2013年度学位請求博士論文

指導教授 **藤岡 明房**

IMPACT ANALYSIS ON ECONOMIC ISSUES AND ENVIRONMENTAL DESTRUCTION IN NEPAL

立正大学大学院経済学研究科
学籍番号:119J00002
名前:デサール バス デーブ

TABLE OF CONTENTS

CHAPTER 1

Part I

Part II

CHAPTER 2

LIST OF FIGURES, CHART AND TABLES

Page No.

CHAPTER 1

CHAPTER 2

Squatters Problems along Bagmati Riverside in Nepal and its Impact on Environment and Economy

CHAPTER 3

An Overview of Agricultural Degradation in Nepal and its Impact on Economy and Environment

CHAPTER 4

A Study on Mining Industry Pollution in Chapagaon, Nepal

CHAPTER 5

BRICK FACTORIES IN KATHMANDU VALLEY AND ITS IMPACT ON ENVIRONMENT AND ECONOMY

CHAPTER 6

EXAMINATION ON THE SOIL EROSION PROBLEM IN NEPAL

CHAPTER 7

Urban Poverty and its Impact on Environment and Economy in Nepal: A Case Study of Kathmandu Valley

CHAPTER 1

Part I

Environmental Issues of Nepal

1.1 Introduction of Nepal

Nepal is one of the richest countries in the world in terms of bio-diversity due to its unique geographical position and altitude variation. Sandwiched between two Asian giants (China and India) Nepal traditionally has been characterized as "a yam caught between two rocks." Noted for its majestic Himalayas, which in Sanskrit means the abode of snow, Nepal is very mountainous and hilly. Its shape is roughly rectangular, about 650 kilometers long and about 200 kilometers wide, and comprises a total of 147,181 km^2 of land. It is slightly larger than Bangladesh or the state of Arkansas. Nepal is a landlocked country, surrounded by India on three sides and by China's Xizang Autonomous Region (Tibet) to the north. It is separated from Bangladesh by an approximately fifteen kilometer - wide strip of India's state of West Bengal, and from Bhutan by the eighty-eight-kilometer-wide Sikkim, also an Indian state. Such a confined geographical position is hardly enviable. Nepal is almost totally dependent on India for transit facilities and access to the sea--that is, the Bay of Bengal--even for most of the goods coming from China.

Figure 1: Geographic Map of Nepal

We can divide various aspects of Nepal as follows:

1.1.1 Geographical Aspect

Nepal can be divided into three geographical regions, each stretching from east to west across the country. The southernmost strip of land, the Terai, is bordered to the north by Himalayan foothills and to the south by the Ganges River. The area was originally covered with tropical vegetation, but has been almost completely converted to agricultural production. The Terai is now the breadbasket of Nepal and is covered with farms.

The central section of Nepal is formed by the Mahabharat Chain, a range of mountains that reach modest altitudes of 2,000-3,000 meters. Farming has become an important activity in the area; terraced farms produce rice, corn and wheat. The Kathmandu Valley, a stretch of green in the middle of the Mahabbarat, is home to Nepal's capital and other historic cities.

The Himalayas stretch across the northern section of Nepal. Eight of the ten highest peaks in the world are located here, and most are covered with permanent snowfields. The area is sparsely populated, with little vegetation above the tree-line (4,200 meters).

The rhythm of life in Nepal, as in most other parts of monsoonal Asia, is intricately yet intrinsically intertwined with its physical environment. As scholar Barry Bishop learned from his field research in the Karnali region in the northwest, the livelihood patterns of Nepal are inseparable from the environment.

The climate varies considerably with elevation. May to October is monsoon season, when rain soaks the Terai and snow falls on the Himalayan peaks. Mid-October to mid-December is prime mountaineering weather: the skies are clear and sunny, temperatures range from warm in the lowlands to crisp in the mountains. March and April are also good months for mountain treks, although temperatures in Kathmandu and the Terai tend to be steamy.

1.1.2 Physical Aspect

For a small country, Nepal has great physical diversity, ranging from the Tarai Plain--the northern rim of the Gangetic Plain situated at about 300 meters above sea level in the south--to the almost 8,800-meter-high Mount Everest, locally known as Sagarmatha (its Nepali name), in the north. It contains more than 240 peaks over 20,000 Ft. (6,096 m) above sea level. From the lowland Tarai belt, landforms rise in successive hill and mountain ranges, including the stupendous rampart of the towering Himalayas, ultimately reaching the Tibetan Plateau beyond the Inner Himalayas. This rise in elevation is punctuated by valleys situated between mountain ranges. Within this maze of mountains, hills, ridges, and low valleys, elevation (altitudinal) changes resulted in ecological variations.

1.1.3 Biological Aspect

This region can also be considered as the shelter of vegetation, agricultural crops, different kinds of birds and animals. Cultivation of millet, barely, wheat, maize, buckwheat, etc. are done in this region. Cultivation of green vegetable, potato, radish, etc. and fruits like apple, lemon, peach, etc. are common in this region. In some ditches and valleys, cultivation of paddy is done. Besides, there are alpine forests and grass fields in some places. Oaks, maples, pines, birches, rhododendron, blue pine, etc. are also found in this belt. Small plants and bushes are found above 4000 meters. Birds and animals like ghoral, snow leopard, bog, black bear, pygmy, pheasant; Munal, Kalij, etc. are available in this region.

1.1.4 Socio-Economic Aspect

The country is a potpourri of ethnic groups and sub-groups who speak over 93 languages and dialects. Nepal offers an astonishing diversity of sightseeing attractions and adventure opportunities found nowhere else on earth. Nepal is the most beautiful and stunning Himalayan country in the world. Though small in size, it is known in the world as a nation of color and contrasts-a hidden Shangri-La of nature, culture and adventure. In the countryside the way of life is still traditional, nature is at its best, high mountains and lush valleys are ideal places for trekking and mountaineering, flora and fauna invites a nature lover for a rendezvous with them. Nepal and Himalayas-the two names go side by side. Nepal, in political maps, is one of the smallest countries of the world but has the amazingly diverse geography, landscapes, culture and traditions. Nepal, situated in the lapse of might Himalayas, is regarded as Dev Bhumi the land of gods and world's two major religions Buddhism and Hinduism co-exist in perfect religious tolerance. Nepal is rich with traditions of art and culture.

By some measures, Buddhism and Hinduism are practiced by a larger majority of people in Nepal. Many Nepali do not distinguish between Buddhism and Hinduism and follow both religious traditions.

The lifestyle, fooding, clothing, occupation of the people of Himalayan region is different from that of other regions. Houses are built with beaten stone and wood with doors and windows small. The chief source of income is animal husbandry and small closes trades. Due to the limitations of physical facilities such as transport, communication, electricity, etc., the life of people has turned out to become very difficult.

1.1.5 Political Aspect

A monarchy throughout most of its history, Nepal was ruled by the Shah Dynasty of kings from 1768, when Prithvi Narayan Shah unified its many small kingdoms. However, a decade-long Civil War by the Communist Party of Nepal (Maoist) and several weeks of mass protests by all major political parties led to the 12 point agreement of November 22, 2005. The ensuing elections for the constituent assembly on May 28, 2008 overwhelmingly favored the abdication of the Nepali monarch Gyanendra Shah and the establishment of a federal multiparty representative democratic republic. The first President of Nepal Ram Baran Yadav was sworn in on July 23, 2008.

Nepal has been made famous for its tourism, trekking, hiking, camping, mountain biking, national wildlife parks, jungle safaris, river rafting, sport fishing, and its many beautiful temples and places of worship.

The other main cities include Pokhara, Biratnagar, Lalitpur (Patan), Bhaktapur, Birendranagar, Bharatpur, Siddhartanagar (Bhairahawa), Birgunj, Janakpur, Nepalgunj, Hetauda, Dharan and Mahendranagar.

We can say that Nepal is a land of great diversity; its cultures, religions, geography and wildlife fascinate and challenge the imagination.

1.2 Economy and Environment of Nepal

The history of planned process of economic development in Nepal is short. Before 1951, some development activities were undertaken but their scope was very limited. Among them were limited programmes to develop power and drinking water facilities in Kathmandu, health programmes in a few districts, some schools, and a college, a commercial bank, a few roads and some small-scale irrigation works. The abolition of slavery in 1925 was the most significant social measure. But as a result of various political and geographic conditions, Nepal remained isolated behind other countries in its social and economic development. However, the economic stimulus of World War II led to the establishment of the first modern industrial units Nepal. Many of these failed to survive the immediate post-war period because of poor management and lack of technical knowledge. Only very recently attention has been given to feasibility studies and the other prerequisites of sound industrial development.

Even after the political changes of 1951-52 relatively little progress was made. The difficulties of changing the political and administrative structure were largely responsible.

Various factors contributed to the economic underdevelopment--including terrain, lack of resource endowment, landlocked position, lack of institutions for modernization, weak infrastructure, and a lack of policies conducive to development.

But at present economic condition of Nepal is not bad and growing annually. Development activities now have been linked to the environmental management and accordingly, the demand for environment related information has also increased day-by-day.

Environmental issues in Nepal are numerous environmental problems.

Sedimentation and discharge of industrial effluents are prominent sources of water pollution, and the burning of wood for fuel is a significant source of indoor air pollution and respiratory problems. Vehicular and industrial emissions increasingly have contributed to air pollution in urban areas.

Deforestation and land degradation appear to affect a far greater proportion of the population and have the worst consequences for economic growth and individuals' livelihoods. Forest loss has contributed to floods, soil erosion, and stagnant agricultural output. Estimates suggest that from 1966 to 2000 forest cover declined from 45 to 29 percent of the total land area. Often cited causes of deforestation include population growth, high fuel wood consumption, infrastructure projects, and conversion of forests into grazing- and cropland. According to government estimates, 1.5 million tons of soil nutrients are lost annually, and by 2002 approximately 5 percent of agricultural holdings had been rendered uncultivable as a result of soil erosion and flooding.

Land degradation is attributed to population growth, improper use of agro-chemicals, and overly intensive use of landholdings that are too small to provide most households with sufficient food. Since the late 1980s, government policies have attempted to address these numerous and related problems, but policies often are hampered by lack of funding, insufficient understanding of Nepal's mountain ecosystems, bureaucratic inefficiency, and sometimes contentious relations between the central government and local communities. Main Threats and Development Pressures There are several threats and development pressures to the biodiversity of Nepal, caused by the cumulative effects of socio-economic status, ecological degradation and political instability (MFSC, 2000). A major threat factor is represented by the Nepalese human population. According to the 1991 population census, the total population of Nepal was around 18.5 million and the population in the year 2000 was estimated at 22 million (MFSC, 2000). More than half (53 per cent) of this population lies under the absolute poverty line and is about to double in the next 26 years (MOPE (a), 2000). Poverty has causal effects on population and vice versa, which contributes to environmental deterioration. Fast growth of the population caused an increase in demand for fuel wood, timber, fodder and land to grow more food (MFSC, 2000). Non-timber forest products are threatened by deforestation, habitat degradation and unsustainable harvesting. Major threats to some protected areas are grazing all year around, poaching for high value products, illegal timber harvesting and unsustainable tourism. Rangelands are suffering from an enormous grazing pressure and wetland biodiversity is threatened by encroachment of wetland habitat, unsustainable harvesting of wetland resources, industrial pollution, agricultural run-off, the introduction of exotic and invasive species into wetland ecosystems, and siltation. Mountain biodiversity is suffering due to ecological fragility and instability of high mountain environments, deforestation, poor management of natural resources, and inappropriate farming practices (MFSC, 2000). Agro biodiversity is under threat due to use of high yielding varieties, destruction of natural habitat, overgrazing, land fragmentation, commercialization of agriculture and the extension of modern high yielding varieties, indiscriminate use of pesticides, population growth and urbanization, and changes in farmer's priorities (MFSC, 2000). More factors for loss of biodiversity include landslide and soil erosion, pollution, fire, overgrazing, introduction of alien species, illegal trade, hunting and smuggling.

The key environmental problems of Nepal are related to forests, soil, solid waste, water and air. In Nepal, largely rural population is depending on land, forest and water resources for their livelihood. Nepal's economic development depends critically on natural resources that are fragile and being rapidly degraded. In Nepal, the links between poverty, economic incentives, institutional weaknesses in government, and the destruction of land, water resources, and forests are more starkly visible than in countries where environmental damage is not, or not yet, so severe.

1.3 Environmental Problems of Nepal

Above problems are current environmental problems of Nepal. But it`s difficult to include and research all those problems in this PhD dissertation. I have included six environmental problems of Nepal in this thesis, which are (i) squatters problems along Bagmati riverside in Nepal and its Impact on Environment and Economy, (ii) an overview

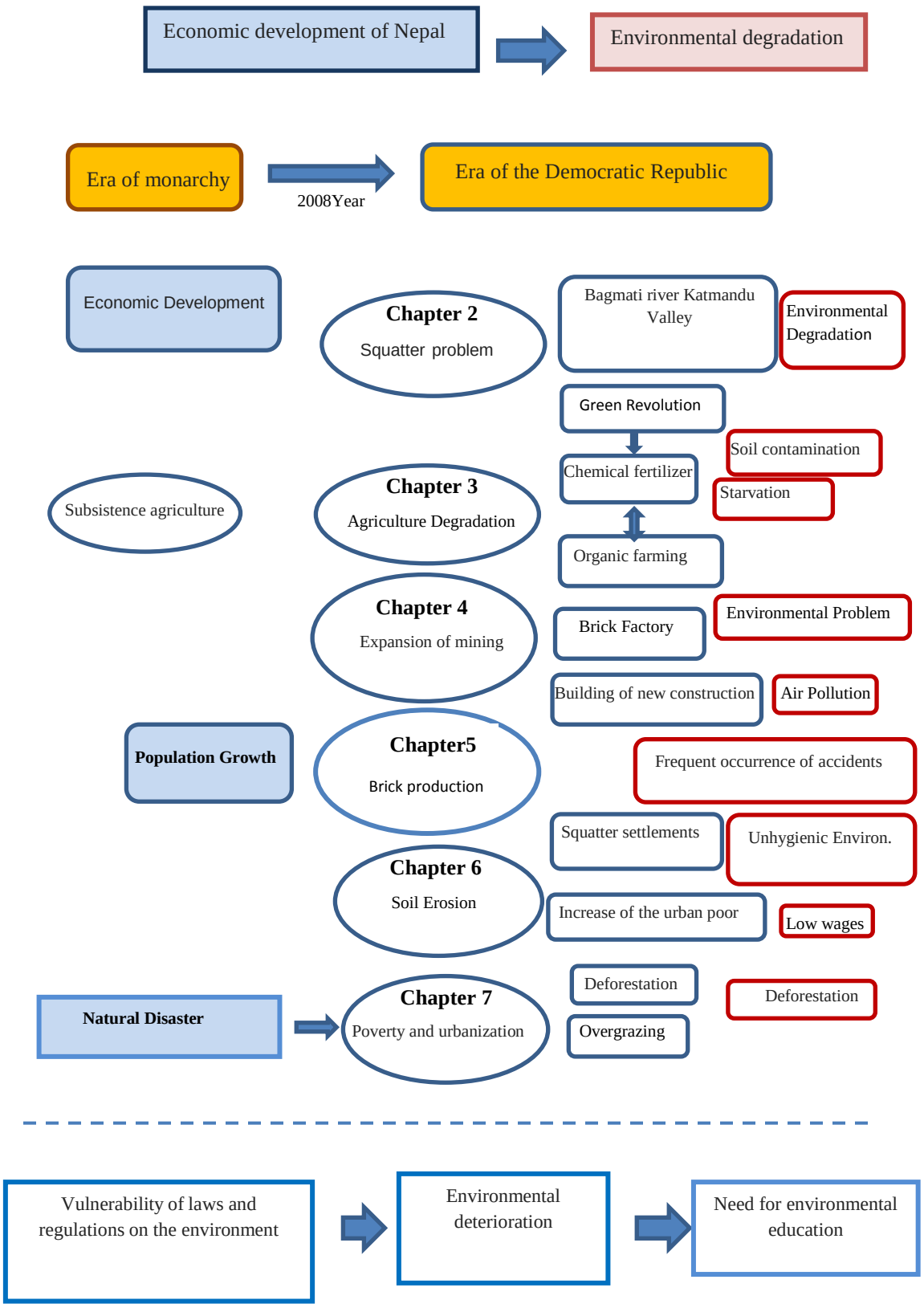
of agricultural degradation in Nepal and its impact on economy and environment, (iii) a study on mining industry pollution in Chapagaon VDC (Lalitpur, which includes in Kathmandu valley), (iv) brick factories in Kathmandu valley and its impact on environmental and economy, (v) examination on the soil erosion problem in Nepal, and (vi) urban poverty and its impact on environment and economy in Nepal: A Case Study of Kathmandu valley.

These are current environmental problems of Nepal. Chapter 2, chapter 4 and chapter 5 focus environmental problems of Kathmandu Valley. As well as chapter 3, chapter 6 and chapter 7 study about whole Nepal`s environmental problems.

In this PhD dissertation, I have tried to focus on the different environmental issues in Nepal and Kathmandu Valley, which are emerging environmental problems of Nepal at present.

The following chart shows the environmental problems of Kathamandu Valley and whole Nepal by chapter wise:

Chart 1: Economic Development and Environmental Problems of Nepal


Economic development of Nepal
Environmental degradation
Era of monarchy
2008Year
Era of the Democratic Republic
Economic Development
Chapter 2
Squatter problem
Bagmati river Katmandu Valley
Environmental Degradation
Green Revolution
Soil contamination
Chemical fertilizer
Starvation
Subsistence agriculture
Chapter 3
Agriculture Degradation
Organic farming
Chapter 4
Expansion of mining
Brick Factory
Environmental Problem
Building of new construction
Air Pollution
Population Growth
Chapter5
Brick production
Frequent occurrence of accidents
Squatter settlements
Unhygienic Environ.
Chapter 6
Soil Erosion
Increase of the urban poor
Low wages
Natural Disaster
Chapter 7
Poverty and urbanization
Deforestation
Deforestation
Overgrazing
Vulnerability of laws and regulations on the environment
Environmental deterioration
Need for environmental education

1.3.1 Squatters Problems along Bagmati Riverside in Nepal and its Impact on Environment and Economy

Chapter 2 outlines `Squatters Problems along Bagmati Riverside in Nepal and its Impact on Environment and Economy`. With economic development squatter problem is arising in whole Nepal, mostly in city areas. Overpopulation of most city areas, exerting heavy pressure on the city's limited infrastructure and services are main causes of this problem. Squatter's problem is not only problem of Kathmandu Valley. It is a great problem of whole Nepal`s problem. But as a capital city of Nepal, squatter's problems in Kathmandu is very serious problem. The haphazard growth of settlements in the Kathmandu Valley is the result of rapid urbanization, growing poverty, and the high cost of land and construction.

Bagmati River flows through the Kathmandu Valley and is the river separating Kathmandu from Lalitpur. The Bagmati corridor contains several important elements of historic and cultural importance. Bagmati riverside is most probably the only open space left in the city core areas of Kathmandu Valley which the study identifies as at risk, although the environmental condition is very poor. The unmanaged sewage connections, solid waste dumping and development uncontrolled squatter settlements along the river banks have deteriorated the environmental conditions. Possible solutions and recommendations are discussed in this chapter for long term.

1.3.2 An Overview of Agricultural Degradation in Nepal and its Impact on Economy and Environment

Chapter 3 of contains `An Overview of Agricultural Degradation in Nepal and its Impact on Economy and Environment`. As agriculture continues to provide a broad base to the Nepalese economy, the growth originating in agriculture holds high potential to have relatively wider impact on poverty reduction and inclusiveness. A large majority of households depend upon agriculture and allied activities such as livestock-rearing and forest product collection. As the agriculture sector is the key sector of the economy, determining economic growth and employment, the standard of living of the majority of the population depends on its development. Despite investment in irrigation and agricultural development projects, agriculture production is still largely determined by favorable weather conditions (EIU 1997). Nepal is developing county with an agricultural economy. Eight out of 10 Nepalese are engaged in farming and it accounts for more than 40% of the GDP. Even in the highly urbanized Kathmandu Valley, large tracts of land outside the city areas are devoted to farming.

Excessive use of chemical fertilizers and pesticides, traditional agriculture system, improper irrigation facilities, fragmentation of land, soil erosion, ignoring for agriculture, natural disasters, different activities of human beings and animals are responsible of agriculture degradation and its impact in environment and economy of Nepal. Important solutions for agricultural degradation are presented in this chapter.

1.3.3 A Study on Mining Industry Pollution in Chapagaon, Nepal

Chapter 4 presents `Mining Industry Pollution in Chapagaon`, (which is in Kathmandu Valley) Nepal. Nepal`s cities grew rapidly and building construction techniques changed requiring greater quantities of gravel. At present many housing company are constructing several housing, colony and apartments. At the same time the road network was expanding in many districts which increased demand for gravel. And large size hydropower construction, bridge construction mining industries are taken as the main sources of building materials. Specially mining materials is excessive using in Kathmandu Valley for development work.

The number of mining industries in Chapagaon has found decreased in 2012, but the environmental impacts have found rather increased. The impacts regarding to environment of Chapagaon are related to the degradation over the scenic beauty of Chapagaon, loss of soil quality, reduction on agricultural production, air pollution, drying the source of drinking water, soil erosion, sedimentation on local streams, habitat loss and fragmentation of wild life,

health impacts on local people etc. It was discussed in detail in chapter 4 as well as possible recommendations and solutions for this mining industry pollution.

1.3.4 Brick Factories in Kathmandu Valley and Its Impact on Environmental and Economy

Chapter 5 deals `Brick Factories in Kathmandu Valley and Its Impact on Environmental and Economy`. For rapidly growing population it needs many houses, so in Kathmandu Valley numerous houses, apartment, mansion are constructing. As well as other many construction work also using bricks. So fulfill of demand of bricks, it`s necessary many brick factories. Bricks are still and will continue to be the preferred walling material due to their abundant availability and pleasing nature widespread use of fired clay is also dependent on the availability of clay deposits for brick making found on agricultural land situated in valley floors and estuaries. Availability of water and market vicinity augment the operation of large number of brick kilns in the Kathmandu valley. That is why brick factories are growing in Kathmandu Valley. But many environmental problems are emerging from brick factories in Kathmandu Valley. Air pollution, loss of soil fertility, several health impacts and other environmental impacts are presented in this chapter. After researched in brick factories in Kathmandu Valley, I have shown possible ways for solve this problem, which was also discussed in this chapter.

1.3.5 Examination on the Soil Erosion Problem in Nepal

Chapter 6 contains `Examination on the Soil Erosion Problem in Nepal`. The 4 main causes of soil erosion are (i) overgrazing, (ii) up and down ploughing, (iii) deforestation and (iv) soil exhaustion.

As well as physical factors or human factors such as improper land use, unscientific cultivation practices and construction of development infrastructures without integrating conservation measures are responsible for soil erosion and loss of soil fertility problem in Nepal. Many reference books of national and international writers, government and non-government reports, international journal are reviewed for prepare this chapter and finally presented some solutions for soil erosion problem in Nepal.

1.3.6 Urban Poverty and its Impact on Environment and Economy in Nepal: A Case Study of Kathmandu Valley

Chapter 7 presents about `Urban Poverty and its Impact on Environment and Economy in Nepal: A Case Study of Kathmandu Valley`.

About 80% of Nepal's people live in rural areas and depend on subsistence farming for their livelihoods. Household food insecurity and poor nutrition are major concerns in these areas. Most rural households have little or no access to primary health care, education, safe drinking water, sanitation or other basic services. They have large families, very small landholdings or none at all. They are also concentrated in specific ethnic, caste and marginalized groups, particularly those of the lowest caste (dalits), indigenous peoples (janajatis) and women. The growing population has put heavy pressure on cultivable land, especially in the Terai region, where there are also many landless migrants from the hills.

Many employment opportunities and available facilities of education, health, modern communication facilities, transportation and other easy access of facilities are available in Kathmandu Valley, so those people migrates in Kathmandu Valley and then urban poverty are growing.

The river banks and lands left by the river in due course of diversion have been confiscated by urban poor. Both permanent and temporary settlements can be seen along the river corridor. Besides the severe encroachment of land, the manual improvised sand mining and direct discharge of their toilet to the river can be seen. These are discussed in this chapter as well as possible solutions and recommendations for solve this problem in Kathmandu Valley.

1.3.7 Conclusion

Chapter 8 shows conclusion of chapter 2 to chapter 7.

1.4 Purpose of Study

The followings are the purpose of this study:

(i) To find out causes of different environmental problems in Kathmandu Valley and Nepal,

(ii) To analyze differential environmental issues of Kathmandu Valley and Nepal.

(iii) To find out possible solutions of environmental problems and recommend possible ways.

1.5 Limitations of Study

Due to appropriate facilities, it is difficult to gather systematic data's of related research and official information about the different environmental problems. But available data`s, references from several sources such as the different government ministry, Central Bureau of Statistics, government and local reports, survey and others were used to study this research.

1.6 Methodology

To achieve research purpose, different methods will be used as chapter wise.

In chapter Two, the field visit; direct interview; study reports and publications of government and non-government organizations especially which are involved in the field of squatters were used.

The chapter Three had studies by reviewed by different references, reports and academic journals.

Chapter Four is purely academic research based on social science. The field survey had been done last October 2012 to December 2012 in the study area.

In chapter Five the field visit, direct interview, study reports and publications of government and non-government organizations especially which are involved in the field of brick factories were used.

Chapter Six is descriptive study and this study had prepared by study of different research papers, books, journals etc.

Chapter Seven deals briefly with the research methodology applied in the study. This is purely academic research based on social science.

Part II

Economic Development and Problems of Nepal

1.7 Economy of Nepal

Nepal, a small landlocked, least developed, poorly economic resource base Himalayan kingdom lying between two big economies belongs in the less developed countries with US $311 per capita income. The total area of Nepal is 147,181 km^2 which is only 0.1 % of the total landmass of the earth but possesses various unique geographical characteristics with abundance of biodiversity and cultural diversity.

The major part of Nepal consists of rolling hills and high mountains covering 83% of the total area, where resources are scattered over many inaccessible place. The people are isolated from one place to another by the most of formidable physical barriers. Economic development pre-supposes development of transport to a considerable extent. Insufficient transport and poor communication are the main barriers of prosperity of Nepal. It remained for 104 years in the hand of Ranas[1] whose interests had been to keep people in the state of ignorance to serve their own interests by their reason. There are not any development processes except some insignificant mileages of roads and railways. Its importance was realized only after the formation of democratic government in 1951 A.D.

Nepal is among the poorest and least developed countries in the world with the 31% of its population living below the poverty line. And among the 194 countries, Nepal is in ranking in 104 List by the World Bank (1990–2012).Agriculture is the mainstay of the economy, providing a livelihood for over 80% of the population and accounting for 39% of GDP. Industrial activity mainly involves the processing of agricultural production including jute, sugarcane, tobacco, and grain.

In past it badly affected by Maoist insurgency, Nepal has considerable scope for exploiting its potentiality in hydropower and tourism, which are the areas of interest for the foreign investors. Prospects for foreign trade and investment in other sectors will remain poor because of the small size of the economy, its technological backwardness, its remoteness, its landlocked geographic location, its civil strife, and its susceptibility to natural disaster.

Nepal is highly dependent on foreign loans and grants. Nearly 60% of the development budget is funded by foreign sources. Government and the other development organizations have put enough effort to poverty alleviation. Current Three Year Interim plan (2007-2010) has given priority to poverty alleviation and taken it as main objective (Economic Survey, 2010).

Likewise, Nepal is not only suffering from economic problems but similarly by the environmental problems in recent years, such as; forest depletion, soil erosion, productivity loss, water pollution, solid waste pollution, air pollution etc. The global environmental problems are also persisting in Nepal such as; global warming, ozone layer depletion, acid rains, disappearance of tropical forest, loss of biodiversity, marine pollution, hazardous and non-hazardous waste, desertification etc.

1.8 Economic Development and Statement of the Problem

Nepal has entered a new phase in the history. The people now expect a real process of national reconstruction. With the advent of inclusive Lok-Tantra (Democracy), hopefully our government will live up to our expectations of people and not just limit itself to excruciatingly agonizing speeches alone. This is the right time for the government to have an open attitude and think about the welfare of Nepal and Nepalese people.

[1] The Rana dynasty (Nepali: Rāṇā shāsana) was a Hindu Rajput dynasty[1] which ruled the Kingdom of Nepal from 1846 until 1951, reducing the Shah monarch to a figurehead and making Prime Minister and other government positions hereditary.

In Nepal, about 80 percent of its population resides in rural areas are farmers and their literacy rate is 64 percent. Agriculture is the main occupation of Nepali people. The share of agriculture in Nepalese economy is about 35 percent in the GDP whereas the engagement of more than 80 percent people in the rural area of Nepal. The contribution of industrial sector to GDP is about 20 percent with the full time engagement which covers 6 percent economically active population in manufacturing sector.

Developing countries in the world, including Nepal, are moving around the vicious circle of poverty. Still more than 31 percent people of Nepal are under the absolute poverty line, according to the government record. The growth rate of Nepal is around 2.5 percent of real GDP. Every year, there is high resources gap in our budget. It means our budget is called deficit budget. There is higher expenditure than revenue, due to the high growth rate of population, lack of capital, technology and skilled human resource there is high saving-investment gap in Nepal. In this situation, foreign aid is being only way to fulfill this types of gap.

Nepal's economic development is a challenging proposition pre-conditioned to several economic and non-economic factors. These pre-conditions are to: (a) Ensure security, peace and stability in the country through developing national consensus among the political forces within the constitutional framework, which will create environment to help bring insurgents to the main stream of national life comprising economic and political activities; (b) Provide good governance by improving transparency and accountability especially in the context of managing state-funding or public exchequer, and effective delivery of goods and services to the people through the process of decentralization and local self-governance; (c) Check rampant corruption in politics, bureaucracy and business sectors that capsized Nepal into high risk country of safe investment. The size of corruption is not yet estimated, but it is deeply rooted and institutionalized in Nepali society, and it is challenging to Commission for the Investigation of Abuse of Authorities (CIAA); and (d) Improve productivity of foreign aid having ownership with control over external resources. The flow of external assistance from donors to Nepal through NGO and INGOs has not been properly recorded in the Office of the Auditor General (OAG). A big chunk of foreign aid is said to have gone back to donor countries by way of payments to consultants for their perks and fringe benefits: (e) Mobilize effectively internal resources by raising voluntary compliance, increasing tax elasticity by expanding legal base and improving efficiency of tax administration particularly through reforms in tax system; (f) Reduce population below absolute poverty line to zero within next twenty years from now by having double digits growth rate in excess of inflation rate; (g) Maximize benefits from the economic progress achieved by neighborhood economies by substantially improving economic relations and promoting joint ventures with India and China with respect to hydropower, tourism and manufacturing sectors; (h) Ensure benefits especially from SAFTA, BIMST-EC through expediting regional cooperation in the field of trade and investment; (i) Mobilize effectively both bilateral and multilateral international cooperation by initiating mega-projects such as Arun III and Karnali for hydropower development, construction of East-West railway connecting Indian border on both East and West for infrastructure development and development of networking of ropeway throughout the kingdom especially in mid-hills; and (j) Maximize benefits from globalization especially through WTO by exploring international markets for Nepalese exports matching quality and prices. These pre-requisites must be fulfilled to achieve desired level of economic growth and accelerate process towards poverty alleviation.

In addition, efforts towards economic development lack consideration of prime issues, which could be called hallmark of development essential for a breakthrough in the economic front. These are to: (i) Establish a national consensus on major economic issues such as harnessing water resources, abolishing dual ownership of land, privatization and FDI; (ii) Design a perspective plan for next twenty years from now; (iii) Conduct a survey of population below absolute poverty line; and (iv) Conduct a survey to identify 'Wealth of Nation' including subterranean resources and estimate the value of state property such as land forests etc.

The process towards development has been severely disrupted in absence of national consensus on major economic issues. The priority of developing small, medium or mega hydropower projects and their funding through indigenous, bilateral, regional and multilateral sources is not guided and governed by a national policy linked up

with the theory of economic development comprising estimation of expected level of growth, magnitude of revenue, size of foreign exchange, prospect for employment, and the number of households to be benefited. Privatization received a big jolt when public enterprises were sold at a throw-away price with a margin of huge kickbacks to authorities involved in the process of privatization. Privatized state-enterprises such as Chinese aided Bansbari Leather and Shoe Factory disappeared within a short span of time, share prices of Harisiddhi Bricks and Tile factory sharply declined from Rs. 10 to Rs 3, and Raghupati Jute Mills, and Biratnagar Jute Mills incurred heavy losses. The management of privatized enterprises is pressing hard to exchequer to provide funding for recurrent expenditures. FDI is not allowed in cottage industries with huge turnover, and services industries such as tours and travels, freight and forwarding, mountaineering and rafting are demanding protection to sustain their activities free from competition due to WTO provisions.

It is crucial to design a perspective plan for the next twenty years to ensure better future of low and middle income households and families. The perspective plan should comprise not only quantitative targets for physical outputs and financial requirements but also commitment of government towards implementation of policies and programs with viable and effective strategy. A long term perspective plan will be the 'Road Map' for economic development in Nepal, which should have very little flexibility over modulation policies and programs with the change in government.

There is also need to conduct a census of the population below absolute poverty line to effectively drag poor and ultra-poor out of poverty trap. It is extremely difficult to be specific about the size of poor people, for there is no mechanism to identify poor below the absolute poverty line in Nepal's 3913 VDCs and 58 Municipalities they live in. The poverty alleviation programs are primarily confined and injected to sample population and, therefore, approach towards addressing poverty is ineffective and partial. Although available data on poverty are conflicting, a majority as high as 70.0 percent population are struggling for their subsistence especially in the western hills and mountains. Poverty in Nepal is acute, pervasive and widespread and has increased over the years resulting in forced migration to district headquarters and the Kathmandu Valley from all over the Kingdom in search of livelihood and security. Although official statistics is grossly underestimated, recent trends in international migration reflect that the number of workers considerably increased in foreign employment.

Government of Nepal lacks approach to measure the 'wealth of nation' including subterranean resources while formulating annual budget and periodic plans. This has minimized economic strength of the country to negotiate funding for mega-projects with multilateral agencies. The total resources of the country must be assessed and their commercial viability examined to prepare a blue print or a 'Road Map' for the economic development of the country. Resources are estimated to meet requirements envisaged in the Medium Term Expenditure Framework (MTEF) based on internal resources available through tax and non-tax sources and external assistance though bilateral and multilateral sources. External resources are subject to the commitment and approval made by donor communities in Nepal Development Forum (NDF) held every alternative year.

Many seek to explain resource degradation as a consequence of the economic production. Private exploitation of land or other resources can cause environmental problem. Entrepreneurs tend to maximize profits in the short term, possibly incurring degradation, and then invest part to all of the profits elsewhere. Mobility of capital makes it possible for the exploiter to avoid the longer term economic, consequences of resources degradation.

External factors acting on the production system can cause or contribute to environmental problem. Such factors include world market forces, neo-colonialism, and the actions of multinational transnational corporations. The terms of international trade are seen by many economists as having caused increased economic dependency and indebtedness of developing countries. It is examined that the development paths of Japan and Java both of which in the 1830s had a similar level of development; the former had, in spite of a poorer endowment of natural resources developed for more; while Java remained underdeveloped, despite a position astride the main trade routes and a good natural resources endowment, because of little reinvestment of profits from resource development.

Developers have come to see technological advance not as the whole benefit but also loss of environmental health. The technological advancement can create the loss of biodiversity, loss of quality of land, forest, water and other essential resources which are essential for daily life. In Nepal environmental degradations such as; loss of bio-diversity, loss of tropical forest, melting of snow of Himalaya range, glacial lake outburst flood, heavy rain, draught, acid rain, rise of temperature, flood, landslides etc. environmental problems are the common in these days.

CHAPTER 2

Squatters Problems along Bagmati Riverside in Nepal and its Impact on Environment and Economy

2.1 Introduction

Urban environment in most Nepalese cities is degrading day by day over last couple of decades due to rapid and uncontrolled urban growth. Kathmandu city is the largest urban center in the country with five major cities, are suffering most due to this uncontrolled urban growth. Several government organizations and local bodies responsible to manage the areas in the valley and hundreds of government committees and non-government organizations working in these sectors have so far failed to make any significant improvement in the situation. Increasing trend in the number of the squatter settlement is one of the key issues related to uncontrolled urban growth in Kathmandu valley. In 1985 it was estimated that there were only 17 squatter communities in Kathmandu, but now the number has grown to 40. Besides, there are other settlements in different parts of the valley. An increasing trend of these settlements has significant impacts in local environment of the valley, any plans and programs designed to improve the valley's urban environment must effectively address the issue of squatter population.

In 1996, Government of Nepal formed the High Powered Bagmati Civilization Integrated Development Committee[2] (HPBCIDC) with the aim of improving the environmental situation of Bagmati River and its tributaries. The committee has initiated new strategies and programs for improving the environment along the Bagmati and its tributaries. Effective management of the squatter settlements along the rivers is one of the high priority activities of the committee.

Accurate and updated information about the squatter settlements along the Bagmati and its tributaries is essential for developing and implementing plans and programs for their efficient management. Although a few studies in past have identified the squatter settlements in the valley and provided their basic data, there is a need to regularly update this information as squatter tend to the temporary and mobile and their status tend to vary significantly over time and space in rapidly urbanizing cities. Recent political developments in Nepal which have increased the rate of internal migration within the country, has had significant impacts in the status of the squatter settlements as well. This study is designed to update the information provided by the earlier studies and to provide data base for the planners and decision makers to address the issues related to squatter problems in Kathmandu valley. The survey of secondary data was carried out in September 2012.

2.2 History and Importance of Bagmati River

Bagmati is a river of Nepal. It flows through the Kathmandu Valley and is the river separating Kathmandu from Lalitpur. The river originates at Bagdwaar on the northern hills of Kathmandu valley and flows through several important parts of Kathmandu including the temple of Lord Pashupatinath[3], the holiest Hindu temple in Nepal. The

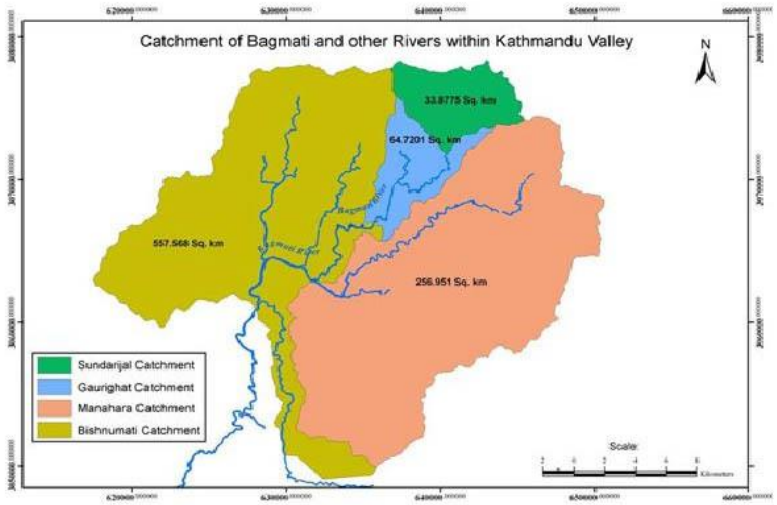
[2] This committee formed and started to work in initial days but because of the political situation of Nepal, this committee couldn't implement any concrete program.

[3] **Pashupatinath Temple** is one of the most significant Hindu temples of Shiva in the world, located on the banks of the Bagmati River in the eastern part of Kathmandu, the capital of Nepal

river mixes with Bishnumati at Teku Dovan. The river crosses Chobar gorge[4], on the south of the valley, to flow out of the Kathmandu valley to finally reach Terai.

The Chovar temple complex is at the entrance to this gorge. Bagmati is an important religious symbol to the Hindus of Nepal. It is considered as a holy river both by Hindus and Buddhists. A number of Hindu temples are located on the banks of this river. The importance of Bagmati also lies in the fact that Hindus are cremated on the banks of this holy river, and Kirants[5] are buried in the hills by its side. According to the Nepalese Hindu tradition, the dead body must be dipped three times into the Bagmati River before cremation. The chief mourner (usually the first son) who lights the funeral pyre must take a holy river-water bath immediately after cremation. Many relatives who join the funeral procession also take bath in the Bagmati River or sprinkle the holy water on their bodies at the end of cremation. Bagmati River is thus considered purifying the people spiritually and physically.

Figure1: Catchment of Bagmati and other Rivers in Kathmandu Valley.



Source: www.nrtc.org.np/Bagmati/river/map-accessed in September, 2012.

2.3 Study Procedure

The squatter communities studied were identified by the field visit, direct interview, study reports and publications of government and non-government organizations especially which are involved in the field of squatters. Some data were taken from government and non-government offices and their websites. The squatter communities out of Bagmati riversides are mentioned just for reference rather than detail study and analysis on these.

2.4 Squatter Settlements in Kathmandu Valley

Nepal is a landlocked country with 26.6 million populations living over an area of 147,181 square kilometers. Its per capita income is just US$742. Kathmandu has recorded the highest decadal population growth 60.93% from

[4] Nepal, this committee couldn't implement any concrete program

[5] The Kirat or Kirati or Kiranti or Kirant people are indigenous ethnic groups of the Himalayas (mid-hills) extending eastward from Nepal into India, Burma and beyond.

2001 to 2010. As per the census results, out of total population, 17 percent (4.5 millions) reside in urban areas (CBS, 2011 Preliminary Report).

Table 1: Name of River and Nearby Squatter Settlements.

Nearby River	Name of Squatter Settleme nts
Bagmati River	Shanti Nagar, Bijay Nagar, Jagrit Nagar, Gairigaun, Chandani Tole, Pragati Tole, Kalimati Dole, Kimal Phant, Bansighat, Kuriyagaun and Sankhamul
Hanumante River	Manohara Bhaktapur
Bishnumati River	Dhikure Chouki, Kumaristhan Buddhajyoti Marga, Balaju Jagriti Tole, Sangam Tole, and Ranibari
Dhobi Khola	Santi Binayak, Devi Nagar, Bishal Nagar, Kupondole and Pathivara
Tukucha Khola	Narayantole, Maharajgung and Khadipakha Maharajgung
Other Locations	Palpakot, Anamnagar, Maijubahal, Kumarigal, Radhakrishna Chowk, Mulpani, Kapan Dhungen, Subigaun, Ramhiti, Mahankal, Dhumbarahi Sukedhara, Mandhikhatar, Galfutar, Ramghat, Dhaukhel and Bhimmukteshwor

Source: www.google.com/kathmandu/squatter-settlements: accessed in September, 2012.

Above table shows that total 11 settlements are residing on the bank of Bagmati River, 1 settlement on Hanumante River, 5 settlements on Bishnumati River, 5 settlements on Dhobikhola, 2 settlements on Tukucha and 16 settlements on the other locations in Kathmandu Valley. The squatter communities on the bank of Bagmati River are taken problematic rather than other settlements, it is because of the central location, heavy settlement area, and out of the sanitation and drinking water facilities. Keeping this in mind, The Government of Nepal destroyed squatter settlements established on the bank of Bagmati River in May 2012 to shift them on other locations but because of an organized protest against government they resettled there after one month.

Figure 2: Distribution of Squatter Population by Location

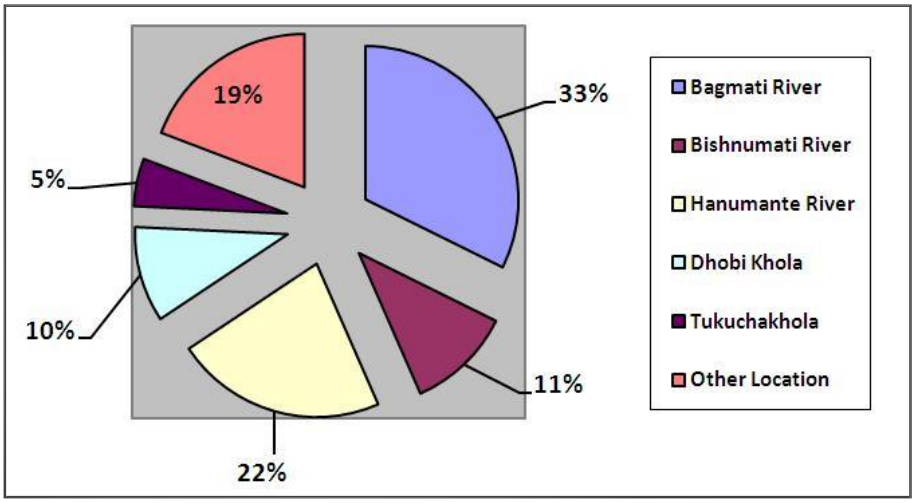
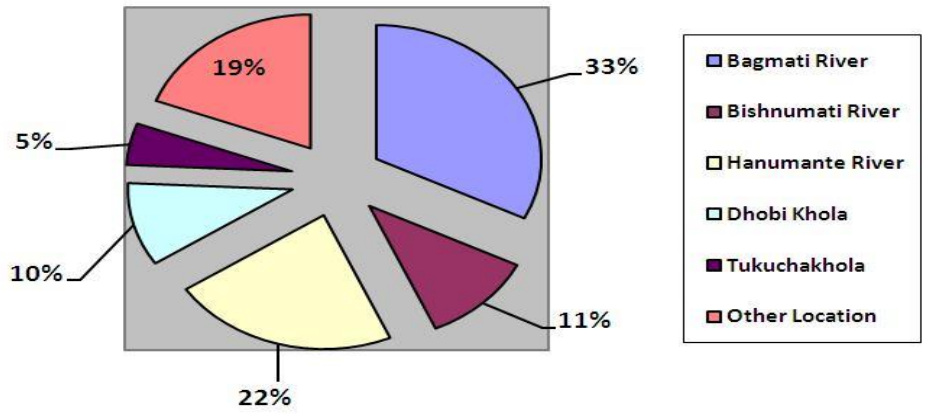


Figure 3: Distributions of Households by Location



Source: Lumanti Bulletin, 2069 B.S.

The 40 squatter settlements of Kathmandu valley are providing shelter for about 12726 people (6612 male and 6114 female) in 2735 households. The average household size of these squatter settlements is 4.7. The population of squatters in different settlements, number of households and average household size are shown in table 2.

Table 2: Populations and Number of Households by Locations.

Location of Squatter	Number of Settlements	Total Population	Male	Female	Total Households	Average Household
Bagmati	11	3903	2052	1851	863	4.5
Bishnumati	5	1564	768	796	306	5.1
Hanumante	1	2422	1290	1132	589	4.1
Dhobikhola	5	1247	653	594	271	4.6
Tukucha	2	843	459	384	176	4.8
Other Locations	16	2747	1390	1357	530	5.2
Total	40	12726	6612	6114	2735	4.7

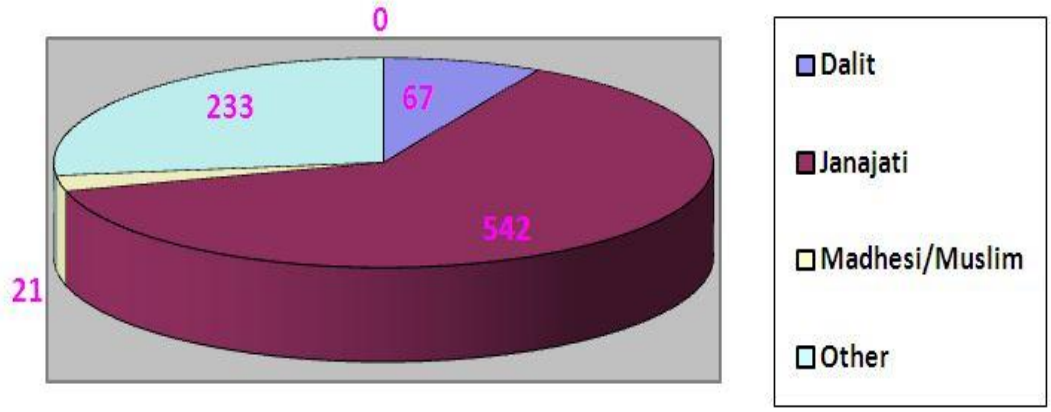
Source: Lumanti Bulletin, 2069 B.S.

The 11 squatter settlements along the Bagmati River have 863 households which is 32% of the total squatter households in Kathmandu Valley. Above table shows most of the squatter settlements established near rivers. There are nearly 10000 people living in 2205 households in squatter settlements along river banks of the valley. Thus a huge number of squatters are residing nearby river.

2.4.1 Squatter Settlements along Bagmati Riversides

The 11 squatter settlements along the Bagmati riversides are residing. Following figure shows the ethnicity of squatter residents along Bagmati riversides.

Figure 4: Ethnicity of Squatter Residents along Bagmati River

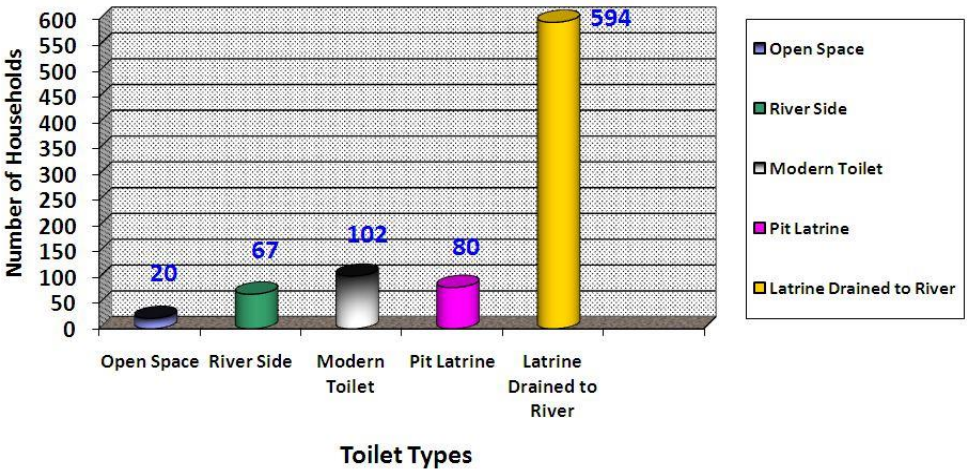


Source: www.google.com/kathmandu/squatter-settlements: accessed in September, 2012.

Above figure shows, the other category of ethnicity consists of mainly Brahmin, Chhetri, Giri, Puri and Thakali. The Janajati consists of more than 50 castes such as Sherpa, Tamang, Magar, Gurung, Newar, Rai, Lama, Limbu etc. Dalit includes Pariyar, Deula and Kami. Madhesi includes Yadab, Thakur, Mahato, Jha etc. and Muslim includes Miya, Chureta, Khan etc.

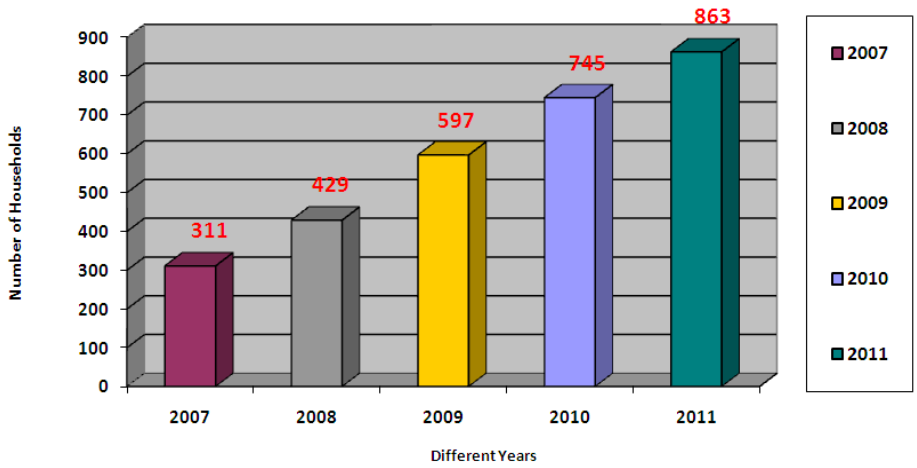
Figure 5 shows that out of total 863 households 20 households use the open space for toilet, 67 households use riverside, 102, 80 and 594 households use modern toilet, pit latrine and latrine drained to the river respectively. It shows that only 182 households out of 863 use the safe toilet and do not pollute the river and surrounding environment. This situation further indicates that one of the major pollutants of surrounding environment is the squatter settlements of Bagmati riversides.

Figure 5: Use of Toilet by Squatter Settlements along Bagmati River



Source: *Lumanti Bulletin, 2069 B.S.*

Figure 6: Increasing Trends of Squatter Households along Bagmati Riversides



Source:*www.google.com/kathmandu/squatter-settlements/in-different-years:accessed in September, 2012*

Riversides, the data have been taken from 2007 to 2011. Within total 5 years the numbers of squatter households increased 311 to 863. The growth rate is 37.94 percent in 2008, 39.16 percent in 2009, 24.79 percent in 2010 and 15.83 percent in 2011. This further indicates rapid growth in the years 2008 and 2009 and slower growth in 2010 and slow in 2011. Now the government has felt squatter settlements as serious problem for the improvement of Bagmati River and its environment. The government initiated in May 2012 to shift squatter settlements from there to other places but organized protest against government and support of some political parties this process stopped suddenly and reestablished the squatter settlements on the bank.

2.4.2 A Case Study

Box 1: Durga Kami and her Situation

21 years old girl named Durga Kami came from Dhading to Kathmandu in 2005, she had no parents but stepmother and a brother. She had left school after primary education due to workload at home. In Kathmandu she joined in a working team of building construction. Within 6 months of working period with this team married with a boy of Sindhupalchowk District, who was also a member of this team. One day while they were working, listened a rumor that on the bank of Bagmati River new settlements were being constructed by homeless workers. Next day they went Bagmati River bank 'Sankhamul' to know the fact; they visited few people who were constructed bamboo cottages, among them few were known of their area, they invited them to make such cottage recently, and then they booked the place for cottage. Next day, they started to make cottage for shelter, now they have 5 children, have passed 7 years on the bank of river and the couple works building construction works. They don't have toilet, drinking water, children are out of school and the subsistence of life is very difficult. Kathmandu Metropolitan City Office forces them to leave the place time and again 'once a month in average' but till this year they are there.

Source: Field Survey, September, 2012.

2.5. Bagmati River and its Environment

Bagmati corridor is most probably the only open space left in the city core areas of Kathmandu valley, although the environmental condition is very poor. The unmanaged sewage connections, solid waste dumping and development uncontrolled squatter settlements along the river banks have deteriorated the environmental conditions and hence has affected not only the aesthetic value but also the economic opportunity of the land alongside the river corridor. The open space and the river which could have been at asset to the urban areas of the city has been

left neglected and polluted. The Bagmati corridor contains several important elements of historic and cultural importance which the study identifies as at risk. Encroachment of land by the squatter settlements is on the rise. There is predominant encroachment of land adjacent to the river, by the people due the vague demarcation of river boundary and water way width. Hence the entire river corridor is in a chaotic state. However with proper planning and efficient implementation strategies this chaotic scenario can be changed. There are a lot of opportunities amidst the prevalent threats and a lot of strengths amidst the weaknesses which needs to be analyzed. Realizing the opportunities and the strengths the development plan for the entire Bagmati corridor has been proposed which is only conceptual. The present river environment deterioration at the rapid rate immediately highlights the necessity of the buffer zone. The concept of buffer zone is not new, but has been developed since long time back. However, till now the concept has been failed to be practiced.

2.6 Squatter Settlements and Environment

The river bank and land left by the river in due course of diversion has been confiscated by squatters. Both permanent and temporary squatter settlements can be seen along the river corridor. Besides the severe encroachment of land, much more environmental impact could be observed due to their settlement to the river. The manual improvised sand mining and direct discharge of their toilet to the river can be seen. Thus, their removal from the corridor is important not only because of the land value but also from river health point of view. Usually, a squatter settlement is highly organized despite being illegal. The occupants have clearly defined behavioral rules, spatial boundaries and methods of solving tenurial disagreements. Illegal housing is sold, land is subdivided and leased, and other transactions are possible as if the land or housing was legal. The settlement is also typically recognized by the public or private landowner, and, if the landowner is private, rents are often transferred. Squatter settlements have gradually become an integral part of the urban fabric.

The proximity to income-earning opportunities in the city center is normally a crucial issue for the urban poor and, to gain access to inexpensive centrally-located land for housing, the urban poor normally have to sacrifice tenure security. They are forced to encroach on any type of vacant land illegally (often ill-suited for housing) and to ignore building and development regulations. Many housing programs implemented by governments have failed because they have been located in the urban fringe where income-earning opportunities normally are scarce.

Eviction has three basic impacts on those affected: physical, economic and psychological. Eviction reduces the housing stock of the city and ruins the economic value of the housing which may be small in real terms but big for the individual. It detaches the squatter from employment opportunities which are usually nearby or even in the settlement itself. It also uproots them from the community which functions as an economic and psychological safety net. The home is the center of everybody's lives and eviction, often forceful, is a very traumatic experience, especially for the children. While the eviction is a traumatic experience in itself, the most harmful impact of eviction may actually be the fear of being evicted. The fear makes people fatalistic, loses confidence in them and discourages them from improving their housing.

It cannot be denied that there are occasions such as major infrastructure projects where eviction cannot be avoided and to generally deny landowners the right to evict would be to, in actual fact, acquire land compulsorily without compensation. Governments will be most efficient if they act as facilitators. The problem of shelter provision is actually more political and institutional rather than technical. Most observers of squatter settlements have realized that people will gradually upgrade their housing over time if they are provided the opportunity. They will invest capital and labour as well as mobilize their social network. However, these gradual improvements will only take place if their housing is considered legitimate. Provision of land is a key issue to alleviate the shortfall of housing for the urban poor. In most cities there are considerable land areas which are suited for housing but not used intensively. The challenge would be to find and implement effective strategies for helping the urban poor. There are already several solutions to the problem of access to land, ranging from provision of the most basic element, tenure security (normally the major component of slum upgrading programs) to sophisticated sites-and-

services programs and land readjustment schemes. The urban poor are capable of improving their housing conditions by themselves if they are provided some type of security, or at least perceived security, of tenure. In actual fact, governments wishing to remedy the housing conditions of the urban poor are left with only two major - more or less costly- options to provide more land: (1) legalizing the tenure of illegal settlers where they are and allowing them to pay below market prices for the land; and (2) allocating public land to low-income households at subsidized rates. The governments would have to provide land which is reasonably close to income opportunities and basic amenities in order to make it a real alternative to squatting.

In case of Bagmati, relocation of the squatter settlements seems to be a viable option. During the evacuation of Bishnumati River corridor, the prevailing squatter settlement was relocated to Kirtipur, for which land was subsidized by the assistance of urban community support fund created by Lumanti and Kathmandu Metropolitan City. This relocation is a successful model that can be replicated in relocation of the squatter settlement in Bagmati River. Following may be the good strategy for removal of the squatter settlement.

- the squatter settlement can be relocated at government land away from the river in the area where land cost is less.
- provide subsidy to get land for their settlement nearby currently settled location.
- the land available at the river corridor can be used to build apartment (flat system) with initial investment by the government. The relocated squatter will have to pay for land as well as for the house in installment

(Source: www.google.com/kathmandu/bagmati-squatter-settlements-and-environment).

2.7 Attempts to Conserve the Environment of Bagmati River

For the last ten years, one such effort in generating awareness about the Bagmati's plight "Bagmati River Festival", the festival of 21st century has been put forward by the Nepal River Conservation Trust (NRCT). NRCT is a non-profit organization that was established by a group of concerned river guides and environmental professional who were alarmed by the ecological, social as well as cultural damage that was wreaking havoc on Nepal's river. The Bagmati river festival was started in 2001 to provide a platform for all interested individuals and organizations to express their concerns and provide solutions to overcome the plight of this holy river.

2.7.1 Bagmati River Festival

In response to the worsening situation of the Bagmati River and in order to alter the biological degradation in it, NRCT had initiated Bagmati river conservation campaign called Bagmati River Festival (BRF) in 2001, in association with some likeminded organizations. The festival aimed to provide a platform for all interested individuals and organizations to express their concern and provide solutions to overcome the plight of this holy river. Since then, BRF is being organized on an annual basis and today, the number of active partner organizations has crossed over hundreds. Also, over four-hundred institutions have participated in this event so far, since its inception in 2001. The partner organizations includes many I/NGOs, I/GOs, academia, research and development organizations, business houses, local clubs, media, actors, singers and music bands, conservation campaigners and civil society. Government organizations like Nepal Tourism Board, Sustainable Tourism Network, Kathmandu Metropolitan City, different Ministries and some I/NGOs along with donor communities, corporate and media houses etc. are providing minimum funding and technical support to organize, the events included in the BRF. The festival has attracted people of all age, groups (School children to university graduates and job holders to retired professionals) and from a variety of professions. The two and half month festival is formally launched every year on June 5th to mark the World Environment Day (WED) and continues till the third or fourth week of August depending on Nepali calendar, it ends on Nagpuja, a holy festival of Hindus.

For the conservation of Bagmati Environment many organized and unorganized attempts through local NGOs, CBOs and Youth Clubs are made but the major attempt from the side of government was made by forming Bagmati Environment Improvement Plan. The features of this plan are mentioned below:

2.7.2 Bagmati Environment Improvement Plan

This plan developed by *Adhikar Sampanna Bagmati Sabhyata Akirit Samitee,* in May 2008 for the conservation of Bagmati environment. But unfortunately this plan has not been implemented yet. The main features of the development plan are as follows:

- Development of green belt all along the corridor, on either side, so as to promote a healthy and Green environment.
- Recharge and maintain the natural flow of river and promote management practices that will help to stabilize the volume of water carried by the river and to safeguarding water quality.
- Promote the natural ecosystem of the river and its territory by giving due emphasis to the growth of biodiversity in the river and along the corridor in terms of fish, plants, birds etc. and improving fishery productivity by encouragement of habitat for indigenous species.
- Develop a riverside road, (which already exists in most of the riversides) so as to ease the traffic congestion in the valley.
- Manage public access to riverbanks enhance the livelihood of the area by developing cycling and pedestrian jogging tracks along the corridor
- Conserve and regenerate the cultural elements like Ghats Pattis, temples etc.
- Create interesting landscape along the corridor so as use the vacant land and to promote a pleasing aesthetic environment along the corridor
- Improve understanding of the river environment amongst land managers, local people, agencies and visitors in order to promote interest in its management.

2.8 Squatter Settlements and Impacts on Environment

Human settlement and various physical works along the river corridor not only alter the practice of land use but also spoil the river environment. The deterioration of the River environment has several unpleasant consequences the important one being the health issues of the inhabitants. The sanitation system of Katmandu Valley and other aspects have played a major role in degrading the river environment.

The establishment of the squatter community along the river is one of the major contributors of the river deterioration. These settlements include the community thriving below the poverty line, and thus are capable of directly exploiting the river environment to their benefit as well as the most vulnerable lot to the river disasters like water borne diseases, flooding, etc. Shanti Nagar, Bijay Nagar, Jagrit Nagar, Gaigaun, Chandani Tole, Pragati Tole, Kalimati Dole, Kimal Phant, Bansighat, Kuriyagaun, and Sankhamul are some of the squatter settlements along the Bagmati River. Both permanent and temporary squatter settlements are present at river banks. Besides the severe encroachment, much more impact could be observed due to their settlement to the river. The sand mining was observed here. Their toilet discharge directly to the river or toilets are constructed above the river.

2.8.1 Solid Waste

Solid waste dumping along the banks of the river by squatter settlements is one of the major causes of river environment degradation. Throughout the stretch solid waste disposal is observed. At some places the disposal is intense and some very scattered. Plastic are the fast eye catchers among those dumped heap as well as in the scattered wastes. Solid waste disposal is not limited to the banks but into the river and the piers of the bridge as well. The disposal has resulted in breaking flow of river and diversion to some extent. Remnants of animals and Slaughter house wastes are another big problem. Construction debris thrown haphazardly along the corridor is also another source of pollution. The river banks are also used by the municipalities to dump the solid waste in some parts.

2.8.2 Water Pollution

Sewage disposal by squatter settlements without any treatment along Bagmati Corridor is one of the major sources of water pollution turning the river virtually into an open drain. Including the disposal of untreated sewage from the municipal sewers, other illegal sewerage disposal points on both sides of the river banks are observed. Trunk sewers have also been discharging the sewage directly open into the river at various points. Besides that, human fecal wastes are observed along the whole stretch comparatively high towards the downstream and mostly at the bridges areas. Many public toilets have been constructed near by the river and the waste is directly discharged into the river stretch. Toilets are very common at the squatter areas and the waste water is being directly discharged into the river.

Utilization of Ground water source (hand pump and shallow boring) is intensive in squatter areas for household use as well as for industrial use. Spring water sources were seen along the river near by the banks. During the field visit those sources were noticed to be utilized for onsite washing, cleaning dishes as well as for consumption.

2.8.3 Air Pollution

Air pollution by the squatter settlements has been observed through solid waste burning practice, decomposition of dumped solid waste and sewage at the site of Bagmati River.

2.8.4 Land Pollution

Land pollution by the squatter settlements has been observed through dumping solid wastes such as plastics, sands, stone, human-stool etc. on the open or agriculture land around their settlements.

2.8.5 Sand Mining

Illegal sand mining on Bagmati River by the squatter community people has created several environmental problems. The flowing space has been extended on the far sides of the river. Open and vegetation area on either sides of river has been converted as the flowing ground of the river. Haphazard piles of sand on the side of river may blow by the air and air is also polluted through this.

2.9 Squatter Settlements and Impact on Economy

Squatter settlements generate public costs of many kinds, many of them a result of negative environmental impacts. Particularly, it compares the cost of providing urban services to them. Squatter settlements upgrading projects may have of huge amount especially to manage public site for housing, land to agriculture or employment, sanitation, drinking water, electricity, health, education, toilets, and other infrastructures. The inclusion of environmental impacts is chiefly responsible or raising the total cost of squatter settlement management schemes. Government, typically, bears the bulk of the extra costs of rationalizing road networks, extending infrastructures,

picking up garbage and management of deteriorated overall environment. But the level of government depends on the strength of economy.

Poor residents of these communities bear much of the immediate negative environmental and health impacts morbidity and mortality rates closely linked to environmental quality, namely infant mortality, diarrhea and respiratory diseases. This may multiply over the nearby other settlement areas and as a whole city may be at risk.

Public health authorities in Kathmandu note that only a miracle has saved the area from major epidemics especially in dry season. In this season squatter settlements mostly use dirty water for the drinking and other purposes.

In Nepal, government has tried to correct the high cost and poor targeting of the traditional approach through upgrading squatter settlements. These upgrading efforts, typically, are one-time investments in infrastructure, for example through rationalizing and paving a road network, by providing water and sanitation systems, etc. and this after land invasions have determined the location and pattern of land development. The lobby for upgrading is often weaker than that for new development. Some politicians promote it because votes can be won by allowing squatter invasions and by further providing infrastructure periodically as the need for support arises, mainly at election time. Housing NGOs and housing experts also often advocate upgrading for a variety of reasons. However, as the Bagmati River bank experience indicates unguided squatter upgrading results in high per unit costs and low cost recovery for modest results. In addition, it provides no additional solutions that relieve the pressure for land invasions.

2.10 Results

The steadily increasing population and related solid waste dumping in the river has made the Bagmati River and its tributaries excessively polluted. The river's capacity to purity itself by means of interaction between biotic and abiotic characteristics of the river tends to zero. Bagmati Corridor has been utilized and encroached at various places for a variety of reasons. This aspect requires emphasis as the river corridor is the most vulnerable environment which comes under the popular problem of "Crisis of the Common" since it is common as a public property. The area is most vulnerable to the over exploitation. Inhabitants can easily encroach upon the corridor if proper monitoring is not undertaken. The squatter environment is the perfect breeding ground for a wide range of social and environmental problems. High unemployment often causes men to stay around the home growing increasingly frustrated with their pathetic situations and the worsening poverty.

Some of the corridor segments run along the pro-urban areas where source of economy is agriculture and to a very small extent in urban areas were used for the temporary cultivation plots. At squatter areas land use for agricultural purpose was seen intensively. The physical infrastructure such as roads and public toilets, were also seen to be encroaching the river territory.

Increasing trend in the number of the squatter settlements is one of the key issues related to uncontrolled urban growth in Kathmandu Valley. Out of 40 settlements 11 settlements are situated along the Bagmati riverside, where 3903 people (2052 male and 1851 female) are residing. The increasing trend of squatter households on this side has found 37.94 percent in 2008, 39.16 percent in 2009, 24.79 percent in 2010 and 15.83 percent in 2011. This indicates rapid growth in the years 2008 and 2009 and slower growth in 2010 and slow in 2011. These settlements are very vulnerable to highly polluted environment and flood risks. In the dry season especially on January, February, March, April and May they are to be suffered from very bad smell of stool and other mixtures of the river. In this season they are also compelled to drink very dirty water of the riverside. The attempt of the government and other agencies to manage squatter settlements and conservation of Bagmati environment seems inadequate in terms of coordination and regulation of it for the longer time. Squatter settlements have seen major causes of river environment pollution through dumping of solid waste, toiled drained to river, sand mining and

encroachment of public property. Squatter settlements are posing extra cost to the government and other agencies to manage their settlements and riverside environment. The historical importance of Bagmati River is also decaying day by day because of the encroachment of river territory and pollution over the river water.

2.11 Discussion of Results

- Squatter settlements along the Bagmati River are living on very vulnerable polluted environment and flood risks, most of them are using open sky toilets or direct drained to the river.
- The growth of squatter settlements on this riverside seems rapid in the years 2008 and 2009 but slower in 2010 and 2011 it may be because of political changes in Nepal. Lack of riversides monitoring mechanism of The Government of Nepal is responsible for the growth rate of them.
- The squatter settlements of Bagmati riverside seems major pollutants to the river environment through solid waste dumping, toilet direct drained to river, plastics and sand extraction around their areas.
- Poverty alleviation strategy and present trend of housing development have failed to address the needs of housing for urban poor living in slums and squatter settlements of the Bagmati River banks.
- Squatter settlements of Bagmati riversides are posing the extra cost of the government to manage their settlements and improvement of the riverside environment. Shifting process of the government failed because of strong protest of them and support of some political parties to them.

2.12 Conclusion

Riverbank seems to be the area that highly attracts the squatter communities. People residing in squatter settlements face many problems like improper sanitation, unhygienic environmental conditions, social, economic, health, educational and cultural problems and many more. The basic problems inherent in slums are health hazards, lack of basic amenities like safe drinking water, proper housing, drainage and excreta disposal services, make slum population vulnerable to infections. The squatter environment is the perfect breeding ground for a wide range of social and environmental problems. High unemployment often causes men to stay around the home growing increasingly frustrated with their pathetic situations and the worsening poverty. For decades the issue related to the poor families living in the slums and squatter settlements have not been addressed well. The Government of Nepal has no proper plan with full of commitments to shift them from there to other places for the improvement of their situation and environment. Only the programs and policies of short period of time have brought limited results to improve the situation. This study gives enough background information on the need of improving squatter settlements making proper arrangement of alternatives with respect to helping people live a decent life as well as contributing to conserve the environment of Holy River. The following recommendations may be long term solutions for this problem in Kathmandu Valley:

(i) Have to develop mechanism for recognize to actual homeless people.

(ii) Have to manage shelter for them at appropriate area.

(iii) Have to create new job for those people who have less income for livelihood.

References

CBS (2011). Preliminary Results of National Population Census, 2011, Kathmandu: Central Bureau of Statistics.

Lumanti (2069). Lumanti Bulletin, 2069, Kathmandu: Lumanti, Support Group for Shelter.

www.nrtc.org.np/Bagmati/river/map-accessed in September, 2012.

www.google.com/kathmandu/squatter-settlements: accessed in September, 2012.

www.google.com/kathmandu/squatter-settlements: accessed in September, 2012.

www.google.com/kathmandu/squatter-settlements/in-different-years:accessedinSeptember, 2012.

www.google.com/kathmandu/bagmati-squatter-settlements-and-environment:accessed in September, 2012.

CHAPTER 3

An Overview of Agricultural Degradation in Nepal and its Impact on Economy and Environment

3.1 Introduction

Agricultural development has emerged as a major subject of development discourse in livelihood improvement and environment degradation in Asia. Shifting cultivation, the first stage of agricultural development was the most widespread agricultural system in South and Southeast Asia until the mid-20th century. It involved basic tools and techniques low level of inputs and subsistence level of production and consumption which was unable to support growing population and their subsistence needs. The food security situation was worse in developing countries where the colonial power invested very little on food production systems. After independence, their situations were much worse. The increasing population[6] combined with government control over common property resources was putting pressure on shifting cultivators to reduce the fallow period. Meantime, shifting cultivators deserve improved lifestyle which was not possible from the low return being provided by their practice of cultivation. Such circumstances forced farmers to seek for more productive agricultural system which otherwise could have brought a hunger and malnutrition situations in Asia.

Nowadays in Nepal, the heavy use of chemical fertilizers and pollutant technologies, the most common farmlands are degraded. These advances including high yielding varieties, more use of chemical fertilizers, haphazard irrigation and other chemical inputs led to a remarkable environmental degradation. The increasing number of livestock and overgrazing over the pasture lands has created environmental deterioration. Growing population has challenged to produce more but because of the traditional production system production has not been increased rather it has been degraded the environment and recorded loss on economy.

3.2 Review of Related Literature

Contribution of agriculture sector to Gross Domestic Product (GDP) during the people's movement-II in 2005/06 was close to 35 percent. Though various programs were implemented to increase agricultural production in subsequent years, the contribution of this sector to GDP just remained between 32 percent and 36 percent. As per the preliminary estimates, contribution of agriculture to GDP during the current fiscal year 2011/12 will be 35.68 percent against the revised estimate of 37.47 percent in the previous fiscal year. In the current fiscal year, GDP is expected to rise by 4.56 percent at constant prices of FY 2000/01, while the growth rate of agriculture sector is expected to remain slightly higher than this with 4.93 percent. Agricultural production in this fiscal year is estimated to increase marginally higher by 0.46 percent than that of the previous fiscal year (Economic Survey, 2012).

Agricultural sector may be detrimental for environment in many ways. In fact, the growing demand for agricultural products, the increasing domestic food production by fewer individuals because of rural exodus, and the need of nontraditional export products as a means of increasing income, and earning valuable foreign currency for the country lead farmers to look for alternative agricultural methods in order to raise their productivity (Andreatta, 1998). One way to address this problem is the excessive use of fertilizer and pesticides, and this has adverse effects in terms of environmental degradation. Fertilizers and pesticides are discharged into the ecosystem

[6]According to National Population Census, 2011 Nepal's population is 2,64,94,504 and population growth rate is 1.35

by drifting, dripping or leaking into areas surrounding the target area. The deposited chemical is then transformed by living systems, heat, light and water to form a pesticide residue (Ghatak & Turner, 1978, pp. 137).

Another important issue regarding the environmental degradation effect of raw agricultural product exports is the comparison of the environmental impacts of primary production and processing (Hecht, 1997).

These residues are dispersed in the ecosystem through natural forces (biologically, physically), and human activities. They can be transported by fluid movements (wind, rain, etc.) in the environment. They can vaporize from falling spray particles and from plant, soil and water surfaces; they can be carried physically as vapor or absorbed in wind-borne particles of soil and dust. Thus, the use of these products in addition to animal feedlots, pastures, dairy farming and aquaculture leads agriculture to provoke soil and water pollution through the discharge of pollutants and residue (phosphorus, nitrogen, metals, pathogens, sediment, pesticides, biological oxygen demand, trace elements) to the soil as well as surface and groundwater, through net loss of soil by poor agricultural practices, and salinization. Agriculture is also responsible for a large amount of methane emission (second most important greenhouse gas) and nitrous oxide emission (third most important greenhouse gas) (Galt, 2008).

Another way to address the problem of high agricultural product demand is the excessive use of water through irrigation, the use of mechanized agricultural methods rather than labor intensive practices and/or extensive use of land. These methods affect physical environment respectively through water shortage, air pollution (CO2 emission) and deforestation. Agriculture is the single largest user of freshwater resources, using a global average of 70% of all surface water supplies according to Ongley, (1996).

In the specific case of agricultural subsector, some arguments have been developed linking international trade to environmental concerns. The scale, technique and composition effects have been discussed for this sector since agricultural product export obviously leads to economic growth (Antle, 1993). Trade liberalization also modifies the relative price of agricultural inputs such as fertilizer, pesticide, tractors, and thus, has adverse impact on the physical environment. Given that developing countries generally import these inputs, openness to trade leads to pollution haven in agricultural subsector. Because of data scarcity, few studies investigated empirically this hypothesis. Through econometric estimation and simulation, Williams and Shumway, (2000) found that the North American Free Trade Agreement (NAFTA) is expected to increase chemical usage substantially in the United States and lead to greater groundwater contamination. They also showed that in Mexico, the expected effects are a substantial increase in fertilizer use but a decrease in pesticide use.

In the areas of semi-commercialized agriculture, farmers are injudiciously using various pesticides for an increased productivity and risk mitigation in crop production, even though an average application rate of 142 g/ha (Adhikari, 2002) and annual consumption of 176mt a.i. (Palikhe, 2002) of pesticides in Nepal is not considered high. According to Palikhe (2006), more than 60% of the applied pesticide remains in the soil materials polluting soil environment as a risk to terrestrial as well as aquatic biosphere. The residual effects of some of the chlorinated hydrocarbons like Chlorodane, BHC, DDT and alien remain in soil for a period of more than nine years (DOA, 2001). Imprudent disposal of obsolete pesticides is also of serious concern as a considerable quantity of persistent organic pollutants (POPs) stored indifferent warehouses would be detrimental to the prevailing ecosystem in the locality.

Average application rate of fertilizers in Nepal is relatively low. It is estimated in Nepalese situation that a general pattern of major cereals removed 310kg of plant nutrients from soil annually on a hectare basis. Since, on an average, only 29 kg of plant nutrients per hectare is added to soil through various fertilizers, net loss of plant nutrients from the inherent fertility reserve in the soil alarming (MOAC, 2007).

Likewise, various types of agricultural operations and hazardous effluents from agro-industries and processing plants, slaughter houses and veterinary hospitals and clinics, when not collected and disposed safely (Haung,

2004), are subject to water, air and land pollution in the country. Despite being the second richest country in water resources in the world, chronic shortages of water at various places of the country is a common problem. Farming with no or low use of agrochemicals becomes a strategic destination towards achieving sustainable development of Nepalese agri-businesses. Such would help to create low carbon economy in the country. Promotion of alternative energy sources like biogas, improved cooking stoves and solar energy from photovoltaic system is important also in achieving environment friendly agriculture development. The Alternative Energy Promotion Centre has been working on such promotions through a twenty-year master plan to reduce pressures on forest resources mainly due to fuel wood supply (G.C., 2003).

The issue of accelerated erosion was developed from a number of studies and impressionistic writings, which claimed that Nepal would slide away into Ganges by the year 2000 and that the Nepalese hill farmer was to blame for this situation (Biot, 1995:96). Soil loss through surface erosion from the agricultural land in hills varies from less than 2 tons ha-1year-1 to highest soil loss of 105 tons ha-1year-1 Acharya, 2007). Soil losses are found to be higher in Bari1 land on sloping terraces (32tons/ha/year) than in Khet2 land (less than 1 ton/ha/year) which is directly related to slope gradient and it is cheaper to make sloping terraces than making level terraces (Shrestha, 2004). Thus, the frequent breaking and loosening of soil through regular hoeing and plough had forced soil to erosion. Soil degradation through nutrient depletion is also a serious issue (Lal, 2000). Many studies have shown that soils in mid-hills have very low nutrients especially nitrogen and phosphorous (Shah and Schreier, 1991). In particular, the double and triple annual cropping rotations are more nutrient demanding. Thus in order to fulfill nutrient requirements, increased number of crops per annum has increased the inputs of chemical fertilizers in their farm. As a consequence of increased fertilizer use during intensification process, soils in mid- hills are becoming more acidic (Westarp, 2004).

The intensification also leads to the deterioration of nearby water bodies like rivers. During the monsoon time, heavy rainfall takes away tons of soil with nutrients from hills to the water bodies. It has been found that water bodies near to the intensification area have higher concentration of nitrogen, phosphorous and potassium. This is due to higher amount of chemical fertilizer use for intensive production of crops and the nutrients have been washed down (Dahal, 2007).

There are some evidences that the climate has been changing in Nepal. The temperature has been increased by 1.8oC during last 32 years and the average temperature increase was recorded as 0.06oC per year. The rainfall pattern is also experienced as inconsistent with higher intensities of rain and less number of rainy days (Malla, 2008). The emission of methane from rice field supplied with 50% nitrogen fertilizer was 49 kg per hectare which is quite high without irrigation facilities (Malla, 2006). The plains (Terai) of Nepal faced a problem of rain deficit during 2005 and 2006 due to early monsoon which reduced the crop production by 12.5% on national basis. Around 10% of the country's arable land was left fallow due to rain deficit whereas there was flood in mid-western Terai, that decreased production by 30% in the same year (Rauniyar, 1998).Early maturity of the crops due to increasing temperature helps to increase the number of crops per year. But increasing number of crops lead to increase in agricultural activities like tilling and agro-inputs. This has potential implication on soil degradation and emission of greenhouse gases in the fragile landscape of mid-hill region.

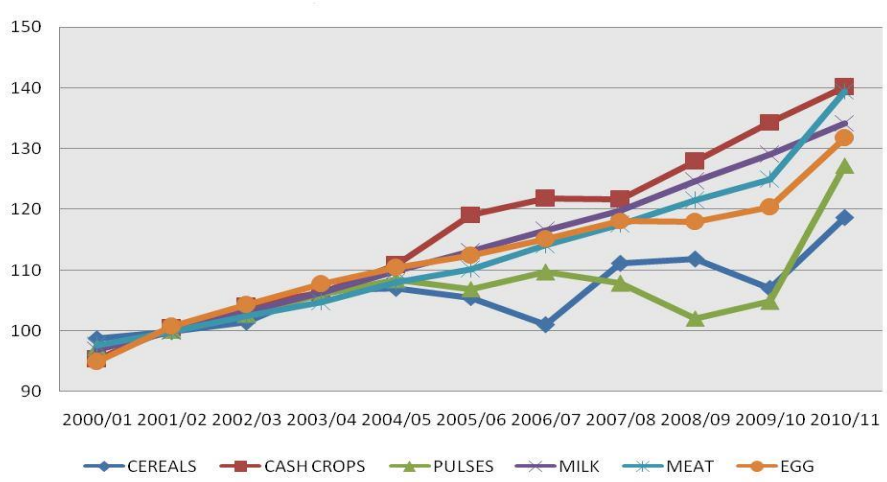
3.3 Hypothesis

This paper is the review of agricultural degradation and its impacts on environment and economy. Nepal contains significant contribution of agriculture; the contribution of agriculture sector on GDP remains average 33 to 39 percent. More than two third population of the country has been depending upon the labor and production of agriculture sector. But in the recent years the per capita land holding has rapidly been reduced and the production system has been converted from organic to chemical, most of the ignorant farmers of remote rural areas are using chemical fertilizers haphazardly, they don't know either their land has needed particular fertilizer or not. Having this background, this paper contains the following major hypotheses.

- There is inseparable relationship between agricultural degradation, economy and environment.
- Agricultural production has been reduced in comparison to population growth.
- The reduced agricultural production system has negatively contributed to the overall economy of the country.
- Existing agricultural production system has been degraded the quality of environment.

3.4 Overview of Nepalese Agricultural Production

Figure 1: Index of Major Agricultural Production



Source: Statistical Information on Nepalese Agriculture, 2010/2011.

1. Total Area of the Nation (km)	**147181**
Mountain	51817
Hill	61345
Terai	34019

2. Land Use Statistics ('000 Ha.)

Agricultural Land Cultivated	3091
Agricultural Land Uncultivated	1030
Forest (including shrub 1560)	5828
Grass Land and Pasture	1766
Water	383
Others	2620

3. GDP at current price (NRs. million), 2010/2011 **1261210**

Agricultural 449676

Non agriculture 811534

4. GDP at constant (2000/2001 prices) [NRs. million], 2010/2011 **608111**

Agricultural 212404

Non agriculture 395707

5. Population engaged in Agriculture 2001 (%) **65.6**

6. Total Agricultural Holdings No., (2001/02) **3364139**

7. Irrigated Area up to 2010/2011 (Ha.) 1254272

8. Area and Production of Cash Crops, 2010/2011

Crops	Area	Production (mt.)	Yield (kg/ha)
Oilseed	213706	176186	824
Potato	182600	2508044	13735
Tobacco	1135	1238	1091
Sugarcan	62998	2718226	43148
Jute	10559	14418	1365
Cotton	135	135	1000

9. Area and Production of Pulses, 2010/2011

Crops	Area	Production (mt.)	Yield (kg.ha.)
Lentil	207591	206869	997
Chick Pea	9124	8130	891
Pigeon Pea	17469	14107	808
Black Gram	27518	22530	819
Grass Pea	9213	8674	941
Horse	7901	5808	735
Soyabean	293173	28318	966
Others	26248	23924	911
Total	334380	318362	952

10. Fruits

	Area	Production (mt.)	Yield (kg.ha.)
Frui	79184	794184	1003

11. Vegetables

	Area	Production (mt.)	Yield (kg.ha.)
Vegetable	244102	3203563	13124

12. Tea 17438 Mt.

13. Coffee 402 Mt.

14. Chilli 27203 Mt.

15. Cardamom	12584 Mt.
16. Ginger	216289 Mt.
17. Garlic	39566 Mt
18. Turmeric	35295 Mt
19. Cocoon	26.10 Mt.
20. Honey	1365 Mt.

Table 1: Area, Production and Yield of Cereal Crops[7] in Nepal (Paddy, Maize and Millet)

(Area in Hectare, Production in Metric Ton and Yield in Kg. per Hectare)

Year	Paddy			Maize			Millet		
	Area	Prod.	Yi	Area	Prod.	Yi	Area	Prod.	Yi
2000/	15600	42164	27	8245	14841	18	2598	2828	10
2001/	15169	41646	27	8259	15107	18	2581	2825	10
2002/	15446	41325	26	8361	15691	18	2591	2828	10
2003/	15594	44557	28	8342	15900	19	2585	2833	10
2004/	15417	42898	27	8498	17160	20	2588	2898	11
2005/	15494	42092	27	8509	17344	20	2616	2909	11
2006/	14395	36808	25	8704	18199	20	2651	2848	10
2007/	15492	42992	27	8701	18786	21	2654	2910	10
2008/	15559	45236	29	8754	19306	22	2658	2926	11
2009/	14812	40238	27	8756	18551	21	2684	2995	11
2010/	14964	44602	29	9062	20675	22	2698	3026	11

Table 2: Buckwheat, Wheat and Barley

(Area in Hectare, Production in Metric Ton and Yield in Kg. per Hectare)

Year	Buckwheat			Wheat			Barley		
	Are	Pr	Yi	Area	Prod.	Yi	Are	Pro	Yi
2000/				6410	11578	18	281	304	10
2001/				6670	12580	18	277	307	11
2002/				6690	13441	20	275	317	11
2003/				6645	13871	20	274	281	10
2004/				6758	14424	21	264	293	11
2005/				6720	13941	20	262	277	10
2006/				7026	15151	21	265	282	10

[7] In Nepal, cereal crops (paddy, millet, maize, wheat and buckwheat) are taken as the major food grains for the subsistence.

2007/				7064	15720	22	261	280	10
2008/				6949	13438	19	258	232	90
2009/				7311	15565	21	266	275	10
2010/	103	88	85	7674	17458	22	284	302	10

Source: Statistical Information on Nepalese Agriculture, 2010/11

Semi traditional to early commercial agriculture[8] system of Nepal has now its economic move in transition from agricultural to early industrial track of economic development. An attempt has been made to assess the relationship between the emerging modern agriculture practices and environmental depletion. Some of the developmental challenges of Nepal like small land holdings, weather dependent farming systems, low per capita income, underdeveloped physical infrastructures and inefficient bureaucratic procedures are associated with comparatively higher cost of agricultural production. Natural disasters and human induced environmental degradation are closely associated with improved farming systems. Nepal has preferential ways of producing niche agricultural products by exploiting its inherent diversified climate to cope with the global open market challenges. Competitive agribusinesses along with the adoption of environmental protection measures keeping the strategy of import substitution and export promotion are the ways for sustainable agriculture development in the country.

3.5 Land-Use Policy 2012

Of the total Nepal's land area, 27 percent is arable, forest covers 39.6 percent, pastures occupy 12 percent, 17.2 percent is covered by snow and rocks and the rest 2.6 percent is covered by water. Due to absence of land-use policy for the proper management of these lands, unplanned residential area and urbanization have continued to grow while the arable land is gradually diminishing. Similarly, the trend to occupy and leaving it barren has also increased while registration and encroachment of government and public lands by squatters have grown in the same way. Likewise, uncontrolled fragmentation of land that led to the decline of agricultural production and productivity consequently providing threat to food security. The National Land-Use Policy 2012 has been enforced as it became imperative to formulate and implement proper policy to get rid of these problems.

Special Features of Land-Use Policy:

Land has been classified into 7 categories on the basis of its use.

1. Agriculture Area
2. Residential Area
3. Commercial Area
4. Industrial Area
5. Forest Area
6. Public Area
7. Other Areas as specified based on necessity

[8] In Nepal, about 80 percent rural population practices non-commercial or traditional agricultural production system. Only urban and semi-urban areas practice the commercial and early commercial production practices respectively.

- A Land-Use Council has been formed at the Centre on Chairmanship of Honorable Vice-Chairman of National Planning Commission comprising Secretary of concerned Ministries and Land-use experts for implementation of the Policy

- Establish a permanent Department of Land-Use Management by permanently restructuring the existing National Land-Use Project under the Ministry of Land Reform Management so as to regularize monitoring and facilitating implementation of land use plan, and to develop basic infrastructure for preparing land use plans to bring the Policy into implementation. The Department will draw the human resource from Agriculture, Irrigation, Forestry, Environment, Housing, Urban Planning, Survey, and Land Management.

- A district level Land-Use Implementation Committee has been established under the Chairmanship of the District Development Committee (DDC) Chair with the representation of various office heads of the districts. Likewise, municipality and village level Land Use Implementation Committees have been established with the representation of office heads of the concerned villages and municipalities.

- Necessary statutory provisions will be developed within two years in order to bring policy into implementation.

- Monitoring and evaluation provisions and risks have also been incorporated in the policy.

- Policy will be reviewed and revised every ten years.

- Government of Nepal, and Ministry of Land Reform and Management has made the provision for the power for removal of road blocks if some problems or difficulties arise while implementing the policy.

- The definition, basis and standard set for specifying areas, details on organization structure and sectorial authority at central, district and local levels are provided in the annexes of the policy (Economic Survey, 2011/12).

3.6 Nepalese Agriculture and Economy

Agriculture sector plays a critical role in the Nepalese economy as this sector still contributes more than one third to Nepal's GDP, and more than two-third of its population depend on it for their employment and livelihood. Lack of adequate knowledge, skill, technology and entrepreneurship to transform the prevailing traditional farming to commercial farming system not only contained farmers to subsistence farming but also they are suffered by the under employment and disguised unemployment problems. Factors like easy access to irrigation facility on agricultural lands, improved seed and seedlings, chemical fertilizers, pesticides, agricultural loans, advance farming technology, and farmers" access to technology and knowledge play vital role in mitigating this problem and enhancing agricultural production. But according to statistics of the previous years, addition of irrigation facility, supply of agricultural credit, chemical fertilizers, improved seeds and seedlings has not been satisfactory. Due to severe fluctuations on availability of such inputs make farmers remain reluctant to take risk due to the uncertainty on the availability and accessibility of these inputs and this has direct impact on agricultural production.

3.7 Special Programs on Agriculture Sector

3.7.1 Mission Program for Agricultural Production:

Promotional programs for production of onions, maize, lemon, fish and oilseeds have been carried out with the objective of substituting imports of these products. These programs were implemented in Sunsari, Sarlahi, Rauthat, Bara, Kavre, Chitwan, Nawalparasi, Rupandehi and Dang for Maize farming while, onion farming covered Saptari, Sarlahi, Siraha, Dhanusha, Bara, Parsa, Runpandehi, Banke and Bardia, districts, piciculture covered Sunsari, Saptari, Bara, Parsa, Chitwan, Nawalparasi, Rupandehi, Banke and Bardiya districts. Likewise, Sarlahi, Chitwan, Lamjung, Nawalparasi, Kapilbastu, Pyuthan, Dang, Surkhet, Banke and Bardiya districts conducted oilseeds

program while lemon farming program covered Terathum, Dhankuta Bhojpur and Makwanpur districts. These programs have transferred modern farming technology to the farmers thereby bringing positive impacts on the agriculture production and productivity.

3.7.2 Cooperatives run Poultry and Pig Farming Program:

This program, which was started from 4 districts in FY 2008/09 targeting Dalits, socially downtrodden and backward communities, janajatis, women, squatters, marginalized and bonded labourers and landless farmers, has now been extended to 26 districts including Kailali, Bardiya, Banke, Dang, Saptari, Jhapa, Morang, Sarlahi, Udaypur, Ramechhap, Dhading, Sindhupalchowk, Syangja, Dolakha, Kavre, Dhanusha, Bhaktapur, Nawalparasi, Lamjung, Parwat, Sindhuli, Parsa, Makwanpur, Mahottari and Banglung. Such program has helped instill the sense of cooperative among the farmers associated with this program together with the rise in their incomes.

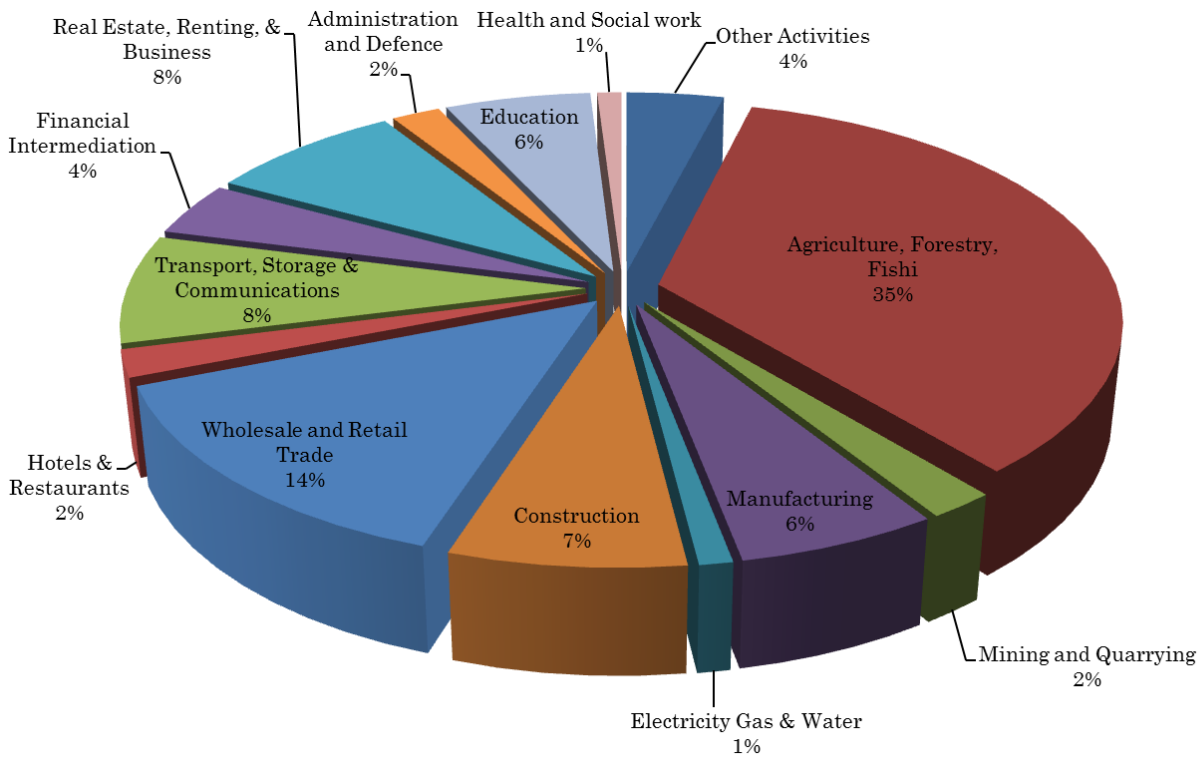
3.7.3 One Village, One Product Program:

One Village, One Product Program, based on the Public-Private Partnership approach, has made remarkable achievement after reaching the second phase with completion of 5 years of its execution. Under this program, betel nuts production in Jhapa, turmeric farming in Sunsari, ginger farming in Salyan and Palpa, rural agro-tourism scheme in Lamjung and Szechwan pepper farming in Myagdi are being conducted in the current fiscal year. Similarly, Jarailo and Basmati Chamal farming in Doti, banana farming in Chitwan and Kanchanpur, fish farming in Dhanusha and Mango farming in Saptari are also included in this program.

3.8 Status of Imports and Exports of Agro- Products

Exports of food items, live animals, tobacco and beverages according to Standard International Trade Classification (SITC) group had increased by 17.2 percent with a total worth of Rs. 10.5 billion in the first eight months of FY 2010/11 as compared to the corresponding period of its previous year. Export of such items during the corresponding period the current fiscal year is estimated to total Rs. 10.12 billion only with a decline of 3.58 percent as compared to the previous fiscal year. Food items and live animals worth Rs 14.54 billion and tobacco and beverages worth Rs 1.7 million were exported in the fiscal year 2010/11. Likewise, food items and live animals worth Rs 29.27 billion and tobacco and beverages worth Rs 2.17 billion were imported in FY 2010/11. In the first eight months of the previous FY 2010/11, food items, live animals, tobacco and beverages worth Rs. 20.49 billion were imported while imports of such commodities has increased by 30.38 percent and reached Rs 26.71 billion in the same period of current fiscal year. Likewise, in the first eight months of the previous fiscal year 2011/12, beverages worth Rs. 1.42 billion were imported while Rs. 1.83 billion has increased in the imports of such item in the same period of the current fiscal year. During the review period, on agro-products (food, live animals, tobacco and beverages) side, last year's trade deficit of this group rose by 66 percent reaching Rs. 16.59 billion.

Figure 2: Percentage Contribution to GDP by Sectors



Source: Statistical Information on Nepalese Agriculture, 2010/2011.

3.9 Nepalese Agriculture and Environmental Degradation

Two third of Nepalese people are involved in farming business exploiting only 21% of cultivable land for their livelihood. Majority of the farm families are semi-literate or illiterate and scattered in rural settlements. An increase in population by 2.2% annually is producing additional labor force in the national labor market. Average size of land holding is small (0.5 ha) fragmented in scattered parcels of three thus limiting agriculture commercialization.

Forty five percent of the farmers, having less than 0.5 ha, share only 13% of total land (CBS, 2010). Owing to modern sophistications and ever-increasing population, meeting people's increasing and changing needs and aspirations, on one hand, is a major burden to the country. On the other, crop profitability (particularly on cereals) is declining due to aforementioned agri-business related challenges. The consequence is over exploitation of natural and land resources.

Such resulted in degradation of environment deeply connected with permanent loss, depletion or pollution of natural resources, adverse weather, changing microclimates and unbalanced situations in the components of inherent chain in the ecosystems. Excluding adverse physiographical, ecological, geological and meteorological factors resulting in common natural hazards such as floods, earthquakes, droughts, cold and hot waves, hailstones, windstorm and cyclone, landslides, disease epidemics, glacial lake outburst flood (GLOF), avalanches, thunderbolt and fires, the environmental degradations are basically caused by human intervention in various aspects of modern technology adoptions. Ever increasing surplus labor forces are compelled in general to cultivate mountain slopes and other marginal lands in the country in meeting their employment and day-to-day basic needs.

The consequence of such practice in long run is land resources and environmental degradation. There is a high and increasing pressure on the forest area because of rapidly growing population and their dependence on fuel wood for major share (77%) of energy required. Besides, encroachment of forest area for cultivation and settlements and thus human induced landslides, floods and water erosion have resulted in massive depletion of forest and agricultural land. The annual deforestation rate is highest in Nepal (1.8%) among the South Asian Countries, and more than 100 thousand hectares of forest were reported deforested within a short period of 1997 to 2000. However, forest regeneration to an appreciable level is reported recently upon coming of community forest user groups (CFUGs) into forest management.

In the areas of semi-commercialized agriculture, farmers are injudiciously using various pesticides for an increased productivity and risk mitigation in crop production, even though an average application rate of 142 g/ha and annual consumption of176mta.of pesticides in Nepal is not considered high. According to Palikhe (2006), more than 60% of the applied pesticide remains in the soil materials polluting soil

Environment as a risk to terrestrial as well as aquatic biosphere. The residual effects of some of the chlorinated hydrocarbons like Chlorodane, BHC, DDT and aldrin remain in soil for a period of more than nine years. Imp rudent disposal of obsolete pesticides is also of serious concern as a considerable quantity of persistent organic pollutants (POPs) stored in different warehouses would be detrimental to the prevailing ecosystem in the locality.

Average application rate of fertilizers in Nepal is relatively low. It is estimated in Nepalese situation that a general pattern of major cereals removed 310kg of plant nutrients from soil annually on a hectare basis. Since, on an average, only 29 kg of plant nutrients per hectare is added to soil through various fertilizers, net loss of plant nutrients from the inherent fertility reserve in the soil alarming.

Likewise, various types of agricultural operations and hazardous effluents from agro-industries and processing plants, slaughter houses and veterinary hospitals and clinics, when not collected and disposed safely (Haung, 2004), are subject to water, air and land pollution in the country. Despite being the second richest country in water resources in the world, chronic shortages of water at various places of the country is a common problem. Impurities in water increase with its scarcity and introduction into water sources of various pollutants because of agricultural operations such as drainage from agricultural lands and processing units. Deforestation, agricultural mechanization, processing plants and crop production such as paddy are responsible for emitting air polluting suspended particles such as CO^2 into the atmosphere. Carbon dioxide (CO^2) is considered as a very important greenhouse gas (GHG), increasing concentration of which in the air is the threat to maintaining the country with Low Carbon Economy (LCE).The aim of a LCE is to integrate all aspects of manufacturing, agriculture, transportation and power-generation with technologies that produce energy and materials with little GHG emission. Recently, most of the scientific and public opinions have concluded that there is an unreasonable accumulation of GHGs (especially CO^2) in the atmosphere; over-concentrations of which in the atmosphere would fundamentally change the earth's climate adversely affecting resource bases and lives in the foreseeable future. For which only humankind is blamed, and LCE is globally proposed as a mean to avoid catastrophic climate change and as a precursor to an ideal zero-carbon economy to maintain everlasting cycle of nature. Therefore, LCE is now considered as the necessary condition for modern agriculture as well.

3.9.1 Strategies for Environment Friendly Agriculture

Nepal, a country of villages and townships, is a dwelling of people making their livelihood largely from agriculture. Having a mountainous geography, very little area is cultivable with poor farming facilities. Because of the economic challenges Nepal is facing, its products cannot compete directly with the commodities of the international trading partners. Presence of plenty of resources with great diversities can be valuable assets to the country for producing agricultural unique products to exploit markets in the international trading arena. In view of the agricultural development situations in the country and environmental concerns aforesaid, Nepal can strategize

its agri-businesses promotion and environmental protection through harnessing comparative advantages of diversified agro-ecological areas and microclimate there in producing niche products for the potential niche markets especially in India, China and other south Asian countries. Organic products, popular products associated with specific geography and the products with distinct uniqueness are the possible areas of production promotion for export. Some commodities such as honey, cardamom, tea, coffee, zinger, vegetable seeds, off season fresh vegetables and citrus fruit (especially mandarin) are the areas where Nepalese farmers can exploit the opportunity. In such view, Nepal has agri-business promotion policy with import substitution and export promotion instruments. However, agriculture sector in Nepal, though mentioned getting top priority in each of the periodic plans and fiscal years, is subject to low budgetary disbursement. Actual budgetary disbursement does not indicate the above stated scenarios. The state has provided the sector with less than 5% of its total annual budget in every year, while the sector is contributing more than 33% to national GDP. This does not coincide with the mission of attaining high economic growth through the intensive and accelerated growth in agriculture sector.

Niche products identification, promotion of such productions in value chain approach and quality assurance and certification are prerequisites for an assured international market of such unique products. In the value chain management, quality standards, timely and sizeable supply and competitive prices are also important as basic requirements of the products' movement into the global market system. Regular production of such products and their competitive disposal in the export markets also needs maintenance of consumer-friendly environment, and assurance of no or low creation of environmental (air, water, soil and/or other) pollution in their production and processing, and thus necessitates very low emission of carbon into the surrounding biosphere. Quality concerns of them are also connected with good agricultural/manufacturing/hygienic practices (GAP/GMP/GHP), sanitary and phytosanitary requirements and good record keeping of such practices for the products' quality assurance and proving them free of pesticides and other harmful chemicals residues, certification by an internationally accredited laboratory and free movement to trans-border markets.

Thus farming with no or low use of agrochemicals becomes a strategic destination towards achieving sustainable development of Nepalese agri-businesses. Such would help to create low carbon economy in the country. Promotion of alternative energy sources like biogas, improved cooking stoves and solar energy from photovoltaic system is important also in achieving environment friendly agriculture development. The Alternative Energy Promotion Centre has been working on such promotions through a twenty-year master plan to reduce pressures on forest resources mainly due to fuel wood supply. Peoples and different devices in use can utilize the energy sources efficiently and recycle the wastes in a way to have a minimal GHGs output. Furthermore, it has been proposed that to make the transition to an LCE economically viable, we should cost on GHGs production through an approach such as emissions trading and carbon taxation based on natural and social justice.

3.9.2 Possibility for export

Organic products, popular products associated with specific geography and the products with distinct uniqueness are the possible areas of production promotion for export. Some commodities such as honey, cardamom, tea, coffee, zinger, vegetable seeds, off season fresh vegetables and citrus fruit (especially mandarin) are the areas where Nepalese farmers can exploit the opportunity. In such view, Nepal has agro- business promotion policy with import substitution and export promotion instruments. However, agriculture sector in Nepal, though mentioned getting top priority in each of the periodic plans and fiscal years, is subject to low budgetary disbursement. Actual budgetary disbursement does not indicate the above stated scenarios. The state has provided the sector with less than 5% of its total annual budget in every year, while the sector is contributing more than 33% to national GDP. This does not coincide with the mission of attaining high economic growth through the intensive and accelerated growth in agriculture sector.

Niche products identification, promotion of such productions in value chain approach and quality assurance and certification are prerequisites for an assured international market of such unique products. In the value chain

management, quality standards, timely and sizeable supply and competitive prices are also important as basic requirements of the products' movement into the global market system. Regular production of such products and their competitive disposal in the export markets also needs maintenance of consumer-friendly environment, and assurance of no or low creation of environmental (air, water, soil and/or other) pollution in their production and processing, and thus necessitates very low emission of carbon into the surrounding biosphere. Quality concerns of them are also connected with good agricultural/manufacturing/hygienic practices (GAP/GMP/GHP), sanitary and phytosanitary requirements and good record keeping of such practices for the products' quality assurance and proving them free of pesticides and other harmful chemicals residues, certification by an internationally accredited laboratory and free movement to trans-border markets.

Thus farming with no or low use of agrochemicals becomes a strategic destination towards achieving sustainable development of Nepalese agri-businesses. Such would help to create low carbon economy in the country. Promotion of alternative energy sources like biogas, improved cooking stoves and solar energy from photovoltaic system is important also in achieving environment friendly agriculture development. The Alternative Energy Promotion Centre has been working on such promotions through a twenty-year master plan to reduce pressures on forest resources mainly due to fuel wood supply. Peoples and different devices in use can utilize the energy sources efficiently and recycle the wastes in a way to have a minimal GHGs output. Furthermore, it has been proposed that to make the transition to an LCE economically viable, we should cost on GHGs production through an approach such as emissions trading and carbon taxation based on natural and social justice.

3.10 Critical Assessment

The relationship of agriculture with environment is even more pronounced in case of Nepal, as the agriculture is the major economic activity of Nepal and this sector contributes around one third percent of total GDP. Despite some increase in agricultural production over the years, the population growth in Nepal has outstripped agricultural production resulting into a growing concern about sustainability of agricultural production system. Although the environmental consequences of agriculture in Nepal have not been alarming, there has been some reporting on the negative environmental impacts due to agriculture sector. Some of the issues of environmental implication reported are environmental effects due to excessive use of pesticides including use and disposal of Persistent Organic Pollutants (POPs) (Rizal and unbalanced use of chemical fertilizers improper agricultural practices in the uplands overgrazing of livestock and methane gas emission by livestock indiscriminate use of veterinary medicine and feed supplements in livestock, erosion of agro-biodiversity. These environmental issues indicate that there is a need for some policy/legal framework to govern such environmentally sensitive activities so that environmental effects of such activities can be minimized and ensure adoption of suitable mitigation measures. The provisions relevant to agricultural sector in the Environmental Protection Act (EPA), 1997 and the Environment Protection Rule (EPR), 1997 are supposed to address these concerns. This paper has attempted to examine the provisions in the EPA, 1997 and the EPR, 1997 and provisions related to agriculture and environment in relevant policy documents of GON such as National Agricultural Policy, 2004; and Tenth Plan, 2002. The paper has also discussed preparedness of Ministry of Agriculture Development (MOAD) to implement such legal and policy provisions. Finally, this paper has discussed mechanisms to facilitate the implementation provisions of EPA under MOAD.

3.11 Conclusion

As agriculture is closely linked with environment, the environmental consequences due to agriculture need to be regulated. In case of Nepal, the environmental consequences due to agriculture sector though not that alarming, some negative implications have been reported. The Environment Protection Act (EPA), 1997; Environment Protection Rule (EPR), 1997 and other policy documents of GON have provided framework for governing agricultural activities in order to minimize its environmental consequences. The provision of Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) in EPA, 1997 provide basis for environmental assessment of activities related to agricultural sector in Nepal.

However, the implementation of the provision of IEE and EIA has not been that effective under Ministry of Agriculture Development (MOAD). Various policy and implementation constrains are impeding the functional implementation of EPA under MOAD. Some of the anomalies in EPR, 1997, lack of explicit 'agro environment policy and procedural guidelines for agriculture sector' and inadequate capability development of human resources under MOAC in environmental issues are the major constraints identified.

The intensive use of inputs with green revolution has not only polluted soil, water and environment causing slow degradation but also affected human beings and animals. With this realization, organic agriculture emerged since late eighties as an alternative to reduce such hazards. At present, world market for organic produce is increasing and people are ready to pay the premium for foods raised without the use of chemicals. As majority of farms in Nepal are still in traditional farming, there is a good prospect to adopt organic measures. However, as per the world regulatory functions, Nepal still face challenges in terms of product certification and other relevant infrastructures and policy framework. In the context of WTO, Nepal needs to re-examine existing policies and formulate policies that support for wider adoption of organic agriculture for which research on technological aspects of organic farming relevant to Nepalese context needs to be carried out.

Organic agriculture can be a sustainable alternative to mitigate the adverse effects of chemicals on human health and environment. Contrary to traditional farming, where farmers use local and indigenous resources, limited organic agriculture with the use of bio fertilizers and pesticides, favors greater production. However, for a developing country like Nepal, lower production in organic farming in the initial years need to be compensated with assured supply of organic manures, pesticides and market assurance. Programs and policies need to support the production and use of organic manures and researches on use of bio-pesticides and other inputs needs to be strengthened. As well as following points may be good points for solutions:

(i) Have to encourage using manure instead of chemical fertilizer for agriculture.

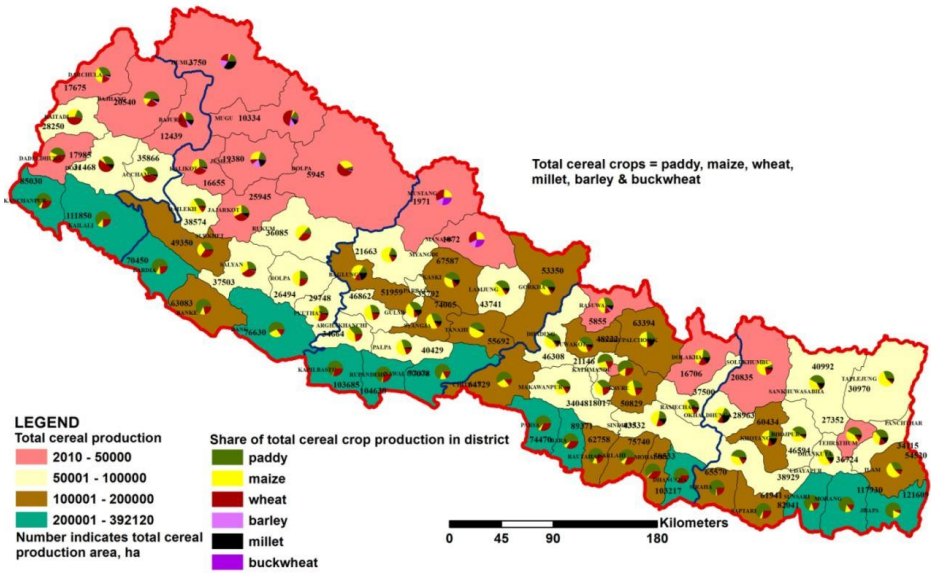
(ii) Have to encourage for multi crops agriculture.

(iii) Awareness programme of tree planting.

(iv) Have to encourage using new technology instead of traditional agriculture system.

Appendix-1

Map On Distribution, Production and Share of Total Cereal Crops Production, 2010/2011



References

Acharya, G. P., (2007). Nutrient losses from rain-fed bench terraced cultivation systems in high rainfall areas of the mid-hills of Nepal. Land Degrad. Develop, 18: 486-499.

Adhikari, P.R., (2002). A Review of Integrated Pest Management Program for Sustainable Agriculture Development in Nepal. Agriculture and Environment Journal, MoAC, Kathmandu.

Andreatta, S.L., (1998). Agrochemical exposure and farm worker health in the Caribbean: a local/global perspective. Human Organization 57 (3),350–358.

Antle, J. M., (1993). Environment, Development, and Trade between High- and Low-Income Countries, American Journal of Agricultural Economics, 75(3), 784-788.

Biot, Y.,(1995). Rethinking research on land degradation in developing countries. World Bank Discussion Papers, pp. 96.

CBS, (2010). National Living Standard Survey, Central Bureau of Statistics, NPC, Secretariat, Kathmandu, Nepal

Dahal, B. D., (2007). Effects of agricultural intensification on the quality of rivers in rural watersheds of Nepal. Journal of Food, Agriculture and Environment, 5(1): 341-347.

DOA, (2001). Annual Report of Soil Science Program, Crop Development Division, DOA/MOAC, Kathmandu, Nepal.

G.C. K., (2003). Environment, Agriculture and Nutrition. Agriculture and Environment Journal, MoAC, Kathamndu, Nepal.

Galt, R.E. (2008). Pesticides in export and domestic agriculture: Reconsidering market orientation and pesticide use in Costa Rica. Geoforum 39, 1378–1392.

Ghatak, S., and Turner R.K., (1978). Pesticide use in less developed countries. Economic and environmental considerations, food policy, May, 136-146

Haung, M.A., (2004). Good Garbage: A Review of Organic Waste Recycling Practices in Kathamndu, Nepal.

Lal, R., (2000). Controlling greenhouse gases and feeding theglobe through soil management. The Ohio State University, Columbus, Ohio.

Malla, G., (2006). Effect of different fertilizers in reducing Methane gas emission from rice fields. Summer crop workshop proceedings.

Malla, G., (2008). Climate change and its impact on Nepalese agriculture. The Journal of Agriculture and Environment, 9: 62-71.

MOAC, 2004). National Agriculture Policy, Ministry of Agriculture and Cooperatives, GON, Kathamndu, Nepal.

MOAC, (2010/2011). Statistical Information on Nepalese Agriculture ABPSD/ MOAC/GON, Kathmandu, Nepal.

MOAC, (2007). Statistical Information on Nepalese Agriculture.ABPSD/MOAC/GON, Kathmandu, Nepal.

MOF, (2011/012). Economic Survey. Ministry of Finance, GoN, Kathmandu, Nepal.

Ongley E. D.,(1996). Control of water pollution from agriculture. Food and Agriculture Organization of the United Nations, Burlington, Canada

Palikhe, B.R., (2002). Pesticides and the Environment. Agriculture and Environment Journal, MoAC, Kathmandu, Nepal.

Palikhe, B.R., (2006). Pesticides as Water Pollutants. Agriculture and Environment Journal, MoAC, Kathamndu, Nepal.

Rauniyar, G.P., (1998).Adoption of management and technological practices by fishpond operators in Nepal. Aquaculture Economics and Management, 2 (3): 89-99.

Shah, P. B. and H. Schreier, (1991). Soil fertility anderosion issues in the middle mountains of Nepal. Workshop Proceedings. Kathmandu, Nepal.

Shrestha, D. P., (2004). Modeling land degradation in the Nepalese Himalaya. CATENA, 57 (2): 135-156.

Westarp, S.V., (2004). Agricultural intensification and the impacts on soil fertility in the Middle Mountains of Nepal. Canadian journal of Soil Science, 323-332.

Williams Shon P., Shumway C. Richard, (2000). Trade Liberalization and Agricultural Chemical Use: United States and Mexico. American Journal of Agricultural Economics, 82(1): 183-199.

Abbreviations/Acronyms

EIA	-	Environmental Impact Assessment
EPA	-	Environment Protection Act
EPR	-	Environment Protection Rule
FY	-	Fiscal Year
GAP	-	Good Agricultural Practices

GDP	-	Gross Domestic Product
GHG	-	Green House Gas
GHP	-	Good Hygienic Practices
GMP	-	Good Manufacturing Practices
GNP	-	Gross National Product
GON	-	Government of Nepal
IEE	-	Initial Environmental Examination
LCE	-	Low Carbon Economy
MOAD	-	Ministry of Agriculture Development
Rs.	-	Rupees
WTO	-	World Trade Organization

CHAPTER 4
A Study on Mining Industry Pollution in Chapagaon, Nepal

4.1 Introduction

Chapagaon is located in the outlying area of the south part of Kathmandu Valley. It is dense traditional settlement area inhabited predominantly by the Newars. The area of Chapagaon VDC (Note 1) is 6.76 km^2 with total population of 12789, out of this 6516 male and 6273 female. It is taken one of the fastest growing VDC in Kathmandu Valley. The development prospect of proposed outer ring road of Kathmandu Valley and closeness to the city center of Kathmandu, this area has been an attractive residential location for many migrants (CBS, 2011).

In this VDC no proper considerations are made for settlement planning, mining, crushing and management of these. The mining industries of this area are taken problematic not only because of the lack of proper considerations about the environment but also because of the narrow road networks of this area. The hauling trucks of this area create the sound whole the day and pollute the air. Mining industries in Chapagaon are concentrated in Ward no. 6 which is adjoining Ward with Lele VDC. This ward is taken as the best for crushing and stone mines because of lots of open spaces and availability of stones. Streams of Chapagaon; Nakhu and Karmanasa are disturbing by stone mines and crushing industries, the volume of drinking water has been reduced gradually because of the extraction of upper layer stones and soil of spring catchment area. In the past years (2010/11) there were more than 30 stone and crushing industries but in 2012 gradually these reduced below No. 9 in Chapagaon and shifted in other neighboring VDCs like Lele, Nallu, Bhardeu etc. (VDC Profile, 2010).

4.2 Objective of the Study

The general objective of the study is to show environmental, social and health impacts of the disordered natural resource exploitation, the specific objectives are as follows:

i. To find out the consequences of mining industries in study area;

ii. To assess the condition of natural resources; and

iii. To recommend some of the ways of natural resources conservation to the concern agencies

4.3 Justification

The criteria adopted for categorizing the mines units as small, medium and large scale, differ from country to country and there exists no universal yardstick (Ghose & Roy, 2007). Recognition of the fact that small-scale mining can make a significant contribution to development objectives, which has been one of the principal motives for this persistent interest (Noetstaller, 1994).

Mining was a flourishing activity in the remote past. But it was conducted with crude technique and to a limited scale. Iron ore, copper, slate, mica, marble, lead, lignite, etc. were the chief minerals exploited and utilized in those days. Subsequently, it was gradually abandoned due to three basic reasons: (a) Exhaustion of easily accessible top deposits (b) Lack of improved techniques (c) Negligence of the then ruling classes (Shrestha, 2004).

Rapid development has been spurring the mining industry in Nepal. Until the early 1990s, there were just few mining sites producing gravel for house and road construction. During the 1990s the population in Nepal`s cities grew rapidly and building construction techniques changed requiring greater quantities of gravel (CLSR, 2009) (Note 2). At the same time the road network was expanding in many districts which increased demand for gravel. As well as mining industries are taken as the main sources of building materials. Stone crushers are small scale industries in the unorganized sector. They provide basic material for road and building construction. They are

highly labor intensive. The various unit operations involved in stone crushing viz., size reduction, size classification and transfer operations have the potential to emit process and fugitive dust (Sivacoumar, Jayabalu, Subrahmanyam, Jothikumar, & Swarnalatha, 2012). The three stages of mineral development, viz exploration, mining and processing, have caused different types of environmental damages, which include ecological disturbance, destruction of natural flora and fauna, pollution of air, land and water, instability of soil and rock masses, landscape degradation and radiation hazards (Aigbedion & Iyayi, 2007).

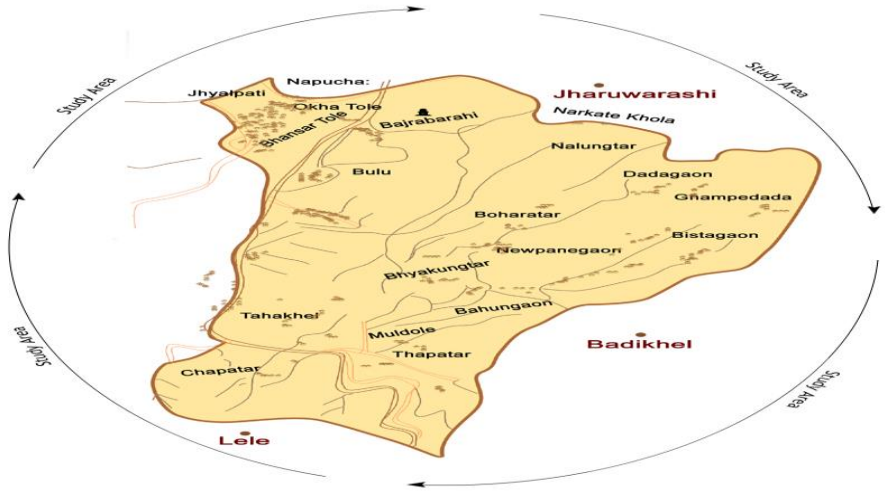
The industries in and around large and small urban areas are increasing day by day. In Nepal, The Mines and Mineral Act, 1985 A.D., its amendment, 1993 A.D. and Regulation 1999 A.D. introduced for the management of mines and mineral industries of the country. After this time the mines and mineral industries are regulated by the Department of Mines and Geology under the Ministry of Industry, Commerce and Supplies. The responsibility of regulation of established mines and mineral industries in Nepal remains on the hand of government with its several local bodies but the proper follow-up and regulation seems very weak.

The case of Chapagaon remains the same; the mining industries established are found not within the parameters of government's approval, these are out of the limitations because of which the local environmental resources are degraded on greater extent. Mainly the mining industries are responsible to decrease the scenic beauty of the place, degradation of the productivity of land, dust and smoke pollution etc. So this study attempts to find out such impacts which are related to the consequences of mining industries in this area.

4.4 Study Area

Chapagaon is the village which is spread in 68 km^2 with the shape of conch shell. It is very close to Mangal Bazar (palace area of Malla Kings) which is just 10 km^2 away from Chapagon. Chapagon can also be known as "Wadey", "Champapu". However the presence of Bajarnarahi temple helps to identify the village more easily. Historically, the village was full of forest with Chanp trees. At first, the village was named as Champapur, as it was developed by demolishing the forest of Chanp tree and later the name was revolted into Chapagaon, Similarly, the name Wadey was assigned from Newari Wa which means rice and Dey means state. Thus, the name Wadey means state of rice. This name was specifically selected as the village has large number of rice production with better quality as compared with other areas of Patan. In various manuscripts, this village was generally indicated with the names of Wadey, Chapagon and Champapur. However, the village is commonly familiar with the name Chapagaon in all government sectors. In order to retain its traditionalist, the municipality of this village is named as Champapur. During the period of Shivadev the Lichhavi king, the village was found to be well development and act as an important business center. For instance, business man from other areas had to pay tax for selling their fish in Chapagaon. Till now, the village has specific plans like Bhansar Tole to execute their implications. This has been evident from the script written on the statue of Jalahari situated near Brahma (Note 3) statue in the ear of Basantadev. From this, it is understood that Chapagon is a well-developed and planned village as of the ancient times. Several historical evidences indicated that Chapagon was highly developed during the period of Malla kings. The culture and religious values are higher in Chapagaon. The most important function of this village is Jatra. This function is celebrated twice a year, one on the Astami (Note 4) of Kartic and other on full Moon Day of Chaitra. At present, Jatra on Astami of Kartic is not celebrated because of the mislaid of idol in 2046 B.S. Bulu and Pyangaun has their own Jatra of Chandra Bhairav and Jatra of Mahadev. Apart from this, there are other ceremonies also conducted such as Dipankar Walk, Samaydhyo Bwayagu, Ganesh and Saraswati Jatra of Jhyalipati (Note 5), Bhairab Jatra (Note 6), Juga Chareor Samyak Dan (Note 7), Pond Fair of Khasimar and Tika Bhairab Jatra (Note 8).

Figure 1: Area map of Chapagaon



4.5 Mine and Mineral Acts and Regulations in Nepal

There are two acts and regulations concerning mines and minerals in Nepal, they are as follows:

i. The Mines and Mineral Act, 2042 B.S. (1985 A.D.) and its amendment, 2050 B.S. (1993 A.D.).

ii. Mines and Mineral Regulation 2056 B. S. (1999 A. D.). Source: Ministry of Industry, Department of Mines and Geology, 2066 B.S. (2009 A.D.).

These two mines and mineral acts and regulations encompass with policies for handling, monitoring, and administrating the mineral department of Nepal. These policies are open to all qualified aspirant. The main intention of promulgating such policies is to regulate, manage, and operate mining of all minerals excluding natural gas and petroleum. The license system for mining minerals is of two stages. Such license can be obtained by any person having technical and financial competency to perform mining operation. Two kinds of license are provided include:

To target mineral source, Prospecting licenses are provided wherein volume and grade of mineral has not been identified and

Mining licenses are provided to perform mining operation wherein amount and quality has been previously determined by corresponding department.

Mining license holders are allowed to do mineral exploration not more than 25 km^2 and not less than 0.25 km^2 in the first 10 to 30 years based on the level of minerals. This period may extend up to 1 to 10 years. Mining license can be provided by Department of Mines and Geology by identifying the mineral deposits of applicants through exploration activities (Pradhan, 2011).The expense encounter by the department in exploration activities can be either converted into share or it can be retrieved from qualified aspirants.

Similarly, prospecting license holders are not allowed to perform mining operation more than 25 km^2 and below 0.25 km^2 for the first 2 to 4 years of operation. This is with a provision of extension up to 1 to 2 years. Eligible candidate must complete the exploration activity within 2 years for ordinary nonmetallic minerals and 4 years for

valuable nonmetallic and metallic minerals. Further, the Mines, and Mineral Act and Regulation of Nepal provide the subsequent provision with reference to:

- Improve safe and secure of mine and miners' workers.
- Proper usage of land.
- Undertake mining activities in an environmental responsible manner.
- Get approval from corresponding department through sending sample for lab testing and exploring outside the country.
- The Government of Nepal has all rights to conduct the mining activities either directly or by selecting eligible persons to conduct activities. They also have rights to participate in the mineral developing activities directly or by any form of contribution.
- The Mining Act and Regulation also provide several offers and rights for lessee while performing mining operations. It includes:
- Right to access the land and materials for mining operations.
- Right to trade and export the mining products.
- Payment renewed on the basis of minerals productions and commodities.
- Right to import equipment and machines for mining activities. The expense for perceiving Prospecting and Mining license is very cheap in Nepal when compared with other countries. The Government provides royalty of mineral products based on the quality, its type, and volume of mineral production. Consequently, the minerals are categorized into non-metallic, fuel, metallic and construction minerals. For metallic minerals, the royalty can be fixed based on metal production. For others, it can be fixed based on the minerals production. At present, 25% income tax is amended for corporate governance. Further, extra charges are not imposed on the interest on foreign loans. The Government also provides tax deduction from corporate income. In addition to this, the Government of Nepal also regulates some legal policies to prevent double taxation on FDI during agreement or providing license for investment (MOI, 2009).

4.6 Environment Related Acts and Regulations in Nepal

Several sectorial agencies such as ministries of Population and Environment, Forestry and Soil Conservation, Physical Planning and Construction, Water Resources and their associated departments and other agencies are responsible to formulate policies and programs to conserve and manage the natural and environment resources in the country. The attempts of these agencies have gained successful in conserving and managing of the resources to some extent on the one hand, while their policies and programs are found to be overlapping, mismatching and conflicting in some cases on the other. Conservation of forest resource is fundamental to the contribution of ecosystem life support systems that help to sustain all different types of ecological processes that are so important for the existence and wellbeing of human beings.

Table1: Natural Resources and Environmental Acts and Regulations

Forest Resource	Soil Degradation	Air Pollution	Solid Waste	Water Resource
National Forestry Plan 1976	Soil and Watershed Conservation Act 1982	Industrial Enterprises Act 1992	Solid Waste Act 1987	Water Resources Act 1992
Master Plan for the Forestry Sector 1989-2010	Soil and Watershed Conservation Regulations 1984	Labour Act 1992	Solid Waste Regulations 1989	Water Resources Regulations 1993
Forestry Sector Policy 1989	Agricultural Perspective Plan 1995	Vehicle and Transport Management Act 1993	Solid Waste Management National Policy 1996	Electricity Act 1992
Community Forestry Program 1978		Nepal Vehicle Mass Emission Standards 1999		Aquatic Animals Protection Act 1965
Private Forest Nationalization Act 1957		Vehicle Exhaust Emission Test and Banned on Three Wheels Diesel Tempo		Patent Design and Trademark Act 1965
Forest Protection Act 1967				
National Parks and Wildlife Conservation Act 1973 and Its Amendment 1993				
Forestry Act 1992 and Amendment 1998				
Forest Regulation Act 1995				
EIA Guidelines for Forestry Sector 1995				
Buffer Zone Regulation 1996				
Plant Protection Act 1997				
International Conventions and Treaties:				
Environmental Regulations 1997and Its Amendment 1999				
Local Self-Governance Act 1999				
Environmental protection Act 1996				
Nepal Environmental Policy and Action Plan 1993				
National Conservation Strategy 1988				
National EIA Guidelines 1993				

Source: *Environment and Natural Resources: Concepts, Methods, planning and Management, 2011*

4.7 Methodology

This section deals briefly with the research methodology applied in the study. This is purely academic research based on social science. The field survey had been done last October 2012 to December 2012 in the study area.

4.7.1 Rationale for the Selection Study Area

The selection of the study area is one of the critical issues while undertaking research work. I admit that my study site is pro-urban area, considered to be one of the famous mining industries site. The rationale for the selection of study area includes:

i. The mining industries were operated in this site before 35 years.

ii. The mining industries in this site are operated in forest areas.

iii. The mining industries in this site are operated out of the limit of government's approval.

iv. The researcher is familiar with the ecology and environment of this site.

4.7.2 Research Design

i. The research design is based on descriptive and exploratory.

ii. It is descriptive as it is based on detailed investigation and record of the mining industries in this area.

iii. It is exploratory in the sense that analysis focused on exploring whether mining industries in this site are rationale to the environment or not. An attempt has been made to make the mining industries more responsible to the local environment.

4.7.3 Nature and Source of Data

Both primary and secondary data have been collected for the purpose of study.

i. Primary data are based on household survey, observation, and interview.

ii. Both published and unpublished documents, records, books and relevant materials related to the subject matters have been incorporated as secondary data.

4.7.4 Universe and Sampling Procedure

This study has been confined within Chapagaon VDC of Lalitpur District, Nepal. This VDC contains 12789 as total population of the VDC. Among these the 100 households of Ward no. 6 were selected for the survey and 6 mining industries were assessed for the purpose of this study. There are all together 10 mining industries in Chapagaon VDC but 6 mining industries were operating in this field visit period.

4.7.5 Data Collection Technique and Instruments

For the collection of primary data, the following techniques were adopted.

i. Household Survey: Household survey was conducted to gather more information about the impacts of mining industries. Various information regarding to the pollution and other impact was collected from structured questionnaire.

ii. ii. Observation: Non-participatory observation was applied during research to study the location, and concerning environmental impacts of mining industries. Interview with Key Informants: Some knowledgeable persons such as elderly persons, members of forest-user group, community based representative personnel, teachers and local leaders were selected as key informants to carryout research. Checklist and guidelines were prepared for key informant's interview.

4.7.6 Method of Data Analysis

The collected data were edited, coded, classified and tabulated for data organization. The quantitative data have been presented in tabular form and suitable statistical tools like percentage, ratio, mean etc. has been adopted for data analysis. Bar-diagram and trend analysis have been presented to make figure attractive. The quantitative data have been interpreted and analyzed in descriptive way based on their numerical characteristics.

4.8 Results

4.8.1 Increased Trend of Mining Industries in Chapagaon VDC

The following figures show the increasing trend of mining industries in Chapagaon VDC in 5 years period of time (2007 to 2012):

Figure 2: Yearly average income of Chapagaon VCD through mining industries (adopted from field survey, 2012)

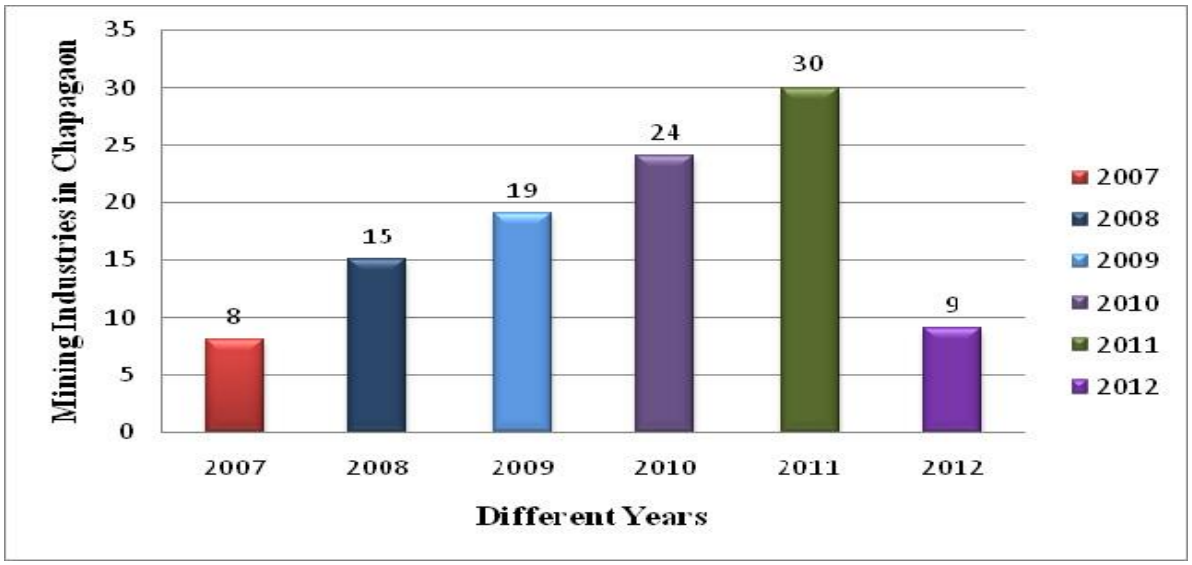


Figure 3: Increase trend of mining industries in Chapagaon (adopted from field survey, 2012)

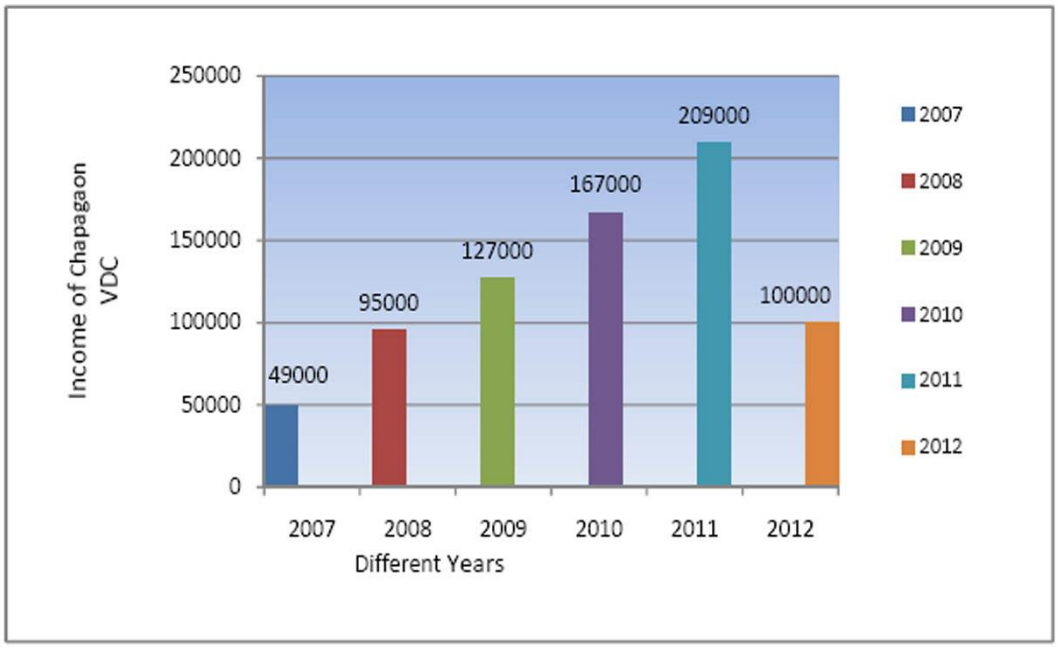


Figure 2 and Figure 3 show that the income of Chapagaon VDC in the year 2007 by 8 mining industries is Rs. 49000 (about 500 US$-in the rate, 1 US $ = Rs. 98), in 2008 by 15 mining industries is Rs. 95000 (970 US$), in 2009 by 19 mining industries is Rs. 127000 (1296 US$), in 2010 by 24 mining industries is Rs. 167000 (1704 US$), in 2011 by 30 mining industries is Rs. 209000 (2132 US$), and in 2012 by 9 mining industries is Rs. 100000 (1020 US$). The fluctuation of income amount of the VDC symbolizes the increasing rate of tax and the system of tax pay of the VDC. Sometimes, because of the disturbances over mining industries the tax amount were not paid by the mine owners.

But Figure 2 doesn't represent the regulation of mining industries whole the year, this only represents the establishment of mining industries in Chapagaon in year basis. Some of the industries established there but production activities remained very less because of the disturbances of workers and local people too, so the income is not as equal to the number of mining industries.

4.8.2 Positive and Negative Impact Assessment of Mining Industries in Chapagaon

In Chapagaon 100 households of mining area (Ward No. 6) were survived, the responses of them about negative and positive impacts of mining industries are mentioned in the table below:

Table 2: Positive and negative impact of mining industries in Chapagagon

No. of Respondents	Positive Impacts of Mining Industries	Negative Impacts of Mining Industries	Positive Percentage	Negative Percentage
100	41	59	43	57

Table 2 shows that majority of the respondents of Chapagaon respond negative impacts of Mining industries in their area. Out of 100 respondents 41 percent only respond the positive impacts of these industries rest of these respond the negative impacts. They were also asked about the aspects of negative impacts too, most of them were

agreed on dust, smoke, vehicular congestion, sound pollution and loss of scenic beauty of the place. At the time of survey, about 50 percent respondents were unknown about the tax payment system of mining industries in this area.

4.8.2.1 Positive Impacts

- Income generation for the VDC.
- Employment generation for the local people.
- Frequent maintenance of local roads by mining industries owners.
- Construction materials on their site on cheap price.
- Use of local resources/mobilization of local resources.
- 4.8.2.2 Negative Impacts
- Disturbance: Sound pollution, water pollution, land pollution.
- Degradation of scenic beauty of the area and degradation of tourism resources.
- Extinction of flora and fauna (plants and animals).
- Extinction of aquatic diversity (water species).
- Gradual drying of drinking water bodies causes the scarcity of drinking water.
- Loss of grazing land for the cattle.

4.8.3 Demographic and Land Use Features of Chapagaon

Table 3: Demographic and land use features of chapagaon

Male/Female	**No of Male/Female**	**In percentage (Male/Female)**
Male	6516	50.95%
Female	6273	49.05%
Total	12789	100.00%

Ward-wise Households and Population			**Area Coverage**		**Land Use**	
Ward No.	**No. of Households**	**Population**	**Ward-wise Area Coverage**		**Land Use Coverage Use in**	
			Ward	**Area in** km^2	**Area in** km^2	
1	189	960	1	0.23	Settlement	0.12
2	211	1114	2	0.76	Bushes	1.22
3	258	1242	3	0.64	Cultivable Land	4.76
4	301	1565	4	0.5	Forest	0.99
5	252	1219	5	0.31	Useless Land	0.02
6	481	2580	6	1.77	Sandy Land	0.09

7	294	1442	7	1.44	Land Cover by Water	0.02
8	219	1073	8	0.96		
9	326	1594	9	0.61	Total	7.22
Total		12789	Total	7.22		

Source: CBS (2011).

Table 3 shows the total population and land area of Chapagaon VDC according to the preliminary results of census survey, 2011. As per this report this VDC contains 12789 total populations and 7.22 km^2 total land area. Out of this settlement area covers 0.12 km^2 area, bushes, 1.22 km^2, cultivable land 4.76 km^2, forest area 0.99 km^2, useless land 0.02 km^2, sandy land 0.09 km^2 and land covered by water 0.02 km^2 area. This further indicates that the large amount of land area in this VDC is cultivable. The mining industries which have been established on the useless land (means out of human use) are not disturbed by the local people but which have been established on cultivable land, bushes area and pasture land are being disturbed frequently by the local people.

4.8.4 Concentration of Mining Industries in Chapagaon and Their Production

Mining industries in Chapagaon are concentrated in Ward no. 6 which is adjoining Ward with Lele VDC (Village Development Committee). This ward is taken as the best for crushing and stone mines because of lots of open spaces and availability of stones. Streams of Chapagaon; Nakhu and Karmanasa are disturbing by stone mines and crushing industries, the volume of drinking water has been reduced gradually because of the extraction of upper layer stones and soil of spring catchment area. In the past years (2010/011) there were more than 30 stone and crushing industries but in 2012 gradually these reduced in Chapagaon and shifted in other neighboring VDCs like Lele, Nallu, Bhardeu etc. (Field Survey, 2012).

The following table shows the Crushing and Stone Mines currently existed in Chapagaon VDC with production capacity of these:

Table 4: Crushing and stone mines existed Chapagaon VDC

These Mining industries of Chapagaon produce mainly 5 types of stones which use in buildings and road

Name of Crushing/Stone Industry	Location	Total Worker	Production Type	Production Capacity
Bajrabarahi Roda Dhunga Udyog	Ward No. 6	5	Gravel and stones	69 Mini Truck/day
Bhanjyang Dhunga Khani	Ward No. 6	6	Gravel and stones	71 Mini Truck/day
Bhuwaneshwor Roda Dhunga Udyog	Ward No. 6	7	Gravel and stones	75 Mini Truck/day
Champapur Dhunga Roda Udyog	Ward No. 6	6	Gravel and stones	72 Mini Truck/day
Excel Stone Crusher	Ward No.6	5	Gravel and stones	67 Mini Truck/day
Lalit Concrete P.vt.Ltd.	Ward No. 6	7	Sand, gravel, and stones	73 Mini Truck/day
Nepal Roda Dhunga Udyog	Ward No. 6	6	Gravel and stones	71 Mini Truck/day
Purna Dhunga Khani	Ward No.6	6	Gravel and stones	69 Mini Truck/day
Santi Roda Dhunga Udyog	Ward No.6	5	Sand, gravel and stones	65 Mini Truck/day

Source: Field Survey, 2012.

construction such as a large stone for the basement of building, small stones for the flooring, and gravel for the road construction, next product has been used for the wall painting dust.

4.8.5 Tax Payment by Mining Industries in Chapagaon

The mining industries of Chapagaon pay the tax to the VDC as according to their volume of export of mine products, the tax has been approved by DDC and VDC has taken the tax on the following manner:

i. Large Truck per trip Rs. 400 (about 4.08US$-in the rate, 1 US$=Rs. 98).

ii. Mini Truck per trip Rs. 150 (about 1.53US$-in the rate, 1 US$=Rs. 98).

Above tax payment system further symbolizes the contribution of mining industries for the development of this VDC. Chapagaon VDC's record shows that yearly in average 100,000 taxes has been collected, this tax has mainly used for the maintenance of road and environmental cleanliness.

4.8.6 Pollution from Mining Industries in Chapagaon

Mining and mineral activities generally affect the outside environment. In the process of making products pollution and waste are produced which ultimately threaten the human health and the surrounding environment. The similar cases are found in Chapagaon area especially from the production and transport of gravel, sand and stones. Different types of impacts of these productions and transport are analyzed below:

4.8.6.1 Health Impact to Local People

Exposure to heavy dust concentration from stone crushers may produce several diseases, chief among them being pneumoconiosis (Zenz et al., 1994). Silicosis, caused by inhalation of dust containing silica, is an important form of this disease. The impact caused by gravel, sands and stone mines in in Chapagaon area is air pollution and its associated health impacts to the local people those located in nearby mine area. In open areas of Chapagaon, the impact of such mines on human health is not likely to be significant. But in the residential areas, when one truckloads of sand and gravel from its excavation and starts transport to its destination mostly in Lalitpur Sub-Metropolitan City and Kathmandu Metropolitan City it fills dirt, smoke, and sound pollution. The following are the main impacts caused by sand, gravel and stone mines.

- Increased air pollution which directly impacts the health of surrounding people
- Dissemination of dust and fumes from gravel and sand at the mining area
- Dispersion of dust due to lack of proper monitoring and lethargic operations
- Fleeting of dust and fumes from exposed or opened dump trucks
- Contamination of ground water due to mixing of waste water from mines.

Each of the impacts listed above produces greater impact to the human health but these are hard to measure. In earlier times, minimal populations and establishment of few mines in Chapagaon made these impacts less noticeable. But now these are observed further serious most of the local people who are on the side of narrow black-topped road area like Pyanggaon, Chapakot, Bajrabarahi etc. are facing several health problems such as headache, dry nose, eye dimming problem, asthmas, respiratory diseases and lungs problems. The field survey has revealed that about 30 people per month directly or indirectly are affected by the cause of pollution from stone and stone-crushing industries in this area. In a day 1264 times the hauling trucks inter and exit from this site which produce the large amount of pollution not only smoke and dust but also sound.

4.8.6.2 Pollution on Agricultural Land

The stone and sand extraction process entails the removal of large amounts of waste too, which becomes pollution for the agricultural land. The deposits and wastes from the stone and stone-crushing mines disturb the general flow of streams and rivers that causes river and stream bank cutting in the rainy season. Most of the agricultural lands especially paddy fields are on the side of Nakhu and Karmanasha streams in Chapagaon which are under the threat of stone mine and crushing industries. The field survey of this area has recorded that about 5 Ropani paddy field of this VDC has been destroyed in average per year especially in rainy season. Moreover, the local people are agree on the fact that the vegetables farmed on about 11 Ropani of land of this VDC are also destroying per month by the dropping sand, gravel and stones on the side of road because of the unsafe coverage of hauling trucks.

4.8.6.3 Impact on Soil Quality

In Chapagaon, soils over large area are destroyed by mining activities. Moreover, agricultural lands near mining and crushing site are particularly affected. The fugitive dust has created significant impact over the agriculture

Land of Chapakot, Pyanggaon and Bajrabarahi area. Erosion of exposed soils, wind-blown dust, dropped pieces of sand, gravel and stone are usually posing the greatest risk over the soil quality.

4.8.6.4 Water Pollution

In most mines, the soil potential and sedimentation get contaminate and thereby affecting quality of water. As the mining activities occupy large area of land and hence large amount of ground materials exposed at site generate soil erosion, which is the major concern at hard-rocking mining sites. Due to erosion, considerable loading of sediments to nearby water bodies, especially during severe storm events and rainy season. In rainy season, excess of contaminated particles are mixed with rain water and drained in rills, natural channels or gullies.

In Chapagaon VDC, two streams namely Nakhu and Karmanasa are polluted through the flow of mine waste. The main factors influencing water bodies pollution includes the volume and velocity of runoff from precipitation events. The stone mines are located on upper slope area of Karmanasa stream and the mine depositions of dry season slip down with the volume of wind and runoff. The heavy rainfall in rainy season sweeps down all deposited items of mines, it causes several floods to the stream and full of sedimentation on Karmanasa stream. The case of Nakhu stream is different than that of Karmanasa. Nakhu stream is affected by the quarrying practices on the sides of it. Due to the cause of heavy quarrying, the paddy field of both sides of this stream has converted as a water flowing area of stream, this stream is widening year by year. The water of both of these streams is polluted so the people of adjoining areas are facing the problem of drinking water and the use for secondary purposes.

Some cumulative impacts of mining in Chapagaon area on water bodies and water species are mentioned below:

- Lost access of locals to the clean water;
- Deposition of mining waste on the water bodies;
- Extinction of water diversity i.e. fishes, frogs, snakes, leaches, worms etc.
- Lost access of locals to the secondary use of water such as irrigating, swimming, washing, fishing etc.

4.8.6.5 Erosion/Sediment of Mining Industries

Major sources of erosion/sediment loading at mining sites can include open pit areas, heap and dump leaches, waste rock and overburden piles etc. A further concern is that exposed materials from mining operations may contribute sediments with pollutants, principally heavy deposits of gravel. The types of impacts associated with erosion and sedimentation are numerous, typically producing both short-term and long-term impacts. In surface water the erosion and waste rock of mines fills up the depth of water level which causes toxic effects in fish. Sometimes the waste materials especially from mines flow to the stream with huge chunks and these make the heavy sediment and the fishes displace from their original dwells. With these chunks of rock and other materials flow the topsoil chemicals as used by miners.

Sediments deposited in layers in flood plains or terrestrial ecosystems can produce many impacts associated with surface waters, ground water, and terrestrial ecosystems. In Chapagaon area erosion/sediment from the upper slope areas of Nakhu and Karmanasa Streams causes the several impacts on water aquatic fish and other species. Field survey has recorded that due to the cause of erosion/sediment the streams of this area are now out of indigenous fish species and other water species, but in past years several fish species were available such as before 3 years in Karmanasha and 15 years in Nakhu Stream.

4.8.6.6 Socio-Cultural Impact

Gravel, sand and stone mining in Chapagaon area has increased traffic congestion and safety hazards. When operating these mines, several trucks run via Chapagaon for more than 10 hours each day. As a result of this, there has been increase in air pollution due to dust, diesel fumes and so on. In Ward no. 6 of Chapagaon VDC, where many crushing and stone mines are located, so heavy traffic hazards like trucks and other heavy vehicles are transported several times per day. In spite of this, the aesthetic degradation due to stone mining and crushing altered land mass of Chapagaon area and vanished green vegetation. Public nuisance is another important impact created by these mines. The state has not been formulated essential regulations for the operation of stone, sand and gravel mines in this area. The conversion of open spaces into built form has degraded the balance of built and non-built spaces that existed in traditional settlement planning and made the place more congested and traffic jam for the longer time. The single lane road of Chapagaon area has been carried 1262 times of transactions of hauling tracks per day. Cumulative impacts of ripping, drilling, blasting Overall, the local residents are highly affected by mining, blasting, transport, drilling, grinding and ripping. All types of above mentioned equipment produced vibration but vibration from blasting drastically affect building structure, people of local residents in a large manner. In Chapagaon area the traditional buildings are gradually disappearing because of the easy access of construction materials of new buildings. And the traditional buildings which are existed at present time are covered with thick dust flying from hauling trucks on the narrow road existed almost at the center of traditional settlements. The traditional identity of Chapagaon area and the great influence of Bajrabarahi Temple has found now on crisis.

4.8.6.7 Economic Impact

The social impact of large scale mining is controversial and complex to describe. Though the mining operation can create employment, roads, and schools, the profit from such operation cannot be uniformly distributed among people. The Chapagaon Village Development Committee fines only 200 rupees per month from a mining industry and takes Rs. 400/trip (about 4.08US$-in the rate, 1 US$=Rs. 98) from large truck and 150 Rs. (about 1.53US$-in the rate, 1 US$=Rs. 98) from mini truck but in reality it has not found paid by each and every. The mining entrepreneurs of Chapagaon VDC are found stronger than locals, the response and social demands of locals are not found fulfilled by industry owners. The perception of inhabitants of this area is that the community has not got any social contributions from mines. But at the time of observation, only 2 mine owners were not paid the monthly tax to the VDC office. Three mines were not operated because of the disturbance of local people. In conclusion, mining

industries are not fully negative, these are contributed Rs.100, 000 (about 1,020.40 US$-in the rate, 1 US$=Rs. 98) per month. Respondents (57%) insisted that the amount paid by them is not sufficient only for the maintenance of road and environment, so the mines are not beneficial for them. Local people have taken mines as the major causes of pollution. Economic contribution of mining industries to the local has found not visible, Village Development Committee fines and takes the money from them but allocates as the total income of VDC, so the contribution of mining industries has found contradictory.

4.8.6.8 Impacts on Flora and Fauna

Generally, the term Wildlife refers to non-domesticated vertebrates, but in broader terms it refers to all plants and animals. By degrading green vegetation and top soil, dissemination of pollution, dislodgment of fauna, the mining operation disrupted the life of flora and fauna. Some of the cumulative impacts of mining on wildlife in Chapagaon area are mentioned below:

4.8.6.8.1 Loss of Habitats

The living pattern of wildlife species depends on conditions such as local weather, soil, altitude, and other local features. The existence of wildlife is directly or indirectly affected by mining operation. Influences of mining to wildlife are primarily from dislocating animals from its place of origin due to pilling of mining wastage. Moreover, the alteration created by land distribution disturbed the living pattern of wildlife and thereby reduced the survival of such species. In Chapagaon area wildlife species like bird species, reptiles, small mammals, amphibians etc. are found disappeared.

4.8.6.8.2 Habitat Fragmentation

Habitat fragmentation has found in Chapagaon area wherein the habitats are dispersed in to smaller groups which resulted in the increased isolation of habitat patches. Due to this, majority of the species are found disappearing from its native places.

4.9 Discussion

Gravel, sand, and stone mines are common across Chapagaon. Although these mines are not regulated under the Mines and Minerals Acts and Regulations of Nepal, they are registered with District Development Committee and some on Village Development Committee only. The primary environmental impact from gravel, sand and stone mines in Chapagaon area are degraded air quality from blowing dust particles, smoke, and dropping sands. Deposition of mine on the side of Karmanas and NakahLake contaminate the surface water quality of Chapagaon. Other impacts of mining operation on environment includes aesthetic degradation, gravel deposition, increased traffics on roads creates high level dust, diesel fumes which impacts the quality life of local residents.

Moreover, current environmental laws in Chapagaon area also not so effective in regulating gravel, stone crushing and mining operations. As compared with smaller minim, larger mines are considered as minor determinant for air pollution and hence these mines are allowed to work with minimal quantity of emission. This may create nuisances to local communities. However the state government did not consider the influence of these impacts. Prevailing regulations failed to consider the location of these mines near residential areas.

Modifications in existing rules and regulations may reduce the impact of gravel, sand and stone minim on environment.

4.10 Conclusion

Mining operations are considered one of the main sources of environmental degradation. Depletion of available land due to mining, waste from industries, conversion of land to industry and pollution of land, water and air by industrial wastes, are environmental side effects of the use of these non-renewable resources. The environmental damage has in turn resulted in waste of arable land, as well as economic crops and trees.

The number of mining industries in Chapagaon has found decreased in 2012, but the environmental impacts have found rather increased. Chapagaon is an adjoining VDC of Lele, Bhardeu and Nallu VDCs, especially the gravel, sand and stone productions of Lele VDC are to be passed through the way of Chapagaon, so the environment of Chapagaon has degraded even after shifting the mining industries from Chapagaon. The income of Chapagaon VDC in the year 2012has found Rs. 100000 (about 1,020.40US$-in the rate, 1 US$=Rs. 98); this symbolizes the reduction of income of Chapagaon VDC. The tax from gravel, sand and stones in Chapagaon remains less while the productions are not existed in Chapagaon. The productions of other VDCs just pay the tax to Chapagaon on large and small truck basis. The impacts regarding to environment of Chapagaon are related to the degradation over the scenic beauty of Chapagaon, loss of soil quality, reduction on agricultural production, air pollution, drying the source of drinking water, soil erosion, sedimentation on local streams, habitat loss and fragmentation of wild life, health impacts on local people etc.

Economic impacts of mining industries in Chapagaon have found some positive too. The collected taxes from mining industries in Chapagaon VDC have utilized for the maintenance of local roads and local environment, the tax has also been utilized for the infrastructures development too. In gist, it can be said that mining industries of Chapagaon are detrimental to the environment but beneficial to the local people. But the perception of local people has found just partially positive.

4.11 Recommendation

In order to control environment pollution, the following recommendation will be useful to reduce the impact of gravel, sand and stone mines.

a. Refuse to provide permission to start new mines or reject permission to re-open the mines. Permission should be given only if the required materials are not existed in given area. This would be appropriate where the damage has already occurred and prevention of incoherent and random accumulation of sand, gravel and stone mines is required.

b. Enforcing existed emission permits strongly and consistently. To obtain this, the state would recruit more competent inspectors to take more appropriate actions against mining operations.

c. Refuse to give permission for operating mining in unsuitable locations. It should be ensured that the permission should not for mines to be operated in historical area of Chapagaon, residential area, rural communities as the mining will destroy charming of such areas.

d. Motivate to use re-processed materials such as recycled stones, gravels etc. This would definitely reduce the beginning of new mines and aids to resolve the overloading problems in mining areas.

e. The historical and natural sites of Chapagaon are to be protected for the prospects of tourism in this area, so the mining industries are essential to be shifted to the other places than presently existed.

f. The areas which are far from the local area, these kinds of areas should be managed for the mining.

g. Miners need to use environmentally friendly equipment's.

h. People awareness programme should be conducted from the Miners and from government about the impact of mining industries.

i. Tree planting programme should be conducted from Miners and local people.

References

Aigbedion. I., & Iyayi, S. E. (2007). Environmental effect of mineral exploitation in Nigeria. International Journal of Physical Sciences, 2(2), 33-38. CBS. (2011). Preliminary Results of National Population Census. Government of Nepal: National Planning Commission Secretariat.

Child Labour report. (2009). Children Working in Mining Industry. World Education and its Ngo partners, Kathmandu.

MOI. (2009). Mines and Minerals Acts and Regulations. Government of Nepal: Ministry of Industry, Department of Mines and Geology.

Ghose, M. K., & Roy, S. (2007). Contribution of small-scale mining to employment, development and sustainability–an Indian scenario. Environment, Development and Sustainability, 9(3), 283-303. http://dx.doi.org/10.1007/s10668-006-9024-9

Noetstaller, R. (1994). Small-scale mining, practices, policies, perspectives, In: Small-scale Mining–A Global Overview (pp. 3-10). In A. K. Ghose (Ed.). New Delhi: Oxford & IBH Publishing Co.

Shrestha, S. H. (2004). Economic Geography of Nepal (2nd ed.). Kathmandu: Educational Publishing House. Sivacoumar, R., Jayabalu, R., Subrahmanyam, Y. V., Jothikumar, N., & Swarnalatha, S. (2012). Air pollution in stone crushing industry, and associated health effects. National Environmental Engineering Research Institute. CSIR, Taramani–600 113, INDIA.

Zenz, C., Dickerson, B., & Horvath, E. B. (1994). Occupational medicine, Mosby, St. Louis, 167–236.Gavin Hilson, Pollution prevention and cleaner production in the mining industry: an analysis of current issues. Journal of Cleaner Production, 8(2), 119-126.

Notes

Note 1. Village Development Committee (A VDC has a status as an autonomous institution and authority for interacting with the more centralized institutions of governance in Nepal).

Note 2. Child Labour Status Report

Note 3. Brahmā) is the Hindu god (deva) of creation and one of the Trimūrti, the others being Vishṇu and Śiva.

Note 4. Astami is the eighth day (Tithi) of Hindu lunar calendar.

Note 5. SaraswatiJatra (Puja) or Shree Panchami is the day to celebrate the birthday of Saraswati (the Goddess of Learning).

Note 6. A festival of Bhairab, Bhairava, sometimes known as Bhairo or Bhairon, is the fierce manifestation of Shiva associated with annihilation. He is one of the most important deities of Nepal, sacred to Hindus and Buddhists alike. Bhairava is invoked in prayers to destroy enemies.

Note 7. The Newari Festival of Samyak Mahadan occurs once every five years.

Note 8. A local festival of Tika Bhairab; Lele, Nepal.

Annex – I

Questionnaire No.

1. Name of the Respondent (not compulsory):
2. Age i. ( ) 16 - 25 ii. ( ) 26 – 30 iii. ( ) 30 – 45
   iv. ( ) 46 – 55 v. ( ) 56 and above
3. Sex i. ( ) Male ii. ( ) Female
4. Education i. ( ) Literate ii. ( ) Illiterate
   If literate,
   i. ( ) Literate only ii. ( ) S L C iii. ( ) I A
   iv. ( ) B A v. ( ) M A and above
5. Occupation i. ( ) Farmer ii. ( ) Community organization member
   iii. ( ) Teacher iv ( ) Bureaucrat
   v. ( ) businessmen vi.( ) others
   if other please specify…….
6. Land holding status i. ( ) less than 1 Ropani ii. ( ) 1 to 5 Ropani
   iii. ( ) 5 to 10 Ropani iv. ( ) 10 to 15 Ropani
   v. ( ) above 15 Ropani
7. Marital Status i. ( ) Married ii. ( ) Unmarried
8. Do you have felt below mentioned disturbances of mining and crushing industries of your area? Please specify:
   (a) very noisy
   (b) dust particles enter into house
9. Is your family member is also working in mining industries? If yes, how many members are working there?
   (a) 1 person
   (b) 2 person
   (c) more than 3 person
10. How much you are earning per day?
    (1) 50 Rs-100 Rs (2) 100Rs-150Rs (3) 150Rs-200Rs
11. If any family member gets impacts in their health then are the mining industries looks, after for the medical treatment? If yes how much percentage you can get?
    (a) Yes (If yes)
    (1) 15%
    (2) 20%
    (3) more than 20%
    (b) No
12. Is mining industries developing to your local areas economically?
    (a) Yes
    (b) No
13. Do you have any suggestions to the crushing and mining industries?
    (a) Area Management
    (b) Completely remove
    (c) It should be continue
14. Do you think that mining and crushing industries are harmful to human health?
    Yes ( ) No ( )
15. Do you have felt below mentioned disturbances of mining and crushing industries of your area? Please specify:

Major Disturbances	Level of Disturbances				
	Very high(4)	High (3)	Normal (2)	Nominal (1)	No
Sound pollution					
Water pollution					
Air pollution					
Landslides/soil erosion					
River/stream bank cutting					
Forest area declining					
Destroy of natural beauty					
Declining of fish species in streams and rivers					

Note: this questionnaire was prepared to use in the field survey

Annex – II

Some Photographs:

Extracted Stones from Stone Mine on the Side of Karmanasa Stream, Chapagaon

Crushing Stones prepared after Crushing in Chapagaon

Prepared Gravel

Crushing Industry and prepared Gravel

Mini Trucks ready to Transport

One of the Crushing Industries in Chapagaon Ward No. 6

CHAPTER 5

BRICK FACTORIES IN KATHMANDU VALLEY AND ITS IMPACT ON ENVIRONMENT AND ECONOMY

5.1 Introduction

Kathmandu, the Capital City of the Kingdom of Nepal, is the only metropolis in the Country. The city is situated in a valley at an altitude of 1,350 meters. Kathmandu experiences all four seasons with the maximum temperature of 34°C in summer and minimum temperature of 0°c in winter. Average rainfall is 1,307mm per year with 90% of the precipitation occurring during the four months of June to September. The City is spread over an area of 50,67km^2 and can be broadly divided into three sectors; historic city core, the city center, and the city outer ring. Administratively, the City has been divided into 35 wards. In Kathmandu Valley there are more than 500 brick factories. Of these, more than 200 are traditional brick kilns. The traditional kiln is of an open brick firing structure, which consists of a temporary elliptical trench-shaped kiln and a pair of movable sheet metal chimneys.

Most of the brick factories are not registered with local authorities. The number of factories has increased by more than 50 per cent since 2000. This has caused a strain on the local environment, including pollution of local farm land and rivers. Complaints about this pollution continue to be raised with employers and local authorities but without any monitoring mechanism this continues to be ineffective.

According to a study conducted by the World Bank in 1996, the main contributing sources for total suspend particles (TSP) in the valley are cement factory (36%), brick kilns (31%), domestic fuel combustion (14%), road re-suspension (9%) and vehicle exhaust (3.5%). However, for the particulate matter of size less than 10 microns concentration, which is of a more concern as these particles can enter the respiratory system; contribution of brick kilns was found to be more than other sources. The share of brick kilns was 28%, domestic fuel combustion (25%), cement factory (17%), vehicle exhaust (12%) and road re-suspension (9%). Although a few studies have been done to indicate that Kathmandu's brick industries are polluting, there is a need for more studies to firmly establish the linkages between pollution from brick kilns and its impact on local environmental quality and public health. Clean Energy Nepal[9] has therefore joined hands with Pro-Public to conduct a field-based study to assess the impact of brick kilns in one particular village in Kathmandu Valley.

5.2 Study Procedure

The brick factories studied were identified by the field visit, direct interview, study reports and publications of government and non-government organizations especially which are involved in the field of brick factories. Some data were taken from government and non-government offices and their websites. The brick factories out of Kathmandu Valley are mentioned just for reference rather than detail study and analysis over these. For the completion of this study descriptive as well as exploratory research design has been applied. Some quantitative data are analyzed through tables and diagrams.

5.3 Background

Kathmandu valley includes three districts namely Kathmandu, Bhaktapur, and Lalitpur. Brick making is one of the traditional crafts in Kathmandu Valley. Evidence indicates that brick making existed in the Valley even during

[9] Established in 2000, CEN is an independent, nonprofit, policy, research and implementation organization focusing on research based education and advocacy campaigns with policy inputs and implementation on issues related to sustainable energy use and environmental conservation

the Licchavi[10] period. In recent years, with increasing urbanization and the demand for construction materials for development work, brick kilns have grown both in numbers and capacity. Most brick factories in the Kathmandu Valley operate from the month of December till May when the monsoon rain arrives in the valley. Kathmandu's brick factories most of which are situated at the southern part of the valley are largely responsible for the degrading air quality in the Valley. Bricks are still and will continue to be the preferred walling material due to their abundant availability and pleasing nature widespread use of fired clay is also dependent on the availability of clay deposits for brick making found on agricultural land situated in valley floors and estuaries. Availability of water and market vicinity augments the operation of large number of brick factories in the Kathmandu valley. The main environmental impact of brick factories is air pollution due to fugitive and stack emission. Fugitive emissions result during the handling of the bricks before firing and after firing. Stack emission occurs during the firing of the bricks in kilns. However, this is not the only adverse environmental impact associated with brick kilns.

Nepal ranks as one of the most picturesque countries in the world, free from the vagaries of modern days technological developments. However with the inclination to keep pace along with the developed world, a pall of crisis is slowly and steadily looming large in the form of a highly polluting atmosphere. Apart from vehicular pollution, numerous brick kilns dotting the landscape are major sources of obnoxious emissions.

In comparison with conventional brick producing means this technology boasts of lower emission standards, reduced energy consumption and economically viable means of brick production, besides creating a socially equitable status amongst the brick community.

5.3.1 Current Scenario

The brick sector in Kathmandu valley, whose functioning and growth is directly linked to construction activity, is presently in the eye of a storm. Negative rate of growth in construction activity in Armed Maoist Insurgency Period[11] had resulted in a proliferation of brick factories, which have reappeared in the Valley with spectacular speed raising serious concerns about the deteriorating air quality. It has been reported that brick factories, producing in excess of 350 million bricks are the major single source of SO2 and SPM in the environment of Kathmandu valley; contributing over 60 percent of the emissions. The solutions to this problem must take into account the following competing factors that are at work.

5.3.2 Market forces

The demand for burnt bricks continues to grow fuelled by an increased demand for housing in the Kathmandu valley. The customers have preference for burnt brick as the primary walling material; even though alternatives such as concrete blocks are increasingly being used for boundary and partition walls.

5.3.3 Economic Forces

The increase in supply of burnt bricks is ensured by willing entrepreneurs who jump at any opportunity for making quick profits. The entry barrier for new opportunistic traders is low.

5.3.4 Political Forces

The government of Nepal is aware of the serious environmental problems created by the brick factories. The efforts are intensified by environmental watchdog organizations and activists, who are going hands with communities to limit the growth of kilns and force them to "clean up" or "close down". The government has set

[10] ruled Nepal beginning in the 4th century CE

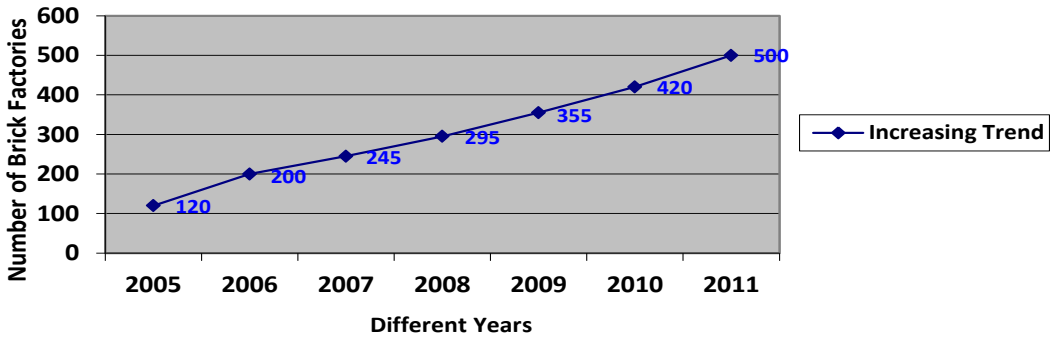
[11] In Nepal Armed Maoist Insurgency started in 1999 and ended in 2005.

into motion the task of setting environmental performance standards for kilns but enforcement, even of existing legislation, continues to be weak.

5.3.5 Related Works

The increasing trend of brick factories in Kathmandu Valley has been presented on the following figure:

Figure 1: Increasing Trend of Brick Factories in Kathmandu Valley



Source: Ministry of Environment, Science and Technology, 2011

Above figure indicates the increasing trend of brick factories in Kathmandu Valley. In the year 2006 brick factories increased by 66.66 percent, it is the highest percentage of increase. Similarly brick factories increased by 22.5, 20.40, 20.33, 18.30 and 19.04 in the years 2007, 2008, 2009, 2010 and 2011, respectively. This trend further indicates rapid increasing trend of brick factories in Kathmandu Valley.

It is apparent that the brick factories in Nepal are very diverse and weak, with production taking place at the village and urban level. The capital to labour ratio and the output to labour ratio of the modern brick plants are very high, whereas the reverse is true for the small scale enterprises. The brick industry sector is a very important part of the urban and rural economy.

5.3.6 District-Wise Brick Factories in Kathmandu Valley

Kathmandu Valley includes three districts namely Kathmandu, Lalitpur and Bhaktapur. The following table shows the district-wise brick factories existed in Katmandu Valley.

Kathmandu	Lalitpur	Bhaktapur
145	173	182

Source: Ministry of Environment, Science and Technology, 2011

Above table shows that the highest numbers of brick factories are existed in Bhaktapur district, it is because of the good clay available in this district. The second highest brick factories are found in Lalitpur which contains several open spaces outside the ring road of Lalitpur district. In Kathmandu district brick factories are comparatively least it is because of very less open spaces for the brick factories.

5.3.7 Existing Brick Making Technologies

Brick manufacturing generally consists of two activities: making of green bricks and brick firing. Green brick making involves selection of suitable clay, preparation of clay by sorting, mixing and tempering, moulding of bricks and drying. The moulding is either done manually using wooden moulds or mechanically using extrusion machines. Once the green bricks are ready, they are fired in kilns. Three types of kilns are used to manufacture bricks in Kathmandu. These are; Hoffman kilns, Bulls Trench Kilns and Clamp Kilns. Of these, the most common type of kiln is the Moving Chimney Bulls Trench Kiln. According to a field survey there are about 500 brick factories in operation in Kathmandu Valley. Of these 56 are Hoffmann kilns, 172 are Clamp kilns, and 272 are Bull's Trench kilns. These are operating in Kathmandu, Lalitpur and Bhaktapur Districts of Valley.

5.3.7.1 Clamp Kiln

Clamp Kilns, locally known as Thado Bhatta, are the traditional and oldest type of kiln used in Kathmandu. It has permanently constructed outer walls, which is open on top. In the inside the kiln is set up with a pile of bricks interspersed with combustible fuels (e.g. crushed coal and firewood). The arrangement is an alternative layer of fuel and green bricks. The usually rectangular firing clamp has some holes at the bottom from where the fire is lit. The size of the clamp varies according to the bricks to be burnt, but the height varies between 3–5 meters.

After the kiln is set up for firing, all openings are closed and plastered with mud to trap flue gases. Finally, the bottom holes are closed after the fire is lit and the fire is allowed to burn the bricks, which takes about 12 days to few weeks. The fired bricks are left for a few days to cool. These kilns do not have chimney and the emission from top is not visible while the bricks are being fired.

The advantages of the kiln are its small size, its adaptability to burn bricks of all shapes and sizes, requirement of low level of skills, and low capital investment. The disadvantages of this kiln are slow burning process, lack of control on fire; inefficiency and higher percentage of over burnt and under burnt bricks. Currently these kilns are used to produce tiles and traditional bricks mostly used for restoration works.

5.3.7.2 Hoffmann Kiln

Hoffmann kilns are the most modern and expensive type of kiln used in Kathmandu valley. They are oval in shape with multiple chambers for brick firing. In these kilns, the air is preheated by passing over cooling bricks in some chambers, and then the passes through firing zone. The cool bricks are removed from one side of the empty chamber; green bricks are stacked on the other side. The fuel is fed from the top, through holes in the permanent arched roof.

The main advantages of these kilns are as follows:

Supply of bricks is continuous and regular

- Pre-heating of the bricks are done by hot gases before they escape into the atmosphere
- Fuel consumption and stack emission is low
- Bricks are burnt evenly and the quality of bricks is good
- Height of the chimney control emissions of particulates and flue gases
- Kiln is operational throughout the year.

The main disadvantage associated with the Hoffman Kiln is the high capital investment.

Harisiddhi Brick and Tile Factory established in 1970, is the first factory in Nepal producing machine made bricks burnt in Hoffmann kilns. This factory was constructed with technical and financial assistance of the government of The Peoples' Republic of China. Two other Hoffman kilns, namely Bhaktapur Brick Factory (also built under grant assistance of the government of The Peoples' Republic of China) and Yeti Brick Factory are in operation in the Kathmandu valley. These kilns are locally known as Chinese Bhatta, because the machines are of Chinese make. These kilns use seasoned clay, prepared at their premises and a combined brick extrusion machine to extrude clay through a die to form a clay column, which is wire-cut into brick-sized pieces. Extruder machines produce denser and stronger bricks. Bricks produced in these kilns are of bright colour, smooth surface, and are used as wall material, without rendering. Harisiddhi Brick and Tiles Factory quote that their bricks tested minimum compressive strength of 150 kg/cm2, which is equivalent to concrete.

5.3.7.3 Bull's Trench Kiln

Bull's Trench Kiln (BTK) technology, locally known as Chimney Bhatta, is about 125 years old. However, over these years, the technology has witnessed little change. In Kathmandu the BTK technology has been in existence since early 1950's.

These kilns are of oval shape with two movable chimney-stacks. The kilns are constructed, usually on leased land, at the beginning of the season and dismantled at the end. A trench with a width of 23 to 32 feet and depth of 6.5 to 7.5 feet is first dug at the site of the kiln in a dry elevated area. The production capacity of a kiln is directly dependent on cross-sectional area of the trench. The height and the base of the chimney are constructed, based on the trench size.

The brick making process right from soil excavation, brick moulding to kiln erection is often done manually. Once suitable clay is depleted, the kiln is moved to a new site. The BTK operates on the principle of the Hoffmann kiln, except that the expensive arched roof and dampers for draught control are omitted. The exhaust gases are drawn through movable sheet metal chimneys, which are about 16 meter high and have a wide base that fits over the open able vent holes set in the brick and ash and rubble, which forms the top of the kiln. The chimneys are moved by 10 to 15 people and held by steel cables.

In these kilns, re-use of heat is achieved by drawing exhaust combustion gases through to successive batches of bricks waiting burning. The pair of chimneys positioned ahead of the fire, sucks in the kiln gases from the entry point and creates a draught through the fire and forward through the bricks. The fired bricks are allowed to cool and then removed. Green bricks are set up at the other end of the kiln while the brick firing is in progress. The fuel, generally a mixture of crushed coal and sawdust, is fed through the holes on the top. Depending on the size of the kiln, daily output ranges from 10,000 and 28,000 bricks.

Low capital investment compared to high profits is the main reason for the popularity of this type of kilns. According to the field survey of ENPHO 2001, the annual total brick production for the year 2000 from Bull's Trench Kiln, Hoffmann kiln and Clamp kiln are 344.65, 51 and 0.36 million pieces respectively in Kathmandu Valley.

The main advantages of this moving chimney Bulls Trench Kiln are as follows:

- The technology does not require complex machines or permanent structures
- It uses of labor intensive brick making and firing process.

In Bull's Trench kilns, different parts of the kiln generally produce different quality of brick. Bricks near the roof, along the sidewalls and the floors of the kiln do not receive enough heat and as a result are of low grade, whereas bricks at the core, which is well fired, are of best quality of first grade. After shorting generally, 60-65%, 20%,

15% and 5% of the brick was found in First, Second, Low grade and waste respectively. But, bricks sold in Kathmandu are not graded as all these graded bricks are mixed together and sold into the market. Such practice is prevalent due to the lack of knowledge of grade to buyers. A national standard, NS: 1-2035, for fired brick exits in Nepal but none of the brick factories comply with the standard or its specifications.

The kiln is constructed without permanent roof and the poor insulation causes significant amount of heat loss. Low chimney height and small sized chimney leads to excessive flue gas temperature to give effective drought. Shorter transfer of heat from a given quantity of fuel and lack of dampers to control draught is also a disadvantage of these kilns. The above factors are affecting the efficiency of the kiln and the quality of bricks produced. Fugitive and stack emissions from these kilns are high as a result of inefficient combustion, use of different grades of coal, molding of bricks in open, storing of coal and saw dust in open and poor handling practices.

5.3.8 Government's Policy on Brick Factories

Recently, Government of Nepal (GON) has taken a few steps to address the problems caused by brick factories. However, much more needs to be done. According to the Environment Protection Act, 1996, entrepreneurs need to conduct Initial Environmental Examination (IEE) before setting up a new factory with a capacity to produce up to 10 million bricks per year and an Environmental Impact Assessment (EIA) for setting up factories with higher capacity. As part of the IEE and EIA process, the entrepreneurs also need to put up a public notice to collect the comments and concerns from the local people. Although this is a good initiative, many factory owners either do not register their kiln or do not do a proper IEE.

According to the Industrial Enterprises Act, 1992 brick kilns are not allowed to be established within 1 km from urban areas or dense settlements. However it is difficult to define what a dense settlement is. Furthermore, brick kilns are not allowed to be established within 3 km from forest areas.

Realizing the severe air pollution problem caused by these brick factories in Kathmandu valley and its impact on human health, in March 2002, the Industrial Promotion Board of GON announced that the government will stop registering Bull's Trench Kilns and it will be phased out in a year and a half. The Board also decided to start legal and administrative work to change existing polluting brick industries towards cleaner options. This is a very positive step and it has forced entrepreneurs to look for options.

5.4 Environmental and Economic Impacts Analysis of Brick Factories

5.4.1 Environmental Impacts Analysis of Brick Factories

5.4.1.1Air Pollution

Air pollution inside Kathmandu valley is a burning problem and its history is not so long. The history of air pollution can be identified with the development of road networks and different types of automobile. The air pollution in Kathmandu's is the high concentration of particulate matter. Total Suspended Particulate (TSP) is the main cause of air pollution in the valley. In the winter season effect of pollution is more serious, because during the night cooling of atmosphere causes the formation of the inversion layer which acts as lid to trap pollution.

Number of brick factories (500 currently) produce significant amount of pollutants. Main cause is that these industries burn low quality coal and tires.

Table 1: Energy Consumption and Emission levels from Various Types of Kilns

Factory Type	Specific energy MJ/kg of	Fuel consumption (tons of coal	SPM Levels
Clamp	1.9-3	30-48	NA

Moving Chimney BTK	1.25-1.5	20-24	1021
Hoffman Kiln	1-1.25	16-20	380

Source: www.google.com/kathmandu/valley/bricks/industries/energy/consumption

5.4.1.2 Loss of Soil Fertility

Brick factories in Kathmandu Valley occupy about 509.1 hectare of land (ENPHO 2001). Out of this, Bull's Trench kilns alone are occupying 463.3 hectare (91%). For the brick manufacturing process, a large plot of land ranging from 40 – 200 ropani (20 ropani in one hectare) is taken on rent from farmers during December and May. Farmers take one crop of paddy, during summer and lease the land for brick making and soil excavation and get between NRs 1200 – 2400 per ropani of land. On an average 80 ropani of land is leased by each kiln and this area includes land on which the factory is constructed.

Characteristics of soil in the Kathmandu Valley with high water holding capacity, rich humus and excellent soil texture are suitable for agricultural use. But Bull's Trench kilns are erected in these agricultural lands for the sake of economic benefits that are leading to serious loss in agricultural productivity. Setting aside of topsoil for back filling is not a practice in the Valley. This is happening due to negligence of the kiln owners. Once the quality of soil becomes unsuitable for brick making, the industrialists abandon the site and move to the new location. Loss of topsoil has a negative impact on agricultural productivity due to nutrient loss/low biological potential, but both the parties have grossly ignored this fact and farmers resort to heavy use of chemical fertilizers to revive the soil fertility. This results in further environmental problems.

5.4.1.3 Health Impacts

Emission from brick factories comprises of fine dust particles, hydrocarbons (HCs), sulphur dioxide (SO2), oxides of nitrogen (NOx), fluoride compounds, carbon monoxide (CO) and small amount of carcinogenic dioxins (if rubber tyres were used as fuel) (NESS, 1995). Studies show that inhalation of even relatively low concentrations of fine particles could affect lung function and lead to increases in cardiovascular and respiratory diseases (Sharma, 2002). Higher amount of CO, which is produced in these kilns due to poor kiln design that results in incomplete combustion of coal, could also increase incidence of heart disease.

Epidemiological studies done in different places around the world have found the evidence that increase rate of bronchitis, asthma, decreased lung function, pharyngitis, cough, eye irritation, fibrosis, emphysema allergic, rhinitis are linked with deteriorating air quality.

5.4.1.4 Other Environmental Impacts

Besides air pollution and loss of soil fertility, the brick kilns are also causing other environmental problems such as lowering of water table. Low fertility during brick factory operation time, poor visibility due to air pollution and drying ground water sources are common problems. According to the local residents of Kathmandu

Valley previously one can easily get water from 4-5 feet below the ground surface. But now days, at the same place there is no sign of water even below 70 feet and most of the water wells got dry. Extraction of topsoil for brick making also increases the possibility of landslides and damage to structures, such as roads and houses.

Disruption of irrigation schemes is another problem caused by the extraction of soil for brick making.

Some farmers claim that they are forced to give their farms for brick making because their neighbors have done so and as a result the elevation of their land is higher than their the neighboring plots, which makes irrigation difficult.

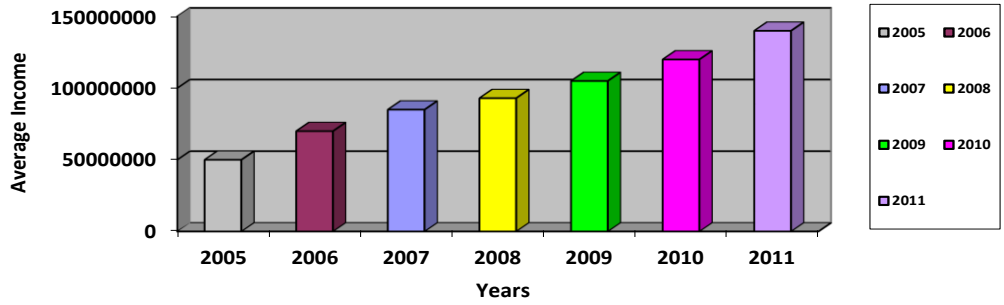
It has also been reported that the poor visibility resulting from the smoke from brick kilns have caused problems to pilots as they try to land at the Tribhuwan International Airport (Rai, 2002).

5.4.2 Economic Impacts Analysis of Brick Factories

5.4.2.1 Source of Income

In Nepal brick factories are taken as the major sources of income for the wage labourers and for the factories owners. Most of the brick factories established around cities are operated through recruiting wage labourers. Among labourers the portion of children, women and men is significant. The average income from brick factories has found as:

Figure 2: Average Year-wise income of Brick Factories Registered4[12] in Kathmandu Valley



Source: www.google.com/brick/factories/kathmandu/valley/income

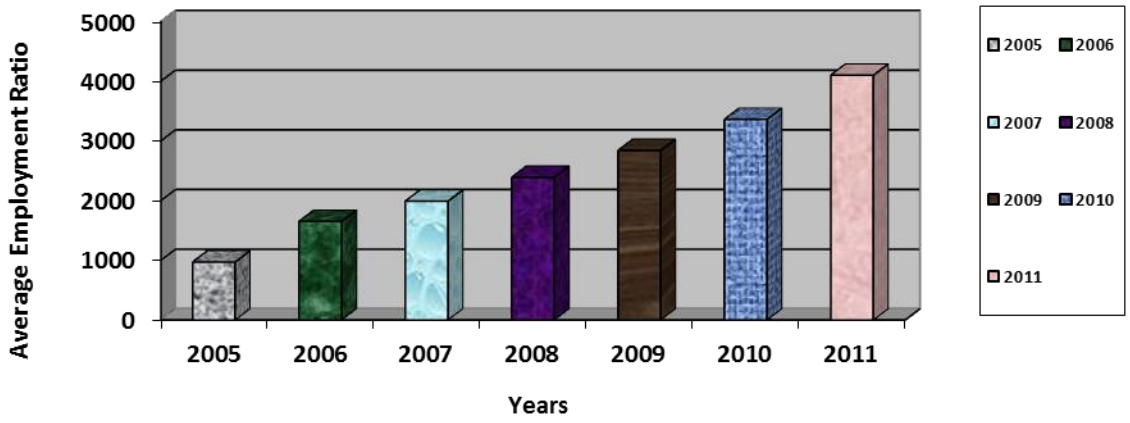
Figure shows that the average income of brick factories registered in Kathmandu Valley. The income of non-registered factories has not been included. The income level of brick factories has increased rapidly because of the rapid growth of numbers of factories too. In the years 2005 to 2011 average incomes have found 50 million,

5.4.2.2 Employment Opportunities

More than 500 brick factories in Kathmandu Valley have provided employment for thousands of people, most of the lower income family members have found engaged in brick making factories to meet minimum basic needs of their family members. The average labour recruitment ratio of brick factories has found as presented on the following figure.

[12] There are some brick factories in Kathmandu Valley operated without registration on local bodies 70 million, 85 million, 93 million, 105 million, 120 million and 140 million respectively. This trend further indicates the increasing trend of source of income too.

Figure 3: Year-wise Average Employment Ratio of Brick Factories registered in Kathmandu Valley



Source: www.google.com/brick/factories/kathmandu/valley/income/employment/ratio

Above figure shows the average year-wise employment generation ratio of the brick factories registered in Kathmandu Valley. The trend of employment generation has been growing rapidly. In the year 2005 only 1000 people were engaged brick factories but in 2011 more than 4000 people are engaged.

5.4.2.3 Other Economic Impacts

Brick factories potentially affect the economic welfare of owners of brick and other structural clay product facilities. The ownership of these facilities ultimately falls on private individuals who may be owner/operators that directly conduct the business of the firm or, more commonly, investors or stockholders that employ others to conduct the business of the firm on their behalf (i.e., privately-held or publicly-traded corporations). The individuals or agents that manage these facilities have the capacity to conduct business transactions and make business decisions that affect the facility. In the context of Kathmandu Valley most of the brick factories are operated with the concept of business. The quality of bricks determines the market value, the most common price in Kathmandu Valley for a brick is Rs 1 but this price may up and down according to the quality of brick and purchase numbers of bricks.

Brick production in Kathmandu Valley and other semi urban and urban areas of Nepal is taken as the most profitable business which provides the construction material for the purchaser and economic resource for the factories operators.

5.5 Critical Assessment

Brick making is one of the traditional crafts in Kathmandu Valley. Evidence indicates that brick making existed in the Valley even during the Licchavi[13] period. In recent years, with increasing urbanization and the demand for construction materials for development work, brick kilns have grown both in numbers and capacity. Most brick kilns in the Kathmandu Valley operate from the month of December till May when the monsoon rain arrives in the valley.

[13] **Licchavi** (also *Lichchhavi*, *Lichavi*) was an ancient kingdom in Nepal, which existed in the Kathmandu Valley from approximately 400 to 750. Centuries earlier, at the start of the Buddhist era a powerful republic known as Licchavi existed in what is today Kathmandu.

Kathmandu's brick factories mostly are situated at the southern part of the valley are largely responsible for the degrading air quality in the Valley. The share of brick factories on pollution has found 31%.

This study has been carried out to assess the environmental and economic impacts of brick factories of Kathmandu Valley which is a large area. It is assumed that as the brick factories in Kathmandu Valley use similar technology, the impact on local environment and economy is probably similar in other areas that have brick factories. Some of the main limitations of this study are as follows:

- This study has primarily based on secondary data available in different concern agencies and websites.
- covers the larger area namely 'Kathmandu Valley' where more than 500 brick factories are on operation so the specific study of a factory has not been mentioned.

In spite of these limitations, the study provides enough information about their technology, generated employment, and income from brick factories and so on to draw conclusions about the environmental and economic impacts of brick factories located in Kathmandu Valley.

Two Famous Brick Factories of Kathmandu Valley

Brick and Tile Factory, Harisiddhi

Established in 1965 to ensure the supply of high quality bricks and tiles, this factory has an annual production capacity of 25 million bricks.

Bhaktapur Brick Factory *This factory has an annual production capacity of 20 million bricks.*

Source: Field Survey, 2012

5.6 Further Work

The study has not been analyzed environmental and economic impacts of brick factories of Kathmandu Valley in depth due to larger study area and time limitation. Therefore, some recommendations for future work are recommended as:

1. The further research work should be to explore whether the environmental impacts are costly then economic benefits of brick factories or not.
2. The further research should be to explore what mechanisms should be adapted to make brick factories more responsible towards the local environment.

5.7 Conclusion

Emission from brick factories comprises of fine dust particles, hydrocarbons, Sulphur Dioxide (SO2), Oxides of Nitrogen (NOx), Fluoride compounds, Carbon Monoxide (CO) and small amount of carcinogenic dioxins if rubber tyres were used as fuel. Studies show that inhalation of even relatively low concentrations of fine particles could affect lung function and lead to increases in cardiovascular and respiratory diseases. Higher amount of CO, which is produced in these factories due to poor factory design that results in incomplete combustion of coal, could also increase incidence of heart disease. Epidemiological studies done in different places around the world have found the evidence that increase in rate of bronchitis, asthma, decreased lung function, pharyngitis, cough, eye irritation, fibrosis, emphysema, allergic rhinitis, low birth weight are linked with deteriorating ambient air quality. The

factories of Kathmandu Valley are found not safe, most of the firing spots of brick factories are haphazard, not safety for the workers. Most of the women and children are employed for the clay preparation, brick making, drying and firing which indicates delicate and sensitive health group people in these factories. Brick factory owners don't know the fertility of the soil but they just know how suitable the soil is for bricks. It indicates the loss of production of the valley. After research in this topic I had found out some possible solutions of brick factories problems in Kathmandu Valley:

(i) Have to encourage using alternative materials instead of bricks to construct buildings and other constructions.

(ii) Have to establish brick factories, where there are no human settlements and which less use for agriculture land is.

(iii) Have to encourage modifying modern technology to produce bricks which are friendly to environment.

Appendix-1

Abbreviations/Acronyms

BTK	-	Bull's Trench Kiln
FC	-	Fixed Chimney
EIA	-	Environmental Impact Assessment
ENPHO	-	Environment and Public Health Organization
GON	-	Government of Nepal
IEE	-	Initial Environmental Examination
TSP	-	Total Suspended Particles
VSBK	-	Vertical Shaft Brick Kiln

Annex – I

Some Photographs:

Polluting air

Working in brick factory

References:

Environment and Public Health Organization (2001), Status of Brick Kilns in the Kathmandu Valley, ENPHO, Kathmandu.

MOEST (2011), Kathmandu Valley Environment Profile, Ministry of Environment, Science and Technology, Kathmandu, Nepal.

NESS (1995), Assessment of the Applicability of Indian Cleaner Process Technology for Small Scale Brick Industries of Kathmandu, Metropolitan Environment Improvement Program, Kathmandu.

Sharma T, (2002), Impact of Air Pollution on Human Health, Paper presented at seminar on Air Quality Management of Kathmandu Valley: Challenges & Opportunities", June 19, 2002, Kathmandu.

Rai H (2002), "Vile Valley Air Just Got Viler" Nepali Times, 25 to 31 January 2002, Himal Media, Kathmandu Accessed Websites:

www.google.com/brick/factories/kathmandu/valley/income/employment/ratio

www.google.com/brick/factories/kathmandu/valley/income

www. moest.gov.np/valley environment profile

www.google.com/kathmandu/valley/bricks/industries/energy/consumption

CHAPTER 6

EXAMINATION ON THE SOIL EROSION PROBLEM IN NEPAL

6.1 Introduction

The kingdom of Nepal with an area of about 147,500 km lies at the northern rim of South Asia. On the basis of physiographic, geology, and geomorphology the country is divided into five major agro-ecological regions, commonly known as Terai, Siwalik, Middle Mountain, High Mountain, and High Himalayan regions. The middle mountain region occupying the largest land area of about 30% of the total has the highest population density per unit cultivated land. Even the marginal areas with steep and very steep slopes have been encroached for cultivation in order to feed the increasing population. Consequently the land resources have been over utilized.

Nepal is basically an agrarian country. Over two-thirds of the country's total land area is occupied by hills and mountains where the majority of the country's population lives. Much of the country's land base is environmentally fragile and susceptible to erosion and degradation. Cultivation on sloping and terraced land is a common feature of the Nepalese hill agriculture. Over the centuries, Nepalese farmers have been adopting a system of land use compatible with their environment such as shifting cultivation. But such a traditional farming system has not been able to cope with the rapid growth of both human and livestock population.

The extent of soil erosion depends on the complex interaction of a number of factors such as the resilience of the natural resource base, the institutional conditions, rate of population growth and the policy environment. (Ananda, J. and Heart, G, 2003). Over the recent decades, degradation of land and mountain ecosystems has become increasingly widespread. The traditional farming system and cultivation on steep hill slopes have accelerated the rate of erosion and degradation. Agricultural productivity especially in the hills and mountains is declining due to the erosion of fertile surface soils every year. Traditional farming system has not been adequate to sustain agricultural production and present level of food requirements. Improved agroforestry system has potentials not only for fulfilling the subsistence requirements (fodder, fuel wood, timber, etc.) but also for increasing land productivity and improving the economic condition of farmers without much change in existing agricultural practices (Neupane, T.P. Thapa, G.B., 2001). Therefore, there is an urgent need to develop suitable land management systems for sustainable agricultural production and environmental protection.

In Nepal, soil erosion has been identified as the major problem concerning sustainable agriculture in hill and mountain farming systems. It causes severe on- and off-site environmental, economic, and social impacts. It is, in general, realized that there is lack of (a) feedback mechanisms to alert producers to problems that may arise from their actions, and (b) strategies to deal with them within the time frame of normal on-farm decision making. These are the most critical barriers to the adoption of more sustainable practices in many countries. To overcome these problems, the Management of Soil Erosion Consortium (MSEC) Project has adopted a new research paradigm based on a participatory, interdisciplinary catchment approach. The three key elements of this approach are: the focus on on- and off-site impacts, the provision of scientifically sound information for decision-makers, and the involvement of the whole range of stakeholders from land users to policy-makers.

While the indigenous methods of hill farming in Nepal were designed to minimize erosion, population growth and strain on the land resources have led to intensification of agriculture generally at the cost of loss of nutrients and productivity in the long run. The challenge now is to introduce farming practices aimed at minimizing soil erosion and nutrient losses. Understanding the hydrological processes, the relationships between rainfall, runoff, and sediment and nutrient transport and the socioeconomic conditions of the farmers in the area is an important part of the research.

Land resource degradation in Nepal is mainly caused by landslides, mudslides, collapse of man-made terraces, and soil loss from steep slopes and decline of forest/pasture areas (ICIMOD, 1994). In the world map on the status of human-induced soil degradation (UNEP/ISRIC, 1990), deforestation, removal of natural vegetation and overgrazing are reported to be the main reasons for loss of topsoil and terrain deformation due to soil erosion in the mountainous regions of Nepal. Deforestation in the middle mountains is, however, not a recent phenomenon. Clearing of forests was not only for timber or firewood collection but also to maximize agricultural surpluses continues mainly for subsistence agriculture. Soil degradation resulting from conversion of forest land into agriculture in Nepal is reported by Burton et al. (1989). In contrast, in Nepal, no significant reduction in forest area has taken place during the recent decades (Gilmour, 1991). This might be because farmers are well aware of the impact of deforestation. In some villages, the farmers have begun to develop their own method for resolving the problem through community management (Fox, 1993). Of all the environmental problems in Nepal, the gradual reduction in soil fertility and soil erosion are among the most pressing. In the hills, particularly at lower elevations where rainfall intensity is highest, erosion is a major contributor to the decline of soil fertility.

Nutrient depletion and soil loss due to rainfall erosion are alarming, particularly in rain fed marginal land and degraded grazing land. Those losses of soil, organic matter and nutrients are clearly unsustainable (Carson, 1992). It is estimated that the country is losing an estimated 240 million cubic meters of soil annually (Asian Development Bank/Finnish International Development Agency, 1988). That lost top soil is raising river beds in the terai at a rate of 15-30 cm every year, increasing the incidence of floods, damaging fertile lands, dams and irrigation channels.

The specific objectives of this paper are to examine:

i. To examine the main causes of soil erosion and land degradation in Nepal.

ii. Analytical reviewed of various references concerning soil erosion, land degradations.

iii. To search and find out possible ways to control and minimize soil erosion in the context of Nepal.

The paper is organized as follows. In Section 1 presents about general introduction of soil erosion in Nepal. Section 2 presents problem of soil erosion in Nepal. The reckless destruction of forest trees, shrubs and all kinds of vegetation leads to the loss of large tracts of fertile land every year during monsoon. As well in this Section it presents factors and causes of soil erosion. In Section 3 it states about land degradation and Land Degradation Control Measures in Nepal. Section 4 presents Controlling Measures of Soil Erosion in Nepal and Section 5 concludes with some recommendations.

6.2 Soil Erosion as Serious Problem in Nepal

Problem of soil erosion in Nepal is serious in the hills. The reckless destruction of forest trees, shrubs and all kinds of vegetation leads to the loss of large tracts of fertile land every year during monsoon. Annually 1.7 mm of fertile topsoil gets lost in Nepal. Every year about 240 million tons of soil moves through rivers from Nepal to the Bay of Bengal. It leads to desertification and decline in land productivity. The estimate of average sediment contribution from the watersheds of some major rivers originating from the high Himalayan region is Tamur 38.0, Sunkosi 21.0, Saptakosi 15.0 and Arun 7.6 tons sediments per hectare per year. The Kosi River carries a load of 9.9 million cubic meter of silt every year (Lekhak, 2010).

The erosion rate in Nepal on grazing land and croplands is 2000-5000 tonnes/ km^2/ year. The soil erosion rates in hills and mountains are 2000-5000 tonnes/ km^2/ year in agriculture fields, and 200 tonnes/ ha/ year in some highly degraded watersheds. Crop yields in these areas declined by 8-21% during 1970-1995.

In Nepal 95 percent crop land is affected by soil erosion and in Nepal per annum 240 million cubic m. of soil has estimated to be eroded (Lekhak, 2010)

Rivers in Nepal destroy the agricultural land along the rivers due to flooding every year and the width of rivers are increasing. It is estimated that the bed width of the rivers in Nepalese Terai is increasing by anywhere from 18 cm to 45 cm per year. Rivers in Nepal carry 336 million tons of soil down to India every year. Nepal's National Planning Commission reported in 1974 that "Soil erosion is almost to the point of no return. Continuation of present trends may lead to development of a semi-arid type of ecology in hilly regions" The world is facing numerous ecological and environmental problems which are related to soil and water, including: soil loss due to erosion that results in physical, chemical and biological degradation and consequent loss of ability to produce food. Water polluted by mineral and organic sediments, and pollutants that are detrimental to drinking water. In addition, polluted water is also often times unfit for irrigation (Lekhak, 2010).

6.2.1 Factors and Causes of Soil Erosion:

The country is mountainous for the most part and the terrain is rugged and characterized by unstable and steep slopes, making it vulnerable to exogenous factors. Of these, the torrential monsoon rainfall that occurs within a short span of time is an important cause of soil erosion from mountain slopes. On the other hand, different forms of mass wasting, such as landslides, slumps, rock and river cutting are responsible for sedimentation in the valleys, plains and river basins, which also causes degradation of soil fertility.

Development works, particularly the construction of roads and irrigation canals, has also contribution to landslides and soil erosion increasing livestock population and over-grazing is a cause of massive soil erosion at greater rates.

Soil erosion by water may have both positive and negative effects depending on the type, magnitude, and extent of erosion. Geologic erosion is responsible for the formation of the most fertile alluvial soils (Indus valley, Indo-Gangetic plains, Nile delta) that have supported intensive agriculture for millennia for many ancient civilizations (Lal, 1998). However, sheet erosion is a serious problem because of its adverse impacts on agronomic productivity, the environment and ecosystem balances. Sheet erosion, in fact, usually occurs at such a slow rate that its cumulative effects may take decades to become apparent. Miller (1992) has illustrated the nature of this form of soil erosion: 'removal of one millimeter of soil, an amount easily lost during a rain, is so small that it goes undetected; but the accumulated soil loss at this rate over a 25 years period would amount to 25 mm - an amount that would take about 500 years to replace by natural processes'. As a result of soil loss, plant nutrients are removed; texture is changed; structure deteriorates; production capacity is reduced; fields are dissected and the sediments produced pollute streams and lakes and pile up on bottomlands, in stream channels and in reservoirs (Troeh et al. 1980). Transport and deposition of eroded material as well as substances dissolved in runoff and attached to soil particles lead to negative impacts on agricultural land and adjacent water bodies (Klik, 2000), water quality decline (Wood, et al. 2000; Richards, 2002), eutrophication (Gruhn et al. 2000; Zemenchik, 2002). Soil erosion in the highlands has induced sediment deposition in the terai plains, increasing the potential threat of river course shifts causing damage and property loss over large areas of fertile land. For example, Koshi River has shifted its course to about 110 km from east to west in 232 years (1731 to 1963) destroying about 1300 km^2 of fertile land by sand deposition (Ghimire and Upreti, 1997). This sudden change in the position of the river has resulted in a number of ecological changes in the area: forest and grassland in the eastern part of the Koshi tappu reserve have been destroyed, new vegetation has regenerated in the western part, agricultural land became more swampy, and 100-250 meter wide strip of marshes developed in the eastern part (Shah and Suselo, 1996). Upreti and Dhital (1996) documented the reduction of life span of the Kulekhani reservoir by half of the targeted design and one quarter of the expected life span due to sedimentation.

Soil fertility decline due to soil erosion and nutrients losses through runoff and leaching is a serious problem in the hills of Nepal (Tripathi et al. 1999 and 2000; Gardner et al. 2000; Paudyal et al. 2001). The annual loss of soil from agricultural plots ranges from a mere 0.1 t/ha to as high as 105 t/ha (Chalise and Khanal, 1997). Carson in 1992 calculated a nutrient loss of 300-kg organic matter; 15-kg nitrogen, 20-kg phosphorus, and 40-kg potassium

by assuming soil loss of 20 t/ha from a marginalized rain fed agricultural land in the mid-hills. A loss of 1-mm topsoil has been estimated to cause loss of 10-kg nitrogen, 7-kg phosphorus and 15 kg of potassium per hectare (Carson, 1992). It was estimated that 1.8 million tones of plant nutrient are removed from soil by crop harvest and soil erosion, and only 0.3 million tones (16 percent) are replenished by organic and inorganic fertilizers (MOPE, 2001). Additionally, in mid-hills, rice-growing farmers are benefited from the accumulation of eroded sediments (Shah, 1996; Schreier and Shah, 2000). Thus, in the hills, agroforestry has potential for enhancing food production and farmers' economic conditions in a sustainable manner through its positive contributions to soil fertility and household income.(Neupane, T.P. Thapa, G.B. ,2001)

For rain fed agriculture in Nepal, soil erosion is most critical during the pre-monsoon season (Schreier and Shah, 1995; ICIMOD, 1998; Nakarmi and Shah, 2000; Nakarmi et al. 2000; Tripathi, et al. 2000; UNEP, 2001) when vegetation cover is at a minimum, the field is freshly plowed and rainfall intensity is high. In the Central hills of Nepal, approximately 13 percent of rainfall occurs during March-May (pre-monsoon) and 79 percent of rainfall occurs during monsoon period (June-September) and the mid-hills experienced local ascending winds that lead to violent thunderstorms accompanied by hail before the arrival of actual monsoon front (Shah and Friend, 1992).

Strip-cropping (Acharya, 1999; Bajracharya, 2001); minimum tillage (Maskey et al. 1992; Acharya, 1999; Rajbhandari, 2000, Bajracharya, 2001); mulching (Acharya, 1999; Rajbhandari, 2000) and incorporation of legumes (Acharya, 1999) could be the possible options for the soil surface erosion control.

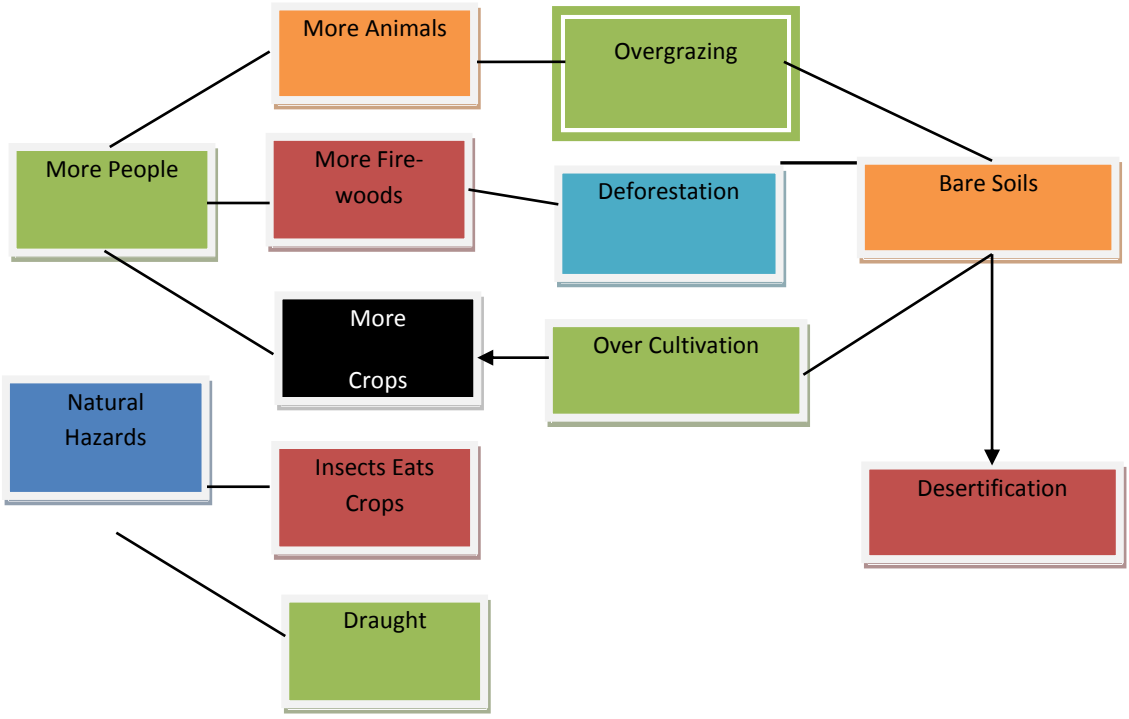
Both human and natural forces play important roles in causing soil erosion and loss of soil fertility. The hill and mountain regions of Nepal are geologically young and the monsoonal tropical climate of the country is characterized by high temperatures with high and intense seasonal rainfall. In that environment the steep hill slopes are subject to frequent landslides and soil erosion. Those processes are further aggravated by increased marginalization of rain fed agriculture and the increased pressure of low-quality livestock on grazing lands (Gilmour, 1991; Wymann, 1991).

Soil erosion on the hills of Nepal is influenced by a number of interrelated factors (Carson, 1985; Asian Development Bank/International Centre for Integrated Mountain Development, 1992):

Soil erosion is recognized as a serious environmental problem in Nepal. The country is mountainous for the most part (>80 percent) and the terrain is rugged and characterized by unstable and steep slopes, making it vulnerable to exogenous factors. Of these, the torrential monsoon rainfall that occurs within a short span of time is an important cause of soil erosion from mountain slopes. On the other hand, different forms of mass wasting, such as landslides, slumps, rock and river cutting are responsible for sedimentation in the valleys, plains and river basins, which also causes degradation of soil fertility.

Development works, particularly the construction of roads and irrigation canals, has also contribution to landslides and soil erosion increasing livestock population and over-grazing is a cause of massive soil erosion at greater rates.

Figure 1: Causes and Consequences of Soil Erosion



6.2.1.1 Rainfall erosion

There is a direct relationship between the magnitude of surface soil erosion and the intensity of rainfall. Data on rainfall intensity are rare in Nepal. A study reports that erosive rainfall (defined as more than 1.5 mm in 30 minutes) was as high as 39 per cent of the total rainfall in the Phewa Tal Watershed (Kemp, 1984). Such heavy rainfall has considerable erosive power, and the situation is worsened if the steep slopes are denuded.

(i) Degree of soil erosion

A number of soil characteristics, such as texture, organic matter content, structure and the rate of infiltration all affect the degree of soil erosion.

Normally, the lower the proportion of fine sand or silt, the higher the organic matter content, the more developed the soil structure and the higher the infiltration, the less erodible the soil will be. However, many parts of the hill region have red soils which are prone to sheet and gully erosion. Overgrazing and burning on such soils lead to severe soil degradation.

(ii) Slope length and steepness

The potential for surface soil erosion increases as slopes become steeper and longer. However, on slopes greater than 30 degrees, the effect of mass movement is greater than that of surface soil erosion.

(iii) Cropping factor

Crops or other natural vegetation protect the soil from erosion during rainfall. The intensity of the surface soil erosion decreases as the density of vegetation increases. Although trees are important, the ability to resist surface

soil erosion really depends on the percentage of cover and density of vegetation at ground level, as well as the presence of herbs, grasses and litter. In many forested areas of Nepal, soil erosion is a problem because of poor ground cover.

6.2.1.2 Declining land productivity

The total production of food grains (rice, maize, wheat, millet and barley) in the country has increased by an average of 2.17 per cent annually during the past 24 years (Thapa and Rosegrant, 1995). That rate is lower than the population growth rate during the same period. More importantly, the food grain increase came mainly as a result of area expansion rather than yield growth. Food grain production in the first half of that period grew by less than a half percentage point annually as the aggregate yield showed negative growth. In the second half of the 24-year period, production grew by about 4 per cent per year in which the contribution of area expansion (2.5 per cent) was significantly higher than that of yield growth (1.5 per cent).

Available data, although sparse and mostly based on generalization in case studies, indicate that soil fertility is declining in many parts of the country and is a major factor for declining land productivity. There are two major causes: farmers are applying inadequate amounts of manure and fertilizer, and their farming practices are inappropriate.

Following the intensification of agriculture, farmers are growing two or more crops in irrigated areas, which have considerably increased the requirement of fertilizing material. However, in the face of limited supplies of organic manure, which still is the major source of soil nutrients for most farmers, they have rightly diverted the use of manure from rain fed areas to more productive irrigated areas. This has led to a rapid decline in the fertility of rain fed land.

Cropping patterns in Nepal do not adequately incorporate legumes and other crops which have nitrogen-fixing ability but are mostly based on cereal crops, which remove significant amounts of nutrients from the soil. With the declining supply of organic manure and unavailability of chemical fertilizers, particularly in the hill and mountain regions, farmers are unable to maintain soil fertility, and yields are declining. It has been estimated that between 10 and 20 per cent of the rain fed cultivated land is no longer being cultivated because of the shortage of fertilizing material (Carson, 1992).

Even in the terai and the accessible areas of the hill region, where the supply of chemical fertilizers is better, inappropriate use of such fertilizers is adversely affecting the long-term soil fertility (Fujisaka and others, 1994).

6.2.1.3 Soil acidification

The pH of a soil is an important chemical characteristic as it indicates the availability of many plant nutrients and toxic elements. The pH of the average cultivated upland soil in Nepal is around 5.4, which does not limit the production of many agricultural crops (Land Resources Mapping Project, 1986). However, in many hill districts the problem of soil acidity has emerged in recent years. For example, in the Jhikhu Khola Watershed in the eastern hills, the average pH was reported to be 4.8 (Schreier and others, 1991). The problem is typical of many hill areas which possess opportunities to grow cash crops for accessible market centers.

Two factors that contribute to increasing soil acidity in such areas are: the increasing use of chemical nitrogen fertilizer and the emphasis of the government reforestation programme on pine trees (Carson, 1992).

Unlike the original hardwood forests, pine tree plantations are inefficient base recyclers and the pine needles produce fairly strong organic acids that accelerate leaching of bases from the soil. In the past, farmers have used high doses of organic manure to buffer the soil. But fodder and labour shortages have led to less and less use of organic manure in recent years.

The problem of soil acidification has also been reported from terai districts. For example, the agricultural research station at Bhairahawa in the western terai has reported heavily acidic soils at a number of experimental plots, after only 10 years of continuous fertilizer use (Carson, 1992). As a result, crop yields have decreased significantly on such soils.

6.2.1.4 Sedimentation

In the rivers of Nepal, sedimentation is an ongoing natural process, which is influenced by both natural and anthropogenic factors. Natural forces include topography, geology, climatic conditions, the intensity, duration and distribution of rainfall, and seismic conditions. Major anthropogenic factors are crop cultivation, deforestation, and grazing and infrastructure development.

Enormous quantities of sediment are transferred each year by rivers from the high lands to the plains. The rate of sedimentation is reported to have increased in recent years as a result of increasing human interference in the land surface (Dixit, 1995). The depositing of sediment each year replenishes the fertility of the land. But the sediment load is a major problem in the design and operation of irrigation, water supply and power projects in the country.

Several researchers have documented the extent and complexity of the sedimentation process in Nepal (e.g., Carson, 1985). However, a significant knowledge gap remains in understanding the dynamics of sediment movement. One important reason for that gap is the unavailability of adequate data. Time-series data on sediment load are available only for 20 stations for past 10 years. Most of those stations only measure the suspended sediment load. More than 90 per cent of the sediment load moves in major snow-fed rivers during the monsoon months (Dixit, 1986). The concentration of sediment is low during the non monsoon months in non-snow fed rivers. Based on available sediment yield records, the total sediment yield from the rivers of Nepal is estimated to be 640 million tons (Shankar, 1992). Another study estimates it to be 726 million tons per year (Dixit, 1995).

In the rivers of Nepal, sediments supplied by point source contributions, such as, landslides and mass wasting create major imbalance in the sediment budget (Carson 1985). The random nature of those events makes it very difficult to predict and assess their contribution to the sediment balance.

6.2.1.5 Rehabilitation

(i) Reclamation of acidic soils

Realizing the impact of soil acidity in the hills of Nepal, the government has promoted the application of agricultural lime as a neutralizing agent. The Agricultural Lime Industry (ABBR), a public sector corporation, produces and sells lime to farmers in several hill districts. In collaboration with district agriculture extension offices, ABBR also provides extension services to farmers in order to promote the use of lime in problem soils. ABBR sales of agricultural lime increased from 70 tons in 1985/86 to 100 tons in 1989/89. To promote lime use in the hills, the government provides price and transportation subsidies for the product. However, transportation difficulties and lack of adequate government financing have limited its use relative to the magnitude of the problem.

(ii) Watershed management

The government soil conservation and watershed management programme is currently being operated in 30 of a total of 75 districts and is projected to double under the eighth Five-Year Plan. The objective of the programme is to address man-induced environmental problems caused by: (a) intensified use by a rapidly increasing population in the hill areas (deforestation, overgrazing, continuous cropping); and (b) poorly designed and maintained infrastructure, such as roads, channels, dams etc. (World Bank, 1993).

The Department of Soil Conservation and Watershed Management uses a multidisciplinary approach to generate a range of technologies for use in: (a) preventing rapid land degradation and soil loss; and (b) enhancing slope

stability and agricultural productivity. That is done through such measures as afforestation, stall feeding and fodder production, conservation farming, bio-engineering in the improvement and rehabilitation of works, water management, and slope and river bank protection.

There are two main issues related to the implementation of the programme. First, attempts to coordinate the activities of other related line agencies in project areas has not been effective, and working relationships with district and village development committees are still being developed. Second, the adoption of prescribed technical options is low because of the shortage of extension agents and an insufficient operating budget.

(iii) River training

A common method used in Nepal to minimize the downstream effects of high water flows is river training. The government has implemented river training programmes which make use of low-cost, locally available materials and labour. A programme for constructing 18 kilometers of river embankment was recently started on the East Rapti River with assistance from the Asian Development Bank (ADB).

However, the impact of river training programmes in terms of the stated aim of ameliorating the negative effects of flooding and riverbank erosion appears doubtful, particularly in relation to their high financial cost (World Conservation Union, 1993). It has been argued that resources might be better spent on educating farmers about farming practices that contribute to erosion, both upstream and downstream, although no economic studies of river training programmes have so far been carried out.

6.3 State of Land Degradation

Because of highly rugged mountainous topography, active tectonics and highly concentrated monsoon precipitation, the country is naturally highly vulnerable to different forms of mass-movement and soil erosion on mountain slopes and flooding and siltation in the low-land area. Moreover, rapid growth in population with subsistence economy and use of traditional sources of energy has been exacerbating the process of land degradation. About 28.24% (3.262 million ha) of the total land is under the process of desertification in one or other. Nearly 36% of forest land, 10% of agriculture lands, 37% of pasture/range land are in degraded condition. About 1% area has been damaged by floods and landslides between 1984 and 2003. Similarly, about 2% forest areas has been destroyed (Table 2.1).

The major processes of land degradation are associated with water erosion. One estimate shows that nearly 45.5% area of the country is seriously affected by water erosion.

Similarly, 4% area mostly in higher altitude and trans-Himalayan region is affected by wind erosion. Land degradation due to chemical and physical processes is less than 2% of the total area of the country. The rate of soil erosion is highly dependent on land use/ land cover and land management practices. Well managed forest and irrigated level terraces used for paddy production have comparatively lower rate of soil erosion. Poorly managed forest and slopping agricultural land have comparatively higher rate of soil erosion. Open rangeland is seriously affected by intense soil loss.

In addition to intense soil erosion on the hill slopes, sedimentation/siltation in river valleys and the Terai area, reduced crop yields due to decline in soil nutrients, acidification and increased pollution is another problem associated with land degradation (Chalise and Khanal, 1997; ODA-NARC, 1995; Carver and Nakarmi, 1995; Carver and Shreier, 1995; Shah and Shreier, 1995, Panday et al., 1995; Joshy, 1994; Carson, 1992 and 1985; Joshy et al. 1992; Pradhan et al. 1992 and LRMP, 1986). Majority of the agriculturally induced soil degradation is occurring in marginalized Bari (rain- fed) land since farmers are diverting more fertility resources to Khet land (irrigated) (Carson, 1992). The traditional practices of green manuring and in situ manuring have been declining.

6.3.1 Land Degradation Control Measures in Nepal

Land degradation is one of the important factors to hinder agricultural production in Nepal. Government level measures to conserve and its proper planning and development have been the following:

1. Establishment of the Department of Soil Conservation and Watershed Management in 1974.[14]

2. Other milestone attempt was the formulation of the Land and Watershed Conservation Act (1982) and its Regulations (1984) to protect the watersheds in the country. But these legal instruments are very restrictive and therefore have not been implemented. At present DSCWM is introducing a process to amend these laws.

3. Adoption of community forestry[15] has been considered one of the successful policy initiatives in controlling land degradation. Its aims are to manage forest resources and use forest products by involving local communities. According to the Department of Forests, until February 2000, more than 650,000 ha. of public forests had been given to local forest user groups to be managed as community forests. Local control of community managed forests has led to increases in productivity and biomass because of strict protection from fires, free grazing, and uncontrolled cutting.

4. Agricultural Perspective Plan (PPP) has identified fertilizer input as a major contributing factor to accelerating agricultural growth. The Ninth Plan recognized that there is now a need to have sound land management programs to maintain land quality and fertility.

5. Nepal has signed various international conventions and treaties related to conservation of land. The UN Convention to Combat Desertification was signed by Nepal on Oct 12 1995 and since then it is obliged to combat desertification and to prepare national action plan including programs for poverty reduction, which is closely related with land degradation (Pradhan, 2008).

6.4 Controlling Measures of Soil Erosion

Unless loss of soil is checked, it would amount to a great loss for mankind. Thus man has made use of his ecological training in the preservation of this one of the most important resources. The chief agents of soil erosion are water and wind. The actual art of soil conservation is based on certain basic principles, which includes:

(a) Protection of soil from the impact of raindrops.

(b) To slow down the water from concentrating the moving down the slope in a narrow path.

(c) To slow down the water movement when it flows along the slope.

(d) Reduction in the wind velocity near the grand by growing vegetation cover, and

(e) To grow the vegetation this might catch and hold the moving particles of soil.

Soil conservation means that the land resource bases must be used rationally and scientifically permitting minimum of damage. The ideal measure of soil erosion is vegetation development. When the vegetation cover is continuous, the soil is well permeated with roots. It increases the soil resistance to erosion because:

- Vegetation reduces the direct impact of rain on the soil surface.

14 Department of Soil Conservation and Watershed Management in Nepal is taken as milestone for soil conservation.

15 Community forestry is taken as one of the successful programs in Nepal and exemplary in South Asia too.

- Vegetation also checks the speed of run-off or water flow on soil surface which reduces the erosive capacity of water and increases percolation, and
- Above all, vegetation increases the amount of organic matter in the soil which increases the water holding capacity of the soil and favors infiltration in the soil.

Keeping in view, above mentioned ideal measures and principles, ecologists and agriculturists have devised several methods of soil conservation which are given below:

6.4.1 Biological Methods

i. Contour Farming: An oldest method useful in areas with low rainfall in the preparation of the field with alternative furrows and ridges. Ridges at the same level are known as 'contour'. The water is caught and held furrows and stored, which reduces run-off and erosion. On slopes, however, this type of farming is coupled with terracing. This system is particularly popular in upland.

ii. Mulching: It is effective against wind as well as water erosion. Some such plants are maize, stalks, cotton stalks, tobacco stalks, potato tops etc. are used as much (a protective layer formed by the stubble i.e. the basal parts of herbaceous plants, especially cereals attached to the soil after harvest). Mulches (2-3" inch) reduce soil moisture evaporation and increase amount of soil moisture by addition of organic matter to soil.

iii. Crop Rotation: It decreases soil loss and preserves the productivity of land. It checks soil erosion. The same crop year after year, depletes the soil mineral. This is overcome by cultivating legumes. A typical rotation consists of one year of follow, followed by winter heat.

iv. Strip Cropping: It involves the planting of crops in rows or strips to check flow of water. It may be contour strip cropping, field strip cropping or wind strip cropping.

v. Lay Farming: This aims to grow grasses in relation with field crops, which helps in building up the structure of soil, preventing soil erosion and improving its fertility.

6.4.2 Mechanical Methods

Mechanical methods are used as supplements to biological methods, such as:

i.Basin Listing: To dig channels suitable intervals and the excavated soil deposited as a wide, low ridge along the lower edge of the channel.

ii. Bench Terrace: To construct a number of platforms along contours or suitable graded lines across the slope.

6.4.3 Other Methods

i. Gully Control/Reclamation: To check the formation or widening of gullies by constructing bunds, dams, drains or diversions through which excess run-off water is channeled.

ii. Stream Bank Protection: To grow vegetation alongside the river bank, to construct drains, concrete or stone pitching etc. for checking the cutting and caving of rivers banks.

iii. Agro-forestry: Agro-forestry is the deliberate growth and management of trees along with agricultural crops and/or livestock in systems that are ecologically, socially, and economically suitable. Simply, agro-forestry is the use of trees in farming system, which control the soil.

iv.Practice of Intercropping and Mixed Cropping: It may also prove beneficial to soil conservation because this practice does not allow simultaneous exposure of the whole field to rainfall as not all the crop mature and are harvested at the same time.

v.Afforestation: Afforestation is an ideal controlling measure of soil erosion, particular fragile and necked areas.

vi.Windbreak or Shelterbelt: This technique is more suitable for arid and semi-arid area. This method breaks the velocity of wind. For this technique, open land should be covered through afforestation. It means around the farm-land the density of forest should developed/high.

vii.Planting in Marginal Lands: This technique is very normal but important to protect soil erosion by planting plants on very fragile, easily broken, breakable or marginal lands.

viii.Control over Over-Grazing: It is also taken very important task to protect soil erosion by either reducing the number of cattle or controlling over the over-grazing of the cattle.

ix. Terracing: Terracing of sloping lands reduces the speed of coater and prevent soil erosion (Sapkota and Khadka, 2065 BS).

6.5 Concluding comments and policy implications

Erosion is a natural process and especially intense in highly sloping land which also gets high amount of rain. It is also made worse by humans in terms of deforestation, overgrazing, over construction and building of roads. Excessive erosion may cause the damage of the ecosystem. Globally, every year about 75 billion metric tons of top soil (equivalent of about 6 million hectares of arable land) is removed from the land primarily from the agricultural land by wind and water. In addition, every year about 12 million hectares of arable land is rendered useless and abandoned because of non-sustainable farming practice.

The erosion of soil may be observed in the silting of reservoirs and from the air as well as from satellite imagery in muddy, silt-laden rivers flowing into the sea. For example, Pakistan's large reservoirs such as Mangla and Tarbela, which store Indus River water for its massive irrigation networks, are known to be losing roughly 1 percent of their storage capacity each year as they slowly fill with silt from their deforested watersheds. Large reservoirs in Nepal such as the one in Kulekahni are being filled up at much faster rate than those in Pakistan.

In Nepal, soil erosion has been identified as the major problem and it causes severe on- and off-site environmental, economic, and social impacts. To overcome these problems, the Management of Soil Erosion Consortium (MSEC) Project has adopted a new research paradigm based on a participatory, interdisciplinary catchment approach. The three key elements of this approach are: the focus on on- and off-site impacts, the provision of scientifically sound information for decision-makers, and the involvement of the whole range of stakeholders from land users to policy-makers.

While the indigenous methods of hill farming in Nepal were designed to minimize erosion, population growth and strain on the land resources have led to intensification of agriculture generally at the cost of loss of nutrients and productivity in the long run. The challenge now is to introduce farming practices aimed at minimizing soil erosion and nutrient losses. Understanding the hydrological processes, the relationships between rainfall, runoff, and sediment and nutrient transport and the socioeconomic conditions of the farmers in the area is an important part of the research.

In the developing countries as well as in Nepal, soils have been seriously degraded by the impact of uncontrolled land uses, such as unmanaged grazing, mining, construction, pollution, and excavation. In many cases, these

activities have led to a hardening or removal of the top layer of the soil. As a result, it is difficult for rain or snow melt to infiltrate the soil.

The pH of a soil is an important chemical characteristic as it indicates the availability of many plant nutrients and toxic elements. The problem of soil acidification has also been reported from terai districts.

In the rivers of Nepal, sedimentation is an ongoing natural process, which is influenced by both natural and anthropogenic factors. Natural forces include topography, geology, climatic conditions, the intensity, duration and distribution of rainfall, and seismic conditions. Major anthropogenic factors are crop cultivation, deforestation, and grazing and infrastructure development.

The government soil conservation and watershed management programme is currently being operated in 30 of a total of 75 districts and is projected to double under the eighth Five-Year Plan. There are two main issues related to the implementation of the programme. First, attempts to coordinate the activities of other related line agencies in project areas has not been effective, and working relationships with district and village development committees are still being developed. Second, the adoption of prescribed technical options is low because of the shortage of extension agents and an insufficient operating budget.

A common method used in Nepal to minimize the downstream effects of high water flows is river training. The government has implemented river training programmes which make use of low-cost, locally available materials and labour. However, the impact of river training programmes in terms of the stated aim of ameliorating the negative effects of flooding and riverbank erosion appears doubtful, particularly in relation to their high financial cost (World Conservation Union, 1993). It has been argued that resources might be better spent on educating farmers about farming practices that contribute to erosion, both upstream and downstream, although no economic studies of river training programmes have so far been carried out.

The problem of soil erosion in hilly and mountainous areas of Nepal has been widely recognized, but very little has been done to conserve it well. Government of Nepal has recently established the Department of Soil Erosion and Conservation for the purpose of conserving soil recourses. But its activities are really very poor and sketchy. Even the Watershed Management which is meant for conserving soil and forest resources is limited to a few selected areas of the country. In fact, the need of soil conservation has been long felt and much spoken, but little done to materialize it. As such, the achievement made so far in this field has been found to be very negligible. In terms of energy generation and consumption, Nepal is environment friendly and has several plans to cut-off the emissions caused by the fossil fuel, and the alternative of fossil fuel, bio-fuels and bio-gas plants are focused to establish. But Nepal still have to design educational syllabus related to resources consumption, proper planning, strategy formulation, energy generation, environmental problem assessment and proper implementation of these measures.

In shortly, Physical Factors or Human Factors are responsible for soil erosion problem in Nepal as well as other developing countries. As described above measures and different kinds of ways of control of soil erosion, Vetiver plant is also very beneficial to control soil erosion in Nepal.

A tall, stiff grass called Vetiver, which grows into a dense hedge when planted in lines along the contours of slopes, can slow runoff and prevent soil from washing oil slopes. This amazing grass seems to be the solution to the problem of soil erosion.

Along the mountain roads of Nepal, Vetiver should be planted along with bamboos and other fast growing trees especially towards the down slope of the roads so that even if there is an accident, the bamboos and trees will prevent the vehicle from falling down the mountain or into the river such as Trisuli River. This measure will not only prevent landslides and soil erosion thereby saving a lot of money in road repair but also save lives. In addition,

it will make the area along the road look beautiful. The local farmers should be given the responsibility to maintain Vetiver and trees and in return they can harvest both Vetiver and bamboo branches as fodder for their animals.

Farmers could plant Vetiver along their property boundary as well as in the slopes of the land along the contour line to prevent soil erosion especially where they grow corn, potatoes and soy beans.

The National Research Council (NRC) USA as well as the World Bank are promoting the use of Vetiver grass as a way of controlling erosion. The NRC panel reported that for centuries, Vetiver's roots have provided anoil used to scent perfumes and soaps. It is grown in 70 countries but few use it for erosion control.

Of all the environmental problems in Nepal, the gradual reduction in soil fertility and soil erosion are among the most pressing. In the hills, particularly at lower elevations where rainfall intensity is highest, erosion is a major contributor to the decline of soil fertility.

Soil fertility decline due to soil erosion and nutrients losses through runoff and leaching is a serious problem in the hills of Nepal. Both human and natural forces play important roles in causing soil erosion and loss of soil fertility. Available data, although sparse and mostly based on generalization in case studies, indicate that soil fertility is declining in many parts of the country and is a major factor for declining land productivity. There are two major causes: farmers are applying inadequate amounts of manure and fertilizer, and their farming practices are inappropriate.

Following the intensification of agriculture, farmers are growing two or more crops in irrigated areas, which have considerably increased the requirement of fertilizing material. However, in the face of limited supplies of organic manure, which still is the major source of soil nutrients for most farmers, they have rightly diverted the use of manure from rain fed areas to more productive irrigated areas. This has led to a rapid decline in the fertility of rain fed land. Besides the techniques described above, we need to conserve and improve the soil. Soil conservation and improvement techniques include those that improve soil structure and texture, and soil fertility. We can improve soil structure and texture by applying organic matter (manure, compost, or mulch) or clay, sand, or lime, and by breaking the crust and loosening the top layer of the soil. We can improve soil fertility by applying minerals and nutrients in the form of artificial fertilizer or manure, or by the manure produced by direct grazing.

As well as tree planting programmes should be start much effectively, for that awareness programme should be conduct all over the country. Government has make effective rule and regulations concerning soil erosion and have to follow strictly those rule and regulations.

Soil erosion is the detachment and movement of soil particles by the erosive forces of wind or water. Soil is detached and transported away from the mountains and is deposited in the Terai. While soil erosion may be controlled, but it is almost impossible to completely stop.

References

Ananda,J. and Herath, G.(2003) `Soil erosion in developing countries: a socio-economic appraisal`, Journal of Environmental Management,

Acharya, G. P. 1999. Review on soil and soil fertility losses from the cultivated hill lands of Nepal and their conservation. Lumle Review Paper No 99/1. Agricultural research station, Lumle, Kaski, Nepal.

ADPI Series No. 9 (Kathmandu, International Centre for Integrated Mountain Development). Application of Satellite Remote Sensing in Forest Resource Management in Nepal, Department of Forest Research and Survey, Kathmandu, Nepal, GON (2000).

Agricultural Projects Services Centre and John Mellor Associates, 1995. Nepal Agricultural Perspective Plan (final draft), prepared for National Planning Commission of Nepal and the Asian Development Bank (Kathmandu).

Agricultural Projects Services Centre, 1990. Household Income Survey, Integrated Rural Development Project, Rapti (Kathmandu).

Asian Development Bank/Finnish International Development Agency, 1988. Master Plan for the Forestry Sector Nepal.

Bajracharya, D, 1983. "Fuel, food or forest? Dilemmas in a Nepali village". World Development, vol. 11, No. 12.VIII. Nepal

Bajracharya, R. M. 2001. Land preparation: an integral part of farming systems in the mid-hills of Nepal. Nepal Journal of Science and Technology, 3, 15-24.

Brown, S and H. Schreier. 2000. Nutrient budget: a sustainability index. In: Richard, Allen., Hans, Schreier., Sandra, Brown and P. B. Shah (eds.). The people and resource dynamics project: the first three years 1996-1999. ICIMOD, Kathmandu, Nepal.

Baker, S. and Bishnu Gyawali, 1994. "Promoting proper pesticide use in Nepal". Research Report No. 28 (Kathmandu, Ministry of Agriculture and Winrock International Institute for Agricultural Development). Banskota and others, 1990.

Bhatta, B. R., 1992. "Management of forest resources". Nepal Economic Policies for Sustainable Development

(Manila and Kathmandu, Asian Development Bank and the International Centre for Integrated Mountain Development).

Bhattarai, B., 1989. "Micro dimensions of off-farm employment". Background Paper No. 3, vol. 2 (Kathmandu, International Centre for Integrated Mountain Development).

Central Bureau of Statistics (2001). Nepal State of Environment, CBS, Government of Nepal, Ksathmandu.

Carson, Brain. 1992. The land, the farmer and the future: A soil fertility management strategy for Nepal. ICIMOD occasional paper No. 21, Kathmandu, Nepal.

Chalise, S. R and N. R. Khanal. 1997. Erosion processes and their implications in sustainable management of watersheds in Nepal Himalayas. In: FRIENDS' 97 – Regional hydrology: concepts and models for sustainable water resource management. IAHS publishing no. 246.

Carson, B., 1985. "Erosion and sedimentation processes in the Nepalese Himalaya". International Centre for Integrated Mountain Development Occasional Paper No. 1 (Kathmandu).

Carson, B., 1992. "The land, the farmer, and the future: a soil fertility management strategy for Nepal"International Centre for Integrated Mountain Development Occasional Paper No. 21 (Kathmandu).

Central Bureau of Statistics, 1988. "Census of Manufacturing Establishments: Nepal, 1986/87" (Kathmandu).

Consulting Engineers Salgzitter, 1992. Report on a survey on private deep wells in the Kathmandu Valley.

Dahal, L., 1994. "A study on pesticide pollution in Nepal". NCS Nepal, vol. IV, Nos.3/4 (Kathmandu).

Dover, M. J., 1985. A Better Mousetrap: Improving Pest Management for Agriculture (Washington, DC, World Resources Institute).

Dixit, A. M., 1986. "Regional sediment erosion and conservation in Nepal", in FEISCA Proceedings (Dhaka).

Dixit, A. M., 1995. "Resource endowment and associated uncertainty of water resources" in B. Thapa and

Bharat B. Pradhan, eds., Water Resource Development: Nepalese Perspectives (New Delhi, Konark Publishers).

Dorfman, M., 1987. Industrial Wastes in Kathmandu Valley: A Cross-sectional Study. (Kathmandu, Solid Waste Management Programme), mimeographed.

Eckholm, E.P., 1975. "The deterioration of mountain environments". Science, No.189; pp. 764-770.

Eckholm, E.P., 1976. Losing Ground. (New York, Worldwatch Institute).

Environment Statistics of Nepal, CBS, Government of Nepal, Kathmandu, 2005

Environment Assessment of Nepal, CBS, Government of Nepal, Kathmandu, 2006

Environment Statistics of Nepal, CBS, Kathmandu, Nepal, 2008

Family Planning Association of Nepal/DISVI, 1989. "Water quality monitoring of Kathmandu city water supply", final report (Kathmandu).

Food and Agriculture Organization of the United Nations, 1984. "Small-scale hill irrigation development identification report, phase I: Lumbini Hills". Report of the Food and Agriculture Organization of the United Nations/International Fund for Agricultural Development Cooperative Programme Investment Centre (Rome).

Fujisaka, S., L. Harrington and P. Hobbs, 1994. "Ricewheat in South Asia: systems and long-term priorities established through diagnostic research".

Agricultural Systems, vol. 46, pp. 169-187.

Gill, G. J., 1993. "Agricultural marketing in the context of economic liberalization in Nepal: concept paper" (Kathmandu, Winrock International Institute for Agricultural Development).

Gardner, Rita., Kevin Mawdesley, B. P. Tripathi, Steve Gaskin and Stuart Adams. 2000. Soil erosion and nutrient loss in the middle hills of Nepal 1996-1998. ARS, Lumle and SSD (NARC) and Queen Mary and Westfield College, University of London, United Kingdom.

Ghimire, M. P and B. K. Upreti. 1997. Combating desertification: report of the national seminar on desertification and land improvement. Nepal Net

Gruhn, P., F. Goletti, and M. Yudelman. 2000. Integrated nutrient management, soil fertility, and sustainable agriculture: current issues and future challenges. Food, agriculture, and the environment discussion paper 32. International food policy research institute, Washington, D. C. USA.

Gilmour, D. A., 1988. "Not seeing the trees for the forest: a re-appraisal of the deforestation crisis in the hill districts of Nepal". Mountain Research and Development, vol. 8, No. 4.

Gilmour, D. A., 1991. "Trends in forest research and management in the middle mountains of Nepal", Workshop Proceedings, Soil Fertility and Erosion Issues in the Middle Mountains of Nepal, Jhikhu Khola Watershed, organized by the International Development Research Centre in Kathmandu, 22-25 April 1991.

Gilmour, D. A. and M. Nurse, 1991. "Farmer initiatives in increasing tree cover in central Nepal", paper presented at the Workshop on Socio-economic Aspects of Tree Growing by Farmers (Gujarat, Institute of Rural Management).

Giri, Mahendra K, 1990. Pesticide and Our Environment (Kathmandu, Research Centre for VIII. Nepal Environmental Management and Planning). Groundwater Development Consultants, Ltd., 1994.

"Reassessment of the groundwater development strategy for irrigation in the Terai" (Kathmandu). International Irrigation Management Institute, 1991. "Process and performance evaluation of Agricultural Development Bank, Nepal supported irrigation schemes" (Kathmandu).

International Labour Organization, 1976. International Recommendations for Labour Statistics (Geneva).

Ives, J. D. and B. Messerli, 1989. The Himalayan Dilemma-Reconciling Development and Conservation (London, the United Nations University; New York, Routledge).

ICIMOD, 1998. Soil fertility issues in the Hindu-Kush Himalayas. ICIMOD Newsletter No. 32, Kathmandu, Nepal.

Japan International Cooperation Agency, 1990. Groundwater Management Project in the Kathmandu Valley.

Karan, P. P. and H. Ishii, 1994. Nepal Development and Change in a Landlocked Himalayan Kingdom (Tokyo, Institute for the Study of Languages and Cultures of Asia and Africa, Tokyo University of Foreign Studies).

Kemp, H., ed., 1984. The Changing Himalayan Landscape in West Nepal (Berlin, Dietrich Reimer Verlag).

Khatri-Chhetri, J. and B. Katwal, 1992. "Off-farm employment in the hill and mountain regions of Nepal". Mountain Population and Employment Discussion Paper Series No. 14 (Kathmandu, International Centre for Integrated Mountain Development).

Klik, Andreas. 2000. Soil erosion on agricultural land. In: B. Stoecker (ed.). Ecosystem service and sustainable watershed management in North China. International conference, Beijing, P. R. China, August 23-25.

KATHMANDU UNIVERSITY JOURNAL OF SCIENCE, ENGINEERING AND TECHNOLOGY VOL.I, No.1, SEPTEMBER, 2005.

Klarman, W., 1987. "Pesticide use in Nepal". ARPP Consultancy Report No. 9 (Kathmandu, Winrock International Institute for Agricultural Development and the United States Agency for International Development).

KATHMANDU UNIVERSITY JOURNAL OF SCIENCE, ENGINEERING AND TECHNOLOGY VOL.I, No.1, SEPTEMBER, 2005.

Kumar, Shubh K. and D. Hotchkiss, 1988. "Consequences of deforestation for women's time allocation, agricultural production and nutrition in hill areas of Nepal". Research Report No. 69 (Washington, DC, International Food Policy Research Institute).

Laban, P., 1978. "Field measurement of erosion and sedimentation in Nepal". Paper No. 5 (Kathmandu).

Land Resources Mapping Project, 1986. Land systems, land utilization and agriculture-forestry reports (Ottawa, Kenting Earth Sciences Ltd.).

Lekhak, H.D. and Binod (2010). Natural Resource Conservation and Sustainable Development in Nepal,Kshitiz Publication, Kirtipur, Kathmandu.

Lal, R. 1998. Soil erosion impact on agronomic productivity and environmental quality. Critical Review. Plant Science 17: 319-464

Mahat, T. B. S., D. M. Griffin and K. P. Shepherd, 1986a. "Human impact on some forests of the middle hills of Nepal: 1. Forestry in the context of the traditional resources of the State". Mountain Research and Development, vol. 6, No. 3; pp. 223-232.

Mahat, T. B. S., D. M. Griffin and K. P. Shepherd, 1986b. "Human impact on some forests of the middle hills of Nepal: 2. Some major human impacts before 1950 on the forests of Sindhupalchok and Kavrepalanchok". Mountain Research and Development, vol. 6, No. 4; pp. 325-334.

Metz, J. J., 1987. "An outline of forest use practices of an upper elevation village in west Nepal".

Banko Janakari, vol. 1, No. 3; pp. 21-28.

Ministry of Finance, 1990. Economic Survey. National Productivity and Economic Development Centre, 1994. "A study on locational aspects of carpet industries in the Kathmandu Valley" (Kathmandu).

Ministry of Environment, Science and Technology (2008). Nepal State of the Environment, MoEC, Government of Nepal, Kathmandu

Maskey, R. B., D. Joshi, and P. L. Maharjan. 1992. Management of slopping lands for sustainable agriculture in Nepal. In: IBSRAM (International Board for Soil Research and Management) (ed.). Technical report on the management of slopping lands for sustainable agriculture in Asia. Phase I, 1988-1991, Network document No. 2, Thailand.

Miller, G. T. 1992. In the environment: an introduction to environment science. Wadsworth Publishing Company, Belmont, California, USA.

MOPE. 2001. State of the environment Nepal (Agriculture and Forest). HMG/N and Ministry of Population and Environment, Nepal.

Neupane, R.P. and Thapa, G.B. (2001) `Impact of agroforestry intervention on soil fertility and farm income under the subsistence farming system of the middle hills, Nepal `Agriculture, Ecosystems & Environment,

Nakarmi, G. and P. B. Shah. 2000. Soil nutrient losses through soil erosion in the middle hills of Nepal. In: B. P. Tripathi. , N. P. Rajbhandari and J. K. Ransom (eds.) Improved Soil Fertility Management for Sustainable Maize Production: Proceedings of a workshop group meeting of the Hill Maize research project. Nepal Agricultural Research Council /HMRP / CIMMYT Nepal

Nakarmi, G., H. Schreier., J. Merg., and P. Mahatma. 2000. Erosion dynamics in the Jhikhu and Yarsha khola watershed in Nepal. In: Richard, Allen., Hans, Schreier., Sandra, Brown and P. B. Shah (eds.). The people and resource dynamics project: the first three years (1996-1999). ICIMOD, Kathmandu, Nepal.

NARC. 2000. Annual report 1998/1999. Nepal Agricultural Research Council (NARC), Khumaltar, Nepal.

National Planning Commission (2003). The Tenth 5-Year Plan (2002-2007), NPC, Government of Nepal, Kathmandu Nepal Economic Policies for Sustainable Development, 1992 (Manila, Asian Development Bank; Kathmandu, International Centre for Integrated Mountain Development).

Nepal Rastra Bank, 1988. "Multipurpose household budget survey" (Kathmandu). New Era, 1990. "Socio-economic and environmental impact assessment of the Trishuli Devighat hydroelectric upgrading project'. Report submitted to CIWEC (Kathmandu).

Pardo, R. D., 1992. "A review of forest policy and legislation in Nepal". United States Agency for International Development Forestry Development Project (Kathmandu).

Poudel, S. N. and C. K. Sharma, 1993. "Technical paper on irrigation and water control", for Agricultural Perspective Plan, Nepal. VIII. Nepal

Pradhan, P.K. (2008). Environment and Natural Resources: Concepts, Methods, Planning and Management, Quest Publication, Kirtipur, Kathmandu

Paudyal, K. R., J. K. Ransom, N. P. Rajbhandari, K. Adhikari, R. V. Gerpacio, and P. L. Pingali. 2001. Maize in Nepal: production systems, constraints, and priorities for research. Nepal Agricultural Research Council (NARC) and International Maize and Wheat Improvement Center (CIMMYT), Kathmandu.

Pradhan, R. B. and K. C. Ganesh, 1992. Country Report on Nepal: Programme Advisory Committee Meeting, Yogyakarta.

Pradhan, U. and T. Ganesh, 1992. "Recent irrigation policies and environmental sustainability in Nepal".

Paper presented at the Fourth Annual Common Property Conference, 16-19 June 1993 in Manila.

Pradhan, P. and R. Yoder, 1990. "Irrigation development: the management and use of irrigation in the mountains of Nepal". Mountain Farming Systems Discussion Paper Series, No. 16 (Kathmandu, International Centre for Integrated Mountain Development). Report on Nepal to the United Nations Conference on Sustainable Development.

Schreier, H., P. B. Shah, G. Kennedy, S. Brown and S. Wymann, 1991. "Discussions of major issues, research priorities and implementation of research results" in Workshop Proceedings, Soil Fertility and Erosion Issues in the Middle Mountains of Nepal, Jhikhu Khola Watershed, organized by the International Development Research Centre in Kathmandu, 22-25 April 1991.

Shankar, K., 1992. Recent Hydrology and Meteorology in Nepal (Kathmandu, WIDPTC).

Sharma, S., 1994. "Economic liberalization and agricultural development in Nepal". Research Report Series No. 26 (Kathmandu, Ministry of Agriculture and Winrock International Institute for Agricultural Development).

Rajbhandari, N. P. 2000. Declining soil fertility constraints maize production in the hills: a review of recent surveys of farmers practices, perceptions and conceptualizing a basis for proper targeting of maize research in the hills. In: B. P. Tripathi., N. P. Rajbhandari and J. K. Ransom (eds.). Improved Soil Fertility Management for Sustainable Maize Production: Proceedings of a workshop group meeting of the Hill Maize research project. Nepal Agricultural Research Council /HMRP / CIMMYT Nepal.

Richards, R.P. 2002. The Lake Erie Agricultural Systems for Environmental Quality Project: An Introduction. J. Environ. Qual. 31: 6-16

Schreier, H and P. B. Shah. 1995. Understanding degradation processes in the middle mountain in Nepal. In: Pie, Shengji. (ed.). Rehabilitation of degraded lands in mountain ecosystems of the Hindu-Kush-Himalayan region. International Centre for Integrated Mountain Development (ICIMOD), Nepal.

Schreier, H and P. B. Shah. 2000. Soil fertility status and dynamics in the Jhikhu and Yarsha khola watershed. In:Richard, Allen., Hans, Schreier., Sandra, Brown and P. B.

Sharma, K. C., 1994. "Current experiences and practices in pesticide use in the Bagmati zone".Stanley International and East Consult, 1994. "The Bagmati Water Management Strategy" (Kathmandu).

Sapkota, B. D. and Khadka, B. (2065 BS). Rural Resources, Environment and Management, Sunlight Publication, Kirtipur, Kathmandu

Shah (eds.). The people and resource dynamics project: the first three years (1996-1999). ICIMOD, Kathmandu, Nepal.

Shah, J. P. and T. B. Suselo. 1996. Shifting of the Koshi river and its impact on the land cover and land use in Koshi Tappu, Nepal. In: P. K. Jha, G. P. S. Ghimire, S. M. Karmacharya, S. R. Baral and P. Lacoul (eds.). Environment and biodiversity: in the contest of South Asia. Ecological Society (ECOS), Nepal.

Shah, P. B. 1996. Soil fertility and erosion based unsustainability concerns in Nepal. In: Dhruba, Joshi (ed.). Workshop on soil fertility and plant nutrition management. NARC- Soil Science Division, Nepal.

Shah, S. G and J. A. Friend. 1992. Mixed crop systems in the Himalaya. In: C. J. Pearson (ed.). Ecosystems of the world: field crop ecosystems. ELSEVIER. pp 291-310

Tripathi, B. P. 1997. Investigation of soil fertility management under maize at LARC and its extension command area: a review. LARC review paper no 97/1. Lumle Agricultural Research center, Kaski, Nepal.

Tripathi, B. P. 1999. Review of acid soils and its management in Nepal. In: Royal Nepal Academy of Science and Technology (RONAST) (ed.). Proceedings of III national conference on science and technology, March 8-11, 1999. RONAST, Nepal.

Tripathi, B. P., R. Gardner, K. J. Mawdesley, G. P. Acharya and R. P. Shah. 1999. Soil erosion and fertility losses in the western hills of Nepal: an overview. Lumle seminar paper No 99/9. Agricultural research station, Lumle, Kaski, Nepal.

Tripathi, B. P., S. P. Shrestha, and G. P. Acharya. 2000. Summary and updating with 1999 season soil and nutrient losses from bari land terraces in the western hills of Nepal. Lumle technical paper No 2000/3. Lumle agricultural center, Kaski, Nepal.

Troeh, F. R., J. A. Hobbs and R. L. Donahue. 1980. Soil and Water Conservation: for productivity and environmental protection. Prentice Hall Inc, Englewood Cliffs, New Jersey, USA.

Thapa, G. "The impact of new agricultural technology on income distribution in the Nepalese terai". PhD thesis submitted to Cornell University, Ithaca, New York (unpublished).

Thapa, Y. B., 1992. "Contribution of infrastructure to agricultural growth in Nepal". Contribution to Nepalese Studies, vol. 19, No. 2.

Thapa, G. and G. Koirala, 1992. "A study of food situation and outlook for Nepal (Kathmandu, Agricultural Projects Services Centre/International Food Policy Research Institute).

Thapa, G., 1994. "Public resource allocation and agricultural performance in Nepal". Research Report Series No. 24 (Kathmandu, Ministry of Agriculture and Winrock International Institute for Agricultural Development).

Thapa, G. and M. W. Rosegrant, 1995. "Projections and policy implications of food supply and demand in Nepal to the year 2020". Winrock International Institute for Agricultural Development Research Report No. 30 May 1995 (Kathmandu). Three Year Interim Plan (2007-2010), NPC, Government of Nepal, Kathmandu、(2007)

United Nations Environment Programs (UNEP). 2001. Nepal: state of the environment 2001. United Nations Environment Programs, Thailand.

Upreti, B. N. and M. R. Dhital. 1996. Land Slides Studies and Management in Nepal. ICIMOD, Kathmandu, Nepal.

United Nations, 1989. "Development and conservation of groundwater resources and water-related natural disasters and their mitigation in selected least developed countries in the ESCAP region". Water Resources Series No. 66 (New York).

United Nations Development Programme/World Bank, 1986. "Water supply and sanitation sector study, vols. 1 and 2 (Kathmandu, Proctor and Redfern International Ltd. in association with P.P. Pradhan and Co. Certified Accountants).

Water and Energy Commission Secretariat, 1982. Summary of findings of joint Water and Energy Commission Secretariat/International Bank for Reconstruction and Development performance study of large public irrigation projects (Kathmandu, Ministry of Water Resources).

Water and Energy Commission Secretariat, 1987. "Report on erosion and sedimentation in the Nepal Himalayas (Kathmandu, Ministry of Water Resources).

Water and Energy Commission Secretariat, 1988. Energy Sector Synopsis Report 1985/86 (Kathmandu, Ministry of Water Resources).

World Bank, 1990. "Nepal Agriculture Sector Review" (Washington, DC).

Wright, R.T. (2007). Environmental Science , (Ninth Ed.), Dorling Kindersley Pvt. Ltd. India

Wood, S., K. Sebastian and S. J. Scherr. 2000. Pilot analysis of global ecosystem: agroecosystems. International food policy research institute and world resource institute, USA

Zemenchik, R A. 2002. Bio-available Phosphorus in Runoff from Alfalfa, Smooth Bromegrass, and Alfalfa-Smooth Bromegrass. J. Environ. Qual. 31:280-286.

CHAPTER 7

Urban Poverty and its Impact on Environment and Economy in Nepal: A Case Study of Kathmandu Valley

7.1 Introduction

Global experiences show that urban poor have to be recognized as valuable citizens and their knowledge and experience used for good governance that ultimately leads to sustainable development of any modern city.

In Nepal, agricultural activities in urban peripheries, especially in the fertile valleys in hills and mountains, provide scope for employment generation of the urban poor. Furthermore, fuller exploitation of the Tarai's rich and fertile alluvial soils for large-scale agricultural operations deserves emphasis.

River banks seem to be the areas that highly attract the squatter communities and are therefore highly crowded with poor families. For decades, this problem has been overlooked. The settlements were allowed to grow without any attention to improving their living conditions. Here are two options to the government/municipalities: Either improve the housing in slums/squatter settlements or resettle them in alternative locations. NGOs can facilitate the relocation of these slums/squatter settlements because it is a long process that requires humanitarian support from many organizations. NGOs' support is also essential in addressing the problems of unemployed, high-school dropout youths, and dependent family members of the slums and squatter communities. Instead of dealing with such communities arbitrarily, slums and squatters should be viewed, mapped, studied and prioritized for their betterment and upgrade of the city as a whole.

In Nepal, squatter settlements, slums, street dwellers, vendors, marginal farm families, and scavenging groups are categorized as poor urban communities. Such communities are concentrated either on the bank of rivers or in the open space near the historical and religious monuments. Hawkers and vendors are concentrated in the city center, religious places and tourist destination sites. Hawkers and vendors are another form of urban poverty in the city, and they are engaged in selling either agricultural products or cloth items or preparing fast food. In a city like Kathmandu, where the price of land is skyrocketing purchasing a parcel of land is beyond the capacity of low income group.

According to Census Survey taken by Central Bureau of Statistics in 2011, the population of urban areas in Nepal is 4523820 out of this 15.46 percent people are living under poverty line. The poverty of the nation has been reduced gradually but the poverty of the urban areas has further increased by 6 percent within the period 2004 and 2011.

The History of squatter settlements on the bank of Bagmati River shows that these were established more than 50 years ago but they were few in comparison to the present. Growth rate is 37.94 percent in 2008, 39.16 percent in 2009, 24.79 percent in 2010 and 15.83 percent in 2011. This indicates rapid growth in the years 2008 and 2009 and slower growth in 2010 and slow in 2011. Settlements are relatively small; some comprise fewer than 20 households are located on public land on the bank of rivers, these are heterogeneous not only in terms of the ethnicity or caste of their residents but also in terms of their places of origin, present occupation and income, family structure and reason of squatting. Riverbank seems to be the area that highly attracts the squatter communities. People residing in squatter settlements face many problems like improper sanitation, unhygienic environmental conditions, social, economic, health, educational and cultural problems and many more. The basic problems inherent in slums are health hazards, lack of basic amenities like safe drinking water, proper housing, drainage and excreta disposal services, make slum population vulnerable to infections. These further compromise the nutrition requirements of those living in slums. The squatter environment is the perfect breeding ground for a wide range of social and environmental problems. High unemployment often causes men to stay around the home growing

increasingly frustrated with their pathetic situations and the worsening poverty. Cramped conditions mean that there is nowhere to go when tensions rise, a factor that regularly leads to domestic violence. Sometimes the situation goes to the other extreme, where people abandon their homes, lured by the prospect of stupor through alcohol or drug abuse.

7.2 Objectives of the Study

The main objective of this study is to analyze the urban poverty and its impact on the environment in Nepal; the specific objectives are as follows:

- To analyze the urban poverty
- To find out the environmental impacts of urban poverty
- To recommend the positive measures on urban poverty, economy and environmental impacts.

7.3 Justification

In Nepal, poverty is a crucial problem. More than 25 percent people are still living under the poverty line. Urban poverty is increasing at high pace 9.55 percent in 2004 and 15.46 percent in 2011. During a decade long political turmoil in the country, many poor communities have chosen Kathmandu as a best destination for securing their lives and properties. The lack of opportunities and increasing psycho-political threat in the rural areas are responsible for such a situation. Urban poor are the source of cheap labor force as well as service provider in the informal sector through the activities like, vending, shoe making, driving and construction work. Unfortunately, they are largely ignored in the development process and labeled as illegal and unauthorized settlers. The poor are marginal communities who migrate to city and live in squatter settlements on the periphery of cities; they include high proportion of illiterates and unskilled laborers. They are socially, economically and politically marginal and are spatially separated from the nearby neighborhood.

Actual data of poor families in Kathmandu and other urban areas has not been published yet but informal surveys revealed that about 64 percent households of urban poor in Kathmandu and other urban areas are migrants, mostly from outside the rural areas or districts. Three scenarios of migration have been identified in this study; first, migration from the central hills and mountain region consists of more than 60 percent of total migration; second, migration from eastern Terai is about 14 percent; and third, eastern hills and mountain represents almost 15 percent of the total migrants in the poverty pockets of Kathmandu Valley.

The migrants from several parts of the country are indeed responsible for the degradation of urban environment. The migrants specially live on the banks of rivers and other marginal lands of any urban areas. They work as cheap labors in the city. Most of the urban poor people work as the labors in hotels, factories, enterprises, and sweepers on the road. The contribution of them on national economy could be found positive but for the surrounding environment that they live is highly detrimental. Most of the urban river banks and open marginal spaces are covered by them and the areas are converted as the haphazard settlement areas. This study focuses on this side of urban poverty, environment and economy.

7.4 Study Area

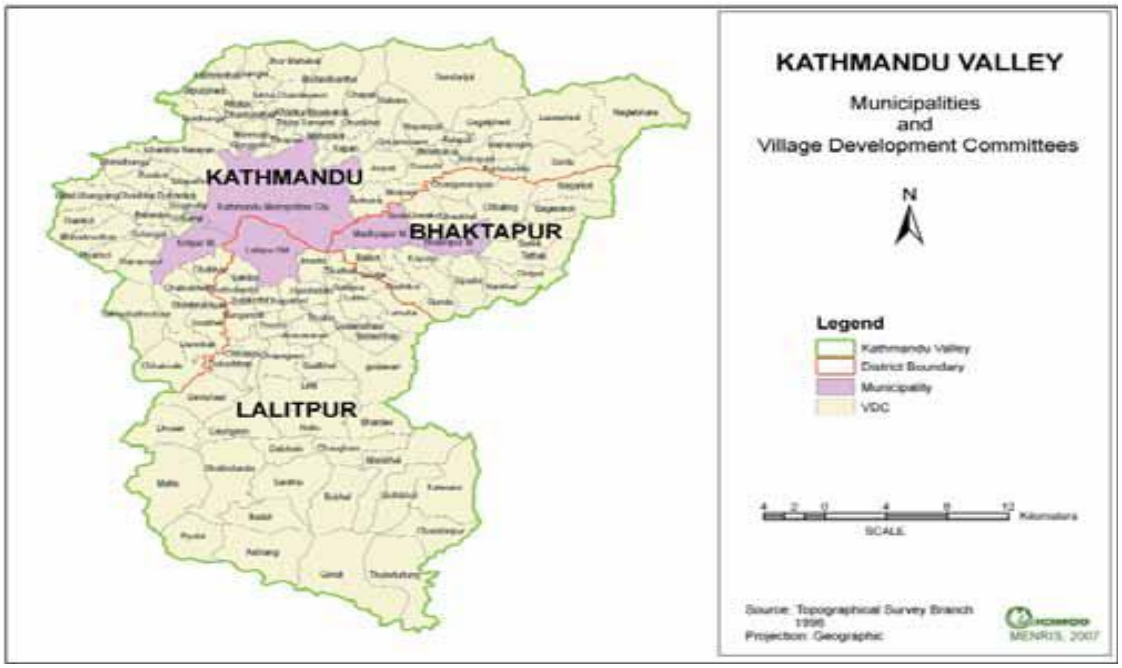
The study covers all the urban areas of the country but special focus has been made to the Kathmandu Valley. Kathmandu Valley covers three districts- Kathmandu, Lalitpur and Bhaktapur. The population of Kathmandu Valley has been estimated to be 4000000 in the year 2013.

Kathmandu Valley lies at 1,300 m on average and is located between latitudes 27°32'13" and 27°49'10" north and longitudes 85°11'31" and 85°31'38" east. Its three districts, Kathmandu, Lalitpur, and Bhaktapur, cover an area of 899 square kilometers, whereas the area of the valley as a whole is 665 square kilometers. The valley encloses the entire area of Bhaktapur district, 85% of Kathmandu district and 50% of Lalitpur district.

The valley is bowl shaped and surrounded by the Mahabharat mountain range on all sides. There are four hills acting as forts of the valley, Phulchowki in the South East, Chandragiri/Champa Devi in the South West, Shivapuri in the North West, and Nagarkot in the North East. The highest altitudes are 2,166m (in Bhaktapur), 2,732m (in Kathmandu), and 2,831m (in Lalitpur). The climate is good, the soil fertile, and it is endowed with rich forests and scenic beauty. The three major river systems in the Valley are the Bagmati, Bishnumati, and Manohara. There are lakes and ponds in all three districts–Taudaha and Indra daha in Kathmandu; Gunaldaha, Katuwaldaha, Godavari, Nagdaha, Bojho Pokhari, and Saraswatidaha in Lalitpur; and Siddhapokhari, Bhajupokhari, and Kamalpokhari in Bhaktapur. Kathmandu Valley has waterfalls at Sundarijal, Chobhar, and Matatirtha. The climate is subtropical, temperate, and cool-temperate, with four distinct seasons: spring from March to May; summer from June to August; autumn from September to November; and winter from December to February (CBS, 2010).

In general, the annual maximum and minimum temperatures are between 29°C in June and 1°C in January. The comparative monthly maximum and minimum temperatures for 1985, 1999, and 2004 are given in Annex 1. The average wind speed recorded by the Hydrology and Meteorology department's station at Tribhuvan International Airport in 1998 was highest in March (2.1 km/hour) and lowest in December (0.8 km/hour). The annual rainfall records for Kathmandu from 1995 to 2003 show fluctuations between 1,171 to 1,868 mm. Figure 1 shows the Kathmandu Valley districts, municipalities, and VDCs. Kathmandu Valley has five municipalities and ninety-eight VDCs and 14 VDCs of the three districts fall outside the valley (CBS, 2009).

Figure 1: An Overview of Kathmandu Valley



Source: Kathmandu Valley Environment Outlook, 2007

7.5 Methodology

This section deals briefly with the research methodology applied in the study. This is purely academic research based on social science.

7.5.1 Rationale for the Selection of the Study Area

The selection of the study area is one of the critical issues while undertaking research work. I admit that my study site is capital urban area, considered to be one of the famous migration destinations of poor people of different districts. The rationale for the selection of study area includes:

i. Kathmandu Valley as a hub of migration of different poor people.

ii. The poor people has been encroached the river banks and marginal lands of the Valley.

iii. The Government of Nepal is trying to shift them from there to other places but not success yet.

iv. The researcher is familiar with the poverty and environment of this site.

7.5.2 Research Design

i. The research design is based on descriptive and exploratory.

ii. It is descriptive as it is based on detailed investigation and record of the poverty and environment of this area.

iii. It is exploratory in the sense that analysis focused on exploring whether poor people in this site are rationale to the environment or not. An attempt has been made to make poor people and concern agencies more responsible about the economy and environment of this area.

7.5.3 Nature and Source of Data

Both primary and secondary data have been collected for the purpose of study.

i. Primary data are based on household survey, observation, and interview.

ii. Both published and unpublished documents, records, books and relevant materials related to the subject matters have been incorporated as secondary data.

7.5.4 Universe and Sampling Procedure

This study has been confined within Kathmandu Valley of Nepal. This Valley contains about 25, 00000 populations out of this about 15 percent people are poor. Among the total poor families 100 households of different parts of Kathmandu Valley were selected for the survey. For the purpose of this study purposive sampling method was applied.

7.5.5 Data Collection Techniques and Instruments

For the collection of primary data, the following techniques were adopted.

Household Survey: Household survey was conducted to gather more information about the impacts poverty to the environment and economy. Various information regarding to the poverty, environment and economy were collected from structured questionnaire.

Observation: Non-participatory observation was applied during research to study the situation of poor family households, their economic contribution to the nation and concerning environmental impacts of their settlements.

Interview with Key Informants: Some elderly members of the poor family, workers on hotels, restaurants, industries etc. were selected as key informants to carryout research. Checklist and guidelines were prepared for key informant's interview.

7.5.6 Method of Data Analysis

The collected data were edited, coded, classified and tabulated for data organization. The quantitative data have been presented in tabular form and suitable statistical tools like percentage, ratio, mean etc. has been adopted for data analysis. Bar-diagram and trend analysis have been presented to make figure attractive. The qualitative data have been interpreted and analyzed in descriptive way based on their numerical characteristics.

7.6 Results

7.6.1 Typology of Urban Poor Family

The following table shows the typologies of urban poor families. The poor families are categorized on the basis of their settlements and living standards observation on the study area.

Table 1: General Typologies of Urban Poor Families

Types	Land Acquisition Status	Physical Characteristics
Squatter Settlements	Invasion of public or private land	Middle and periphery where security of tenure then upgrading is likely.
Squatters / Shanty Towns	Dominant of squatters (usually renters)	Mostly downtown and around city centre, small plots with few public amenities and little prospect of their provision. Likelihood of self help improvement.
Street Sleepers / Dwellers	May have regular sleeping place, Invasion of public road/land	Downtown/inner city. Shelter removed daily often associated with workplace.
Slum	Converted large houses of permanent or semi-permanent structures, usually rentals.	Mostly downtown. An increasing portion of new rental accommodation in older irregular settlements. Single room per family and share the same.
Vendors and Hawkers	Makeshift/Mobile	Mostly dominated in the central of the city.

Source: Field Survey, 2013

In Nepal, squatter settlements, slums, street dwellers, vendors, marginal farm families, and scavenging groups are categorized as poor urban communities. Such communities are concentrated either on the bank of rivers or in the

open space near the historical and religious monuments. Hawkers and vendors are concentrated in the city center, religious places and tourist destination sites.

Hawkers and vendors are another form of urban poverty in the city, and they are engaged in selling either agricultural products or cloth items or preparing fast food. In a city like Kathmandu, where the price of land is skyrocketing purchasing a parcel of land is beyond the capacity of low income group. In this background, the main objective of this study is to examine an economic status of the poor communities and their access of financial institutions in Kathmandu.

7.6.2 Per capita Income and Poverty

The following table shows the per capita income and poverty status of urban poor families.

Table 2: Per-capita Income Ranges and Poverty Status

Income Ranges (Rs.)	Status
Less than 12,000	Poor
12,000- 25,000	Lower Medium
25001-60,000	Medium
Above 60,000	Upper Medium and Rich

Source: Lumanti Bulletin, 2005

Accordingly, persons having income less than Rs. 12,000/person/annum are categorized as poor, and persons having Rs. 12,001–25,000 /person/annum have been categorized into lower medium people. And income more than Rs 60,000 represented as an upper medium and rich class (Lumanti 2005, 12).

However, actual data of the urban poor communities in Kathmandu Metropolitan city and Kathmandu Valley has not been published yet. Even, the metropolitan city does not have an accurate figure of urban poor. Who actually are poor and how many of them are living in the metropolitan city? What are the dimensions of urban poor and what are they doing for their livelihood in the metropolitan city? These are some of the major issues debated in the contemporary urban literature in Nepal. There is no any accepted definition of urban poverty in Nepal. In many cases, social researchers have recognized that poor urban communities are those who are living in the slums and squatter settlements (permanent, semi-permanent or temporary or legal or illegal) either in the open spaces, religious sites or on the bank of the rivers.

Lumanti (2005) defined 'poor' as those people who have annual income less than Rs. 12,000. At this level, 13% people and 8% households in the metropolitan city were found below the poverty level. Although, squatter settlements, slums, street dwellers, vendors, marginal farm families and scavenging groups are categorized as the poor urban communities. Such communities are concentrated either on the bank of rivers or in the open space near the historical and religious monuments.

7.6.3 Poverty Trend of Kathmandu Valley

The following table shows the poverty trend of Kathmandu Valley since 2004 to 2012. The poverty of Kathmandu Valley has found growing on fast pace. During the Maoist insurgency period of Nepal (1996 to 2006) in-migration to the Kathmandu Valley increased rapidly. Most of the people who felt unsecure on their native

places migrated to the Valley for the protection of their lives and property, during this period security of the country was only limited to the district headquarters and some other urban areas only.

Table 3: Poverty Trend of Kathmandu Valley

Year	% of Poverty in Kathmandu Valley
2004	9.55
2005	10.23
2006	11.43
2007	12.80
2008	13.23
2009	14.14
2010	14.90
2011	15.46
2012	16.70

Source: Lumanti Bulletin, 2013

The above table shows the increase trend of urban poor in Kathmandu Valley since 2004 to 2012. In the year 2004 the percentage of urban poor was just 9.55% and that increased by more than 1 percent per year. It is estimated that the percent of urban poor in Kathmandu Valley has been estimated to be double at the end of the year 2014.

7.6.4 Environmental Impacts Analysis of Urban Poverty

a. Encroachment Over River Banks and Marginal Lands

The river banks and lands left by the river in due course of diversion have been confiscated by urban poor. Both permanent and temporary settlements can be seen along the river corridor. Besides the severe encroachment of land, much more environmental impact could be observed due to their settlement to the river. The manual improvised sand mining and direct discharge of their toilet to the river can be seen. The settlements are of well-organized in spite of illegal. The occupants have clearly defined behavioral rules, spatial boundaries and methods of solving tenurial disagreements. Illegal housing is sold, land is subdivided and leased, and other transactions are possible as if the land or housing was legal. The settlement is also typically recognized by the public or private landowner, and, if the landowner is private, rents are often transferred. The settlements of the poor have gradually become an integral part of the urban fabric.

The proximity to income-earning opportunities in the Kathmandu Valley is normally a crucial issue for the urban poor and, to gain access to inexpensive centrally-located land for housing, the urban poor normally have to sacrifice tenure security. They are forced to encroach on any type of vacant land illegally (often ill-suited for housing) and to ignore building and development regulations. Many housing programs implemented by governments have failed because they have been located in the urban fringe where income-earning opportunities normally are scarce.

Eviction has three basic impacts on those affected: physical, economic and psychological. Eviction reduces the housing stock of the city and ruins the economic value of the housing which may be small in real terms but big for the individual. It detaches the squatter from employment opportunities which are usually nearby or even in the settlement itself. It also uproots them from the community which functions as an economic and psychological safety net. The home is the centre of everybody's lives and eviction, often forceful, is a very traumatic experience, especially for the children. While the eviction is a traumatic experience in itself, the most harmful impact of eviction may actually be the fear of being evicted. The fear makes people fatalistic, loses confidence in them and discourages them from improving their housing.

b. Other Environmental Impacts

i. Urban Poor Use Few Non-renewable Resources

Most of the houses in which poor urban people live (and often build for themselves) make widespread use of recycled or reclaimed materials, and little use of cement and other materials with a high-energy input. Such households have too few capital goods to represent much of a draw on the world's finite reserves of metals and other non-renewable resources. Most low-income groups in urban areas rely on public transport (or they walk or bicycle) which means low average figures per capita for oil consumption. Low-income households, on average, have low levels of electricity consumption, not only because those who are connected use less but also because a high proportion of low-income households has no electricity supply. Thus, they are responsible for very little of the fossil fuel use that arises from oil, coal or gas-fuelled power stations (and most electricity is derived from such power stations).

iii. Urban Poor Generally have Low Levels of Use for Renewable Resources

Low-income urban dwellers generally have much lower levels of use for freshwater than middle- or upper-income groups although this is due more too inconvenient and/or expensive supplies than to need or choice. They occupy much less land per person than middle- and upper-income groups. They consume less food and generally have diets that are less energy and land intensive than higher-income groups. There are examples of low-income populations that do deplete renewable resources – for instance, where low-income settlements have developed around reservoirs into which they dump their liquid (and perhaps solid) wastes or where low-income settlements have developed on slopes which, when cleared for housing, contribute to serious soil erosion (and the clogging of drains) – but these are generally problems caused by the failure of urban authorities to ensure that they have access to other residential sites. In many low-income countries, a considerable proportion of low-income urban population use fuel-wood or charcoal for cooking (and, where needed, heating) and this may contribute to deforestation – although claims that this is the case have often proved unfounded.

iii. Urban Poor generate much Lower Levels of Waste Per person than Middle- or Upper-income Groups

The urban poor generally play a very positive role from an ecological perspective, as they are the main declaimers, re-users and recyclers of wastes from industries, workshops and wealthier households. If it were possible to determine who consumed most of the goods whose fabrication involved the generation of most toxic or otherwise hazardous wastes, or of persistent chemicals whose rising concentration within the environment has worrying ecological and health implications, it is likely to be middle- and upper- income groups. There are examples of small-scale urban enterprises (including illegal or informal enterprises) which cause serious local environmental problems – for instance, contaminating local water sources – but their contribution to city-wide pollution problems relative to other groups is usually small. In addition, it is difficult to ascribe the pollution caused by small-scale enterprises to the urban poor when many such enterprises are owned by middle- or upper-income groups.

iv. Low-income Urban Dwellers have, on Average Very Low Levels of Greenhouse Gas Emissions Per person

Low-income groups usually generate much lower levels of carbon dioxide per person than middle and upper income groups, as their total use of fossil fuels, of electricity derived from fossil-fuelled power stations, and of goods or services with high fossil fuel inputs in their fabrication and use are so much lower. The only exception may be for some low-income households in urban areas where there is a need for space heating for parts of the year and where a proportion of the urban poor use biomass fuels or coal in inefficient stoves or fires. This may result in these households having above-average per capita contributions to greenhouse gas emissions (and also to urban air pollution) but these are exceptional cases.

Table 4: How Environmental Actions can help to Reduce Poverty or the Deprivations Associated with it

Environmental Actions	Direct Effects	Other Effects
Improved provision for water and sanitation	Can bring a very large drop in health burdens from water-related infectious and parasitic diseases and some vector-borne diseases – and also in premature death (especially for infants and young children). Safe disposal of excreta from the home and neighborhood environment is a great health bonus.	• For income-earners, increased income as a result of less time off work due to illness or to nursing sick family members, and less expenditure on medicines and on health care • Better nutrition (e.g. less food lost to diarrhea and intestinal worms) • Less time and physical effort needed to collect water • Lower overall costs for those who, prior to improved supplies, had to rely on expensive water vendors
Less crowded, better quality housing – through supporting low-income groups to build, develop or buy less crowded, better quality housing	Can bring a large drop in household accidents (often a major cause of serious injury and accidental death in poor quality, overcrowded housing) and remove the necessity for low-income groups to occupy land sites at high risk from floods, landslides or other hazards. Can also help reduce indoor air pollution.	• Lower risk to low-income groups of losing their homes and other capital assets to accidental fires or disasters • Secure, stimulating indoor space an enormous benefit for children's physical, mental and social development
Improved provision for storm and surface water drainage	Reduced flooding and reduced breeding possibilities for disease vectors bring major health benefits. Reduced risk of flooding means less risk of infection for the inhabitants, especially children (floods often spread excreta all over the site, especially where pit latrines are used)	Lower risk of floods which can damage or destroy housing, which is often low-income households' main capital asset and also where they store other assets
Avoidance of	Reduces number of people at risk	Sites within cities that may be hazardous for

hazardous land sites for settlements	from floods, landslides or other hazards. The damage or destruction of housing and other assets from, for instance, floods or landslides can be the 'shock' which pushes low-income households into absolute poverty	settlements are often well suited to parks or wildlife reserves and may also be well suited to helping in flood protection and groundwater recharge
Promotion of cleaner household fuels	Reductions in respiratory and other health problems through reduced indoor and outdoor air pollution	Reduced contribution of household stoves to city air pollution
Improved provision for solid waste management	Removes garbage from open sites and ditches in and around settlements. Reduces risk of many animal and insect disease vectors and stops garbage blocking drains	Reduces time and physical effort for previously unserved households. Considerable employment opportunities in well managed solid waste collection system where recycling, reuse and reclamation are promoted
Support for community action to improve local environment	If well managed, many low-cost ways to reduce environmental hazards and improve environmental quality in informal settlements	Employment creation; minimum incomes help households avoid poverty. Can reduce sense of social exclusion
Support for more participatory plans	Low-income groups with more possibilities of influencing city authorities' priorities on environmental policy and investment	Precedents set in participatory Local Agenda 21s and other action plans can lead to low-income groups having greater influence in other sectors
Improved public transport	Cheap, good quality public transport keeps down time and money costs for income-earners in low-income groups getting to and from work; also enhances access to services	Can reduce air pollution and its health impacts. Can reduce the disadvantages of living in peripheral locations and help keep down house prices

Source: DANIDA, 2005.

7.7 Economic Impacts Analysis of Urban Poverty

Urban poor generate public costs of many kinds, many of them a result of negative environmental impacts. Particularly, it compares the cost of providing urban services to them. Poor settlements upgrading projects may have of huge amount especially to manage public site for housing, land to agriculture or employment, sanitation, drinking water, electricity, health, education, toilets, and other infrastructures. The inclusion of environmental impacts is chiefly responsible for raising the total cost of poor settlements management schemes. Government, typically, bears the bulk of the extra costs of rationalizing road networks, extending infrastructures, picking up garbage and management of deteriorated overall environment. But the level of government depends on the strength of economy.

Poor residents of these communities bear much of the immediate negative environmental and health impacts morbidity and mortality rates closely linked to environmental quality, namely infant mortality, diarrhea and respiratory diseases. This may multiply over the nearby other settlement areas and as a whole city may be at risk. Public health authorities in Kathmandu Valley note that only a miracle has saved the area from major epidemics

especially in dry season. In this season squatter settlements mostly use dirty water for the drinking and other purposes.

In Nepal, government has tried to correct the high cost and poor targeting of the traditional approach through upgrading poor/squatter settlements. These upgrading efforts, typically, are one-time investments in infrastructure, for example through rationalizing and paving a road network, by providing water and sanitation systems, etc. and this after land invasions have de facto determined the location and pattern of land development. The lobby for upgrading is often weaker than that for new development. Some politicians promote it because votes can be won by allowing squatter invasions and by further providing infrastructure periodically as the need for support arises, mainly at election time.

Other Economic Impacts of Urban Poverty

Urban poor people are the major source of labor force in urban areas. Most of the urban poor support for the construction, industries, household works, support to the hotels, restaurants, banquets and many other field where the cheap labor force is required. In Kathmandu Valley most of the urban poor are contributing for the growth of capitalist sector. Capital formulation by industry sector has heavily depended on urban poor people. Urban poor people are doing very risk task too. Their livelihood has been dependable to the daily wage rate so their option is to do the labor.

7.8 Discussion

The poor urban community has been involved in the diversified livelihood activities, and most of them are involved in informal sector. Self-employment, daily wage unskilled work, domestic help, public transport work e.g. driving and fare collection, transportation of building materials e.g. sand, concrete and cement, waste collection, pretty trade, running hotels, small restaurants and private tuitions are supporting livelihood activities of the poor urban communities. Urban poor are very close to the radical political parties. In the case of Kathmandu, many of them are associated with left-wing political parties; hoping that the radical government would provide land, shelter, employment and urban services to them.

This is one of core reasons for increasing inflows of rural poor in urban area including Kathmandu, especially after the democratic movement in 1989/90. The growth of informal wage helps in reducing the incidence of urban poverty even though they have no fixed place for work, no fixed working hours, any regular wage and security of job. In this sense, they are economically vulnerable group in the urban society. Age, level of education and gender are key determinants affecting the level of household income among the urban poor. There are less possibilities to be poor in those household in which the proportion of male adolescence aged 9-14 is higher, similarly educated head of households have less possibility of being poor, higher the share of adults, lower the possibility of being poor (World Bank, 2007-15).

Together with above mentioned factors, gender is also a determinant of household income particularly in Kathmandu. Higher the proportion of female in the family, higher the chance of being poor. This is obvious that poor women are physically weak due to the high fertility/reproductive rate and are involved mostly in the home-based and casual work in construction sectors and petty business near the poverty cluster. In this perspective, it is true that, family socio-economic status is based on family income, parental education level, parental occupation and social status in the community (Baker and Schuler, 2005).

An average income of poor urban in Kathmandu is Rs 250/day/family. Foreign employment seems to be an important source of household income. But very few households are involved in the foreign employment. It also depends on the financial and social networking and individual willingness to go abroad to support his/her family income. Besides this, sample data revealed that skill–based activities fetch comparatively higher returns than others.

For example, income/day from driving, carpentry and masonry, underling private and professional services has better increases. Petty business and contractual work are also a major source of family income. The worst activity in terms of income is domestic helper (Rs 86/day) where only women are involved, followed by agriculture and livestock (Rs 133/day). Overall, the highest return is calculated from contractors in construction activities (Rs 625/day) followed by driving (Rs 600/day). An earlier study in Afghanistan reveals that urban poor have earned Afghan Afghani (Af) 116, 123 and 29 (equivalent to Rs 178, 189 and 45 respectively3 from casual work, self-employment and home-based activities respectively (Schutte, 2006-17).

7.9 Conclusion

Urban poor are assets of urban economy and are mostly involved in informal sector of urban economy. They have diversified and unstructured sources of income due to their and seasonality of employment/works. The common areas of interests for earning cash are wage/labor, small scale business including vending; and private and professional services. Many youth are attracted either to private and professional services, which include secretarial services, repairing, maintenance and painting, or in the foreign employment in the gulf or south-east Asian countries. Statistical significance test of income generation activities by age, ethnic background and level of education, it is found that particular kind of activities are confined to specific age group and to given ethnic and education background. Similarly, amount of family income largely depends on ethnic background, working hours, nature and seasonality of works. Among other, there is a significant impact of education and working hour on household income.

It is true that, large numbers of poor families are living in the squatter and slum area, they are not only poor and unemployed but some of the economically well-off people are also living in the area. We could not neglect them; they are assets of urban economy, hardworking and decent people; and contributing to boost informal sector of urban economy. However with poor policies and working mechanism, they are discouraged and largely ignored in the development process. They have poor accessed of modern banking and financial, in many cases, policies discouraged them for providing credit facilities.

7.10 Recommendations

Urban poor are the source of cheap labor force as well as service provider in the informal sector through the activities like, vending, shoe making, driving and construction work. Unfortunately, they are largely ignored in the development process and labeled as illegal and unauthorized settlers. The poor are marginal communities who migrate to city and live in squatter settlements on the periphery of cities; they include high proportion of illiterates and unskilled laborers. They are socially, economically and politically marginal and are spatially separated from the nearby neighborhood. So they are to be involved in formal sector too.

Non-agriculture employment is an important factor in poverty reduction, substantiated by the Nepal Rural Credit Survey (NRCS) as well as NLSS. The NRCS data show that as many as 42 percent of households in the landless and marginal land-owning groups are better off than other poor households because they earn substantially more from non-agricultural sources, mainly in the form of salary and wages. A recent publication that has further explored the contribution of wage work to total income reveals that the share of salary and wage in total income is highest for the bottom quartile of the landless and owners of marginal lands; it monotonically decreases with each higher quartile group. Unfortunately, non-agricultural employment is not expanding fast enough to absorb even a fraction of the approximately 200,000 people who enter the labor force each year. Some seek employment abroad and significantly reduce their poverty. However, those who cannot avail themselves of such opportunities, either within the country or abroad, remain trapped in poverty. So the poverty reduction programs in agriculture and non-agriculture sector is most of by concern agencies including Government of Nepal.

Some other recommendations are mentioned on short points:

- The urban poor settlements are essential to manage by providing alternatives of settlements.
- The poor of urban areas are involved in informal sector because of lack of education and income so they are to be promoted for the formal sector too.
- The quality of life of urban poor is pathetic so their living standards improving projects are essential to implement.
- The Government of Nepal has not been published the actual data of urban area i.e. Kathmandu and other this is most to do on the related survey.
- The donor agencies which are related to poverty reduction should provide the proper concern towards the urban poor.
- Have to decentralize development work in local area (VDC, District) .
- Encourage to young people to engage in agriculture in their home town for their economic development.
- Strictly rule and regulations for protection of environment of valley and beauty of city

References:

Baker, Judy and Nina Schuler (2004). Analyzing Urban Poverty, A Summary of Methods and Approaches. The World Bank. Policy Research Working Paper 3399.

CBS (2009). National Population Report, 2009. Kathmandu: Central Bureau of Statistics.

CBS (2010). National Population Report, 2010. Kathmandu: Central Bureau of Statistics.

DANIDA (2005). Workshop Papers: Improving the Urban Environment and Reducing Poverty; December 5, 2005; Copenhagen, Denmark.

ICIMOD (2007). Kathmandu Valley Environment Outlook, 2007. Kathmandu: International Centre for Integrated Mountain Development.

Lumanti, (2005). A Survey on Poverty, Income, Employment and Urban Facilities in Kathmandu Metropolitan City. Kathmandu: Lumanti Support Group for Shelter.

Lumanti, (2008). Status of Squatter Communities along Bagmati River and its tributaries in Kathmandu Valley. Kathmandu: Lumanti Support Group for Shelter.

Lumanti, (2013). Status of Poor Communities along Bagmati River and its Tributaries in Kathmandu Valley. Kathmandu: Lumanti Support Group for Shelter. March 2013].

Schutte, Stefan (2006). Poor, Poorer, Poorest: Urban Livelihoods and Vulnerability in Mazar-i-Sharif. Kabul: Afghanistan Research and Evaluation Unit (AREU).

www.geo.fuberlin.de/geog/fachrichtungen/anthrogeog/zelf/median/downloaded/schuette[Accessed 29

CHAPTER 8

Conclusion

8.1 Conclusion of Nepalese Economic Development

Nepal is one of the poorest countries in the world where the majority of the people live in abject poverty with less than $ 1 a day. The economic parameters reveal that economic situation is fragile and vulnerable engulfed by on-going conflict of the late decade and recession. The economy is a high cost economy due to land-locked feature and suffers from inherent structural constraints. Structure of the economy is still dominated by rural subsistence farming. However, in recent years services sector has taken a prime role in contributing to GDP. Unfortunately, the size of GDP is small, growth rate is decelerating and GNI per capita is conspicuously low. Nepal's small economy is excessively dependent on Indian economy but with existence of acute and pervasive poverty. The major issue facing Nepalese economy is how to escape from poverty trap or low level of equilibrium trap, and accelerate economy towards a great leap forward by attaining sustainable high economic growth rate.

The extent of poverty could be diminished by providing employment opportunity to economically active but unemployed and underemployed population in cooperation with private sector especially by mobilizing FDI, and higher growth target could be achieved through initiating mega-projects especially in hydropower and infrastructures development by mobilizing external resources from both bilateral and multilateral sources. The role of Federation of Nepalese Chambers of Commerce and Industry and Chamber of Commerce etc. as apex bodies of private sector will be crucial to drive export, create employment opportunities, and increase efficiency and competitiveness to reap benefits from regional and international markets. However, growth will be robust through capacity building by utilizing Technical Assistance (TA) available under WTO and SAFTA agreements, and to be provided by multilateral financial institutions to continue the loan facility to recipient countries. Although foreign aid is highly competitive and subject to conditionality, Nepal needs greater quantum of external assistance with increasing productivity.

In addition, there is tremendous scope to address poverty and growth in Nepal through the cooperation of neighborhood economies of India and China especially by initiating joint ventures in potential area of mutual interest. Also there is need to penetrate bilateral, regional and global markets by further improving efficiency and competitiveness in new products, in addition to carpet and garments. Establishment of International Finance Services Center would be highly instrumental to mobilize and attract international capital, which will establish credibility of Nepal in global market. However, economic reforms are pre-requisites for successful economic development that require improving investment climate, governance and social inclusion in Nepal. In addition, good governance is antidote to corruption and empowering people is strength for economic development at the grassroots. The vision of mission to make Nepal the "Switzerland of Asia" in twenty-first century could be translated into reality, if efforts towards economic development are geared up with honesty and dedication full of compassion and wisdom. The governments in the past were preoccupied with crisis management and less with economic development in Nepal, now it is time to exhibit strength and prove credibility to build Nepal a strong economic nation-state for survival and prosperity with applying common sense paradigm of development.

For Nepal's economic development problems that need to be addressed urgently are especially in areas of agriculture, natural resource and environment management, infrastructure, human resource, financial sector reform, private sector development, utilization of power potential. In addition, there are non-economic factors such as leadership, education, polity and culture, on the one hand, and civil society, human rights and transparency, on the other, that will have significant bearing on the praxis and process of development in Nepal.

There is a dire need to exploit resources-social and human capital, natural resources and appropriate technology that are instrumental in accelerating the pace of development. But more importantly, there is a need for sacrifice on

the part of the power elite and privileged ones to ensure national consensus on major economic issues to promote economic strengths within the space of plurality and democracy. Nowhere in history have countries achieved a desirable level of development without adequate sacrifice. Additionally, progress requires vision, political will and determination and statesmanship.

Development does not occur with sheer enjoyment, nor can it be captured by adjustment, sound budgets, fiscal management, education, health and technical fixes alone. It is about getting the macroeconomics right, building infrastructure, empowering the people, writing the laws, recognizing women, eliminating corruption, educating the girls, building banking systems, protecting the environment and bio-diversity and inoculating the children. Moreover, development is about putting all the components together in a cohesive spirit of social justice for the benefit of all the people. The problem of underdevelopment in Nepal continuous to exasperate the people, for there is no exemplary strategy to deal with the problem. The Growth, poverty alleviation, employment generation ad good governance with strong motivation to check corruption are the cornerstones of success in a developing economy of Nepal.

A top priority must, therefore, be accorded to existential aspects of the people who have been neglected for years by our development practitioners. It requires development of the hill economy and the promotion of small and cottage industries-both instrumental for poverty reduction. Although globalization is a necessary, but not a sufficient condition for growth, it has to be achieved through increasing efficiency and competitiveness to maximize the benefits from opening up. If globalization is for growth, economic nationalism is for survival that takes care of the livelihoods for the people and sustainability of the economy.

'Either perish or prosper' is the choice left with the vulnerable economies such as Nepal. Thus, Nepal has a limited menu of choice for survival and development. Setting the agenda for the next millennium entails the reordering of inter-sectorial and priorities, for broadly speaking survival and growth are the two ends of the same continuum.

Nepal has become the 147th member of the WTO. The main aim of membership is to improve Nepal's economy by opening up trade with the world. Before being able to reap the full benefits that WTO membership implies, policymakers and businessmen need to be aware of how to make the most of these opportunities and how not to be overcome by open trading. One of the commitments made by Nepal was to amend the Environment Protection Act 1996 to compliment requirements of WTO agreements related to trade and environment. Nepal also needs to develop additional environmental standards for protecting human and plant life and to consider issues like Trade Related Intellectual Property Rights (TRIPS), which have threatened the rights of developing countries' farmers rendering them more vulnerable and marginalized. Another thorny and delicate issue under the WTO is that of agricultural subsidies, which many poor WTO members believe harm their exports. Building the capacity of environmental cells in the Federation of Nepalese Chambers of Commerce and Industries and other major associations of commerce and industry will be required. Industries should be motivated to adopt and comply with International Standards Organization (ISO) standards and eco-labeling of industrial products.

The environmental laws and regulations that do exist are only weakly enforced. Nepal's poor performance in the environmental sector has in large part, been the failure to fully empower regulatory bodies to enforce regulations, monitor compliance, and impose penalties. The environmental commitment of institutions nominally responsible for enforcement such as National Planning Commission and Ministry of Environment and Soil Conservation is weak and enforcement is piecemeal; there is a lack of coordination among the different agencies. A strong institutional base is needed to monitor and strengthen the legal instruments applied to environmental conservation. In many cases law enforcement is thwarted due to poor institutional infrastructure, the lack of institutional decentralization or the constant shifting of responsibilities from one institution to another. A strong, transparent and effective monitoring system is needed to support proper enforcement of laws and regulations. For example, to comply with international treaties, a list of rare and endangered species has been prepared. The difficulty, however,

is that there is no scientific monitoring to ascertain whether these species are actually still endangered or rare. Surveillance of legal instruments both internationally and nationally is lacking. Creating a repository of all the relevant environmental information in the country and making it accessible to all stakeholders through electronic means would help to make the system more transparent and easier to enforce. The section below on an "Environmental and Natural Resources Information Network" begins to address this issue.

Under the provisions of the Environment Protection Act and Environment Protection Regulations, the technical, industrial, and socioeconomic impacts of development projects on the environment and the population must be assessed. MOEST must approve the requisite environmental impact assessment (EIA) reports before any project is started. Projects without significant environmental impacts only need an initial environmental examination (IEE) to be conducted by relevant agencies. The NPC has adopted and applied the concept of Strategic Environmental Assessment (SEA) for project development policies and programs included in the Tenth Five-Year Plan (2002–2007). While the EIA assesses environmental impacts of development projects at the project level, the SEA assesses impacts at the planning, policy, and programming stages and can be used in evaluating strategic proposals for appropriate decision making. EIA and SEA capacity issues are acute. The EIA is still largely considered to be an "add-on" project burden and EIA reports are commonly based on inadequate data. Although Ministry of Environment Science and Technology (MOEST) has already approved 25 EIA reports from different projects, it has not been able to monitor the proposed mitigation of identified impacts and there is no indication that its successor MOEST will do any better.

Recent experience based on a cross-section of development projects shows that the EIA process is usually enforced only as part of the initial approval process. The problems come later at the implementation stage. Capacity development in augmenting, mobilizing, and enhancing Nepal's EIA and SEA capability must be strengthened. The knowledge, tools, and skills necessary to operate an EIA or SEA system to an acceptable level of performance must be developed. The scope of capacity development can range from establishing preconditions for EIA or SEA development to benchmarking good practices. Supporting measures include research, policy analysis, institutional design, information exchange, training and skills transfer, building networks, professional development and guidance on implementing good practices.

In this context, following recommendations have been proposed:

- Nepal should be export agricultural products, herbal products, handicrafts in the foreign countries and import necessary infrastructure from foreign countries
- All education system should be change according to physical, geographical and social structures.
- Establishing national consensus on major economic issues and setting national priorities for development, based on the four foundations of the Nepalese economy-biodiversity, water resources, human resources and tourism. National consensus is essential to give continuity to public policies. (Implementation: National Development Council).
- Survey of the population below the poverty line and identification of the population needing employment must. (Implementation: Ministry of Health and Population).
- Survey of the 'Wealth of the Nation' to identify the stock of resources, including subterranean resources and examination of their commercial potential. This is essential for innovative resource planning. (Implementation: Ministry of Industry).
- Developing strategies for the preservation of bio-diversity for sustainable agriculture, environment and tourism. (Implementation: Ministry of Agriculture; Ministry of Environment; and Ministry of Tourism).

- Designing a special package program for the development of the hill economy that will be instrumental in poverty alleviation. (Implementation: National Planning Commission).

- Survey of small and cottage industries all over the Kingdom and formulating strategies for their development which could give a new lease of life to the Nepalese economy by generating employment opportunities and foreign exchange. The use of indigenous skill, capital, raw materials and entrepreneurship would be a significant step towards poverty alleviation and sustainability of the economy. (Implementation: Federation of Nepalese Chambers of Commerce and Industry (FNCCI); Federation of Small and Cottage Industries; and Department of Small and Cottage Industries; GON).

- Establishing a computer network to simplify taxation and preparing a roster of tax payers (especially income tax payers) in the line of voter's list. Income tax laws and regulations need to be simple and compatible with evolving global norms and practices. (Implementation: Department of Tax-GON).

- Setting-up of a "High Power Committee" for a genuine (not rent-seeking) implementation of selective privatization, with an emphasis on people participation. This would help attract Foreign Direct Investment (FDI) and effectively manage Portfolio Investment (PI). (Implementation: Ministry of Finance and FNCCI).

- Farming a Perspective Plan for the next 20 years entitled 'Nepalese Economy and Environment: Vision 2020" (Implementation: National Planning Commission).

- Setting-up of an 'Independent Tribunal' especially for economic development and environmental conservation and control the corruption. (Implementation: National Planning Commission; Ministry of Finance; and Ministry of Environment Science and Technology).

8.2 Conclusion of Environmental Problems in Nepal

In this PhD dissertation I have tried to focus on the different environmental issues in Nepal and its Impact on Environment and Economy. Even though, being an underdeveloped country Nepal is quiet aware in environmental issues. There has been lot of good movements by the government and private sector for keeping the country clean and green. Although, practical implementation is lacking in different places and availability of energy not being up to the needs, the sincerity towards environment is positive overall and also the possible solutions are also discussed.

Squatters (referred to as sukumbasi in Nepal), on the other hand, are slum dwellers settling on land without legal right, neither as tenants nor as owners. These people may live on the land for decades, but have no legal title to it. Technically, sukumbasi are people who do not own land anywhere in the country. In the urban context, sukumbasi are squatters unauthorized to reside where they do, while they may still own land elsewhere in the country.

People residing in squatter settlements face many problems like improper sanitation, unhygienic environmental conditions, social, economic, health, educational and cultural problems and many more. The basic problems inherent in slums are health hazards, lack of basic amenities like safe drinking water, proper housing, drainage and excreta disposal services, make slum population vulnerable to infections. Only the programs and policies of short period of time have brought limited results to improve the situation. The government to work out a "national plan of action" to find long-term solution to the problems facing the landless squatters in different parts of the country as well as the Government is currently seeking views on how to address, and reduce squatting. A number of alternative recommendations flow from the evidence.

1. Raise awareness and dispel some of the myths about squatters. There is a need to acknowledge squatting is a manifestation of housing need, and is a homelessness and welfare issue

2. Provide support and outreach services targeted at squatters. This is a sizeable population, many of whom, for a variety of reasons, is disengaged from services and is vulnerable. Many also require and want support, assistance and alternative housing.

3. Protect homelessness services from cuts, and increase homelessness provision. Many people squat because they have no other options. Increasing and improving access to temporary housing provision, to housing advice and support, and doing more to help single homeless people find affordable housing will prevent people having to squat. Squatting is likely to escalate if there are cuts to homelessness services.

In case of Nepal, the environmental consequences due to agriculture sector though not that alarming, some negative implications have been reported. The Environment Protection Act (EPA), 1997; Environment Protection Rule (EPR), 1997 and other policy documents of GON have provided framework for governing agricultural activities in order to minimize its environmental consequences.

The intensive use of inputs with green revolution has not only polluted soil, water and environment causing slow degradation but also affected human beings and animals. With this realization, organic agriculture emerged since late eighties as an alternative to reduce such hazards. In the context of WTO, Nepal needs to re-examine existing policies and formulate policies that support for wider adoption of organic agriculture for which research on technological aspects of organic farming relevant to Nepalese context needs to be carried out. Chemical fertilizers are used together with chemical pesticides, herbicides and fungicides. Use of chemicals has a negative impact on the soil, the water as well as the crop as the vegetables, for instance; still contain chemical traces which are then absorbed upon eating. As well as Chemical fertilizers kill microorganisms which in turn will make the soil useless where nothing can grow. Chemical fertilizers and pesticides are responsible for water contamination. For excessive enrichment of ponds, rivers and lakes is due to an overuse of chemical fertilizers. Usage of chemical fertilizers has a long term effect on the plants, the soil, the environment and all of us. So avoiding chemical fertilizers it should be used manure and fertilizer.

Mining in Nepal takes place in almost every district but the largest stone mining operations take place along the rocky riverbeds of Dang, Kaski, Rupandehi, Kathmandu, Lalitpur, Kavre, Makawanpur, Jhapa and smaller mining operations in many more districts.

Mining operations are considered one of the main sources of environmental degradation. The number of mining industries in Chapagaon has found decreased in 2012, but the environmental impacts have found rather increased. Chapagaon is an adjoining VDC of Lele, Bhardeu and Nallu VDCs, especially the gravel, sand and stone productions of Lele VDC are to be passed through the way of Chapagaon, so the environment of Chapagaon has degraded even after shifting the mining industries from Chapagaon. The impacts regarding to environment of Chapagaon are related to the degradation over the scenic beauty of Chapagaon, loss of soil quality, reduction on agricultural production, air pollution, drying the source of drinking water, soil erosion, sedimentation on local streams, habitat loss and fragmentation of wild life, health impacts on local people etc. To control environmental pollution those recommendation will be useful to reduce the impact of gravel, sand and stone mines, which are described in chapter 4.

Kathmandu was a stronghold of the national government during the civil war of the late 90's and early 2000's. Because the Valley was significantly safer than outlying areas many people moved for security reasons. The population of the Kathmandu Valley has, according to some estimates, doubled in the past 20 years (from 2 to 4 million). A consequence of this population growth is an ongoing boom in residential construction. Many of the buildings in urban and semi-urban Nepal are built predominantly of brick. Much of the Valley's bricks come from Lalitpur district, which lies just south of Kathmandu proper, and happens to be where I live with my family.

Emission from brick factories comprises of fine dust particles, hydrocarbons, Sulphur Dioxide (SO2), Oxides of Nitrogen (NOx), Fluoride compounds, Carbon Monoxide (CO) and small amount of carcinogenic dioxins if rubber tyres were used as fuel. The factories of Kathmandu Valley are found not safe, most of the firing spots of brick factories are haphazard, not safety for the workers. Most of the women and children are employed for the clay preparation, brick making, drying and firing which indicates delicate and sensitive health group people in these factories. The brick sector in Kathmandu valley, whose functioning and growth is directly linked to construction activity, is presently in the eye of a storm. Negative rate of growth in construction activity in past few years has resulted in a proliferation of brick kilns, which have reappeared in the Valley with spectacular speed raising serious concerns about the deteriorating air quality. It has been reported that brick kilns, producing in excess of 350 million bricks are the major single source of SO2 and SPM in the environment of Kathmandu valley; contributing over 60 percent of the emissions. The solutions to this problem must take into account the following competing factors that are at work.

a. Market forces

The demand for burnt bricks continues to grow fuelled by an increased demand for housing in the Kathmandu valley. The customers have preference for burnt brick as the primary walling material; even though alternatives such as concrete blocks are increasingly being used for boundary and partition walls

b. Economic Forces

The increase in supply of burnt bricks is ensured by willing entrepreneurs who jump at any opportunity for making quick profits. The entry barrier for new opportunistic traders is low.

c. Political Forces

The government of Nepal is aware of the serious environmental problems created by the brick kilns. The efforts are intensified by environmental watchdog organizations and activists, who are going hands with communities to limit the growth of kilns and force them to "clean up" or "close down". The government has set into motion the task of setting environmental performance standards for kilns but enforcement, even of existing legislation, continues to be weak.

Soil erosion is an inherent characteristic of Nepal's physio-climatic and socio-economic conditions. Sharp physiographic and climatic contrasts in combination with other natural phenomena contribute to the fragility of Nepalese mountains. The combined effect of geologically unstable, steep and rugged mountain topography and intense monsoon rainfall make the country prone to high soil erosion rates. Cultivation of marginal hill slopes to meet the demands of increasing population further aggravates the naturally high soil erosion rate. Deforestation, overgrazing and poorly maintained marginal lands contribute to the degradation of our watersheds. In addition, other human activities such as improper land use, unscientific cultivation practices and construction of development infrastructures without integrating conservation measures have also exacerbated the problems of soil erosion, landslide, flooding and environmental degradation.

In recognition of critical situation of soil erosion and watershed degradation in the country, Government of Nepal established the Department of Soil and Water Conservation in August, 1974 under the then Ministry of Forests. In 1980, it was renamed as Department of Soil Conservation and Watershed Management (DSCWM) to better represent its roles and responsibilities of watershed management. Since its establishment, various efforts have been continuing to meet the challenges of soil erosion and watershed degradation faced by the country.

As well as tree planting programmes should be start much effectively, for that awareness programme should be conduct all over the country. Government has make effective rule and regulations concerning soil erosion and have to follow strictly those rule and regulations.

Mulching, multiple cropping, high density cropping, agro forestry, shifting cultivation, rotational grazing, proper forest management, reforestation, afforestation, soil management, wind breaks, terracing are possible solutions for soil erosion control.

The education related to environment are taught in school, colleges and universities from quite a long time, but the practical implementation of the taught education is lacking. Some organizations helps government by developing new ideas and goes to rural village and does plantation of trees and teaches the villagers as “forest are our friends and we should preserve it”, but due to lack of possible source of energy they are compelled to cut the trees. Even though some plants are planted by those villagers but due to lack of proper care, several of them dies, because those visiting organization just teaches them to plant trees and give theoretical advice on proper care. Practical education is the need and the only possible solution to teach the uneducated villagers on planting new trees. Education related to environment should be given to students from early age and awareness camps for protection of environment should be frequently held in a possible gap periods. The checking and nursing of planted trees can also be a good possible solution.

Identification of the poor is a difficult problem in the urban areas because of the wide variation of economic activities that have different labor productivity and wages. In the context of Nepal, however, women working as wage laborers in manufacturing industries, women involved in risky works such as sex trade, street children, people living in slums and squatter settlement, informal commercial vendors, rag pickers, and internally-displaced low-income people constitute a big chunk of the urban poor in Nepal. Urban poverty is likely to increase in Nepal in the foreseeable future due to rapid urbanization. The Department of Urban Development and Building Construction need an ‘integrated poor community development program’ besides engaging in sectorial physical planning. NGOs and community based organizations can contribute to comprehensive urban poor community development programs if one were to go by the experiences of South Africa. Provision of revolving fund among women saving and credit groups should be established to expand the urban poverty reduction campaigns in Nepal.

The national development policy should adequately articulate the problem of urban poverty before this becomes very difficult and costly to address. The resettlement of the highly-dense slums/squatter settlement would be too costly and cumbersome if it prolongs. The government should be aware of the tenure issue of the squatter communities and control the unplanned growth of these settlements. A separate slum and squatter policy is essential. NGO sector can work as a catalyst for the resettlement and launch some welfare programs among the relocated people during the transition.

The above specified recommendations can play a significant role to meet the development and environmental conservation challenges of Nepal. This calls for increased contributions of donor agencies, the only active partners of development in Nepal, in the years ahead. Their generous cooperation will be meaningful and appreciated by the people of Nepal only when the partners of development see an economically and environmentally sound Nepal in the next millennium.

And we know that only government sector can’t solve all environment problems of the country. Local people, local NGO, INGOs have to solve together all the environmental problems and its effects, only then it can be success. For example we can learn lesson from Japanese people and Japanese Government.

During the period of rapid industrial growth in Japan between the mid-1950s and early 1970s, serious pollution problems began to surface all over the country. Examples include the industrial mercury poisoning that led to an outbreak of Minamata disease, the severe health impacts of air pollution from the giant petrochemical complex in Yokkaichi, and the mining-caused cadmium pollution that made people suffer from the "itai-itai" disease (literally, the "ouch-ouch sickness"). In response, anti-pollution campaigns were launched, mainly by the local residents most affected.

As the movement spread across the country, environmental awareness among the general public continued to grow. People realized they were not alone in being affected by these problems, and that they had the power to influence society; they could get corporations to take responsibility for their actions, and get governments to implement the necessary laws and regulations. Under pressure from this widespread anti-pollution movement, the government began to introduce a variety of pollution control laws and regulations, while corporations started to more seriously tackle environmental problems.

Another landmark was in 1997, when an international conference of the UN Framework Convention on Climate Change was held in Kyoto to negotiate and adopt the Kyoto Protocol. Many Japanese citizens worked together in the hopes of making this meeting a success. To this point, most NGOs in Japan were still small and worked locally. Inspired by the examples of previous climate change conferences overseas, however, where many NGOs in host country had formed a network to speak with a common voice at the conference, some NGOs began form a network in Japan as well.

For the Kyoto Conference, many Japanese citizen organizations and NGOs jointly established the "Kiko Forum" ("kiko" means "climate"), a network-based NGO to work on issues from the citizen's perspective. It was a major step in coalescing the power of citizens, by creating a network of groups on this issue. The forum later evolved into the "Kiko Network," which continues even now to work on global warming issues.

Referenes

The latest information on environmental topics from Japan to the world - Japan for Sustainability (JFS), 2013-10-23

The end

Acknowledgement

Foremost, I would like to express my sincere gratitude to my advisor **Professor Akifusa FUJIOKA** for his careful reading of the original manuscript and his many helpful suggestions and comments. As well as I am grateful with him for the continuous support of my Ph.D. study and research, for his patience, motivation, enthusiasm, and immense knowledge. His guidance helped me in all the time of research and writing of this thesis. I could not have imagined having a better advisor and mentor for my Ph.D. study.

Besides my advisor, I would like to thank the rest of my thesis committee: **Professor Yasushi Motoki** and **Professor Koji Serita** for their encouragement, insightful comments, and their kind guidance.

I also thank my friend **Mr. Tsuyoshi Enomoto** for providing support and friendship that I needed.

I wish to thank my parents, **Deshar Shanta Lal** and **Deshar Chiri Maya**, for giving birth to me at the first place and supporting me spiritually throughout my life. Their love provided my inspiration and was my driving force. I owe them everything and wish I could show them just how much I love and appreciate them. My wife, **Maharjan Deshar Shova**, whose love and encouragement allowed me to finish this journey. She already has my heart so I will just give her a heartfelt “thanks.”