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PEOPLE AND LAND USE STUDY OF HILKOT WATERSHED MANSERA DISTRICT, PAKISTAN

BY

Firoj Ansari

B.Sc. Forestry (1994-96)

FOREST EDUCATION DIVISION
PAKISTAN FOREST INSTITUTE
PESHAWAR

1999

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BY

FIROJ ANSARI

A Thesis Submitted to the University of Peshawar
in Partial Fulfilment of the Requirement
for the Award of the Degree of

MASTER OF SCIENCE IN FORESTRY

APPROVED:

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FOREST EDUCATION DIVISION

PAKISTAN FOREST INSTITUTE

PESHAWAR

1999

I dedicate this work to

My family
and
all those who are working for the
conservation of mountain environment

ACKNOWLEDGEMETS

I feel oblige to my advisor, Dr. Muhammad Rafique Sardar, Range Management Officer, Pakistan Forest Institute for helping me to bring out this research work in a standard readable form. Despite his other heavy engagements, he always managed to guide me on the subject. His useful criticisms, suggestions and keen interests had been very valuable assets for me during the entire course of this study.

I am also thankful to Raja Muhammad Ashfaque, Director General, Pakistan Forest Institute for approving my study plan to work on social aspects of the watershed area.

The cooperation of Mr. Wilayat Khan, Social Organizer, Peoples and Resource Dynamics Project (PARDYP) Pakistan, is highly appreciated by the author and sincere thanks are also extended to other members of this Project: Mr. Muhammad Jahangir, Mr. Irfanullah Marwat, and Mr. Abdus Salam for their assistance.

Raja Muhammad Zareef, Assistant Professor of Forestry needs special mention here because of his valuable help in analysis of the data.

Sincere thanks are also due to Mr. Richard Allen, Regional Coordinator, PARDYP and Mr. Pramod Pradhan, Head, MENRIS, International Center for Integrated Mountain Development (ICIMOD) for their assistance.

I take this opportunity to extend my thanks to International Tropical Timber Organization (ITTO), Yokohama, Japan for sponsoring my 2 years M.Sc. Forestry at the Pakistan Forest Institute and ICIMOD, Nepal for providing partial funding to .my research works for this thesis.

Last but not least, I am very much grateful to all the respondents of this study and all others who helped me one way or other, during this research work.

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CHAPTER-I

INTRODUCTION

1.1 General Consideration

Though the mountainous upland watersheds of the world constitute about 20 percent of earth surface but there is hardly any area on the earth not affected by their environmental characteristics. These watersheds, of mountains and hills are most densely populated mountain ranges in the world occupied by over one-tenth of the word's people with very large population living below poverty line. Over hundred of years and, in particular, in current century, the impact of human activities on mountain environment has increased considerably (ICIMOD, 1998) in many places of the world. To meet requirements of the grains the demand for new agricultural land and the forestland for much dependency on wood for energy, have increased.

The human interventions in this part of the world, particularly in the form of removal of vegetation and expansion of cultivated lands on marginal land, and in conjunction with intense monsoon rainfall is triggering massive erosion and land slides resulting in soil impoverishment and soil loses- all that have created an alarming situation in some countries (ICIMOD, 1998) and the condition is even worse in developing countries because of low literacy rate, poverty and less technological advancement. Mushrooming population and its pressure on limited land area and the rapid changes in land use are considerably affecting and threatening the sustainable use of bio-physical resources in the mountains (Shrestha, 1998). The effect of unplanned and faulty upland

activities is not only restricted to these mountains but in most cases it is more disastrous to low lands.

Pakistan being a developing country and having similar problems of population and land uses is not untouched of this alarming condition. The country is one of the major watersheds of the world with diverse physiographic and climatic conditions, and complex socio-economic structure of the population inhibiting it. The total area of Pakistan is 79.61 million ha, out of which roughly 5.41 million ha or approximately 25 percent of the total area, is mountainous and semi mountainous. The population in mountain areas of the country is about 18 percent of the total population (ICIMOD, 1999).

These mountains have been classified on several bases such as climatic conditions, altitude, etc. Out of which some parts of the country are included in Hindu-Kush Himalayan (HKH) region that is of 2400 km arc of the mountains (Panday, 1991), and spread over eight countries, namely Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal and Pakistan. Such an Himalayan region can be wholly classified as watershed. A large population of this region depends upon agriculture and other land based activities for their livelihood, interacting and using watershed resources. Poverty, soil degradation, deforestation, lack of medical and social facilities are some of the common problems shared in this HKH region by all countries. These mountains are the sources of water supplies to the big rivers like Indus, Ganges, Brahamputra, Koshi, Mekong and Yangtze, etc. and threatening the livelihoods of more than one billion people downstream (ICIMOD, 1998).

The people of the mountain ranges of Pakistan are facing similar problems as the people of other countries in this region. The country has a number of big catchment areas that are very vital for the economic development of the country. Though the people living in any watershed areas are influencing its resources, particularly the way they use natural resources determines the safety of the livelihood and the property of people living in watershed areas and the downstream, yet no attention has been paid to study the people and how they use land, the major resource of the earth, while developing and managing watersheds of the country. Big dams of the country, Tarbela and Mangla are producing hydro-electricity and also meeting demands of the irrigation. The storage life of both the dams is threatened because of rapid silting up. If the present trend continues these dams will no longer help the country or the people unless their catchment areas have not been given timely and proper attention.

Pakistan depends entirely on precipitation received on mountain watersheds of upper Indus and Jhelum rivers to sustain irrigated agriculture, that is the backbone of the country, and to produce hydroelectric power (ICIMOD, 1991). Any activities that are carried out by the inhabitants of this part will not only affect the irrigated agriculture and the dams of the country but also to the entire economy. According to one study, in present terms, about 25 million people of the country in one way or the other will be affected by the change in environmental phenomenon of the mountains of the country (ICIMOD, 1999).

Panday (1991), referring to the study of Ali et al (1981) stated that free-grazing opportunities available to farmers in the Northern Pakistan have led to over grazing and consequently caused severe degradation of the pastures, deterioration in the fodder base and animal quality, and heavy erosion. Similarly other problems of the people of mountains of the Northern part of this country as outlined by Muhammad (1991) are dense population, low per capita income, heavy and unregulated livestock grazing, small land holdings, slope cultivation, irregular cutting of forest trees, and forest fires.

The miserable conditions of watershed are created by men's own (mis)use of the watershed resources, mainly because of not thinking about the future. Though it is hard to think of future when the present seems to be dark, i.e., in economic development sense which is very slow and when people are engaged thinking of meeting hand to mouth only and for other basic necessities because of poor economic conditions. Under these circumstances, at least in these developing or under developed parts of the country, it is very difficult to expect positive response from the people in natural resource management unless they don't see direct economic benefits. Though this is a very difficult task for a manager but people are main actors in the deteriorating the natural resources so a manager must think something of compromising and planning must be based on involving them.

The time has not gone far away and still a lot of opportunities are available before the planners in different forms, how to mobilise the resources for the betterment of local population. But the welfare of people cannot be done by only concentrating on the

technical sides of management as was done about half century ago. Moreover, it is widely realised by the natural resource managers that the planning should be based on the studies of the people. In a simple language, one can say that the people's activities on any watershed are changing the condition of soil, which is very slow in renewing phenomenon. In most of the cases, this has resulted in soil erosion that reduces the capacity of soil to grow crops.

Any watershed area is composed of various land uses such as agriculture, range, forest roads, recreation and others. The human population and their livestock- all changing the watershed conditions. The type of peoples inhibiting the area, climate, topography, and soil factors of the region determine the land use. Although the countries of the HKH Region experience common economic and ecological problems, the sources of these problems and their implications are not the same one. It is the people, their social customs and ethnic beliefs that are making differences, and presenting different approaches in solving a particular problem.

Mountain region of this country comprises diverse climate, distinct natural vegetation, different land uses and variety of people with their own customs and traditions can be called various ethnic groups. All these diversities are creating a significant challenge for watershed management in the mountain environment. In such a case management of mountain watershed is a real complex task, requiring both the sound technological as well as sociological knowledge.

1.2 Objective of this Study

Concepts of management, particularly of natural resource management have been changing very fast in the world, subject to the change in standards of living and various requirements. Certainly the bases for managing these resources have gone under many changes in recent decades because of the definition of resource ownership. The concept of "borrow" has been in dominating in this regard than "inheriting"- means we have borrowed the resources from our descendants, not inherited from ancestors. This gives obligation onto us, not only to make a wise use of the available resources but also think how sustainability of resources can be maintained. This concept compelled the planners to involve the people in planning and management of the resources, a factor responsible for changes in watershed condition. These are the people who have been using and interacting with the resources for long period in one way or the other. This principle of "borrowing" when try to implement in the field compelled to think on participatory management in which the fundamental thing is to analyse the relationship between people and their resources. So that without much altering the way they are managing the resources, a positive approach of technical input and indigenous formula can be incorporated to yield better lives to mountain people.

Keeping in view the relationship between land use and population, one can say that unless we study the resources of the area, particularly people and the land, no sound planning for the welfare of the resources and people can be made. This will be unjust with the people as well as resource of the country if any attempt is made to formulate plans without considering and studying these factors. Earlier, managing any watershed area was meant to adopting biological or engineering means to check erosion. In the

past, various agencies were involved in the research activities of watersheds of the country based on technical considerations only. For instance, the Pakistan Forest Institute, Peshawar has conducted a research on re-vegetation and water/sediment production in mountain catchment areas. Similarly WAPDA has established several monitoring stations on the major rivers and streams in the country for measuring water and sediment production (Shah et al, 1990) but no attention has been paid in studying the people and the land of any watershed area for management.

To go away from the past trend of purely technical management and believing that the efforts should be made in formulating the strategy for watershed management in which a due consideration to be paid to the social aspects, in this study the efforts have been made to study: the people and the land use of the Hilkot watershed- a very vital part of any watershed management, which had been left in the past. The author hopes that this study will present relationship between the population of this watershed and the resource use, particularly the land. This kind of study was needed to serve as a guide to know about this watershed's complexities to the planners or interested parties before making people oriented plan, based on participatory watershed management concept.

The Hilkot watershed is the part of Siran River watershed, an important tributary of Indus River system. Currently in this Hilkot watershed "People and Resource Dynamics Project (PARDYP)" is in operation, which is being carried out in five watersheds of the four countries of ICIMOD partners namely; China, Pakistan, Nepal and India with the objective of natural resource management to improve the socio-economic condition of people of this region.

The overall objectives of this study are:

- To study the socio-economic conditions of the peoples of the Hilkot watershed.
- To study the people in relation with land uses of the watershed area.

1.3 Scope of the Study

The ecology and socio-economic conditions of the Hilkot watershed is not representative to other watersheds of the country and thus the study carried out here is applicable only to this particular area. However, the methodology adopted for social survey and other analysis may be applicable to any upland watersheds of the country or region for similar study and is valid but the validity of results is greatly influenced by how accurately the information is provided by the sample respondents (Rafique 1986).

The reason for selecting this site was that an already working Institution (PARDY, Pakistan) in the area may provide some latest information on climate and socio-economic conditions of the people and accessibility of the area was easy.

1.4 Organization of the Study

Chapter I deals with the introduction of the upland watersheds and the objectives of the study. In second chapter, the study done by various authors in recent past on relationship between land uses and population and various models to estimate these changes, are reviewed. How the data are collected and analysed, and the problems, confronted during the course of the study, are briefly described in chapter III. Socio-economic conditions, population, land tanurial systems, and other factors are discussed in the chapter IV "Results and Discussion".

CHAPTER-II

LITERATURE REVIEW

The study of relationship between the people and watershed resources with particular reference to demographic changes and land use dynamics had been made by various foresters, environmentalists and other natural resource scientists. Some studies carried out in the past on such topics and the socio-economic aspects of the watershed are reviewed here.

Alig et al (1998) used econometric models to estimate land use change for the Coastal Plain and Interior Highlands physiographic regions of the south-central states of the USA - Alabama, Arkansas, Louwasiana, Mwasswassippi, Oklahoma and eastern states- Tennessee and Texas. They were consistent with the economic hierarchy of land use, with macroeconomics and demography notably influencing forest area change. According to them the area in urban use grew with population and affluence, changes in personal income also appear to have altered patterns of forest ownership, and much farm forest has transferred to other private non-industrial owners. Their findings regarding the importance of relative agricultural and forestry market-based incomes in influencing regional land use shifts suggested that farm programs play an important, but continually changing, role in land use change.

Bluffstone (1998) evaluated the policies for addressing forest degradation in developing country hill areas where agriculture was the major activity and villagers

depended on forests for important economic inputs. Population growth, poverty, and open access probably explain most 'overuse' in such areas, but these were very difficult, long-term problems, he argued. He explained that under such conditions interim demand-side policies should be seriously considered, but the case was also made that the set of feasible instruments was quite small. He, focusing on the case of Nepal, two instruments for reducing fuelwood demand - promotion of more efficient, wood-burning cook stoves and policies that reduce the prices of alternative fuels (e.g., through subsidies) were evaluated. Using a simple analytical model and results from two household surveys conducted in Nepal, it was concluded that promoting improved stoves was a much more efficient and equitable instrument than, for example, subsidizing the major alternative fuel, which was kerosene.

Hatcho (1998) while explaining the reason for land degradation in Latin American countries mentioned that it was mainly due to over-grazing, deforestation, and inappropriate cultivation practices. He stated that this resulting decline in crop yields, which caused the forced expansion of cultivation to marginal lands, has further accelerated land degradation with increasing population and prevailing poverty. He suggested that to alleviate these problems, this paper presents a new approach and discusses the importance of involving small farmers, who were the direct managers of local resources. Further he proposed that the importance of initiating activities from a small catchment in an integrated manner would be very much helpful for the management of the resources of the watershed. To encourage the participation of small

farmers, it was important to address not only the direct causes of land degradation, but also poverty issues and other problems that farmer's face on a daily basis.

Wilkie et al (1998) devised a spatial model of land-use change in the Ituri tropical moist forest of northeastern Zaire to examine changes in forest structure brought on by the concentration of 4 formerly dispersed horticulturist villages along a road. This cell-space model used 8 land-use categories: road, village, active shamba (field), farm-bush, Musanga forest, old seral forest, climax forest and forest wastelands. The model consisted of two main parts: forest succession and shamba selection. Forest succession was determined by the time since cultivation. They estimated that the climax forest returns to the open 'farm-bush' class with a probability of 0.0025 per year. Shamba selection for each village involved the age of a cell, travel time to the cell from the village, and whether the cell was in the village's usufruct (territory a village holds in trust for future generations). They found that the productivity of each site was a function of the number of years of fallow allowed. Acceptance of the model was done by comparing results with transects of vegetation types taken in 1983 and LANDSAT imagery from 1985. With no population growth, the model predicted a more open habitat near the road, but was able to support the villages indefinitely. They calculated that with 5 percent population growth, the area near the road was converted almost entirely to farm-bush and Musanga forest in 45 years, productivity of shambas was decreased, and the area must be abandoned after about 80 years.

Heilig (1997) presented some of the recent sources on land-use data in China and explained the inconsistencies between them, particularly in the estimates for forest and grassland and in the under-reporting of cultivated areas. He argued that the land-use change was distinguished from land-cover change. According to him, five anthropogenic factors were major driving forces of land-use change in China namely; population growth, urbanization, industrialization, changes in lifestyles and consumption, and shifts in political and economic arrangements and institutions. For this study, he collected a set of empirical data and used to delineate the demographic and socio-economic changes that were likely to affect future land uses. He suggested that in the next half-century the population of China is likely to grow by some 300 million, and rural urban migration and the growth of cities and industrial infrastructure will be the dominant factors in land-use changes.

Hofstad (1997) discussed the causes of vegetation degradation in woodlands of Tanzania. His findings revealed that the shifting cultivation has contributed to woodland degradation and the fallow period was shortened when population growth was high, leading to decreased yields, and the clearing of more virgin forest land can become more economic than continuing the fallow/cultivation on the same site. He also found that permanent agriculture was expanded due to the need for increased food production. He explained that the planting of trees and sustainable woodland management were important, but the crucial development factors in the region were population growth and agricultural development. According to him, most household energy consumed in urban areas of Tanzania was wood fuel and reduced demand due

to high prices, and shift to other forms of energy, were the decisive factors controlling charcoal burning. Woodland degradation was influenced by institutional factors, but altered land tenure would not slow down clearing of arable woodlands significantly. It was suggested, however, that more secure land tenure might contribute to reducing overgrazing and overexploitation of non-arable woodlands.

Leach et al (1997) studied the gender relations and changes in food production patterns over the last 30 years for the Mende people who live in the rain forest environment of eastern Sierra Leone. They found that land use has changed considerably with respect to how, and how frequently, different farm site types were used and argued that such agro-ecological dynamics cannot be attributed to population pressure and environmental degradation, the causal variables usually thought to drive land use change in African agriculture.

Muschler et al (1997) in a study in Central America found that with increase in population, the agricultural frontier in tropical countries was being expanded into previously untouched or little changed areas, frequently resulting in environmental degradation. At the same time, the use of agricultural lands was undergoing rapid changes in response to increasing environmental concerns and external market forces. They further said that in large areas of Central America, for example, the production systems for coffee had lost much of their biological diversity in the last couple of decades. Their observations of apparently higher yields in high-input and low-diversity systems resulted in recommendations to eliminate shade trees from the system. They

recommended that the necessary changes in the objectives and management of land-use systems must be gradual to assure high acceptability of the new practices. According to them under such conditions, which were typical for most traditional land-use systems, the development of practices, which integrate trees into the agricultural land-use systems, assumes special importance and agro-forestry practices can help to improve land-use systems towards higher sustainability and/or provide a stepping stone towards other, often tree-based, land-use systems of higher viability. They outlined appropriate research and extension methodologies to help evaluate improved system.

Bisht et al (1996) studied the Gomti watershed of UP, India and found that the rapid growth of the human population during recent years, and the absence of any viable means of livelihood other than uneconomic crop farming had led to the uncontrolled exploitation of land areas and the consequent degradation and depletion of critical biophysical resources in the Lesser Himalayan region. They observed the need for sustainable development therefore, makes it imperative to adopt a comprehensive land use policy based on land capacity analysis that was scientific and practical. The main objective of their study was to evolve an optimal land use framework for the Gomti Watershed, situated in Kumaon, Lesser Himalaya, Uttar Pradesh, India. The authors made a detailed study of the traditional land use, regional agricultural system and the areas prone to environmental hazards was made throughout the watershed, through the preparation of large scale topographical forest and land record maps, field surveys and mapping.

Pasicolan et al (1996) did a study on a grass species and land uses. For many years, *Imperata cylindrica* in Ilagan of Philippines infested grasslands had been regarded as unproductive and of low potential for development. They argued that the light-loving nature of *Imperata,* coupled with continuous burning, perpetuates that species' dominance over other plants. Thus reforestation, or any tree based cropping system, was regarded as the most ideal land use type to eradicate this weed effectively. However, government attempts in the Philippines to reforest grasslands through the overseas aided Contract Reforestation Program had been costly, with a very poor performance in the initial phase.

Their studies gave an account of the spontaneous transformation of grasslands to other productive land use types in Salindingan, and describe the various factors that had led to the land conversion processes. They had used aerial photographs and satellite imagery of the area for 1950, 1980 and 1990 were analyzed, and interpreted, which were also supplemented by field interviews and secondary information. They found natural forest cover in the 3 years studied was 40, 7, and 0 percent, respectively. For grassland, the cover was 35, 33 and 6 percent, and for agriculture 25, 60 and 85 percent, respectively. However, by 1990, 9 percent of Ilagan's total land area had been turned into either wood lots or agro-forestry farms - some of these tree systems being established spontaneously by farmers who had already participated in the failed government mediated Integrated Social Forestry Program (WASFP) introduced in

1989 which had encouraged contour planting. They outlined the factors responsible for land use change being:

(i) population pressure forcing the clearance of forest and grasslands

(ii) loose initial tenurial status of the land providing the legal climate to induce continuous landholding expansion,

(iii) an information campaign for yellow corn [maize] by the San Miguel Corporation and the Department of Agriculture, which increased cropping intensity, and

(iv) the presence of ready market and credit assistance from private moneylenders motivating farmers to change cropping patterns towards higher productivity and environmental stability.

Rawat et al (1996) discussed about the case of Central Himalayas of India. According to their findings, over-population in relation to poor land productivity and cultivation in less fertile lands was resulting in land degradation and deforestation in the hills of Uttar Pradesh, India. Growing demand for more food production and the increasing need for more cash in hand had forced the hill people to cultivate all kinds of land, resulting in the denudation of land resources and soil erosion. They mentioned that these changes resulted in out migration of the area's human resource. They proposed a new management system for the revival of natural resources and the sustainable utilization of the area's human population and livestock, involving active local participation in order to change the existing land-use to a system based on the soil fertility scale.

Siriprachai et al (1996) while studying "Population growth, fertility decline, poverty and deforestation in Thailand, 1850-1990" examined a number of ideas on population over the said period 1850-1990, focusing on the linkages between economic growth, fertility, poverty and the environment, particularly deforestation. They found that poverty exists and acute environmental problems had been created, especially in Bangkok. They presented population figures for the period between 1850 and 1990. The demographic transition of Thailand, which began in the 1960s with high fertility rate dropping to low incremental fertility rate by the 1980s was also examined.

Hall et al (1995) had developed two spatial models to simulate rates and patterns of tropical land use change. Their study was mainly of environment concern as these models were used to calculate total amounts and spatial distributions of the carbon content and carbon dioxide exchange resulting from deforestation and other land use changes. For their study they had used two basic approaches: hypothesis deduction (GEOMOD1) and statistical deduction (GEOMOD2). Their hypothesis deduction approach for selecting pattern drivers was based on user-supplied assumptions about how people actually use land and statistical deduction approach analysed historical patterns of land use change and compared them to user-supplied map layers of physical and cultural attributes. They used digitized and remotely sensed data for Southeast Asia and Africa to test these models. Their results indicated that:

(i) the variation in accuracy of the model predictions (74 percent-96 percent) depends on the time scale used, the number of land classes modeled and the accuracy of initializing data.

(ii) the drivers of land use change were scale- and terrain-dependent: specifically topographic features were more important than climate variables for large-scale simulations where topography was rugged.

(iii) the amount of land use change was influenced greatly by population growth and land use policy in different countries, but physical features fundamentally determine the pattern of land use change; and

(iv) the spatial modeling approach does improve the spatial and temporal resolution of carbon release estimates from tropical land use change, although it does not yet fundamentally change the magnitude of carbon exchanged relative to previous national level studies.

Rai et al (1995) assessed the impact of land-use change on environmental degradation in the Mamlay watershed of Sikkim, India. They found that between 1980-81 and 1992 the forest cover decreased by 20 percent, agricultural land increased by 11 percent and wasteland increased by 8 percent. The changes in land use were attributed to increasing population and livestock pressures and indiscriminate lumber cutting for timber. They revealed that in that area changes led to reduce soil productivity, accelerated soil erosion and climate change, and a higher frequency of natural disasters.

Thapa et al (1995) had discussed the case study of one of the watersheds of Nepal under the subject "Status and management of watersheds in the Upper Pokhara Valley, Nepal." Data from land use analysis, household surveys in 1989 and 1992, meetings with villagers and field observations were used to study the status and management of

four watersheds in the Upper Pokhara Valley, Nepal. They argued that under forests and grazing lands declined rapidly between 1957 and 1978, mainly in response to government policy of increasing national revenue by expansion of agricultural land, nationalization of forests, population increase and dwindling household economy. They found that the rate of deforestation had declined considerably since 1978, primarily through remaining forests being on steep slopes and implementation of a community forestry program. Forests with relatively sparse trees and grazing lands near settlements had, however, undergone degradation because of fuelwood and fodder collection and livestock grazing. They documented that erosion was a particular problem because of the steep gradients, weak rock formations and relatively high precipitation and farmers were unaware of the economic implications of land degradation and had adopted various land management practices, but agricultural practices still practiced on some of the *bari* lands on the hill slopes had hastened land degradation. On the basis of their study, they outlined a broad management strategy for facilitating environmental conservation and eco-restructuring for sustainable development.

Virgo et al (1994) in a study of eastern hills of Nepal investigated the land-use change over the period of 12 years (1978 to 1990) for a pilot area of 200 square km of the Middle Mountain zone in Koshi hills of Dhankuta District. The studies were based on interpretation of air photographs taken in 1978 and 1990 and field checks on a sample of 13 sites of 300 ha each (representing a 20 percent sample). They mapped six land use categories namely; agriculture (7 sub-categories); abandoned farmland; forest (7

subcategories); grazing land; shrub; and other (such as landslides, urban, and water). They estimated population changes by house counts on the air photographs. The results indicated a stability in land use, despite an estimated 19 percent increase in population. No statistically significant changes in overall land use were detected but considerable internal trading occurred between categories within sample areas, especially between 'forest' and 'shrub', demonstrating a flowing of land use. They said that the total forest cover increased from 36.5 percent of the sample area in 1978 to 38.8 percent in 1990, which indicated a significant improvement in on-farm fodder, fuelwood, and fruit tree resources. They also found that landslide areas increased from 1.0 percent of the total sample in 1978 to 1.9 percent in 1990.

Smith et al (1993) made a study on changes in regional land use trends in Northeastern USA from 1952 to 1987. They projected a decline in the timberlands mainly due to urbanization for the years 1990 to 2040. They argued that different States would experience large differences in timberland losses depending on state size and population growth. They said that smaller ownership classes were accounting for an increasing percentage of timberland because of land scales and sub-division and commercial timber production will be concentrated on fewer large tracts. They discussed problem areas and research objective listed forest soil research priorities.

Mwaura et al (1991) had used color infrared LANDSAT imagery to estimate area changes in forest and woodland vegetation of the Lake Elementeita watershed in Kenya's rift valley over the area of 335 sq. km. They estimated the rate of depletion in

1973-84 to be between 4 and 11 sq. km/year. They found that during this period, the basin was stripped of a total of 88 sq. km of woodland and forest (or 58 percent of the total area), mostly through replacement by agro-ecosystems. They attributed this change to a rapid population increase, which was estimated at 5.7 percent/year in 1962-69 and an average annual growth rate of 3.1 percent for the period 1962-79. They also discussed the effects of this land use change on rates of soil erosion, water availability and Lake Levels.

Mahat et al (1987) explained some features of agriculture subsistence, including rates of population change, land use and agricultural production, main crops and animal husbandry. They reviewed some features of the forests, including types and areas, and the effects of subsistence agriculture on the forests. They did not consider the use of fuelwood and timber for buildings as a main cause of deforestation in recent years but collection of foliage for fodder and animal bedding was the main effect of subsistence agriculture on forestland.

CHAPTER-III

MATERIALS AND METHODS

Originally this study "The people and Land Use of the Hilkot watershed" was planned to be carried out by collection of data mostly from the aerial photographs or satellite imageries of the area over the years. Using photo interpretations and GIS techniques, the various land uses on these photos could have easily been identified. Similarly by counting the houses on such maps/photos, one could determine the population of the area by multiplying the national average household size with the number of households. However, to study the people in relations to the natural resource uses, one cannot do it alone in the laboratory. Notwithstanding, the methodology of questionnaire-cum-interview and discussion with key inhabitants proved useful to establish relationships between population and the land uses of the area. Though the present study could have been combined with the laboratory exercise- study of aerial photographs or satellite imageries and socio-economic surveys (questionnaire techniques) but laboratory exercise was abandoned due to the following reasons:

- It was not possible to obtain the aerial photographs in Pakistan due to security reasons. These photos cannot be easily made available to common people by concerned authorities. Efforts were made to obtain the photographs from the Forest Management Center, Peshawar but failed because of the reason mentioned earlier.
- The study area is very small and one has to enlarge the photographs to 1:5000 or 1:10000 scale to identify land uses and to count households. This requires necessary equipment but the Institute lacks these facilities. Further due to lack of time it was not possible to contact other local organizations working in this field.

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Due to the difficulties mentioned above, the study was confined only to the questionnaire-cum-interview technique. Before explaining the methodology, the study area is discussed briefly as under:

3.1. Description of the Study Area

3. 1.1. General Conditions

The Hilkot watershed falls within the administrative boundary of Mansera district of North West Frontier Province (NWFP), Pakistan. It lies near 34° 4' North latitude and 73° 2' East longitude (Khan & Shah 1999). It has one main stream "Hilkot Khwar". This watershed forms a part of Siran river watershed, an important tributary of the Indus River falling into Tarbela dam. The lowest mark of the watershed, measured at outlet, near Malakan village is 1448 meters above Mean Sea Level (MSL) and the highest point is 2423 meters above MSL (measurements taken with Altimeter). The total area of the watershed measured with Planimeter on a GT Map (Appendix- I) comes to 1287 ha.

Two types of people inhibit the area namely; land owners and tenants. The tenants were in majority by numbers and they rent-in the lands of Khans (Swati tribe) to the extent that is hardly sufficient for their livelihood. Level of education and other social facilities available to the people of the area are below the national averages. The education level, particularly of tenants is very low. The entire watershed area, which is inhibited by more than 8000 people (Table 23) had no college or even a high school. Similar is the case with health and hygienic conditions, which are not satisfactory by any standard. It has only one Basic Health Unit (BHU) to provide basic health facilities

10990

but in reality a very little medical facilities are available to the people of the area from this Unit which lacks staff and materials. The road stretches to the point inhibited by only about 25 percent of the Hilkot watershed. On the basis of above facts, the overall economic conditions of the area can be rated as poor.

3.1.2 The people

The watershed comprised of three major villages namely; Hilkot, Kund Bala and Dheri Nambar Dhara (DN). Hilkot is the biggest of all the villages in the watershed that includes a number of hamlets. The population of Hilkot Watershed during 1988 is given in Table 1.

Table 1: Population of the Hilkot watershed

S. No.	Villages/Hamlets	No. of Households	Population		
			Male	Female	Total
1.	Hilkot	160	677	597	1274
i.	Banda	78	204	191	395
ii.	Tare Hada	56	167	140	307
iii.	Bojri	21	78	38	116
iv.	Gul Dheri	40	102	89	191
v.	Kandi	45	182	154	336
vi.	Kothri	101	306	238	544
vii.	Naka Bisa	92	220	187	407
viii.	Naka Sher	111	238	237	475
ix.	Sathan Gali	164*	367*	332*	699*
x.	Sumbul	62	137	136	273
2.	Kund Bala	105	273	243	516
3.	D.N. Dhara	73	164	173	337
	Total	1108	3115	2755	5870

(Source: PARDYP, Pakistan)

* Figures were estimated to be 55 percent of the total households and population of Sathan Gali to be included in the study area, rest being out of the watershed boundary.

There were three main groups of people distinguished on the basis of languages they speak. Majority speaks Gujari, followed by Pushto. Hindko was also spoken by a small number of population. The major occupation of the Gujars (who speak Gujari) was agriculture and majority of them were tenants. Whereas Pushto speaking people were landowners and belong to Swati tribe. The socio-economic conditions of Hinki (Hindko speaking people) were similar to that of Gujars. However, the cultural diffusion is so much so that almost all the adults of the study area spoke all of the three languages i.e. Gujari, Pushto and Hindko.

The major occupation of the people of the study area was agriculture whereas some people were also working as paid labours in Karachi or in other big cities of the country as well as the in Gulf states.

3.1.3 The land use

Forest, pasture, agriculture, infrastructures, river(s) beds, barren lands were the major land use categories of the study area. The upper part of the watershed area is hilly with kail (*Pinus wallichiana)* a dominant forest tree species. Ridges were occupied by Oak (*Quercus* spp). Other species found in this area were *Populus ciliata, Acer caesium, Juglans regia, Taxus baccata*, etc. Most of the forests were private property of the Khans. The Guzara forests were negligible, where found were also divided among Khans and the tenants. In some cases, tenants do not have rights to use the forests at all. Somewhere they had access to small woods but only after having permission from

the Khans. The tenants in most cases take care of these forests, which were owned by Khans.

The major agricultural crop on the rain fed areas was maize whereas the irrigated lands were used for rice cultivation. The vegetables they grow include potato, onion, turnip, garlic, tomato, chilly, etc. Farmers grow these crops mainly for their domestic use. The production was not surplus that could be taken to market outside the village. Though there was potential for fruit orchards because of the climate but nothing concrete has been done either by the concerned departments or by the people themselves though they preferred horticulture as the best occupation for livelihood (Table 23).

Only a few households had cylinder gas for cooking and therefore majorities of the people of the area were dependent on the fuelwood either grown on marginal lands or in forests to meet the demand of fuels for cooking and heating purposes. On the ridges of agriculture fields they grow Shroll (*Wallichiana wallichiai*) for firewood, and pear, apricot, apple trees, etc. for fruits.

The third major land uses of the area was pasture; mainly rains fed areas not suitable for agricultural crops, and were not scientifically managed. Khans were seldom interested in livestock rearing business because they think that it's the job of the Gujars. Most of the people, from tenant class, have buffaloes to meet the requirement of milk whereas some have goats and mules for meat and transportation purposes, respectively.

The data collected from the office of the Union Council, Chattar Plane for the land uses of the watershed are given in Table 2.

Table 2: Area under different land uses in Hilkot watershed

Land Uses		Villages (Area in ha)			Total (ha)
		Hilkot	Kund Bala	Dheri N. D.	
Agricultural Land	Irrigated	51.42	0	0	51.42
	Rainfed	522.28	55.06	28.34	605.68
Forest		305.26	118.62	3.24	427.12
Range		305.26	0.41	12.55	318.22
Field Margins		82.19	7.29	5.26	94.74
Waste Land		2.43	0	1.22	3.65
Non-cultivable Land		65.18	1.70	2.02	68.90
Total		1334.02	183.08	52.63	1569.73

3.1.4 Mean maximum temperature and rainfall of the Study Area

The study area falls under semi-humid climate with monsoon rainfall as predominant. The PARDYP had established meteorological stations/observatories in the watershed area. The average maximum temperature and rainfall data for eight months (January to August, 1999) collected at six of its stations are reported. The elevations at which these meteorological stations are established are given in Table 3 whereas meteorological data are given in Table 4 and 5. This information will help explain the climatic conditions of the study area.

Table 3: Elevation of meteorological stations

S. No	Name of the site	Elevation (m)
1	Malkan	1448
2	Syedabad	1646
3	Maira	1707
4	Bhojri	1753
5	Guldehri	1829
6	Tal	2286

Table 4: Mean maximum temperature data

Month	Stations						Mean
	Malkan	Syedabad	Maira	Bhojri	Guldheri	Tal	
January	8.15	16.9	7.35	6.29	14.7	N/A	10.67
February	10.40	12.3	8.74	6.87	9.2	N/A	9.49
March	14.20	14.3	12.79	12.32	14.1	N/A	13.54
April	22.20	20.6	20.16	19.06	21.4	N/A	20.69
May	26.57	24.5	24.87	24.27	25.4	N/A	25.13
June	28.73	28.6	26.65	26.48	26.2	23.5	26.70
July	27.50	26.9	25.69	25.19	26.9	20.1	25.38
August	23.5	23.3	23.8	24.2	23.3	26.8	19.8

(Source: PARDYP, Pakistan 1999)

N/A= data not available

Table 5: Total Rainfall

Month	Stations					Mean
	Malkan	Syedabad	Maira	Bhojri	Guldheri	
January	138.0	158.0	166.0	198.0	109.0	153.8
February	109.0	58.0	151.0	152.0	56.0	105.2
March	248.0	245.0	259.0	301.0	281.0	266.8
April	34.0	30.0	38.0	38.0	33.0	34.6
May	42.0	41.0	57.0	62.0	57.0	51.8
June	76.0	18.0	45.0	57.0	45.0	48.2
July	152.0	144.0	187.0	195.0	180.0	171.6
August	175.0	125.0	174.0	195.0	180.0	169.8

(Source: PARDYP, Pakistan 1999)

3. 2 The Study

This study was carried out with the following objectives:

- To study the socio-economic conditions of the peoples of the Hilkot watershed.
- To study the people in relation with land use of the Hilkot watershed.

To meet these objectives information was gathered through questionnaire. The social survey was done on the principles of social science, which differ greatly from the physical science. In physical study, for example 3 multiplied by 2 will always results 6 but the social science is different. Human behaviour or responses change with the change in his own condition as well as the condition of their surroundings. And moreover, they are human being, and a rational approach of social scientists should be to treat them as a very sensitive and high responsive being in the world, not as a material or lifeless object. The another important feature of the human behavior is that, the individual response may differ from the collective response. One may act differently when he is alone but may behave differently in a group. The villagers are quite different from the urban people and therefore demand different treatments. With these assumptions, in this study, an individual was treated as a living segment of the society who could response, argue, think/rethink, and then his opinions were generalised for any particular common problem, being faced by the whole community or the society. A good atmosphere was created before interview/discussion was carried out.

3.3 Procedures

3.3.1 Sample villages/hamlets

The whole study/watershed area was divided into three main villages namely; Hilkot, Kund Bala and Dheri Nambar Dhara (D.N). It was done so because the Revenue Office, Chattar Plane, Mansera district maintained record of these three villages. Further some other offices, such as Election office, has also some information of these villages only. Out of these three, the Hilkot was the biggest which included a number of small hamlets such as Kandi, Tare Hada, Syedabad, Banda, Gul Dheri, Sathan Gali, Kothri, Bojhri, Naka Bissa, Naka Sher and Sumbul. Kund Bala was known as Kund and Dheri N. D. was called Dheri only in the area. The sample households from all the villages mentioned above were interviewed.

3.3.2 Sampling procedure and intensity

Before actual data collection, a preliminary survey of the people and the resources was undertaken. During this survey the already prepared questionnaire was tested and where required some changes, it was re-framed. With the consultation of the advisor changes were finalized. During this preliminary survey a list of all the households of all the three sample villages was prepared. Individual sample household heads were selected by random sampling procedure. The sampling intensity was 4.5 percent. Proportionate samples were drawn from the three sample villages as under:

Table 6: Number of household heads interviewed

S. N.	Name of the Village	No. of Household (HH)	No. of HH Heads Interviewed	Intensity (%)
1.	Hilkot.	930	42	4.5
2.	Kund Bala	105	5	4.8
3.	Dheri N. D.	73	3	4.1
	Total	1108	50	

3.3.3 Selection of Individual Household Heads

A list of household heads was prepared using the voter lists of Local Body Election. Except in two stages, nowhere the biases were introduced. The researcher was interested to know the views of two big landlords of the area and so they were selected purposively. The serial numbers of the so prepared list were considered as respective codes. These codes were written on chits and using a pot it was shuffled thoroughly. Every time before picking another chit, the pot was shuffled. The coding and shuffling was done separately for each sample village.

It was realized that it may not be possible to find all those persons (household heads) selected as samples for interview in the field so 50 percent more of the total samples were selected by the same procedures as alternate candidates to be interviewed. In this way we had 50 candidates as original sample and 25 as reserve sample. It was tried at best to locate the original samples for interview and in cases they were not available, alternate samples were interviewed. This arrangement proved useful when the survey was started practically in the field.

The interviews of tenant samples were carried out mostly during morning time among tenants as during the day these people were busy in their domestic chores and in the evening were tired/resting. Whereas the landowners were interviewed in the evening time was better.

3.4 Tools Used in this Study

Without tool no scientific study is possible. Any conclusion based on personal experiences or observations do not have the same validity as that of drawn on some established methods after testing a particular problem through standardised tool. Such information obtained through standerized method can be analysed statistically and the inferences of wide efficacy can be drawn.

Tools employed in this study was questionnaire-cum-interview (Appendix-II) which was formulated with the guidance of the thesis advisor, Dr. Muhammad Rafique Sardar to collect following major information:

- Present household size and the demographic changes over the period.
- Education level of the people of the area.
- Land holdings and the status of ownership.
- Land use changes
- People perception about increase in population.

The following three explanations are considered necessary for the readers:

1) To know the demographic changes, the individual interviewed was treated as independent unit. It means if he was single during 1978, his family size was 1. Similarly if he was married without child then 2 and if he had children then that number of children was also included in his family size of 1978.
2) The purpose of asking about the kind of fuels, they use in the house, was to know their living standard. Fuel can also serve as an indicator how much they were dependent on forest resource.
3) Similarly the question on existence or need of family planning institution was based on the idea to know the views of the people regarding population explosion.

In addition to serving questionnaire, the discussion with key persons were also held to know the condition of social facilities and resources.

3.5 Problems Confronted and Assumptions in the Study

During the course of the study, a number of problems were confronted which were dealt accordingly, keeping in view the time available for the study as under:

- One of the villages of the watershed namely; Sathan Gali, which falls in the administrative set up of Hilkot extends on both sides of divide of the watershed. According to a crude estimate it was concluded that about 55 percent of the households of this village lie inside the watershed boundary. Hence for sampling purpose the figure of 55 percent was considered.

- People don't have exact records that how much land of which kind i.e. irrigated, waste, range, etc. they own or cultivate. However, in order to find the relationship between different land uses and the individual land holdings, the information provided by the respondents was taken as correct.
- Since the researcher and his guide both were male so it was difficult to approach the female household heads due to religious and social factors. Hence only views of males were recorded.

3.6 Data Collection

3.6.1 Primary data

The primary data on availability of social facilities (school, health center, library etc.) in the area were collected on first hand investigation by the direct field visits. Similarly, with the help of questionnaire the primary data on the lives of the people and their opinion about population growth, land holdings or the uses of land were collected.

3.6.2 Secondary data

The secondary data were gathered from reviewing various relevant papers and journals, published and unpublished reports. The data on weather, which is unpublished, were collected from the files of the PARDYP, Pakistan. Similarly data on population, land holdings, etc. were collected from Revenue Office, Local Bodies election office and population census reports.

CHAPTER-IV

RESULT AND DISCUSSION

The data were collected on various aspects to evaluate the interrelationship between different factors to have idea about the people and land use of Hilkot watershed, through methodology explained in the previous chapter. The observations gathered through questionnaire, information noted during discussions and experiences made at the time of field visits, are analysed to explain the subject "land use and the people" of the study area.

For analysis, the data collected were processed, computed and analysed by simple statistical package "SAS". The Microsoft Excel program was also used to calculate averages and other parameters, and for designing model equations as well as to generate relevant Tables and charts in explaining the topic. The results are discussed below:

4.1 Age of Sample Respondents

The average age of sample respondents in the study area was 46 years while 26 and 80 years were the ages of the youngest and the oldest respondents, respectively. Eighty four percent of the respondents were of more than 30 years while sixteen percent were of less than 30 years of age.

Table 7: Ages of sample respondents by tribes

Age Group (years)	Tribes (percent)			Percentage of Total
	Gujar	Swati	Other	
Less than 30	16.0	18.2	-	16
31-45	44.0	40.9	33.3	42
46-60	24.0	27.3	33.3	26
More than 60	16.0	13.6	33.3	16
Total	100.0	100.0	100.0	100

If the age is considered as a factor of maturity and experience, in this survey, all the respondents were mature and therefore the information provided by them could be considered valid based on their experience.

4.2 Population Size and Population Dynamics

4.2.1 Present household size

Two major tribes inhibited the study area: Gujar and Swati. Out of 50 respondents, only three (two Kashmirees family and one 'Lohar') were from other tribes. Average number of male and female members in a household by tribe of the sample population are shown in Table 8.

Table 8: Average family members by tribes

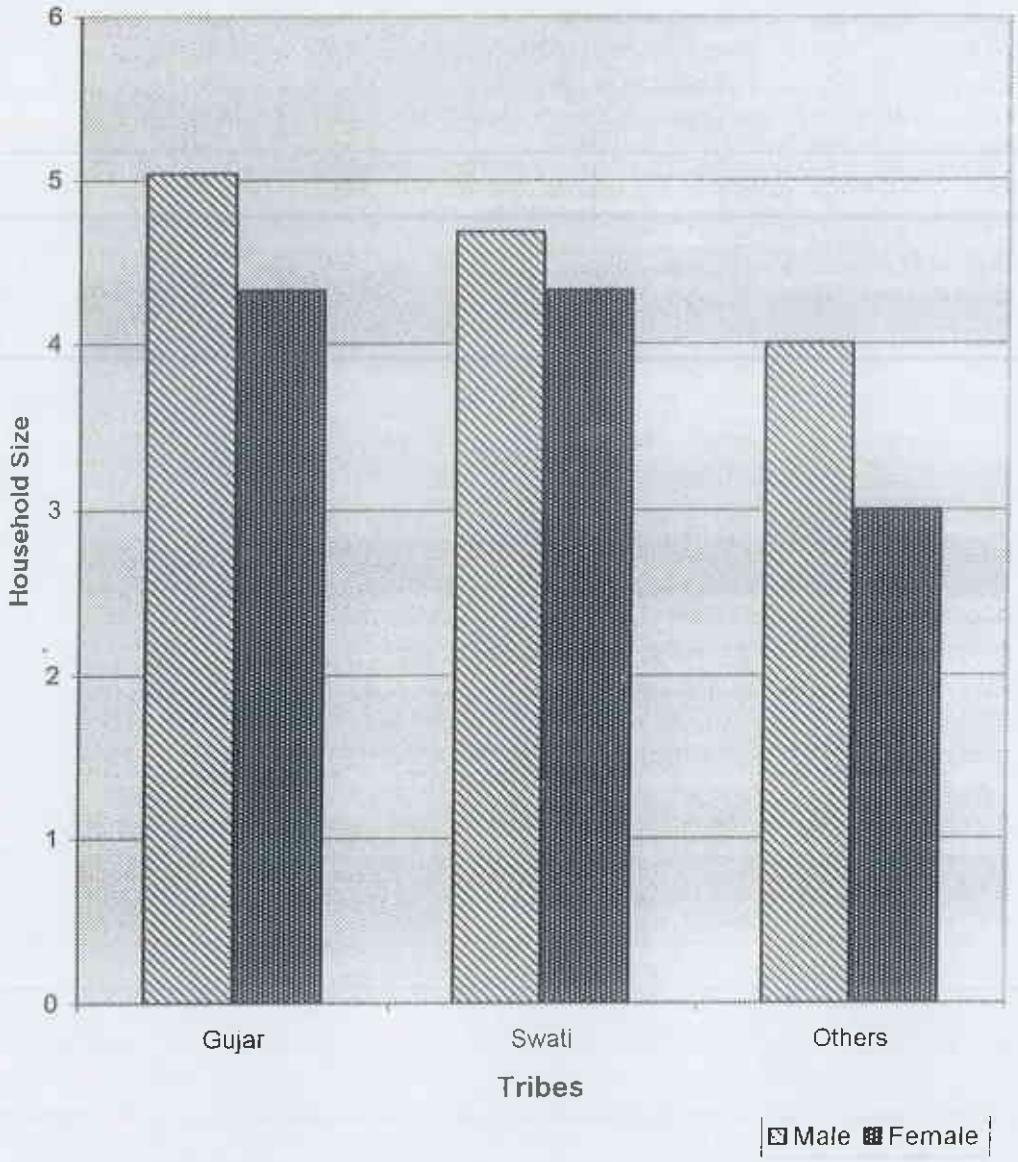
TRIBE	Below 10 Years		11- 20 Years		21 Years and Above		Total
	Male	Female	Male	Female	Male	Female	
Gujar	1.4	1.4	1.3	1.0	2.3	2.0	9.4
Swati	1.6	1.5	1.3	0.7	1.8	2.1	9.0
Others	1.0	1.3	1.7	1.0	1.3	0.7	7.0
Average	1.3	1.4	1.4	0.9	1.8	1.6	8.5

Besides, explaining the average members of different ages in a family, the above Table also shows that 60 percent of the population of the watershed is below 20 years of age that is certainly imbalance between the working and non-working force. Women of the area were also not involved in any money earning business as none of the respondents mentioned about the female being earning member in the family. According to the respondents, their main job was to look after kitchen affairs while some also assist in collection of fuelwood, taking care of livestock and assisted in agriculture, but it is hard to estimate the contribution of women force in income generation of the family.

Among these tribes, the Gujars were ranked first on the basis of household size with average number of 9.4 members followed by Swati with the size of 9.0 members. The lowest family size is of other tribe with average number of 7.0 members. Over all the average household size of the study area was 8.5.

It is important to mention that due to less number of samples from other tribe, their average family size was only 7.00, which may increase if more samples of this category were included as reported by Khan and Shah (1999) that the average family size of the households of the watershed was 11 members.

Fig. 1: Average Number of Male and Female Members of a Family



4.2.2 Present estimated population

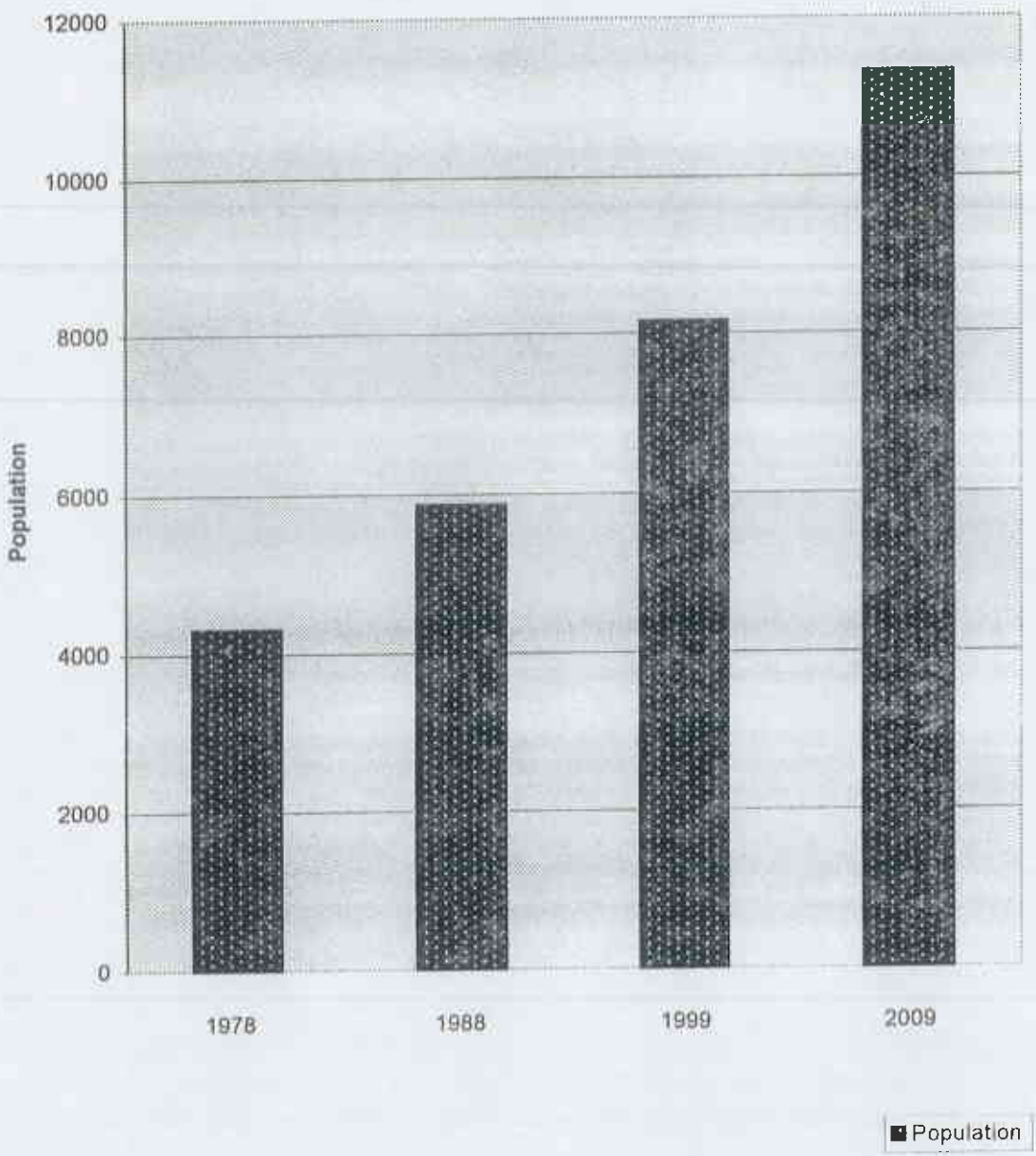
The population of the Hilkot watershed for 1999 was estimated on the basis of national population growth rate. During 1981 census, the growth rate was 3.30 percent and during 1998 census it was mentioned to be 2.77 percent. For purpose of the estimation, the average of these two (3.035 percent) is taken. This estimation shows that total present population of the study area was 8156. The village-wise estimated population is given in Table 9.

Table 9: Estimated population of the study area

S. No.	Village/ Hamlets	Population		
		Male	Female	Total
1.	Hilkot	941	829	1770
2.	Banda	283	265	548
3.	Tare Hada	232	195	427
4.	Bhojri	108	53	161
5.	Guldheri	142	124	266
6.	Kandi	253	214	467
7.	Kothri	425	331	756
8.	Naka Bisa	306	260	566
9.	Naka Sher	331	329	660
10.	Sathan Gali	510	461	971
11.	Sumbul	190	189	379
12.	Kund Bala	379	338	717
13.	Dheri N. D.	228	240	468
Total		4328	3828	8156

If the same growth rate were assumed for next decade, by the 2010 the population of study would become 11332, which mark an increase in present population by 39.9 percent.

Fig. 2: Population over Decades (1978 - 2009)



4.2.3 Average household size by tribe over last 20 years

Like other parts of Pakistan, population growth in this watershed was very high. In a period of 20 years the population has increased by more than double (Table 10).

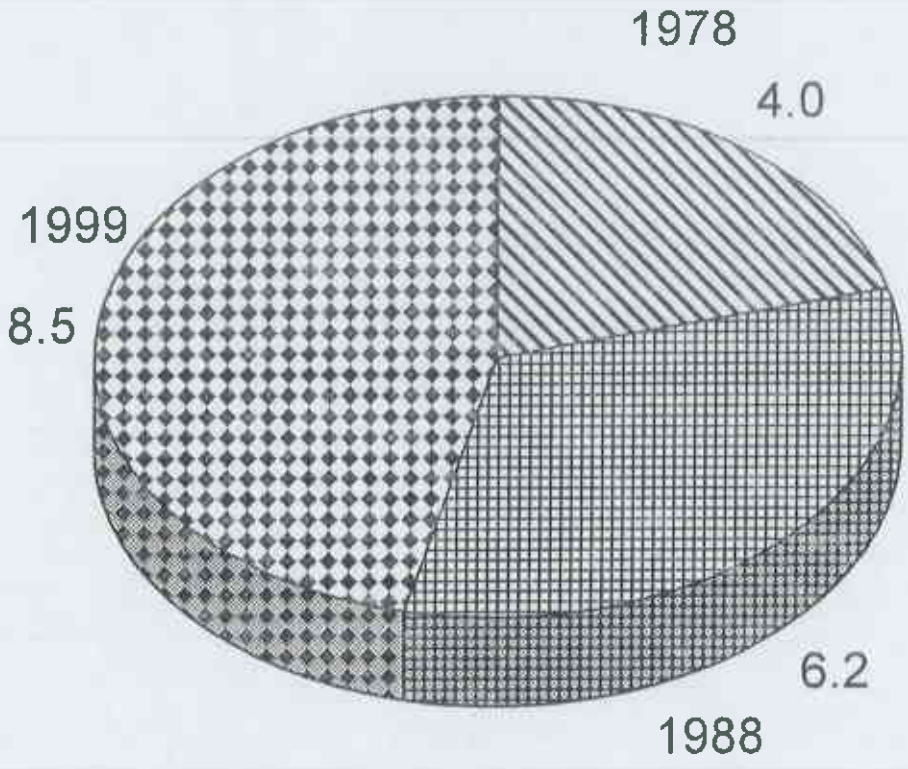
Table 10: Average household size (1978-99)

Tribes	Year		
	1978	1988	1999
Gujar	4.8	7.4	9.4
Swati	3.0	4.7	9.0
Other	4.3	7.7	7.0
Average	4.0	6.2	8.5

In the year 1978, average family size of Gujar tribe was 4.8, which has doubled by the year 1999. Similarly in Swati tribe, the numbers of average members in a family were 3.0 during 1978, which is 9.0 by now. Contrary to above, the case is different with other tribe whose family size has decreased in 1999 as compared to 1988 (Table 10). This may be due to smaller sample size from this tribe or death of family members.

Overall, the average number of members in a family were 4 during 1978, which has increased up to 6.2 by the 1988 and presently the watershed has average members of 8.5 per household.

Fig. 3: Family Size Increase in Last 20 Years



4.2.4 Percentage ratio of family size by tribes

On the basis of information collected through questionnaire, the percentage ratio of family sizes during last decades (1978, 1988 and 1999) was as under:

Table 11: Percentage ratio of family size over last 20 years

Year	No of Family Members	Tribe (percent)		
		Gujar	Swati	Other
1978	Up to 8	64	91	67.7
	Above 8	36	9.1	33
	Total	100	100	100
1988	Up to 8	64	91	67.7
	Above 8	36	9.1	33
	Total	100	100	100
1999	Up to 8	56	59.1	33
	Above 8	44	49.9	67
	Total	100	100	100

Table 11 shows that there was no change in the ratio of family size between 1978 and 1988 as the percentage of different tribes' family size remained the same. On the other hand, at present in 1999, the ratio has changed. In Gujar tribe, 44 percent of the people have family size of more than 8 members, which were only 36 percent in 1988. Similarly 41 percent of the Swatis are having more than 8 individuals in a family now as against 9 percent during 1988. In other tribe till 1988, 67 percent of people had less than 8 members in family but now, exactly the same percentage i.e. 67 percent have more than 8 individuals in a family. In a tabulated form the summary of above table is given in Table 12.

Table 12: Family size over last 20 years

Size of Family	Percentage of Population over Years		
	1978	1988	1999
Up to 8	76	76	56
More than 8	24	24	44
Total	100	100	100

Table 12 shows that just before a decade only a small portion (24 percent) of the population had more than 8 individuals in family whereas presently 44 percent of the households are having more than 8 members in their family.

4.3 State of Education and Social Services

4.3.1 Educational and social services' facilities

The available social services and its status are not satisfactory. A list of such facilities available in the study area is given in Table 13.

Table 13: Educational and health institutions in the study area

S.N.	Name of the Village/Hamlet	Category and Number of Educational Institutions					Health Facilities (BHU)
		Maktab*	Primary		Co-education**		
			Boy's	Girl's	Primary	Middle	
1.	Hilkot	-	1	1	-	1	1
2.	Syedabad	-	-	-	1	-	-
3.	Kandi	-	-	-	1***	-	-
4.	Tare Hada	-	1	1	-	-	-
5.	Jogran	1	-	-	-	-	-
6.	Banda	1	-	-	-	-	-
7.	Naka Sher	-	1	1***	-	-	-
8.	Naka Bissa	1	-	-	-	-	-
9.	Kothri	-	1	1***	-	-	-
10.	Sathan Gali	-	-	-	1	1***	-
11.	Baya	-	-	-	1	-	-
12.	Kund Bala	-	1	1	-	-	-
13.	D.N. Dhara	-	-	-	1	-	-
Total		3	5	5	5	2	1

* No particular school infrastructure but mosque is used for imparting education. The syllabi are the same as of government primary school.

** Where there is no separate school for boys and girls, coeducation system exists.

*** The building has been constructed but schooling has not been started yet.

Normally single teacher runs the Maktabs, which is attended by both boys and girls. The first formal school in the watershed area was established on 16-7-1949, which was the primary school at Hilkot. The second school was founded at Kund Bala in 1961 and the third one was at Sathan Gali established in 1964/65. Recently (1999) one English medium school, Green Hills Middle Public School has started functioning in Malkan near the outlet of watershed/study area.

In Sathan Gali, according to local population, they have been trying to pursue the concerned authorities for about a year to assign teachers so that the middle school could be started but nothing came out.

The foundation stone of the BHU was laid on December 2, 1989 but it started functioning only from 1992 onwards. This was the only health service center available for the people of Hilkot watershed but this was also running short of staffs and medical equipment, and therefore was unable to provide required medical facilities to the population of the area.

There was no other medical facility than one Basic Health Unit (BHU) and which is only at Hilkot. The entire area is devoid of high school or college. Library or other social gathering places cannot be found in the Hilkot watershed area.

4.3.2 Education level by tribes in the Study Area

Out of fifty sample respondents from various tribes, only one was Graduate and he was the wealthiest person of the area. In the study area there was strong relationship between tribes and education, which is shown in Table 14.

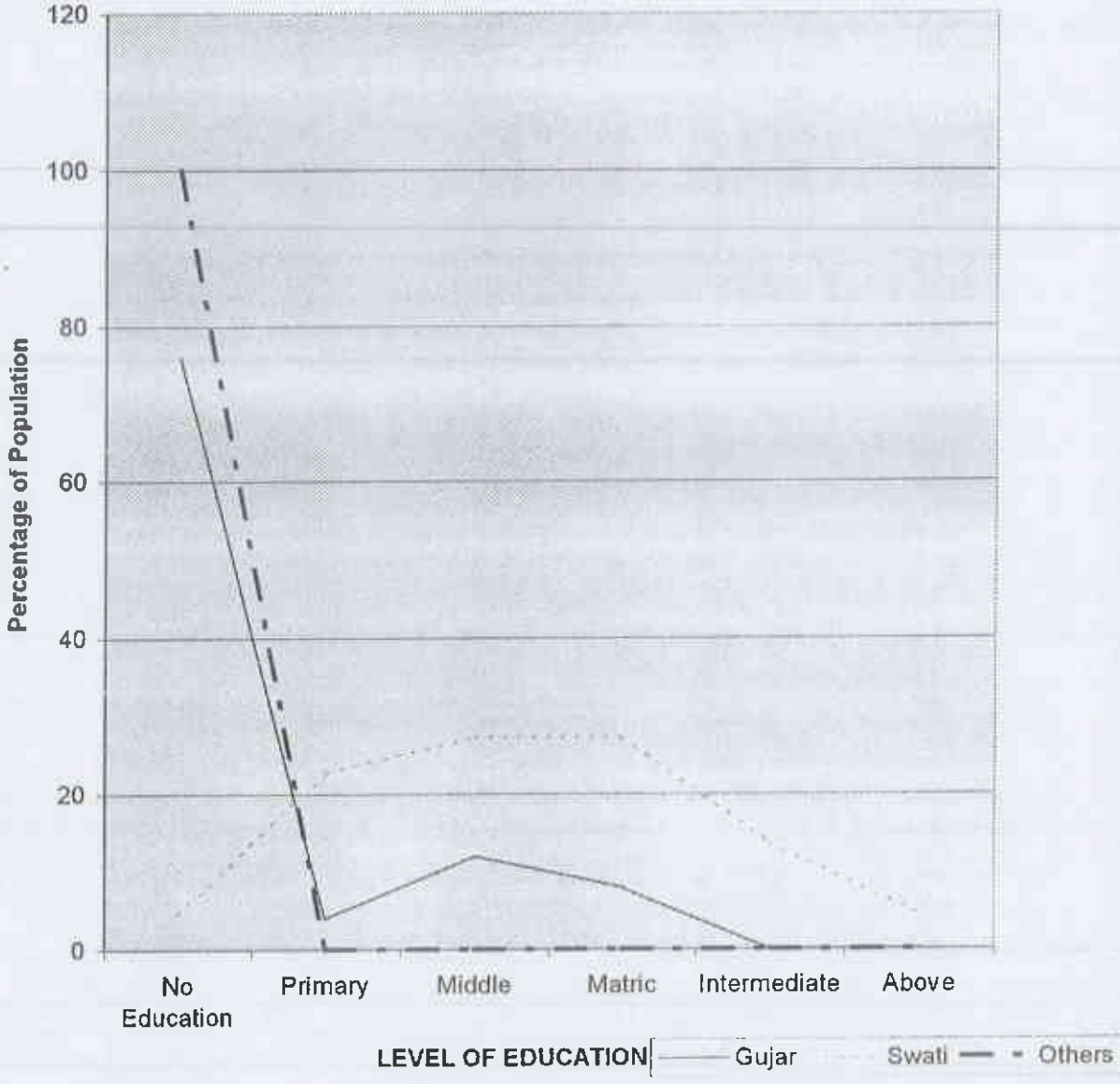
Table 14: Education level of different tribes

Education Level	Tribes (percent)			Percentage of Total
	Gujar	Swati	Others	
No Education	76	04.6	100	46
Primary	04	22.7	0	12
Middle	12	27.3	0	18
Matric	08	27.3	0	16
Intermediate	0	13.6	0	6
Above Intermediate	0	04.6	0	2
Total	100	100	100	100

Majorities of the illiterate people were from Gujar and other tribes. In case of Gujar, 76 percent had not attended any school whereas 100 percent of other tribe were non-educated. As compared to these, 95 percent of the Swatis were literate. The analysis revealed that tribe is associated with level of education and income in the study area.

In general, 46 percent of the peoples of this watershed were illiterate on the basis of result drawn from sample population and exactly the same percentage (i.e. 46) had education up to Matric level, and remaining 8 percent had acquired education above Matriculation.

Fig. 4: Education Level of Different Tribes



4.4 Land Uses and Tenure System

4.4.1 Land uses

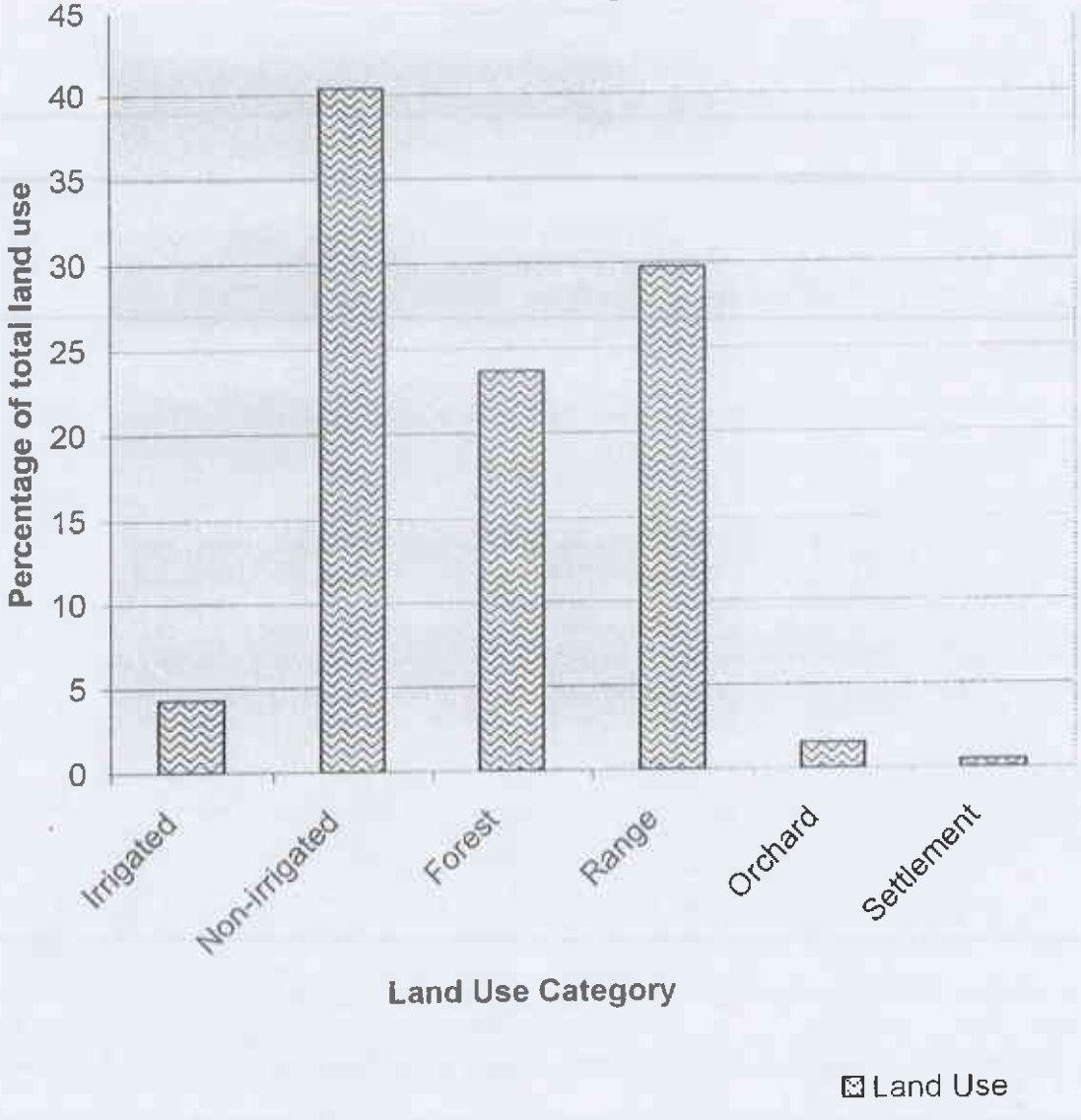
Any watershed is composed of various land uses such as agriculture, forests, ranges, etc. All these uses prevail in different conditions requiring separate treatments. Keeping this in view, the study of land uses of Hilkot watershed was done. The various land uses in the study area, estimated from the information collected through questionnaire are given in Table 15.

Table 15: Different land uses of the Study Area

S. N.	Land Use Category	Percentage of Total Area
1.	Irrigated Land	04.3
2.	Non-irrigated Land	40.4
3.	Forest	23.6
4.	Range	29.7
5.	Orchard	01.5
6.	Settlement	0.5
Total		100

In the study area, the estimatimation shows that there were only 4 percent of the land under irrigated condition and a vast tract of lands, 70 percent were non-irrigated land or range. Though, horticulture is the most preferred business in the study area (Table 23), only 1.5 percent of the total area was under fruit orchard.

Fig. 5: Different Land Use in the Study Area



4.4.2 Relationship between land holdings and tribes

Generally speaking, three categories of ownership systems prevail in the study area. The first category being owner, the second one tenant and the third category is tenant-cum- owner. In the third category those tenants fall who have managed to buy some lands in addition to that under their tenancy.

Swatis or Khans of the area are owners of the lands of all categories- from irrigated to rain fed and forests. Gujars and other tribes are tenants. In recent days, some tenants managed to buy lands from Khans but they were still tenants in a sense that they were cultivating lands of Khans on tenant-owner system. There is significant relationship between tribes and ownership in the study area (Table 16).

Table 16: Land holdings by tribes

Size of Land Holding (in Kanal*)	Tribes (percent)		
	Gujar	Swati	Others
Up to 50	80	13.6	100
50 to 100	16	18.2	0
Above 100	4	68.2	0
Total	100	100	100

* 19.76 Kanal = 1 ha

Among the Gujar respondents, 80 percent have less than 50 Kanals of the lands. This category of the lands includes irrigated and non-irrigated agricultural lands as well as ranges. In case of Swati tribe, 68 percent of the sample population have more than 100 Kanals of lands. The condition of other tribe was miserable as all the respondents had less than 50 Kanals of lands.

4.4.3 Relationship between land ownership and tribes

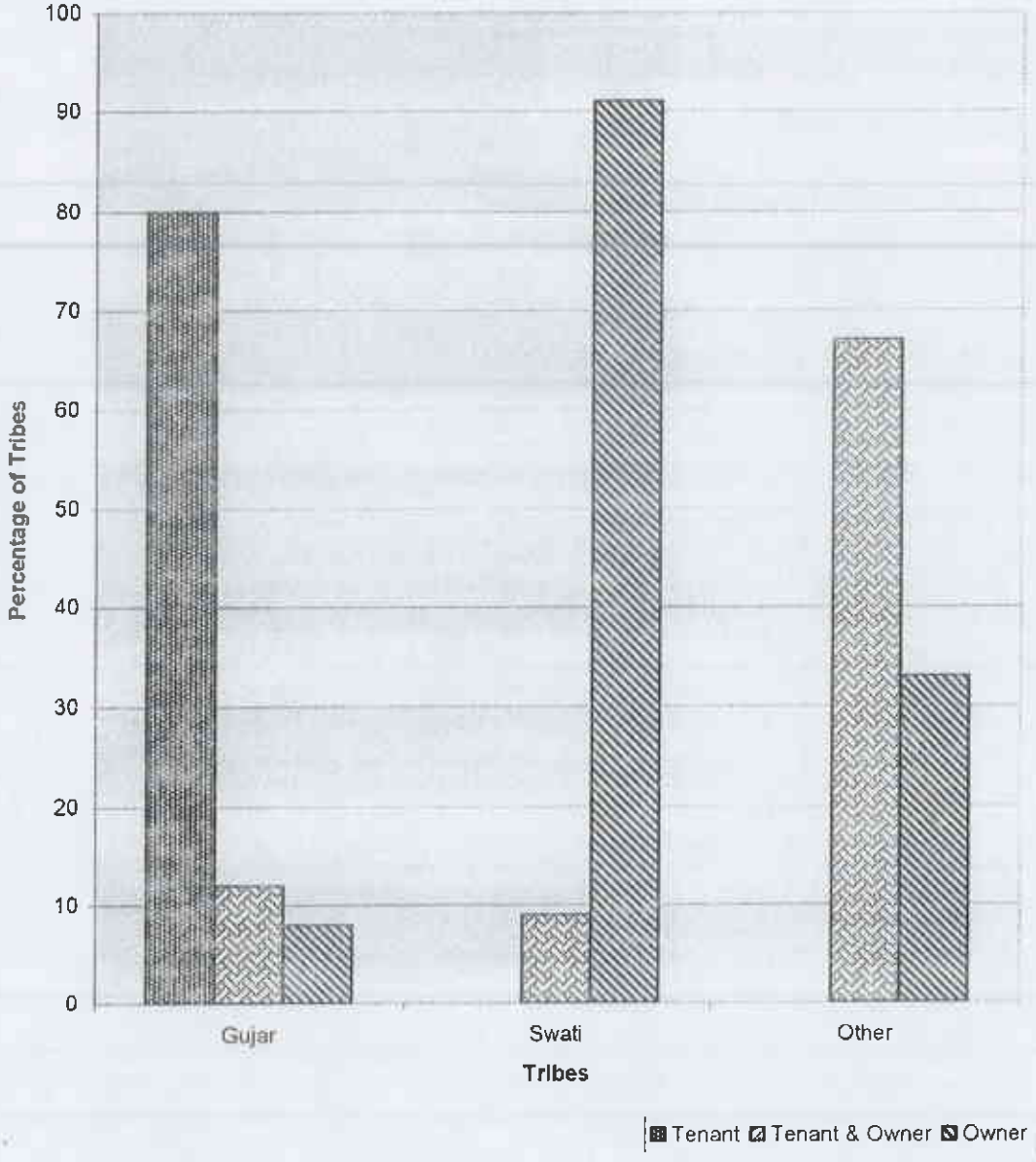
Like other factors such as land holdings and education, the ownership is also significantly related with tribes. Eighty percent of the sample population among Gujars were tenant whereas only 8 percent were owner and the rest, 12 percent were owner-cum-tenants. In case of Swati, more than 90 percent have their own lands and similarly there is no tenant among other tribe (Table 17).

Table 17: Land ownership by tribes in the Study Area

Category of Ownership	Tribe (percent)		
	Gujar	Swati	Other
Owner	8	90.9	33.3
Tenant	80	0	0
Tenant-cum- Owner	12	9.1	66.7
Total	100	100	100

Here, it may be noted that the third category is not real tenant but along with their own lands, they are also looking after and cultivating the lands of their relatives according to the same system as tenants do, in case of Swati family and in case of other tribe, they are cultivating the lands of Khans.

Fig. 6: Ownership Categories by Tribes



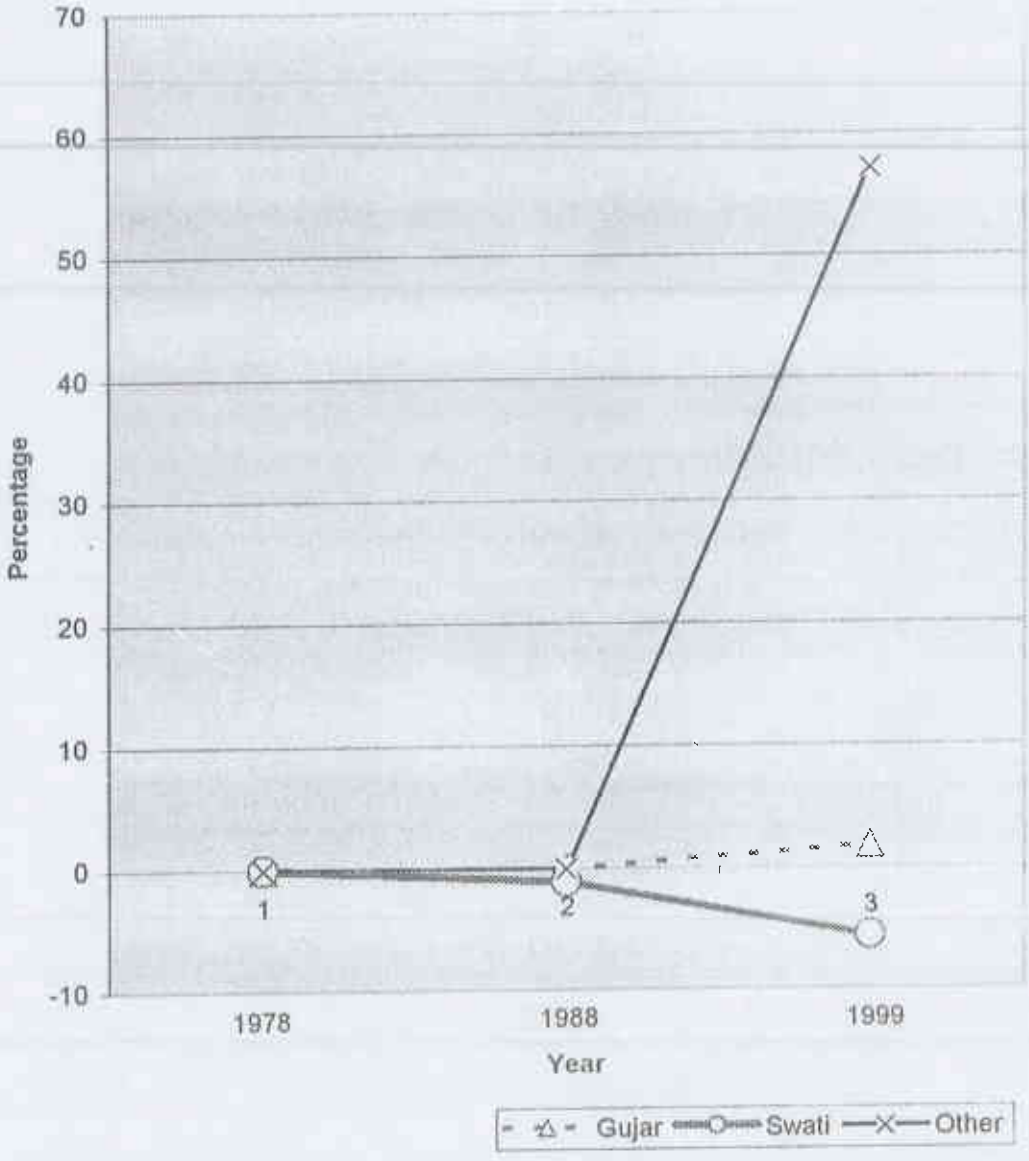
4.4.4 Change in land use

The people of the study area do not have exact information about the change in land use. However, when asked the question, they replied only about the change in agricultural land. There is increase in agricultural land of Gujars by 1.8 percent between the period of 1988 to 1999. The reason for change was that they bought lands from Khans (though this may not be change) and only 4 percent of Gujars said that they cleared about 2 ha forest for cultivation. Similarly among Swatis, the changes took place by 1.01 percent between the period 1978 to 1988 whereas between 1988 to 1999 there is change of 5.6 percent. The changes were negative and the reason was that they sold lands to others (tenants as well as Swati fellows). On the other hand, among other tribes they have managed to own 57 percent more lands than they had till 1988 (Table 18).

Table 18: Change in land use

Tribe	Change in Percentage		
	1978	1988	1999
Gujar	0	0	1.8
Swati	0	-1.01	-5.6
Other	0	0	57.07

Fig. 7: Change in Land Use



4.5 Household Size and Land Holdings

The relationship between household size and land holdings is shown in Table 19. Among Gujars whose family size was less than 8, 28 percent, 16 percent and 4 percent held less than 50, between 50 to 100 and between 100 to 500 Kanals of lands respectively. On the other hand, 48 percent of Gujars whose family size is more than 8, held less than 50 Kanals. Similarly about 41 percent of Swatis whose family size was less than 8 have land holdings between 100 to 500 Kanals and about 18 percent had more than 500 Kanals. Among other tribes, all the people had less than 50 Kanals of land, out of which 67 percent falls in a group whose family size was less than 8 and the rest 33 percent had more than 8 members in a family.

Table 19: Relationships between household size and land holdings

Land Holdings (Kanal*)	Tribe (Household Size)						Percentage of Total (< 8)	Percentage of Total (> 8)
	Gujar (%)		Swati (%)		Other (%)			
	< 8	> 8	< 8	> 8	< 8	> 8		
<50	28	48	4.5	9.1	66.7	33.3	20	30
50-100	16	4	4.5	13.6	0	0	10	8
100-500	4	0	40.9	9.1	0	0	20	4
>500	0	0	18.3	0	0	0	8	0
Total	48	52	68.2	31.8	66.7	33.3	58	42

* 19.76 Kanal = 1 ha

4.6 Household Size and Ownership

In the study area, 8 percent of Gujars whose family size was less than 8, were owners, 28 percent were tenants and 4 percent were tenant-cum-owner. On the other hand, 52 percent were tenant and 12 percent were owner-cum-tenant among this tribe who had more than 8 members in a family. Similarly, among Swatis, 59 percent and 31 percent

were owner with family size up to 8 and more than 8 respectively. Among Khans 9.1 percent had more than 8 members in a family and they were tenant-cum-owner. Thirty three percent from other tribe were owner whose family size was up to 8 on the other hand the remaining, 67 percent, who all were tenant-cum-owner had more than 8 individuals in a family (Table 20).

Table 20: Relationships between household size and ownership

Household Size	Tribe									Percentage of Total		
	Gujar (%)			Swati (%)			Other (%)					
	O*	T**	O&C***	O	T	O&C	O	T	O&C	O	T	O&C
Less than 8	8	28	4	59.1	0	0	33.3	0	0	32	14	2
More than 8	0	52	8	31.8	0	9.1	0	0	66.7	14	26	12
Total	8	80	12	90.9	0	9.1	33.3	0	66.7	46	40	14

O* Owner

T** Tenant

O &C*** Owner –cum-tenants

4.7 Household Income

4.7.1 Relationship between income and tribe

In Hilkot watershed, almost every social phenomenon is related with tribe. During analysis, an attempt was made to find out the relationship between tribes and income. Out of 25 Gujar respondents, 14 household heads (56 percent) had income less than Pak Rs. 3000.00 whereas 9 (36 percent) household heads were earning between Rs 3000.00 to 6000.00 and only 2 (8 percent) earn more than Rs. 6000.00. On the other hand, respondents from Swati tribe, 27 percent were earning more than Rs. 6000.00 in

a month and 59 percent had monthly income between Rs. 3000.00 to Rs. 6000.00 and 14 percent were having income up to Rs. 3000.00.

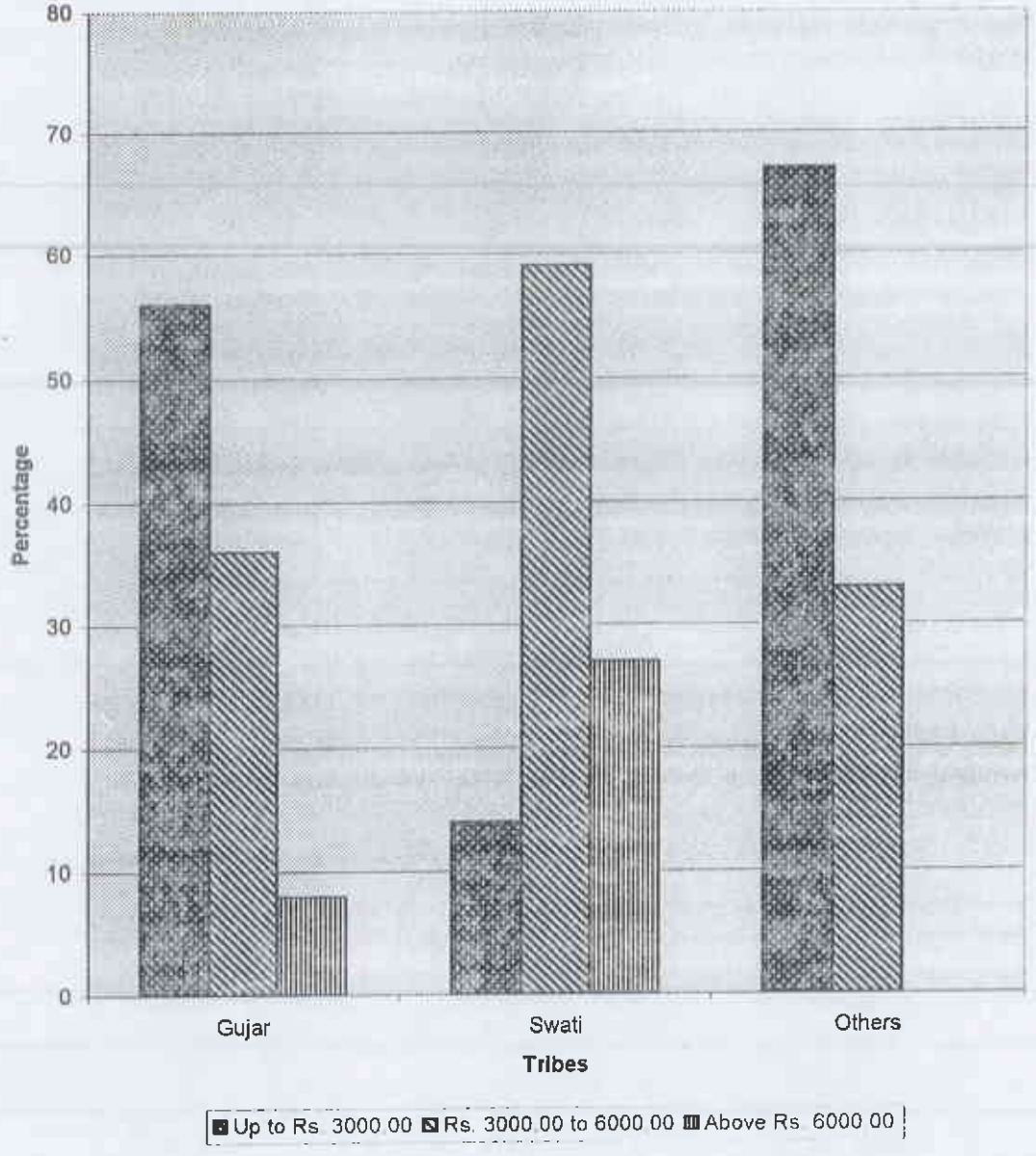
The condition among other tribe is really miserable. None of the respondents of this tribe had income of more than Rs. 6000.00. Majority (67 percent) had income less than Rs. 3000.00 in a month and the rest (33 percent) were having income between Rs. 3000.00 to 6000.00. (Table 21)

Table 21: Income distribution by tribes in the Study Area

Income Group	Tribe (percent)			Percentage of Total
	Gujar	Swati	Others	
Up to Rs. 3000.00	56	13.6	66.7	38
Rs. 3000.00 to 6000.00	36	59.1	33.3	46
Above Rs. 6000.00	8	27.3	0	16
Total	100	100	100	100

Overall 46 percent fall in middle income group of Rs. 3000.00 to Rs. 6000.00 per month whereas only 16 percent of the population was able to earn more than Rs. 6000.00 per month. The rest were earning less than Rs. 3000.00.

Fig. 8: Income Distribution by Tribes



4.7.2 Income and family size

The analysis of the data showed that there was more income of larger family size than smaller one. For example, there were two categories of family size: the one having less than 8 members in a family and the other with more than 8 members. Forty six percent of the sample population having family size up to 8 earned less than Pak Rs. 3000.00 per month whereas 43 percent had monthly income between Rs. 3000.00 to 6000.00 and 11 percent of the sample population were earning more than Rs. 6000.00 per month. On the other hand, 23 percent of family size with more than 8 members were earning more than Rs. 6000.00 per month and 50 percent were having income between Rs. 3000.00 to Rs. 6000.00 And the rest 27 percent were earning less than Rs. 3000.00 in a month (Table 22).

Table 22: Income and family size relationship

Income per Month (in Rs.)	Family size (percent)	
	Up to 8	More than 8
Up to 3000.00	46.4	27.3
3000.00 to 6000.00	42.9	50.
More than 6000.00	10.7	22.7
Total	100	100

4.8 Preferences for kind of Occupation as a Source of Livelihood

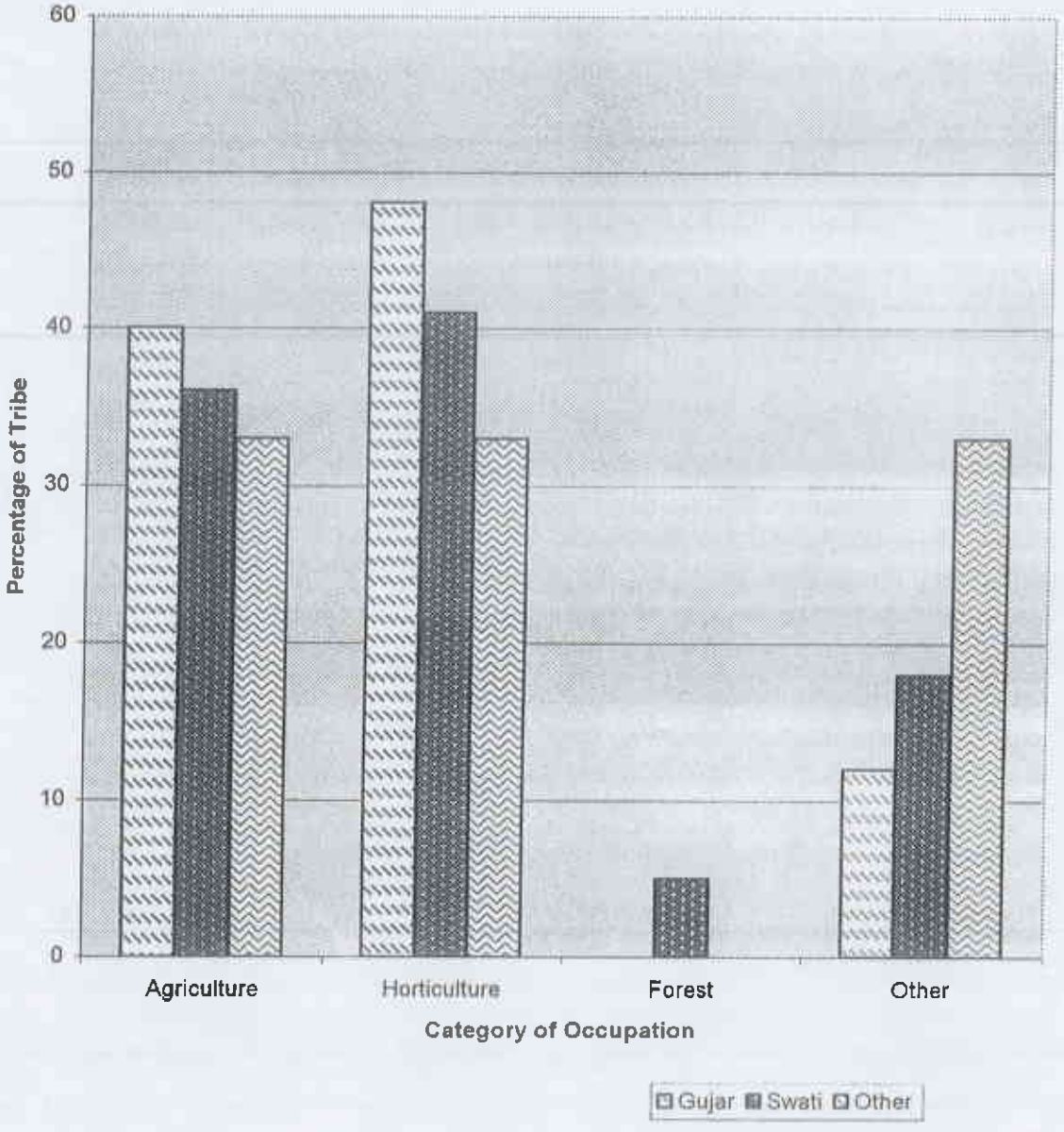
The analysis revealed that horticulture was the most preferred business in the area. Though the preference is less among Swati tribe as compared to Gujras, even then overall raising fruit trees for livelihood was liked by majority (44 percent) of the population.

Forty eight percent of Gujars and 41 percent of Swatis preferred horticulture as the best way of earning livelihood. Agriculture was the second preferred business in this area, as 40 percent of Gujars and 36 percent Swati like this. The preference for agriculture may be due to the fact that their basic requirement for food is met from this work. Among other tribe, their preferences are equal for agriculture, horticulture, and other business. Other type of business stands at third preferred job among the people of study area, which includes paid labors, driving or running a shop. Only 2 percent have said that they prefer to earn livelihood from income of forests (Table 23).

Table 23: Preference for different occupation by tribes

Type of Business	Tribe (percent)			Percentage of Total	Preference Rank
	Gujar	Swati	Other		
Horticulture	48	40.9	33.3	44	I
Agriculture	40	36.4	33.3	38	II
Forest	0	04.6	0	2	IV
Other	12	18.1	33.3	16	III
Total	100	100	100	100	

Fig. 9: Occupation Preference by Tribes



4.9 Different kinds of Fuels being used in the Study Area

In the study area, 100 percent of the people from Gujar and other tribe were using wood as a source of energy for cooking and heating whereas in addition to wood, Swati people had also been using gas to meet the requirements of energy. There were 18 percent among Swatis who used primarily gas and secondarily fuelwood. On the other hand, 41 percent of Swati population had been using fuelwood only and the same percentage used primarily wood and secondarily gas for cooking purpose (Table 24).

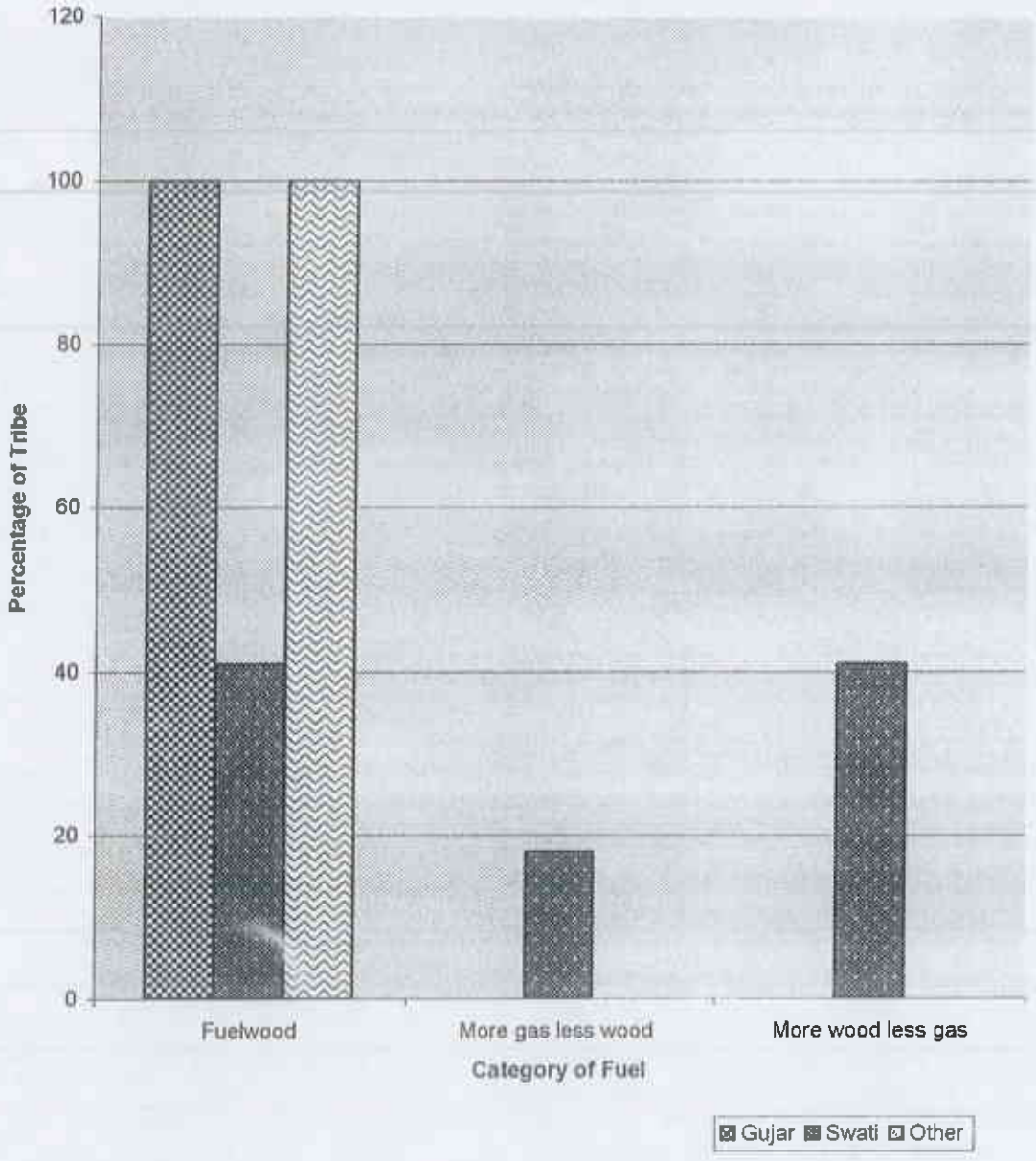
Table 24: Different kinds of fuels being consumed

Kind of Fuels	Tribe (percent)			Percentage of Total
	Gujar	Swati	Other	
Fuelwood	100	41	100	64
Primarily Gas	0	18	0	8
Primarily Wood	0	41	0	18
Total	100	100	100	100

The consumption of gas was also related with tribes as only Swati people seem advance in the area as they had access to modern cooking facility, which they can afford, but others couldn't.

Out of total population of the watershed, 64 percent were relying on wood to meet their requirement of energy and only 8 percent had been using primarily gas and secondarily wood for cooking and heating purpose. Similarly, 18 percent of the population were primarily using wood and secondarily gas as fuel. The analysis indicates that 100 percent of the population of this watershed dependent on forest or trees grown on their land to meet the requirement of energy in one way or the other.

Fig. 10: Sources of Different Fuels



4.10 Population Increase and People's Perception

There was not any social organization or governmental institution in the area to teach the effects of mushrooming population. Peoples of the area think that this is a work of natural process by God and they cannot stop it. They were not equally aware that God has also put the responsibility to better look after their children. In such a condition of scarce resources, they were not able to provide good medical facilities and schooling to the children. There was a need of such an institution, which may teach about family planning though majority (64 percent) of the people opposed this idea. This thinking was also motivated by the level of education as majority of the people from Gujar tribe of which a considerable population was uneducated opposed the idea of establishment of any institution that may teach about family planning. When questioned do they feel necessary of such an institution, though majorities have said "No" but a handsome percentage of respondents (36 percent) favored the idea of establishment or existence of such a body of spreading information on family planning (Table 25).

Table 25: Need of family planning institution

Necessity of the Institution	Tribe (percent)			Percentage of Total
	Gujar	Swati	Other	
Yes	32	41	33	36
No	68	59	67	64
Total	100	100	100	100

Only 2 percent respondents replied that with the increase in population they don't have enough land to feed the increased number of people of the family and the land got divided between heirs. According to them, this division had created a miserable

condition for them as the people did not have alternate source of income and the land was not producing enough food to meet the requirements of increased population.

CONCLUSION

There were two main tribes in the study area, namely Gujar and Swati. Out of 50 respondents, only three (two Kashmiree family and one Lohar family) were from other tribes. The average family size of the study area was 4 persons per family during the 1978, which was 8.5 persons at the time of survey. There is more than 100 percent increase in population in a span of 20 years and there was no sign of change in the trend which certainly draws the attention of concerned authorities to devise a plan and act to reduce the population growth rate.

Majority of the population (46 percent) had monthly income between Pak Rs. 3000.00 to Rs. 6000.00. The relationship between income and family size was progressive. The study has revealed that the household with larger family size earns more than household with smaller family size.

Peoples from Swati tribe were landowners and 68 percent among them had more than 100 Kanals of lands. 80 percent of the sample population among Gujars were tenant whereas only 8 percent were owners and the rest, 12 percent were owner-cum-tenants. There was no major change in land use except for agriculture, which may be due to the reason that people do not have exact information of the categories of the land they own for years. Only 2 percent of the respondents replied that they had cleared the forests for cultivation and the rest changes, they referred to buying and selling of the lands.

Though the analysis has revealed that there is no relationship between land holding and family size, and family size and ownership but the other factor- the ownership status, will change in due course of time as tenants are becoming land owners with the purchase of lands or conversion of forests for agriculture.

Forty four percent of the people in the study area preferred horticulture as the best occupation for livelihood whereas 38 percent liked agriculture. Similarly some Khans (4.6 percent and 2 percent of the total) reported forests as the best source of income for livelihood. So, more emphasis is needed to develop the horticulture in the area, as it is more income generating than the raising cereal crops as reported by the respondents.

Majority of the people (64 percent) had been using wood as a source of energy for cooking and heating whereas 8 percent primarily used gas and secondarily wood for cooking. This clearly indicates that if alternate source of fuel is not supplied to the area, the dependency from trees for fuelwood cannot be reduced as 100 percent of the population were dependant on wood to derive energy for cooking and heating in one way or the other, and this will put more pressure on existing resources, particularly the forest.

The change of forest land to agriculture and requirements of fuel will certainly pose a threat to the watershed resources if the population will continue increasing in the same trend, which will subsequently cause reduction in forests area, more erosion and other soil related problem.

During 1988 the population of the watershed was 5870 and presently the population is estimated to be 8156. The watershed area lacks social or governmental organization to motivate and convince the people towards family planning, but a small portion of the population of watershed preferred to have an institution which may teach the impacts of population increase and may guide on family planning issues. So if governmental organization or any other institution wants to initiate family planning program, they can do so as the people who preferred to have family planning institution are educate and influential and can support such move to establish an institution to teach the family planning system.

In the study area, there is need of an integrated watershed management plan based on socio-economic conditions of the people and the resources. The plan may focus on increasing literacy rate among Gujar and other tribes, to provide alternate source of livelihood by starting more income generating business or industrial installation and watershed management according to land suitability.

SUMMARY

The upland watersheds are highly populated mountain ranges in the world. The population in mountain watersheds of Pakistan was about 18 percent of the total population of the country. A large population of this region depends upon agriculture and other land based activities for their livelihood, interacting and using watershed resources. The people of this region are facing similar problems as the people of other countries in Hindu-Kush Himalayan region.

The human activities are responsible for changes of the watershed conditions. Since human beings become one of the ingredients of the watersheds, the planners were compelled to devise a system of management in which people could be involved. Keeping this in a view, it was established that no sound planning for the welfare of the resources and people could be made unless the study of the people and resources of the area could be carried out. This study was done in Hilkot, one of the upland watersheds of Mansera District, North West Frontier Province, Pakistan. The title of the study is "People and Land Use Study of Hilkot Watershed". The Hilkot watershed is the part of Siran river watershed, an important tributary of Indus River system. The watershed area falls under semi humid climate.

Questionnaire-cum-interview was the main method, adopted for this study. Using stratified random sampling principle and the intensity of 4.5 percent data were collected. The gathered data were processed and analysed using computer by statistical package called "SAS" and Microsoft Excel.

According to one estimate 8156 people inhibit the villages within watershed boundary but have no high school or college. The road stretches up to the area inhibited by about 25 percent of the Hilkot watershed population. The watershed comprised three major villages namely; Hilkot, Kund Bala and Dheri Nambar Dhara. Pushto speaking people are Khans and they are landowners, belonging to Swati tribe whereas Gujari speaking are tenants and belong to Gujar tribe.

Average household size of the study area was 8.5 persons. The population growth of among Gujars was very high. Forty four percent of the people of this tribe had family size with more than 8 members, which were only 36 percent up to 1988. Like other parts of Pakistan, population growth in this watershed was very high. The present population of the Hilkot watershed was estimated to be 8156, which may increase to 11332 by 2010 if the growth rate remains the same, marking an increase of 39.9 percent in present population. The study area did not have any organization to teach the impacts of population increase but some people favored creation and existence of such an institution. Only 2 percent respondents replied about the problem of population increase and stated that they don't have enough land to feed the increased number of people of the family, and the land got divided between heirs. Illiterateracy was another problem of the area and the literacy rate, particularly among Gujars and other tribes was very low.

In case of Swati tribe, 68 percent of the sample population had more than 100 Kanals of lands. Eighty percent of the sample population among Gujars were tenant whereas only 8 percent were owner and the rest, 12 percent were owner-cum-tenants.

Majority (67 percent) of the people of the area had income less than Rs. 3000.00 per month and the rest 33 percent were having income between Rs. 3000.00 to 6000.00. There was positive relationship between income and family size. Forty six percent of the sample population having family size up to 8 earned less than Pak Rs. 3000.00 per month whereas 43 percent has monthly income between Rs. 3000.00 to 6000.00 and only 11 percent of the sample population earn more than Rs. 6000.00 per month. On the other hand, second category of family size, with more than 8 members, 23 percent earned more than Rs. 6000.00 per month and 50 percent have income between Rs. 3000 to Rs. 6000. Horticulture was considered as more income generating profession and liked by majority of the respondents than farming.

No marked change in land use was observed during the study. Only 2 percent of the respondents cleared the forests for cultivation and the rest changes were attributed to "buy and sale" of the lands. In this regard, there was an increase in agriculture lands of Gujars by 1.8 percent between the period of 1988 to 1999 whereas during the same period there was decrease in land amounts of Khans by 5.6 percent. There was no relationship between land holding and family size, and family size and ownership.

Sixty four percent of the people of the study area were using fuelwood whereas 8 percent were primarily relying on cylinder gas and secondarily on wood for cooking. The study has revealed that, 100 percent of the population depend on wood to derive energy for cooking and heating in one way or the other.

Overall the study has revealed that there were strong relationships between tribes and socio-economic conditions of the people.

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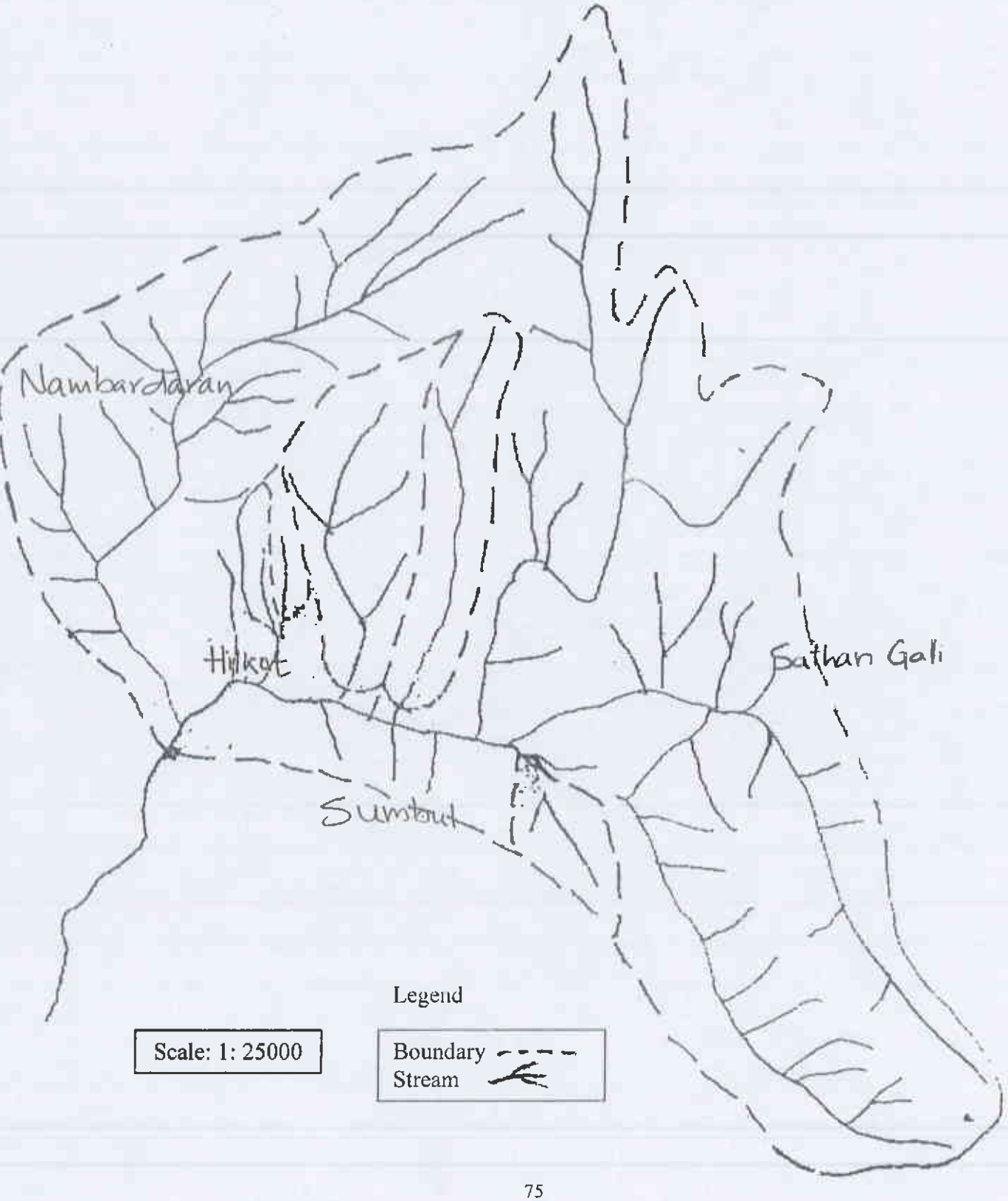
APPENDIX I

Map of the Study Area
Hilkot Watershed, Mansera District, Pakistan



APPENDIX-II

Hilkot Watershed Analysis Questionnaire

People and Land Use Study of Hilkot Watershed

Interviewer:_____ Schedule No.:_____

Village:_____ Hamlet:_____ Date:_____

I. General Information:

1. Name: _____ Age:_____

Education: No education-0, Primary-1, Middle-2,Matric-3, FA-4, Above-5

Occupation: Agri-1; Job-2; Labor-3; Agri+Other-4

Tribe/caste: Gujar-1; Swati-2; Others-3

2. No. of family members:

Below 10 years		11- 20 years		21 years & above	
Male (M1)	Female (F1)	Male (M2)	Female(F2)	Male (M3)	Female (F3)

3. Number of earning members Male:..... Female:.....

4. Household size: 1978:.....1988:.....Present

5. Major sources of livelihood: During 1978 1988 Present

....

(Forest-1; Agri-2; Other-3; Forest+Other-4; Agri+Other-5)

6. Household Income (in Pak. Rs./month):

II. Farming Activities

1. Livestock no.:

Cattle:_____ Sheep/Goat:_____

2. How do you feed livestock: (Stall feeding-1, Grazing-2, Both-3, Others-4)

3. Where do you graze your livestock: (Forest-1, Agri.-2, Range- 3, Other-4)

4. How much land do you own (in Kanal) .....

Of which a) Cultivated..... i.) Irrigated.....ii.) non-irrigated.....

b) Non-cultivated:

i.) forest ..... ii.) range..... iii) orchard.....

iv) waste/barren..... v) under settlement (building) .....

vi) to tenants if u r owner.....

5.	Land Uses/changes (in Kanal): (8 Kanals = 1 acre)	Before 1978	1988	Present (1999)
	Forest	.....	.....	.....
	Range/pasture	.....	.....	.....
	Agriculture	.....	.....	.....
	Orchard/Horticulture	.....	.....	.....
	Settlement	.....	.....	.....

6. Ownership Status: (Owner-1, Tenant-2, Other-3)

7. Reason of Increase/decrease in land amount & quantity (in kanal):

Forest	.....	.....	.....
Range/pasture	.....	.....	.....
Agriculture	.....	.....	.....
Horticulture	.....	.....	.....
Settlement	.....	.....	.....

(Sale-1; Bought-2, Division-3; Forest is converted into agri-4)

III. Miscellaneous

1. Do forest degradation harm our environment: Yes-1, No-2, Others-3
2. What are the impacts of forest degradation: (Soil erosion-1, Floods-2, Less production-3, less fuel wood-4 , less income-5, others-6
3. Which fuel do you use in the house for cooking: Gas-1 Fuelwood-2, More gas less wood-3; More wood less gas-4
4. What are the impacts of population increase: Livelihood difficult-1, No better education-2, Others-3

5. Do social organisations exist to teach impacts of population increase: Yes-1, No-2

6. Do you feel necessity of such an institution: Yes-1, No-2

7. Which is most profitable business: Forest-1, Agri.-2, Horticulture-3, Others-4

Any interesting event about population increase or land uses

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