BTTAP Grazing Restriction and Livestock Productivity: A Case Study of Hazara Region

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CERTIFICATE

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ABSTRACT

The BTTAP is designed to implement "Green Growth Initiative" in forestry division of the province by forest department of Khyber Pakhtunkhwa in 2014 and ended in 2020. Hazara region is one of the largest regions where this project executed because this region has both territorial area and watersheds. The 90 percent population of Hazara division is living in rural areas and directly dependent on forest base products. People use forest resources for their animal grazing, timber for furniture and wood for energy purpose. We purposely selected three larger districts Abbottabad, Mansehra and Haripur of Hazara Division. We used "primary data" collected through questionnaire-based survey. The 10 villages (4 from the Mansehra district and 3 from each Abbottabad district and Haripur district) and 150 respondents selected from the study area where grazing restriction has been imposed. We used OLS log-linear model on our data to estimate the impact of grazing restriction on the herd size and animal-based nutrients (milk and meat). Our results demonstrated that the herd size has been decline (37.4% goat and 33.9% cow) after the restriction in the study area. Monthly fodder cost per animal has increased by Rs.347 and Rs.618 for goat and cow respectively after the restriction. Our results demonstrated that there is 8.7% and 23.5% decline noticed in the monthly consumption of milk and meat respectively after the grazing restriction. Study also aimed to investigate the economic feasibility and environmental benefits of the project. People used goats' milk for domestic and cows' milk for commercial purposes. Cost and benefit of the project is calculated by converting all the benefits and costs into present value. The benefit cost ratio of the project is 1.7 and the value of internal rate of return (IRR) of the project is 7%.

Key words: Green growth, Forestry division, Grazing restriction, Hazara, Khyber Pakhtunkhwa.

TABLE OF CONTENTS

List of tables

List of Abbreviations

BTTAP	Billion Tree Tsunami Afforestation Project
KP	Khyber Pakhtunkhwa
FAO	Food and Agriculture Organization
DBH	Diameter at Breast Height
AGB	Above Ground Biomass
WHO	World health organization
DFO	Divisional Forest Officer
WWF	Worldwide Fund for Nature
GHG	Green House Gases
cm	Centimeter
OLS	Ordinary least square
BCR	Benefit-cost ratio
NPV	Net present value
IRR	Internal rate of return

INTRODUCTION

1.1 Introduction

Forest covered 30 percent area of the global land (which are approximately 3.8 billion hectares) in 2005, which has slightly increased up to 31 percent (which are 3.9 billon hectares) in recent times (FAO, 2020). Climate change is a threat to global economy and a big challenge for world. Greenhouse gases are major contributor in climate change and CO_2 is important factor of greenhouse gases. In all over the world, approximately 1.6 billion people are dependent on the forests for livelihood (FAO, 2020).The planted forest is on increasing trend while the natural forest area has declined in the last two decades (Keenan et al., 2015) . The rapid economic and agricultural development caused immense pressure on forest cover, meanwhile forest resources continue to play significant role in ensuring food security among rural household communities in the developing nations (Angelsen et al., 2014).

In the Asia, Pakistan is counted in highly populated Countries with relatively less forest covered round about 5% of its total land (Nazir & Olabisi, 2015). According to (Ahmed & Long, 2013) in Pakistan almost half of the CO_2 emissions generated by natural gas. There are different ways to mitigate or reduce the CO_2 emissions and the cost of sequestration through forest or other land management is relatively lower than the other methods to co2 emissions reduction. According to some scientific studies co2 emissions have some positive impacts such as forest productivity (Keutgen & Chen, 2001).

United Nations gives framework under Kyoto Protocol (1997) which have the main purpose to reduction in climate change through managing carbon market and invest on emissions. Clean development mechanism is one article of Kyoto Protocol. After that agreement as a result many national utilities and private companies invest in forestry sector. In Pakistan, the population expansion, poor governance, and the economic instability contributed in sustaining the ecosystem of the earth desperately and the ecosystem has undergone in the huge destruction in current decades (Liu et al., 2012). In 2014, the Khyber Pakhtunkhwa province of Pakistan launched a Billion-Tree Tsunami Afforestation Project (BTTAP) and this project completed in August 2017 under the recommendations of Khyber Pakhtunkhwa Forest ordinance 2002 and forest policy. The objective of this project was to push the green growth initiative, livelihood, and livestock in the rural area, and mitigate the impact of climate change.

The plantation of forests and planting new trees are well established by the public and private sectors. According to the report by Food and Agriculture Organization, it is stated that up to 2010 planted area covered only 7% of global forest (FAO, 2016b).The new projects of the plantation are established at different locations and areas that were not covered under forest before to satisfy the timber products demand and mitigate the climate change effect (McEwan et al., 2020). The increasing trend of the planting trees has greatly contributed to the forested agriculture land and plantation forests were, and continue to be, established to satisfy increasing global demand for timber products (FAO, 2009, 2016a).

Under specific conditions, the increasing plantations are expected to enhance capacity of sequestration of CO_2 as compared to existing natural forests. The regenerating forests or newly planted trees have ability to keep the sequestering of carbon for 20 to 50 years or more than 50 years in undisturbed environment. Tree plantation has yet the limited considerable contribution in declining the CO_2 benchmark in the atmosphere, in the comparison to avoiding the loss of natural forest. Approximately 101 to 106 Giga Tones CO_2 per year can be remove by planting the tree, compares to total global emission of GHG equivalent of 50 GT in 2004 (Kamal et al., 2019).

The development of REDD+ (Reducing emissions from deforestation, degradation, sustainable forest management, conservation and enhancement of carbon stocks in the forests) as the vital apparatus and forest-based climate change mitigation in under developed nations imposes the reliable assessment of total biomass of standup plants in the jungle (Agrawal et al., 2011). The exactness of biomass evaluations depends upon the availability of trustworthy algometric models to deduce the oven-dry biomass of trees from forest catalogue data (Chave et al., 2014). Regression used to guess the biomass of standup trees depend upon numerous variables containing diameter at breast height (DBH), total tree height (ht), crown diameter and wood density in given site. Furthermore, the involvement of these variables to the above ground biomass (AGB) diverges from location to location, stand structure, disorder level and species structure (Whitmore, 1984).

However far-reaching studies have directed to develop the (Brown, 1997; Chave et al., 2005; Litton & Boone Kauffman, 2008), minute work has been done for tree species of Temperature Mounts.

1.2 Background

In the recent time, various countries all over the world have started the forest tree plantation in their respective region; the aim is to mitigate the impact of global warming. For example, the Chinese government more than 60,000 arms men reassigned superficially to plant the tree and to increase the forest of the nations and they want to be covered round about 84,000 KMs Square of trees before 2018 is over. The main objective of the campaign is to increase the inclusion of nation’s forest from 21 percent up to 23 percent of its aggregate landmass by 2020. It is further stated by China Forestry Administration officer that country is targeting to expand forest area up to 26 percent by 2035 (Campbell, 2014). . On the National Tree Plantation Campaign and Tree

Fair event in 2018, the government has reported that three million trees planted in all over the country (Xinhua, 2018). In India the volunteers planted 66 million trees in 12 hours only in 2017 and they submitted in the Paris Agreement, to expand the forest land through five 5 million hectares by 2030 to mitigate the climate change impacts (Baynes, 2017).

In 2014, the Khyber Pakhtunkhwa province of Pakistan launched a billion-tree tsunami afforestation project (BTTAP) under the recommendations of Khyber Pakhtunkhwa Forest ordinance 2002 and forest policy and is completed in Nov 2017. This project was design to contribute in the forestry of KP Province and to expand the green growth initiative (WWF, 2016, 2017). The main objective of BTTAP was to contribute in the controlling the major effects of climate change in Pakistan, which ranks 7th most vulnerable country in the world to the climate change (WWF, 2016). Pakistan is 6th most populous country which have almost 5.7 percent growth rate. Area under forest cover in Pakistan is almost 5% (Nazir & Olabisi, 2015), but according to international standard it is necessary for every country have almost 25% area under forest. Khyber Pakhtunkhwa is the province of Pakistan located in northwestern region along the Afghanistan border. In 2014 Khyber Pakhtunkhwa government launch a billion-tree tsunami project. The main objective of this BTAAP is to encourage the green growth. Under the project afforestation rate is 40% and other 60% was regenerated. More than 27 types of species are planted. Under this project government invest 126 million dollar and allocate 100 million dollars for maintain the project till 2020. This project is very helpful for fight against climate change. No doubt by this project there are some social and economic benefits like improve health, job creation, environment protection. The BTTAP covered the area about 150 million hectares of degraded land and deforested in to new forest and restoration by 2020, and 350 million hectares by 2030 (Kamal et al., 2019). These forests are expected to contribute to the livelihood by promoting livestock in the rural communities.

Livestock is the sub-sector of agriculture sector and playing important role in rural economies of under developing countries like Pakistan (Randhawa et al., 2018). Majority of small holder formers are using the forests for the livelihoods and they draw a significant part of their income from the forests (Wunder et al., 2014). Forests supply broad range of goods and services and are the major source of the livelihoods for the people in developing countries (Ali, 2018). In these developing countries, forests are playing a significant role in poverty alleviation and reducing income inequality. One of the important services that forest provide is animal feed which is a rich source of protein and nutrients for livestock. In Pakistan, the total forest sector is contributed 0.43 percent to GDP (Ali, 2018; WB, 2019). Globally, on the agriculture land livestock is the largest user. Livestock consume the major part of agricultural yield (FAO, 2018).

In the developing countries the livestock sector contributes to almost 40 % of total agriculture output. Approximately, livestock contribute 34% to the global food protein supply (FAO, 2019). In the developing countries like Pakistan livestock production is playing an important and significant role in the farmer’s life. Pakistan livestock sector contributed 11.8% to the GDP and 56.3% value added to agriculture sector in the year of 2014–15. Similarly, in 2014–15 the livestock gross value addition was highly increase to Rs.803 billion from Rs.778.3 billion. Livestock is the source of foreign earnings, and it is also playing a major role in the economic development.

The livestock sector provides meat, eggs, and milk for domestic use which are rich source of energy and protein. Pakistan is among the World’s largest milk producer and ranked at 3rd position in milk production (BizVibe, 2020). Globally, 750 million people are engaged in production of milk. In 2018 World milk production recorded 838 million tons (82% cow milk, 14% buffalo milk, 2% goat milk and 1% sheep milk) in 2018 (Sattar, 2020). Pakistan has 44.4 million cattle producing 20 billion liters of milk yearly and 37.7 million buffaloes with annual milk production of 34 billion liters (Tahir et al., 2019). The demand of meat and milk has significantly increased during the last decades mainly due to rapid economic growth, increase in population, increase in industrialization, rapid urbanization and changing the knowledge and lifestyles of the people for the diet (FAO, 2017). According to Pakistan Economic Survey 2020 – 21, the total meat production is 4955 thousand tons. More than 8 million households are engaged in raising livestock in the rural area and driving more 35-40% of their income from this source. The livestock sector is strengthening the socioeconomic condition of landless rural poor and small farmers and plays the significant role in the poverty alleviation. The beef production is 2380 thousand tons and 765 thousand tons is mutton production (PES, 2020-21).

In the KP most of the people are dependent on the forest for the livelihoods and livestock. BTTAP launched by the KP government in 2014. Different communities are facing various issues related to the grazing of the animals on communal based forest because restriction imposed after the execution of this project. It has created problem of feed and fodder for animals-affecting the animal productivity. People in Hazara Region of Khyber Pakhtunkhwa are mostly linked with forest in different ways, either their houses are located in forest area or for their livelihood. The local people of the community use forest products for domestic purposes (dry wood, medicinal plants etc.) and sold out these products in the markets to improve their livelihood. The community has a lifestyle of keeping animals as pets or for earning purpose. In this community pets' animals include Goats, Sheep, and Cows. As the mountains are full of lash green grass but people can get economic and environmental benefits of this eco system. In normal practice, animals are taken to the mountains for grazing as it has high cost of feeding at home when it comes to collective care and cost. After grazing for hours and hours, these animals are brought back to home at evening time and milked properly for sale purpose, sometime family size is larger, and it is milked for only family consumption. But if there is no animal at home people buy milk and meat from the market. The cost of purchasing milk and meat has increased in last few years because the government of KP has imposed restriction on grazing cows, goats, and sheep in the community forest to maintain plantation and to get maximum environmental benefits out of it. Although forest has positive impacts on the environment, livelihood, and livestock in the rural community of the various countries but in case of Pakistan it has been restricted to environmental benefits only.

Problem statement

The plantation of tree under BTTAP and their care has several implications for community living nearby the forest area. The restriction by government official from grazing the goats and cows, has seriously affected the prices of those nutritional products, which were free before the execution of project. Moreover, limited access of the local community has reduced the access to medicinal plants which has increased health expenditure of local community. The restriction of livestock to natural forest has vanished the opportunity to save capital in the form of livestock because cost of raising animal has significantly increased. The government restriction for grazing animal in the forest has adversely affected the prices of livestock based nutritional product among communities living near the forests. The livestock is not only the source of income generation but also a rich source of nutrition for the owner’s family.

Significance of the study

Various studies have been conducted to explain the afforestation impacts on livelihoods, livestock, milk and meat production and its contribution to the GDP. However, little information is available about restrictions on grazing land and its impacts on livestock production and nutrition prices. The contribution of present research is expected to be significant in term of forest protection and its impact on community welfare. The welfare of community is expected to decrease in the short run but may increase in the future (long run) because of the study area dynamics. People are looking after their livestock as an asset but due to grazing restrictions, the rate of livestock keeping has declined. This study aimed to explore the impact of grazing restriction due to BTTAP on livestock holding, milk, and meat production and the economic analysis of the project in study area.

1.3 Research Question

1. What is the impact of billion tree tsunami project on livestock size as capital in Hazara region?
2. Does the restriction on grazing has decreased the consumption of livestock-based nutrition in the study area?
3. What types of cost bare by the society and the benefits of this projects?

1.4 Objectives of the study

In the light of above discussion, the objectives of the study are:

1. To find out impact of grazing restriction on herd size (number of livestock) in the family as capital in the region.
2. To estimate the impact of grazing restriction on the prices of milk and meat in the rural areas of Hazara Region.
3. To do Cost-Benefit Analysis of the Billion Tree Tsunami Afforestation Project (BTTAP), to estimate project's viability.

1.5 Organization of the Study

This study consists of five chapters. Introduction given in first chapter. The 2nd chapter of the study contains Literature Review. 3rd chapter consists of study area & data collection, sampling techniques and methodology, which is to be used for findings of the study. 4th chapter of the study consists of Results and Discussions. In this chapter we will be discussing the results in detail. The conclusion and the policy recommendation are given in the 5th chapter of this study.

CHAPTER 2

LITERATURE REVIEW

The views of previous studies about the restriction on grazing in forests or mountains and its impact on livelihood, herd size and nutrition are included in this chapter. The change in quantity and price of livestock-based nutrients in restricted area is also examined in these studies. This chapter also explores the impact of afforestation on livestock in the rural community.

(Alkan & Ugur, 2015) established a study on view of hair goat breeders concerning nomadic liv0estock and forestry. Objective to find the opinions and expectations of goat's breeders' especially nomadic livestock breeding and who carried out this activity about forestry and livestock and how to develop these two-sector investigated. Questionnaire based survey conducted from 121 goat breeders across the 46 villages. The alpha method was used to analyze the relation between livestock and forestry. Results of this study indicate that the number of goats in this area decreased due to low price of milk and meat and high prices of inputs feed and other inputs. Negative relation between livestock and forestry is the main reason of stock contraction. The higher livestock breeding perception is related to the forest and restriction on grazing of goats in the forest has adverse impact on views and perception of locals regarding to the forest.

(Gurung et al., 2009) established a study to determine the effect of grazing restriction on livestock. Objective of study to identify the pressure of livestock on available resources, alternative used by the people and survey-based opinions of locals regarding to the limitation on grazing around Chitwan National Parked, Nepal. Questionnaire based survey conducted to obtain information about the perception of policies, stock of animals, seasonal husbandry and fodder cutting.

Published government record used to estimate the pressure on available fodder. 7700 households listed in four VDCs of Madi Valley. Four hundred household sampled evenly from population.

Fodder supply and demand were calculated in term of total digestive nutrition's (TDN). Livestock standard unit (LSU) per year used to estimate the livestock grazing pressure on available resources. Most of the people approved the restriction but number of livestock per household changed due to the restriction policies. In the valley people shifted from grazing to "stall feeding" but still high pressure on grazing land. Higher "stall feeding" helps to decrease the pressure on grazing and increases the forest area but increased demand of fodder cutting also raise potential human/wildlife interaction. (Hazari & Kumar, 2003) conduct the study on ban of grazing livestock in India. The main purpose of the study to analysis the structure of household's livestock, by using a model the first order derivative and second order derivative for profit maximization on the based household behavior. The results revealed that the relationship between the landholder and livestock are significant because landholding is play very important role in the livestock structure of the household. On the other side the policy of restriction on the grazing livestock negatively affects the caste groups and ban are eliminating the goats and sheep's due to restrictions of the government and the income of these group are affected inversely because the caste group are dependent on grazing. (Hu et al., 2019) has analyses the impact ecological and grassland compensation policy on the livestock production of household in China. The objective of the study to find out the effects of the grassland and ecological compensation policy on the livestock such as sheep, cattle, and the prices of livestock. The primary data were collected through stratified random sampling from 36 villages and the fixed effect model was used for the estimation. The results indicate that overall, there is no significant impacts on the total number farm size of livestock due to grazing ban. On the other side in the forage – livestock balance only large farm of livestock is decline in the total number. The large farm sized is affected more as compared to small and medium farm sized due to ban because the small and medium farm sized received the subsidies in the form of incentives.

(Pietikäinen, 2006) studied the overstocking and overgrazing in Babati woodlands, Northern Tanzania. The purpose of the study is that, to study the overgrazing is affect the woodlands or not and to find out the severe problems of the overstocking and overgrazing in the forests. The data collected from the residence of the Babati district through interview and used the secondary data from various sources such as studies and summarized these all data. The finding shows that the grazing land for livestock and managing various livestock is the traditional procedure and there is contribution to Soil erosion by overgrazing among other, for example over-cultivation, deforestation, and poor irrigation. The livestock are decrease due to overgrazing because due to overgrazing imposed the restrictions for controlling.

(Röös et al., 2016) establishes a study in which he designed a method based on principle of ecological leftovers and further assessing the sustainability of such diet. If we want to achieve the environmental objective such as limiting expansion of agriculture land and reducing GHG emissions, we must need to curb the overconsumption of resource- demanding foods. Since western world is a high consumer of protein containing food in which a large portion is served by animal-based products. In addition, vegetarian diets are land-demanding and climate impacting. To find a middle way in which we can decide what number of livestock must be compromised to find environmental, economic and social sustainability. The 'ECOLEFT' method was used in which arable land be used for production of food for humans, livestock be fed by biomass not suitable for human consumption and semi natural grassland be used for livestock production. By using this method ECOLEFT diets for Sweden was calculated, Nordic nutrition recommendation must be followed for the human diet to be nutritional adequate. In ECOLEFT diets meat consumption was reduced and consumption of plant-based protein increased in the E-Milk and suckler diet. The country's location offers inadequate lands to produce I-Milk, E-Milk and suckler diet which requires the cultivation of grain legume production which must increases up to 10 folds compare to current production. While the country's soil types, and climatic condition is not feasible to meet such a demand. The approach used in the study for letting the ecological resource capacity to be constraining factor for livestock production, in order to fulfill nutritional requirement and production of these diets still results in environmental impact that causes several planetary boundaries to be transgressed.

Traditionally, countryside smallholders in developing nations have been viewed mostly as farmers, principally cultivating crops and raising livestock for their livelihoods e.g., (Zuckerman, 1977). It therefore amounted to almost a revolutionary finding when researchers and improvement policy circles started to understand that off-farm earnings were becoming ample more essential and even offsetting farm income in many smallholder sets, such that rural households progressively profited from wage-employment in agriculture, mining, or service sectors and small business enterprises (Holden et al., 2004), (De Janvry & Sadoulet, 2001), (Reardon et al., 2000). Correspondingly, allowances from permanently or temporarily migrated family members can further decrease the economic dependence of smallholders on farming (Barrett et al., 2001). Smallholders were thus not just simple farmers, but economic mediators hunting diversified livelihood strategies (Ellis, 2000).

Instantaneously, proof also mounted that rural households produce high "environmental revenues," i.e., cash- or subsistence-based assistances from non-cultivated plots such as natural forests, mangroves, bush, rivers, or other wild lands. Most income from forest is environmentally sourced (i.e., a "subsidy from nature" with low management intensities), but plantation forestry is excluded. A case study in Zimbabwe using quarterly surveys for household income accounting discovered high household dependency on environmental sources, and thus inspired other studies, including the PEN project which replicates this type of household income accounting across the developing world (Cavendish, 2003). Wide references to the growing forest and environmental income literature are provided by (Angelsen et al., 2014). In other words, the confirmation so far, overwhelmed though it is by mechanical problems and discrepancies in the underlying case studies (Vedeld & Angelsen, 2004) has pointed to a substantial "subsidy from nature" (Anderson et al., 1991) into rural economies.

A major part of this literature pointed to the possibility that forests and wild lands are predominantly important as resources to rural tenants for avoiding falling into (deeper) paucity, not only as security nets in reply to (unforeseen) jolts such as family illness, bad harvests, etc. (McSweeney, 2004), but also as periodic gap-fillers throughout (foreseeable) income slack periods, such as between agricultural harvests (De Beer & McDermott, 1989), and (Angelsen & Wunder, 2003).

According to a third possible use discovered, environmental resources may potentially act as a steppingstone out of poverty (Angelsen & Wunder, 2003). While there have been instances of forest products being utilised to create riches, the overall consensus seems to be that this is uncommon (Belcher et al., 2005) and (Neumann & Hirsch, 2000).

Several characteristics that draw persons to environmental resources are also found in other people. Finally, extraction of ecological resource can reduce the resource base, environmental services biodiversity. First, this can create tradeoffs between current and upcoming extractive incomes, and rural families' asset-building policies can help understand poverty dynamics (Nielsen et al., 2012). Second, negative externalities for society at large can be created by degradation; even low extractive earnings could go hand in hand with unequal damage to threatened species and habitats (Arnold & Pérez, 2001). Contrariwise, degradation fears may justify exterior conditional compensations to smallholders for preserving rather than degrading ecological services, perhaps generating a new locomotive for forest-based livelihood assistances e.g., (Dewees et al., 2010). Therefore, if environmental resources and natural forest from wild lands are so vital to households in their daily livelihoods, and even more important in periods of income deficits, has the gradual exposure of this "hidden harvest" (Scoones et al., 1992) also attracted the attention of development experts? Has it changed their strategies and perceptions, comparable to the paradigm swing we have seen in the wake of the off-farm income finding?

So far, this "discovery of the wild" has not really occurred. Environmental income remains broadly ignored by policymakers in their strategies regarding to poverty reduction (Oksanen & Mersmann, 2003). National accounting systems in many countries lump forestry under agriculture in their national income calculations (McConnell, 2008), while other—perhaps most—environmental income may not be counted at all. In most household surveys representing population, such as Living Standards Measurement Surveys (LSMS), material on forestry and environmental revenue is often very narrow, at best containing only questions on fodder, fuel, or building materials. Giving limited attention to, or ignoring environmental income in such surveys may lead to the underestimation of total household incomes, by understating the value of the environment to rural households (PROFOR, 2008), (Vedeld & Angelsen, 2004), thus also skewing our understanding of the generation and distribution of wealth within the rural economy (Fisher, 2004).

(Dong et al., 2007) aiming to identify the attitude of stakeholders towards Grassland Ban Policy (GBP), beliefs about the environmental condition of grasslands and to consider its improvement and implementation of GBP. A total of 40 counties were selected in April-October 2004 using mail survey questionnaire, respondents were farming household, extension workers and local officials. Farmers claimed that they had been negatively influenced by these changes and urged to mitigate the degradation of grasslands. Local officials indicated that grassland degradation caused by overexploitation of grasslands resources accelerate by climate changes. Farmer's response for the rejection of GBP was most often because of difficulty in obtaining new feed resources. Extension worker's response did not differ as the main cause of grassland degradation was overgrazing followed by climate change, over farming, land reclamation and other human activities.

(Levers et al., 2014) developed various schemes to identify the use of biomass and for increasing forest protection. European forest information scenario model applied in the study for 26 countries. The impact was assessing by analyzing by impact on provisioning and other services for the period 2010 to 2030. Study found that round wood, residue, and stump biomass production could be strengthened, but there are trade-offs with non-marketed ecosystem services. Growing biomass production could lead to a net societal benefit in 2030. However, larger benefits would be attained within Europe if forest biodiversity protection is improved.

(Yao, Piao, & Wang, 2018) examine the future forecast the capacity of carbon sequestration of China forest. The main findings of that study is that by rising of forest age, climate change and co2 concentration the impact positively on forest biomass because of the selection of effective tree species.

(Siraj, 2017) examine that the carbon sequestration potential of tree species in Arsi Nagelle forest wield life of Gambo district. It was observed that Grevillea Robusta have the maximum capacity of carbon sequestration as well as having highest survival capacity. So, author recommend the

Grevillea robusta for carbon sink.

(City, 2001) investigate that the carbon sequestration potential of flora tree around the Pune city. The result shows that the flora tree sequestrates only 2% of carbon emission. Anogeissus latifolia is better than Eucalyptus, Acacia auriculiformis because of its potential and can serve as the promising candidate for future afforestation programs. It is also fire resistant and can indirectly help in checking and spreading of forest fires and subsequent release of carbon in atmosphere due to trash burning.

(Richards & Stokes, 2004) studied that carbon sequestration cost of the several past dozens of years that have evaluated the cost effectiveness of the forestry options. Results shows that the 40 percent of 1990 US emissions could be reduced through forest programs with marginal costs of less than 60 dollars per ton.

(Albrecht & Kandji, 2003) investigate the carbon storage capacity of agro forestry system and that they can play for reducing the co2. Also indicate that agroforestry can take an important role fir sequestrate the carbon. Through agroforestry the soil sequestrates the carbon.

(Jong, Tipper, & Montoya-go, 2000) estimate the cost of incentives to famers for carbon sequestration through agro forestry. The management of natural forests and secondary vegetation will therefore be the most important element of any large-scale carbon sequestration program in Chiapas.

(Suryawanshi, Patil, & Sciences, 2014) investigate that to what extent the university relay on the selected tress can sequestrate the carbon.

(Lemma, Kleja, Nilsson, & Olsson, 2006) investigate those Tropical rainforests have the highest above-ground biomass carbon sequestration potential (IPCC).

(Zhou et al., 2018) Forest vegetation is a major ecosystem and provide low-cost options to mitigate climate change.

Research Gap

In the light of above literature, there were fewer studies to explore the impact of the grazing restrictions on the herd size of a household. With the best of my knowledge the economic evaluation for the community-based forest has not been done for rural community. The impact of the grazing restriction on livestock & livelihood of rural community and economic analysis of Billion Tree Tsunami Afforestation project has been analyzed in this study. This research focused on the livelihood of locals living in the rural area of Hazara Division depending on the communitybased forest as grazing source for their goats & cows directly. Moreover, the cost and benefits from the trees planted in communal land or community-based forest also examined.

CHAPTER 3

DATA AND RESEARCH METHODOLGY

This chapter aims to solve the research problem and it is divided in to three sections. The study area and data collection discussed in 1st section. In 2nd section the description of sampling technique is given, and 3rd section of this chapter describes the research methodology.

3.1 Study Area and Data Collection

Study area comprised of the communal based forest and grazing land in the Hazara division where forest department has done plantation through seed sowing, dibbling and woodlots. The BTTAP is implemented by Forest Department of Khyber Pakhtunkhwa in the entire province. In this project there are three forest regions i.e., Southern and Central region, Malakand region and Hazara region. Hazara region also includes the Watershed Management Circle (WWF 2016). Region wise record of plantation taken from the consolidated physical and financial reports by forest division of KP after every phase. According to WWF report 2016, Hazara region and hazara watershed areas collectively are at top where plantation through has been done under this project.

Hazara region is mostly comprises of hilly areas. People keep goats and cows as pets for milking and other nutritional purpose. The weather is cold in winter, and snow falls on mountains. In summer weather condition remains moderate and heavy rain falls in monsoon season. People depend highly on forest resources for food and fodder purposes. People use wood for cooking and heating in most of the areas of Hazara Division. Forests are used as pastorals and livestock productivity is directly related with the availability of pasture lands for grazing in the region.

Our study is based on primary data, which has been collected through questionnaire from the study area. We have selected four villages Hadobandi, Mandhar, Attar Sheesha and Phagla from the

Mansehra district, three villages Bakot, Moolia and Hotrol from Abbottabad district and three villages Dhinda, Jagal and Sarri from Haripur district as our study area. The data of this research is cross sectional. The study aims to compare the present number of livestock and livestock-based nutrients i.e. milk and meat consumption (after the implementation of the project i.e. when restriction is imposed) with the situation when there was no restriction on grazing (before the implementation of the project).

3.2 Sampling Technique

This research is based on two groups with (after the implementation of the project i.e. also named as treated) and without (before the implementation of the project i.e. also named as non-treated). The data has been taken from the selected villages, where the government officials have banned grazing of cows, goats and sheep on mountains and community-based forest. Through recall-based survey we asked about the number of animals they own before and after the restrictions and similarly about the milk and meat consumption. We use multistage sampling technique. At the first stage we purposely selected three districts i.e. Abbottabad, Mansehra and Haripur with major population share in Hazara Division. The BTTAP project is implemented through village development committees (VDC) which was formulated based on the size of the population. So, at the second stage we selected VDCs randomly from each district. The number of VDC in each district were selected based on the total population. Higher the VDCs in a district means larger the number of negheban (caretaker) for grazing restrictions. Population data is taken from census report 2017(PBS, 2017) and VDCs stats taken from the official website of the KP government (G. KPK, 2017). We selected total of 150 respondents from 10 VDCs. Finally, we randomly selected 15 respondents from each VDC.

Table 3.1: Data Sampling

District	Population as per 2017 Census	Village Council (VDCs)/ Selected VDCs	No. of respondents
Abbottabad	1332912	209/3	45
Mansehra	1556460	194/4	60
Haripur	1003031	180/3	45

3.3 Research Methodology

This section of study discussed that how we established the different models to explore the relationship between our dependent and independent variables. This section is further divided in to three parts. Our 1st part discusses that how we established relationship between our dependent variable (number of animals in a household) and independent variables i.e., daily number of grazing hours, monthly per animal fodder cost and land available to keep animal. In the 2nd part of this section, we tried to establish the relationship between our dependent variables (monthly consumption of milk and monthly consumption of meat) and independent variables i.e., household size, total monthly income, and number of milking animals in a family. We tried to examine that how our dependent variables have affected by the grazing restrictions imposed in the study areas. We used OLS log-linear model to estimate the changes in our dependent variables in percentage form to get more meaningful picture. The change in our dependent variables due to the restriction has been shown in percentage, while we kept our independent variables in linear form. The 3rd part of the study discusses that how we calculated the different determinants for our cost benefit analysis.

3.3.1 Impact of grazing restriction on herd size of a family

The objective was to find the determinants of herd size. Our dependent variable (number of animals in a family) is continuous variable and depends on multiple variables such as household income, land size for keeping animals, size of private grazing lands. We have used log linear model to get changes in percentage form.

$$logTNA = \beta o + \beta 1\ DBNA + \beta 2\ NGH + \beta 3\ LAK + \beta 4 LOFG + \beta 5\ TMIK + \beta 6\ PAFC + \varepsilon t \qquad (1)$$

Where,

βo: Intercept

TNA **:** Total number of animals (Goats and Cows) in a household before and after the restriction.

$DBNA$ **:** Dummy for grazing i.e. if grazing is allowed then dummy=0 and if restriction is imposed then the value of dummy=1

NGH **:** Number of Grazing Hours (Daily)

LAK **:** Land available adjacent to the house in Marla to keep animals

LOFG= Land Ownership for Grazing in Marla

$TMIK$ **:** Total monthly income in Thousand PKR.

$PAFC$ **:** Per animal monthly fodder cost in PKR.

3.3.2 Impact of grazing restriction on monthly consumption of milk and meat of a family

Livestock products are important part of human consumption and rich source of vitamins.

Therefore, it is important to investigate the how grazing restrictions has impacted the milk and meat consumption. The impact of grazing restriction of milk and meat examined separately as the consumption of both commodities depend on different factors. Milk and meat consumption has strong relation with their prices. However, prices could either increase due to restriction on grazing or due to inflation. In order to differentiate the impact of restrictions and inflation on milk and meat consumption we develop two dummies (Dummy for increase in price due to restriction if yes then 1, otherwise 0 and same for inflation) based on the respondent's perception.

I. Impact of grazing restriction on monthly consumption of milk

First we attempt to explore the relationship of restriction on milk consumption by employing the OLS model. This model will explore the impact of restriction along with other explanatory variables on consumption of milk. The detail model has been given in Equation 2.

$$logMCM = \beta o + \beta 1\ DBNA + \beta 2NMA + \beta 3TMIK + \beta 4\ \ NIHH + \beta 5\ NAHH + \beta 6DIPMR + DIPMI + \varepsilon t \qquad (2)$$

Where,

βo : Intercept

MCM : Monthly consumption of milk in litters

$DBNA$ **:** Dummy before and after. Before =0, after 1.

NMA **:** Number of milking animals

$TMIK$: Total monthly income in thousand PKR.

$NIHH$: Number of Infants in a Household

$NAHH$: Number of adults in a Household.

$DIPMR$: Dummy Increase in Price of milk due to the grazing Restrictions. Dummy 1= yes, otherwise 0.
$DIPMI$: Dummy Increase in Price of milk due to the Inflation. Dummy 1= yes, otherwise 0.

II. Impact of grazing restriction on monthly consumption of meat

This model examines the effect of restriction on consumption of meat. Monthly consumption of meat depends on total monthly income, number of adult male and number of adult male in the family. The perception of the respondents regarding the meat consumption prior and after the restriction have been considered.

$$logMCMe = \beta o + \beta 1\ DBNA + \beta 2\ TMIK + \beta 3\ NAM + \beta 4\ NAF + \beta 5\ DIMeR + \beta 6\ DIPMeI + \varepsilon t \quad (3)$$

Where,

βo : intercept.

$MCMe$: Monthly consumption of meat in kilograms of a household.

$DBNA$ **:** Dummy before and after. Before =0, after 1.

$TMIK$: Total monthly income of a family in thousand PKR.

NAM : Number of adult males in a family.

NAF : Number of adult females in a family.

$DIMeR$: Dummy Increase in Price of Meat due to the grazing Restrictions. Dummy 1= yes, otherwise 0.

$DIPMeI$: Dummy Increase in Price of Meat due to the Inflation. Dummy 1= yes, otherwise 0.

3.3.3 Cost and Benefit Analysis

We also evaluated the BTTAP project by conducting economic evaluation of the project for communal land or community-based forest in Hazara region. There are many types of costs and benefits associated with the execution of this project on communal land or community-based forest. We tried to mainstream some major costs and benefits in our analysis, for this purpose we used both secondary and primary sources to estimate the costs and benefits of this project. Furthermore, we converted the total costs and benefits of the project into the present value to get accurate and meaningful monetary number for our analysis. The benefit cost ratio (BCR) and IRR is estimated to assess the economic feasibility of project. Our monetary unit is million PKR, while hectare is taken as unit of analysis.

The costs incurred on the plantation on communal lands or communal based forest and costs bared by the society have been considered in our analysis. Some major costs incurred while the execution of this project and costs bared by the community are given below.

Costs:

1. Cost of plantation through sowing and dibbling (In three phases)
2. Cost on negheban salary.
3. Opportunity Cost of not grazing the animals.
4. Total loss in the form of decrease in the price of animal at the time of sale.
5. Opportunity cost of sold animals
6. Opportunity cost of the land used for plantation.

These costs calculated in monetary terms. The unit of the costs is million PKR.

Costs from Secondary Source

The cost of plantation, Cost on Rehabilitation of degraded watershed, Cost on Watch & ward, Maintenance & watering and cost on negheban salary taken from the secondary source (BTTAP-Project document PC-I & PC-II).

1. Cost on plantation, cost on rehabilitation of degraded watersheds and Watch & ward cost on communal land

It includes the fixed costs such as cost of seeds, cost of sowing seed and dibbling (woodlots) on communal land or forest, transportation cost, cost on rehabilitation of degraded watershed and Watch & Ward cost for communal land or forest in Hazara region. Project is executed in three phases. Phase 1 during 2014-2015, Phase 2 during 2015-2016 and Phase 3 during 2017-2020 implemented respectively. Operational cost, maintenance cost (watering cost, watch and ward cost) remained continue up to five years after the plantation. However, seedling cost and plantation cost occurred only once at the time plantation. The detail about different costs has been well documented by the KP government (KPK, 2014-15, 2015-16, 2017). The costs in monetary terms are estimated in million PKR.

2. Cost on Neghebans' Salaries

Neghebans or watchmen appointed by the government to execute the BTTAP efficiently on each enclosure. The neghebans received monthly salary from the government for their sercices. The caretaker was responsible for watering the plants and to watch the plants. Neghebans were also responsible for the protection of plant from the animals, and they did not allow people to graze animals where plantation has been carried out. So strict restriction policy executed through neghebans.

$$CNS = NE * PYS \quad (4)$$

Where,

CNS is total cost on neghebans' salary

NE: Number of enclosures established by the forest department.

PYS: Per year salary of each negheban. We multiply the monthly salary of a negheban with 12 to get the yearly salary of a negheban.

Costs from Primary Data

When restriction on grazing the animals in communal land imposed, in result the community bared different type of costs. We have included the questions related to the opportunity costs associated with grazing, sale of animals and use of communal land in our questionnaire (see Annexure A). The costs associated with the grazing restrictions and animals' sale are hypothetically calculated and detail of each cost has given below. people decided to sell their animals and there was surplus of supply. Among different cost that we considered in the analysis includes, opportunity cost not grazing animals, loss due to decline in price at the time of sale, opportunity cost of sold animal (forgo earning due to selling of animals), and opportunity cost of land. The description of each cost is given below.

3. Opportunity Cost of not Grazing animals on communal based forest

Grazing restrictions increase the fodder cost. Opportunity cost of not grazing is measured by multiplying the average fodder cost per animal with the number of animals dependent on per hectare and area eligible for grazing in hectares.

$$OCNG = AYFC * NAGH * GAH \qquad (5)$$

Where,

$OCNG$: Per year opportunity cost of not grazing the animals in million PKR.

$APYFC$: Fodder cost per animal.
$NAGH$: Number of animals that can be grazed on one hectare.

GAH: Area eligible for grazing in hectares

Eligible area for grazing is the percentage of the total grazing area where animals can climb and return back.

The total opportunity cost of not grazing is different for each phase due to variation in area of plantation in each phase.

4. Total loss in the form of decrease in the price of animal at the time of sale

When all people decided to sell the animals due to restrictions then there was surplus of supply. It leads to significantly decline in prices. If the people sell their animals in normal situation, then they would have get higher prices that could lead to higher profit. The loss on per hectare is estimated by multiplying the number of animals depending one hectare for grazing with the total number of hectare eligible for grazing in each phase. The estimation process has further elaborated as below.

$$TLSA = ATLF * ADH * AHG \tag{6}$$

Where,

TLSA is the total loss on sale of animals in million PKR.

ATLF: Average total loss of a family on sale of animal/animals.

ADH: Animal dependent on one hectare of grazing land.

AHG: Eligible area in hectares on which grazing can be done. The total area of plantation varies for each phase.

The total average loss on sale of animals is not the same for every year because plantation has been made over the years and numbers of hectare for each year are different.

5. Opportunity cost of sold animals

Opportunity cost of the sold animals is measured to assess the forgo benefit that could be attained if animals have not been sold due to the restriction. Opportunity cost of sold goats and cows measured in million PKR separately as milk yields of goat and cow are not same.

$$OCSA = ADH * VMY * TMY * AHG \tag{7}$$

Where,

$OCSA$: Opportunity cost of sold animals.

ADH: Number of animals dependent on one hectare. We estimated the ratio of milking animals in our sample and used the same ratio for the study area i.e. average number of milking animals from total sold animals.

VMY: Value of milk lost (yearly)

AHG: Eligible area in hectares on which grazing can be done.

The average number of sold animals gathered from primary from the primary data collected through questionnaire while other components taken from secondary data.

6. Opportunity cost of land

The opportunity cost of land is calculated by multiplying the land rent (Rs.12355/hectare) with the total number of hectares under plantation. The land rent is continuing to enter in the analysis for the total years of the project and it is considered as a fixed cost. The yearly land per hectare rent of the non-agriculture in the Hazra region is Rs.12355.

Present Value of Total Cost

The present value of total cost has been calculated by the formula

$$Present\ Value\ of\ total\ cost \sum^{20}{}_{t=0} = TC_{20}/(1+r)^{20} \quad (8)$$

Where,

$$t = 0,1,2, \ldots \ldots \ldots \ldots \ldots, 20$$

"0" is the initial year and "20" will be the last year for which a cost incurred. r=

real interest rate 7.25% on September 2021.

Benefits:

There are several benefits of afforestation like carbon sequestration, economic value of tree, timber can be used for furniture and use of wood for fire. We calculated just the carbon sequestration capacity and economic value of tree as wood cutting is not allowed in communal based forest area. Therefore, the benefits of BTTAP are listed below.

1. Per tree Carbon Sequestration capability
2. Economic Value of Standing Trees

The benefit calculated in monetary term and the unit of the benefit is millions PKR.

Benefit from carbon sequestration

The carbon sequestration capacity of a tree calculated by the weight of dry biomass in it. Each tree carried almost 47% of carbon of its total biomass (Ali 2020). Major tree species planted during BTTAP in communal lands are Pinus Roxburghii (Chirpine), Eucalyptus, Cedrus Deodara (Deodar), Pinus Wallichiana (Kail), Acacia Modesta (Phulai), Acacia Nilotica (Kikar) and Robinea. Sequestration rate in tons for each species in each year has been taken from a publication "Biomass and Carbon Tables for Major Tree Species of Khyber Pakhtunkhwa" in 2020 (Ali, 2020). We used the same carbon table presented by Anwar Ali in our study for each specie's growth and sequestration capacity after every year. The carbon sequestration rate for each specie for every year is calculated and the benefit from the carbon sequestration is presented in this study. Regression model selected for each specie depending upon its nature weather its conifer or broad leave. According to the study all tree species measured by the identical method. Diameter at breath height (DBH) and total tree height of sample tree measured before flooring. Age of tree calculated through counting of annual rings on stump. Moreover, stand form, stand density, altitude, aspect and coordinates were also documented with the help of GPS. Different models tested to calculate the biomass of all species listed above, the best yielded model (power law combined) used by the author for the estimation of all species is given below.

$$M = a(D^2H)^b \qquad (9)$$

Where

M = Dry biomass of a tree in Kg.

D = Diameter at Breast height in cm.

H = Total height of tree in meter.

a = Regression constant. b =

Regression coefficient.

The monetary value of per ton carbon stock is \$36.4 for Asian countries. The dollar value converted into PKR. The number of trees planted and area in hectares in each phase are different so we calculated the carbon stock for each phase separately according to the survival rate of plantation for that phase. The value of carbon stock for each phase will be in million PKR.

Economic Value of Standing Trees

The economic value of tree calculated for each species. To calculate the economic volume of a tree in cubic foot we converted the DBH in cm and height in meters to feet. The economic value or price of wood of a standing tree in cubic foot for each specie taken from the DFO kunhar and Unhar (Hazara Reigon) office. The formula use to find out the volume of a tree is given below.

$$V = \pi R^2 H \tag{10}$$

Where
V = Volume of tree π

= 3.14

R = Radius of the tree in foot. Radius obtained by dividing diameter in feet with 2.

H = Height in feet. Height in feet obtained by converting height in meter to height in foot.

Volume of a tree increased with the growth of tree after every year.

Economic value of a tree is the product of volume and price of a stand up tree for particular specie in cubic foot.

$$EV = V * P \tag{11}$$

Where,

EV = Economic value

V = Volume of tree in cubic feet

P = Price of standing tree given by forest department.

We calculated the economic value of a tree for each specie separately. The total economic value of trees in every phase obtained by adding the values of all species in that particular phase and converted in to million PKR.

The price of cubic foot standing tree for different species is given below.

Deodar = Rs 650 cubic foot

Chirpine = Rs 350 cubic foot

Kail = Rs 450 cubic foot

Eucalyptus, Kikar, Robinia etc = Rs 300 cubic foot.

Present Value of Total Benefit

The present value of total benefit has been calculated by the formula.

$$Present\ Value\ of\ total\ benefit\ \sum^{20}{}_{t=0} = TB_{20}/(1+r)^{20} \qquad (12)$$

Where t= 0……………..20

"0" is the initial year and "20" will be the last year from which a will be attained.

Benefit- Cost Ratio:

$$Benefit\ to\ Cost\ Ratio = PVTBn/PVTCn \qquad (13)$$

PVTBn is the present value of total benefits over the years.

PVTCn is the present value of total costs in over of years.

Divide the estimated benefit by the estimated cost, which will give a benefit-to-cost ratio. If this ratio is greater than 1, it means that the choice is profitable. If the ratio is less than 1, it means that the choice will not be profitable.

Internal Rate of Return (IRR)

The internal rate of is the rate of return on a project. If the value of IRR is greater than the present interest rate it endorses that we should have to invest in that project instead of keeping money in bank. If the value of IRR value of a project is less than the interest rate, then saving money is better option than investing in that project. The present interest rate is 7% per annum.

Cut-off point

Cut-off point in cost benefit analysis is that year in which total benefit become greater than total cost. This study will estimate the cut-off point of BTTAP.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Descriptive Analysis

This chapter demonstrates evidence-based analysis of the models based on primary data. In descriptive analysis the change in the dependent variables (herd size, consumption of milk and consumption of milk) is measured after the restriction. The separated two group situation is used by creating the dummy before restriction and after restriction for our dependent variables. The two-group having same respondents, for before restriction "Group 0" with dummy value = 0 and for after restriction "Group 1" with dummy value = 1. The impact of grazing restrictions on our dependent variables assessed by applying the t – test with dummy before restriction and after. Descriptive analysis demonstrates the results of t – test for each model. Our unit of analysis will be family in all three models.

4.1.1 Number of Animals before and after the Restriction

Number of animals in a family is dependent variable in our first model. Number of animals included the number of goats and cows. We employed t – test to examine the change in number of animals in a family after the restriction. The results in Table 4.1 demonstrate how grazing restriction have affected the number of goats and cows in a family. Our results showed that on average there were 3.2 goats and 2.25 cows in a family before the grazing restriction. The average number for goats and cows recorded as 2.02 and 1.53 respectively after the restriction. The number of goats and cows in family decline by 1.18 goats and 0.72 cows respectively. Our results shown that the number of goats in a family has declined by 37% and number of cows has declined by 32% after the restriction and results are statistically significant at 1% level of significance. So, we rejected the null hypothesis and accepted the alternative hypothesis.

Table 4.1: T- test for number of Animals

Group	Number of Goats			Number of Cows		
	Mean	Min	Max	Mean	Min	Max
Animal Before Restriction	3.20	0	12	2.25	0	6
Animal After Restriction	2.02	0	09	1.53	0	4
Difference	**1.18**	-	-	**0.72**	-	-

Group 0 is the number of animals before the restriction has dummy 0 and group 1 is the number of animals after the restriction has dummy 1.

Difference= mean (0) - mean (1)

The grazing restriction may also affect the per animal fodder cost. We also try to examine how monthly per animal fodder cost of a family changed due to the restriction as grazing was allowed in forest and communal before plantation. We applied t – test on per animal fodder cost and results shown in below Table 4.2.

Table 4.2: T- test for per Animal Fodder Cost

Group	Per goat fodder cost			Per Cow fodder cost		
	Mean	Min	Max	Mean	Min	Max
Before restriction (0)	639	0	700	1181	0	1300
After Restriction (1)	987	0	1200	1799	0	2000
Difference	**-348**	-	-	**- 618**	-	-

"Group 0" = monthly consumption of milk in litters before restriction, dummy= 0. "Group 1" = monthly consumption in litters after the restriction, dummy= 1. Difference= mean (0) - mean (1)

Average per animal fodder cost were Rs.639 for goat and Rs.1181 for cow of a family before the grazing restriction. The average fodder cost for a goat and cow recorded as Rs.987 and Rs.1799 respectively after the restriction. The average fodder cost for goat and cow of family increases by Rs.348 and Rs.618 respectively. Our results shown that per animal fodder cost of a family has significantly increased 55% for goats and 52.3% for cows after the restriction and results are highly significant at 1%. So, we rejected the null hypothesis and accepted the alternative hypothesis.

4.1.2 Monthly consumption of milk before and after the grazing restriction

Monthly consumption of milk is our dependent variable in second model and depends on the herd size of a family. So, here we try to investigate that how monthly consumption of milk effected by the grazing restriction. The t – test applied on monthly consumption of milk and results in Table

4.3 demonstrates that the average milk consumption of a family before the grazing restriction was 50Litters/month and after the restriction its 43Litters/month. Milk consumption of a family has significantly declined by 15% (7Litters) after the grazing restriction and results are highly significant (1%). So we rejected the null hypothesis and accepted the alternative hypothesis.

Table 4.3: **T- test for monthly consumption of milk**

Group	**Monthly consumption of Milk**		
	Mean	Min	Max
Consumption Before restriction (0)	50	15	120
Consumption After Restriction (1)	43	15	112
Difference	7	-	-

"Group 0" = monthly consumption of milk in litters before restriction, dummy= 0. "Group 1" = monthly consumption in litters after the restriction, dummy= 1. Difference= mean (0) - mean (1)

As monthly consumption of milk depends upon the number of milking animals in a household. We also try to assess how milking goats and cows in a family has been affected by the grazing restrictions. So, here again t – test employed on number of milking animals and results in Table 4.4 demonstrate that on average decline of 39% in and 21% respectively happened in number of milking goats and cows in a household after the grazing restriction. Our results are highly significant (1%), so we rejected the null hypothesis and accepted the alternative hypothesis.

Table 4.4: T- test for Number of Milking Animals Milking Goats, Milking Cows

Group	**Milking Goats**			**Milking Cows**		
	Mean	Min	Max	Mean	Min	Max
Milking Animal Before Restriction (0)	1.78	0	05	1.06	0	03
Milking Animal After Restriction (1)	1.1	0	04	0.84	0	02
Difference	**0.68**	**-**	**-**	**0.21**	**-**	**-**

Group 0 is the number of milking animals before the restriction has dummy 0 and group 1 is the number of milking animals after the restriction has dummy 1.
Difference= mean (0) - mean (1)

4.1.3 Monthly Consumption of meat before and after the grazing restriction

Monthly consumption of meat is dependent on the availability of animals for slaughtering. As, we observed that number of animal reduced in the area due to grazing restriction. So, here we try to investigate that how monthly consumption of meat effected by the grazing restriction. The t – test applied on our dependent variable monthly consumption of meat and results given in Table 4.5.

Our results demonstrate that average meat consumption of a family before the grazing restriction was 6.1KGs/month and its 4.8KGs/month after restriction its. The monthly meat consumption of a family declined by 1.3KGs/month. Our results for monthly consumption of meat are highly significant (1%) and which indicates that consumption of meat declined by 23% after the restriction, so we rejected the null hypothesis and accepted the alternative hypothesis.

Table 4.5: T- test for monthly consumption of meat

Group	**Monthly Consumption of Meat**		
	Mean	Min	Max
Consumption Before restriction (0)	6.1	2	15
Consumption After Restriction (1)	4.8	1.5	11
Difference	**1.3**	-	-

"Group 0" = monthly consumption of meat in kilograms before restriction, dummy= 0. "Group 1" = monthly consumption of meat in kilograms after the restriction, dummy= 1. **Difference= mean (0) - mean (1)**

4.2 Results of Econometric Analysis

This chapter demarcates the outcomes of econometric models and their descriptions. Results of econometric analysis is divided into following three subsections: Section one deals the change occurred in herd size due to the grazing restrictions. Section two is about the impact of restriction on monthly consumption of milk and section three deals with impact of grazing restrictions on per month meat consumption of a family. The OLS regression model applied to examine the impact of different factors on our dependent variables. The results of the regression models use in our study are explained below.

4.2.1 Number of Animals in a household before and after the grazing restriction

The herd size of a family depends on the fodder sources. We used log linear model to express change in herd size in percentage form. Grazing is the most prominent source for foddering the animals' cattle and goats in the study area. The OLS regression model applied to examine the impact of different factors on herd size of goats and cows of a household. To explore this relation, we employed ordinary least square method (Equation 1). Particularly we used dummy variable to differentiate the two situations (before and after the restriction). It is important to note that our unit of analysis is family.

I. Total number of goats in a household

We used two different models by keeping the same dependent variable (Total number of goats). In the first model we used dummy variable to capture the impact of grazing restriction (i.e. if restriction imposed then D_BNA=1, otherwise 0). In the second model we used the interaction of grazing hours with the D_BNA along with other explanatory variable. Before grazing restriction there was two sources of grazing i.e. grazing on communal land and grazing on their private land (owned by the family). There is only one source of grazing left i.e. on private land, after the grazing restriction imposed on communal land. This implies grazing hours has significantly decreased after the restriction. So, when we take the interaction of dummy for restriction (if restriction imposed then 1, otherwise 0) with the number of grazing hours then the resultant variable has number of grazing hours after restriction. The OLS regression results for both models in the Table 4.6 (column 2 for 1st model and column 3 for 2nd model) demonstrate how herd size has been affected. Total number of goats in a household is dependent variable in these models. The coefficient of dummy before and after restriction indicates that number of goats in each family has declined by 37.4% after restriction on grazing and coefficient is highly significant (1% significance level). Daily number of grazing hours decreased after the restriction and result is also significant at 1% of significance level. The coefficient of decline in grazing hours still have negative impact on number of goats. Our results demonstrate that when one grazing hour decline then the number of goat decline by 11.1%.

Table 4.6: OLS regression results number of goats

Variable	**Total number of goats Dummy for restriction Before and after**	**Total number of goats Dummy for number of grazing hour after restriction**
Constant	.296*** (0.87)	0.223*** (0.86)
Dummy before and after	-.374*** (0.05)	-
Daily Number of Grazing hours	-	-0.111*** (0.015)
Land available to keep animals	0.035*** (0.007)	0.035*** (0.008)
Land ownership for grazing purpose	0.001*** (0.000)	0.001*** (0.000)
Monthly income in thousand rupees	-0.0007 (0.001)	-0.0006 (0.001)
Per Goat Fodder cost	-0.016 (0.003)	-0.015 (0.002)
Household size	0.046*** (0.014)	0.047*** (0.015)

*** Significant at 1%, ** significant at 5%, and * significant at 10% of significance level. Dummy 0= before restriction and dummy = after the restriction.

Coefficient of dummy before and after was greater than the coefficient of grazing hour after the restriction. This implies that dummy for restriction capturing broader changes (i.e., Environment, management practices, inflation, etc.) while we are specifically interested to investigate the impact of decline in grazing hours on number of goats. If land available to keep animal adjacent to the house increases by 1 Marla, then the number of goats in a household also increase by 3.5% in both models and results are significant at 1%. Our results for household size in both models are highly significant (1% significance level). If household size increases by one person, then the number of goats in a family also increase by 4.6% and 4.7% in our first and second model respectively.

Total number of cows in a household before and after the grazing restriction

Similarly, we used two different models for our dependent variable total number of cow as we used above for total number of goats. In the first model we used dummy variable to capture the impact of restriction (i.e. if restriction imposed then D_BNA=1, otherwise 0). In the second model we used the interaction of grazing hours with the D_BNA along with other explanatory variable. The results of OLS regression model in Table 4.7 (column 2 for 1st model and column 3 for 2nd model) demonstrate that how grazing restrictions has affected the number of cows in a family.

Table 4.7: **OLS regression results for number of Cows**

Variable	**Total Number of cows Dummy restriction Before and After**	**Total number of cows Dummy grazing hours after the restriction**
Constant	0.015*** (0.088)	-0.063 (0.085)
Dummy before and after	-0.339*** (0.048)	-
Daily Number of Grazing hours	-	-0.113*** (0.01)
Land available to keep animals	0.032*** (0.007)	0.034*** (0.008)
Land ownership for grazing purpose	0.001*** (0.000)	0.001*** (0.000)
Monthly income in thousand rupees	0.003*** (0.012)	-0.003*** (0.001)
Per Cow Fodder cost	-0.010 (0.003)	-0.010 (0.03)
Household size	0.027* (0.015)	0.027* (0.015)

*** Significant at 1%, ** significant at 5%, and * significant at 10% of significance level. Dummy 0= before restriction and dummy = after the restriction.

The coefficient of dummy before and after restriction indicates that number of cows in each family has declined by 33.9% after restriction on grazing and coefficient is highly significant (1% significance level). Daily number of grazing hours decreased after the restriction and result is also significant at 1% of significance level. The coefficient of decline in grazing hours still have negative impact on number of cows. Our results demonstrate that when one grazing hour decline then the number of cow decline by 11.3%. Coefficient of dummy before and after was greater than the coefficient of grazing hour after the restriction. This implies that dummy for restriction capturing broader changes (i.e. Environment, management practices, inflation etc) while we are specifically interested to investigate the impact of decline in grazing hours on number of cows.

Our results for land available to keep animal adjacent to house in both models are highly significant (1% significance level). If land available to keep animal adjacent to the house increases by 1 Marla, then the number of cows in a household also increase by 3.2% and 3.4% in our first and second model respectively. Our results for household size in both models are highly significant (1% significance level). If household size by one person, then the number of cows in a household also increase by 2.7% in both models and results are significant at 10%.

4.2.2 Monthly Consumption of Milk

Milk is a necessary consumable commodity in a household's consumption bucket. The monthly consumption of milk of a family in rural areas depends upon the many factors, i.e. monthly income, household size, number of infants and number of milking animal in the house. Grazing restriction has affected the herd size in the study area, which implies that it might have impact on the monthly consumption of milk too as milk consumption depends on number of milking animals. We used two different models by keeping the same dependent variable (Monthly consumption of milk).

In the first model we used dummy variable to capture the impact of restriction (i.e. if restriction imposed then D_BNA=1, otherwise 0). In the second model we used the interaction of increase in price with the D_BNA along with other explanatory variable. Two separated dummy variables (increase in price due to restriction and increase in price due to inflation) created to determine which factor caused the increase in price of milk. If increase in price is only due to restriction dummy increase in price due to restriction =1, otherwise 0. If price raised due to inflation only the dummy increase in price due to inflation = 1, otherwise 0.

The results of OLS regression for both models given below in the Table 4.8. The OLS regression model applied to examine the impact of different factors on monthly consumption of milk in a household.

Table 4.8: Monthly Consumption of Milk

Variables	**Milk Consumption Dummy Restriction Before and After**	**Milk Consumption Dummy increase in price**
Constant	3.03*** (0.046)	3.011*** (0.043)
Dummy before and after	-0.087*** (0.027)	-
Total Monthly Income in Thousand Rupees	0.003*** (0.000)	0.003*** (0.000)
Number of milking goats	0.073*** (0.016)	0.073*** (0.015)
Number of milking cows	0.069*** (0.028)	0.068*** (0.019)
Number of infants in a family	0.162*** (0.019)	0.155*** (0.019)
Number of adult in a family	0.072*** (0.008)	0.074*** (0.009)
Dummy Increase in price of Milk due to Restriction	-	-0.094*** (0.028)
Dummy Increase in price of Milk due to Inflation	-	-0.041 (0.031)

*** Significant at 1%, ** significant at 5%, and * significant at 10% of significance level. Dummy 0= before restriction and dummy = after the restriction.

In our first regression model the coefficient of dummy before and after restriction indicates that monthly consumption in each family has declined by 8.7% after restriction on grazing and coefficient is highly significant (1% significance level). The coefficient of number of milking goats implies that if there is increase of one goat in a household, then the monthly consumption of milk also increases by 7.3% and statistically highly significant (1%). If number of milking cow increased by 1, the monthly consumption increases by

6.9% and highly significant (1%). The coefficient of milking goat is greater than the coefficient of milking cow, which implies that people use goat's milk for domestic use, i.e., feeding the children, as it has more nutrients. The cow milk is used for commercial purpose. Monthly consumption of milk increases by 16.2%, if addition of 1 number in infants happened, result is significant at 1%. The coefficient of monthly milk consumption demonstrates that milk consumption increases by 7.2%, if number of adult increased by 1 and highly significant (1%). Monthly consumption of milk increased more by the addition of infant in a family as compared to the adult implies that consumption of milk is more necessary for infants.

In our second model Dummy increase in price, people think that monthly consumption of milk decreases by 9.4%, due to restriction and results are statistically significant at 1%. Monthly consumption of milk decreased by 4.6% in dummy increase in price due to inflation. The coefficient of dummy increase in price due to restriction is higher than the coefficient of dummy increase in price due to inflation, which advocates that people think the major change in price of milk happened due to the restriction

4.2.3 Monthly Consumption of Meat

Meat consumption is another nutrient factor which purely depends upon the availability of livestock. Consumption of meat for a household depends on different factors like availability of meat, monthly income and household size. Grazing restriction in the area caused decline in the livestock. We tried to examine the impact of grazing restriction on the monthly consumption of meat in the study area. Here, we also used two different models by keeping the same dependent variable (Monthly consumption of meat) as we did above for monthly consumption of milk. Factor caused increase in price of meat measured similarly as above for milk. The OLS regression model applied for monthly consumption of meat and results demonstrated below in Table 4.9.

In our first model the coefficient of dummy before and after restriction indicates that monthly consumption of meat in each family has declined 23.5% after restriction on grazing and coefficient is highly significant (1% significance level). The coefficient of number of adult males implies that if number of male increases by 1, the monthly consumption of meat also increased by 4.9% and statistically highly significant (1%).

Table 4.9: Monthly Consumption of Meat

Variables	**Meat Consumption Dummy Before and After**	**Meat Consumption Dummy Increase in Price**
Constant	0.754*** (0.00)	0.683 (0.033)
Dummy before and after	-0.235*** (0.018)	-
Total Monthly Income in Thousand Rupees	0.015*** (0.000)	0.015*** (0.00)
Number of Adult Male in a family	0.049*** (0.009)	0.056*** (0.009)
Number of Adult Female in a family	0.034*** (0.008)	0.038*** (0.008)
Dummy Increase in Price of Meat due to Restriction	-	-0.184*** (0.022)
Dummy Increase in Price of Meat due to Inflation	-	-0.091*** (0.025)

*** Significant at 1%, ** significant at 5%, and * significant at 10% of significance level. Dummy 0= before restriction and dummy = after the restriction.

If number of adult females increases by 1, the monthly consumption increases by 3.4% and highly significant (1%). The coefficient of number of adult males is greater than the coefficient of number of adult females, which implies that meat consumption in male is relatively high than the females. In our second model Dummy increase in price, monthly consumption of meat decrease by 18.4% due to restriction and results are statistically significant at 1%. Monthly consumption of meat decreased by 9.4% due to inflation. The coefficient of dummy increase in price due to restriction is higher than the coefficient of dummy increase in price due to inflation, implies that huge change in price of meat happened due to grazing restriction in people' point of view.

4.3 Cost Benefit Analysis

To endorse or finance in any plan in public sector its economic assessment is required which generates a signal for government and policymakers. There are many indicators of economic assessment containing cost-benefit analysis, net present value, and internal rate of return. We engaged a cost benefit analysis to assess the carbon sequestration capacity and economic value of Billion Tree Tsunami Afforestation program in our study area.

We have costs i.e., cost of plantation in communal land, cost on rehabilitation of degraded watersheds, watch and ward cost of planted trees on communal land and cost on neghebans' salaries are from the project documents PC-I & PC-II. We collected data from the study area through the questionnaire for the costs from primary source. The costs taken from primary data are i.e., opportunity cost of not grazing, opportunity cost of sold animals, loss on the sale of animals and opportunity cost of land used for plantation. Benefits of the project are carbon sequestration capacity and economic value of the standing trees. Carbon sequestration capacity of the trees calculated through formula given in Equation (9) and economic value of standing trees is also calculated through formula mention in equation (11). The million PKR is used as monetary unit. We include only analysis for eight years in Table 4.10 due to space constraint. The analysis for 20 years of this project is given in Appendix B.

Table 4.10: **Cost and Benefit Analysis of BTTAP**

Cost Benefit Analysis	0	1	2	3	4	5	6	7
Costs in Millions PKR:								
Cost on Plantation	111	1763	803					
Cost on Rehabilitation of degraded watershed	12	40						
Cost on Watch & ward, Maintenance & watering		19	395	395	376			
Opportunity cost of not grazing	321	3326	4622	4622	4622	4300	1296	
Cost on Neghebans' Salary	209	209	209	209	209			
Opportunity cost of sold cows	97	1006	1398	1398	1398	1301	392	
Opportunity cost of sold goats	79	1109	1553	1553	1553	1474	444	
Loss of families on sale of animals	37	515	757					
Opportunity cost of land	51	730	1022	1022	1022	1022	1022	1022
Total Cost in millions	919	8717	10760	9200	9181	8098	3154	1022
Present value of total Costs	919	8147	9399	7510	7004	5773	2102	637
Adding each year Costs	919	9066	18464	25974	32978	38752	40854	41490
Benefits in Million PKR:								
Benefits from carbon's sequestration in Phase 1		10	14	18	26	36	43	63
Benefits from carbon's sequestration in Phase 2			186	267	346	498	674	762
Benefits from carbon's sequestration in Phase 3				59	82	105	154	207
Benefits from Economic value of trees in Phase 1		38	16	30	60	81	86	109
Benefits from Economic value of trees in Phase 2			289	185	431	940	1424	1827
Benefits from Economic value of trees in Phase 3				176	87	166	327	458
Total benefits in Million	0	48	505	87	1033	1826	2707	3425
Present value of total	0	45	441	166	788	1302	1804	2133
Adding each year Benefits	0	45	485	651	1439	2741	4545	6678
Net profit in Millions PKR	-919	-8102	-8958	-7344	-6216	-4471	-298	1497
Benefit Cost Ratio (BCR)	1.7							
Internal Rate of Return (IRR)	6%							

Our results demonstrate costs and benefits of the BTTAP for communal land in the Hazara region. Cost of plantation is recorded as Rs.111 million, Rs.1763 million and Rs.803 million respectively for Phase 1, Phase 2 and Phase 3. Cost of rehabilitation of watersheds and the maintenance cost varies from each phase as area and number of trees are not same in three phases.

Cost on Rehabilitation of degraded watershed is reported as Rs.12 million and Rs.40 million for Phase 1 and Phase 2 respectively. On average 1075 trees planted on one hectare during each phase. Cost on Watch and ward, Maintenance and watering of plantation for year 1, year 2, year 3 and year 4 recorded as Rs.19 million, Rs.395 million, Rs.395 million and Rs.376 million respectively. Opportunity cost of not grazing animals on communal based forest is calculated. The cost bared by the society for not grazing is recorded as Rs.322 million for the first year and Rs.1296 million for the seventh year after the execution of project. The average cost on neghebans' salaries is Rs.209.4 million and it is carried for all five years. Forgo cost of sold animals is also included in our analysis. Opportunity cost of sold cows and goats is calculated separately as the yield of both type of animal is not same. The opportunity cost of sold cows is recorded as Rs.97 million in first year and Rs.392 million for the seventh year. Similarly, opportunity cost of sold goats is Rs.79 million and Rs.444 million for the first year and seventh year for the project respectively. Loss of families on sale of animals is calculated as Rs.37 million, Rs.515 million and Rs.757 million respectively for all three phases. The rent of non-agricultural is considered as the opportunity cost of land. The opportunity cost of land is continued for the last year of project. Opportunity cost of land is recorded as Rs.52 million in first year and its increases as the area under plantation increases in each phase. Opportunity cost of land approaches to maximum value at 3rd year Rs.730 million and remains for all 20 years. The total cost of the project is calculated by summing the cost of each year. The net present value (NPV) of the cost is calculated by applying the NPV formula. Similarly, we calculate benefits of the project as we calculated the cost. The total benefit from the carbon stock and economic value of trees in all three Phases is calculated separately. The benefits from carbon stock and economic value are started after the one year of plantation for each phase.

The value of carbon stock after the one year of plantation are recorded as Rs.10 million, Rs.186 million and Rs.59 million for Phase 1, Phase 2 and Phase 3 respectively. The value of carbon stock for the last (20th) year of analysis is recorded as Rs.620 million, Rs.10716 million and Rs.2916 recorded for Phase 1, Phase 2 and Phase 3 respectively. The economic values of trees after one year of plantation in each phase are recorded as Rs.38 million, Rs.289 million and Rs.176 million respectively for phase 1, phase 2 and phase three. In the 20th year the economic values of trees for phase 1, phase 2 and phase 3 are Rs.681 million, Rs.11368 million and Rs.3706 million respectively. The value of benefits is added, and we get total value of the benefits in each year. Our results disclose that billion tree tsunami afforestation projects recover its cost in the 8th year after the execution of project. The average age of conifer tree species is more than 100 years and for broad leave its more than 50 years. Benefit cost ratio represent that if we spent Rs.1 on BTTAP it generates Rs.1.7 in return. Internal rate of return (IRR) for billion tree afforestation project is 6% percent. The value of IRR is relatively low from the current interest rate. The benefit cost ratio direct that investment on BTAAP generates greater profit, indicating viability of the investment.

Chapter 5

Conclusion and Recommendations

5.1 Findings of the study

This study has done to assess the impact of grazing restriction under Billion Tree Tsunami Afforestation project on rural livelihood of Hazara Region. The Hazara division have population about 5.3 million from which 90 percent of people settled in rural areas (PBS Censes 2017). The people of this region depend on tourism, fruit products, dairy and livestock, education, and mineral extraction. People mostly kept goats and cows to fulfill the dairy and nutrients needs. Pasture lands and communal based grazing areas are major source of fodder in the area. The herd size of a family in study area is directly dependent on the area of grazing as cows and goats are grazed in open area on the hills. The "Billion Tree Tsunami Afforestation Project" shortly called BTTAP launched by the Government of Khyber Pakhtunkhwa intended at designing, planning, commencing and implementing "Green Growth Initiative" in forestry division of province. The project has been executed by Khyber Pakhtunkhwa government in whole province through three forest regions i.e. southern and central region, Malakand region and Hazara region. Hazara region also includes the watershed management circle. Plantation has been done in departmental forest, communal base land and private lands. Government authorities-imposed restriction on grazing of animals on pasture and communal based lands. This restriction has affected the livelihood of people living in rural areas. This study examined the impact of grazing restriction on the herd size of a family, monthly consumption of milk and monthly meat of a family. All these variables are related with the grazing restriction under the BTTAP. However, the present study focuses on herd size, animalbased nutrients like milk and meat by employing primary data. The viability of project estimated through the secondary data. The data was collected through a well-structured questionnaire from the rural area of district Haripur, Abbottabad and Mansehra. The total sample size of our study was 150. Our study is based on four different models. In our first three model we used OLS loglinear model to explore the impact of grazing restrictions on our dependent variable. We explored the impact of grazing restriction on, the number of animals (goats and cows) in a household, monthly consumption of milk and monthly consumption of meat in our first, second and third model respectively. The fourth model is about the cost and benefit analysis of BTTAP.

We employed ordinary least square (OLS) Log-linear model on our first three models. The dummies of our dependent variables have been created to separate the two situations i.e, before grazing restriction and after grazing restriction. Before restriction have dummy value 0 and for after restriction dummy have value 1.

In our first model, the dependent variable is Total Number of Animals. We attempted to explore the impact of grazing restriction on number of animals in a household. The number of goats and cows estimated separately. Two-sample t test with equal variances on number of animals applied. The result in t- test showed that number of goats and cows decreased by 37% and 32% respectively after the restriction. T- test applied on per animal fodder cost before restriction and after the restriction. The per Goat fodder cost of a household increase by 55% and per Cow fodder cost raised by 52.3% after the restriction. In first regression the number of goats in regression dummy before restriction and after restriction show a decline of 37.4% in number of goats after the restriction and statistically significant at 1 percent. Dummy number of grazing hours shows decline in one hour of grazing leads to decrease of 11.1% in number of goats after the restriction. Similarly, for number of cows results indicated decline of 33.9% happened after the grazing restriction in a household and result was significant at 1% level. In Dummy number of grazing hours, as restriction on grazing increased by one hour the total number of cows in a household decreases by 11.3% and result is also significant at 1% of significance level

In our second model, we tried to determine the impact of grazing restriction on monthly consumption of milk. The OLS log-linear model used, and we employed two regressions, i.e., first for consumption of milk before and after the restriction and second regression for increase in price of milk either due to restriction or due to inflation. The t-test result for monthly consumption milk showed decline of 15% (7 litters) in monthly consumption of milk after the restriction in a household. The results of OLS regression model indicated that that before restriction the milk consumption was significantly high. In our first regression model for monthly consumption of milk, the coefficient of dummy before and after restriction indicates that monthly consumption of milk in each family has declined by 8.7% after restriction on grazing and coefficient is highly significant (1% significance level). If addition of one milking goat happened in herd size of a family, the monthly milk's consumption also increases by 7.3% and if one cow increased in a household, the consumption of milk increases by 6.9%. Monthly consumption of milk increases by 16.2% if addition of an infant occurred in a family. If one adult person in a household added, the monthly consumption of milk increases by 7.2%. our second regression model for monthly consumption of milk, the dummy increase in the price of milk due to restriction or due to inflation. People think that the domestic consumption of milk in a household has decline by 9.4% due to increase in price after the restriction.

The third model used to determine the impact of grazing restriction on monthly consumption of meat. We used same technique in this model as we used for the monthly consumption of milk above. The OLS log-linear model used, and we employed two regressions, i.e., first for consumption of meat before and after the restriction and second regression for increase in price of meat either due to restriction or due to inflation. The t-test result for monthly consumption meat showed decline of 23% (1.3Kg) in monthly consumption of meat after the restriction in a household. The results of OLS regression model indicated that that before restriction the meat consumption was significantly high. In our first regression model for monthly consumption of meat, the coefficient of dummy before and after restriction indicates that monthly consumption of meat in each family has declined by 23.5% after restriction on grazing and coefficient is highly significant (1% significance level). If addition of one adult male happened in a family, the monthly meat's consumption also increases by 5% and if one adult female increased in a household, the consumption of meat increases by 3.4%. The consumption of meat increased more when addition of adult males in household happened as compared to the addition of adult female, which indicates that meat consumption in males is higher as compared to females.

Monthly consumption of meat increases by 1.5% if household's income increases by PKR 1000. The above discussed coefficients are significant at 1%. In our second regression model for monthly consumption of meat, the dummy increase in the price of meat due to restriction or due to inflation. People think that the domestic consumption of meat in a household has decline by 18.4% due to increase in price after the restriction.

Different tools employed for project estimation to explore the economic feasibility of investment in “Billion Tree Tsunami Afforestation Project”. The BCR ratio of BTTAP is 1.7 indicating that investment in BTTAP is economically largely viable. BCR ratio indicates huge return on each rupee invested this project. The internal rate of return (IRR) is also reasonably high for BTTAP. The IRR value of this project is 6% percent. The values of BCR and IRR quite high and reasonable to attract investment in this sector.

5.2 Conclusion

Our research explored the impact of grazing restriction on rural livelihood of study area. It is observed that the grazing restriction has adverse impact on the livelihood of people in short run. The ban on grazing in community-based forest has not only affected the herd size, but the monthly consumption of milk and meat have also been affected. The study reflets that number of animals in restriction period has significantly declined. The supply of milk and meat also decreased due to the restrictions. The monthly consumption of milk and meat significantly declined after the grazing restriction. The increase in domestic consumption happened more when addition of a goat happened in herd size as compared to a cow, which implies that people use goat's milk for domestic use, i.e., feeding the children, as it has more nutrients. The cow milk is used for commercial purpose. The economic analysis showed that this project is widely viable and profitable for community in the long run.

5.3 Policy Recommendation

In the light of above argument following policy recommendation can be suggested

- Provincial Government should compensate the loss of locals happened during the restriction period by providing animals at lower price.
- There is no surveillance after the completion of project. Authorities should keep negheban for protection and raising of the trees.
- Plantation in a VDC has been carried out together in all enclosures, it could have been done step wise like one enclosure must be planted and one open for grazing.
- This kind of project can be more beneficial to the community if plantation of fruit species done. Locally community can earn by selling fruits instead of cutting the forest.

Furthermore, this kind of project should be launched by other provinces too to contribute in green growth and giving a better environment to our future generation.

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Annexure A

Questionnaire

Economic Evaluation of BTTAP and Impact of GRAZING RESTRICTION on Rural Livelihood in HAZARA REGION of KP

Questionnaire No. _____________ Village: _____________

Date: ___________

1. Name of the Household _____________
2. Age of the HH head _____________ Years
3. Number of children between 2 to 6 years
4. Gender

   Male Female
5. Residence

   Urban Rural
6. Marital Status

   Single Married Widow
7. Highest level of education

   No Education Grade 1 to 5 Grade 6 to 8

   Matric F.SC. Or F.A BSc (Hons)/Master (16 years of Edu)

   Vocational School Other

8. Occupation

Family member	Male/Female	Age (years)	Education (Years)	Type of Occupation	Income (Rs./month)

9. Detail of animals and prices before and after restrictions

Type of animal	Numbers	Price (grazing hours) before restriction (Rs./animal) (hours/day)	Price (grazing hours) after restriction (Rs./animal) (hours/day)	Reason of increase/decrease (price, cost, consumption)[a]
Buffaloes				
Cows				
Goats				
Fodder cost (Rs./month	-			
Grazing hours	-			
Price of beef	-			
Price of mutton	-			
Price of milk	-			
Average consumption of meat	-			
Average consumption of milk	-			

10. Did you used agriculture land for grazing?

Yes No

11. If Yes then mention the ownership of the agriculture land

Rental Owned

12. If rental then how much you paid for the rent Rs ______

13. Size of your agriculture land ____________ Marla's/Hectares.

14. Available land near to your house for keeping Animals.

Yes No

15. Available land near to your house for grazing.

Yes No

16. Is price of meat increases due to restriction?
    Yes No

17. Is the prices of meat increases due to inflation?

    Yes No

18. Is price of milk increases due to restriction?

    Yes No

19. Is price of milk increases due to inflation?

    Yes No

20. Have you sold your animals due to restriction?

    Yes No

21. If yes, then how much you bear average loss on sale of animal/animals?
22. Do you think you will have benefit in future as increase in woodlot?
23. Future benefit from decrease in the purchase of wood in future?
24. Do you used communal land for grazing before the grazing restriction?
25. Yes No
26. How much area of communal land was accessible/ grazeable?

Annexure B

Cost and Benefit Analysis for 20 Years

Cost Benefit Analysis	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Costs in Millions PKR:																				
cost of Plantation in milliions	111.3	1763.1	803.3																	
Cost on Rehabilitation of degraded watershed	12	40																		
Watch and ward, Maintinence and watering cost		18.9	395	395	376															
opportunity cost of not grazing	321.8	3326.2	4622.1	4622.1	4622.1	4300.3	1295.8													
Cost on Neghebans' Salary	209.4	209.4	209.4	209.4	209.4															
opportunity cost of sold cows	97.3	1006.2	1398.3	1398.3	1398.3	1300.9	392.0													
opportunity cost of sold goats	78.8	1108.7	1552.9	1552.9	1552.9	1474.1	444.2													
Loss of families on sale of animals	36.6	514.6	757.4																	
Opportunity cost of land	51.9	729.9	1022.3	1022.3	1022.3	1022.3	1022.3	1022.3	1022.3	1022.3	1022.3	1022.3	1022.3	1022.3	1022.3	1022.3	1022.3	1022.3	1022.3	1022.3
Total Cost in millions	919	8717	10760	9200	9181	8098	3154	1022	1022	1022	1022	1022	1022	1022	1022	1022	1022	1022	1022	1022
Present value of total Costs in Millions PKR	919	8147	9399	7510	7004	5773	2102	637	595	556	520	486	454	424	396	371	346	324	302	283
Adding each year Costs in Millions PKR	919	9066	18464	25974	32978	38752	40854	41490	42085	42641	43161	43647	44100	44525	44921	45292	45638	45962	46264	46547
Benefits in Million PKR:																				
Benefits from the sequestration of carbon in Phase 1		10.2	14.1	17.9	26.4	35.7	42.9	63.0	87.6	116.9	156.3	200.6	241.5	278.6	332.9	379.5	429.3	498.2	562.6	620.2
Benefits from the sequestration of carbon in Phase 2			185.6	266.9	346.4	498.3	673.9	761.7	1220.7	1723.6	2359.2	3096.3	3883.8	4732.9	5537.4	6492.6	7373.0	8370.7	9570.9	10716.1
Benefits from the sequestration of carbon in Phase 3				59.0	82.5	105.1	153.6	206.7	246.4	367.0	511.2	684.4	909.5	1160.7	1401.0	1620.9	1937.6	2216.6	2515.5	2916.5
Benefits from Economic value of trees in Phase 1		37.5	16.3	30.3	59.9	81.1	85.5	109.5	141.3	172.6	216.3	250.0	291.6	345.2	447.2	473.7	526.7	602.3	553.5	681.4
Benefits from Economic value of trees in Phase 2			288.6	184.7	430.7	940.2	1424.3	1826.5	2480.7	3310.1	3951.6	4905.9	5618.9	6576.3	7499.6	9044.1	9686.9	10774.4	12914.6	11367.9
Benefits from Economic value of trees in Phase 3				176.2	86.8	165.7	326.9	458.0	503.6	651.6	839.8	1029.6	1301.7	1500.4	1783.9	2095.8	2678.7	2913.7	3267.4	3706.5
Total benefits in Million PKR	0	48	505	87	1033	1826	2707	3425	4680	6342	8034	10167	12247	14594	17002	20107	22632	25376	29385	30009
Present value of total benefits in Millions	0	45	441	166	788	1302	1804	2133	2724	3450	4084	4830	5438	6056	6594	7288	7666	8033	8694	8298
Adding each year Benefits in Millions PKR	0	45	485	651	1439	2741	4545	6678	9402	12852	16936	21766	27204	33260	39854	47141	54808	62841	71535	79832
Net profit in Millions PKR	-919	-8102	-8958	-7344	-6216	-4471	-298	1497	2129	2894	3565	4345	4984	5632	6197	6917	7320	7710	8391	8015
Benefit Cost Ratio (BCR)	1.7																			
Internal Rate of Return (IRR)	6%																			