Role of Medicinal Plants in Provision of Livelihood and Treatment Services: A Case Study of District Shangla Khyber Pakhtunkhwa

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PIDE2016FMPHILENV06

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CERTIFICATE

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Dedicated To My Beloved Parents and Teachers

Acknowledgment

First and above all, I thank ALLAH for His blessings and for giving me the strength to proceed successfully with my studies.

My special gratitude and thanks goes to my supervisor, Dr. Abedullah Anjum, for his professional support, full-fledged assistance, personal interest, valuable comments and suggestions that guided me right from the very beginning of making the research proposal up to thesis write up.

I am also grateful to Dr. Rehana Siddiqui and Dr. Anwar Hussain for their valuable comments and suggestions in improving my research work. I express my sincere and warm gratefulness to my beloved colleagues Gulam Nabi for his complete help, allowed time devoted to my work and moral support. Allah bless him always!

Last but not the least my deepest sincere thanks to my parents, brothers and sisters for their prayers, moral, financial support, encouragement, and appreciation that helped me throughout my life to reach up to this level.

Haidar Ali

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Abstract

Medicinal plants are important for human being in term of livelihood and treatment services all over the world. This study has two dimension one for role of medicinal plants in provision of livelihood and treatment services while the second one is the factors that are affecting quantity collection of medicinal plants in district Shangla KPK. The study was based on primary data collected through semi-structured questioners from medicinal plants harvesters and local community of the district. The empirical analysis of the study was examined through descriptive statistics, ordinary least square, binary logistic and two-stage least square method. The result found that medicinal plants have a great potential to contribute in local community livelihood and health services. Although, factors deforestation, increasing temperature, decreasing rainfall and overgrazing (grazing of livestock) negatively affect quantity collection of medicinal plants. Thus, it is needed to sustain these flora for the betterment of local community livelihood and health services.

Keywords: Medicinal plants, Livelihood, Health treatment services, Conservation

Chapter 1

Introduction

There is no existence of life without plants (Haq et al., 2012). Plants are the essential foundation of medicine (Aslam & Ahmad, 2016). Approximately there are about 250,000 species of plants worldwide which are genetically modified and important for human life. Medicinal plants have been identified and used throughout human history (Hamilton, 2004). Some important drugs that are still in use today are derived from traditional medicinal herbs (Phillipson, 1997).

The director of World Health Organization (1999) indicated that 80% of the developing countries population rely on traditional medicines mainly plant-based, especially for their primary health care needs. Medicinal plants have been used since ancient times for the prevention of various diseases such is for hepatitis, antibiotic, throat treatment, snake bit and Pain (Balunas & Kinghorn, 2005). These plants are considered for humans and animals health treatment all over the world (Bisht et al., 2010). MPs contribute a significant role to the human health (Farnsworth et.al., 1985).

Pakistan has famous for its variety of flora in Himalayas, Hindukush, and Karakorum with highest altitude ranging from 0 to 8611m. There are 6000 plants exists in Pakistan, 12% out of them flora are medicinally used (Akhtar et al., 2000). According to Abbasi et al., (2012) natural medicines have cultural values as well as important for keeping the health of peoples, especially in rural areas. Where communities excess to doctors and facilities are limited (Hamayun, 2007). Medicinal plants have been used by Hakims and in traditional medicine. Mostly rural population in Pakistan are using MPs for their health treatment (Ishtiaq et al., 2015).

(Bibi et al., 2014) conducted a survey on ethnobiology of 92 plants species in Kala Chitta Hills and concluded that plant species are frequently used by the the local community for medicinal purposes. According to Shinwari et.al., (2013) people of Bar and Shinaki valleys are using 22% medicinal plants for gastro-intestinal treatment and 11% for respiratory pulmonary aliments.

Furthermore medicinal plants have a role in the economic wellbeing of collectors, traders and healers (Phondani et.al., 2011). Besides they offer a significant base of income to rural people in developing countries, particularly through the sale of wild harvested material (Carloo, 2013). The selling of these plants contributes 15 to 30 % share to the total income of poorer households (Lim, 2014).

The significance of MPs is known in the Himalayan region mostly from ecological, social, and economic perspectives (Joshi & Joshi, 2014). Medicinal plants and animals are a source of economic return to local communities and for the country as a whole, when collected and managed for export. In the 1990s about 50 tons of dried morels (mushrooms) were collected and exported from the northern mountains of Pakistan (USAID, 2012).

Collection and sale of medicinal plants and other non-timber forest resources are a vital economic activity in the Northern parts of Pakistan. About 5000 families in northern areas are involved in the gathering and processing of medicinal plants in the region. The women and children are also involved in the collection of medicinal plants, the MPs are a source of income for the collectors (Gulshan et al., 2012).

Moreover there are several factors affecting medicinal plants like deforestation, overgrazing, overharvesting and climate change (Haq et al., 2012). The major threats to medicinal plants resources is overharvesting (Van Andel et al., 2015). Shinwari, (2010) reported that many species are becoming scarce in the Hindukush region because of overharvesting. Due to Overharvesting the effective population size of medicinal plants are also reducing, which

may have great genetic consequences on medicinal plants (Edeoga et al., 2005). Overharvesting occurs due to trade pressure of MPs which causes extinct of flora in any regions (Agisho et al., 2014).

Similarly overgrazing is also a threat for medicinal plants (Lee et al., 2008). Livestock is playing a crucial role in rural economy to uplift the poor household (Gurib, 2006) but grazing of livestock has negative impact on the stock of MPs and plant population. (Murad et al., 2013) suggested that livestock effects medicinal plants species in three ways, through walk on plants which reduce the natural habit, eating of herbs, small trees and bushes. Besides walking on soil which pressed the soil particles together in result the natural habit of plants don't grow on that soil.

Another factor which affects the availability of MPs is deforestation (Giday et al., 2003). According to World Bank (2015) medicinal plants are at a high risk of extinction due to deforestation. Globally, deforestation is a major threat to medicinal plants (Casse et al., 2004). Concern about this process has led to renewed interest in medicinal plant research, and it is important to discover medicinal properties of plants before its extinction (Achard et al., 2002). According to Shahbaz et al., (2007) due to deforestation many species in Pakistan are reducing like mushrooms, medicinal and aromatic plants, and other biological diversity.

Besides climate change is another factor which is disturbing the taxonomy of plants (Tangjitman, Trisonthi, Wongsawad, Jitaree, & Svenning, 2015). Climate change is a threat to biodiversity (Ratha et al., 2012) and affects the natural distribution of species and increases frequency of disease (Duraiappah & Naeem, 2005). According to Baede et al., (2007) increase in temperature will be harmful consequences for the ecosystem. Extreme weather events already impact the availability and supply of medicinal plants on the global level and projected future increases in extreme weather are negatively affect medicinal plants growth (Cavaliere, 2009).

1.2 Significance of the study

Medicinal plants contributed in multiple dimensions, health support, financial income and livelihood security (Razzaq et al., 2010). Many people depend on MPs in district Shangla. These plants play a significant role for local community of the district in term of income and treatment of various diseases. But unfortunately the availability of these resources is becoming scarce day by day. In district Shangla, there are many problem related to MPs like overharvesting, overgrazing, deforestation, unskilled people, losses incurred during collection and storage. These factors directly and indirectly affect the quantity and quality of MPs. The species like *Polygoanatum verticillatum, Viiola canescens, Berbeirs vulgaris, Valeriana jatamanisii, Paeonia emodii and Podophyllum hexandrum* are already rare in district Shangla (Razzaq et al., 2013). These plants may become extinct from the area in future if constantly being exploited. Thus current study is attempting to identify the factor contributing in extinction.

1.3 Research question

1. Does local people of district Shangla use medicinal plants for their health care?
2. Does local community depend on these medicinal plants for their livelihood?
3. What are the factors that influence the availability of medicinal plants in District Shangla?

1.4 Objectives of the study

1. To investigate the share of medicinal plant in total health expenditures.
2. To explore the determinant of use of medicinal plant for treatment.
3. To investigate the impact of perception about environmental factors (rainfall, temperature etc.) on the availability of Medicinal plants.

4. To estimate the role of collection of medicinal plant on community's livelihood of district Shangla.

1.5 Hypotheses testing

1. Medicinal plants species has positive impacts on people livelihood security in the district.
2. The factors deforestation, climate change, overgrazing and overharvesting have negative impacts on medicinal plants in the district.
3. Medicinal plants have a positive impact on local community health in the district.

1.6 Organization of the study

The study is organized into different chapters. Introduction of the study is given in chapter one. Literature of the study is reviewed in the second chapter. Third chapter is comprised on data and methodology. In fourth chapter role of medicinal plants are discussed. Descriptive data and econometrics analysis are discussed in chapter 5. While conclusion and recommendations are given chapter 6.

Chapter 2

Literature review

The boreal forest of Canada is home to several indigenous people. These indigenous people have been using traditional medicine for health care system for a decades (Uprety, Asselin, Dhakal, & Julien, 2012). The main objective of the study was documentation of the use of medicinal plants species for indigenous people in Canada. For estimation descriptive statistic has been used. Total 546 taxa of plants were identified which are used by indigenous people for their health treatment. These taxa treat 28 diseases and highest plants species were used for the gastro-intestinal disorder, and musculoskeletal disorder. The study also observed that the availability of pharmaceutical and therapeutically important MPs species declining and the number of rare and threatened species among MPs is increasing in boreal forest.

Nepal has been known for his famous flora, a study conducted by Singh et al., (1979) in Terai forest of Nepal. The main objective of the study was to investigate the indigenous knowledge on plant utilization and conservation measure. Primary data were collected through questionnaire and surveys. For empirical analysis botanical method use value (UV) has been adopted. The main finding of the study was 66 species of plant taxa were identified; these plants are belonging to 38 families and 65 classes. The 41 plant species were used by local for various diseases. Such as for cold fever, diarrhoea, dysentery, boils, skin disease, and urinary infection. But unfortunately the study also found that theses flora are under great pressure due to deforestation, overharvesting and overpopulation.

According to Nergard et al., (2015) MPs have also important for women health treatment in Mali West Africa. The main objective of the study was to explore the use of MPs for women health treatment in case of pregnancy. The study was based on the primary data source and 203 women were interviewed in health care centre. The main finding of the study was 79.9%

women were used medicinal plants during prenatal period. Only 8.5 % women had received a recommendation from a traditional healer. Although high use of medicinal plants in pregnancy leads to malaria and urinary infections which is pose a high health risk for mother and child. The author suggested it's important to collaboration with health-care centre on the safe use of MPs.

An ethnobotanical survey was conducted by (Ahmed et al., 2013) in Patriata , Murre in Pakistan. The objective of the study was to find traditional knowledge about the usage on wild plants. The study was based on primary data and for estimation binary logit regression has been used. Total 94 plant taxa were identified in area study. These plants were used by local for medicine 27 %, ethno veterinary 4.79%, fruit 8.55% vegetable 9.52% and for fuel 19.90%. The study also revealed that these species are playing an important role in local food security as well as for medicine, especially for poor people. Thus it should be considered in future management plans for local and regional forest conservation.

Bano et al., (2014) emphasize that Skardu valley has a great potential for the botanic diversity. The study area was Skardu (Gilgit Balitistan). The main focus of the study was the quantitative ethno medicinal diversity of the region and to collect information on the uses of MPs. For estimation botanical method relative frequency citation (RFC), use value (UV) and statistical method Pearson Correlation Coefficient was taken. A key finding of the study was 50 medicinal plants were identified, most frequent part used is leaves and roots. Most of the plants were used for Asthma/breathing problem, Diarrhoea, wounds, body ache, stomach ache, cough, blood purification, teeth cleaning, and lung disorder. The author suggested there is a further need for research in the region to discover new medicinal plants.

A study was taken by (Ii, 2003) in the Himalayan (Nepal) he highlighted that commercial medicinal plants are collected from the forest by local residents and sold it for increasing their household income. The study was based on primary data included open ended

questionnaire from local people. The survey was collected from 232 medicinal plants collector, 66 wholesaler, and 16 herbal production companies. The result shows the worth of these plants in millions of US dollars. These plants have a great economic potential for local people of himalayan. Collection of MPs was found to create a significant part for local livelihood in the region. These MPs contributing in the household income is an average of annual 12 %. The study also found that due trade pressure of MPs it lead to overharvesting of species, as a result it might create a genetic consequences for medicinal plants resources.

H. Ali et al., (2011) highlighted collecting and selling of medicinal plants is a source of income for local people of Swat region. The study was conducted in swat valley of Pakistan. The main objective of the study was to find a collection pattern of MPs which is an economic activity for local community. Local collector and dealers were surveyed about their quantity collected, price and income received from selling of medicinal plants. For estimation, descriptive statistics have been used. A significant finding of the study was that, collection of medicinal plants is mostly done by poor people and earns additional income. But its market share has been declining reason for declining were identified that as unreliable and poor quality of the material supplied, length of the supply chain and poor marketing strategies. These problems can be addressed do develop suitable harvesting practices and improving linkage among all steps in the chain.

A study was taken by (Arshad et.al. 2016) to investigate the medicinal plants distribution, diversity and threats to it in Khunjarab National Park Gilgit Baltistan. The study was based on primary data sources included questionnaire and field walk for the identification of medicinal plants. The main finding of the study was that medicinal plants are under great pressure of global climate change and anthropogenic factors such as over collection, overgrazing, rapid increase in population of local area and rapid losses of traditional knowledge for their sustainable uses.

Conservation study of 45 threaten species was taken by (Asad et.al. 2014) in Mankhil valley in Hindukush range of Pakistan. The study was based on primary data sources and filed walk. The study exposed that there are several factors which are contributing in the losses of medicinal plants species. These factors were including deforestation 15.5%, over collection 75.5%, overgrazing 28.9%, and fuel wood usage 35.45%. Due to these factors the medicinal plants species are in great pressure in Mankhil village.

A study was taken by (Ahmed et al., 2013) about to predict the potential climatic functions of three medicinally important Asclepiad: *Pentatropis, Tylophora hirusta and Vincetoxicum arnottianum.* The data were collected from herbarium specimens held in major herbaria of Pakistan and two years (2010 and 2011) of field survey. For data analysis Maxent model were employed. The study was found that these species of plants are under constant extinction threat due to climatic variation in Pakistan.

According to Shinware et al., (2013) ethnobotanical knowledge is proving to invaluable for drug in the wake of prospecting from biodiversity. But unfortunately theses resources are under great threats from anthropogenic activities and climatic variation. The study was led in Malakand district, data was collected through open ended questionnaire from local community. For data analysis relative frequency citation and use value was employed. The result of study revealed that 92 plant species belonging to 56 families was identified, these species are used local community for medical purposes as well as for food. However, the result found that these species of plants are under pressure from human activates such from overexploitation, overpopulation, deforestation and overgrazing.

A study was taken by (Hussain et al., 2013) in swat valley. The focused of study was to analyse medicinal plants resources for poverty alleviation in milieu of swat. For data analysis use value of plant and relative frequency was used. The study found that local people are used medicinal plants for various treatment such as for gastro intestinal problem, arthritis, as

anti-helminthic, laxative, for the cue of skin, sore throat and fever. The study also found that these species are facing several issues resulting in depletion of the plants population. The main conservation issued by medicinal plants in swat are overharvesting, deforestation, soil degradation, overgrazing, losses during collection and storage, unmonitored trade, lack of clear resources tenure and custodianship, little understanding of sustainable management parameters and knowledge of market requirement.

2.2 Contribution of the study

Although, major share population heavily depends on medicinal plants for the treatment of different diseases but still factor affecting the use of medicinal plants are unknown in the context of Pakistan. In rural set up where forests are in accessible range, of the livelihood of rural population is medicinal plants. However, the contribution of medicinal plants in rural livelihood is also unknown. The presenting study is attempting to investigate the contribution of medicinal plants in rural livelihood and determinant of rural livelihood. So that the policy maker focus on those parameters which has large and positive impact on rural livelihood. To the best of my knowledge there is no academic research exist in Pakistan focusing on determinants of the use of medicinal plants and rural livelihood obtained from medicinal plants. Thus this study will bridge the gap.

Chapter 3

Data and Methodology

3.1 Study area

Shangla district is located in the Khyber Pakhtunkhwa province of Pakistan. Alpuri tehsil is head quarter of the district. Before 1995 it was a part of swat district, but after 1995 it was upgraded a separate district by the chief minister Aftab Sheerpao. The district has 1586 square meter area in which 36% is cultivated and 64 % is none cultivated. Similarly 32% area is covered by forest. The landscape of the district is dominated by high mountains and narrow valleys in western boundaries of Himalaya. Besides general elevation of the district is 2000 to 3500 meter above from the sea level. Kuz Gansahl is the highest point in district shangla. Total population of the district is 757,810 with number of house hold 89,695 (Pakistan Bureau of Statistics, 2017). The district shangla is bounded by Kohistan in north, in the east by Battgram District; in the west by Swat, similarly in the south by District Buner. Local people depend on agriculture sector. District Shangla is full of natural resources such as water, forest, medicinal plants, diamonds and wild life. There are 76 different medicinal plants species were identified, amongst these 76 plants species is 12 plants are shrubs, 52 plants species are herbs, 11 tress and one is fungus (Razaq et al., 2010). The most economically valuable species which are identified in study area is *Morchellaesculenta, Aconitum hetrophyllum, Dactylorhiza hatagirea, Podophyllum emodi, Trillium govanianum, Viola canescens, Thymus linearis, Thalictrum foliosum and Geranium wallichianum* (Shah & Hussain, 2012).

3.2 Data collection procedure and methodology

3.2.1 Data collection procedure

This study was based on primary data. The data was collected through questionnaire from medicinal plants collectors and local households. For estimation the quantitative analysis was employed. District Shangla has been selected purposively. The district has three tehsil Alpuri, Puran and Chakeser which are shown in (Figure 3.1). The data was collected from all three tehsils, besides multistage sampling techniques was employed.

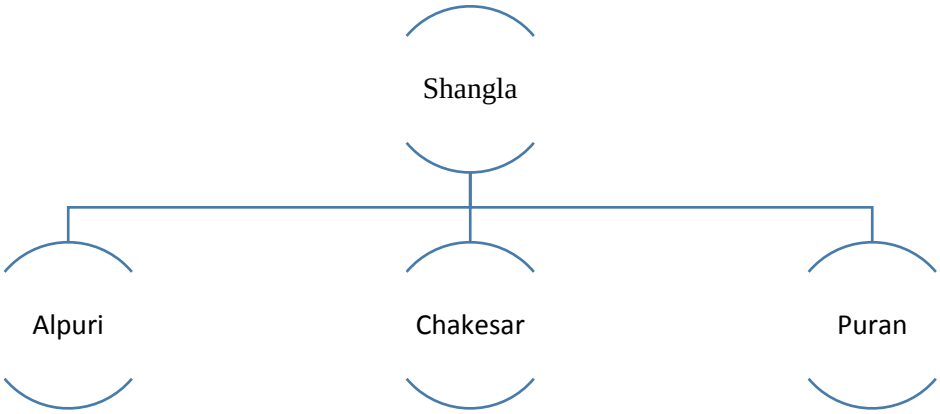

Figure 3. 1 Tehsils of district Shangla

At the first stage two villages from each tehsil was selected randomly which is shown in (Table 3.1). At the second stage 30 respondents from each village was purposely selected, including 15 collectors and 15 non collectors. At the third stage a list of collectors and non-collectors was prepared by getting information from village elder. Then at the last stage 15 each from collectors and non-collectors was randomly selected.

Table 3. 1 Sample size allocation for each tehsil and villages

Tehsils	Villages	Collectors of medicinal plants	MPs consumption	Total sample size for each villages
Alpuri	Ajmir	15	15	30
	Leloni	15	15	30
Chakeasr	Opal	15	15	30
	Galibat	15	15	30
Puran	Chagam	15	15	30
	Yakhtangy	15	15	30
Total		**90**	**90**	**180**

3.3 Field walk in study area

During the field walk in research area with local medicinal plants collectors we found that MPs are widely available in district Shangla. Most of the plant diversity are distributed in mountainous region. Which is far from the villages as an average 7km is distance from village to mountain. Some other species of plants are exist outside of villages. The medicinal plants species is different from area to area according to each species. Our first field walk was started from Ajmir village to Liloni (Banda) and around its areas (Logia, Ghanshal, Bar Banda and Takht Banda). These areas are considered a hub for medicinal plants diversity (Figure 3.2). The most popular species were recorded during first field walk in Ajmir to Leloni valley are *Menthe longifolia, Mesuafeera, Bergenia Cilitia, Valerina Jatamansi, Trillum Govaninum Wall, Geradina Wall, Phodophylum Emodi and Morcella Esculanta.*

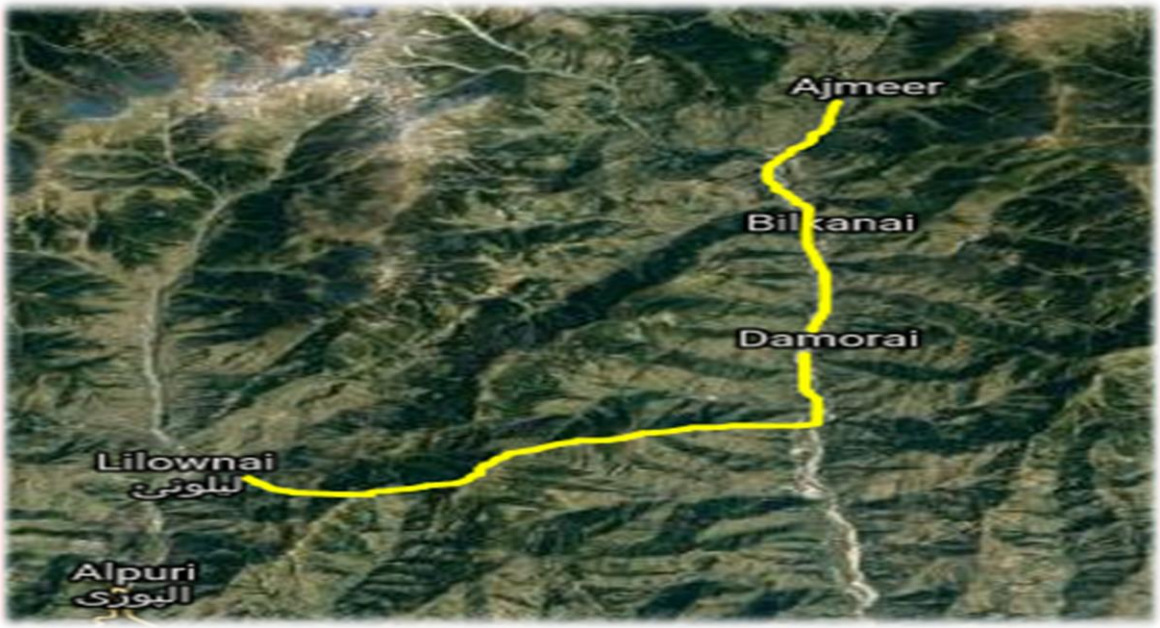

Figure 3. 2 First field walk in Tehsil Alpuri (Source: Google Map)

Field walk in tehsil Chakesar

Second field walk was started in Chakesar tehsil from Shang village to Sydanoo Derai which are shown in (Figure 3.3). Between these two villages the main forest area are exist. Chakesar tehsil is also famous for rich flora. According to our observations the plant species *like Indiegeoferra, Lepedium Sativium, Rumex Dentatus, Viloa Oderata, Ajuga Bbarcteosa, Ajuga Parviflora, Cana Indica Linn and Morchella Esculenta* are found in Chakesar tehsil.

Figure 3. 3 second field walk in Chakesar Tehsil (Source: Goggle Map)

The last field walk we started in Puran Tehsil from village Chagam to Martung. The most important species which we were found during in this field walk are *Berberies Lycem, Achyrnanthes Aspera, Acruscalamus Linn Zizyphus Sativa, Viola Odorta, Taraxacum Officinale, Gerardina Wall, Aconitum Hetrophyliumm, Menthe longifolia, D. belophylla and Morrchella Esculenta* (Figure 3.4).

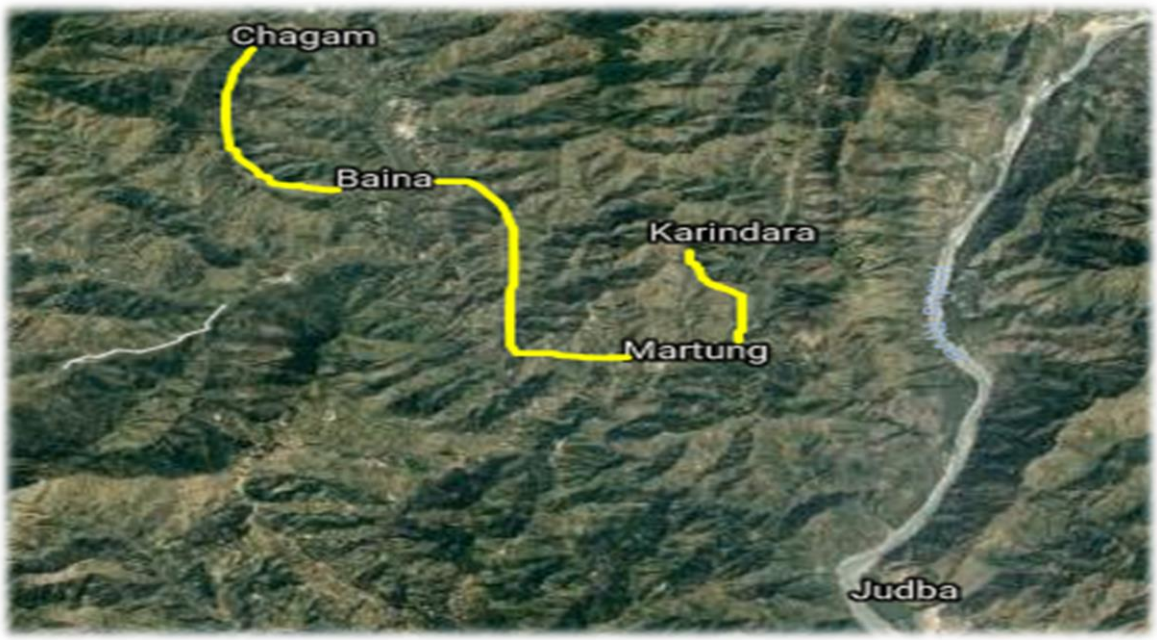

Figure 3. 4 Third field walk in Puran Tehsil (Source: Google Map)

Focus group discussions

Three focus group discussion was held in each tehsil (Alpuri, Puran and Chakesar) for the purpose of management, collection and using of medicinal plants. The members of the focus group discussions composed of male aged 20 to 60 year. The discussion was held in native language Pashto. In each focus group discussion, about 20 to 25 local respondents participated. Beside the FGDs were held in convenient centres like Hujra and Masjid.

3.4 Empirical frame work of the study

Empirical frame work of this study is include statistical and econometric analysis for each objective. For objective first "To investigate the share of medicinal plant in health expenditure" the descriptive statistic has been employed. For second objective of the study

"To explore the determinants of use of medicinal plants for treatment (consumption-collectors and non-collectors)" probit model is used for this objective. Furthermore for third objective "To investigate the impact of perception about environmental factors on the availability of medicinal plants" ordinary least square method is employed. Additionally for objective four "To estimate the role of collection of medicinal plants on community livelihood of district Shangla" two stage least square method is employed.

3.4.1 Empirical frame work for determinants of medicinal Plants uses

The first objective of the study is to investigate the factors determining the use of medicinal plants for the treatment of different diseases. Among these factors includes household size, household income, education of household head, age of the respondent and the strength of believe on religion. It is hypothesized that these factors directly and indirectly affect the use of MPs. In order to investigate these relations a Probit model is employed by considering use of medicinal plants as dependent variable which is 1 for use and 0 otherwise and household size, household income, education of household head, age of the respondent and the strength of the believe on religion as independent variables. The effect of household income on medicinal plant use is negative, it implies that higher household income break the financial barrier and thus expected to have better excess to medical doctor and to purchase medicine. Similarly effect of age on use of medicinal plants is positive it show that old age peoples more towards to the use of medicinal plants. In addition education of household head is negatively correlated to the use of medicinal plants, because more educated person have better understanding that how to medicate himself. But those who have less education have higher inclination to the use of medicinal plants, therefore education is negatively correlated to the use of medicinal plants. Similarly household size is positively affecting the use of medicinal plants. Because large family size have no such financial resources to visit physician, therefore they might have higher preferences to use medicinal plants for health

treatment. Furthermore religion is also affecting the use of medicinal plants. The religion index is estimated based on (Prayer, performed Hajj, fasting and Zakat).

$$probit[p(UM = 1) = \phi(\beta_0 + \beta_1 HS + \beta_2 HY + \beta_3 EDU + \beta_4 AGE + \beta_6 RE + \varepsilon)$$

Variable specification

UMP: Use of medicinal plants it is a dummy variable if the respondent use the MPs is a medicine then 1, if no then 0. For the use of medicinal plants seven diseases was taken such as Asthma, bone problem, headache, stomach problem, general pain, urinary tract infection and fever.

HS: Household size

HY: Household income per-month/R.s

EDU: Education level of household (head year of schooling)

Age: Age of household head (number)

RE: Religiousness is estimated by developing religious index (based on Prayer, Hajj performed, Fasting and Zakat). The religiousness index is construct through principle component analysis (PCA).

3.4.2 Empirical frame work for determinants of medicinal plants harvesting

The determinants of medicinal plants quantity harvesting are climate change, deforestation, overgrazing, overharvesting, working hour of collectors and distance (from home to area of collection). These factors directly and indirectly affect the quantity harvesting of MPs. Overharvesting has placed due to commercial and scientific attention on MPs (Roberson, 2008). Therefore overharvesting is indirectly affect on quantity harvesting of medicinal plants. On the other side, overgrazing is also adversely affect on quantity harvesting of MPs.

The number of animals was taken a proxy variable to capture overharvesting. Similarly climate change is another factor which is indirectly affects the quantity harvesting of medicinal plants. For climate change effect on quantity harvesting, increase in temperature and decrease in rainfall pattern over the years was asked from collectors of MPs in form of close ended question. These two variables are in Likert scale. Another factor which affects the quantity harvesting of medicinal plants is deforestation. Working hour is also affect quantity harvesting of MPs, therefore working hour is expected to increase quantity harvesting of medicinal plant. Similarly distance from home to area of collection is indirectly affect the quantity of MPs. Increase in distance from home to collection area will be decrease quantity harvesting of MPs. Based on above theoretical framework the empirical model has been made below.

$$\boldsymbol{Q_{MP} = B_0 + B_1 RF + B_2 TMP + B_3 DF + B_4 OVG + B_5 XP + B_6 WH + B_7 DIST} + \in$$

Variable specification

QMP: Quantity harvesting of MPs (in kg) per-year.

B_0: Intercept

RF: Decreasing rainfall over the years was in Likert scale from 1 to 5 (1 very low decreasing, 2: low decreasing, 3: no change, 4: high decreasing, 5: very high decreasing)

TEMP: Increasing temperature over the years was also in Likert scale (1: very low increasing, 2: low increasing, 3: no change, 4: high increasing and 5: very high increasing).

DF: Deforestation in term of Likert scale from 1 to 5 (1: very low rate of deforestation, 2: low rate of deforestation, 3: neutral, 4: high rate of deforestation and 5 very high rate of deforestation).

OVG: Overgrazing: the number of animal was taken (as a proxy variable) from MPs collectors to capture the overgrazing.

WH: Working hour in the field for quantity collection of MPs.

XP: Experience in terms of year about collection and selection of medicinal plants species.

DIS: Distance from home to collection area in hours.

∈**:** Error term

3.4.3 Empirical frame work for medicinal plants and livelihood of farmer

In rural areas of Pakistan employment opportunity are limited and mostly they depend on agricultural or forest based employment. In Shangla district collection of medicinal plant is common and people are driving a significant share of their income from medicinal plants. Therefore livelihood of collectors depends on income from medicinal plants as well as income from other sources. In addition, collectors selling medicinal plants after grading are expected to earn higher profit. Similarly yearly of experience also contribute to decide which species is more valuable that should be collected and from where it will be available, implying that experience could have positive impact on livelihood. In addition, quantity harvesting of medicinal plants quantity collection of MPs are also contribute in the livelihood of collectors. Besides quantity collection of MPs is also depend on other variables which are explained in Table 2 (temperature, rainfall, deforestation, overgrazing, overharvesting, distance and working hour). Therefore quantity collection of MPs is not exogenous variable rather it is endogenous thus, its endogeneity is corrected by identifying proper instrumental variable. The instrumental variables are working hour and distance is taken for quantity collection of medicinal plants. For this analysis two-stage least square (2SLS) regression is employed.

$$\boldsymbol{Y = B_0 + B_1 WM_1 + B_2 EDU_2 + B_3 G_3 + B_4 XP_4 + (Qmp = B_1 WH + B_2 DIST) + \varepsilon}$$

Variable specification

Y: livelihood of respondents (income from medicinal plants and other sources) in one month/R.s.

$\boldsymbol{B_0}$**:** Intercept

WM: Working member in the family (number).

EDU: Total year of education of household members having age more than 20 year (year of schooling).

G: Grading of MPs: it is a dummy variable taking value 1 if the collector is properly grading the plants otherwise 0.

XP: Experience (about collection and selection of species in term of year); more experience of the harvester more will be the income of MPs harvester.

QMP: Quantity collection of medicinal plants per-month, in this analysis QMP is endogenous therefore proper instrumental variables are identified such as working hour (WH) and distance (DIST) from home to collection point in hour.

Chapter 4

Use and Role of Medicinal plants in Human Life

4.1 Categorize of medicinal plants

Approximately 76 species of MPs are identified in district Shangla. Among these 52 are herb, 13 are shrub, 11 trees and 1 is fungi (Figure 4.1). Most of medicinal plants species are belong to the family of *Lamicecia, Portulacaceae, Anacardiaceae* and *Geraniaceae*.

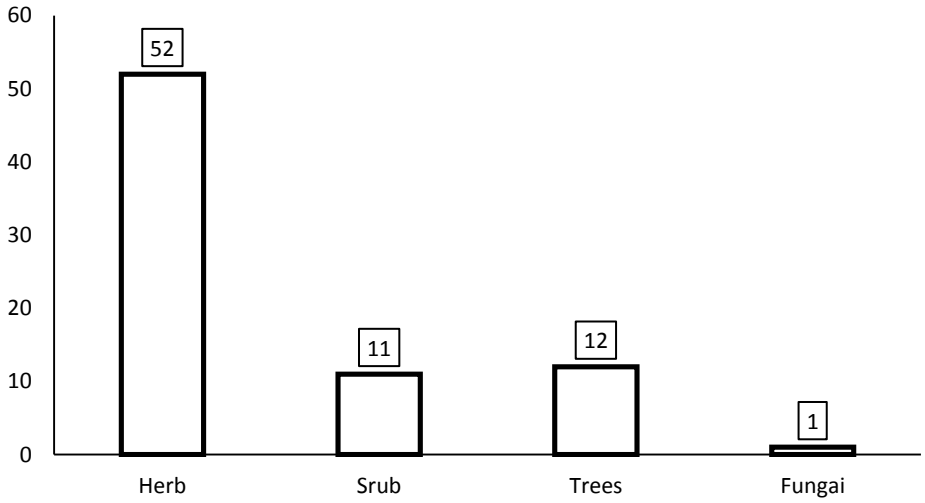

Figure 4. 1 Distribution of species of medicinal plants among different categories

Medicinal plants are widely distributed in study area. These plants are available from forest, riverside and at road side. Majority of them are available in forest 54% in area study remaining 12% at riverside and 34% at road side 34% (Figure 4.2). The local community also consider forest as important source of MPs because they believe that forest diversity is a rich source of good quality of MPs. It is generally believe that MPs along road side and riverside are comparatively polluted than MPs available in forest. Therefore local community firstly prefer forest medicinal plants instead of other. The flora that exist along riverside absorb more water (more water consuming) and among these specific species includes, *Menthe Longifolia, Portulaca Oleresisecia, Menthaspictrum, Nasturatim Officinale and Viola Odorata.*

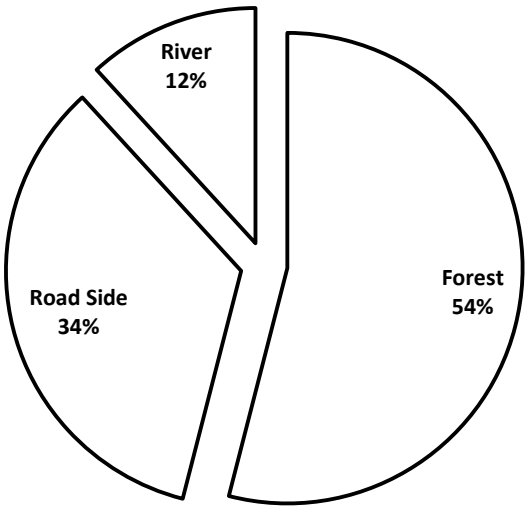

Figure 4. 2 Distribution of Medicinal Plants

4.1.2 Seasonal availability of medicinal Plants

Most of medicinal plants species in study area are depends on seasonal availability. In winter it is very difficult to find any species of medicinal plants. Although winter start in November but MPs availability drastically declines during 25th of December till 15th of March. Due to very low temperature in these two months majority of plants species disappear it is reported that only 2% MPs species are available in winter season in study area (Figure 4.3). During winter season most of plants species die, and start to regenerate after 15th March in study area. Generally MPs are available in spring, summer and winter seasons. Most of plants species are available in spring season 47%, summer 30% and winter 21% in study area (District Shangla). The intensive harvesting start from the month of April. Because in this month the species like *Morchella Esculental* and *Mesuferra* are available in huge quantity. Although many plants species reproduction starts during the month of March, but if collectors harvest them immediately after reproduction start then it seriously affects the availability of plants population in future. According to our survey in area most of the collectors start harvesting of medicinal plants from the month of April.

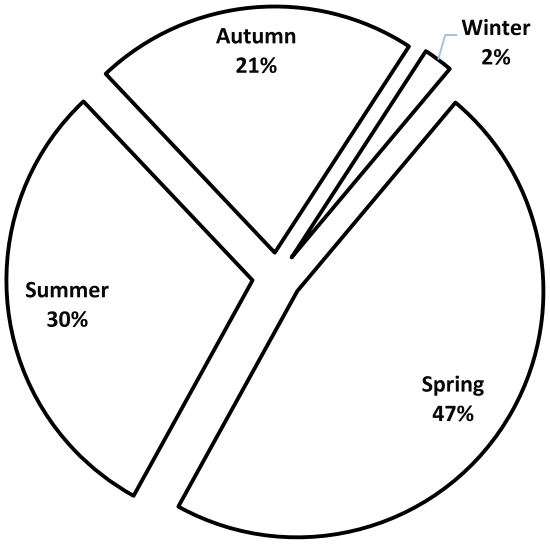

Figure 4. 3 Availability of medicinal plants by season

4.1.3 Harvesting techniques

Different tools, techniques and information employed in the collection of medicinal plants were investigated through field walk in study area. We observed MPs collectors are using knife and other tools such as (Pickaxe, spade, shovel, hand fork, and shears) for the harvesting of medicinal plants. Shovel and hand fork is mainly use for digging of roots and shears are using for cutting roots or for cutting some other parts of plants. In case if all other parts of plants are important for them then collectors directly extract the whole plants. In case of bush plants only roots are harvested and collectors just pull the bush outside and don't make hole. Because they are aware that making hole stop the regeneration of the bush. Traditional healer/Hakeem are also harvesting the MPs, but their procedure of harvesting is different from MPs collectors. During the discussion with Hakeem it is revealed that they are using only pickaxe instead of spade. Because spade damage the roots but pickaxe can take few roots out by leaving the rest inside which allow the plant to regrow quickly. Therefore the harvesting tools and technique is different among traditional healers/Hakeem and professional MPs collectors. Healer/Hakeem collect only those species which are required to fulfil their basic needs for medicine to treat patients and leave other plants for regeneration.

The logic provided by traditional healers/Hakeem is very important for the conservation of medicinal plants. However, professional collectors are collecting MPs for the income purposes and don't care much about the sustainability of the system. This implies that professional collectors also need to aware regeneration process of the MPs for their sustainable income.

4.2 Role of medicinal plants in health

For the local community of district Shangla medicinal plants are equally comparable with medicine from doctor. Because of low per capita income local community heavily depends on cheaper source of medical facilities. Medicinal plants are primarily used in providing basic health services by cock doctors at a cheaper rate compared to that of medical doctors in study area. It is observed that 46% household are using medicinal plants for their health treatment services (Figure 4.4). Medicinal plants are basically used for simple disease such as cough, pain[1] and headache. However, in some cases expert cock doctors also attempt to treat complex diseases with the help of medicinal plants without knowing the rate of success.

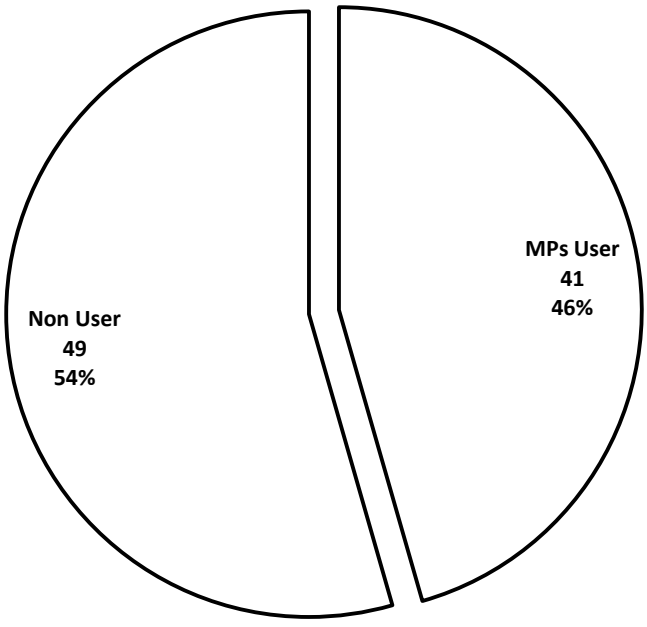

Figure 4. 4 Household consumption of medicinal plants

[1] It is a grouped form many types of pains such back pain, body pain knee pain etc.

Medicinal plants are not only a rich source treatment to human health but it is observed that local community also use MPs for animal treatment. It is observed that 47% respondents are using MPs for their self-treatment, 7% for animal treatment and 46% for both animal and self-treatment services (Figure 4.5).

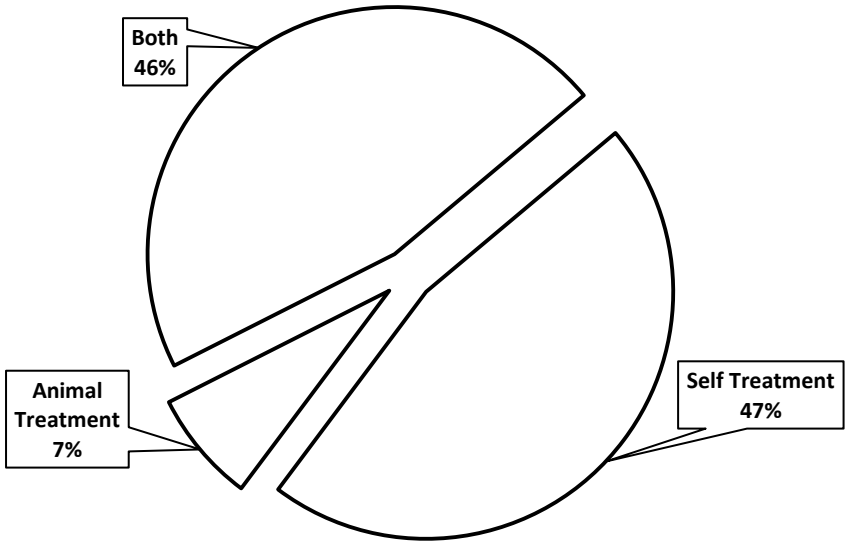

Figure 4. 5 Use of medicinal plants

The current study attempt to investigate seven most common diseases in study area for which respondents are using medicinal plants. These diseases includes Asthma, urinary tract infection, stomach problem headache, pain, dental carries and bone problem. The frequency of disease faced by respondents during the last six months is also asked and the distribution is reported in (Figure 4.6). During the discussion with local community it is also revealed that medicinal plants are also being used for the treatment of other diseases like respiratory system, eye disorder, and for body growth. The MPs species which are commonly used for the treat of these diseases includes *Paeonia Emodi, Datorra Stramonium Mil, D.Belophlla, Mentha spicata lin, Geraninum Wallichianum, Rumex Dentatus, Artemisa griffithiana, Lepedium Sativum.*

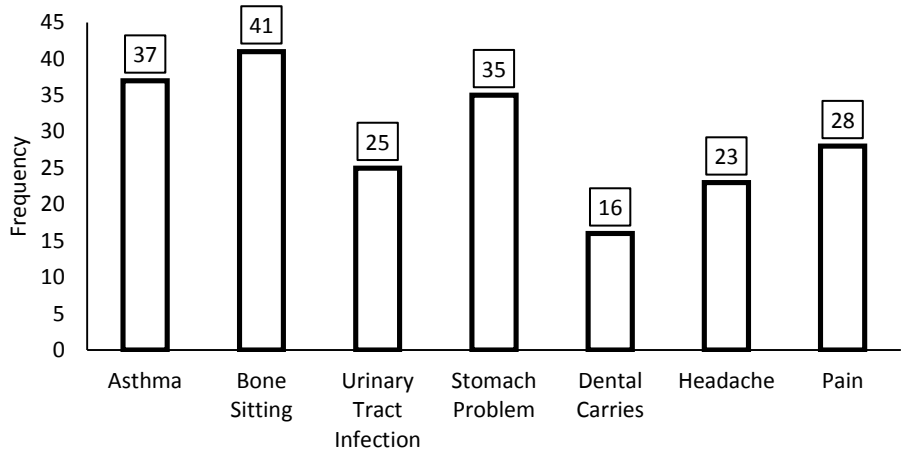

Figure 4. 6 Frequency of diseases in Human for last six months

It is observed that local community is also using medicinal plants for the treatment of poultry and animals in study area. During survey it is discovered that because of limited DVM (Doctor of Veterinary and Medicine) peoples are motivated to use MPs for the treatment of different types of animal's diseases. Among most common diseases in animals for which MPs are used includes Fever Pyrexia, Red water, foot and mouth disease (F.M.D), milk fever, Black Quarter/ Gangraena (B.Q) and Haemorrhagic Speticaemia (H.S). Frequently of different disease observed during the last six months are reported in (Figure 4.7). The medicinal plants species like *Skima Laurionlia, Adiantum Venstum, Cyperius Scariouse, Ajuga Parvifolia, Verbascum Thaspus, Micromienia Bifolra Benth, Galotropsia Procerra and Cana Indicia Linn* are frequently used for the treatment of animal and poultry.

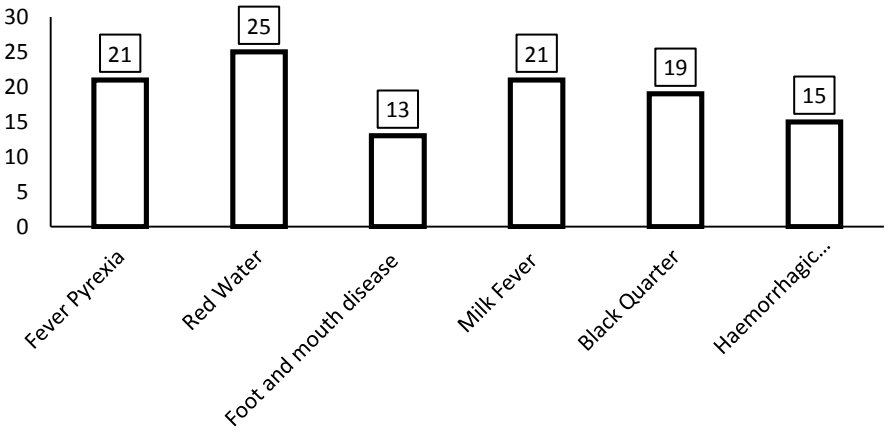

Figure 4. 7. Frequency of diseases in animals for last six months

4.3 Health expenditure of household

Total health expenditure incurred at the household level during the last six month is investigated in our sample area. There are two major sources of treatment cock doctor (Hakeem) and physician and there are respondents who visit both. In term of cock doctor rely on medicinal plants while physician depends on English medicines of different companies. In our case total household expenditure includes the cost of medicinal plants, doctor fee and cost incurred on English medicines. It is observed that on average family spends Rs.1475 on medicinal plants for the treatment purpose during the last six months. Surprisingly, it is reported that cock doctors did not receive any fee charges separately rather their fee includes in the cost of medicines (medicinal plant). However, physicians charge fee separately and in case of physicians total cost includes, doctor fee, travel cost and cost of medicines. It is observed that on an average each family spends Rs.3719 on doctor fee, medicine and travel cost during the last six months (Table 5). It is concluded that cost of treatment from physicians is almost double than cost of treatment from cock doctor.

Table 4. 1 Health Expenditure of households for last six month

Variable	Mean	Std. Dev.	Min	Max
Cost on medicinal plants	1475	683	200	3000
Some of cost of doctor fee, medicines and travel	3719	1531	1,200	7,800

Observation 41

4.3.1 Share of medicinal plants in health expenditure

In term of percentage share of cost of medicinal plants is 28% which is less than half of the share of cost of treatment from physicians 72% (Figure 4.8).

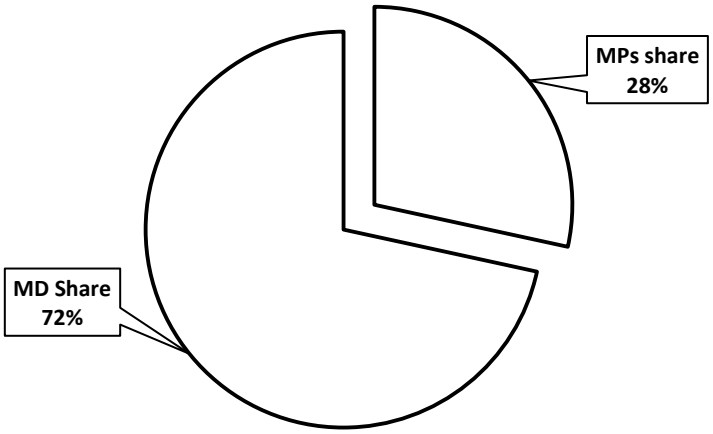

Figure 4. 8 Share of medicinal plants in health expenditures

Besides economic reason there are several other reasons reported by respondents that why they prefer to use medicinal plants over English medicines from physician. A significant proportion of respondents (20%) reported that medicinal plants are cheaper source of treatment compared to that of the treatment from physician. Another, 18% claimed that MPs have no side effect. It is observed that medicinal plants also have culture value and 17% sample respondents are using MPs because of its culture value. However, low income also motivate respondents to use MPs rather to visit physician for treatment. It is observed that only 17% respondents decided to use MPs mainly because of low income. However, there are 13% respondents using MPs because of limited excess to medical facility (excess to physicians). Another segment of society consists of 15% of respondents are using MPs mainly because of long distances to health centres (Figure 4.9).

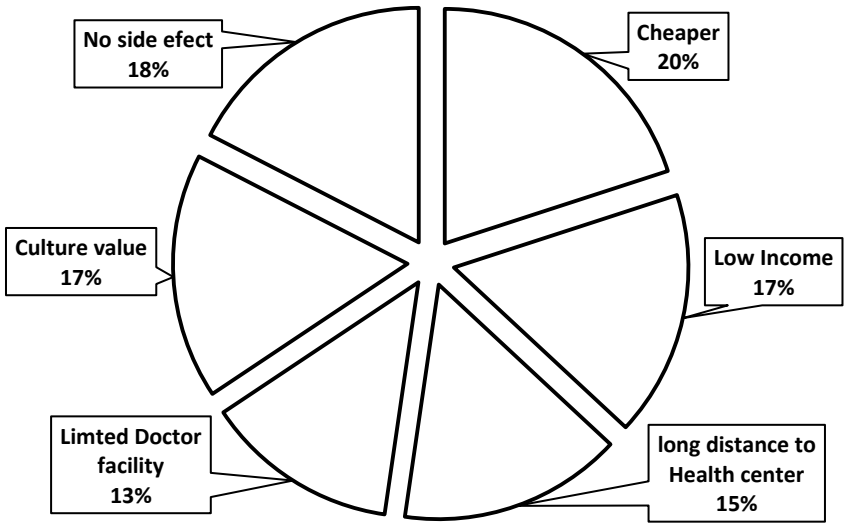

Figure 4. 9 Reason for choice of medicinal plants as a medicine

4.3 Role of medicinal plant in livelihood

Medicinal plants is one of the rich source of income contributing in total household income in district Shangla, indicating an important role in improving the livelihood of the community. Total 90 medicinal plants collectors are purposively selected to get information about the amount of MPs and income received from MPs. Our data revealed that selling of medicinal plants is an income generating activity that contribute relatively a significant amount of money in the family's total income. It is observed that majority of the MPs collectors are collecting species that have high economic values such as *Viloa Canesence, Meseufeera, Valeriana Jatamansi, Trillum Govaninum Wall, Germinium Wallichiaum, Geradina Wall, Thalictrum Folisioum, Phedophylum Emodi, Dactylorhiza Hatagreia and Morchella Esulenta.* Six most popular markets of MPs are surveyed in study area (Olander, Shahpur, Karora, Alpuri, Besham and Puran) to find the true economic value (Market price of MPs) of each species of medicinal plants. The average price of each species based on six markets are reported in Table 4.2.

Table 4. 2 Average market price (based on six market) of different species of medicinal plants in study area

S.No	Botanical Name	Local Name	Habitat	Price per-kg
1	Morchellaa esculenta	Gojai	Fungi	18000
2	Viloa Caneesence	Banfshaan	Herb	1100
3	Mesufeeraa	Laldanaa	Herb	800
4	Valeriania Jatamansi	Muashkibala	Herb	600
5	Trillum Gaovaninum	Yakaha Jarri	Herb	500
6	Germiniuam Wallichiaum	Sarrai Jarri	Herb	500
7	Geraidina Wall	Ghwaira Jarri	Herb	400
8	Thaliactrum Folisioum	Mamiera	Shrub	300
9	Phedoaphylum Emodi	Kakoora	Shrub	300
10	Dactyloarhiza Hatagreia	Panjaa	Shrub	250

Source: Author own survey

It is observed that Morchella esulenta has highest price in the market (Rs.18000/kg followed by Viloa Caneesence (Rs.1100/kg)

4.3.1 Income from medicinal plants in district Shangla

Average annual income earned from different species of medicinal plants is given in Table 4.3. The table provides empirical evidence that how forest diversity (i.e. diversity in species) contribute to improve the livelihood in the study area. Our finding reveals that maximum contribution to improve livelihood is made by Morcella Essulenta (Gojjai), followed by Viloa Canesence (Banfsahah) and Mesufeera (Laldana), implying that these three species are highly economical and valuable for local community. These three species are difficult to find and takes longer time to search them, because the price of these species is higher than other species. Besides these three species seven other species are also contributing reasonably to improve the livelihood in the study. However, price depend on various factors like quality, grading and experience of collection. However, grading is assumed to be contribute largely in the price received.

Table 4. 3 Average income from medicinal plants in year from each species

Income source/Plants Name	Observation	Mean	Min	Max
Viloa Canesence	84	8303	2700	22500
Mesufeera	89	7334	3000	21000
Trillum Govaninum	72	5134	1200	12000
Valeriana Jatamansi	86	4844	1600	12800
Germinium Wallichiaum	64	2932	900	5400
Geradina Wall	35	2648	900	4500
Thalictrum Folisioum	19	3052	2000	10000
Phedophylum Emodi	79	3068	900	6000
Dactylorhiza Hatagreia	4	2400	1600	4000
Morchella Esculenta	76	8703	4500	36000

Source: Author Own survey

Table 4.4 illustrate different sources of income of medicinal plants collectors. These sources are include agriculture sector, livestock, monthly wages and selling of fuel wood & others. As an average from agriculture sector the MPs collators are received 1098 rupees per month, similarly from livestock sector they received as an average 1953 rupees per-month. In addition from selling of woods and daily wages they are received as an average of 2076 and 2351 rupees per-month respectively.

Table 4.4 Different sources of average income of MPs collector per-month

Variable	Mean	Std. Dev.	Percentage Contribution
Agriculture sector	3050	1732	30%
Selling of fuel wood	2075	1557.3	21%
Income from daily wages	2359	1378.47	23%
Income from medicinal plants	2660	668.79	26%
Average total income per-month	10144		

The result of Figure 4.10 indicates income contribution of each sources and MPs in livelihood of collectors. The shares of MPs in the income (livelihood) of collectors is 26%, among other sources agriculture 30%, selling of fuel woods 21% and daily wages 23% are recoded to contribute in the livelihood of medicinal plants collectors in district Shangla.

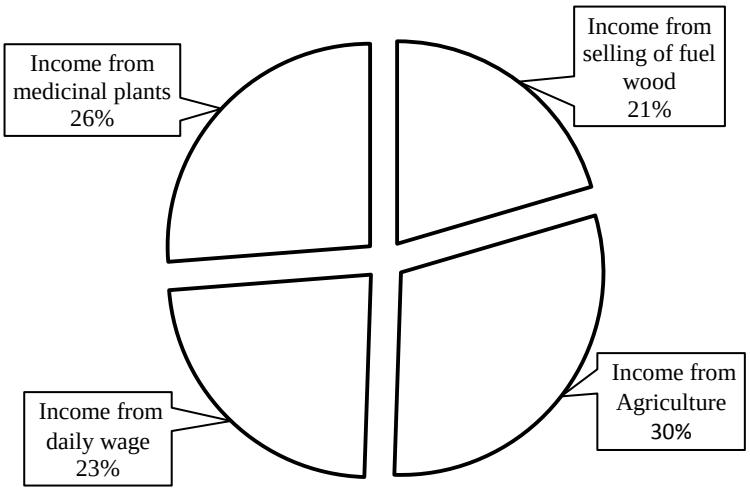

Figure 4.10 Share of MPs in the livelihood of collectors

4.4 Value chain of medicinal plants

According to our survey majority of the harvesters sell MPs to whole sellers in the local market. These whole seller sells their product in Mingora (Swat) because Swat is the main trading centre for the whole sellers of district Shangla. Trade for different species and collection pharmaceutical plants vary from market to market and area to area depending on the demand and supply and availability. The dealers from national market contact with their representative sitting in the local market of swat to purchase medicinal plants according to their demand. They indicate their demand in advance to the swat traders who transmit the signal of demand to local agent of the valley. They are performing the role of bridge between trader of swat and local shopkeepers and collectors. Small shopkeepers and medicinal plants collectors receive signals of demands from these agents. Thus MPs collectors gathered plants species for agents and local shopkeepers to fulfil their demand. Due to lack of education and

with least negotiation power they fail to bargain for better prices which lead to their exploitation. When collection process is completed then dealers at Mingora receive MPs material from collectors through agents (Figure 4.11). According to Sheer et al., (2009) three to four middleman involved in the value chain of medicinal plants before it reached to pharmaceutical industries.

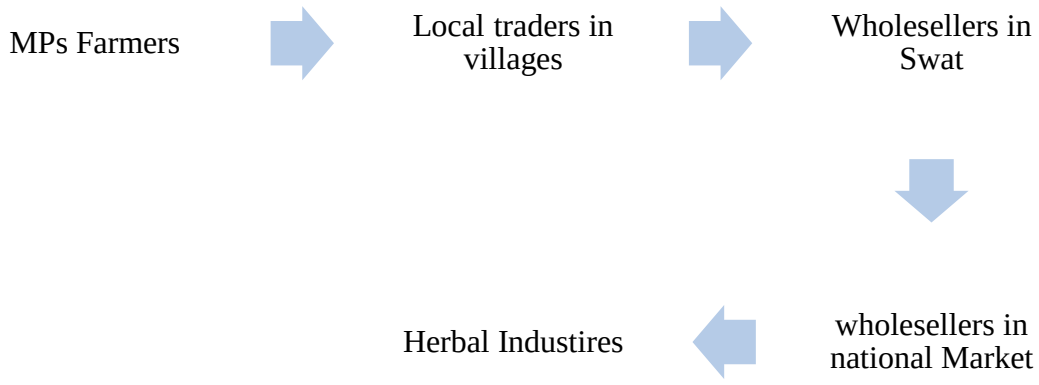

Figure 4.11 Value chain map of medicinal plants

4.5 Factors affecting availability of medicinal plants in district Shangla

The perception of farmers about the factors that are affecting collection of medicinal plants are summarized in (Figure 4.12 to 4.19). Among these climate change related factors includes increase in temperature over the years, increase temperature at flowering stage and decreasing rainfall over the years. Other factors are deforestation, overgrazing (number of animal going for grazing is considered as a proxy variable for overgrazing) and losses during collection and storage. The perception of these factors was measured on Likert scale such as very low, low, no change, high and very high. The 8% respondent are in the opinion that increase in temperature over the year is very low effect on the availability of medicinal plants. Similarly 38% and 30% are in the opinion that increase in temperature is low and remain same overtime. However 17% and 8 % respectively are in the opinion that increase in temperature is high and very high over the year to affect the availability of medicinal plants

in the area (Figure 4.12). Similarly perception about decreasing rainfall is 17% who claimed that decrease in rainfall over the year is very low and 21% claimed that decrease in rainfall is low but 24% are in the opinion that there is no decrease in rainfall over the year. However 28% are in the favour that decrease in rainfall is high which is affecting the availability of MPs and 10% are strongly favour that decrease in rainfall is mainly responsible to affect the availability of medicinal plants over the year (Figure 4.13). Some of the respondents mentioned that rainfall during the month of April is critical for the availability of MPs because if there is no or little rain in the month of April then it seriously affect the availability of MPs because of shortage of water affect the growth of MPs. The conclusion is that a moderate temperature and rainfall is playing an important role to promote the growth of MPs in the study area. The perceptions about deforestation which is indirectly affecting the availability of MPs is reported in (Figure 4.14). About 8% respondents are in the favour that there is very low rate deforestation. However 11% and 17% respectively, are in the opinion that deforestation is low and did not change overtime. On the other hand 39% and 25% respondents respectively, are in the opinion that deforestation is high and very high which is seriously affecting the availability of MPs in the study area. Throughout research survey MPs collectors highlighted that cutting of trees in winter season is one of the major reason of unavailability of MPs. They blamed forest department (Forester and Forest Guard) for not taking care of the forest in winter season. Timber mafia get achieve during the winter and start cutting the trees which is seriously affecting the availability of MPs. Overgrazing (grazing of Animal) is another factor affecting the availability of MPs in the study area. In our sample 1% respondents are in the opinion that overgrazing has very low (little) effect on the availability of MPs. Another 8% and 22% respondents respectively are in the opinion that overgrazing has low and no effect on the availability of MPs. However, 32% and 37% respondents respectively are in the opinion that overgrazing has high and very high negative

impact on the availability of MPs in the study area (Figure 4.15). Some collectors also highlighted that with little or no experiences (particularly children) don't care of other plants which are irrelevant to them. This is seriously affecting the diversity of forest and finally availability of MPs. Moreover because of lack of experience these children also harvest irrelevant species which are not useful in the context of MPs. Another reason of lack of availability of MPs is referred to the increase in number of collectors in the study area.

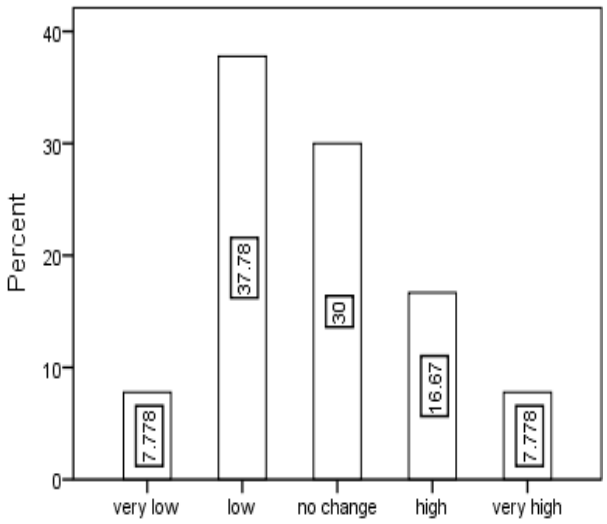

Figure 4.12 increasing temperature

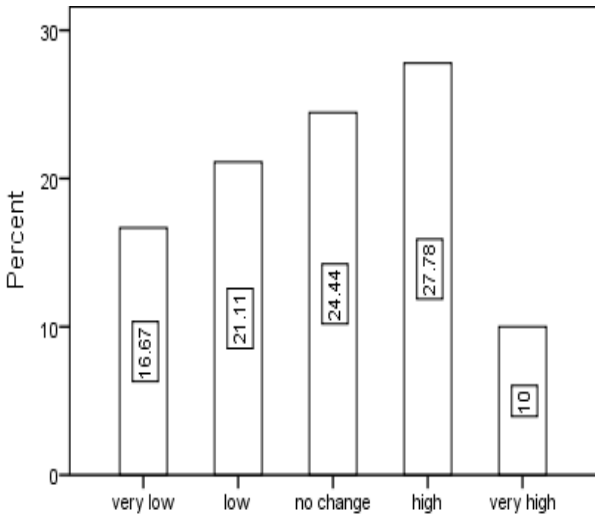

Figure 4.13 Decreasing rainfall

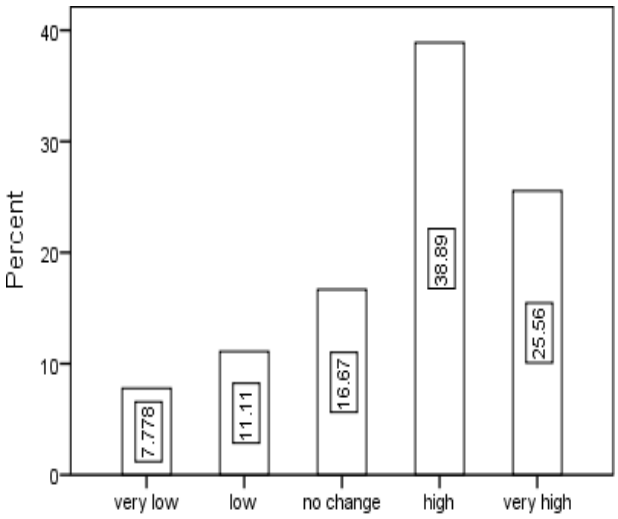

Figure 4.14 Deforestation

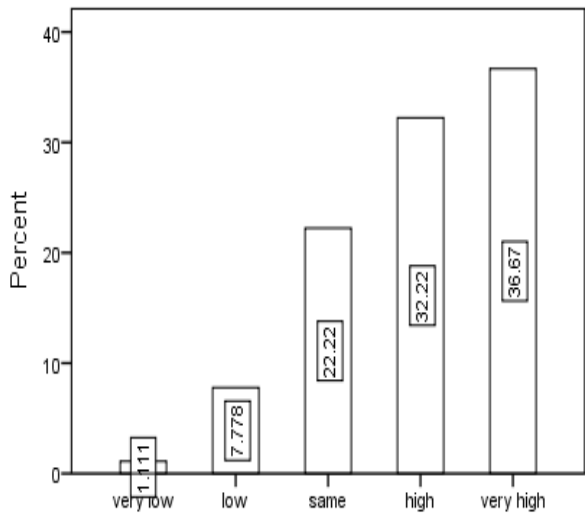

Figure 4.15 Overgrazing

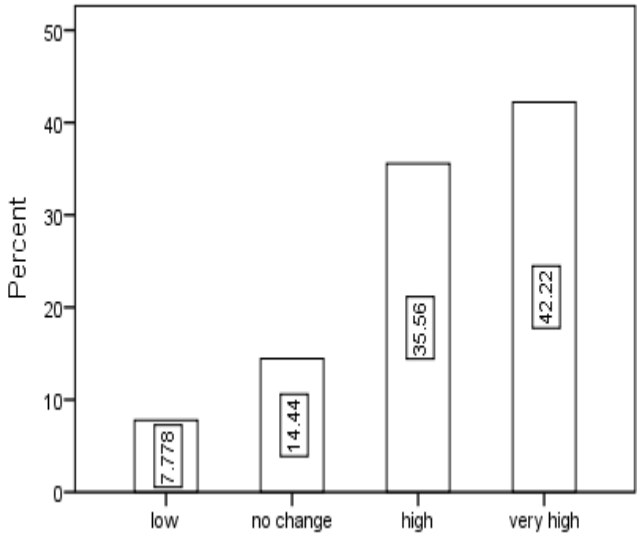

Figure 4.16 increasing collector of MPs

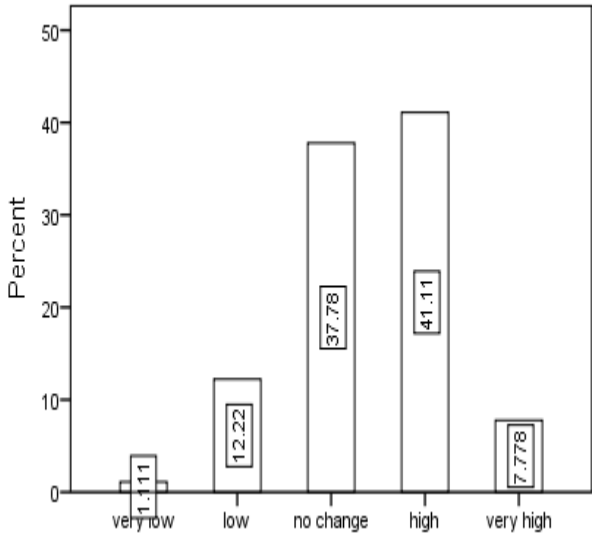

Figure 4.17 Extinction of species

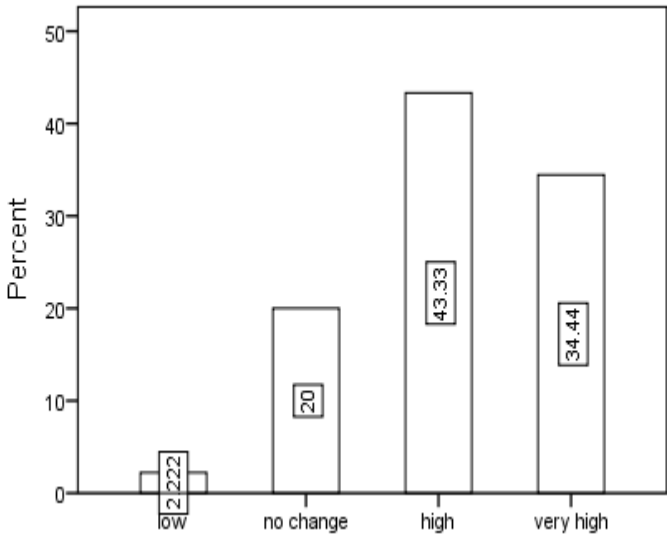

Figure 4.18 Losses during collection

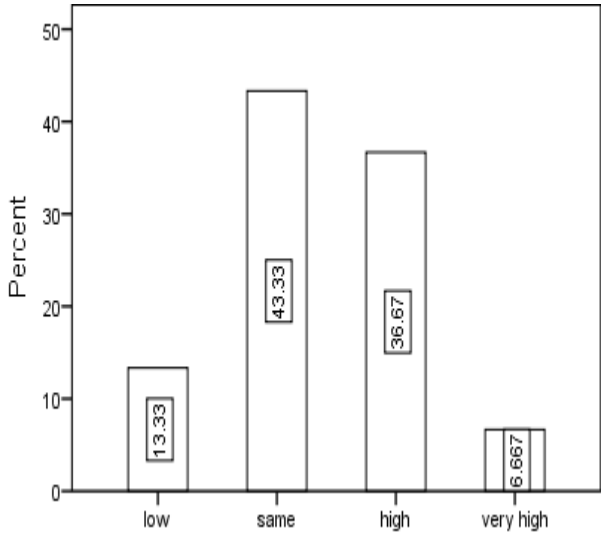

Figure 4.19 increasing temperature at flowering stage

4.6 Management rules for the collection and using of medicinal plants

During focus group discussion MPs collectors and local household in three tehsil (Alpuri, Puran and Chakeaser) of the study area, I concluded that there is no proper management of the sustainability of natural resources for the longer period of time. It is generally observed that there is no authority to monitor and issue permit for the collection of medicinal plants. Moreover, such authority should be responsible to guide what to harvest and then how to harvest. This will help to sustain the resources for longer period of time.

During the focus group discussion it is observed that there is no restriction for anyone to get involved in the collection of medicinal plants, implying that it is open excess resources. Open excess always leads to extinction because of over extraction than economical optimum. Collectors are collecting MPs for home use and for commercial purposes. It is reported that even collectors are coming to collect MPs from outside the district. Focus group discussion also revealed that local community learns from elders and cock doctors that how to use MPs for medicine purposes. Medicinal plants are generally first dried in the sun and then crushed in the juicer before its use. However, it is explained by the participant that for different medicinal plants are used in different ways.

4.7 Measure for the conservation of medicinal plants

Eight different factors for the conservation of medicinal plants in the study area and frequency distribution of these measure are reported in Figure 4.20 to 4.27. The information on these conservation related factors are taken on Likert scale starting from 1 which is stands for no important, 2 low important, 3 for neutral, 4 for important and 5 for very important. According to our survey the views of collectors about domestication (Plant domestication is a process whereby wild plants have been evolved into crop plants through artificial selection) are reported that 54% respondents indicate that domestication is important factor for the conservation of medicinal plants (Figure 4.20). Providing licence are another factor for MPs

conservation, it is reported 45% respondents are opinion that licence is very important, similarly 31% respondents indicate licence is important for the conservation of MPs (Figure 4.21). About increasing awareness on sustainable harvesting 37% respondents are claimed that it is important and 32% claimed that increasing awareness is very important factor for the conservation of MPs (Figure 4.22). Programme on conservation are also a part for the conservation of MPs 41% respondents are strongly in favour of important and 24% claimed that programme on conservation is very important factor for the conservation of MPs (Figure 4.23). Role of forest department is also playing a key role for the conservation of MPs. About 50% respondents are specify that it's important factor for the conservation of MPs. Similarly 24% are mentioned that role of forest department are very important factor for the conservation of MPs (Figure 4.24). Community scouts is another factor for the conservation of MPs 44% respondents revealed that community scouts is important factor for conservation of MPs. However, 22% are in the favour that community scouts is very important factor for the conservation of MPs (Figure 4.25). Furthermore about botanic gardens 55% respondents are agree that botanic gardens are important for conservation of MPs, while 23% are claimed that botanic gardens are very important factor for the conservation of MPs (Figure 4.26). Protected areas *(A protected area is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values IUCN 2008)* are another factor for conservation of medicinal plants. It is observed that 41% respondents are mentioned that protected areas are very important, while 28% samples indicates that protected areas are very important factor for the conservation of medicinal plants (Figure 4.27).

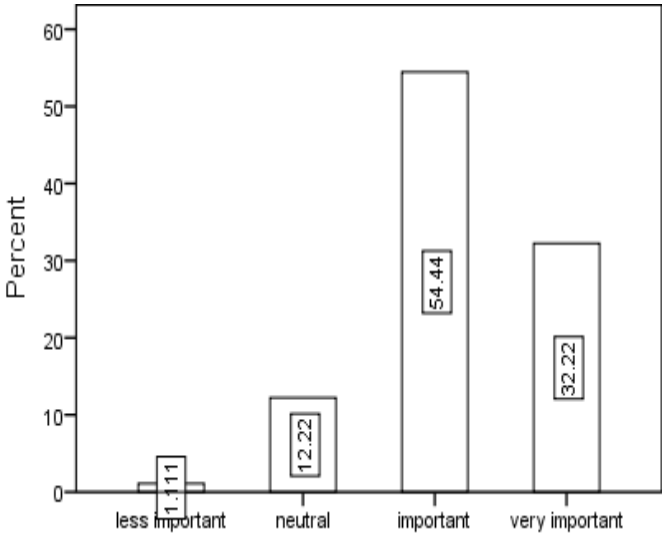

Figure 20 Role of licence

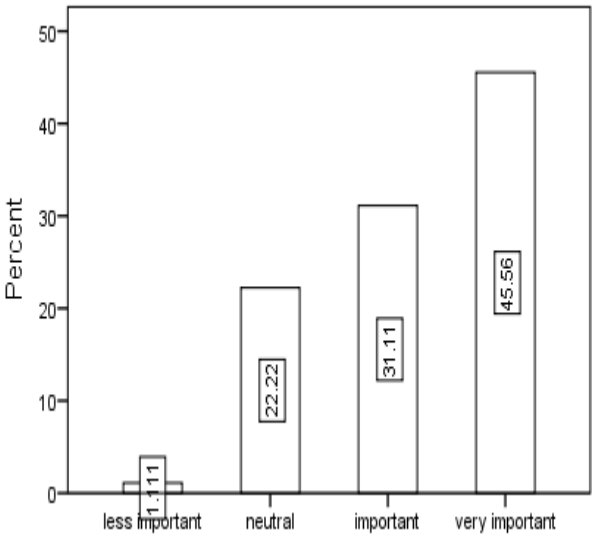

Figure 21 Role of domestication

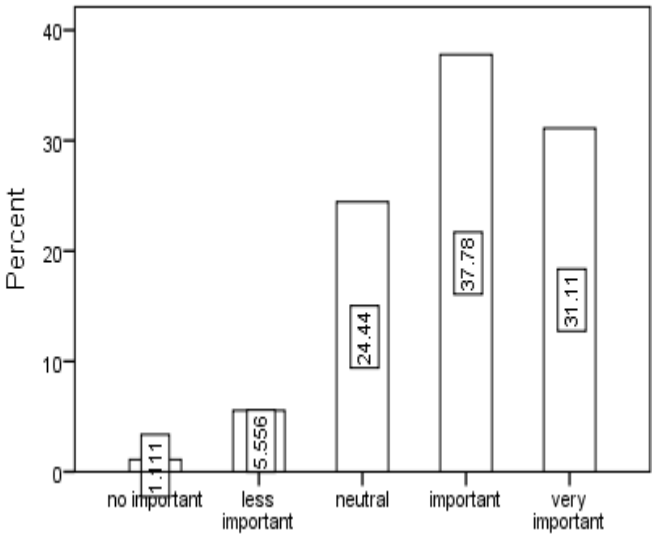

Figure 4.22 Sustainable harvesting

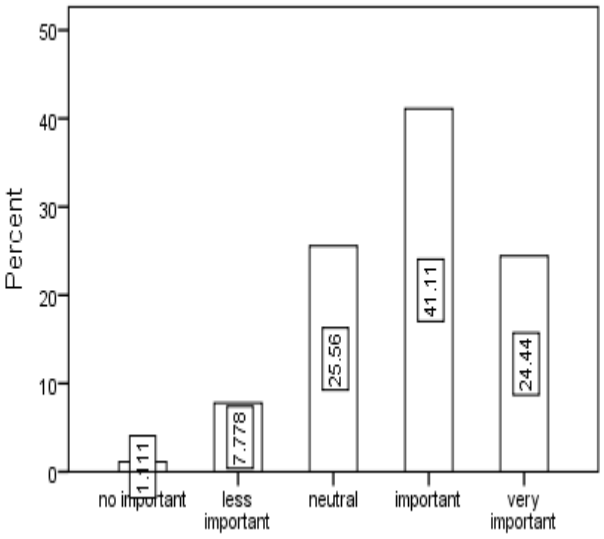

Figure 4.23 Programme on conservation

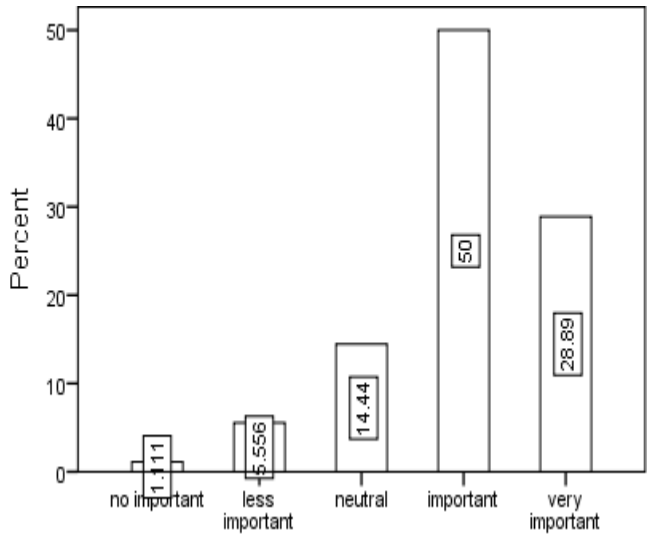

Figure 4.24 Role of forest department

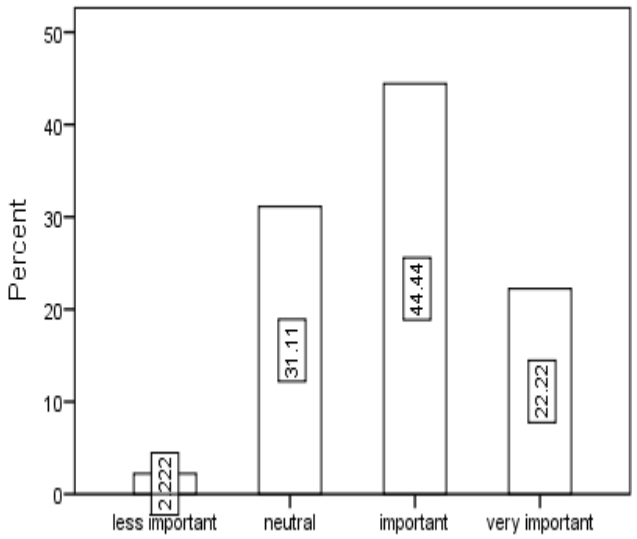

Figure 4.25 Role of community scouts

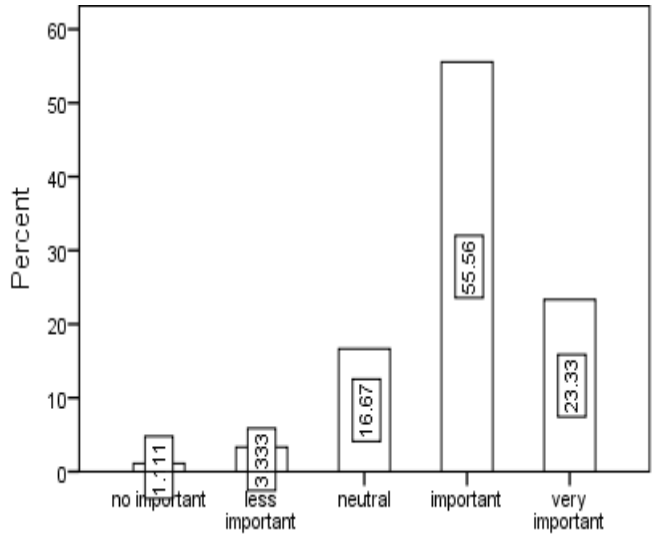

Figure 4.26 Role of botanic gardens

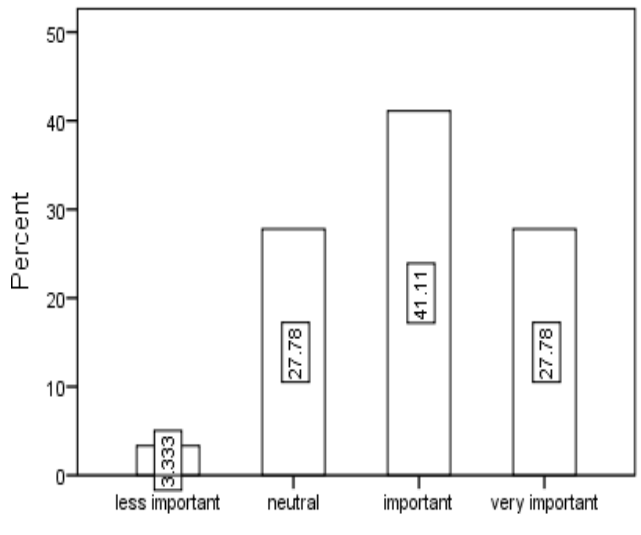

Figure 4.27 Role of protected areas

Chapter 5

Result and Discussion

5.1 Descriptive Statistics

The descriptive statistics of different variables employed in the determination of use of medicinal plans are reported in Table 5.1. Use of MPs as a medicine is a categorical variable (dummy) while household attributes: household income, household size, education and age of household head are continuous variables. In addition, religious attribute is based on religiosity index (Prayer, fasting, Zakat and Hajj in year), it is made through principle component analysis (PCA). Average household income is recorded Rs.40857 per month; the average household size is 5 members per family; the average education and age of household head is 10 and 4and 40 years.

Table 5. 1 Descriptive statistics of different variables used in our model

Variables	Mean	Std. Dev.	Min	Max
Household income per-month (R.s.)	40858	12839	18000	65000
Household size (members)	5.4	2.01	2	9
Education of household head (year of schooling)	11	4.27	4	16
Age of household head (years)	44.5	8.92	27	65
Religiosity index	7.29 e^{08}	1.02	-1.5	1.4

The descriptive statistics effecting collection of medicinal plants are reported in Table 5.2. The quantity collection of MPs per year, livestock (animals numbers going for grazing is used as proxy variable for overgrazing), distance, working hour and experience are continuous variables. However change in temperature, rainfall and deforestation is measured on Likert scale. Our analysis revealed that quantity collection of MPs is 45 kg per year and average rate of deforestation is 3.6. Based on respondents perception increase in average temperature is 2.788 Celsius per year. But change in average rainfall is 2.98 mm per year.

Our analysis indicate that average number of livestock at home 2.5 while the average distance from home to collection point is 6.4 hours. Our data reveal that on an average collector's works 8.4 hours per day and an average experience of collection medicinal plants is recorded to 7 years.

Table 5. 2 Descriptive statistics of collection of medicinal plants

Variable	Mean	Std. Dev.	Min	Max
Quantity collection of MPs per year (kg)	45.6	9.27	20.5	70.5
Deforestation (Likert scale)	3.63	1.20	1	5
Increasing temperature over the years (Likert scale)	2.8	1.06	1	5
Decreasing rainfall over the years (Likert scale)	3.00	1.25	1	5
Livestock: proxy variable for capturing of overgrazing (numbers)	2.67	1.19	1	6
Distance from home to collection area in hour (hour)	6.43	1.30	4	9
Working hour of MPs collectors in a day (hour)	8.56	1.74	3	12
Experience in term of year about collection and selection of species (years)	7.67	1.97	3	12

The descriptive statistics of variables employed in livelihood model to investigate the factors affecting the livelihood of medicinal plants collectors is reported in Table 5.3. Among these variables, income, working members in the family, total education of working members having age more than twenty years, experience of household head (collectors), quantity of collection, distance, working hours are all continuous variables, while grading of plants is a dummy variable. The average monthly income of farmer from MPs and from other sources is Rs.8856/month and the average number of working members is 2.2. The average education of family members is 8.4 years while average experience of collecting medicinal plants is more

than 7 years. It is observed that on average each family collects 45.5 kg of medicinal plants each year. Further our result reveal that collectors cover a long distance of 6.4 hours to collects MPs and on an average they work 8.5 hours in the field every day.

Table 5. 3 Descriptive statistics of medicinal plants and livelihood of farmer

Variable	Mean	Std. Dev.	Min	Max
Income of MPs collectors from medicinal plants and from other sources per-month (R.s)	10144	1403.94	5958	15000
Working members in the family (numbers)	2.22	0.57	1	3
Education of family members having age more than twenty years (year of schooling)	8.45	2.82	5	18
Grading of plants (dummy)	0.44	0.59	0	1
Experience in terms of year about collection and selection of species (year)	7.67	1.97	3	12
Quantity collection of MPs per-month (kg)	3.8	9.18	20	70
Distance from home to collection area (hour)	6.43	1.31	4	9
Working hours in a day (hour)	8.45	1.74	3	12

5.2 Econometric Analysis

5.2.1 Factors determining the use of medicinal plants

To investigate the factors affecting the use of medicinal plants for the treatment purposes Probit model is employed. In the model, the dependent variable is dummy variable which is 1 if used medicinal plants for treatment and 0 otherwise. The decision to use medicinal plants for treatment could be affected by various variables such as age of household head,

household size, household income (per-month), education of household head and Religion. It is generally believed that older people has strong believe on the effectiveness of medicinal plant on treatment, therefore, age is expected to have positive impact on the utilization of MPs. And it's also investigated by (Bekalo & Woldemariam, 2009) that old age peoples more towards to the use of medicinal plants. Similarly, large household size lead to smaller amount of resources available per capita which limits the visits to physician because of lack of financial resources. According to Cordell & Colvard, (2005) increase in household size they will be higher preference to the use of medicinal plants. Hence, large family size motivates to depend more on MPs for treatment and expected to have positive impact on the utilization of MPs. On the other hand large family income provide better opportunity to get better excess to medical facility and thus reduces the dependency on MPs and promote to visit physician for proper treatment. In the literature effect of household income on medicinal plant use is reported as negative (Ankli et al., 2002). Because higher household income break the financial barrier and thus expected to have better excess to medical doctor and to purchase medicine. Hence, higher family income expected to have negative impact on the utilization of MPs for treatment. Education is one of the rich sources of awareness and thus educated person can well understand the role of physician in treatment process. The effect of education is mixed, according to Pandit & Bevilacqua, (2011) low education have a slightly higher tendency to utilize traditional medicine, but those who have higher types of education use less amount. Chhetri, & Nielsen,(2012) also suggested that more educated person better know that how to medicate himself. Therefore, education is expected to reduce the dependency on MPs for treatment purpose. The last variable in the model is religiosity which is measured as index from different variables. The components of religiosity index include prayer, fasting, zakat and hajj. The religion index is made through principle component analysis (PCA). It is hypothesized that the person who is more religious have strong believe

on nature and thus depends more on MPs for the treatment purpose. The results of Probit model are reported in (Table 5.4) and signs of coefficients are exactly according to our prior expectations. All explanatory variables are continuous variables while religion is based on religiosity index as explained earlier. The coefficient of age of household head, household size and religion is positive, exactly according to prior expectations. Similarly, according to economic theory as explained above, the coefficient of household income, education level of household head is negative. The probability of use of MPs increases with the increase in age of household head, implying that aged people use more medicinal plants for the treatment purpose. It might be because of having longer experience of utilization of medicinal plants established their trust on the effectiveness of MPs for treatment purpose. On the contrary, young people tend to opt for physician's prescribed medication. It is observed that age variable is statistically significant (p=0.041) at 5% of significance level. The probability of use of MPs increase with the increase in household size, implying that large households is more inclined towards use of medicinal plants compared to small one. It is generally observed in developing countries that with the increase in family size purchasing power is declines because of high unemployment. Because of resources constraint, it increases the dependency on use of medicinal plants. Once, again our result confirm the economic theory that probability of use of medicinal plants increases with increases in household size. Household size is found to be significant (0.03) at 5% level of significance. Household income and education which provides better excess to resources and awareness is found to have negative impact on the probability of use of MPs. Both family income and education are found to be significant at 5% and 1% significance level. It is simply because higher income provide better excess to services and facility, thus leading to decline the dependency on MPs for treatment purposes. This clearly implies, as income increases people prefer to have treatment from physician rather to depend on cock doctors and MPs. Similarly, education

contributes to improve the level of awareness about the role of proper treatment. It also helps to understand the contribution of proper treatment in improving the human productivity. Our empirical result reveals that educated people have fewer propensities to depend on MPs for treatment purpose. Lastly, the probability of use of MPs increases with increase religiosity, implying that religious people are depending more on MPs for treatment compared to their counter parts. The religiosity index is statistically significant (p=0.02) at 5% level of significance. This implies that religiosity is positively correlated with the use of MPs for treatment purposes. It might be because religious people have strong believe on nature and they believe that whatever disease comes it is from Allah. If Allah want to recover us then it is also equally possible from MPs and if Allah do not want to recover us then even if we visit to physician then we will not. Simply they have strong believe that whatever diseases may come, it is from Allah (SWT) and only He through His bounties in form of medicinal plants can cure the disease.

Table 5. 4 Factors affecting the use of medicinal plants

Use of medicinal plants	**Coefficient**
Age of household head (years)	0.11**
	(0.05)
Household size (numbers)	0.35**
	(0.16)
Household income per month (Rs./month)	-0.00**
	(0.02)
Education of household head (years)	- 0.30***
	(0.08)
Religion index	1.15**
	(0.51)
Constant	-1.16
	(2.34)
Pseduo R^2	0.70
Observation	90

*, **, *** represent significance level at 10%, 5%, 1% respectively and value in parenthesis are standard error

5.2.2 Factor affecting the collection of medicinal plants

To investigate the relationship between quantity collections of medicinal plants with other explanatory variables, the ordinary least square (OLS) model has been employed. In this model quantity collection of medicinal plants per year is dependent variable and among explanatory variables includes deforestation, perception about decrease in rainfall and increase temperature over the years, number of livestock going for grazing (it is a proxy variable for capturing of overgrazing), distance from home to collection area measured in hour, working hours in the field and experience of collection of medicinal plants measured in years. The results of econometric analysis are reported in Table 5.5. The coefficients of deforestation, perception about increase in temperature and decrease in rainfall over the years, number of livestock (overgrazing) and distance from home to collection area is affecting the amount of collection of MPs negatively. This implies that as deforestation increases due to increase in cutting of trees, this will lead to decline in the collection of MPs. Our result revealed that when one unit increase in deforestation on Likert scale lead to decline 1.12 kg per annum in the collection of medicinal plants, implying that deforestation is one of the major threat to the collection of MPs. It is observed that when perception about the decrease in rainfall on Likert scale increase by one point then the collection of MPs decreases by 1.1 kg per annum. Similarly when perception about the increase in temperature increase by one point on Likert scale then it lead to decline in the collection of MPs by 1.6 kg per annum. Our result revealed that when one animal increase in the grazing list it lead to decline 1.35 kg per annum in the collection of medicinal plants. It is mainly because animal destroy the plants before it get mature. Hence, smaller number of plants provides fewer amounts of MPs. Also one hour increase in the distance from home to collection point it lead to decreases the collection of MPs by 2.4 kg per annum. It is observed that coefficient of grazing, distance, perception of rainfall, temperature and deforestation are significant at 5%, 1% and 5%

respectively. However, working hour and experience of collectors of MPs are positively affecting quantity collection of medicinal plants. Our result indicates that one hour increase in working hour it lead to increases collection of MPs by 2 kg per annum, implying that more working hour in the field more will be the collection of medicinal plants. Similarly one year increase in the experience of collectors about collection and selection of MPs it lead to increases the collection of medicinal plants by 0.70 kg per annum. It is observed that coefficient of working hour and experience of harvester are significant at 1% and 5% respectively.

Table 5. 5 Factor affecting the collection of medicinal plants

Quantity collection of MPs per year	**Coefficients**
Deforestation (Likert scale)	-1.10** (0.50)
Increasing temperature over the years (Likert scale)	-1.60*** (0.56)
Decreasing rainfall over the years (Likert scale)	-1.11** (0.47)
Number of livestock going for grazing (numbers)	-1.35*** (0.52)
Distance from home to collection point (hour)	-2.37*** (0.45)
Working time in the field (hour)	1.18*** (0.47)
Experience of collection MPs (year)	0.74** (0.34)
Constant	53.65 (6.04)
R^2	0.68
Adjusted R^2	0.65
Observation	90

*, **, *** represent significance level at 10%, 5%, 1% respectively and value in parenthesis are standard error

5.2.3 Factor affecting the rural livelihood of MPs collector

In order to investigate the relationship between total income (income from MPs and other sources) with other explanatory variables two stage least square (2SLS) model has been employed. The result are reported in Table 5.5. In this analysis total income (livelihood of collector) is dependent variable, among independent variables education of household members having have age above twenty year, working members in the family, experience of collector (year), grading of plants and quantity collection of MPs (per-month). However, quantity collection of MPs is not exogenous rather it is indigenous variable. Without correcting endogeneity problem an instrumental variable (IV) approach is suggested. Two instrumental variables, working hour in the field and distance from home to collection point are suggested to correct the endogeneity of the amount of medicinal plants. Hence two stage least square is suggested. In the first stage regression quantity collection of MPs (per-month) is regressed on working hour in the field and distance from home to collection point along with other variables. While in the second stage regression, income from MPs (per-month) is regressed on above mention variables except from instrumental variables. The result indicates that coefficient of grading of plant is positively correlated to quantity collection of MPs. It implies that if a collector of MPs is properly grading the plants then they will be receives higher profit from the selling of MPs, higher profitability motivate to collect more medicinal plants. Thus the relationship between quantity collection and grading of plants is positive. Our result revealed that one unit increase in grading of plants lead to increases quantity collection of MPs by 0.25 kg per-month. Similarly the relationship between quantity collection of MPs and experience of collector is also positive. It indicate that if a collector have more experience about collection and selection of MPs then they will be collected more medicinal plants instead of those who have not sufficient experience. Our empirical findings indicates that one year increase in experience of MPs collection lead to increases in quantity

collection by 0.07 kg per-month. In addition working hour in field is also positively correlated to quantity collection of MPs it implies that if a harvester of MPs spend more time in the field then the amount he collects will be higher. Our result reveals that one hour increase in the field will lead to increases quantity collection of MPs by 0.25 kg per-month. Similarly distance from home to collection point is negatively correlated with the quantity collection of MPs. It indicates that if distance from home to collection point increase then amount of MPs collection will be decline. It is because if collectors spend more time to reach to destination then he/she has less hour to work in the field and moreover his energy level will be reduces which will lead to decline in the quantity collection. Our result revealed that one hour increase in distance spend in travelling lead to decreases in quantity collection by 0.29 kg per-month. Grading, experience, working hour and distance are statistically significant at 10% and 1% level of significance respectively. Our empirical analysis find that working members in the family is negative impact on the collection of MPs, it might be because they have be better other sources of income for their livelihood. Our result revealed that one unit increase in working member in the family lead to decreases collection of MPs by 0.004 kg per-month. Similarly total education of household members (having age above twenty years) have also negative impact on collection of MPs. This implies that when education are increases in the family members they will be prefer other sources of income for livelihood instead of collection of MPs. It might be because there are a lot of other opportunities for educated person to earn income. Resultantly, relationship between collection of MPs and total education of household members are negative. Our empirical finding indicates that one year increase in education of household members lead to decreases collection of MPs by 0.02 kg per-month.

In the second stage regression total income of collector (income from MPs and other sources per-month) is regressed on working members in the family, total education of family

members having age above twenty years, grading of plants, experience of collector, and quantity collection of MPs (per-month). The empirical result find that quantity collection of MPs is positively affecting total income of collectors. This implies that if a collector harvests more medicinal plants then the total income of farmer will be increased and better will be the livelihood. Because if a collector harvest more medicinal plants then he/she obtains higher income from MPs. Our result revealed that one kg increase in the collection of MPs lead to increases total income of collectors by Rs.712 per-month. Similarly education of household members (having age more than twenty year) has also positively correlated with total income of collector. This indicates that more educated members in the family play an important role for the betterment of livelihood of collectors as well for improving their living standard. Our result find that one year increase in education of household members lead to increases total income (livelihood) of collector by Rs.111 per-month. It is observed that coefficient of quantity collection of MPs and education is statistically significant at 5% and 1% respectively. In addition working members in the family are also contributing in the total income (livelihood) of MPs collector. The empirical result revealed that there is positive relationship between working members in the family and total income (livelihood) of MPs collector. This implies that more working members in the family have great potential of earning for the whole family, hence more working members in the family better will be the income (livelihood) of MPs collector. Our empirical result find that one unit increase in working members in the family lead to increases total income (livelihood) of collector by Rs.427 per-month. Grading of plants is also positive impact on total income of MPs collector. The positive relationship between grading of plants and income indicates that if a collector properly grading the plants then he/she receives higher profit on each unit of MPs. Our empirical findings show that one unit increase in grading of plants lead to increases total income (livelihood) of MPs harvester by Rs.454 per-month. It is observed that working

members in the family and grading of plants is statistically significant at 5% level of significance respectively. Similarly the relationship between total income (livelihood) of MPs collector and experience about collection and selection of medicinal plants is positive. This implies that more experienced collectors have advantages to earn more profit by selling medicinal plants. This is because if collectors have more expertise in terms of years about collection and the selection of species, then the total income (livelihood) will be higher. Our empirical result revealed that one year increase in the experience of MPs collection lead to increases income (livelihood) by Rs.117 per-month. However, experience of MPs collector is not statistically significant. It is because the independent variable (experience) does not contribute in the variation of (total income) dependent variable, and hence it is not relevant considering such independent variable.

Table 5. 6 Factors determining rural livelihood

Variables	**First stage regression**	**Second stage regression**
	Quantity collection of medicinal plants per-month	**Total income (from MPs and other sources) per-month**
	Coefficient	**Coefficient**
Education of household members having age more than twenty years	-0.02 (0.02)	111*** (41.41)
Working member in the family (numbers)	-0.004 (0.01)	427.83*** (141.83)
Grading of plants	0.25** (0.13)	454.70* (257.03)
Experience of collectors (years)	0.07* (0.04)	117.71 (87.62)
Working hour	0.25*** (0.05)	
Distance from home to collection point (hour)	-0.29*** (0.05)	
Quantity collection of medicinal plants per-month		712.12** (319.12)
Constant	3.06 (0.55)	3168.02 (1023.96)
R^2	0.57	0.61
Observation	90	

*, **, *** represent significance level at 10%, 5%, 1% respectively and value in parenthesis are standard error

Chapter 6

Conclusion and Recommendation

6.1 Conclusion

The result show that there is positive relationship between medicinal plants and the livelihood and health of the local community in district Shangla. Medicinal plants play an important role in provision of livelihood and treatment services for local community of the district. In study area, 46% households are using medicinal plants for their health care services. The study found that consumption of medicinal plants as a medicine is dependent on household attributes and religious attribute. It is further recognised that age of household head, household size and religiosity index increase the probability of medicinal plants consumption. While income of household and education decreases the probability of medicinal plants consumption. Therefore, consumption of medicinal plants as a medicine is considered complete treatment for local community. However, medicinal plants cannot only be used for treatment services but also they signify culture, spiritual and religious values. To understand the meaning of medicinal plants in local scenario it is important to see medicinal plants as a part of local community's understanding of their own culture and religious reality.

Similarly ten most economical medicinal plants species have been identified in study area, such as *Morchellaa esculenta, Viloa Caneesence, Mesufeeraa, Valeriania Jatamansi, Trillum Gaovaninum, Germiniuam Wallichiaum, Geraidina Wall, Thaliactrum Folisioum, Phedoaphylum Emodi, and Dactyloarhiza Hatagreia.* These species of plants are contributing to the livelihood of local community. As an average, the collectors of medicinal plants received Rs. 48,418 in one year from the selling of MPs. But unfortunately our empirical analysis indicates that environmental factors (decreasing rainfall and increasing in temperature) deforestation and grazing of animals negatively affect the quantity collection of medicinal plants species in the study area. So, these factors negatively impact the livelihood

of the local community. Thus it is important for national and local government to build a verified agenda for the conservation of medicinal plants.

6.2 Policy Recommendations

The above results have an important policy implications.

Government and health department of the district must encourage local community on the safe use of medicinal plants.

The little ethnobotanical knowledge in the young generation is a red flag indicating the potential loss of the knowledge because it is limited to the old age people, therefore there is a need to document and promote its transmission to the young generations.

Forest department of the district should encourage the local community to stop deforestation, to conserve natural habitats of plants and to sustain available diversity of medicinal plants in district Shangla.

Those areas which are under the control of forest department should be declared protected areas for the conservation of medicinal plants.

The forest department of the district should be restricted from outside goat-herders, those who are coming from outside districts such as from Buner and Swat.

It is important for local government to encourage those collectors whose better experience about collection and selection of species and share their knowledge with those who do not have such experience. Their sharing of knowledge would be better for sustainable harvesting as well for a maximum collection of medicinal plants which leads to a positive impact on their livelihood.

The government should build a proper infrastructure channel in those areas where medicinal plants exist. It would reduce distance travel to the field and as a result, maximum will be the collection of medicinal plants.

Increasing in temperature and decreasing in rainfall negatively affect the avalibility of medicinal plants as a result it indirectly affects the local livelihood. Therefore, there is a need to monitor and improve understanding about the impact of increasing temperature and decreasing rainfall on medicinal plants.

Limitation of the study

The major limitation of our research study is the time. To some extent the time reduces the quality of our research as we could not get certain detail information. For example, we could only make the trend analysis of the factor affecting availability of medicinal plants in general but not for some specific species. Availability of and accessibility to the targeted informants are also major constraints. For instance, on one hand, we could not get in-depth information because the informants did not had no more time for us.

Area for future research

The major research agenda for future would be to analyse the utilisation of medicinal plants by widening the research scope to incorporate well-being and preventive care. During research study it is clear that medicinal plants are used for multitude of reasons, so it will be interesting to explore other dimension of health and reason for use.

Another major research area would be on marketing of medicinal plants such as implication of the trade, management option for addressing issue in the trade, undertaken small-scale cultivation trials for selected species, looking at the economics of cultivating indigenous medicinal plants for market.

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Appendix .1

Role of Medicinal Plants in Provision of Livelihood and Treatment Services

(A Case Study of District Shangla Khyber Pakhtunkhwa)

Questionnaire for Medicinal Plants Harvester:

I am Haidar Ali, student of MPhil Environmental Economics at Pakistan Institute of Development Economics (PIDE) Islamabad. I am doing thesis on **(*Role of Medicinal Plants in provision of livelihood and treatment services*)**, as a partial fulfilment of MPhil degree requirement. I do herby request you to participate in this survey. Feel free to express whatever you feel appropriate. I assure you that you will be not to receive any suffer or loss due to what you have expressed in this survey.

Thank you!

Section-I

General Information:

Tehsil: _____ Village: _____ Date: _____ Time: _____

Respondent Detail:

Name	Age	Gender	Job nature	Education	Income (pm)
		1=Male 0=Female	1= Govt employees 2= Private employees 3= Self-employed		

Household Attribute:

1. Household Size: _____
2. Number of Male: _____
3. Number of Female: _____
4. Working members in the family: _____

Religious Attribute:

S.no	Dimension	Scale				
i.	How many prayers do you praying in a day on an average?	**1**	**2**	**3**	**4**	**5**
ii.	How regular you are fasting during Ramadan.	**1**	**2**	**3**	**4**	**5**
iii.	How regular you are in paying Zakat according to the asset you hold?	**1**	**2**	**3**	**4**	**5**
iv.	How strongly you wish to perform Hajj?	**1**	**2**	**3**	**4**	**5**

Note code: 1: Strongly disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly agree

Total year of education of household members having age more than 20 year and its income per/month:

Table No: 1

Family members	Age	Education level	Job Nature	Income (pm)	Income from MPs per-month
Husband					
Wife					
Daughter					
Son1					
Son 2					
Total					

Note: Code for job Nature: 1=Govt. employees, 2=private, 3=self-employed

Section-II

Medicinal plants Harvesting:

1. From how many years you are collecting Medicinal plants? _____
2. How much time you take from home to collection area in hour _____
3. How many days in a week you go for collection _____
4. How many hour you are spending on the collection of MPs every day? _____
5. From where you are collecting MPs?

   □Forest □ River side □ road side □ all of these

6. How much quantity per kg in a month you are collecting _____
7. Which specie is high demanding in market? Please specify below the quantity collected, quantity sold during each season and its price.

Medicinal Plants, Prices & Demand

Table No: 2

	Local Name	Market Demand	Collected in Summer (kg)	Sold in Summer (kg)	Price received per-kg (PKR)	Collected in Spring (kg)	Sold in Spring (kg)	Price received per-kg (PKR)	Collected in Autumn	Sold in Autumn (kg)	Price received per-kg (PKR)	Collected in Winter	Sold in Winter (kg)	Price received per-kg (PKR)	Purpose of consumption at home
1	Banafshan														
2	Laldana														
3	Muskibala														
4	Yakhajarrai														
5	Srrajarai														
6	Ghawarajri														
7	Mamera														
8	Kakora														
9	Gojai														
10	Ponja														
11	Other														

Note: Code for market demand 1-High demand, 2-Medium, 3-Low demand, 4-No demand

Note: Code for purpose of consumption: 1=Food: 2=Medicine: 3=both.

8. Before selling the MPs you properly grade it? □Yes □No
9. In case of grading do you get higher profit? □Yes □No
10. How many animal/livestock do you have?

Table No: 3

S. No	Name	Number	Sold last year	Bought last year
1	Goat			
2	Cow			
3	Buffalo			
4	Donkey			
	Total			

11. Where you can take these animals to feed?

□ Forest □At home feed □Both

12. What was family's income from other sources in last one month?

Table No: 4

S. No	Sources	Quantity sold kg or mound/month	Quantity consumed kg or mound/month	Mkt price (Rs./kg/lit/mound
1	Wood (mound)			
2	Milk kg			
3	Desi Ghee (kg)			
4	Butter (kg)			
5	Wheat			
6	Corn			
7	Vegetables			
8	Daily wages			
9	Other			
	Total income in last month			

Section-III

Threats to Medicinal Plants:

1. Is there is any change in the availability of MPs in last 5 years? □Yes □No

2. Is number of persons involved in collecting of MPs from your own home has increased over the last 5 years? □Yes □No
3. Do you believe that availability of MPs has decreased overtime? □Yes □No
4. If yes then give weight to the factors contributing in decreasing the availability of MPs overtime?

S. No	Sources	Scale				
1	Deforestation (cutting of trees)	**1**	**2**	**3**	**4**	**5**
2	Increasing temperature at flowering stage	**1**	**2**	**3**	**4**	**5**
3	Increasing temperature over the year	**1**	**2**	**3**	**4**	**5**
4	Decreasing rainfall	**1**	**2**	**3**	**4**	**5**
5	Increase in grazing of animals is responsible of decline in availability of MPs.	**1**	**2**	**3**	**4**	**5**
6	Increased number of persons over the last 5 years involved in collection of MPs.	**1**	**2**	**3**	**4**	**5**
7	More valuable species are getting extinct.	**1**	**2**	**3**	**4**	**5**
8	Losses incurred during collection and storage	**1**	**2**	**3**	**4**	**5**

Note: (Code: 1: very low, 2: low, 3: same, 4: high, 5: very high)

5. Which of the following factors is more appropriate for the conservation of MPs and how much?

S.no	Codes for the conservation of MPs	Scale				
1	Role of Domestication	**1**	**2**	**3**	**4**	**5**
2	Role of Community Scouts	**1**	**2**	**3**	**4**	**5**
3	Role of programme on conservation	**1**	**2**	**3**	**4**	**5**
4	Role of awareness increasing on the sustainable harvesting.	**1**	**2**	**3**	**4**	**5**
5	Role of forest department	**1**	**2**	**3**	**4**	**5**
6	Role of protected areas	**1**	**2**	**3**	**4**	**5**
7	Botanic gardens for conservation of MPs	**1**	**2**	**3**	**4**	**5**
8	Role of licence	**1**	**2**	**3**	**4**	**5**

Note: Code for conservation: 1: No importance, 2: Low importance, 3: Neutral, 4: Moderately important, 5: Very important.

Section IV

Information on the use of Medicinal Plant:

1. Do you use medicinal plants? □Yes □No
2. If yes, please identify the treatment of:

   □Human □Animal □Both
3. Do you collect MPs your-self or buy from Hakeem?

   □Yes □No □Both
4. If you are using MPs for your medication then for what diseases you are using it?

Table No: 5

S. No	Diseases	Frequency of sickness	Plants Name (local)	Amount used in (gram)
1	Asthma			
2	Bone sitting			
3	Urinary tract infection			
4	Stomach problem			
5	Dental carries			

Note: Frequency of Sickness during Last six month

5. If for animal treatment then specify the diseases below.

Table No: 6

S. No	Diseases	Frequency of sickness in last six month.	Plants Name (local)	Botanical Name
1				
2				
3				
4				
5				

6. Why you are using MPs instead of conventional medicines? Please identify below

S. No	Reasons	Yes	No
1	Provide Cheaper treatment	□	□
2	Due to low income	□	□
3	Long distance to health centre	□	□
4	Doctor facility is limited	□	□

5	Culture value	□	□
6	No side effect	□	□

Section-V

Health expenditure:

Which disease faced by any of your family member in last six months? Please stated below.

Table No: 7

Disease	Medicine used			Source of MPs		Expenditure on MPs	Expenditure on MD
	MPs	MD	Both	Self-Collection	Purchased		
Asthma							
Bone sitting							
Urinary tract infection							
Stomach problem							
Dental carries							
Diabetes mellitus							
Headache							
Fever							

Codes: MPs: Medicinal Plants, MD: Medicine from doctor.

Thank you for your Cooperation

Appendix. 2 Econometric analysis

Determinants of use of medicinal plants

Probit regression — Number of obs = 90
LR chi2(5) = 87.21
Prob > chi2 = 0.0000
Log likelihood = -18.423526 — Pseudo R2 = 0.7030

ump	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.1074428	.0527125	2.04	0.042	.0041283	.2107574
hs	.3472035	.159217	2.18	0.029	.035144	.659263
hy	-.0000669	.0000352	-1.90	0.058	-.0001359	2.23e-06
religion	1.144254	.5032056	2.27	0.023	.1579889	2.130519
edump	-.2951211	.0863942	-3.42	0.001	-.4644507	-.1257915
_cons	-1.193569	2.952859	-0.40	0.686	-6.981066	4.593927

Factor affecting quantity collection of medicinal plants

Source	SS	df	MS	Number of obs	=	90
				F(7, 82)	=	25.12
Model	5116.23988	7	730.891412	Prob > F	=	0.0000
Residual	2386.19137	82	29.0998947	R-squared	=	0.6819
				Adj R-squared	=	0.6548
Total	7502.43125	89	84.2969803	Root MSE	=	5.3944

qmpy	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
df	-1.107588	.5056878	-2.19	0.031	-2.113562	-.1016135
tmy	-1.602039	.5598863	-2.86	0.005	-2.715832	-.488247
rf	-1.114094	.4767451	-2.34	0.022	-2.062492	-.1656961
ls	-1.349937	.5236152	-2.58	0.012	-2.391574	-.3082992
dist	-2.371407	.4560019	-5.20	0.000	-3.27854	-1.464274
wh	1.994554	.3899985	5.11	0.000	1.218723	2.770385
xp	.7420937	.3376381	2.20	0.031	.070424	1.413763
_cons	53.56756	6.041993	8.87	0.000	41.54811	65.58701

Factor determining rural livelihood

First-stage regressions

Number of obs	= 90
F(6, 83)	= 14.81
Prob > F	= 0.0000
R-squared	= 0.5701
Adj R-squared	= 0.5390
Root MSE	= 0.5195

qmp	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
wm	-.0036166	.0932902	-0.04	0.969	-.1891671	.181934
edu	-.0124021	.0237277	-0.52	0.603	-.0595956	.0347914
g	.2499631	.1280568	1.95	0.054	-.0047367	.5046629
xp	.0699517	.0422911	1.65	0.102	-.0141637	.1540671
wh	.1767466	.0451975	3.91	0.000	.0868506	.2666426
dist	-.1995071	.048331	-4.13	0.000	-.2956355	-.1033787
_cons	3.058652	.5473009	5.59	0.000	1.970092	4.147211

Instrumental variables (2SLS) regression

Number of obs	= 90
Wald chi2(5)	= 117.90
Prob > chi2	= 0.0000
R-squared	= 0.6178
Root MSE	= 863.16

y	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
qmp	712.1243	319.1092	2.23	0.026	86.6818	1337.567
wm	427.8386	141.8326	3.02	0.003	149.8518	705.8255
edu	111.0136	41.4118	2.68	0.007	29.84793	192.1792
g	454.7011	257.0292	1.77	0.077	-49.06676	958.469
xp	117.7173	87.62397	1.34	0.179	-54.02256	289.4571
_cons	3168.021	1023.965	3.09	0.002	1161.087	5174.955

Religiosity Index

Principal components/correlation — Number of obs = 90; Number of comp. = 4; Trace = 4; Rho = 1.0000

Rotation: orthogonal varimax (Kaiser off)

Component	Variance	Difference	Proportion	Cumulative
Comp1	1.00001	.0000100641	0.2500	0.2500
Comp2	.999999	9.94192e-07	0.2500	0.5000
Comp3	.999998	4.04938e-06	0.2500	0.7500
Comp4	.999994	.	0.2500	1.0000

Rotated components

Variable	Comp1	Comp2	Comp3	Comp4	Unexplained
prayer	0.0000	0.0000	1.0000	0.0000	0
fasting	0.0000	1.0000	-0.0000	0.0000	0
hajj	1.0000	-0.0000	-0.0000	-0.0000	0
zakat	0.0000	-0.0000	-0.0000	1.0000	0

Component rotation matrix

	Comp1	Comp2	Comp3	Comp4
Comp1	0.6024	0.3245	0.4385	0.5827
Comp2	-0.2791	0.8436	0.2608	-0.3775
Comp3	-0.1989	-0.4235	0.8596	-0.2054
Comp4	-0.7209	0.0614	0.0283	0.6898

```
. predict religion
(score assumed)
(3 components skipped)
```

Scoring coefficients for orthogonal varimax rotation
sum of squares(column-loading) = 1

Variable	Comp1	Comp2	Comp3	Comp4
prayer	0.0000	0.0000	1.0000	0.0000
fasting	0.0000	1.0000	-0.0000	0.0000
hajj	1.0000	-0.0000	-0.0000	-0.0000
zakat	0.0000	-0.0000	-0.0000	1.0000

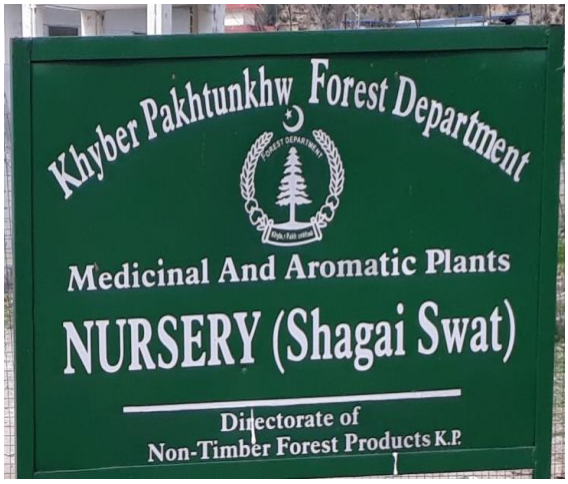
Keen observation on overgrazing

Focus group discussion at Alpuri Tehsil

Focus group at Tehsil Puran

Field walk with medicinal plants collectors

Medicinal Plants Species



Appendix.3 Medicinal Plants in District Shangla

Table-1. Botanical name, habit, habitat, part used, seasonal availability and local uses of the medicinal plant species in district Shangla.

S.No	Local name	Botanical Name	Family Name	Habit	Part used/ Season	Local uses
1	Banafshan	Viloa canescens	Violaceae	H/F	W/Sp	Diuretic, Diaphoretic, Astringent, Emollient
2	Shawdapaei	Sonchus Olerraceous	Asteraceae	H/F	L/Sp	Depurative, Blood Purifier, Anticancer Diuretic, Anti-inflammatory and burns
3	Datoraa	Datura Stramonium Mil	Solanaceae	H/RdS	S/Su	Sedative, Narcotics Bone sitting Headache Antispasmodic
4	Shanaei	Pistaceaintegerrima	Anacardiaceae	T/F	S/Sp	For curing chronic, fever vomiting wounds, jaundice
5	Velaney	Menthe longifolia	Lamiaceae	H/F	L/Su	Carminative, Antiseptic, nervous system stimulant, very useful in colic
6	Laldanea	MesuaferreaL.	Lamiaceae	H/RvS	W/Sp	Good in taste and use a flavour
7	Seuma Kulfa	Portulaca Oleracea	Portulacaceae	H/F	W/Su	Used in urinary infections
8	Baerham Dandi	Echinopsechinatus	Asteraceae,	H/F	W/A	Used against skin itching
9	Gadd Panra	Bergenia ciliate	Saxefragaceae	H/F	W/A	Hepatitis, Antibiotic, Kidney disorder
10	Gogaenda	Saurauianapaulensis	Actinidiaceae	H/F	W/Sp	Used as healing purposes

11	Bhat Khanda	D. belophylla	Dioscoreaceae	H/RdS	W/Su	Tonic for kidney, lung and stomach. Body growth
12	Muskibaela	Valerianajatamansi	Caprifoliaceae	H/F	R/Su	Aromatic, Constipation, antispasmodic Neuroses
13	Yakhajarreai	Trillium govanianum Wall	Trilliaceae	H/F	R/A	useful in controlling bleeding and diarrhoea
14	Bhangg	cannabis sativa	Cannabaceae	S/RdS	W/Su	Narcotic drugs, Malaria, Blood poisoning
15	Choraa	Angelica glauca	Apiaceae	H/F	W/Su	Heart tonic, stomach troubles, bilious Complaints.
16	Warkhharay	Portulaca olearaceaeL	Portulocaceae	H/RvS	W/Su	Used in urinary infections
17	Arhandaa	Riciniscommunis	Euphorpiaceae	S/F	W/Sp	Blood purifier, treating Hepatitis,
18	Jabaii	Alismaplantago aquatic	Alismataceae	H/Rds	L/Su	
19	Narsaeway	Adiantumcapillusveneris Linn	Punicaceae	T/Rds	L/Su	Skin diseases, fever, Hair
20	Akas Biil	Cascutareflexa Roxb.	Cuscutaceae	H/F	L/Su	Positive effects on reproductive health, Osteoporosis and Alopecia.
21	Janj E Qeatel	Andrographispaniculata	Acanthaceae	T/Rds	L/Su	Antibacterial, cold and fever. Antimalarial
22	Podeena	Menthaspicatalinn	Lamiaceae	H/RvS	L/Su	Stomach ache, food digestion,
23	Ghwaaraskey	Dodonea viscose L	Sapindaceae	S/RdS	R/A	Antibacterial potential. expel roundworms
24	Tarkhaa	Artimisagriffithiana	Asteraceae	H/Rds	W/Su	Stomachic tonic anathematize
25	Akhroot	Juglansregia	Juglandaceae	T/Rds	Fr/A	Used as a dye, heart tonic, antifungal,

						Intestinal worm
26	Ghoureja	Indigeofera Heterantha	Papilionaceae	S/Rds	L/A	wound healing , headache , sore throat
27	Mamikh	Paeoniaemodi	Paeoniaceae	H/F	W/A	Hepatic, Stimulant, Drastic, Purgative, Back pain,
28	Alam	Lepedium Sativum	Brassicaceae	T/F	S/Su	Use for asthma, bronchitis and cough
29	Nor E Alam	Poligonatum Verticelatum	Asparagaceae	H/F	S/Su	Rheumatism, Kidney pain and hips and as aphrodisiac
30	Srrajarai	Geranium Wallichianum	Geraniaceae	H/F	W/A	Root infusion used for mouth ulcers, stomach ulcers
31	Tarvapanra	Bistorata Amplexicaule	Polygonaceae	H/F	R/Su	Anti-inflammatory, Astringent
32	Papra	Fumaria Indica Pugsley	Funariaceae	H/RdS	W/Sp	Blood purifier, antipyretic and diaphoretic
33	Shalkhay	Rumex Dentatus L.	Polygonaceae	H/RdS	L/Su	Treating Hepatitis, Sore eye, Asthma, piles, Blood purifier
34	Skhabotay	Chenopodium Ambrosioides L.	Chenoppdiaceae	S/RdS	R/Su	Laxative ,Aparint, anti-hepatic
35	Thambera	Nasturtimofficinale	Brassicaceae	H/RvS	W/Su	Used in chest complaints
36	Kamacho	Solanum nigrum L.	Solanaceae	H/F	R/A	Prove fatal for cattle, liver diseases.

37	ToraPana	Viola Odorata	Violaceae	H/RvS	W/Su	Diaphoretic, astringent
38	ZiarhGulay	Taraxacum Officinale	Asteraceae	H/RdS	L/Su	Used in several eye disorders.
39	Ghwara Jari	Gerardiana Wall.	Papilionaceae	H/F	W/Sp	Rhizome is dehydrated, processed, bubbled in liquid and helps in dropping hypertension
40	Marjarai	Arisaema UtileHook. f	Araceae	H/RdS	W/A	Antidote in snake bite, irritant, stimulant
41	ZahrMohra	Aconitum Hetrophyllum	Ranuncullaceae	H/F	R/Su	Poisonous plant, total violent contraction of the face and limbs
42	Boti	Ajugabracteosa	Lamiaceae	H/RdS	W/Wn	Aromatic tonic, Used in fever cardiac smut diuretic, hepatitis.
43	Khardag	Verbascum Thapsus L.	Scrophulariaceae	H/F	L/A	used in cough, pulmonary and skin diseases
44	Nazarpanra (nameer)	Skimmia Lauriolia S.	Rutaceae	H/RdS	L/Su	Burned leaves smoke used in nasal tract Cleaning in cold and cough.
45	Tharokay	Rumex HastatusD.Don.	Polygonaceae	H/RdS	L/Su	Used in jaundice and as Antiseptic.
46	Anjabar	Polygonum bistorta Lin	Meliaceae	H/F	R/Sp	Increasing milk production,
47	Kalizereen	Cuminum cyminum	Umbelliferae	H/F	W/A	Have power over of bacterial diseases

48	Sumbal	Adiantum Venustum	Polypodiace	H/RvS	W/Su	Aromatic and emollient & bronchial problems.
49	Tor Banj.	Quercus Dilatata Kindl.R	Fabaceae	T/F	S/Su	Gonorrhea, astringent, diuretic, diarrhea, indigestion and asthma
50	Nagar Mouth	Cyperus Scariosus	Cyperaceae	H/RvS	S/A	Anti-fungal, anti-bacterial, growth Regulator
51	Shamakay	Micromeria Biflora Benth.	Lamiaceae	H/RdS	L/Su	Used as anmusky. The aromatic blossoms of Dogwood trees creating white beauty on hills
52	Srazela	Ajuga Parviflora	Lamiaceae	H/F	W/A	Blood purifier, effective in fever, colic and in diabetes
53	Wogakai	Allium sativum L	Alliaceae	H/F	W/Sp	Diuretic, expectorant and antiseptic. High blood pressure
54	Bangara	Tephrosia candida	Fabaceae	H/F	L/Su	Powdered leaves are used as an insecticide
55	Ghiskay	Achyranthus Aspera L.	Amaranthaceae	H/F	L/Su	Tooth problems, Diuretic and Laxative
56	Spalmai	Calotropis Procera	Asclepiadaceae	H/RdS	L/A	Used for snake bit, Pain killer
57	Anangori	Punica Granatum L	Punicaceae	T/RdS	Fr/Sp	Used for diabetes
58	Kharerhay	Agaricus Campestris L.	Agaricaceae	H/F	W/Sp	Use for throat treatment.

59	Kutt	Inula Royleana	Asteraceae	S/F	W/Su	Use for high blood pressure
60	Mamera	Thalictrum Foliosum	Ranunalaceae	H/F	L/Su	Used in several eye disorders.
61	Kakora	Podophyllum Emodi	Podophyllaceae	S/F	R/A	Emetic, uterine diseases, colic, epilepsy ,dropsy, Hysteria
62	Tarokey	Rumexhastatus Linn.	Polygonaceae	H/RdS	L/Sp	Treating Hepatitis, Blood purifier
63	Markhaney	Zizyphus SativaG	Rhamnaceae	T/RdS	Fr/A	Use as remedy for pain, fever, diabetes.
64	TasfaBotay	Cana indica Linn.	Cannaceae	S/F	W/Su	As a Narcotic, Blood poisoning, Dysentery, Sexual stimulation
65	Kwaray	Berberis lyceum royle	Berberidaceae	S/F	W/A	For hepatitis chronic diarrhoea an piles
66	Panja	Dactylorhiza Hatagirea	Orchidaceae	S/RvS	R/Sp	Diarrhoea, chronic fever, cough, stomach-ache, wounds,
67	Tarmera	Nasturtimofficinale R. Br.	Brassicaceae	H/RvS	W/A	Used in chest complaints
68	Gojai	Morchella EsculentaL	Helvelaceae	FN/F	W/Sp	Used as a body tonic and mostly used as Flavour, Heart disease
69	Toot E Siyaah	Morus Nigra L.	Moraceae	T/RdS	Fr/Sp	Febrifuge, laxative, lower blood pressure, blood sugar.

70	Benakai	Pleurospermum Austriaca	Apiaceae	H/F	W/A	Used in renal pain, stomach-ache, diarrhoea
71	Spay botay.	Achyranthes Aspera L	Amaranthaceae	H/F	L/A	Laxative and effective in the removal of Kidney stone
72	Asadghand	Myrtus CommunisL.	Myrtaceae	S/RdS	W/Su	Antiseptic, hair-care, anti-diarrheal.
73	Anjeer	Ficus Palmate Forssk.	Moraceae	T/RdS	Fr/A	Use in diseases of lungs and bladder
74	Da PayoShamakay	OleaferrgineaRoyle.	Lamiaceae	H/F	L/W	Effective in cold, cough and digestive troubles
75	Khona	Oleaferrginea Royle	Oleaceae	T/F	Fr/Su	Used as a healing agents.
76	Skhawaja	Acruscalamus Linn	Areaceae	H/F	W/A	Colic, diarrhoea and snakebites

S=Shrub, T=Tree, H=Herb, FN=Fungi, F=Forest, RdS=Roadside, RvS=Riverside, W=whole plant, L=Leaves, S=Seed, R=Root, Fr=Fruit, Sp=spring, Su=summer, A=autumn, Wn=winter.

(Ashraf et. al, 2016), (Khan et al., 2015)

(A. Razzaq., 2015), (S.Hassan., 2013)

(I.JAVED et al.,2014)