

**INFLUENCE OF HUMAN ENCROACHMENT ON
ECOLOGICAL SERVICES OF MARGALLA HILLS,
ISLAMABAD, PAKISTAN (A CASE STUDY OF SAIDPUR
VILLAGE).**



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2020

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A thesis submitted to Bahria University, Islamabad in partial fulfillment of the requirement for the degree of B.S in Environmental Sciences

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ABSTRACT

The Margalla Hills National Park (MHNP) is an immense ecological resource. On the footsteps of MHNP, Saidpur village is located, which is home to approximately 12,000 inhabitants. This research is an ecological analysis to assess the interaction of Saidpur's population with MHNP and the impacts associated with this interaction. Interviews were conducted using self-structured closed ended questionnaire, with 70 inhabitants to acquire information regarding their demographics, conduct of life and consciousness towards the ecological resources of the MHNP. The response from the respondents was fluctuating in terms of the factors for which they were assessed. The statistical analysis of the survey data depicted no common trend. Educational statuses of respondents did not play any role in awareness of ecological resources of MHNP. Floral assessment using quadrat analysis technique performed between the boundary of MHNP and Saidpur, clearly demonstrated the effects of human encroachment. A fuel source is a necessary requirement for a human being of the present time to survive and, surviving by any means is the motto of the people of Saidpur. The study shows that in order to survive, measure taken by the inhabitants, devastate the environmental and ecological conditions of MHNP. Lack of education and awareness about MHNP also contributes towards the deterioration of the flora of MHNP. Inclination towards sustaining the ecosystem of MHNP was observed among the respondents. Though their actions were contradicting, but in order to survive, irrational motives are adopted even against the will, such that effected the ecosystem of the MHNP. If provided with basic necessities and facilitated in accordance, the interaction between inhabitants of Saidpur and ecological resources of MHNP can opt to mutualism and commensalism, instead of competition and predation.

ACKNOWLEDGEMENTS

Foremost, we thank Allah Almighty for providing us the ability and courage to conduct this study. We are grateful to have Dr. Aansa Rukya as our supervisor . We express our sincere gratitude, for supporting and assisting us during the entire tenure of this study. Without their guidance and encouragement, this study would have not been possible. We would also like to thank each member of our group for working responsibly and depicting cohesion.

Lastly, we would not have been at this moment in our lives, without the seamless efforts and prayers from our parents.

ABBREVIATIONS

AFSEEE	The Forest Service Employees Environmental Ethics Association
CDA	Capital Development Authority
IUCN	International Union for Conservation of Nature
IWMB	Islamabad Wildlife Management Board
IWO	Islamabad Wildlife Ordinance
MHNP	Margalla Hills National Park
NGO	Non-governmental Organization
SDVI	Standard Deviation Vegetation Index
SPSS	Statistical Package for Social Sciences
TPA	Transboundary Protected Areas

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CHAPTER 1

INTRODUCTION

The biodiversity provides us with a number of direct and indirect resources. We are losing biodiversity at an alarming rate, 1000-10,000 times higher than the history (Singh et al., 2000). Rapid population growth leads to unsustainable use of natural resources, leading to deterioration and destruction of natural ecosystems. Every single individual in the population not only increases the burden on the ecosystem, but also reduces the quality of life by increasing pressure on natural resources (Saleem et al., 2015).

To ensure the quality of life for present and future generations, there must be sufficient land, water and energy. Today, worldwide, there is an evident problem in the production and distribution of food. More than 3.7 billion people are now malnourished (Pimetel et al., 2009). With the growing imbalance between population size and vital life support resources, mankind must actively protect arable land, freshwater, energy and biological resources. Need to develop renewable energy. Humans around the world must understand that rapid population growth will harm the planet's resources and weaken human well-being (Almeida et al., 2005).

Mountain ecosystems support a high degree of biodiversity and a large number of endangered plants, many of which are ecological indicators of these specific habitats. The Himalayas are the youngest, tallest and largest mountain in the world, and have high plant diversity. People living in the area use their traditional ecological knowledge to use the local natural resources, so they have a valuable understanding of the surrounding environment. Many areas within the region are still known for their plant diversity, plant species distribution, and vegetation ecosystem services, but indigenous peoples rely heavily on local plant resources and may cause irreversible loss of plant species due to unsustainable use (Khan, 2015).

Many studies have shown that population growth is an important determinant of natural resource consumption, deforestation and commercialization, and ultimately leads to the loss of natural resources, biodiversity and habitat. This phenomenon is particularly evident in developing societies where residents rely on ecosystem services on a larger scale

and are poorly managed. Pakistan is also listed as an Asian developing country with abundant natural resources (Suler, 2002). Nearly 4% of Pakistan's land is covered with various types of forests, but from 1990 to 2010, the proportion of forests has fallen sharply recently. In this era, more than 33% of Pakistan's forests are lost, including all forest territories (Waqas et al., 2016)

In the past, animals have become extinct for various reasons. In some cases, competition for resources between animals has led to extinction, and in other cases, environmental change has led to extinction. Scientists believe that dinosaurs became extinct because meteorites hit the earth and caused environmental changes those dinosaurs and other animals and plants could not adapt (Khalid et al., 2018).

Humans are a responsible to cause environmental changes that harm animals and plants. They are taking up much of the space on Earth for homes and cities. Human are polluting the natural habitats. They hunt and kill animals illegally. They bring alien species into our habitat. All of these activities have kept animal and plant resources and habitats away from plants and animals.

An important factor leading to the reduction of forest resources is population growth. Pakistan was estimated at 149.6 million in 2002 and continues to grow at a rate of 2.6% per year. As the population increases, there is increasing pressure on forests. This is clear from the fact that, despite the very fast deforestation, there are still 300,000 tons of wood, pulp, paper and other by-products were imported in 2001 (Usman et al, 2001). Supply and demand development parameters, excluding inaccessible areas (25% of total forest area) (Covered), total forest stock will be completely consumed sometime between 2015 and 2025.

Today, the updated forest cover still accounts for almost 2% of Pakistan's territory. Since forests still have important value in the national economy, this shocking situation signals future instability. An ever-changing world of demographics and social inequality has increased population pressure on the natural environment. Financial conditions such as per capita income, daily necessities, availability of resources, education level and level of awareness are effective parameters for increasing or decreasing population pressure on resources. In areas with limited land in response to large populations, people tend to

migrate to natural areas and nature reserves, which can lead to complexities in ecosystems and often undermine the sustainability of the current environment (Nawaz et al., 2007). With the accelerated urbanization process, the population's dependence on and development of natural resources has been further aggravated, and this phenomenon has finally reduced the carrying capacity of the system. Because of these factors, many underdeveloped countries face the risk of uninhabited nature reserves and related environmental security issues, as the continuous use of natural resources through legal or illegal means is constantly occurring.

Human encroachment towards animal habitats and commercialization of woodlands have consumed resources available to wildlife. Wild animals and plants are susceptible to human pressure, and often lead to conflicts between humans and wild animals and plants, fragmentation of natural habitats and illegal wildlife trade (Ahsan et al., 2012). Animals and plants have always struggled to survive. Scientists have estimated that more than two-thirds of the flora and fauna that once present on Earth are now extinct.

Human encroachment often changes or destroys the habitats needed for plant and animal survival. Because populations are growing so fast, flora and fauna are disappearing 1000 times faster than in the past 65 million years. Scientists estimate that 100 species are becoming extinct every day in the 21st century.

1.1 Objectives

The objectives of study are

1. To assess the socio-economic conditions of the inhabitants of Saidpur and their interaction with MHNP.
2. Cross tabulation of the statistical qualitative data obtained from closed ended questionnaire surveys.
3. Floral Assessment of the boundary between Saidpur and MHNP.

1.2 Measure for controlling this issue

Encroachment cannot be curtailed without proper laws. There are several reasons that cause encroachment:

- Population explosions that increase need for space especially in the developing countries.
- The greater need for industrialization for economic stability and progress.
- Lack of interest in sustainable development.
- The costs involved in the pursuit of green initiatives is something companies and governments don't want to foot
- Value of animal life as tourist and heritage attractions are not properly exploited.
- Increasing wars and famines especially in Africa and logging etc. in Amazon is detrimental.

1.3 Fuelwood

Fuel wood is the main source of energy in the developing world. Use of fuelwood as an energy source as old as human history. In developing countries like Pakistan, there is a shortage of fuel wood production. Pakistan is facing shortage of fuel wood because of increasing population and increase in national energy consumption. The country is poor in forest growth (Shah et al., 2007).

For most families in the villages of MHNP, Pakistan, fuelwood is a vital element. The survey results show that according to our work, villagers rely on wood to meet their daily needs, and 70-79% of Pakistani households rely on firewood for energy. Wood consumption varies with climatic conditions, geography, and socio-economic conditions in the area. The results show that most villagers rely on the forested areas of MHNP. Because of the poor economic situation, they harvest the timber they need, while villagers who collect fuelwood from elsewhere tell them to buy timber from timber warehouses to meet their needs. According to discussions, communities in the Himalayas face severe energy shortages due to poor economic conditions.

1.4 Illegal Cutting and Corruption

Protected areas / forests are government property, but all use rights are provided to local communities, and commercial logging is limited to protected areas. Outsiders benefit from cutting trees from MHNP and they are running the wood Mafia. The results indicate that obtaining wood from the MHNP forestry sector involves high levels of corruption. According to the Ministry of the Environment (2009), there is political interference in illegally harvested timber. The G8's background action plan on forests (2002) states that developing countries are more involved in illegal logging than developed countries, and Pakistan is one of the developing countries with a high illegal logging rate (Khalid et al., 2008).

In addition, the G8 action programme on forests is working with developing countries to prevent or reduce illegal logging. According to the G8 programme of Action on Forests and Background (2002), involving the public will help make decisions to reduce illegal logging, and the results of the study indicate that the public or local people have not contributed.

1.5 Changes in Temperature and Biodiversity

As temperatures rise, species and individual numbers decrease, as endemic species in the area could even lead to extinction if deforestation is widespread. Experts believe that due to changes in land use and deforestation, climatic conditions may change locally, forest fires may cause temperatures to rise, air flows to change, and reduce atmospheric humidity and cloud formation.

1.6 Uses of Native Plants

Ethnobotany is the study of how people use native plants in specific cultures and regions, while ethnobotanists explore how plants are used in food, shelter, medicine, clothing, hunting, and religious rituals. Ethnobotany is the relationship between society and its environment, especially the plant world.

Aboriginal knowledge is as old as human civilization, but the term "ethnobotany" was originally coined by American botanist John Harshburger (1896) to study plants used by primitive and aboriginal peoples. Since then, it has been defined as the traditional knowledge of indigenous communities, the diversity of surrounding plants, and research on how indigenous peoples use specific plants and cultures (Jabeen et al., 2009). Ethnobotany stems partly from interest in finding plants that can help fight disease like for treating digestive disorders, rheumatic diseases and wounds. In fact, medicine and botany are closely linked. Many medicines today are derived from plant resources.

Traditional Unani drugs are part of our culture, and Pakistan is one of the countries where traditional Unani drugs are widely used in most of its population. It originated in Greece and was founded by ancient Greek philosophers and was used / documented by Muslims during the glorious period of Islamic civilization. It was brought to the Indian-Pakistani continent by Muslim scholars and practiced here for hundreds of years. In addition to using animals and minerals, traditional Unani medicine also relies heavily on medicinal plants (Khalid et al., 2015). Climate change in Pakistan, although distributed over a large area, is rich in medicinal materials. All the plants studied grew in the wild and no systematic attempts were made to collect and grow herbs in an appropriate manner.

1.7 Threats to the ecosystem

Human settlements in MHNP designated natural areas pose the most serious threat to park resources. The issues related to settlements and their impact on parks are very complex and present daunting challenge to park management. About 80% of parks fall under the jurisdiction of the CDA, but many settlers continue to illegally occupy property and resist the CDA's efforts to move them out of the park. People living in the park are free to graze livestock; they cut down trees for fuel; collect animal feed; and divert natural water flows to arable land near their homes (Jabeen et al, 2009). Some residents even hunt native animals such as hares and birds for food and sport. Humans are most affected near villages with gentle slopes.

Over the past two decades, great attention has been paid to local participation and government involvement in community-based conservation programs. Although the main purpose of taking such measures is to improve the transparency of resource management and local decision-making, forest services are marginal. The main premise is that forest services are too corrupt and inefficient to play a beneficial role in natural resource management (Nyborg et al., 2010).

A quarry is a 300-hectare limestone mine located deep in the valley. The quarry is operated by a lease arrangement established by the CDA Planning Authority. After the park was completed, some leases were granted, but public pressure, mainly from the civic organization Margalla Hills Society, forced such leases to terminate.

The CDA ordered the closure of all mines on July 31, 1991. Most quarries have ceased operations, while others are expected to close in the near future. The 30-year lease of limestone awarded by Fecto Cement in 1983 is not included in this order. There is a clear conflict between park law and management goals (Nawaz et al., 2016).

By applying the general concepts and empirical observations found in the literature on social change and resource sociology, the attitudes and values of US Forest Service employees on resource management issues were studied. The concept of the resource management paradigm was developed and implemented in research conducted by Forest Service employees nationwide. The results show that the attitude and value of a particular sector of forest service employees, the Forest Service Employees Environmental Ethics Association (AFSEEE), represents an alternative resource management paradigm, which is very different from the dominant management paradigm owned by most forest people different. Service employees. In the history of federal land administration agencies, the emergence of this group of employees outside the organization committed to institutional reform is unprecedented. Their sociodemographic and attitude characteristics were compared and contrasted with the characteristics of non-AFSEEE forest service employees. Compared to other changes that occur concurrently in the Forest Service, the potential role of AFSEEE as a change agent. Despite advances in decision-making tools and frameworks, consideration of ecosystem services in local, regional and national scale planning remains limited (Harri et al., 1991). As population growth increases, ecosystem

services that exist within growth target areas are initially compromised. However, once the pressure of growth reaches the threshold, ecosystem services in the region will drop sharply. These findings suggest that community-level planners will face trade-offs when considering ecosystem services in the context of population growth.

Fires are widespread in the Margalla Mountains and require significant expenditures and manpower to extinguish them. Eighty-five percent of the fires occurred during the dry period from May to June before monsoon rains. Between 1986 and 1991, an average of 43 fires occurred each year. Most fires occur on uphill's or ridge tops in southern areas and are often man-made. Grazing livestock has become a serious problem (Manuel et al., 2013). When large numbers of cattle step on young trees, it is almost impossible to regenerate forest cover. Cows, goats, buffalo, sheep and donkeys compete for food and space with native animals. Native animals are always forced to retreat to smaller and smaller habitats that are increasingly unsuitable. It is estimated that of the 7,000 hoofed animals in the park, goats account for 42%, cattle account for 31%, and buffalo account for 25%.

It shows a compelling positive correlation between the remaining anteater and bark deer habitats and the small number of livestock. These smaller ungulate species are the only native species still found in the park, with extremely small populations. In small parks like MHNP, it may not be possible to protect native animal populations if livestock are also allowed to graze in the same area. The expansion of human settlements in park areas is also one of the major threats to parks. The capital borders the southern mountains. To the northwest is the early industrial center of Taxila. Encroachment in these urban areas is severe.

The ecological baseline of MHNP threatens the integrity of the park's wilderness. Similarly, road construction and the expansion of Saidpur and Nurpur villages threaten the park environment. The air around the national park carries a large number of suspended particulates that are produced by rock mining and cement plants in the area. It may also carry harmful gases (Ali et al., 2015). The polluted air also obstructed the view of Islamabad from the mountains. Ironically, the city was originally planned at this location with a backdrop of attractive hills. Polluted air also affects public health and has proven to

be a direct cause of increased upper respiratory disease. Certain types and quantities of air pollutants can also damage plants and wildlife.

The unrealistic introduction of different crops, such as *Broussonetia papyrifera*, *Parthenium* and *Lantana camara*, disrupts the park's natural balance. For example, mulberry paper (*B. papyrifera*) imported from Japan in 1960 is an extremely invasive and unpopular alien tree species (Nawaz et al, 2017). It grows quickly, forms thick bushes, causes allergies, and competes with local species.

1.8 Tourism Threatening MHNP

The number of tourism inside and outside the MHNP is increasing, fires are frequent, and the population is growing, threatening its habitat, biodiversity and beauty. According to officials at the Islamabad Wildlife Management Board (IWMB) in charge of the park, the increasing number of visitors to the national park has resulted in habitat degradation, pollution and disruption of biodiversity.

Due to urbanization of roads with two lanes from Islamabad to Daman-e-Koh, Pir Sohawa and Makhnial, and roadside lighting in the park, Increased traffic flow and therefore increased air and noise pollution. This increasing traffic and roadside lights that are turned off until late at night limit animal movements and disrupt their nightlife patterns.

Sometimes fires spread in the Margalla Mountains and require significant expenditures and manpower to control them. About 85% of these fires occurred during the dry season from May to June before monsoon rains, and they were all caused by humans. One of the main causes of forest fires is the negligence of tourists. Often, tourists throw smoke after cooking or do not completely extinguish the fire, leading to forest fires (Nizami et al., 2008). IWMB sources said that when local community members were fined or punished for illegal activities, they were involved in initiating forest fires in retaliation for authorities. The local community deliberately set fire in the forest to collect dry wood after the fire was extinguished, as high fines could be imposed for cutting green trees. There are more than 30 settlements around and near the park. The total population of the national park settlements is close to 70,000.

The largest settlements are in Nurpur, with a population of just over 15,000, followed by Chauntra (about 12,000), and Kot Hathial, Gokena, Talhar, and Shah Allah Dita (about 9,000 each). According to conservationists, people should not litter, ignite, avoid smoking and disturb wildlife. There are two famous stories about the name of the area. According to one statement, Margalla is a combination of two words-Mar means snake, and Galla means herd. It is said that there are many snakes on Margalla Mountain, hence its name. According to another story, the hills are named after killing gangs that once ruled the area.

Despite its small size, the park has a wide variety of animals because of its diverse habitats, including lush vegetation and steep hillsides, providing shelter for a variety of animals, birds and reptiles. The national park was established to avoid grey targets, barking deer and leopards, and rhesus monkeys, wild wolves, wild boars, porcupines, meerkats, and pangolin or scale anteaters. The park has been placed in a category V management category (protected landscape of the International Union for Conservation of Nature (IUCN)), an international organization engaged in the fields of nature conservation and sustainable use of natural resources.

In developing countries, governments are often trapped by resources that conserve, preserve and sustainably use natural resources. In this context, ecotourism can play an important role in ensuring the protection of natural resources and economic growth (Jamal et al., 2014). A growing body of literature highlights the role ecotourism can play in managing national parks and protected areas. In developing countries, park entry fees are usually low and sometimes non-existent, so there is little benefit to park management. In addition, regardless of existing tourism income, it is often merged with other general sources and is not dedicated to park maintenance. Since ecotourism income cannot be effectively obtained, even on public land, alternative land uses can bring short-term benefits, such as logging, agriculture and livestock grazing, which seems to be profitable. The result is often deforestation, soil erosion, watershed degradation, and irreversible loss of biodiversity. In national parks, the potential benefits from charging user fees and using differential pricing are huge. The royalties are a mechanism to obtain the public benefits of ecotourism. The public benefits of ecotourism usually come mainly from the private sector.

They can also be used to reduce access to areas of overuse and ecological damage. Developing countries have little experience in guiding natural resource managers in designing effective pricing strategies. An assessment is needed to assess the impact of user fees and differential pricing so that appropriate policies can be developed and implemented. Like many other developing countries, Pakistan is seeking to revitalize its tourism sector, including nature tourism. In terms of biodiversity, Pakistan is one of the poorest South Asian countries. Forest coverage is only 5% of the country, and deforestation is high. However, in recent years, the Pakistani government has shown interest in the expansion and proper maintenance of the national park system (Nizami et al., 2017). However, despite the small number of national parks and protected areas in Pakistan, their management is far from satisfactory. This may be partly due to insufficient government funding and free access to these places by tourists. The economic value assessment of these environmental resources can provide valuable information for better management of the park.

1.9 Willingness to Pay for National Park Management

Like many other developing countries, Pakistan is seeking to revitalize its tourism sector, including nature tourism, to expand its national park and protected area system. In South Asia, Pakistan is one of the poorest biodiversity countries. Deforestation rates have been high in recent years (World Resources Institute, 1996). Forests account for only 5% of the country's area. As the population continues to increase, mainly due to the conversion of forests to agriculture and residential uses, the forest coverage of forests is getting lower and lower. In recent years, the Pakistani government has expressed serious concerns about deforestation and has shown great interest in developing the famous national park system (Khan et al., 2004).

Pakistan has many national parks, nature reserves and wildlife reserves in different parts of the country. Although the number of national parks and reserves is limited, their management is far from satisfactory. This is partly due to insufficient government funding and tourists can enter these places for free. Access to Pakistan National Park is currently free. However, revenue can be generated by introducing ticket fees, which can be used to

improve the quality of the park. A thorough investigation is needed on how to properly manage these parks and how to evaluate these environmental resources. Pakistan has never conducted a study on the valuation of national parks. People use natural resource systems such as lakes, rivers, streams, estuaries, forests and parks for a variety of recreational activities. Natural resource systems provide valuable services to people.

Global industrialization and the concomitant reduction of many natural resources have become factors for the differentiation of marketing products. Environmental certification programs are increasingly seen as important market-based tools that connect manufacturing and consumer purchases (Vlosky et al., 1999). The relationship between intrinsic environmental motivations and the willingness of environmentally certified wood products to pay a premium. A conceptual model was proposed that captures the effects of perception, awareness, and price on consumers' willingness to purchase and pay for environmentally certified forest products premiums.

From an economic perspective, these services have two important characteristics. The first is that the economic value of these services depends on the characteristics /of the natural resource system. Knowledge of the value of these services can be important for various resource management decisions. The second important feature is that access to entertainment resources is usually not distributed through the market. Instead, it is usually open to all visitors at zero price or a nominal admission fee, regardless of the cost of providing the visit. And these visit prices have little or no change over time or across sites, and can provide data for econometric estimates of demand functions. Like other environmental resources and public goods, national parks benefit society in many different ways (WWF Pakistan, 2010). National parks also help increase the nation's valuable foreign exchange revenue. Pakistan's forest resources are very scarce because, as mentioned earlier, the forests cover only 55% of its willingness to pay for its MHNP, and the country has only a few parks. However, national parks are often threatened by forest fires, soil erosion, human settlements in the park, pollution caused by villagers or park visitors, and invasion by local villagers.

The overall negative impact caused by one or another human activity is usually related to insufficient funding to manage these parks. Park management requires two main

sources of funding. Revenue from federal and / or provincial government budget allocations and park entry fees. The government budget allocated to national park management is often very limited because it must compete with other development programs, including education, health care, infrastructure, defense spending, and other programs in the country. Therefore, another option is a fee that can be used to generate additional income for park management. Currently, only token or no admission fees are charged. Admission fees to these parks can generate sufficient funds. In addition, as long as the park is priced reasonably, ticket revenue can increase. This suggests that given that the federal government's budget for national park management may still be small, adjusting park ticket fees may provide the required park revenue. There is an urgent need for sustainable management, which in turn requires correct valuation.

1.10 Review of Literature

MHNP is one of the most ecologically significant parks and protected areas of Pakistan. It is located at the foot of the Himalayas. MHNP covers an area of 17,386 hectares (173.9 square kilometers). MHNP has important biological, environmental, and sociocultural functions, but is threatened by land occupation and deforestation due to human encroachment (WWF Pakistan, 2010). The park has 600 plants, 250 birds, 24 mammals and 13 species of reptiles, including mammals (such as Asian leopard, grey goat, bark deer, wild boar, golden jackal, red fox, white pig, pangolin, monkey, fruit bat), reptiles, such as (Russell viper, Indian cobra, snake, sawed viper), vegetation (deciduous and evergreen), shrubs, pine and oak forests), birds (such as lark, black grouse, pheasant, Egyptian) buzzard, falcon, Indian sparrow, black part and hawk).

MHNP was declared a National Park in April Under section 21 (1) of the Islamabad Wildlife Ordinance (IWO) 1979, and Recognized as a wildlife sanctuary. Under this section, any business activity and settlement in the area is prohibited. But chain restaurants, cabins have caused the loss of habitat for people and tourism affects this diverse park and its biodiversity, disturbed during the breeding season, destroying flora and forcing animals to migrate.

In addition, solid waste generated by restaurants, cabins and tourists has increased pollution and destruction of the aesthetic value of this national park. Mostly waste including polyethylene bags, food packaging. Plastic bottles, wrapping paper, metal, glass, oil, sewage water and other polluted waterways, plant and tree roots, drinking animals polluted water and feed on solid waste thrown by hotels and tourists. Plastic bottle and polyethylene bags are non-biodegradable and can last longer and affect soil fertility. Wildfires are key factors that disrupt biodiversity, destroy flora and affect forests. Wildlife (animals and birds) due to habitat loss. Illegal occupation of cities, poaching, cutting down trees is affecting the park's ecosystem.

National parks are to be conserved and protected. Ideally, there is little human activity. The core areas of these parks are usually limited to research. Development and road construction have reduced wildlife interactions and established physical obstacles on both sides of the road. Research Center, (Dr. Fakhar Abbas, Institute of Biology According to documentation from the Resource Research Center, in 2003, about 40 gray goats Found in MHNP. Due to human activities and excessive tourism, animals and plants has disappeared from the area not only due to loss of habitat, but also from poaching. Hundreds of cars on the road to restaurants and attractions have been disrupting wildlife and its habitat due to light and noise. Even at night, there are many lights on the road at night severely disturbed the wildlife of the national park. There are several animals hit by a vehicle on the road, of which wild boar is common. (Manfredi et al., 2010). Unscientific solid waste management, open defecation and septic tanks in poor condition; and direct disposal solid waste in watercourses or on bare surfaces is a major source of bacterial pollution in the park area. Find pollutants and microbial contamination in water bodies and open dumping activities and non-serious behaviors towards environment, such as solid waste dumps, defecation, suggesting that poor septic tank conditions may affect the quality of water.

There is a clear direct impact on leisure and tourism, such as removal vegetation for infrastructure or damage caused by trample, horse riding, mountain biking and off-road vehicles. Similarly, indirect effects, although less obvious, may be more severe (Chandio et al., 2019). This includes the effects of self-propagation associated with trail weed spread

and road. It also includes severe impacts on local vegetation, including many rare and threatening plants. This research was conducted to understand the impact human encroachment on the natural resource of Margallah Hills National Park Islamabad (MHNP).

Human encroachment of ecosystems is a global threat to large predators, especially in the African savannah, where the increasing demand for human resources continues to weaken connectivity and viability. Zambia borders eight countries, including three transboundary protected areas (TPA), and manages nearly 40% of its land for wildlife, so it has a regionally important role in the conservation of large predators (Nyirenda et al., 2015). In Zambia's natural resource management, deforestation, especially encroachment, is generally considered a problem. However, due to the lack of adequate mapping of encroachment, the mapping of cultivated and cleared savannahs that are vulnerable is generally difficult, and there are serious errors in previous land cover data sets.

A compound farm is a family-style agroforestry system that involves the deliberate management of multi-purpose trees and shrubs, associated with multiple layers of crops and small livestock in a single house complex. In addition to diversifying production, minimizing risks, increasing labor and nutrient use efficiency, and the advantages of soil protection, compound farms also represent a germplasm bank that contains many useful tree / shrub species that are currently short due to deforestation (Okafore et al., 1987). Agriculture is the main type of land use in southeastern Nigeria. However, about 90% of the farms are less than 4 hectares, and about 55% are less than 1 hectare. This small piece of farmland usually consists of two or more plots, usually scattered around the village.

Contrary to the claim that irreversible desertification is widespread in the Sahel in Africa, recent seasonal green increases in large areas of the Sahel have been observed, which is explained by the recovery of the Sahel drought. Based on the analysis of the standard deviation vegetation index (SDVI) time series and gridded satellite rainfall estimates from 1982 to 2003, this study investigated the temporal and spatial patterns of vegetation greenness and rainfall changes in the Sahel, Africa, and their interactions (Herrman et al., 2005). Although rainfall has become the main cause of increasing the

greenness of vegetation, there is evidence that another cause exists, assuming that human changes are superimposed on climate trends.

The Great Tonle Sap Lake in Cambodia is of great significance for its biological and social diversity and its fundamental role in the local and national economy. Conflicting natural resources have exacerbated population pressures and governance deficiencies, thereby threatening the ecological and economic viability of lakes and their systems (Bonheur et al., 2002). To this end, as part of a broader governance reform plan, the Cambodian government has started to promote the integrated, system-wide natural resource management of Tonle Sap Lake. The main feature of the strategy is the designation of the Tonle Sap Biosphere Reserve as part of the UNESCO World Network of Biosphere Reserves.

Pakistan is rich in biodiversity, especially in arid and semi-arid areas, which cover almost 80% of the total land area. Many animal and plant species are threatened and / or endangered due to overexploitation and loss of natural habitat. The rapid population growth is putting increasing pressure on the country's natural resource base. Increased poverty has forced rural people to use biodiversity at an unsustainable rate. Deforestation, overgrazing, soil erosion, salinization and waterlogging pose major threats to the country's remaining biodiversity. The continued loss of forest habitats and their associated flora and fauna will have a serious impact on other natural and agricultural ecosystems in the country.

The protected area system was established to protect biodiversity in situ, and although laws have been put in place to protect the various components of biodiversity, they have not yet been implemented (Subaiee et al., 2011). Without local involvement, all efforts to reverse losses and promote diversity are futile. The Government of Pakistan formulated the National Conservation Strategy in 1992, which included biodiversity conservation as an essential component. Pakistan is a signatory to many international initiatives and is working together to protect its biodiversity in all ecological regions. It is recommended that all stakeholders, including government agencies, local communities and NGOs, work together as partners to protect biodiversity.

The motive behind this study was to investigate the impact of human encroachments on the ecological services provided by the Margalla hills (Jamil et al., 2008). These mountains are part of Murree hills. It is a mountain range with many valleys and mountains. The high diversity of birds in Margalla is attributed to the combination of many ecological components, making it a unique location.

CHAPTER 2

MATERIAL AND METHODOLOGY

2.1 Study Area

MHNP lies between 33° 43' N latitude and 72°55' E longitude North East of Islamabad, Punjab. It occupies an area of 15,883 hectares. MHNP was established as a park in 1980. It has a ragged topography, with elevation ranging from 465 to 1600 meters. The rock structure is mainly lime (Jabeen et al., 2009).

Saidpur village resides at the footsteps of Margalla Hills, Islamabad. It is located between 33° 44' and 33° 44' North, and 72° 55' and 73° 20' 0" East. It is nothing less than a wonder of history; contains rich heritage that is around five hundred years old. The basic rock structure of Saidpur is similar to that of MHNP, that is limestone (Fig 2.1, 2.2).The research was mainly conducted at Saidpur, and its boundary with MHNP (Shinwari et al., 2000).

The residents of Saidpur village are the oldest residents of Islamabad. The interaction between human populations of Saidpur and the floral populations of MHNP has been in constant competition and the human population is at a greater edge (Bajwa et al., 2015). Humans are utilizing the ecological services of MHNP at a devastating rate, which holds threats to the floral population and microclimate of the area.

The study comprises closed ended self-structured questionnaire survey and quadrat analysis. The study was conducted between October 2019 and December 2019. The survey was conducted on random sampling of the human population, whereas floral diversity and density was estimated by quadrat analysis method. For impacts of human encroachment comparison of the results of this study area with the same area studies in 2004, whereas for comparison of presence of plants species with a research paper on 'Indigenous uses of economically important flora of MHNP, Islamabad, Pakistan' by Asma Jabeen et al in 2009. Although the mentioned study covers 23 villages located near water streams and springs, our study only focuses of Saidpur Village.

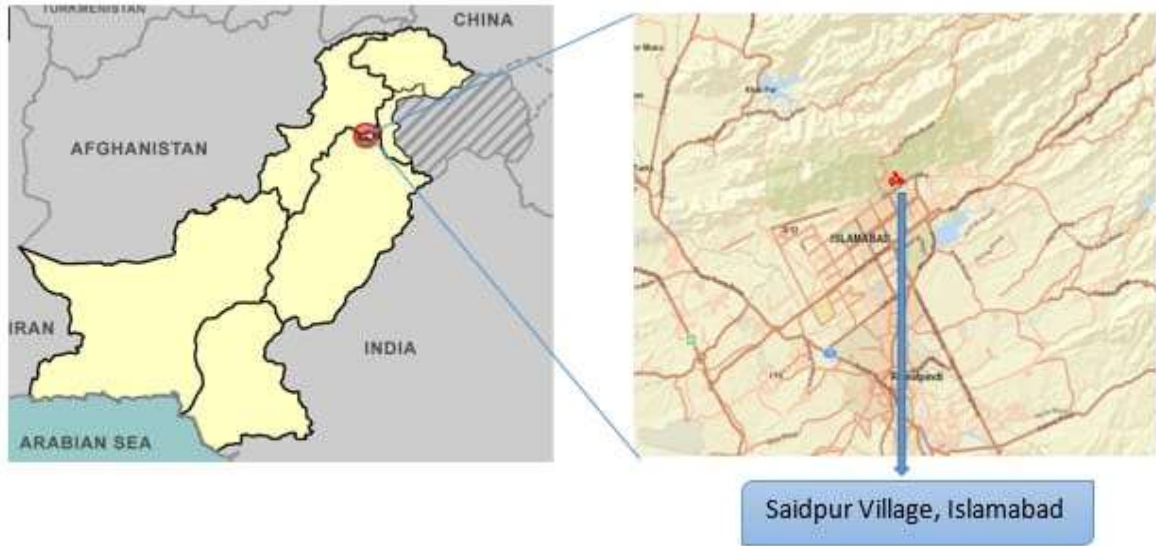


Figure 2.1 Location of Saidpur Village in Federal capital territory, Islamabad city.

Saidpur Village General Map

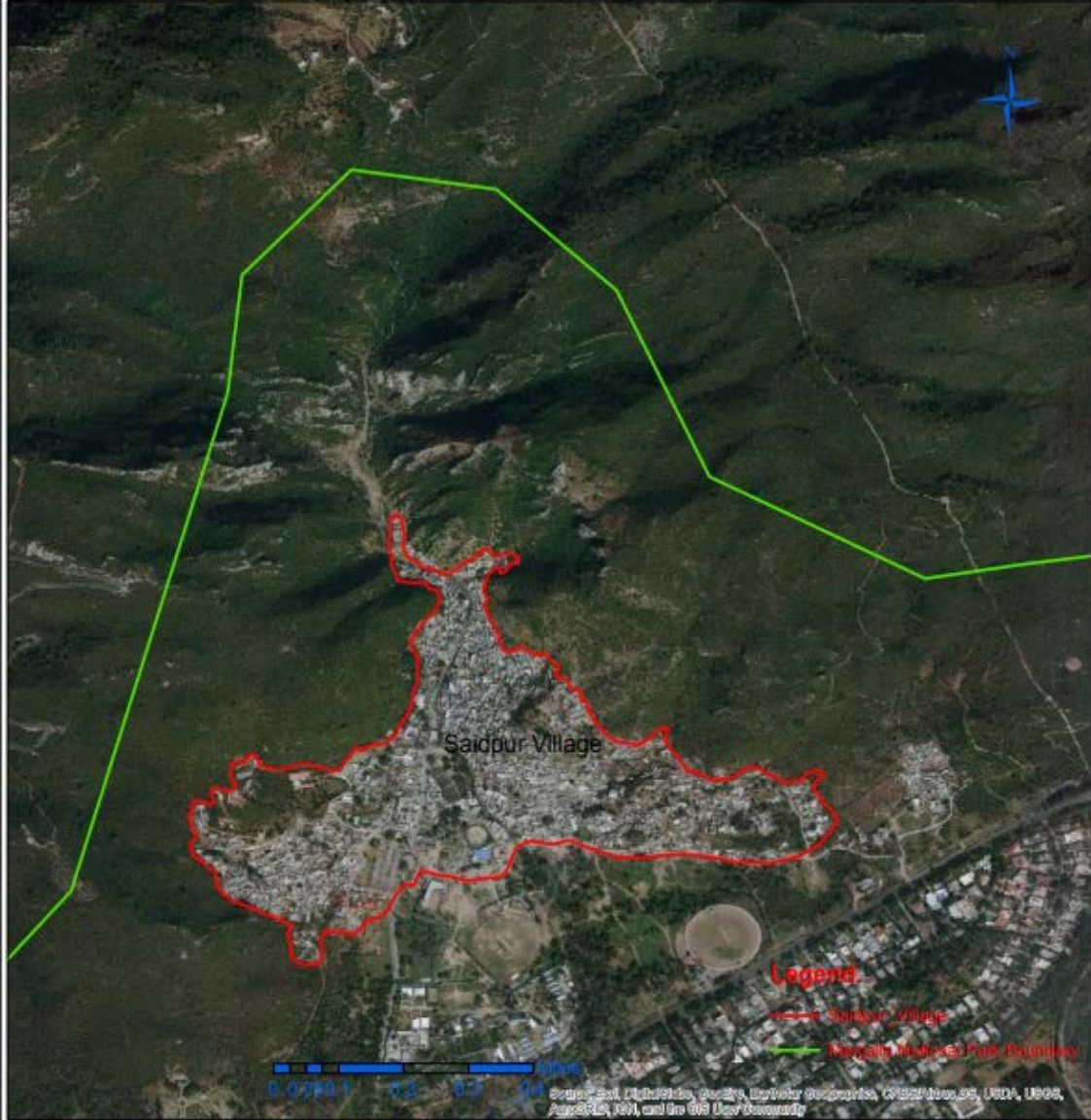


Figure 2.2 Map of Saidpur.

2.2 Data Collection by Survey Questionnaire

A survey study was conducted in Saidpur village to get information about demography, geography, work history of individuals, socioeconomic factors and response and awareness. First hand primary data was collected through self-structured closed ended questionnaire (Saleem et al., 2014). The sample size for conducting the survey on the

population of Saidpur was 70. Interviews were conducted on personal level for 70 individuals, in which all questions that were the part of the questionnaire were briefed to the individuals in the national language and recorded their response in terms of the closed ended answers. The inhabitants cooperated with us to respond to the questionnaire, and provided us with their perspective of things.

25 questions in total were asked to each individual related to age group, education, monthly income, living period, profession, working hands in the house, primary fuel source, wood burning, plant cutting, annual firewood usage, presence and use of medicinal plants, garbage disposal and incineration, waste dumping facilitation by government, knowledge about the ecological resources, resource use by residents, preference of plantation, protection of ecological resources, willingness to cooperate with governmental and non-governmental agencies for protection of ecosystem, and amount of contribution for ecosystem protection.

The purpose of conducting questionnaire survey was to get information about; consciousness of the inhabitants of the Saidpur, in regards to Environmental protection and awareness; and to get information about awareness of the valuable ecological resources of MHNP; and how much the residents are inclined towards maintaining the ecological balance.

2.3 Floral Population and Specie Analysis

For floral population and specie analysis, quadrat method was used. This technique has been used by several ecologists and botanists to assess an areas floral specie population (Baxter, 2014). The area under consideration was the boundary between Saidpur and MHNP. Saidpur and MHNP are situated so close to each other as one is the part of the other. One Path lead to a hill located at North West of the boundary and another path that was North East had a pathway formation due to constant human walking. This area was clearly segregated the basis of an area with less human encroachment and another area with reasonable human influence. It was the exact middle of the boundary between Saidpur

and MHNP. The quadrats were taken 650 meters from where the residence ended and the boundary blended into the vicinity of MHNP.

Random sampling was done and on the basis of division mentioned above, total 12 quadrats were sampled. Each quadrat was of 300 cm x 300 cm (3m²). All quadrats were recorded for their coordinates by using a GPS. Six quadrats were sampled from the pathway that had visible human influence and the other six were sampled from the path that led to the hill with less visible influence (Fig. 2.3, 2.4).



Figure 2.3. From the boundary facing towards Margalla Hills.



Figure 2.4 From the boundary facing towards Saidpur Village.

The selection of the quadrats was random based on the observation of the area. Each species was taken as a sample from each quadrat (Table 2.1). The coordinates are plotted on the map as shown in figure 2.5. The population of that specie was also calculated precisely for each quadrat in case of herbs and shrubs. The grass specie for each quadrant was taken as sample as well, but the population of the grass was approximated on the basis of its cover in that quadrant as measured and recorded in terms of percentage.

Table 2.1 GPS Coordinates of quadrats.

S no.	Coordinates
1	33°44'57''N 73°3'58''S
2	33°44'51''N 73°3'59''E
3	33°44'55''N 73°3'58''E
4	33°44'58''N 73°3'58''E
5	33°44'58''N 73°3'59''E
6	33°44'59''N 73°3'59''E
7	33°45'0''N 73°3'60''E
8	33°44'59''N 73°3'58''E
9	33°44'58''N 73°3'56''E
10	33°44'59''N 73°3'57''E
11	33°44'58''N 73°3'56''E
12	33°44'59''N 73°3'57''E

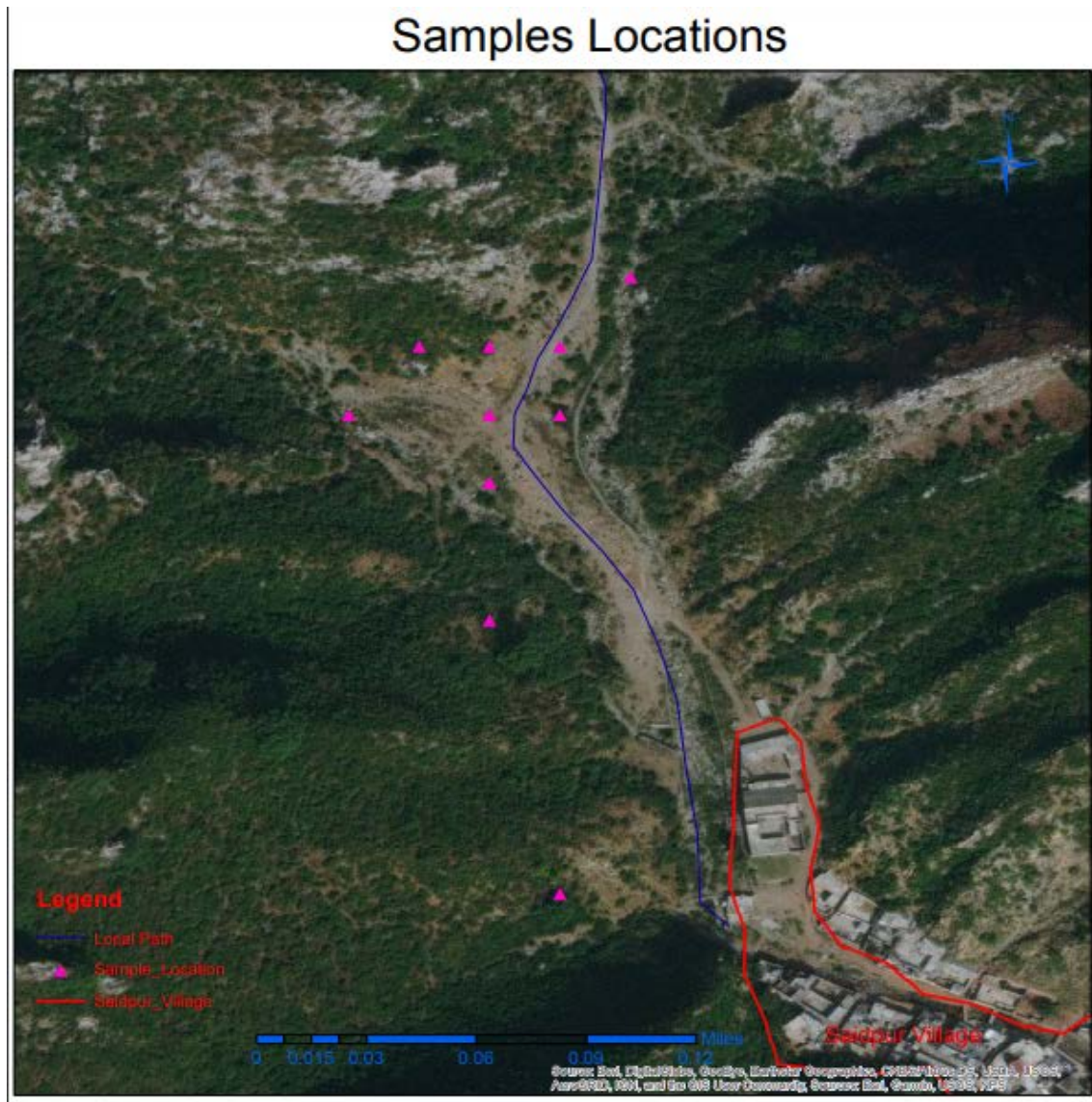


Figure 2.5 Quadrat analysis sampling points.

2.4 Statistical Analysis

Statistical Package for Social Sciences (SPSS) is the software used to perform statistical analysis of various variables to understand research and data. The qualitative data observed from the questionnaire survey is converted to quantitative data by using SPSS. Cross tabulation is conducted in order to assess the significance of dependency of multiple variables on one another. The variables are assessed from the qualitative data collected through the questionnaire survey (Arkkelin, 2014). After the entire data for the

questionnaire survey was collected and sorted, cross tabulation was performed in order to understand how multiple parameters were affecting each other. Chi-square tests were performed in order to measure the dependency of certain factors on one another. The p-value was calculated using the SPSS and used to assess the significance of dependency.

2.5 Population density

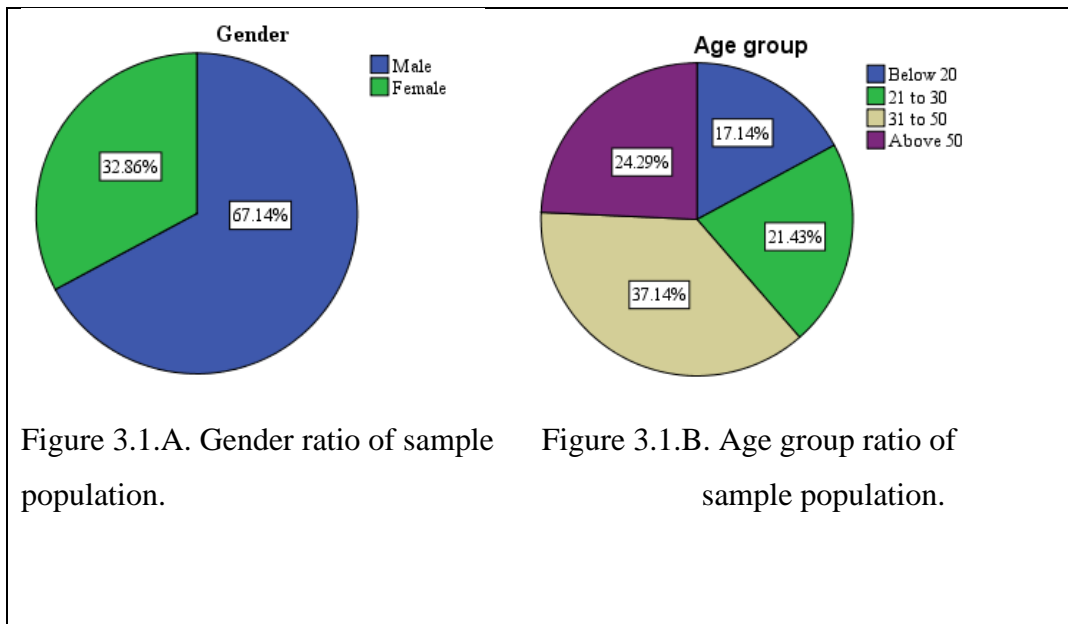
Once the quadrat analysis is done, the data from the analysis will be used to calculate the floral abundance density. The following equation was used for this purpose (Rashid et al. 2012).

$$\text{Density} = \text{Number of individuals of species in all quadrats} \div \text{Total area sampled}$$

CHAPTER 3 RESULTS AND DISCUSSION

3.1 Statistical Analysis

On the basis of the data collected through closed ended questionnaire, and communication with the residents of Saidpur, the behavior and consciousness of the population towards ecological resources and environment was recorded. The sequence of the questionnaire was set, so that each question adds up the questions that followed next. (Sherin, 2008). This was done in order to make sure an individual's sample of population is measured by its personal lifestyle and how it affects their inclination towards environment. The first section of the questionnaire consisted of personal information, followed by their socioeconomic conditions and finally inquiring about their awareness towards their surroundings.



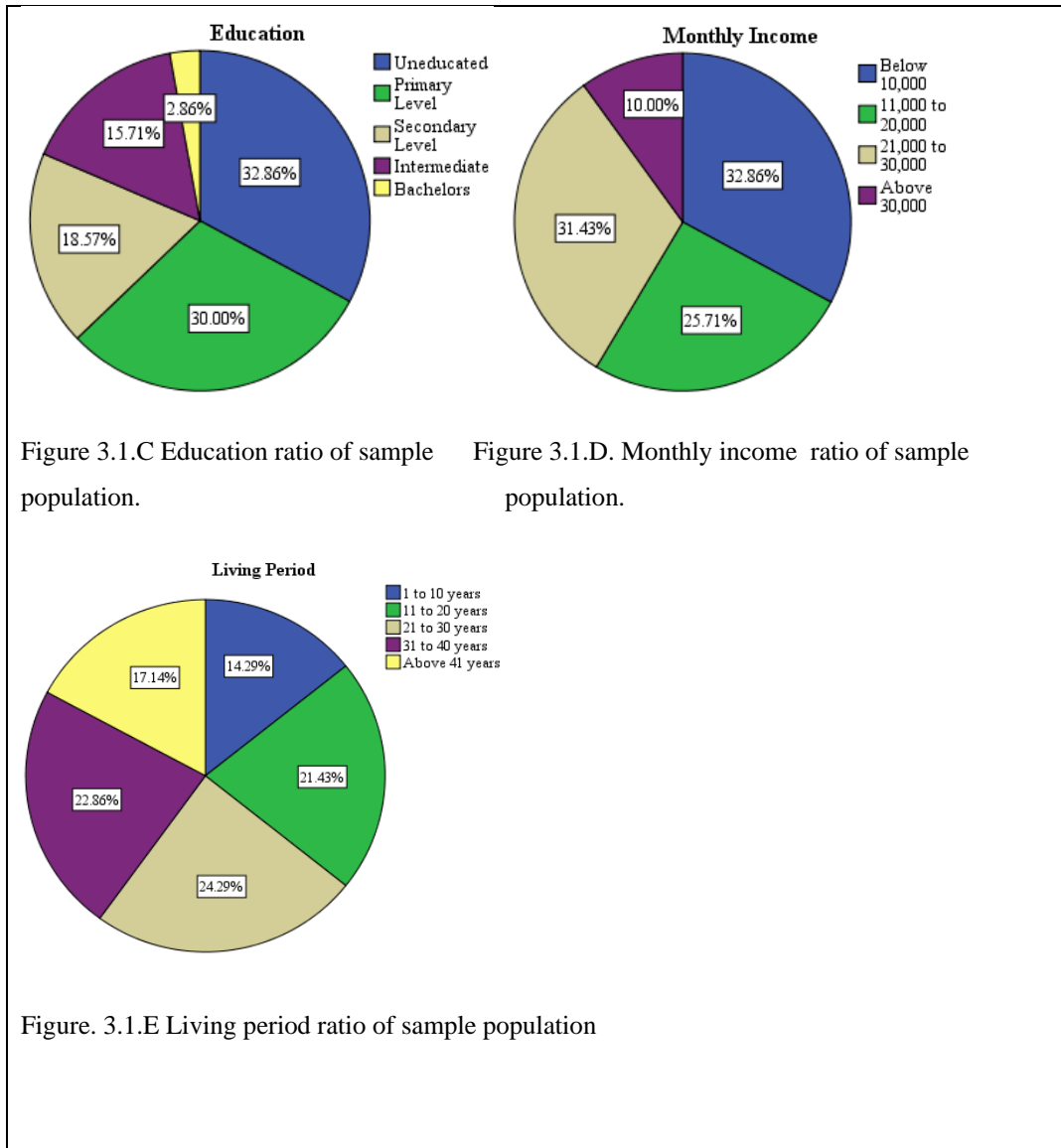


Figure 3.1 Personal Information analysis through survey data.

Out of the 70 questionnaires, based on gender, 67.1% were responded by male population and 32.9% by female (Fig 3.1.A). The questionnaires were distributed randomly, around the Saidpur. Among the sample population, 17.1% people were below the age of 20, 21.4% between the age of 21 to 30, 37.1% above 31 and 17% above 50 (Fig 3.1.B). The trends for education were quite prominently displaying lack of education. 32.9% people were uneducated, 30% people had education till primary level, 18.6% people

till secondary level, 15.7% till intermediate level and only 2.9% had their studies till bachelors (Fig 3.1.C).

Most people of Saidpur had mediocre monthly incomes. 32.9% people had their monthly income below PKR 10,000, 25.7% had their income below PKR 20,000, 31.4% had there's below PKR 30,000 and only 10% people somehow were able to earn more than PKR 30,000 while (Fig 3.1.D).

Questionnaire also comprised of questions regarding number of years the sample population had spent living in Saidpur (Bajwa, 2015). This question had the potential to approximate whether migrated people know the worth and significance of the ecological resources that surround them. 14.3% of population was living in Saidpur between the ranges of 1 to 10 years, 21.4% people were living since 11 to 20 years, 24.3% were living since 21 to 30, 22.9% since 31 to 40, and only 17.1% were there who were living in Saidpur for more than 40 years (Fig 3.1.E).

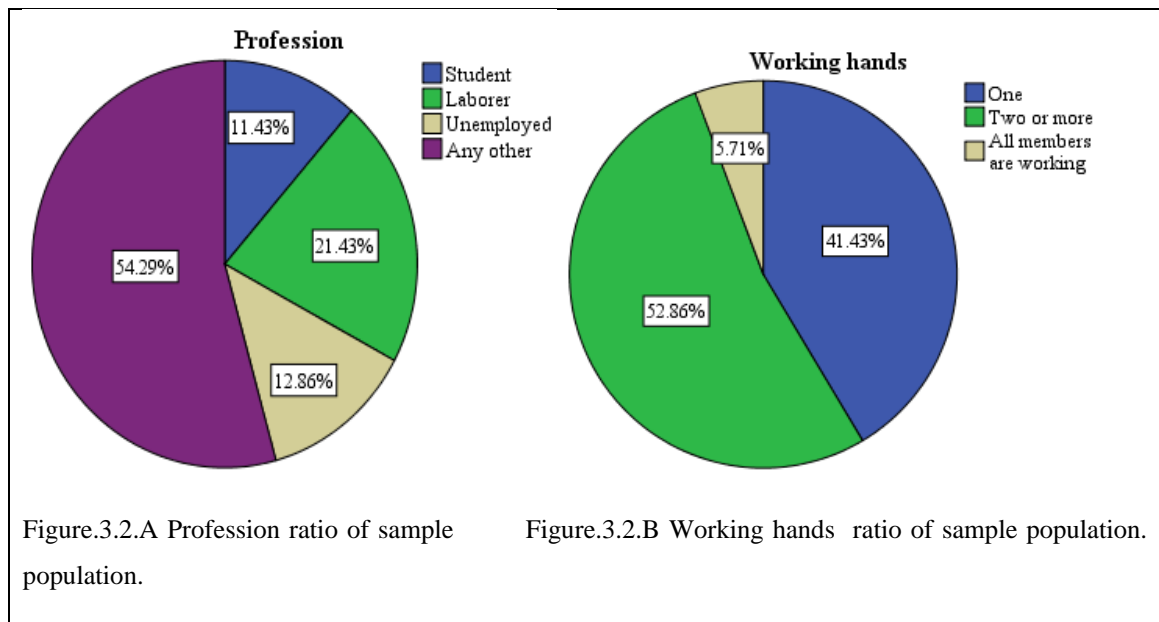


Figure 3.2. Personal Information analysis through survey data.

.The questionnaires displayed the statistics that 11.4% were students, 21.4% were laborer and 12.9% unemployed at the moment. 54.3% of the people were doing other jobs, mostly drove taxis, professional painters, carpenters, guards, and such other means of employment (Fig 3.2.A). 41.4% people only had one person employed or working in their family, 52.9% had more than two people and 5.7% had their entire family working (Fig 3.2.B).

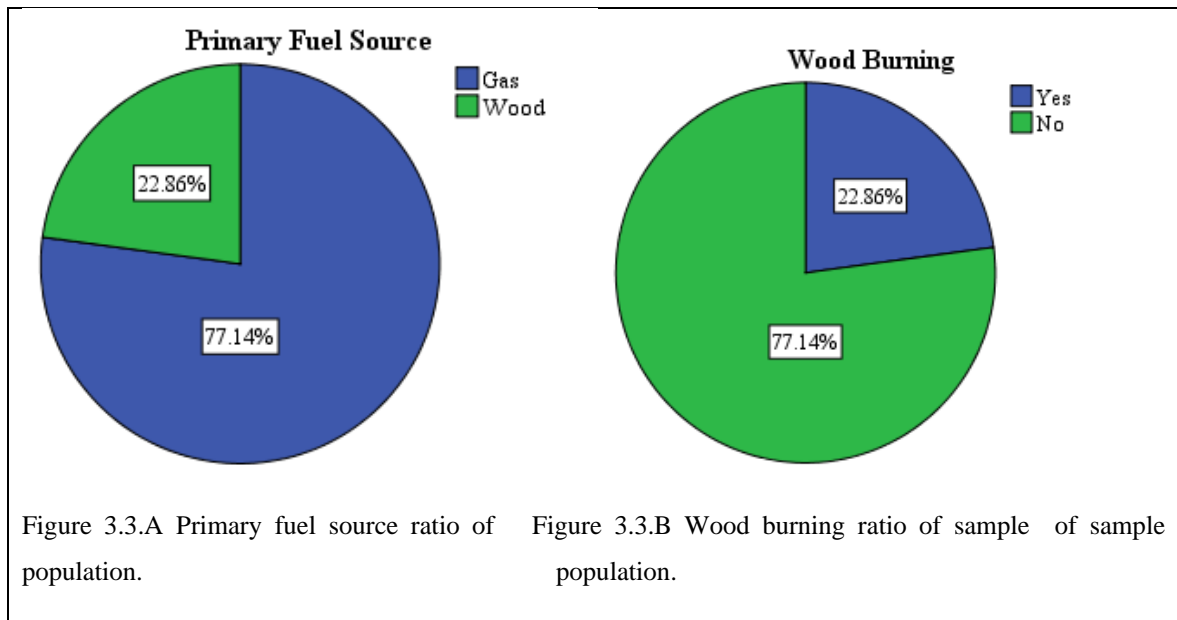


Figure 3.3. Socioeconomic analysis through survey data.

Personal questions were followed by socioeconomic questions, which is the second section of the questionnaire. It included the sources and means of energy for residents of Saidpur. Primarily, there were two fuel sources being used in Saidpur, natural gas and wood (Hossain, 2016). The data collected through survey displays that 77.1% people use gas as their primary fuel source and 22.9% people depend on wood (Fig 3.3.A). Same were the statistics for people who burnt wood, only 22.9% burnt wood whereas 77.1% did not (Fig 3.3.B).

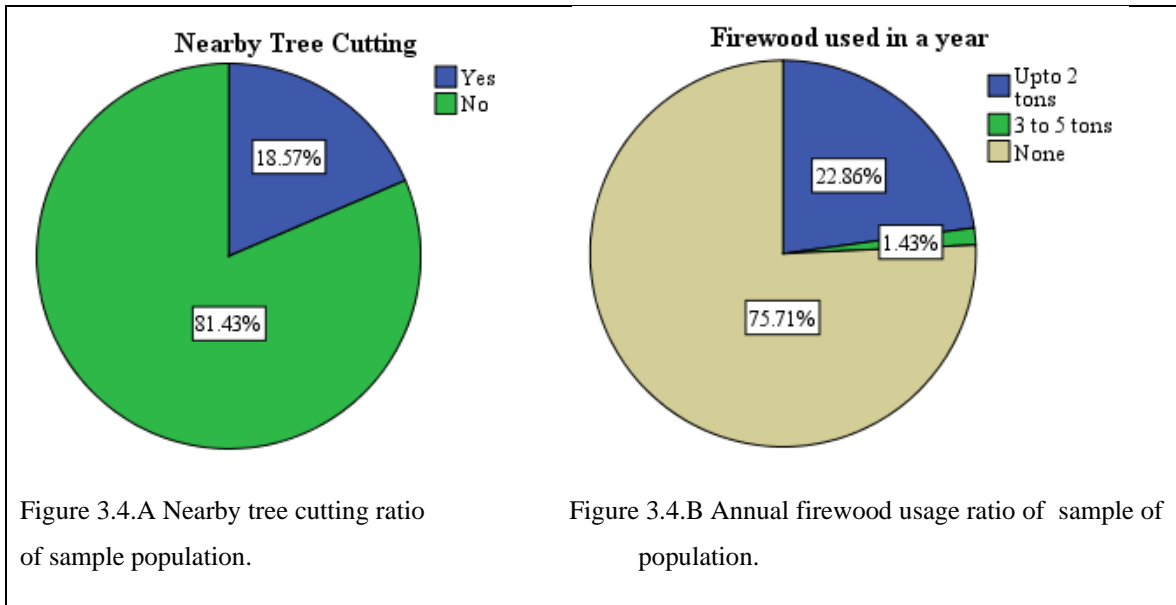


Figure 3.4. Socioeconomic analysis through survey data.

The statistical analysis shows that 18.6% of the interviewees acquire wood from MHNP whereas 81.43% of the respondents who answered no to this question either did not use firewood at all or obtained wood from outside sources (Fig 3.4.A). Out of 24.29% of the respondents, 22.86% used wood up to 2 tons whereas 1.43% of the respondents used wood up to 1.43% (Fig 3.4.B).

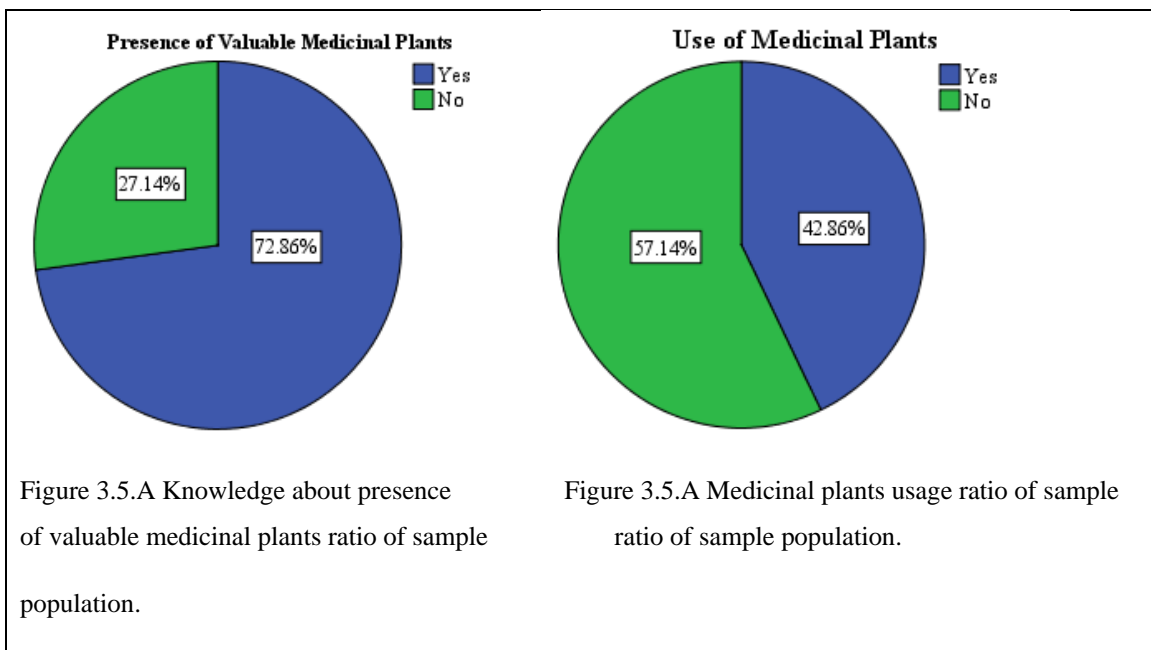


Figure 3.5. Socioeconomic analysis through survey data.

The study depicts positive response of the respondents towards awareness about the presence of the medicinal or valuable plants close to MHNP. 72.9% of the interviewees were aware about the presence of the valuable medicinal plants near Saidpur village whereas, 27.1% interviewees were unaware (Fig 3.5.A). Out of 70 respondents, 42.9% made use of medicinal plants whereas 57.1% of the respondents did not (Fig 3.5.B).

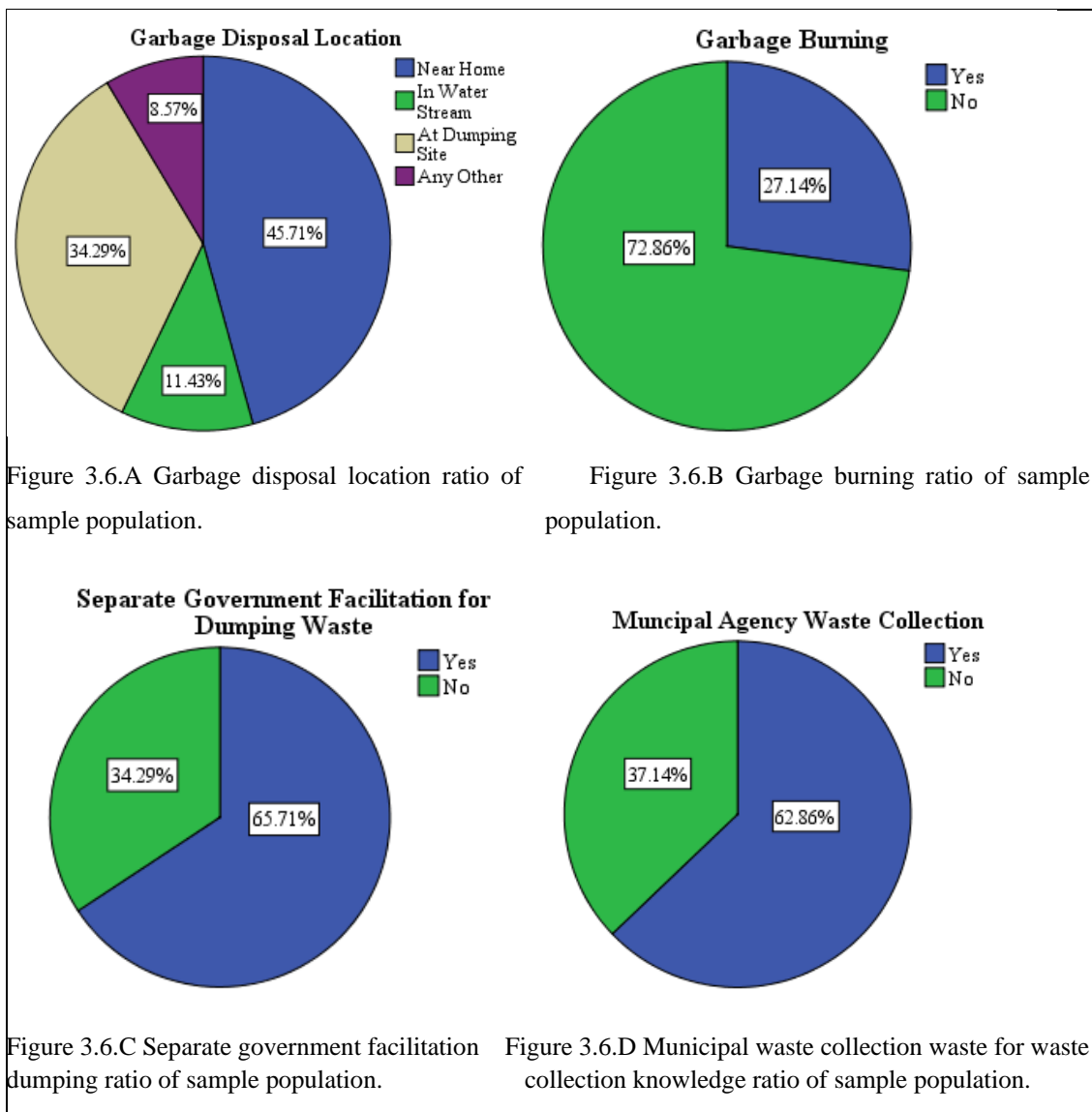


Figure 3.6 Socioeconomic analysis through survey data.

In response to garbage disposal, 45.7% of the respondents disposed garbage near houses, 11.4 disposed in the water stream, 34.3% disposed it a common dumping site and

8.6% had mixed approaches (Fig 3.6.A). Also, 27.1% of the respondents burnt their garbage, whereas the majority of 72.9% people did not (Fig 3.6.B). 65.7% of respondents had knowledge about separate government facilitation site for waste dumping whereas 34.29% respondents were unaware (Fig 3.6.C). 34.3% people were not even aware that they had a municipal agency waste collection area for Saidpur (Fig 3.6.D). There was a common waste collection area present.

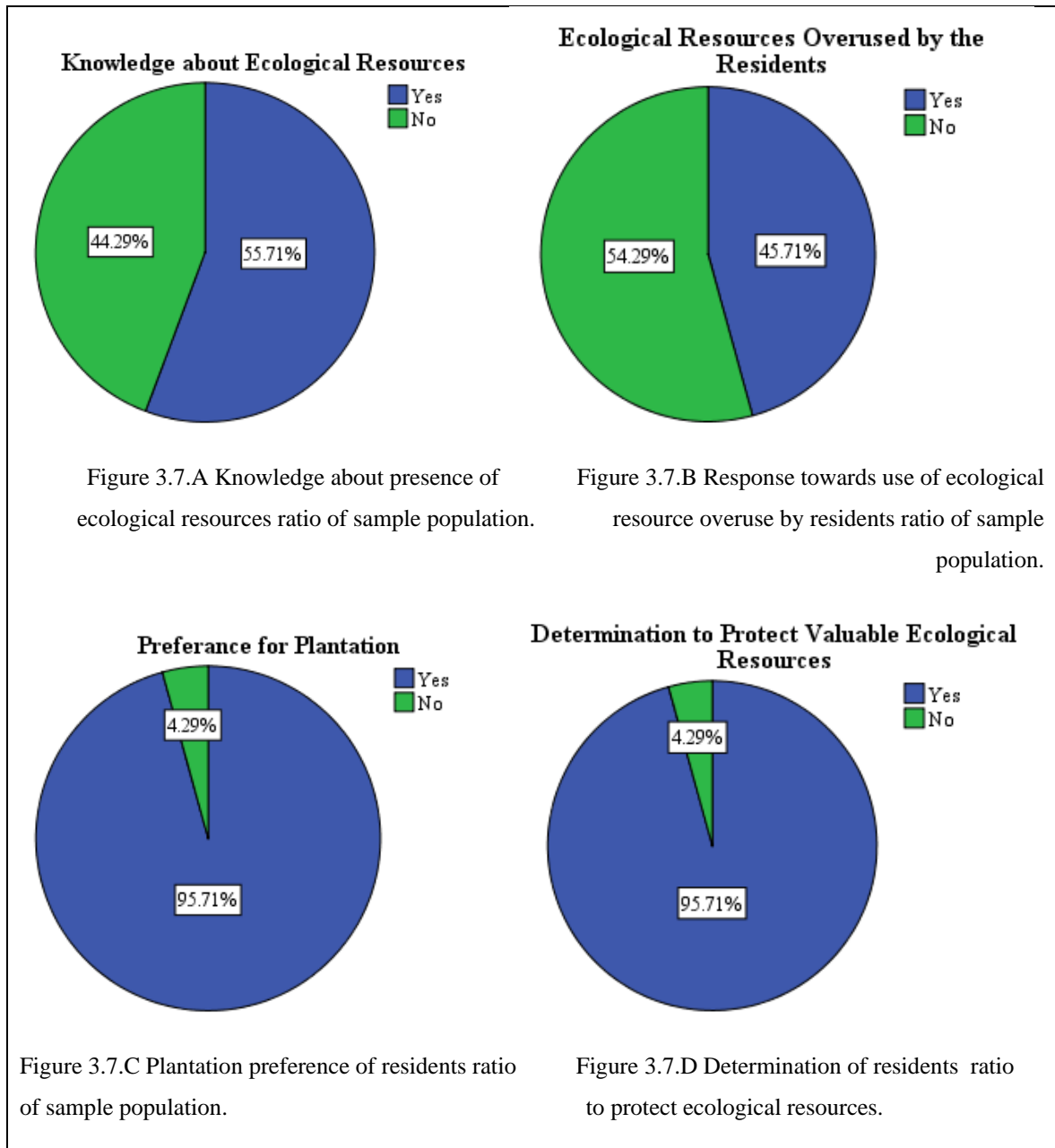


Figure 3.7. Response and Awareness analysis through survey data.

The third section of the questionnaire survey was designed to draw out information about the awareness of the ecological resources that were there (Bohdanowicz et al., 2016). 55.7% respondents had knowledge about the benefits that MNHP presence's hold, whereas 44.3% respondents had no knowledge (Fig 3.7.A). 45.7% people were inclined towards the idea, that the resources area being overused by the residents of Saidpur (Fig 3.7.B). 95.7% people were up inclined towards protecting the ecological resources and environment of Saidpur village and making it cleaner (Fig 3.7.C, Fig 3.7.D).

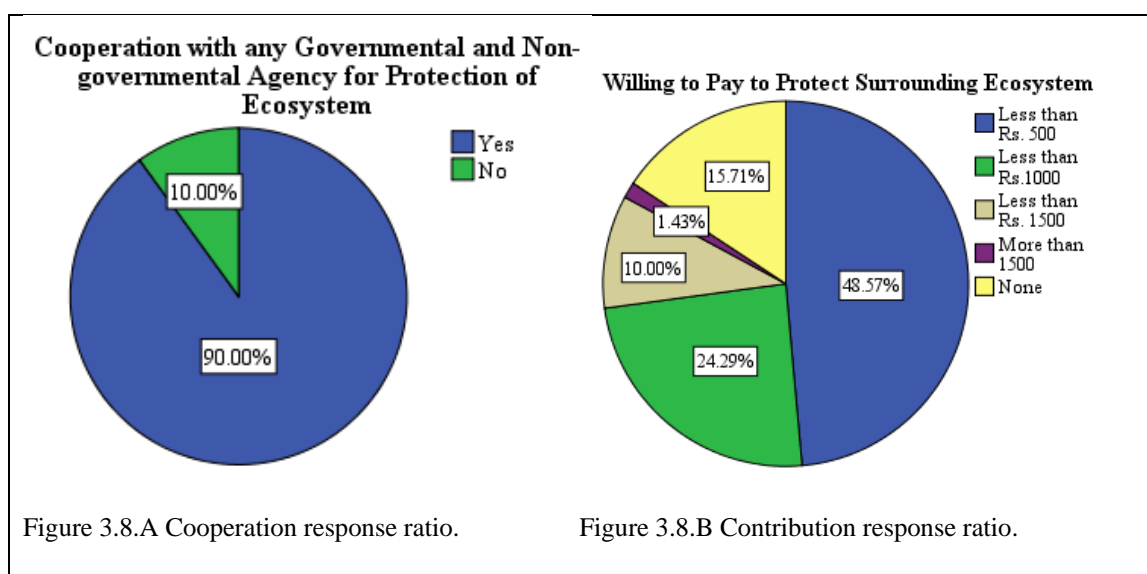


Figure 3.8. Response and Awareness analysis through survey data.

3.2 Cross Tabulation

The study shows 90% of the respondents are willing to cooperate with any organization (Governmental or non-governmental) in order to initiate protective programs for the ecosystem of MHNP and Saidpur (Fig 3.8.A). The statistical analysis depicts the willingness of residents to pay money for restoration of ecosystem and what amount can they pay (Michael, 2001). The results were very positive as compared to their social lives and their incomes. 48.6% respondents are willing to pay up till PKR 500, 24.3% were up for paying till PKR 1000, 10% people are happy to pay up to PKR 1500, and 1% were

willing to pay above PKR 1500. In total, 84.3% people were willing to pay to restore and protect Saidpur, whereas 15.7% respondents were not up for paying anything (Fig 3.8.B).

Table 3.1 Crosstab for Education and Knowledge about Ecological Resources of MHNP

Count							
		Education					Total
		Uneducated	Primary Level	Secondary Level	Intermediate	Bachelors	
Knowledge about Ecological Resources	Yes	12	10	5	10	2	39
	No	11	11	8	1	0	31
Total		23	21	13	11	2	70

Table 3.2 Crosstab for Education and Garbage Disposal Location of inhabitants

Count							
		Education					Total
		Uneducated	Primary Level	Secondary Level	Intermediate	Bachelors	
Garbage Disposal Location	Near Home	11	12	5	3	1	32
	In Water Stream	1	3	2	2	0	8
	At Dumping Site	8	6	4	6	0	24
	Any Other	3	0	2	0	1	6
Total		23	21	13	11	2	70

Cross tabulation for education and awareness about the surrounding ecological resources of the inhabitants were statistically analyzed to assess the dependency of each factor (Table 3.1) (Marshall et al., 2007). The results of the Chi-square test suggested that, the two factors, awareness and knowledge of the ecological surroundings and education are independent. This depicts that education does not play a part in knowing about the ecological resources of Margalla Hills. Furthermore, another cross tabulation was conducted in order to observe the likelihood of dependency between the variable education and the variable of garbage disposal location of the interviewees (Table 3.2). The Chi-

square test for these two variables also suggested that two variables are independent. For these two variables it can be observed that the result shows education does not depend on where the garbage is being disposed. This clearly suggests that education is independent of where the inhabitants dispose their waste. The ones who are educated, they do not dispose their garbage at the dedicated sites that are present in Saidpur (Mustafa, 2003).

Table 3.3 Cross tabulation for Wood Burning and Primary Fuel Source

Count				
		Primary Fuel Source		Total
		Gas	Wood	
Wood Burning	Yes	1	15	16
	No	53	1	54
Total		54	16	70

Another cross tabulation was also performed for the variables wood burning and primary fuel source of the 70 respondents (Table 3.3). The results of the Chi-square test showed that it can be concluded the two variables are dependent. It can be interpreted from the results that, if the primary fuel source is gas there is very minute likelihood of wood being burnt by the inhabitants (Herein, 2009).

Table 3.4 Cross tabulation for Wood Burning and Living Period of respondents

Count				
		Wood Burning		Total
		Yes	No	
Living Period	1 to 10 years	1	9	10
	11 to 20 years	3	12	15
	21 to 30 years	2	15	17
	31 to 40 years	6	10	16
	Above 41 years	4	8	12
Total		16	54	70

Also, the significance of dependency for the variable of wood burning and living period was assessed (Table 3.4). It was observed through the test that wood burning was independent of living period of the 70 respondents. Similar results reflected when the

variable of wood burning was assessed for its dependency on education of the respondents. The trend was similar, the study shows that wood burning is regardless of the educational status and living periods of the respondents. Some educated respondents were burning wood, whereas the uneducated were not and vice versa (Coulson, 2007). The observed trends depict that the necessity of wood burning depends upon the fuel source of the respondents.

3.3 Floral Density

Following the questionnaire survey analysis, quadrat analysis was also conducted in order to assess the floral biodiversity and abundance (Valone et al., 2003). This method was applied at the area of interest, which was the boundary of Saidpur and MHNP. The floral biodiversity information that was collected through quadrat analysis is shown in table 3.5.

Table 3.5. Species abundance through Quadrat Analysis.

S no.	Coordinates	Species	Species Abundance
1	33°44'57''N 73°3'58''S	A	67
2	33°44'51''N 73°3'59''E	A	11
		B	1
3	33°44'55''N 73°3'58''E	A	12
		B	2
		C	5
		D	6
4	33°44'58''N 73°3'58''E	A	19
		B	6
		C	4
		E	3
5	33°44'58''N 73°3'59''E	A	6

		B	3
		C	6
		F	1
6	33°44'59''N 73°3'59''E	A	7
		B	3
7	33°45'0''N 73°3'60''E	A	8
		B	5
		E	1
		F	1
		H	1
8	33°44'59''N 73°3'58''E	A	8
		B	2
		I	1
9	33°44'58''N 73°3'56''E	A	12
		B	5
		E	7
10	33°44'59''N 73°3'57''E	B	4
11	33°44'58''N 73°3'56''E	B	9
		C	3
		F	1
12	33°44'59''N 73°3'57''E	B	5
		F	1

The following calculations depicts the information that was compiled on the basis of the (above table) and represents density found at each quadrat on the basis of their coordinates:

$$\text{Area of single Quadrat} = 3\text{m} \times 3\text{m} = 9\text{m}^2$$

$$\text{Total number of Quadrats} = 12$$

$$\text{Total area sampled} = \text{Area of single Quadrat} \times \text{Total number of Quadrats}$$

$$\text{Total area sampled} = 9\text{m}^2 \times 12 = 108\text{m}^2$$

$$\text{Total number of individuals of species in all quadrats} = 236 \text{ total individual species}$$

Using the following formula to calculate the floral density:

$$\text{Floral Density} = \frac{\text{Total Number of Individuals of species in all Quadrats}}{\text{Total Area Sampled}}$$

$$\therefore \text{Floral Density} = \frac{236 \text{ Total Individuals of species}}{108\text{m}^2} = 2.1 \text{ Species per m}^2$$

The above calculated data depicts the floral density that was observed at the sampled area. 2.1 species per m² were observed as a result. The effects of floral density are complex and operate on multiple scales (Essenberg, 2012). These results suggest that the floral abundance is consistent as it was in previous studies conducted. Even though the majority of the inhabitants have moved to a newer energy source i.e. natural gas, and the cutting of wood has declined substantially, the floral abundance is still resembling the results that were conducted in a previous study (Aansa Rukya Saleem*, 2014). The reason for being not practicing replantation.

CONCLUSION

With the introduction of Natural Gas as a fuel source, the use of wood has been minimized to substantial amount. Though wood is still being cut and burnt, and the floral assessments depicts the floral density at the boundary of Saidpur and MHNP is still being affected. 22.86% of the respondents were dependent entirely on wood as a fuel source. The willingness of the inhabitants towards sustainable development can be sensed through the survey. 84.29% respondents were willing to pay some amount in order restore and clean their surroundings. Regardless of the socio-economic conditions of the respondents, 72.86% population from the sample size knew about some ecological resources of MHNP. The survival instincts of a man are likely to involve him in taking unfavorable actions, such 18.57% surveyed inhabitants cutting nearby trees. The behavior observed by the inhabitants of the Saidpur in this study, depicts how lack of resources prompt humans to acquire resources on their own.

RECOMMENDATIONS

Those living in the vicinity of MHNP should be facilitated and provided with adequate necessities and resources, so that competition and predation may not arise. Awareness campaigns can also contribute to eradicate anti-environmental practices long adopted by the inhabitants. By adopting collaborative approaches, such as facilitating the inhabitants and promoting restoration and protection of MHNP, the balance can be maintained within the ecosystem. Afforestation should be practiced in order to improve the floral density of the area. MHNP being a very valuable resource should be protected and restored responsibly.

Appendix A
Questionnaire

QUESTIONNAIRE

Research topic: Influence of human encroachment on ecological services, Margalla Hills,
Islamabad, Pakistan.

Survey Area: Saidpur Village, Margalla Hills, Islamabad, Pakistan

PART 1: Personal data

Q1. Gender

- a. Male
- b. Female

Q2. Age

- a. Below 20
- b. 20 to 30
- c. 30 to 50
- d. Above 50

Q3. What is your education?

- a. Uneducated
- b. Primary level
- c. Secondary level
- d. Intermediate
- e. Masters

Q4. Monthly income?

- a. Below 10 thousand
- b. 11 to 20 thousand
- c. 21 to 30 thousand
- d. More than 31 thousand

Q5. How long have you been living here?

- a. 1 to 10 years
- b. 11 to 20 years
- c. 21 to 30 years
- d. 31 to 40 years
- e. Above 41 years

Q6. What is your profession?

- a. Student
- b. Laborer
- c. Unemployed

- d. Government employer
 - e. Any other
- Q7. How many working hands are there in the household?
- a. One
 - b. Two or more
 - c. All members are working
 - d. None

PART 2: Socioeconomics

Q8. What is your primary fuel source?

- a. Gas
- b. Fuel wood
- c. Oil

Q9. Do you burn wood during winter cold?

- a. Yes
- b. No

Q10. Which part of a plant do you cut for fire purposes?

- a. Dry leaves
- b. Twigs and branches
- c. Whole plant
- d. None

Q11. Do you cut trees nearby to obtain wood?

- a. Yes
- b. No

Q12. How much firewood do you used in a year?

- a. Up to 2 tons
- b. 3 to 5 tons
- c. 6 to 8 tons
- d. More the 8 tons
- e. None

Q13. Would you use firewood if you have another option?

- a. Yes
- b. No

Q14. Are there any valuable medicinal plants in your area?

- a. Yes
- b. No

Q15. Do you use the medicinal plants in any way?

- a. Yes
- b. No

Q16. Where do you dispose your garbage?

- a. Near your houses
- b. In water stream
- c. At dumping site
- d. Any other

Q17. Do you burn your garbage?

- a. Yes
- b. No

Q18. Does the government facilitate a separate place for dumping waste in your area?

- a. Yes
- b. No

Q19. Does any municipal agency visit your area for collection of waste?

- a. Yes
- b. No

Part 3: Response and awareness

Q20. Do you have the knowledge about ecological services/resources present in your area?

- a. Yes
- b. No

Q21. Do you believe these ecological resources are being overused by the residents?

- a. Yes
- b. No

Q22. Do you prefer plantation for ecological progress in Saidpur?

- a. Yes
- b. No

Q23. Are you determined to protect these valuable ecological resources?

- a. Yes
- b. No

Q24. Can you cooperate with any governmental and non-governmental agency for protecting your ecosystem?

- a. Yes
- b. No

Q25. How much you are willing to pay to protect your surrounding ecosystem?

- a. Less than Rs. 500
- b. Less than Rs. 1000
- c. Less than Rs. 1500
- d. More than Rs. 1500
- e. None

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