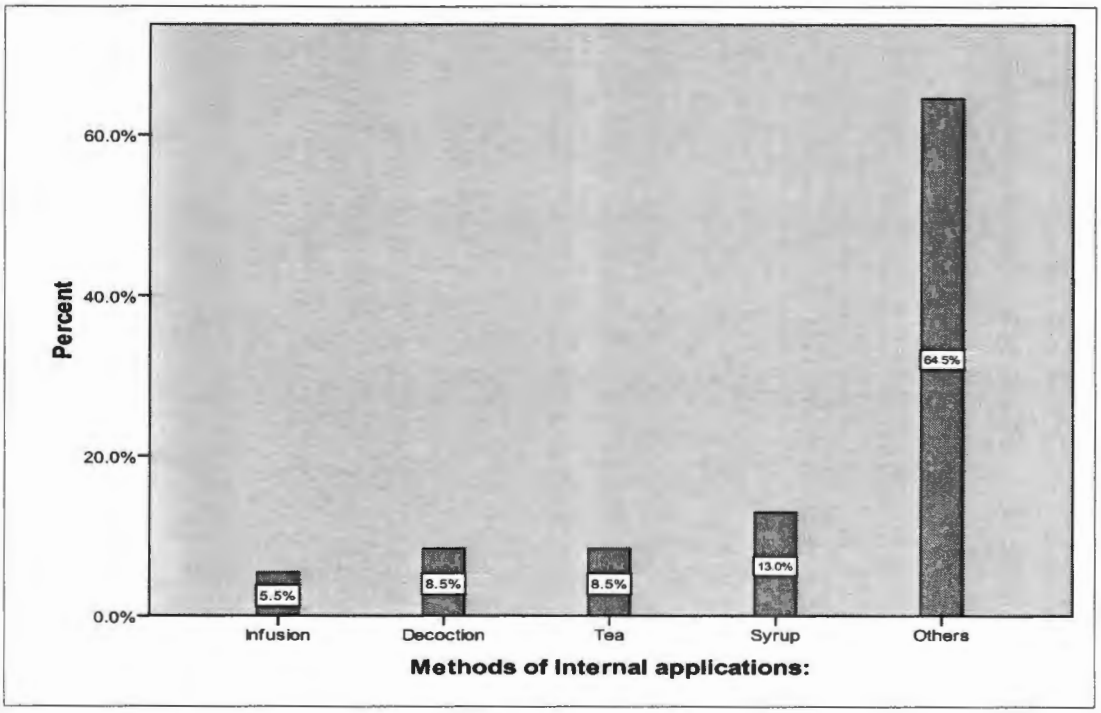


Figure 12: Response about methods used for indigenous medicine preparation in District Shangla.

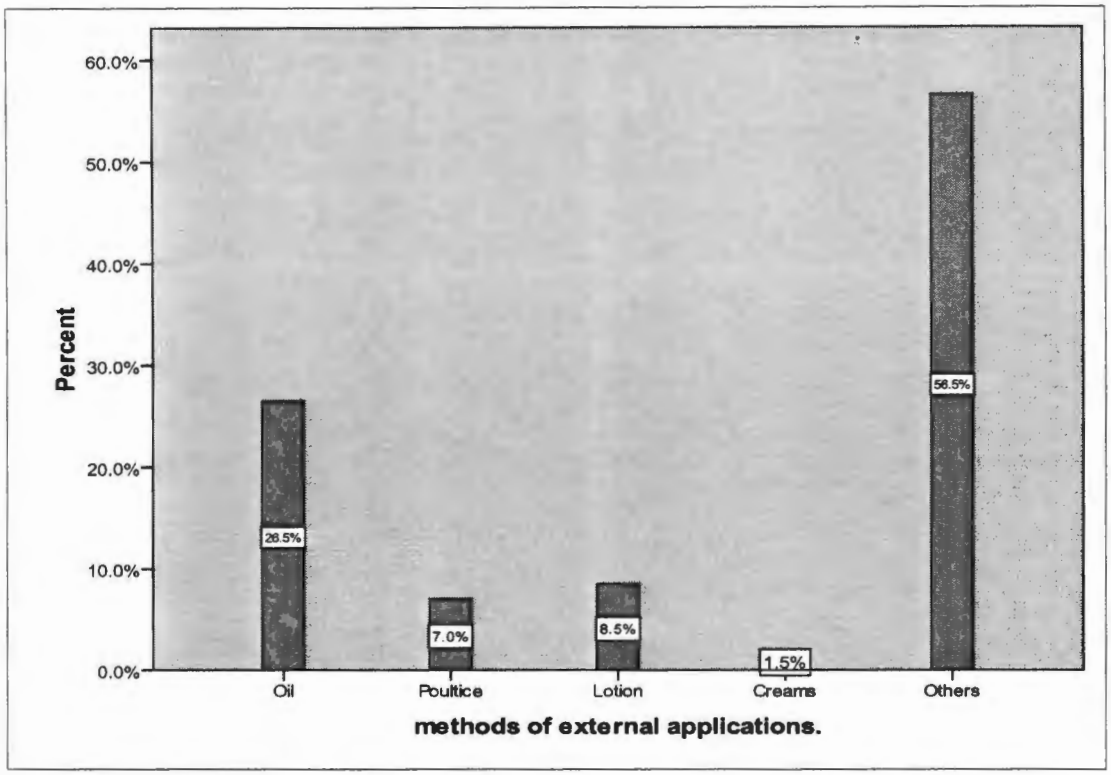


Figure 13: Method of use for the indigenous herbal medicines in District Shangla.

The survey indicated that the medicinal preparations are variable according to use e.g. in the form of Infusions, Decoction, Tea, Syrup, and others as Oil, Poultice, Lotion, Creams etc as shown in **figure 13**.

The information retrieved from the survey Performas shows that the plant materials of the specimen to be stored, it is interesting that people know how long the plant could be stored like days, Months and even years (fig.14).

Market survey and approximate price of the plant shows that these plants are have a very low to a very high market value like menthe sp (wild mint) is among the cheapest while Guji (morchella) is having the most expensive price of over 5000 PKR /kg (fig.15). These plants are mainly found in pansar shops, and with the herbalist/hakeems, Herb dealer and others (fig.16).

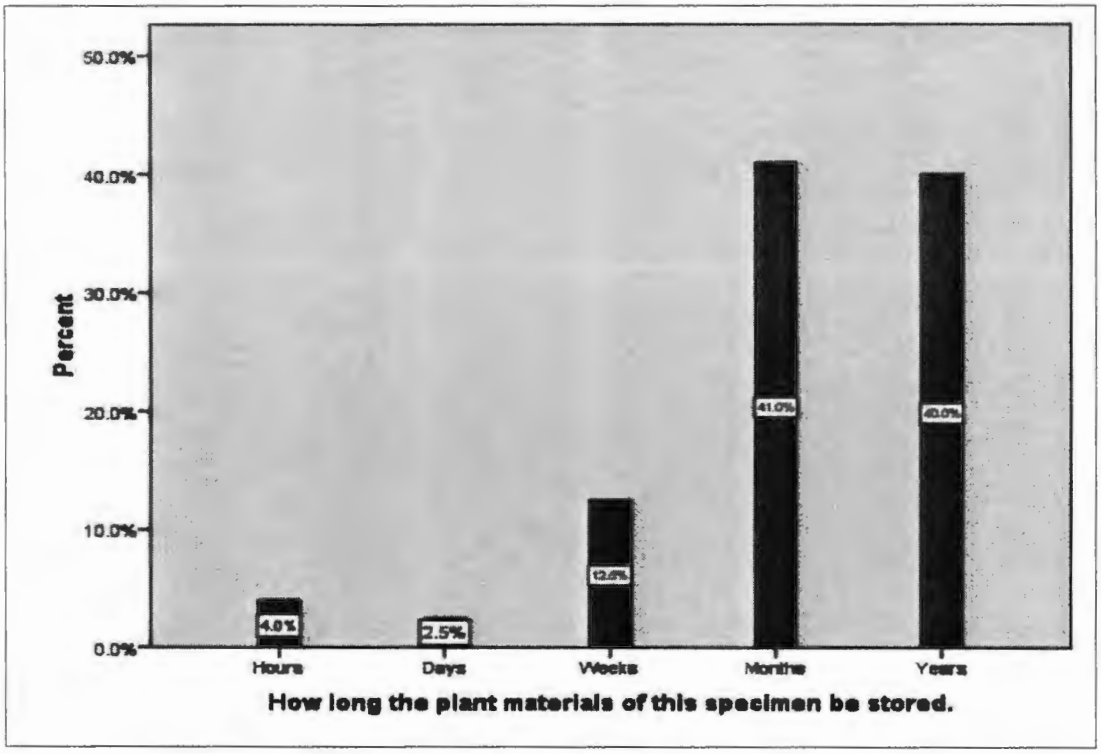


Figure 14: Informants data about methods used for storage and preservation of medicinal plants

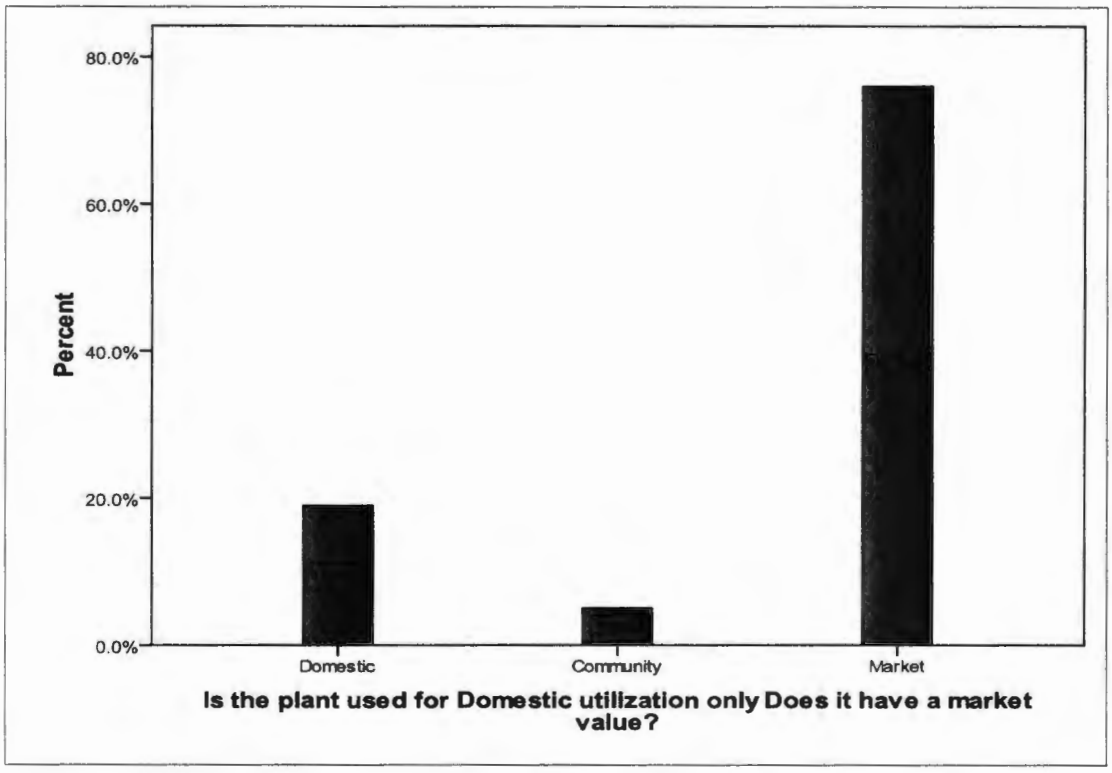


Figure 15: Perception about utilization pattern of the collected herbs by local community in District Shangla.

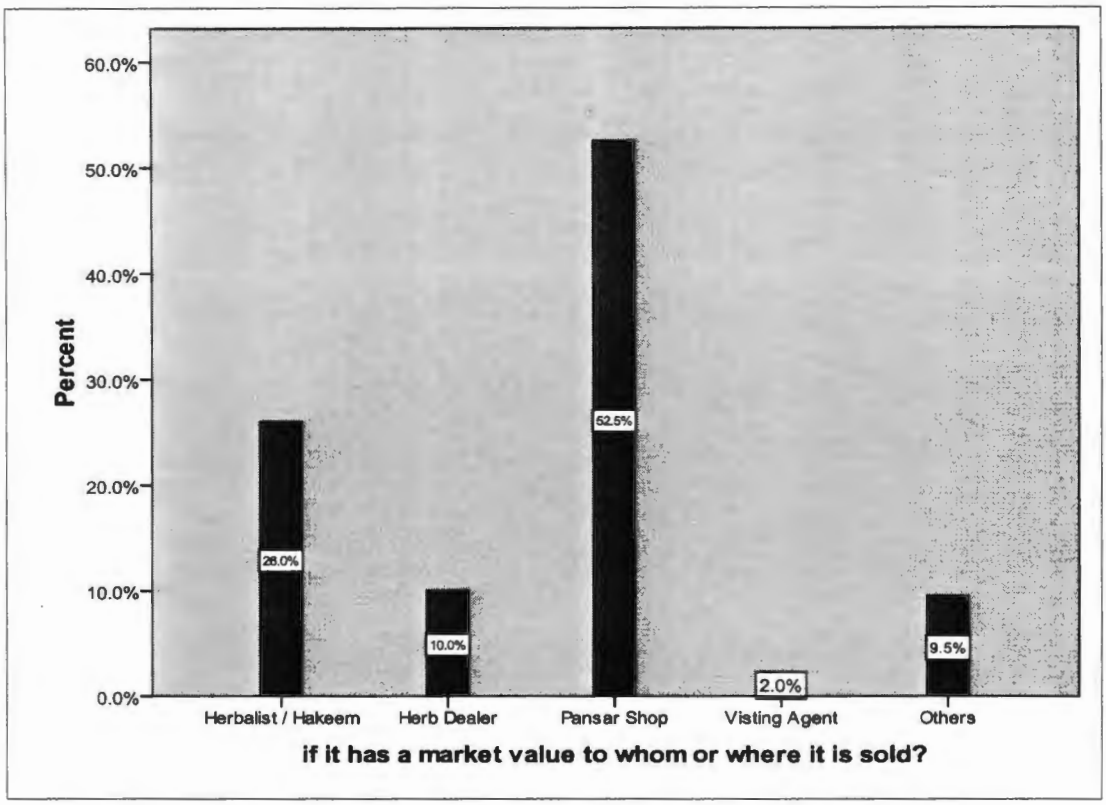


Figure 16: Information about market value and source/outlet for the herbal medicines in District Shangla.

Due to poverty in the area most of the people remain deprived of basic facilities such as health care units, electricity, gas and coal. And hence are dependent on forests for fuel wood. Some 37 plants including Berberis lycium, Continus cogyra, Cotoneaster integerima, Dodonaea viscosa, Plectranthus rugosus, Quercus incana, Q. balloot, Spiraea lindleyana and Vibernum cotinifolium were used as fuel wood. The results agree with those of Badshah *et al.*, (1996). The survey revealed about 69% of the people are dependent on forest resources for their fuel wood. Which is one of the causes of deforestation in the area. The study reveals that people fulfill their household fuel needs directly from the wood available to them from forest as shown in **figure 17.** The results also showed that the people go to the thicker parts of the forest which is up in the mountains, because the thinning of the forests in the lower altitude areas has left no fuelwood in the areas adjoining the human settlements. This takes hours to reach the forests because of the distance to cut and collect the wood, they use it for their own requirements and also sell this into the local market in order to get some money (fig.18)

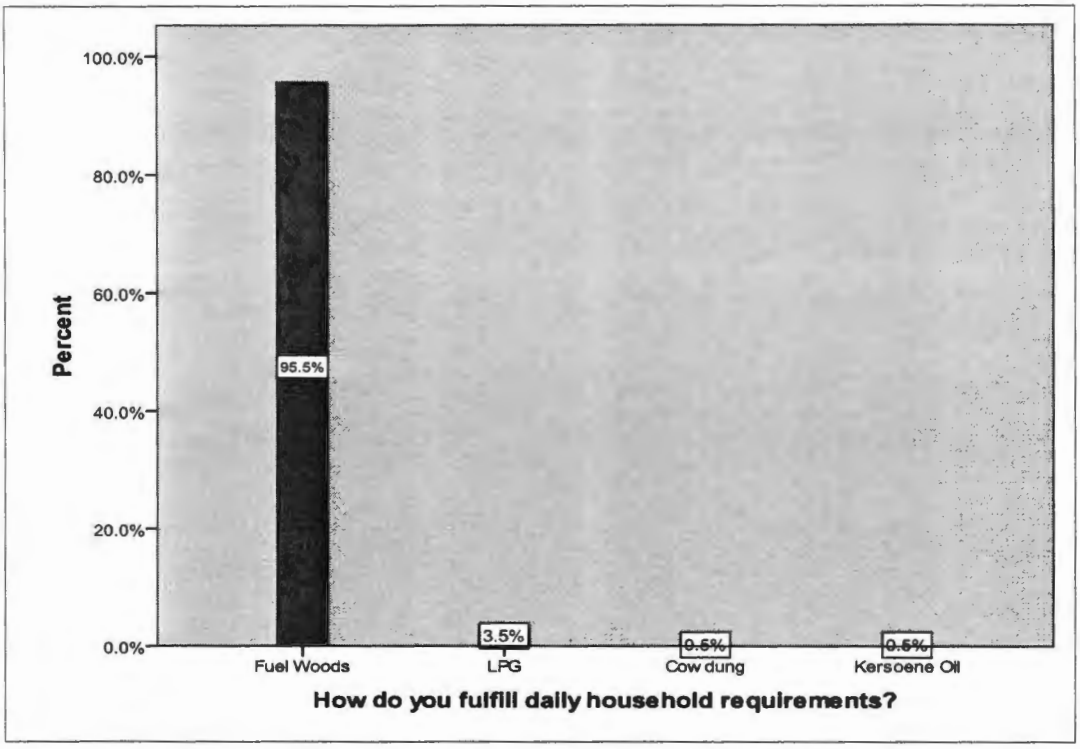


Figure 17: Local perception of fuel resource utilization out of forest products and alternate fuels

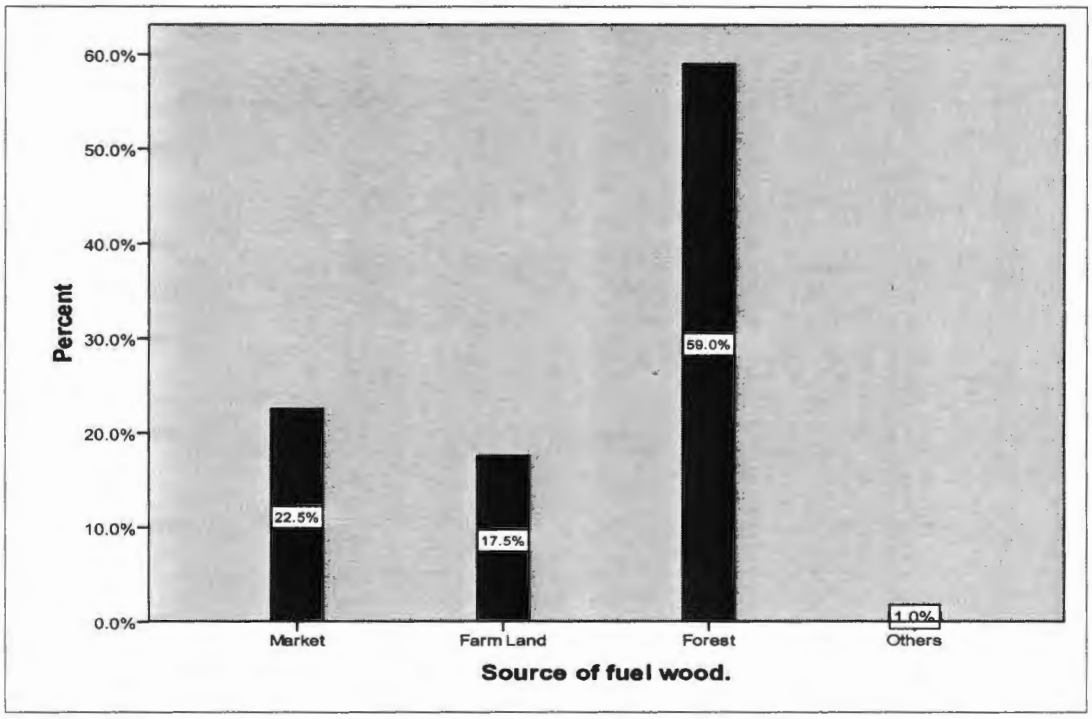


Figure 18: Perception of local people about fuel wood sources for the local population in District Shangla.

There are people who do not afford to spend so much time in collecting the fuel wood from forests hence they have to purchase it from the local market shown in **figure 19.** Mostly this is men who use to collect and cut the wood, in some areas women and children do the job but it is very rare shown in **figure 20.**

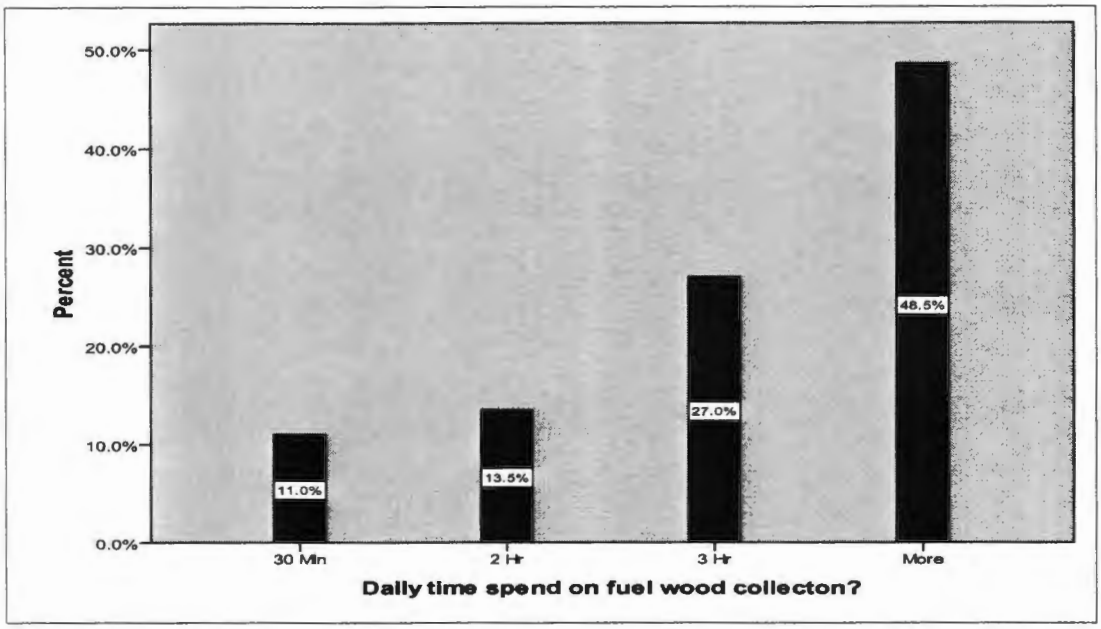


Figure 19: Understanding of respondents about time slicing for fuelwood collection pattern in District Shangla.

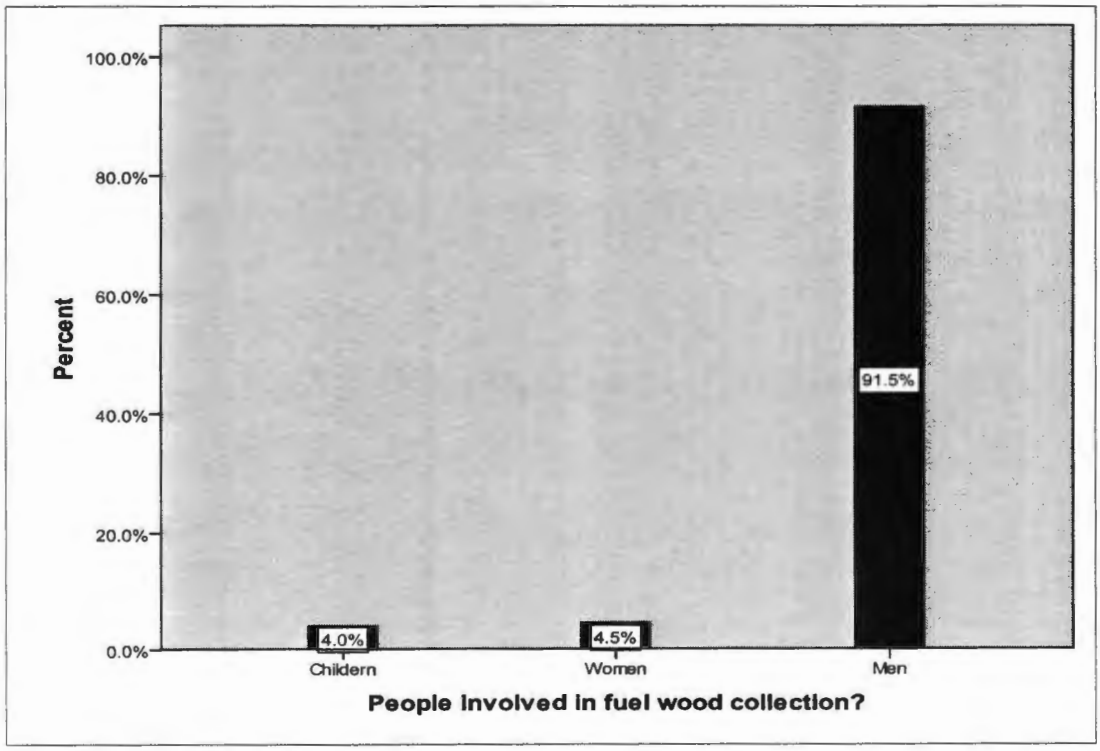


Figure 20: Response of Locals about major fuel wood collectors of the population in District Shangla.

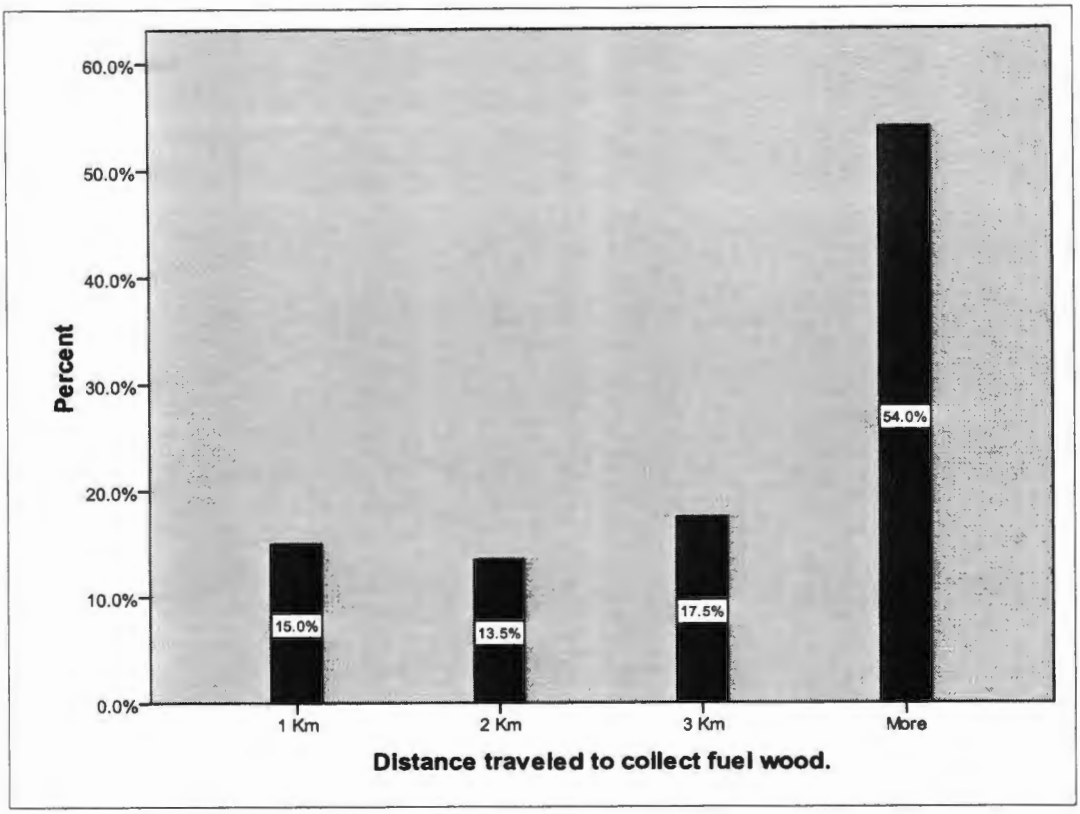


Figure 21: Perception of local population about access to the fuelwood collection sites in District Shangla.

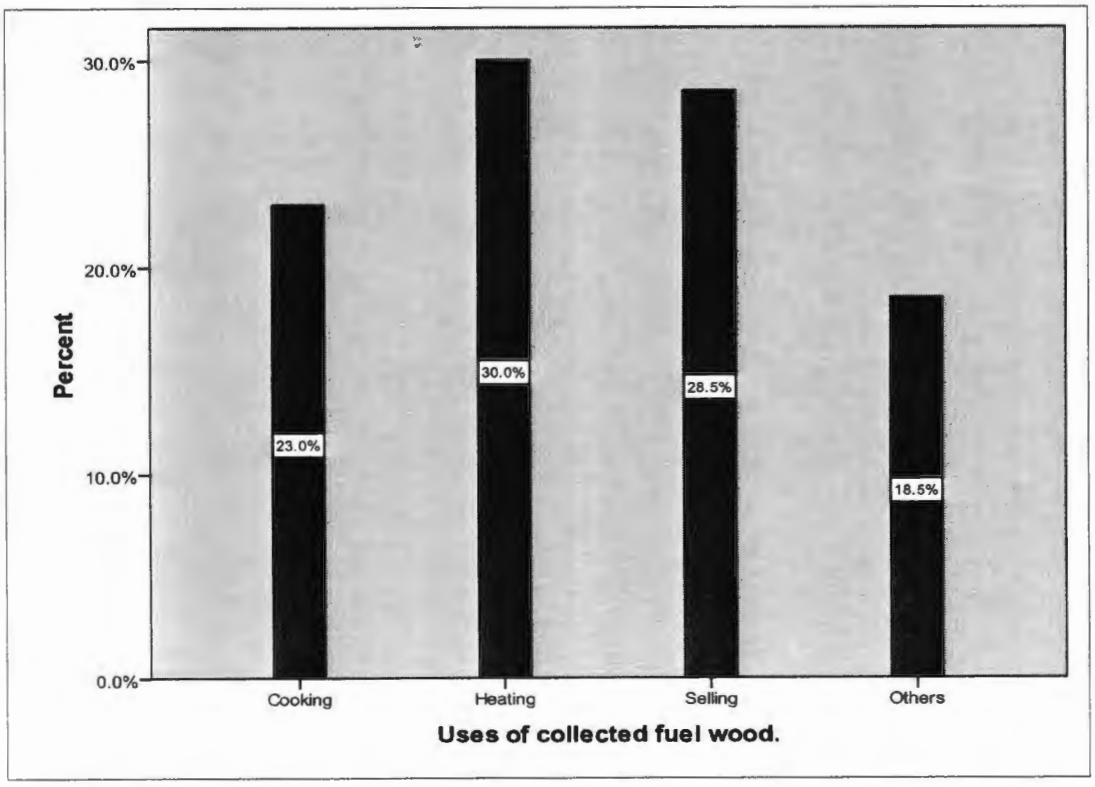


Figure 22: Response % of local people about utilization pattern of the fuel wood from the forest

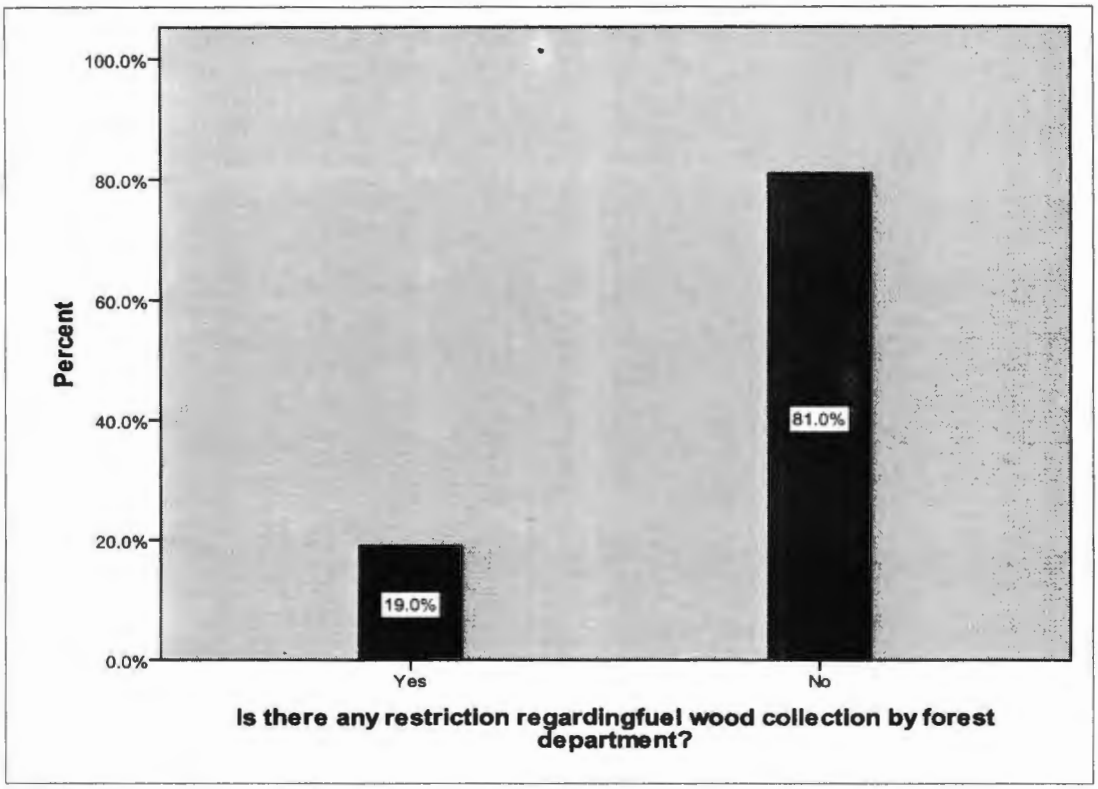


Figure 23: Perception of local communities regarding fuelwood collection rights in District Shangla.

The uses for the collected wood are variable in different parts of the study area , and there is a marked difference observed for different locations of the district for the wood utilization. Typically the major portion of the wood is used for cooking as in other mountain areas of the country. Indoor heating for cold winters is another important component of the wood utilization. This is one of the important uses in the study area posing a lot of pressure on forest resources as this wood is being collected extensively throughout summer and specially in autumn in huge quantities for the over winter use . In many areas people use to make different articles (fig.22).

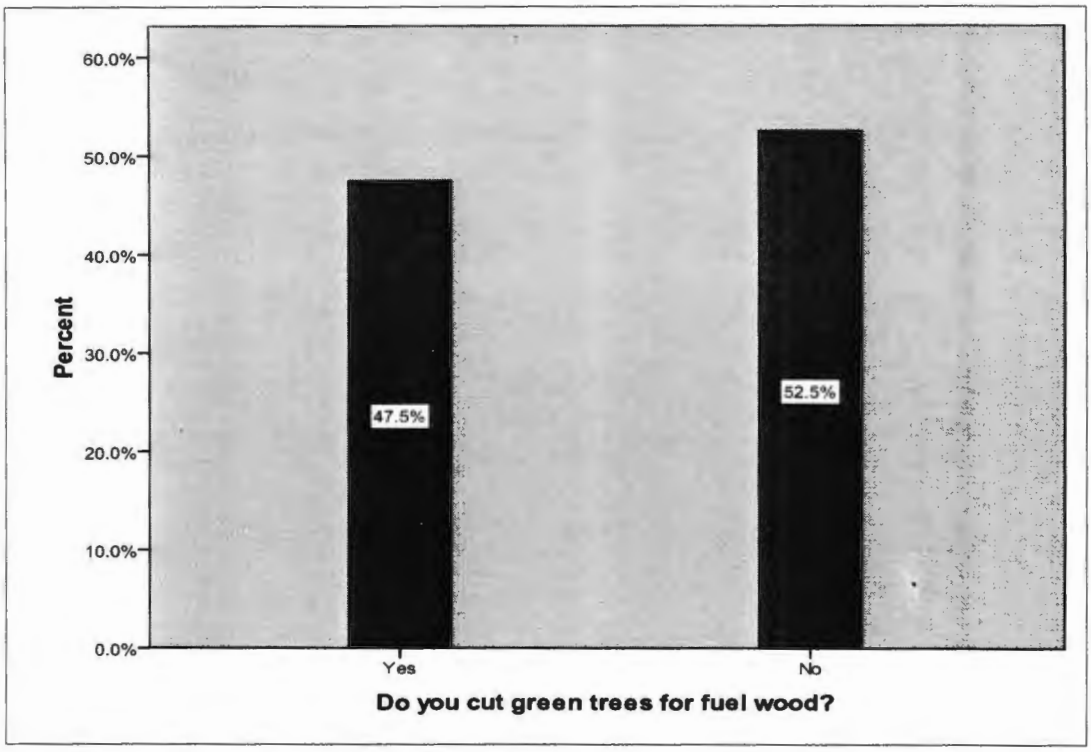


Figure 24: Fuel wood collection from forest plots and younger plantations in District Shangla.

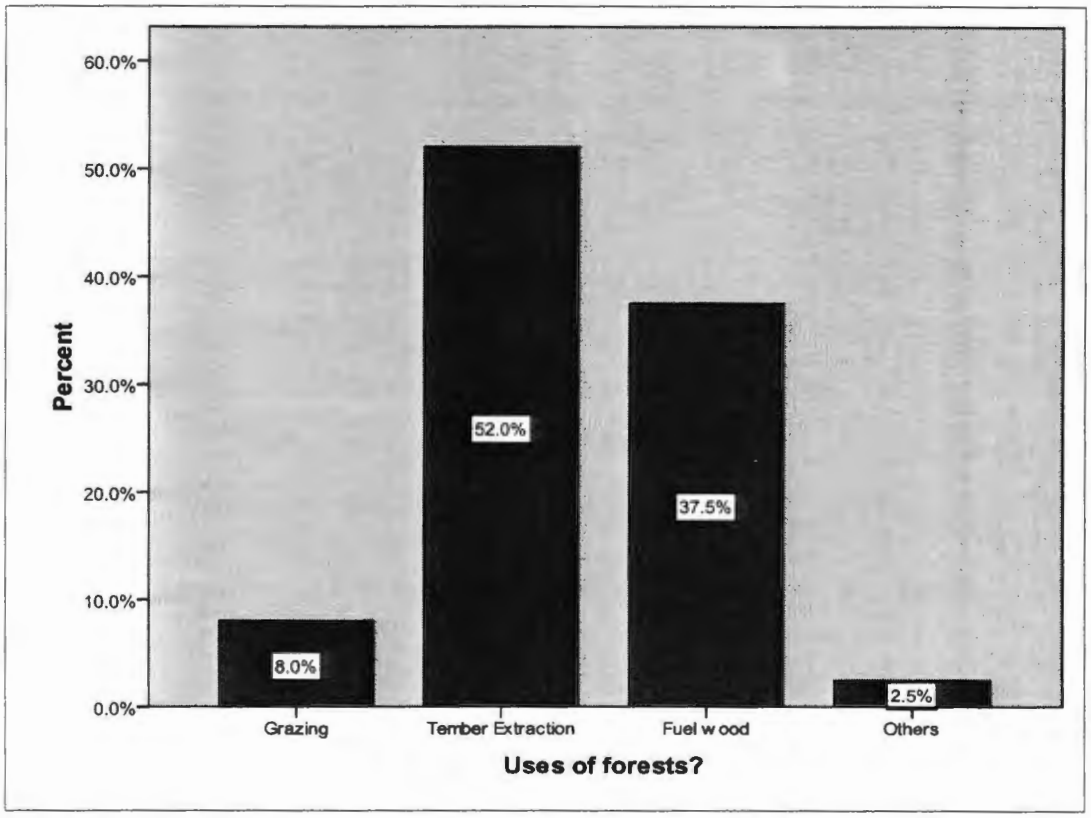


Figure 25: Local population's response about pressure and dependence on forest resources in District Shangla.

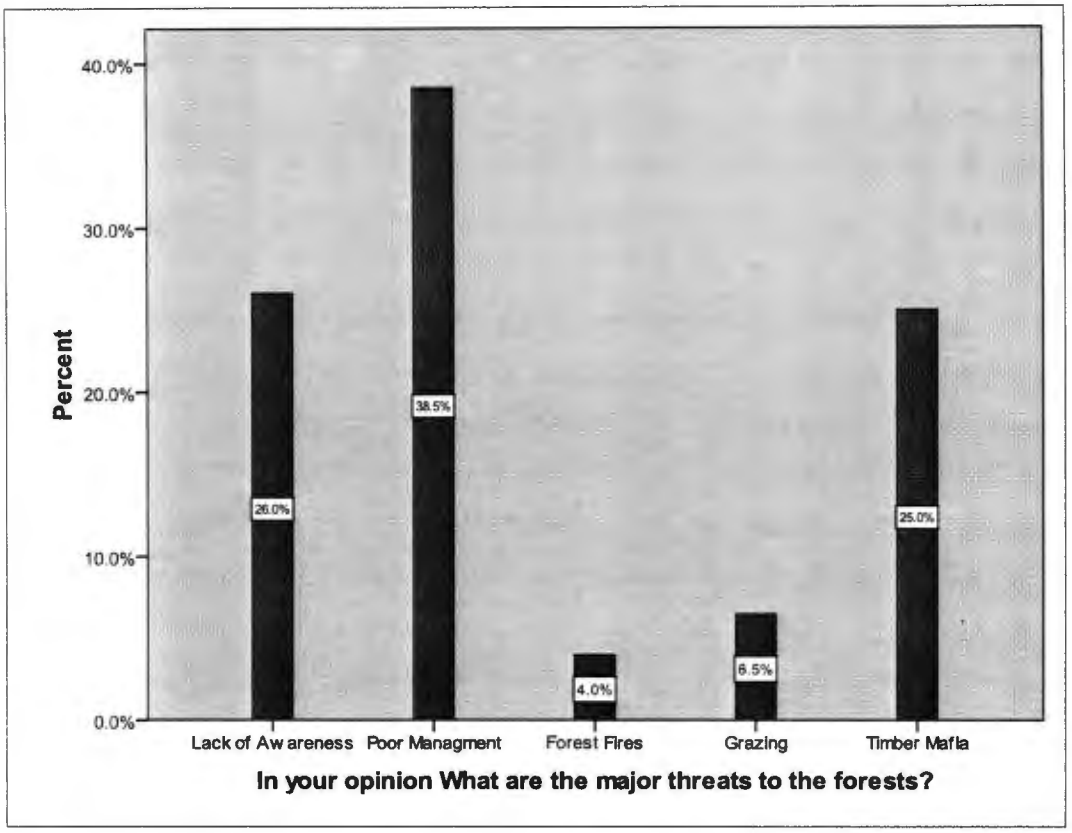


Figure 26: Opinion % of the local populations about threats to local forest in District Shangla.

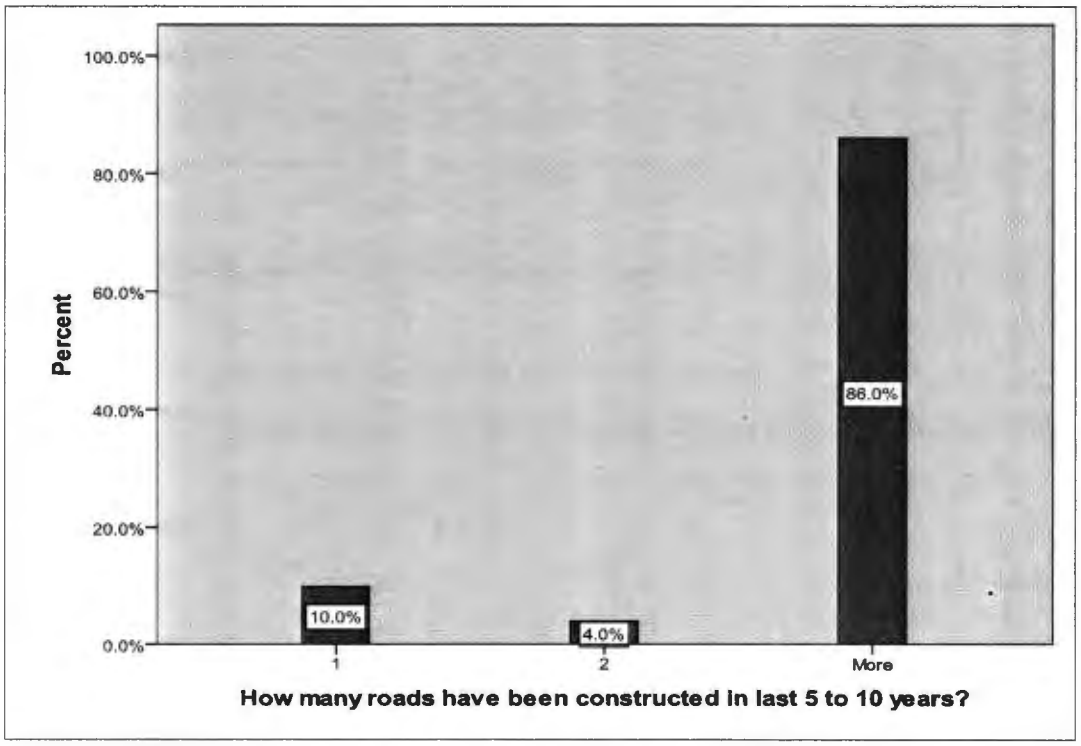


Figure 27: Road network extension and local perception about infrastructural development in District Shangla.

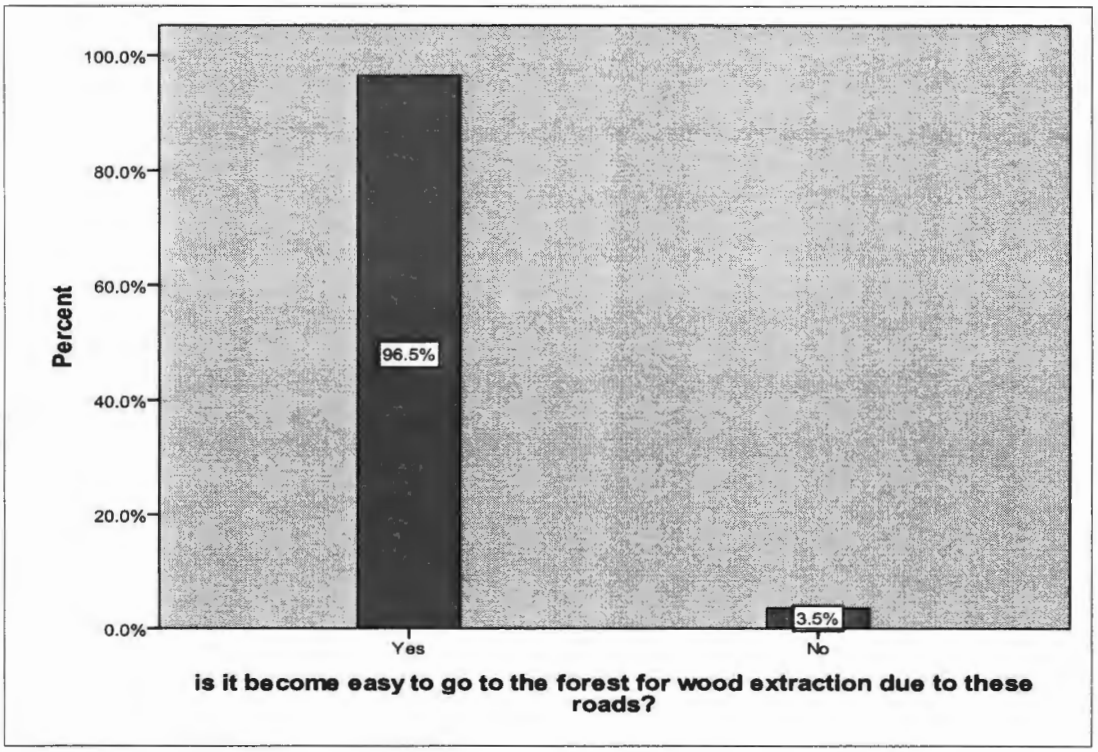


Figure 28: Perception about road networks as a threat to the local forests in District Shangla.

Most of the people were of the opinion that illegal timber harvesting and poor management are the main reasons and threats to the forests while many are of the opinion that lack of awareness and land mafia is the threat **figure 26.** The study reveal that more roads have been constructed during the last 5- 10 years which make the forest more vulnerable to cut and transported to different areas (fig.27). New roads infrastructure and extensions has a very bad impact on forest as it become very easy to go into the forest for illicit cutting by the timber mafia **figure 28.**

Due to lack of Forest check post on each road there has been a reduction seen from the last decade **figure 29**. Hence new roads constructions has a very bad impact on the forest. Most of the respondents are of the opinion that forest officials are involved in timber extraction.

The study also reveals that there is no awareness campaigns done on the Natural resources conservation in community by the forest department and that is reason of the unsatisfactory situation of forests of the study area shown in **figure 30.**

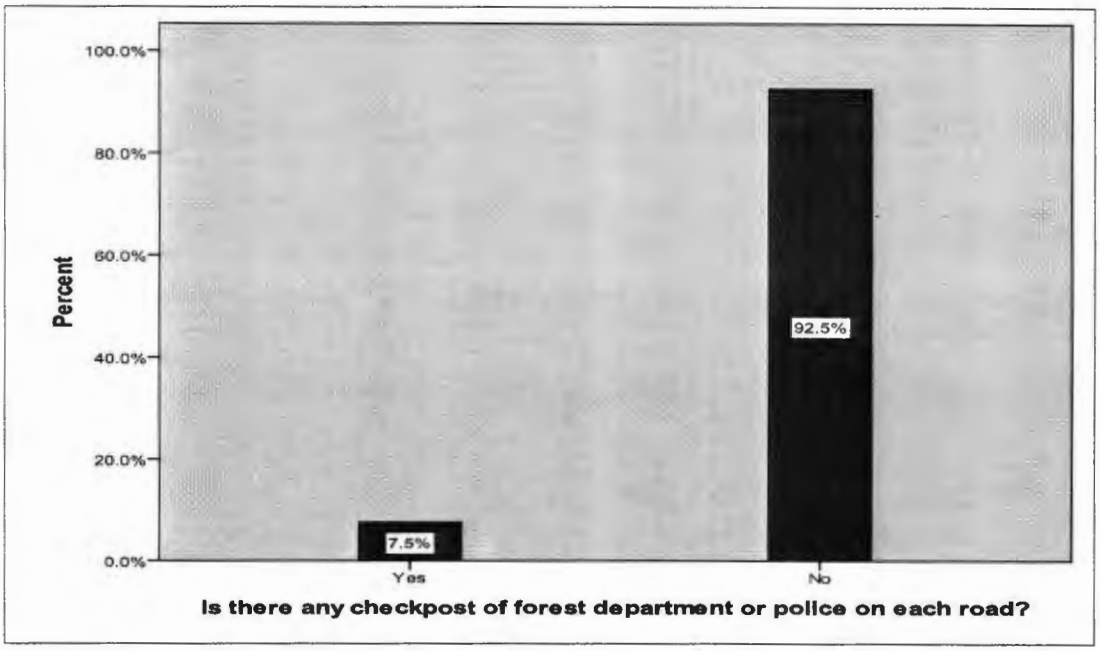


Figure 29: Forest Departmental Check posts in conserving the local forest in District Shangla.

As shown in **figure 31** the study also revealed that most of the people believe that the condition of forests in District Shangla is far worst then the previous years, as compared to the past and there has been nothing changed positively in the conservation of forest resources in the past 15 years shown in **figure 32.**

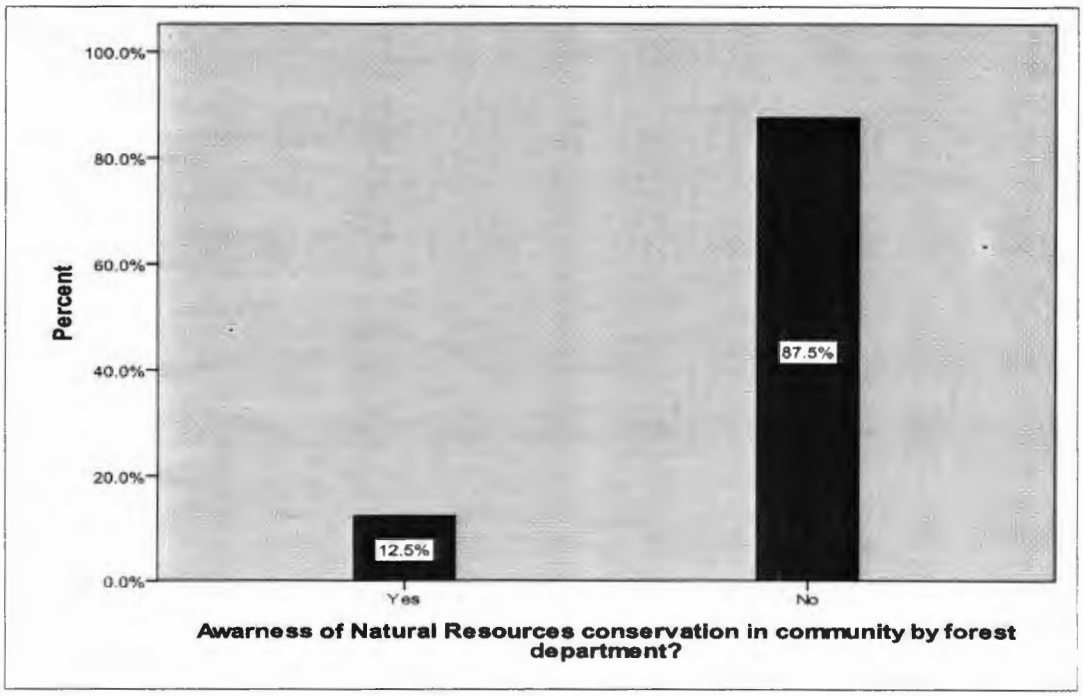


Figure 30: Role of the Forest department in raising the awareness about conservation in District Shangla.

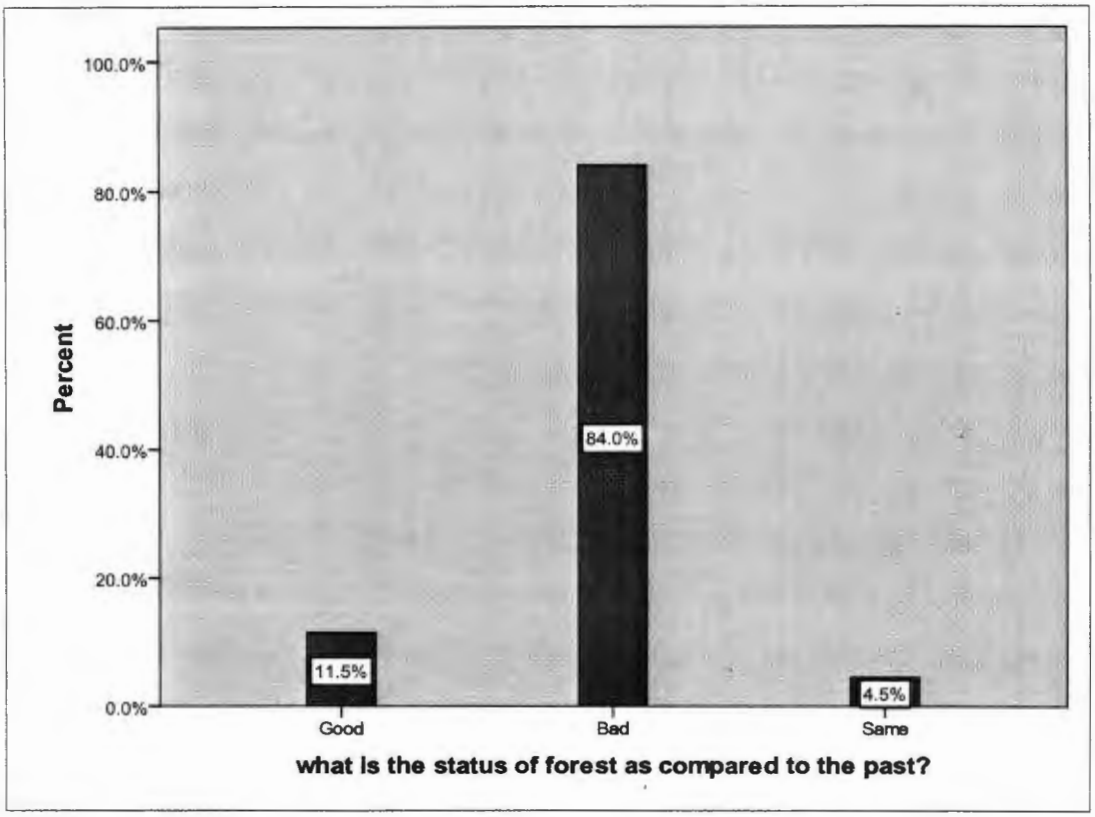


Figure 31: Local perception about change in forest cover as understood by the local people in District Shangla.

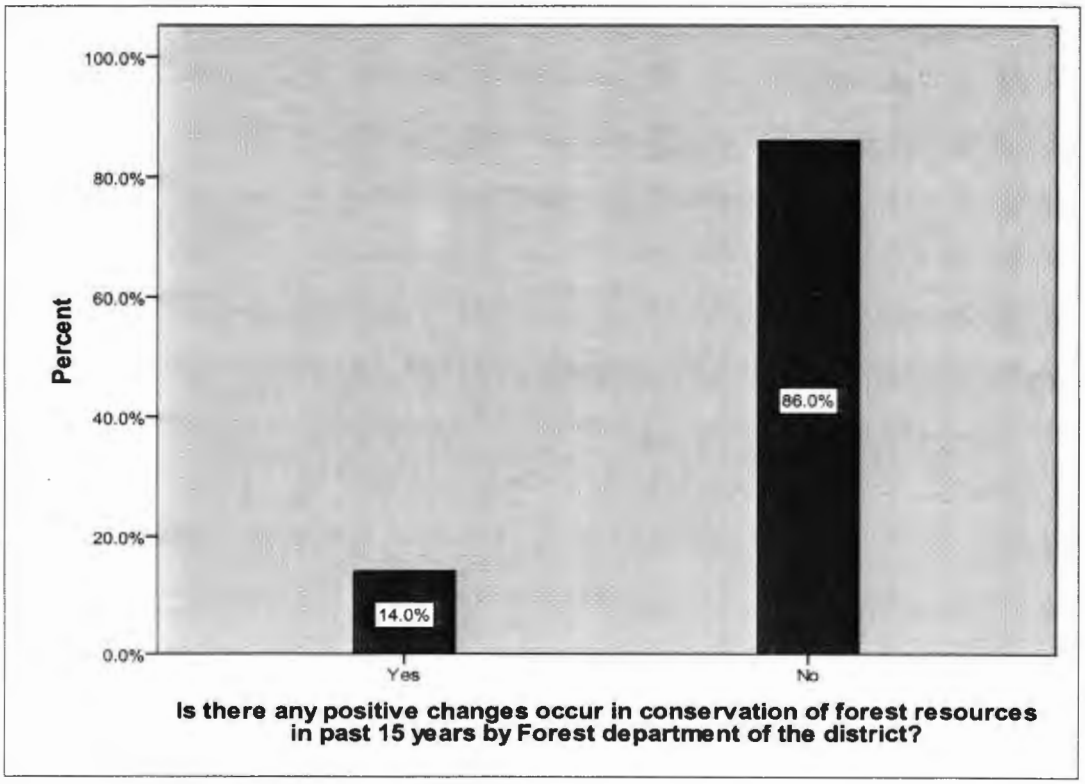


Figure 32: Conservation of local forest as understood by the local people in District Shangla.

The study shows us that Traditional system of conservation will be good than departmental system and this system should be highlighted in order to make forests conservation an efficient one (fig.33). Most of the respondents said that Local people having their own forest on their own lands are the best managers than forest department.

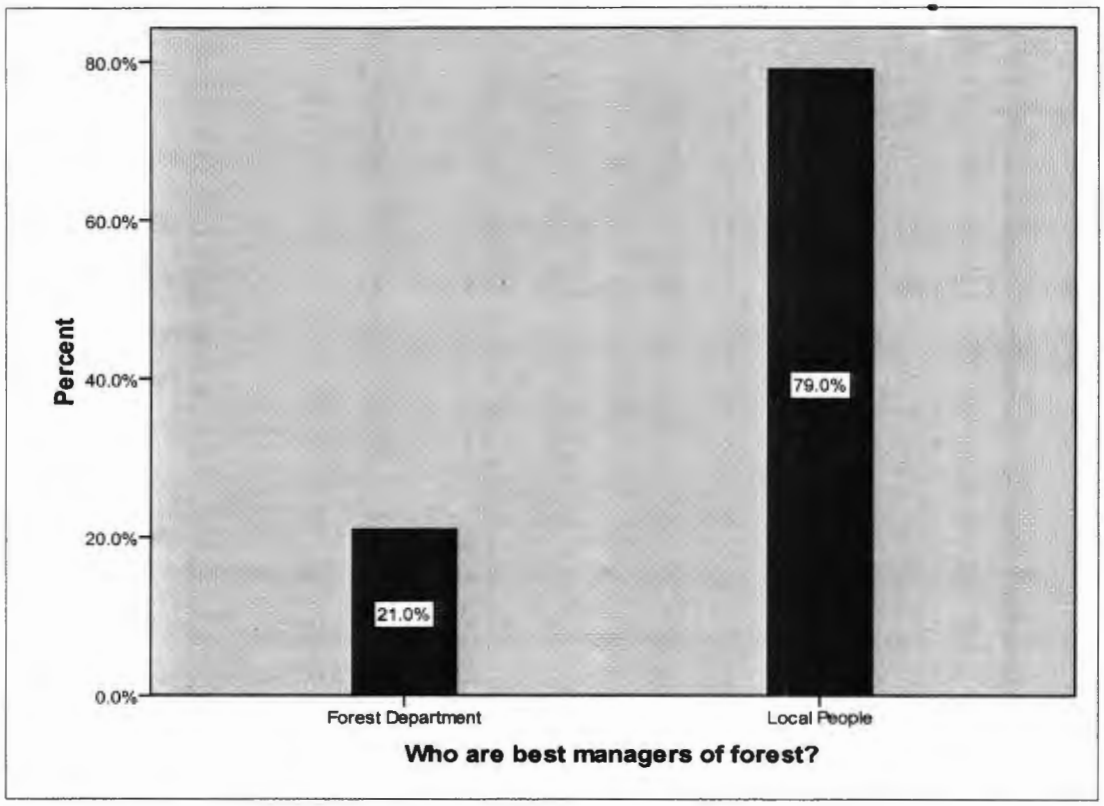


Figure 33:Evaluation % of ownership among local people for forest conservation in District Shangla.

This study shows us the most important fact about the depletion of forest in the area, most of the respondents were of the opinion that forest guards belongs to their native areas and they are involved in illegal timber extraction **figure 34.** Most of the people were not satisfied with forest guards. Although the study showed most of them belong to District Shangla and are local people **figure 35.**

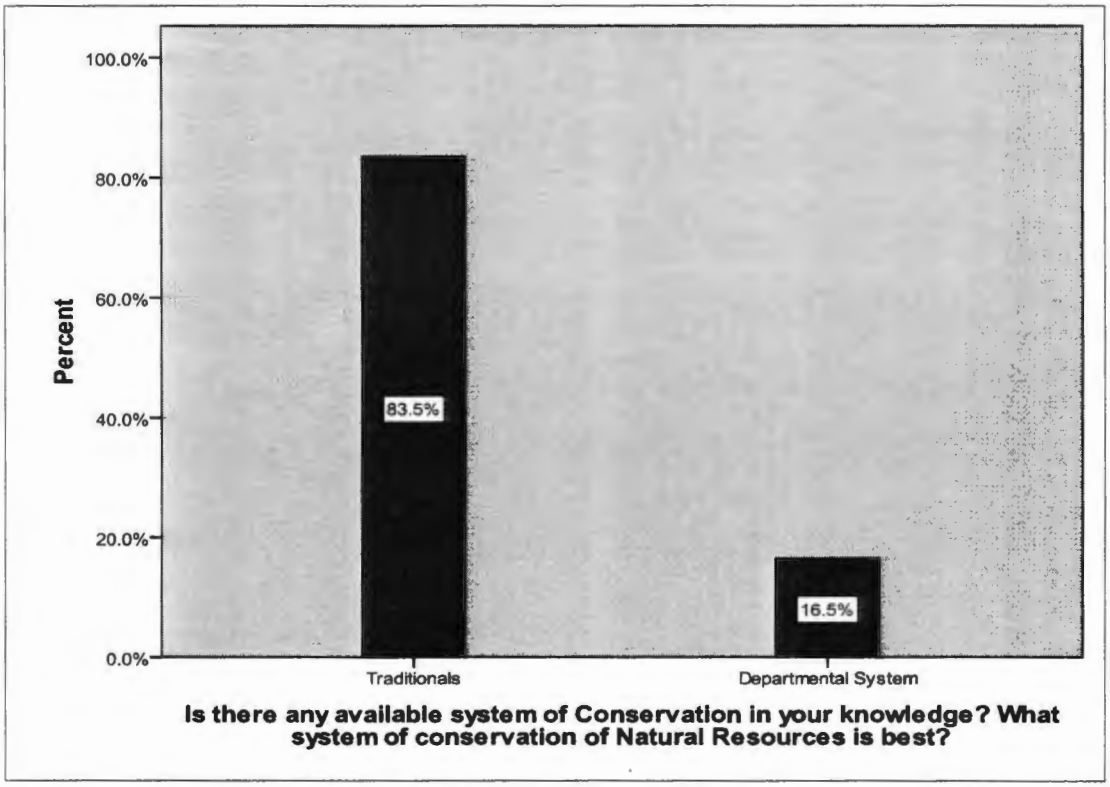


Figure 34: Alternate conservation possibilities with local communities in District Shangla.

Figure 35: Forest department and local employment in District Shangla.

4.1.Ethnobotanical Results

During this survey of the vegetation in Shangla region seventy different plant species from 24 families were documented. While the cryptogrammic species, the fungi was represented by only 1 family (Helevelaceae) with a single species of very high economic/ethnobotanical valued medicinal mushroom *Morchellaesculanta*, while there were some of the species belonging to the Pteridophytesand were mostly represented byfamily Equisetaceae, and two more families of Polypodiaceae, Petridaceae were also representing the Pteridophytes (Khan et al., 2007).

Being the area represented by the high altitude coniferous forest dominated by the pine zone vegetation, the gymnosperms were represented by two families (Pinaceae, Taxaceae) in which the family Pinaceae is represented by 4 to 5 species including *Pins roxbergii, P. girardiana, P. vallichiana*and *Taxaceae* by only 1 species *Taxusbaccata.* The upper reaches of the study area is represented by the high altitude palatable greases of the alpine meadows, while the surrounding region of the Indus at lower altitude also dominated by the medium to tall grass, these monocots were dominated by the grasses those most of palatable species, and are represented by 5 families containing approximately40 species. (Rizwana 1996; Shinwari and Khan, 1998).

Most dominat family was Compositeae/Asteraceae with 6 to 7 species dominated by the Genus *Echinops*. For thhe other dichotomous species,the common plants were belonging to the families Amaranthaceae, Brassicaceae, Moraceae, Solanaceae, Cucubrbitaceae, Oleaceae, Rosaceae, *Lamiaceae*, Polygonaceae, EuphorbiaceaePapilionaceae, Ranuculaceae and Myrcinaceaerepresented each by the range of species between 1-6.

Among medicinal plants there were around 25 wild medicinal plants and about 8 to 10 plants were cultivated. Some miscellaneous uses of plants such as washing and cleaning utensils, fish poison sacred and holy plants, plants specified for graveyard, are also common in the area.

Over 40 medicinal plants were collected from the area. Out of these 7species were reported to be commonly used for their diuretic properties, 5 in stomachic and laxative. Similarly 4, species are used as Aanthelementic, 3, Carminative, 3,

antiseptic, 2, Expectorant, 1, Astringent and purgative respectively, while the remaining species have one or more than one medicinal use in the local community (Shah, 1993).

Thirty species were collected for trade purposes, of which medicinal plants such as Berberislycium, Origanum vulgare, Bergeniaciliata, Aesculusindica, Podophyllumemodi, Pterediumaquilinum, Bergeniahimalyca, Viola spp., Ajugabracteosa, Morchellaesculenta, Paeoniaemodi, Atropa acuminate, Aconitum violaceum, Polygonumamplexicaule, Bupleurumlongicaule, , Juglansregia, Diospyrus lotus and Menthalongifolia are important(Ahmed and Siraj, 1996).

4.2.Change Detection Results:

Satellite Images and related Data:

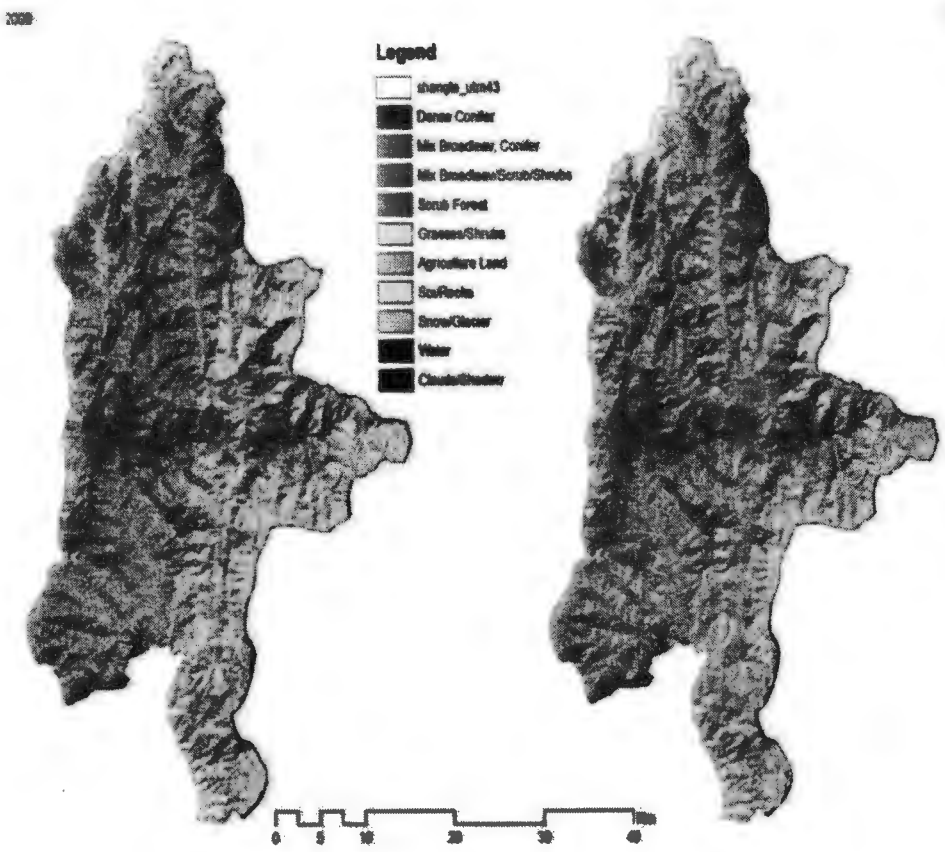
Landsat (Landsat satellites orbit 705 kilometers (about 435 miles) above the Earth, and image an area every 16 days interval) and other satellite imagery sources were accessed in order to collect the satellite maps of past 15 to 20 years, in order to develop an idea about gross destruction of the land cover in local forest, to show the deforestation in timescale.

Data analysis:

After collecting the primary data through field visits, household surveys, key informants interviews and focus groups discussion and some secondary data already present and some from Forest department will analyze for further expected outcomes and results. Rate of change was detects according to the following eq.

$$rate = \left(\frac{1}{t2 - t1}\right) \cdot ln\left(\frac{Al_2}{Al_1}\right)$$

Figure 36: Land use/Cover Change Detection in the Study area from 2000 to 2016 in District Shangla:



Year →	2000	2016	Annual Rate of Change
Dense Conifer	**29240.8**	**21100.56**	**-0.033**
Mix Broadleav, Conifer	**23204.84**	**16634.84**	**-0.033**
Mix Broadleav/Scrub/Shrubs	**18076.11**	**15503.02**	**-0.015**
Grasses/Shrubs	**33586.62**	**28373.79**	**-0.017**
Agriculture Land	**19198.26**	**14411.17**	**-0.029**
Soil/Rocks	**14258.92**	**51503.47**	**0.128**
Snow/Glacier	**1311.894**	**6862.723**	**0.165**
Water	**7073.084**	**3856.989**	**-0.061**
Clouds/Shadow	**12649.47**	**353.4375**	**-0.358**
	(158600)	**(158600)**	

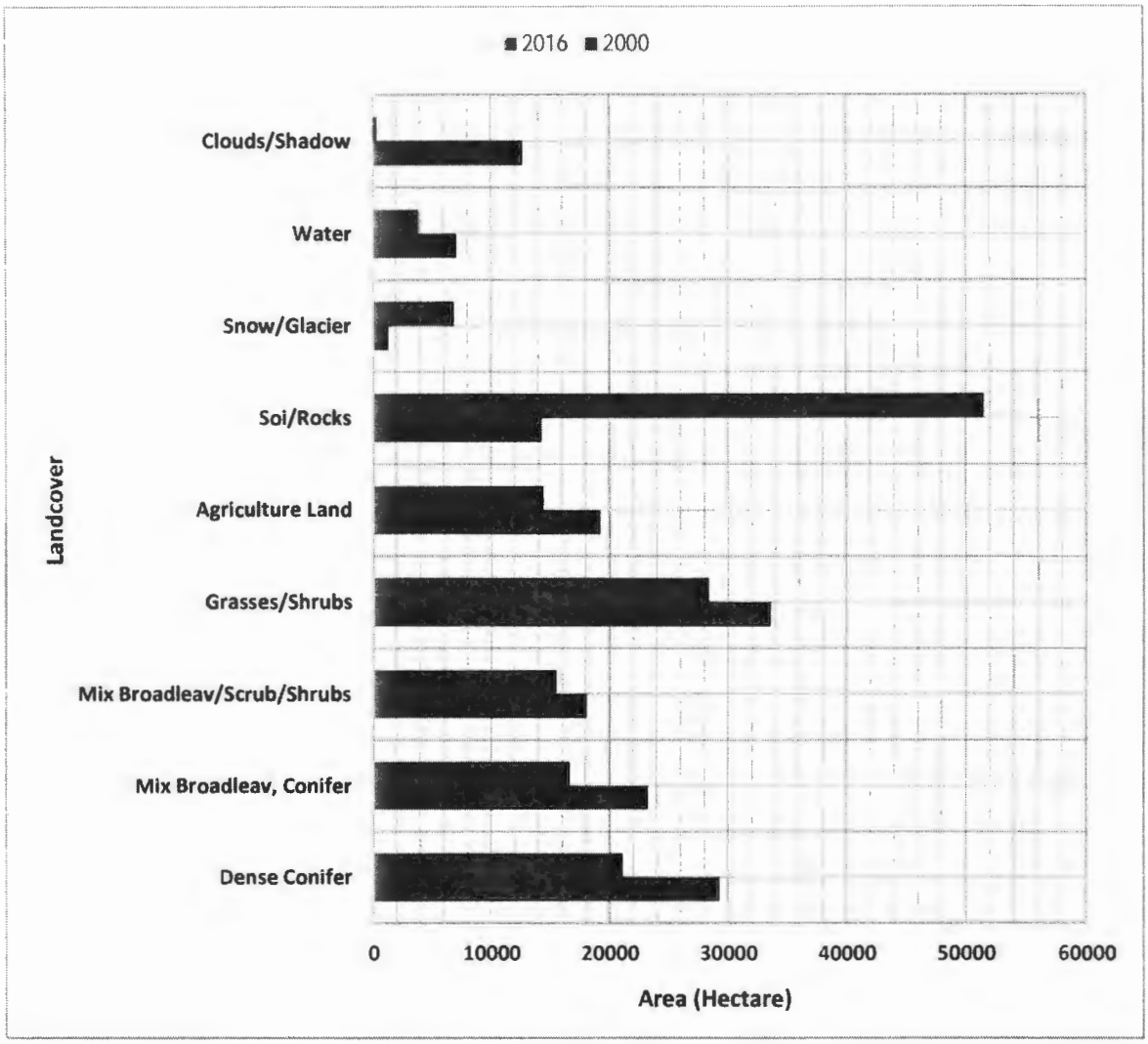


Figure 37: Graphical presentation of Land use Change Statistic in the Study area 2000-2016 in District Shangla

As shown in fig 36the overall Conifer forest is reduced to 0.033% of the total land area of the Shangla district, while the other vegetation category of mix broadleaved forest is also reduced at the same pace. However alpine meadows, the grass land and the shrubby vegetation is reduced by 0.015% and the Agriculture Land has also reduced at the rate of 0.03% out of the total available land area. The open Rocks and the exposed soil type category is increased during the 16 years period at the rate of 0.128% of the total land. Perpetual Snow and Glacier seems to build up a little while open Water channels and pounds/lakes are reduced to a 0.061% while among the two categories the Clouds cover/Shadow is 0.0358 which I was not ratified.

Shrinkage of the agricultural land and the Coniferous forest simultaneously is not something common in such types of mountain areas and this shows a negative trend sustainability of the overall plant cover in the area.

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Ethno-botanical Studies and Vulnerability Assessment of Forest Resources of District Shangla, Khyber-Pakhtunkhwa, Pakistan.

Name of respondent _____ Age _____Education_____

Type of family (Joint, Nuclear)_____No. of members

QUESTIONNAIRE: (VILLAGE LEVEL INFORMATION)

Physical Resources: Pakka Road, Katcha Road, No Road Access

Dispensary / Hospital **(Yes/No)** School Electricity **(Yes/No)** Telephone / Mobile **(Yes/No)**

Sanitation System **(Yes/No)** Mills Industries **(Yes/No)** Water Channels **(Yes/No)**

Ethno-botanical Studies and Vulnerability of Forest Resources of District Shangla, Khyber Pakhtunkhwa, Pakistan.

1. Do you use Herbal Medicines? **Yes** **No**

2. Do you consult a Hakeem? **Yes** **No,** if yes...why.....

3. For what reason would you go to a Doctor in preference to use Herbal Medicines? **Surgery** **Accidents** **Birth** **Unavailability of Herbs** **Other**

4. Who collect the Medicinal plants? **Men** **Women** **Children** **others**

Information about uses of specific plant species

a) Local Name of plant_____ Bot.Name after identification_____

Status **(Wild Cultivated)** Local Flowering Period_____

b) Which part of the plant is used? **Stem, Leaves, Flowers, Seed, Root, fruit, bark, whole plant**

c) Where you commonly find this plant?

Meadows, Hillside, Marshlands, Barren land, Rocky Areas, Valleys, Riverine, others

d) Preferred Harvesting Season? **Autumn, Winter, Early Spring, Spring to summer, Summers**

e) Methods of preparation. **Dried Or Fresh**

Ground Infusion Boiled Distilled Juice Others

f) Methods of Internal Applications: **Infusion, Decoction, Tea, Syrup, Others**

g) Methods of external applications: **Oil, Poultice, Lotion, Cream, others**

h) Do you use this Herb for Health Maintenance or as a Tonic? **Yes No**

i) How long the Plant materials of this specimen be stored? **Hours, Days, Weeks, Months, Years**

j) Is the plant Used for Domestic Utilization only Or does it have a market value?

Domestic, Community, Market, others

j) If it has a market value to whom or where it is sold?

Herbalist/Hakeem, Herb dealer, Pansar Shop Visiting agent Others.

k) How is this specie prepared/processed for sale? **Dried, Ground, Boiled, Distilled Others.**

l) In what Quantity is it sold? **Kilograms, Liters, Pile, Bundles, Others**

Ethno-botanical Studies and Vulnerability of Forest Resources of District Shangla, Khyber Pakhtunkhwa, Pakistan.

1. How do you fulfill daily house hold requirements?

Fuel wood LPG Cow Dung Kerosene Oil Others

2. Sources of Fuel wood.

Market Farmland Forest any other; If market. Cost/Bundle___

3. Approximate weight of one bundle?

10kg 15kg 20kg more

5. Daily time spend on fuel wood collection?

30minute 2hr 3hr more

6. People involved in fuel wood collection?

Children women men

7. Distance traveled to collect fuel wood.

1Km 2Km 3Km more

8. No. of Individuals involved in fuel wood collection per Family.

1 2 3 4 more

9. Uses of collected fuel wood.

Cooking Heating selling others

10. Is there any restrictions regarding fuel wood collection by forest department? **Yes No**

11. Do you cut green trees for fuel wood? **Yes No**

12. Uses of forests? **Grazing Timber extraction fuel wood others**

13. In your opinion what are the major threats to the forests?

Lack of awareness poor management forest fires Grazing

Timber mafia land mafia land slides

Over collection

1. How often do you collect/cut wood?

Everyday alternate days after two days other

2. What do you do with the wood that is left? **Store it uses on the next day**

3. Where do you store it? **Open area covered area**

4. How much you have stored wood presently? **Kg**_____

5. Do you have wood that was collected 5 to 10 years ago? **Yes No**

6. What you do with the wood that is not fit for burning? **Throw it any other use**

Alternate Resources

1. What do you use when there is no wood?

Kerosene oil LPG Solar stove other

2. How much LPG you use per month?

Less than 1cylinder 1 cylinder 2 cylinders more

3. Have you heard about Bio- Gas (Cow Dung gas/Gobar Gas)? **Yes No**

4. Have you heard about solar water geysers? **Yes No**

QUESTIONS

1. Are there any new roads made in last 5 to 10 years? **Yes** **No**
2. How many roads have been constructed in last 5 to 10 years? **1** **2** **3** **more**
3. Is it become easy to go to the forest for wood extraction due to these roads? **Yes** **No**
4. Do you think that new roads infrastructure has a bad impact on forest? **Yes** **No**
5. Is there any check post of forest department or police on each road? **Yes** **No**
6. Who is involved in timber extraction? **Locals** **police** **Forest officials** **other**
7. Awareness of Natural Resources conservation in community by forest dept? **Yes/No**
8. What is the status of forest as compared to the past? **Good** **Bad** **Same**

   Why_____
9. Is there any positive changes occur in conservation of forest resources in past 15 years by forest department of the district? **Yes** **No**
10. Who are best managers of forest? **Forest Department** **Local people**
11. Is there any available system of Conservation in your knowledge? What system of conservation of Natural Resources is best? **Traditional** **Departmental system**
12. Is there any conflict between the locals and Forest Department on method of forests resource Conservation? **Yes** **No** **Why**_____
13. Forest guards belong to the local area? **Yes** **No**
14. Are you satisfied with the local forest guards and foresters? **Yes** **No**

Key Informants Interviews: Questionnaire

1. What are the contributing factors for the degradation of forest resource in your area.

a) Climatic factors b) Local Pressure. c) Timber mafia d) Over Population e) others

2. What do you assess for the contribution of forest resource for the uplift of Socio- economic condition of the local people?

a) 5% b) 10% c) 20% d) 30% e) more

3. What do you assess for the consumption of forest resource for the uplift of Socio-economic condition of the local people?

a) 5% b) 10% c) 20% d) 30% e) other

4. What are the possible threats and causes of deforestation?

a) Poverty b) Fuel wood c) Timber mafia d) population e) Other

5. How do you see the present management system in your area?

a) Good b) Very Good c) Satisfactory d) Bad

6. Roads extension is threat to forest resource in your area?

a) Agree b) Up to some extent c) not agree

7. How would you assess the possible causes of vulnerability of forest resources in district Shangla?

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8. If population increase and unavailability of other resources are the main causes of forest depletion then what should be done to reduce/minimize the rate of depletion?

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