LINKING ENVIRONMENTAL STRESS WITH HUMAN DISPLACEMENT: A CASE OF BELASPUR VILLAGE, NUWAKOT, NEPAL

A Dissertation Submitted to

CENTRAL DEPARTMENT OF ENVIRONMENTAL SCIENCE
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Tribhuvan University
Kirtipur, Kathmandu, Nepal

In Partial Fulfillment of the Requirements for the Award of Degree of
M.Sc. in Environmental Science

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DECLARATION

I hereby declare that the work presented in this dissertation is a genuine work done originally by me and has not been submitted anywhere for the award of any degree. All the sources of information have been specifically acknowledged by reference to the author(s) or institution(s).

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Date: 25th August, 2017

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RECOMMENDATION

This is to certify that **Miss. Sijal Pokharel** has completed this dissertation work entitled **"Linking Environmental Stress with Human Displacement: A Case of Belaspur Village, Nuwakot, Nepal"** as a partial fulfillment of the requirements of M.Sc. in Environmental Science under our supervision and guidance. To our knowledge, this research has not been submitted for any other degree, anywhere else.

We therefore, recommend the dissertation for acceptance and approval.

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LETTER OF APPROVAL

On the recommendation of supervisors "Prof. Dr. Rejina Byanju Maskey" and "Dr. Amina Maharjan", this dissertation submitted by **"Miss Sijal Pokharel"** entitled **"Linking Environmental Stress with Human Displacement: A Case of Belaspur Village, Nuwakot, Nepal"** has been approved for the examination and submitted to the Tribhuvan University in partial fulfillment of the requirements of M.Sc. in Environmental Science.

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CERTIFICATE OF ACCEPTANCE

This dissertation entitled **"Linking Environmental Stress with Human Displacement: A Case of Belaspur Village, Nuwakot, Nepal"** submitted by **"Miss. Sijal Pokharel"** has been examined and accepted as a partial fulfillment of the requirements of M.Sc. in Environmental Science.

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ABSTRACT

Environmental change is shaping human migration now and will do so in future; specifically through its influence on a range of economic, social and political drivers. Development of the vision for how human population movements across the world could be affected by global environmental changes with a focus on the diverse challenges and opportunities for populations in originating and receiving regions is as inevitable as environmental change. The study was conducted to see the linkage of environmental change with human displacement in Nepal. The study used primary data collected through ethnographic surveys from displaced community of Thansing VDC of Nuwakot district to analyze the drivers of migration adopting the indictors from the Foresights framework. The climatic data was analyzed in relation with the variability of ecosystem services such as water availability, as determinant of people's decision to stay or move from their settlements. The personal and household characteristics which is supposed to contribute in migration decision was assessed by using Kuppuswami index. Water stress among the environmental driver was found to be the major migration initiator and perpetuators such as for education, employment opportunity, agricultural producer and consumer prizes, conflict and demographics. The factor contributing to water scarcity was acknowledged to be inter annual variability in precipitation pattern with significant decreasing trend and insignificant increase in temperature. The decision of migration also depended upon a series of intervening factors and personal or household characteristics which is assessed by using the ethnic group and socioeconomic class lens. The majority of upper lower and lower socioeconomic class people were from disadvantaged ethnic group i.e. *Mijar,* who due to lack of network and resources were forced to live in environmentally stressed area and faced the jeopardy of being trapped in the environmentally prone area. The consequences of mass displacement was found to be land underutilization, increased human-wildlife conflict and demotivation of development in the place of origin. The existing governance fora and its long term planning for environmental change should be focused on livelihood diversification of the trapped and displaced population in order to build the resilience of such population. The formulation of internal migration policy in the National policy can have short as well as long term implication to address such vulnerability.

Keywords: displacement, environmental stress, water scarcity, trapped population.

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ACRONYMS AND ABBREVIATIONS

CBS	Central Bureau of Statics
CIDA	Canadian International Development Association
DHM	Department of Hydrology and Meteorology
GoN	Government of Nepal
HH	Households
HKH	Hindu Kush Himalaya
Hi-AWARE	Himalayan Adaptation Water and Resilience Research
ICIMOD	International Center for Integrated Mountain and Development
INR	Indian Rupees
NAPA	National Adaptation Plan of Action
NPR	Nepalese Rupees
NELM	New Economics of Labour Migration
NRB	Nepal Rastriya Bank
NUCPI	National Urban Consumer Price Index
PRA	Participatory Rural Appraisal
SES	Socio-economic Status
UN	United Nation
VDC	Village Development Committee
FGD	Focus Group Discussion

CHAPTER I: INTRODUCTION

1.1 Background

Migration is a mobility of people aimed at adjusting to changes. People usually migrate in search of better opportunity being driven by multi causal factors. Black et al. (2011) has identified five family of drivers which affect migration decision namely economic, social, demographic, political and environmental drivers where the environment drives migration through mechanisms characterized as the availability and reliability of ecosystem services and exposure to hazard. Environmental conditions are but one factor in a complex of causally interconnected variables whose mutual influence cannot be sorted out in qualitative accounts (Massey et al., 2010). There is increasing evidence that serious and relatively rapid alterations to ecosystems induced by climatic and anthropogenic factors will have direct and indirect impacts on societies which, when other coping mechanisms are overcome, will have no other option but to migrate as a permanent or temporary coping strategy (Boano et al., 2008).

Climate change is regarded as a significant driver that is shaping the evolution of Hindu Kush Himalayan (HKH) range in the last decade. The impact of climate change is further triggering the fragility and harsh livelihood in the mountain region, and people there are compelled to adapt now, and from ages to the various environmental stresses as a consequence of climate change. HKH range is often referred to as the third pole, also the range is the water tower of Asia and regulates the flow of nine major river systems that serves a total population of almost one and a half billion (Schild et al., 2008). Throughout the upstream and downstream areas of the HKH, mobility and migration is taking place at greater pace which is concerning the communities, researchers and policy makers alike. Migration as a livelihood strategy has both positive as well as negative impacts on the livelihoods of the households as well as the communities (Scoones, 1998).

Existing pressures on water resources will be exacerbated by increase in population and also by climate change (Gosling & Arnell, 2016). Various studies have explored how both these factors might affect global water scarcity in the future by using population projections and simulated changes in climate from global climate models (GCMs) with water resources models (Alcamo et al., 2007; Arnell et al., 2011). Because water is fundamental to health and agricultural production and cannot be easily substituted, it must be available in sufficient quantities at the local level wherever people

live in order to sustain communities (Kirstin et al., 2005). Thus, the threat of water scarcity is a potential contributor to population movements. The availability of ample, high-quality water influences rural livelihoods in many ways and the degree of a household or community's vulnerability to water scarcity becomes an important dimension of migration decisions (Kirstin et al., 2005).

Migration has been interpreted as closely linked to agrarian change, and a range of causal factors from environmental change (Massey et al., 2010) to geographic differences in wages are reported (Wise & Veltmeyer, 2016). The case of land underutilization, as manifested in specific parcels of the Nepal's rural landscape, is indeed a result of a complex socio-environmental process that cuts across several broader domains, such as migration, development, environmental change, political economy, and local politics (Ojha et al., 2017). While migration is presumed to be a cause of land underutilization, traditionally it has also been assumed that migration from rural areas is driven by poverty and dearth, as migrants and their families strive to improve their living conditions (Ravenstein, 1889; Lee, 1966).

The strength of financial, social, political and physical assets is deterministic in the protection of self and associates from most of the stress and hazards, and the one with low strength are likely to be more vulnerable. Hence a significant group of people living in environmentally prone locations in the future face a double jeopardy: they will be unable to move away from danger because of a lack of assets, and it is this very feature which will make them even more vulnerable to environmental change (Foresight, 2011).

1.2 Rationale

Mountains are often a blank spot in terms of academic research and available data on societal responses to climatic and environmental change. The relationship between migration and environmental and climatic changes is a crucial driver of livelihood dynamics in mountain areas which has barely been studied in a systematic way (Kollmair & Banerjee, 2011; Skeldon, 1985). In this context, it is surprising how standard theories and explanations of migration as an important social phenomenon do not incorporate environmental aspects in a meaningful manner. At the same time, academic discussions on environmental change have been, until recently, almost completely silent on the role of migration (Black et al., 2011). In particular, there is lack of longitudinal studies and, due to disciplinary divides, existing work on climate change and migration has barely

been analysed in the context of socio-economic transition, and the adaptation angle is almost completely lacking. This research aims at filling this gap and attempts to assess the role of migration in the livelihoods of the people living under environmentally stressed down-stream areas of the HKH region.

1.3 Research question

➢ Is there any changes in the trend of available climatic data?
➢ What are the environmental stresses associated with key natural resources that has been responsible for people's decision to migrate?
➢ What is the role of migration in the lives of environmentally stressed population of mid-stream of Gandaki River Basin?

1.4 Objectives

The general objective of the research is to identify the role of migration in environmentally stressed population of mid-stream of the Gandaki River Basin.

Specific objectives:

➢ To analyze climatic data (precipitation and temperature) of study area.
➢ To test the Foresight framework of drivers of migration.
➢ To identify the environmental stresses and its impacts in the study area

1.5 Limitations

Since the study was based on the ethnographical study, the entire findings on the Environmental stress is validated by collating the data and observation obtained by using the tools from PRA. The hydrogeological study which governs the occurring and movement of water in underground aquifers was not done to explore the reason behind the water scarcity of that very place, and change in the climatic data was done to acknowledge the reason behind the drying of the spring. The water volume in terms of water scarcity couldn't be obtained because the estimation of water availability in the past was not feasible. The study tries to entrench the social dimension of the environmental stress rather than the science behind the stress itself, which is major limitation of the study.

CHAPTER II: LITERATURE REVIEW

Migration is a process of crossing of the boundary of a political or administrative unit for a certain minimum period of time (UN, 2015). People usually migrate in search of better opportunity being driven by multi causal factors. Black et al. (2011) has identified five families of drivers which affect migration decision namely economic, social, demographic, political and environmental drivers.

2.1 Drivers of migration

Individual migration decision is influenced and very specifically affected by various drivers operating in combination. According to Black et al. (2011), environment drives migration through mechanisms characterized as the availability and reliability of ecosystem services and exposure to hazard. Environmental change also affects migration indirectly, in particular through economic drivers, by changing livelihoods for example, and political drivers, through affecting conflicts over resource while in combination with other factors, may amplify or significantly change existing patterns of migration where people have the resources and freedom to make choices concerning whether they move and to where (Black et al., 2011). Population movement as a result of cumulative environmental changes, however, is inevitably harder to identify as cumulative environmental change has a slow onset and tends to occur alongside economic, social and political change, as a result, it is rare that environmental change alone can be singularly attributed to population movement (Lonergan, 1998).

2.1.1 Social driver

According to Massey et al. (1970), access to family, social or other networks facilitates migration by migrants, while limited family and other ties also explain a lack of migration by others. Social drivers of migration include family and cultural expectations, cultural practices regarding inheritance, the need to acquire funds for dowries or bride payments, and the search for educational opportunities where access to education generally increases the ability and aspiration to migrate and significant number of people migrate specifically in pursuits of education (Black et al., 2011), though the cases in which the pursuit of education is negatively correlated with migratory aspiration (William & Massey, 2002).

2.1.2 Economic driver

Economic drivers have direct effects on both internal and international migration. Net income understood as wage differentials (Bijak, 2006; Massey et al., 1993), and income volatility play key roles in driving migration (Harris & Todaro, 1970).The New Economics of Labour Migration (NELM) models constitute the third type which differs substantially from the other types in two key aspects: the introduction of rural risk as a factor in the migration decision, and the strong focus on the potential migrant-sending household, rather than the individual migrant, as the unit of analysis (Stark & Lucas, 1988). Although economic drivers tend to stimulate mobility, it is possible to conceive of circumstances where a sudden economic collapse could trigger short-term reactive displacement.

2.1.3 Demographic driver

According to De Haas (2011), theories of migration have drawn heavily from the idea that 'population pressures' are major determinants or even 'root causes' of human movement. Plane (1993) states that it is not the presence of large numbers of people in a region per se that will trigger outmigration, but rather the presence of large numbers without, for example, access to employment or livelihood opportunities. According to Black et al. (2011), demographic characteristics may be affected not only by birth and death rates, but also the burden of disease and ill-health within a community. Similarly, the demographic characteristics of a receiving area such as an ageing population may affect the demand for jobs and employment opportunities, and hence the perceived attractiveness of that area.

2.1.4 Environmental driver

Ecosystem services are those parts of the environment and ecosystems that are utilized to produce human well-being (Fisher et al., 2009; Millennium Ecosystem Assessment, 2005), through the functions of provisioning (e.g. providing food and water), regulating (e.g. erosion protection) and cultural services (e.g. having emotional or spiritual value). According to Brown (2008), the meteorological impact of climate change can be divided into two distinct drivers of migration; climate processes such as sea-level rise, salinization of agricultural land, desertification and growing water scarcity, and climate events such as flooding, storms and glacial lake outburst floods. According to Black et al. (2011), rapid-onset extreme environmental events such as floods, tsunamis,

landslides, earthquakes, wildfires and volcanic eruptions are well-known triggers of displacement.

2.1.5 Political driver

According to Zolberg (1989) and Raleigh (2011), political drivers have a number of direct effects on migration, breakdown of the governance being the most obvious one, which leads to the emergence of conflict beyond acceptable levels, and trigger a decision to move or lead to displacement. Political uncertainty, even in the absence of actual conflict, may also be push factors for migration (Black et al., 2011). More positively, perceived political stability may be a pull factor that attracts immigrants, or at least encourages people not to leave (Reileigh, 2011).

2.2 Environmental change and its effects on environmental driver

Environmental change is a proximate factor in migration (Barnett & Webber, 2010). Since at least 1988 climate change has been identified as a potential driver of migration (Jacobson, 1988). It is difficult to find an environmental migrant per se, as there are various economic, political, social and cultural push and pull factors that influence the migration decision alongside environmental issues (Afifi & Jager, 2010). Knowledge of the relationship between environmental change and migration is limited, a point recognized by almost all researchers working on this topic (Döös, 1997). Environmental change will play an important role into the future through influencing the environmental drivers of migration as well as other drivers of migration, by changing both 'average' conditions and patterns of variability (Foresight, 2011).

Changes in rainfall regimes would increase exposure to hazards through flooding and fire, affect the security and quality of water for domestic, municipal, industrial and agricultural uses, and also result in shifts in land productivity in all parts of the world. Soil erosion and waterlogging associated with heavy precipitation could influence agricultural income and well-being by damaging crops and increasing the frequency of failure (Kundzewicz et al., 2007; Easterling et al., 2007). Furthermore, loss of agricultural productivity as a result of reduced precipitation could also lower rural wages (Mendelsohn et al., 2007) and impact crop prices (Parry et al., 2009).

Increases in temperature raise the frequency of high-temperature extremes, which can potentially affect land productivity in warmer areas and hence food security by increasing the risk of crop failure. These losses have, in turn, been shown to affect rural

wages (Mendelsohn et al., 2007) and crop prices (Parry et al., 2009). Increases in temperature can also increase exposure to hazards, increasing the possibility of pest outbreaks and wildfires which negatively affect agriculture and forests (Easterling et al., 2007). Furthermore, they can affect human health, for example heatwaves pose risks to vulnerable populations (Confalonieri et al., 2007). Although increases in temperature extremes are significant, other factors, such as the magnitude and timing of extreme temperatures, must also be taken into account in determining impacts on areas such as agricultural productivity (Gornall et al., 2010).

Water stress and migration

Historically, migration and water were related, broadly, to nomads and pastoralists looking for water and food for their animals. According to the analysis drawn from Swain and Anders (2016), the new debate tries to see linkages between water scarcity (which includes natural variability), migration (and refugee flows), and conflict. The loss of livelihood due to increasing water scarcity and variability could force those affected to migrate. Furthermore, the water scarcity is becoming much more problematic (e.g. through increased variability of flow with subsequent vulnerability) due to global climate change.

2.3 Migration as adaptation

Scholars have addressed migration as a response to climate change (Black, 2001; Castles, 2002; McLeman & Smit, 2006), as well as the importance of assessing individual perceptions of climate change risk and adaptive capacity (Dessai et al., 2004). According to Mortreux and Barnett (2009), the environmental migrant centric approach within the environmental change and migration discourse has sidelined the contribution of migrants whose decision to move may not have been influenced by environmental stressors which does not prevent these migrants from contributing to the climate change adaptation of their families left behind in origin communities. For example, migrants belonging to a flood-affected community are likely to provide assistance to their families in origin communities irrespective of whether their decision to migrate had been influenced by flood impacts. Therefore, a wider set of migrants has a potential role in climate change adaptation. During the same period, research studies done by McLeman and Smit (2003) and Foresight (2011), have attempted to position migration as an adaptation response to perceived future climate change impacts. Although there is growing consensus among migration scholars regarding the potential contribution of migration to the lives of the

migrants and their families left behind, the extent to which migration can contribute to climate change adaptation among migrant sending households is complex and requires further exploration (Mortreux & Barnett, 2009). The contextualization of migration in terms of terminology associated with climate change adaptation vulnerability, adaptation, resilience, coping, adaptive capacity lacks clarity. For example, McLeman and Smit (2006) suggest that throughout history migration has been a vital component of adaptation to changes in natural resource conditions and environmental hazards, and this is unlikely to change in the future. Agrawal and Perrin (2008), recognize mobility as one of the four analytical types of coping and adaptation strategies in the context of livelihood risks. Although Adger et al. (2009), recognize migration as an adaptation strategy, they consider involuntary migration to be undesirable for migrants leaving their homeland since a disruption of economic ties, social order, cultural identity, knowledge, and tradition would be detrimental to a successful transition. However, Meze-Hausken (2000) perceives permanent distress migration as a last resort. Scholars have addressed migration as a response to climate change (Black, 2001; Lonergan, 1998; McLeman & Smit, 2006), as well as the importance of assessing individual perceptions of climate change risk and adaptive capacity (Dessai et al., 2004). One of several factors linked to environmental degradation and the increase in frequency of hydro-meteorological events is climate change (Julca, 2010).

The latest reports from the Intergovernmental Panel on Climate Change have increased the scientific basis linking climate change and anthropogenic processes and have continued to highlight the vulnerability of people to the effects of climate change (Intergovernmental Panel on Climate Change (IPCC), 2007). Adger et al. (2007) highlight that migration because of the impacts of climate change shows the limits of adaptation strategies but that nonpermanent migration in itself can be considered an adaptation strategy. Nevertheless, future migration due to the effects of climate change is not quantified by the IPCC because of the many interrelated push and pull factors, which motivate people to migrate and thus the difficulty in isolating strict environmental push factor (Wilbanks et al., 2007).

Although Adger et al. (2009) recognize migration as an adaptation strategy, they consider involuntary migration to be undesirable for migrants leaving their homeland since a disruption of economic ties, social order, cultural identity, knowledge, and tradition would be detrimental to a successful transition. However, Meze-Hausken,

(2000) perceives permanent distress migration as a last resort. In turn, Felli and Castree (2012) have criticized the notion that migration can be an adaptation strategy because of the overemphasis on autonomous actions by individuals or communities and market mechanisms to deal with environmental degradation, rather than on political economy transformations.

2.4 Migration for adaptation

Many of the benefits of migration for the adaptive capacity of communities of origin arise through remittances (Barnett & Webber, 2010). Remittances have many positive effects, including that they: smooth consumption of basic needs such as food across seasons; sustain access to basic needs in times of livelihood shocks such as drought; finance the acquisition of human, social, physical and natural capital; and increase demand and so stimulate local production (De Haan,2000; Ellis,2003). Families with labor migrants who remit incomes fare better during livelihood crises than those that do not (Ezra, 2001).

Khadka (2014) conducted a study to estimate the level of Sustainable livelihood strategy of remittances for the residents of Balthali and Dewabhumi Baluwa Village Development Committee of Kavre district in Nepal. The results of this study show that the people in the community are highly dependent on remittances for their livelihoods. The statistical analysis however, shows that the dependency on remittance is determined by the age of the household, as cited in the paper as "remittance income is decreasing with age of the household".

Adhikari (2014) in his study finds that the access of piped drinking water, modern toilet facilities, access the radio/tape, mobile/telephone, land ownership, average months of food sufficiency and average per capita consumption expenditure was better for the (any member) migrant's households compared to non-migrant's households. Based on this poverty line, it was derived that around 34 percent households fall below the poverty line. The incidence of poverty was higher for the non-migrants' households compared to any member migrants' households.

Massey et al. (2010) in their study conducted in Chitwan, has operationalized environmental change in terms of declining land cover, rising times required to gather organic inputs, increasing population density, and perceived declines in agricultural productivity. The findings however was more focused on what makes sort time and

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distant migration, unlikely to how migration has become last resort in case of such environmental change. There is increasing evidence that serious and relatively rapid alterations to ecosystems induced by climatic and anthropogenic factors will have direct and indirect impacts on societies which, when other coping mechanisms are overcome, will have no other option but to migrate as a permanent or temporary coping strategy (Boano et al., 2008).

According to Gioli et al. (2014), in the study accessing migration as adaptation strategy conducted in environmentally stressed area of Pakistan, Yasin and Hunza valley, the study area have experienced rapid socioeconomic and environmental change, Migration has been successful in enhancing households' ability to absorb shocks while migration as an ex post strategy is mostly undertaken by poorer households to cope with losses and damages in the wake of environmental shocks. This might prove detrimental in the medium or longer term, as it erodes important assets and decreases the household's overall resilience. The study confirmed that non migrant households are more likely to be caught in the poverty trap.

2.5 Conclusion

The meteorological impact of climate change is seen in various climatic processes including water scarcity as well as in form of extreme climatic events. In this midst of unprecedented change in the earth climate, migration stands as a strategy to cope with its impacts. Migration however is not true in every circumstances and vary widely with time and space. Environmental causes of migration is more pronounced among other drivers of migration with the rapid alternation in the ecosystem. Migration has been acknowledged as a problematic out-come of global environmental change, which is also sidelined by migration scholars (White, 2008), but the truth about how the choice of migration provides the resource to sustain livelihood (Black et al., 2011) is barely addressed.

CHAPTER III: MATERIALS AND METHODS

3.1 Study area

Nuwakot district, part of Bagmati zone, is one of the seventy-five districts of Nepal with Bidur as its district headquarters. It covers an area of 121 km^2 and Elevation ranges from 457m to 5144m and has a population of 277,471 in 2011 (CBS, 2011). The district with historical significance such as located in the village of Devighat at the confluence of the Tadi and Trishuli River and is surrounded by Sindhupalchowk in the East, Kathmandu and Dhading in the South, Rasuwa in the North and Dhading in the West.
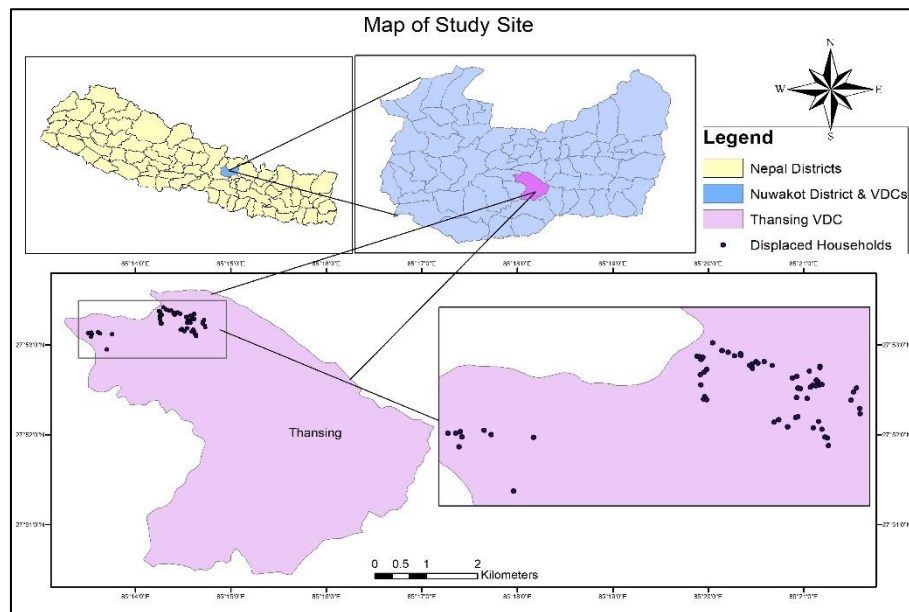
Figure 1: Study area

Thansing is a VDC in Nuwakot District in the Bagmati Zone of central Nepal. At the time of 2011 Nepal census, it had population of 6126 people living in 1388 household CBS, 2011). Thansing VDC contains a government affiliated school "Shree Mahindra Higher Secondary School". It is situated in the middle of village, giving the higher education to the locals. There are many religious places to visit in Thansing mainly Jalpa Devi, Mahadev Temple and Kalika Devi Temple. Belaspur is village of Thangsing VDC where the environmental stress of migration in form of water scarcity was observed. The village in response to water scarcity displaced toward downhill within same administrative boundary which is major subject of investigation in this research.

3.1.1 Climatic profile

Nuwakot district is located in the central part of Nepal and is prone to facing natural hazards including soil erosion, forest degradation, and drought. On top of that in recent years, Nuwakot has been experiencing noticeable evidence of climate change. The climatic data from Nuwakot climate station shows an increasing trend of temperature. The 26 years (1984-2010) temperature analysis shows that average annual maximum and minimum are decreasing. On the other hand, 38 years (1972-2009) rainfall data indicates decreasing trend with pronounced inter-annual variability. Nuwakot district is highly vulnerable to landslide hazard. Besides this, the rainfall/temperature and ecological vulnerability is moderate. However, the overall vulnerability index for Nuwakot is very low (GoN/NAPA, 2010).

The adaptation capability for Nuwakot is high in terms of infrastructure and technology, while the socio-economic adaptation capability is relatively low. In general, the combined adaptation capability is moderate (GoN/NAPA, 2010).

3.1.2 Socio economics

Table 1: Key development statistics of Nuwakot District (CBS, 2011).

Population	277471
% change in population 2001-2011	-3.8
% change in population 1991-2001	17.6
Population growth rate	-0.4
% of household headed by male	78.7
Literacy rate 2001	51.4
% of HH with Tap piped as source of Drinking water	87.6
% of HH with Tube well/pump as source of Drinking water	0.1
% of HH with Covered Well as source of Drinking water	1.0
% of HH with uncovered Well as source of Drinking water	3.8
% of HH with spout as source of Drinking water	5.8
% of HH with river as source of Drinking water	0.6
% of HH with wood as cooking fuel	89.8
% of HH with Kerosene as cooking fuel	0.6
% of HH with LPG as cooking fuel	6.6
% of HH with Dung as cooking fuel	0.0

% of HH with Bio gas as cooking fuel	1.9
% of HH with Electricity as cooking fuel	0.1
% of HH with Electricity as lighting	83.0
% of HH with Bio gas as lighting	13.2
% of HH with Solar as lighting	0.2
Economic Activity Rate, 2011	60.8
Poverty Rate (% of district population)	20.3
Total Area available for Cultivation(Hectare)	69,445
Total area of cultivated land(Hectare)	43,677
Irrigated land area as a percentage of total holdings area	41.6
Overall Land (Ha)	31783.0
Irrigable Total (Ha)	15047.0
Irrigated Total (Ha)	6473.0
Road Density (Km/ 100km2)	13
Telecommunication services (Telephone lines)	2000

3.2 Methods

The study is primarily based upon the broad social science research methods such as ethnographic survey with heavily relied review of secondary data relating climatic data recorded over time and space. Furthermore, supplementing review was done from different published and unpublished journal, articles, papers, e-papers, newsletter etc.

Ethnographic survey was partially supplemented by selected Participatory Rural Appraisal tools (Fowler, 1998; Babbie, 1990) like Checklist survey, Village Group Discussion and Key Informant Interview along with further field observations to collect field data. One village discussion was conducted in Belaspur, a village in Thansing VDC, for the identification of environmental stresses based on the people's perception. Furthermore, the pre designed checklist survey was done to test the foresights framework, which was done by household level interview. Rainfall and temperature data were collected from Department of Hydrology and Meteorology. These rainfall, temperature data were collated with the peoples' perception data for triangulation and cross validation of the research findings. The information gathered were processed, tabulated, analyzed and expressed in different pictorial devices.

3.3 Research design

The research design refers to the overall strategy that is chosen to integrate the different components of the study in a coherent and logical way, thereby, ensuring the effectiveness of addressing the research problem; it constitutes the blueprint for the collection, measurement, and analysis of data (Vaus, 2001).

The research is based on the descriptive research design concept. The study has fit the element of both quantitative and qualitative research approach. The qualitative information drawn from the field to know the trend, composition and pattern of migration is expressed in the numerical continuum and quantitative data drawn from the climate change analysis is collated with the qualitative information. The information drawn from both the approach is presented and described as descriptive research involves gathering data that describe events and then organizes, tabulates, depicts, and describes the data collection (Glass & Hopkins, 1984).

3.4 Research process


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                    │  Problem identification │
                    └─────────────────────────┘
                                 ↓
                ┌─────────────────────────────────┐
                │ Checklist formulation for the   │
                │            village              │
                └─────────────────────────────────┘
                                 ↓
                    ┌─────────────────────────┐
                    │     Data collection     │
                    └─────────────────────────┘
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Secondary	Primary Data
Hydrological data from DHM & local stations, Newsletter, Bulletins,	Oral history taking, Checklist survey, FGD & Key Informant Interview

Socio-economic classes

Water availability/ Stresses

Human-wildlife conflict

Land underutilization

Climate data analysis

Data tabulation

Data Processing and analysis

Generalization and interpretation

Draft report

Review by Mentor

Final report

Presentation

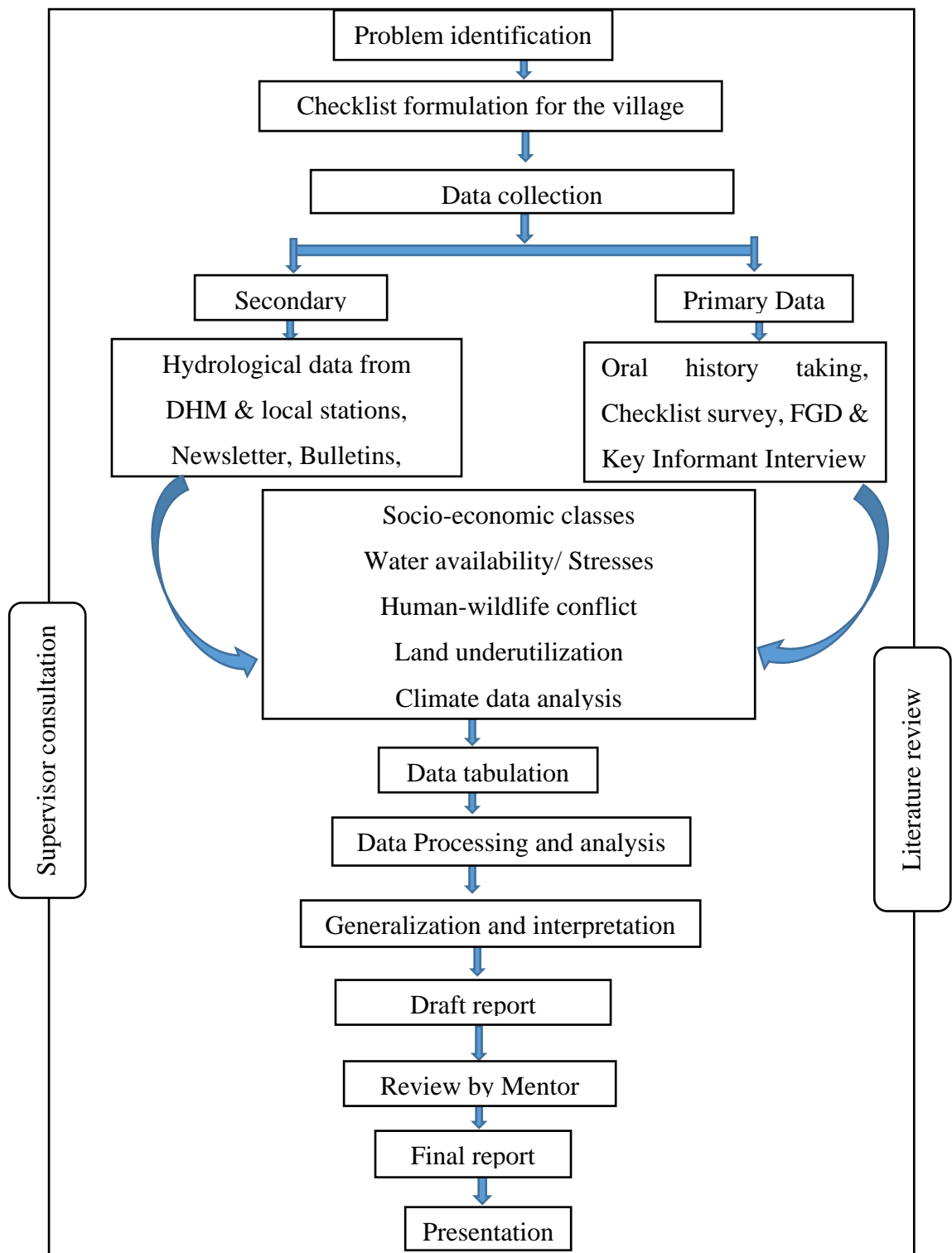Supervisor consultation

Literature review

Figure 2: Research process

To collect perception data checklist (Appendix I) was designed to achieve against each objective through primary data collection. These check lists were used to cross validate and extract information from the community. Secondary data are collected from different published and unpublished journals, articles, newsletter, papers and e-papers which were tabulated, processed, collated, analyzed for reference to compare and contrast with the present research findings. After a brief review of the literature on the content, research methodology and previous research findings, a draft proposal was drafted to discuss and further refine the framework with the supervisors and other professionals. Review of literature is done throughout the work. Final report is submitted and paper is presented. Figure1 shows the process of the research.

3.5 Conceptual framework

It aims to explain first, what drives migration, and then focuses attention on how global environmental change might influence these migration drivers in the future. The framework acknowledges that migration is already occurring in most parts of the world, as a result of a variety of factors, rather than there being a wholly new migratory phenomenon which is attributable to environmental change.

Conceptualized as a pentagon (Figure 3), the framework groups a wide range of migration drivers into five categories: social, political, economic, environmental and demographic. In each case, it is the existence of spatial and temporal variability in one or more of these five dimensions that creates the conditions (or 'drivers') for migration, allowing that these might interact or overlap in different ways in different places.

The proposed framework, applicable to both international and internal migration, emphasizes the role of human agency in migration decisions, in particular the linked role of family and household characteristics on the one hand, and barriers and facilitators to movement on the other in translating drivers into actions (Black et al., 2011). The drivers of migration indicated at the edges of the pentagon differs spatially or temporally from each other akin in some respects to Lee's (1966) conceptualization of the 'push-pull' factors that influence migration.

Five drivers of migration: The five drivers rarely act in isolation, and the interaction of the five drivers determines the details of movement.

1. Social: Social drivers include familial or cultural expectations, the search for educational opportunities, and cultural practices over, for example, inheritance or marriage.
2. Economic: Economic drivers include employment opportunities and income differentials between places.
3. Political: Political drivers cover not only conflict, security, discrimination and persecution, but also the political drivers of public or corporate policy over, for example, land ownership or enforced relocation.
4. Environmental: The environmental drivers of migration are exposure to hazard and availability of ecosystem services such as water availability.
5. Demographic: Demographic drivers include the size and structure of populations in source areas, together with the prevalence of diseases that affect morbidity and mortality.

Terminology used for various responses to environmental stress in line with Human Development Report, 2009.

Displacement: Displacement is a particular form of migration, in which individuals are forced to move against their will.

Mobility: Human mobility (or 'movement') is defined as the ability of individuals, families or groups of people to choose their place of residence.

Migration: Migration or migrants is to refer to individuals who have changed their place of residence either 'by crossing an international border (international migration) or by moving within their country of origin to another region, district or municipality (internal migration). 'Migration' is used as an umbrella term which incorporates two types of movement: voluntary 'migration' and involuntary 'displacement'.

Trapped: Large populations who do not migrate, yet are situated in areas under threat, will be at risk of becoming 'trapped', where they will be more vulnerable to environmental shocks and impoverishment. Those who stay behind, and indeed those who are unable migrate and who become trapped in parlous environmental circumstances is known as trapped population.

Foresights framework of drivers of migration

Personal/household characteristics
Age, sex, Education. Wealth, Marital Status, Preferences, Ethnicity, Religion, Language

Environmental

Political

Social

The influence of environmental changes in drivers

Demographic

Economics

Decision

Move

Choose to leave (Migrate)

Force to move (Displace)

Stay

Unable to move (Trapped)

Choose to stay (Immobile)

Intervening obstacles and facilitators

Political/Legal framework
Cost of moving
Social networks
Diasporic links
Recruitment agencies
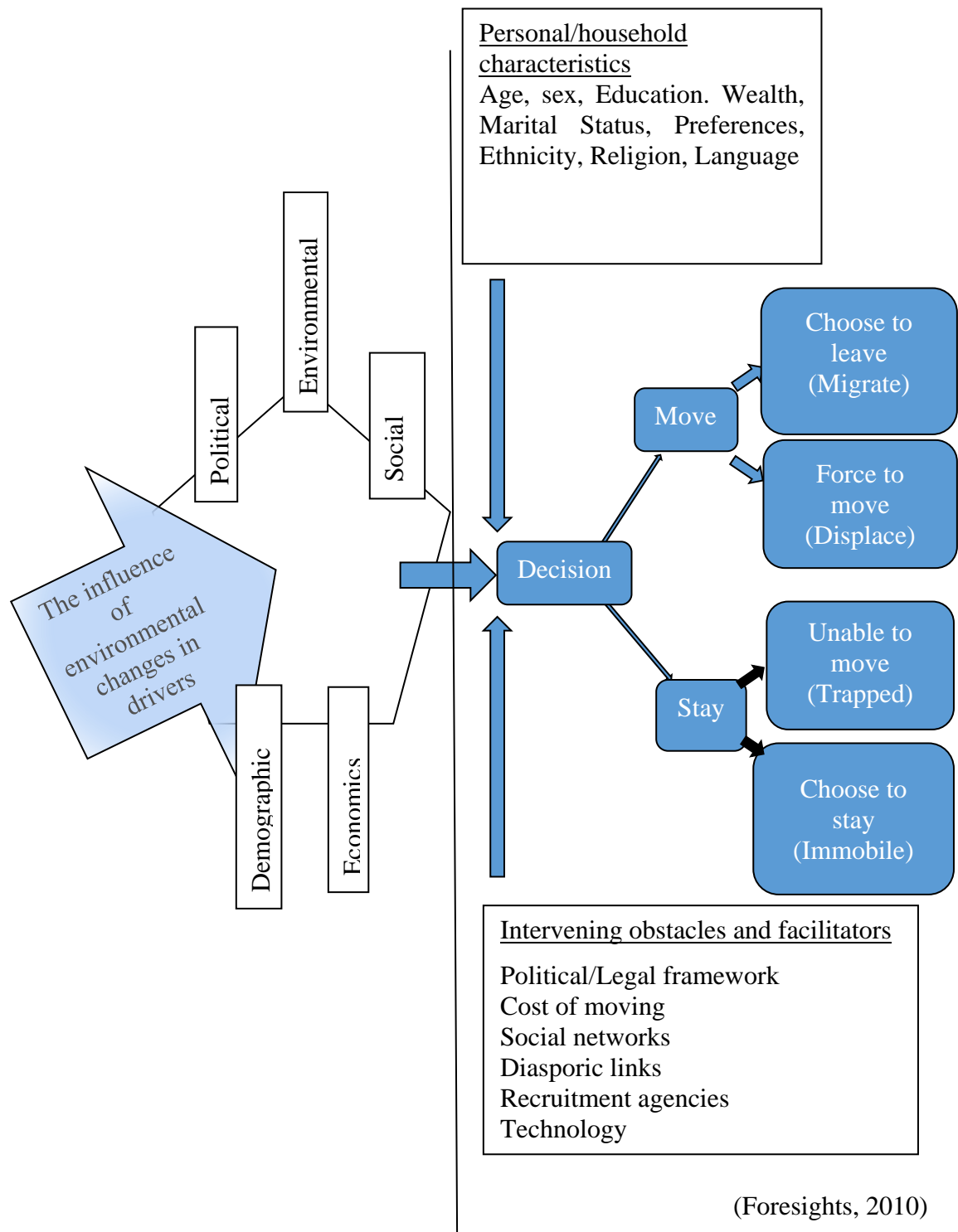Technology

(Foresights, 2010)

Figure 3: Conceptual framework

3.6 Methods of data collection

3.6.1 Primary data collection

Household survey

All the 76 household within Belaspur was surveyed adopting census approach of data collection. Oral history taking was done in every household. The checklist survey was focused in three different broad categories i.e. socioeconomic parts, climate change in different forms of rainfall and temperature affecting water availability and livelihood of migrants and trapped people. Information on the trend of migration, decisions of migration, pushing and pulling factors of migration, choice of destination, difficulties during the stay in environmentally stressed area, livelihood options in the destination were major interest during the study.

Key informant interview

To build up an idea on the migration issue, informal discussion and interview with key informant was conducted. KII was done with VDC secretary, Assistance secretary and President of Belaspur Drinking Water Plan. The interview was focused on the general description of the research site along with extraction of idea on the migration domain, climate issues and livelihood.

Focus group discussion

Village discussion was carried out in one location to draw the information about the environmental stress in the village. Discussion was mainly focused on the consequences caused by the stresses. The major participants were the elderly people (Photograph 3) who were intentionally involved in the discussion as the history of the extreme environmental events and its impacts along with the other social dimensions could be best portrayed by that very age group of people.

Observation

Direct field observation was carried out around the research sites for additional information and for field verification. Land underutilization, Human-wildlife conflict, vulnerability among the trapped population, dried springs were few field based observation to validate the information obtained from the respondents.

3.6.2 Secondary data

Secondary data were extracted from published and unpublished documents, newsletter, journal, bulletins, annual reports and relevant articles. VDC profile was collected from

the VDC office, Thansing. Rainfall and temperature (1971-2016) data were collected from Department of Hydrology and Meteorology (DHM) of the station PA 100471 1in Nuwakot.

3.7 Data analysis

Data analysis includes collation of primary and secondary data. Primary data were interpreted using secondary data to authenticate the finding of primary data. The data and information collected were tabulated in the MS-Excel-2010, R package (R core team, 2013) and MS-Word 2013 and was used for data processing, data analysis and interpretation of information collected. Missing weather data were imputed using predictive mean method (Yuan, 2010). The results were then presented in a variety of forms including tables, graphs, charts and pictorially. The data were analyzed by using different statistical tools. The results thus obtained were presented pictorially in charts, diagram, graphs etc.

3.7.1 Climatic data analysis

All the data are analyzed using R package (R Core Team, 2013) . Missing data are common in the raw data sets of DHM. Missing weather data were imputed using predictive mean method (Yuan, 2010). Five multiple imputations were carried in order to best predict missing data. Climate data were analysed by carrying out time series analysis and trend analysis (Mudelsee, 2013)) in R. Significant of the trend was analysed using Mannkendall test (Yue, Pilon, & Cavadias, 2002).

3.7.2 Socioeconomic class assessment

Assessment of socioeconomic status (SES) is an important aspect in community based studies (Card, 2009). Several methods or scales have been proposed for classifying different populations by socioeconomic status, Kuppuswami Index, 1976 is one among them. Since this index was developed quite earlier and in the context of India, this study has used modification to the Kuppuswami's scale for use in Nepal, which takes into account the current national price indices of Nepal. In the modified scale, the educational and occupational criteria remain the same because of similar educational and occupational milieu in India and Nepal. To modify the economic criteria, initially the family income per month of each group, which is stated in Indian Rupees (INR) in the original scale, is converted to Nepalese Rupees (NPR) by multiplying with 1.6 (INR 100 is equivalent to NPR 160). In addition, the National Urban Consumer Price Index

(NUCPI) for Nepal is noted for the current year from the website of Nepal Rastra Bank, Nepal (NRB, 2009).

The definition and criteria of indicators used in the score card is applicable also in context of Nepal, as it was first designed for India. However, the scores given to each indicators is obtained from the Modified scale designed for Nepal. A profession is a vocation founded upon specialized educational training, the purpose of which is to supply disinterested objective counsel and service to others, for a direct and definite compensation, wholly apart from expectation of other business gain. A semi-profession is an occupation that requires advanced knowledge and skills but is not widely regarded as a true profession. Traditional examples of semi-professions include social work, journalism, librarianship, teaching and nursing.

Table 2: Score card to assess the socioeconomic status of the study area

Education	Score
Professional or Honors	7
Graduate or Post-Graduate	6
Intermediate or Post-High-School Diploma	5
High School Certificate	4
Middle School Certificate	3
Primary School or Literate	2
Illiterate	1
Occupation	
Profession	10
Semi-Profession	6
Clerical, Shop-owner, Farmer	5
Skilled worker	4
Semi-skilled worker	3
Unskilled worker	2
Unemployed	1

Table 3: Modified family income groups in Nepalese rupees of the Kuppuswamy's socioeconomic status (Modified for 2009).

Original*	Modified**	Score
>-2000	45751	12
1000-1999	22851-45750	10
750-999	17151-22850	6
500-749	11451-17150	4
300-499	6851-11450	3
101-299	2301-6850	2
<_100	2300	1

*In Indian rupees **Rounded off to nearest 50 in NRP   (Source: Urban, 1976)

Table 4: Socioeconomic classes based on the score obtained from score card

Total Score	Socioeconomic Class	
26-29	Upper (I)	
16-25	Middle	Upper Middle (II)
11-15		Lower Middle (III)
5-10	Lower	Upper Lower (IV)
<5		Lower (V)

(Source: Card, 2009)

CHAPTER IV: 4. RESULTS

4.1 Climate trend

4.1.1 Precipitation

Missing data pattern of precipitation

This plot shows the pattern of missing precipitation data of Nuwakot station. For the month of October, most of the data were missing. Missing weather data were imputed using predictive mean method in R. Five multiple imputations were carried in order to best predict missing data.
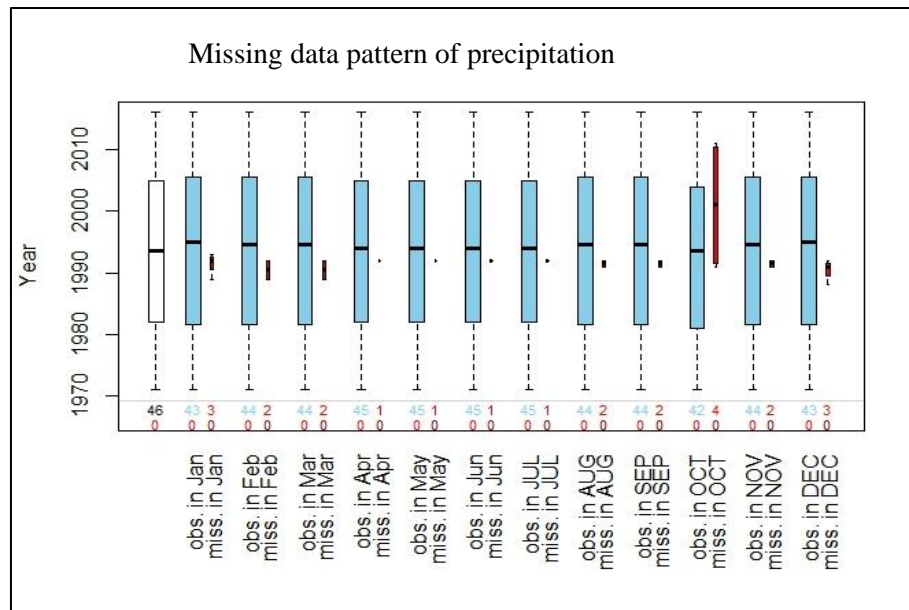
Figure 4: Missing data pattern of precipitation

Distribution of monthly precipitation
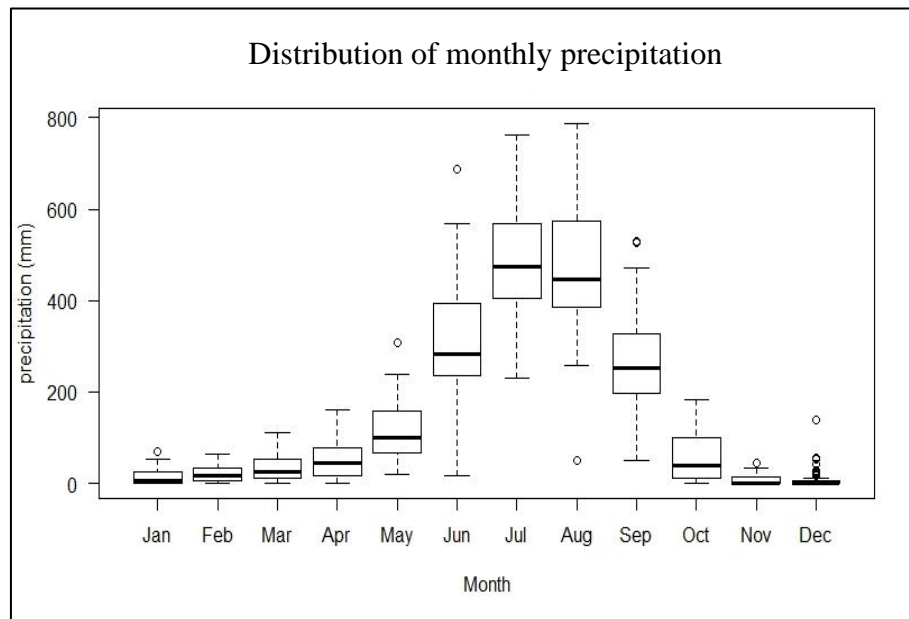
Figure 5: Distribution of monthly precipitation

This plot (Figure 6) shows the distribution of monthly precipitation over the period 1971-2017. Highest rainfall occurred during August while least during December. Post monsoon (June, July, August and September) receives highest amount of rainfall.

Time series of precipitation

This graph (Figure 6) shows the time series of precipitation over the period 1971-2017. This series is composed of three components; seasonal effect, trend and the random component. This series clearly shows the seasonal effects. Decomposing the series gives clearer picture of the effect and all the component.
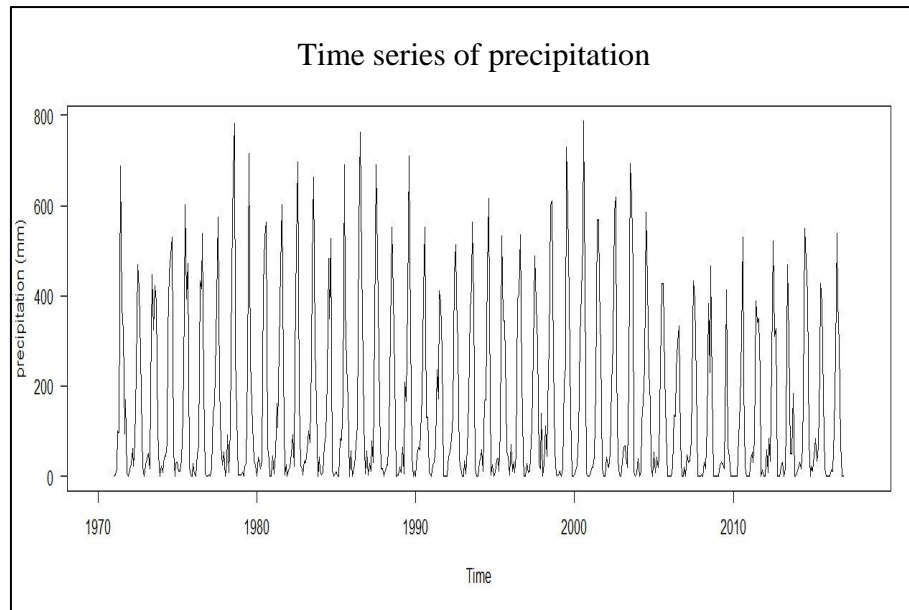
Figure 6: Time series of precipitation

Decomposition of additive time series
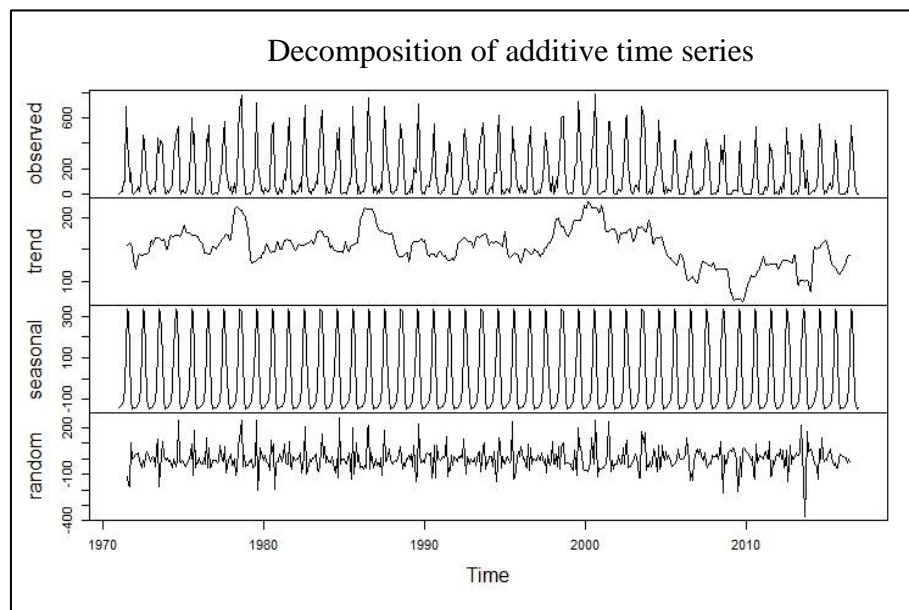
Figure 7: Decomposition of additive time series

Decomposition of precipitation trend
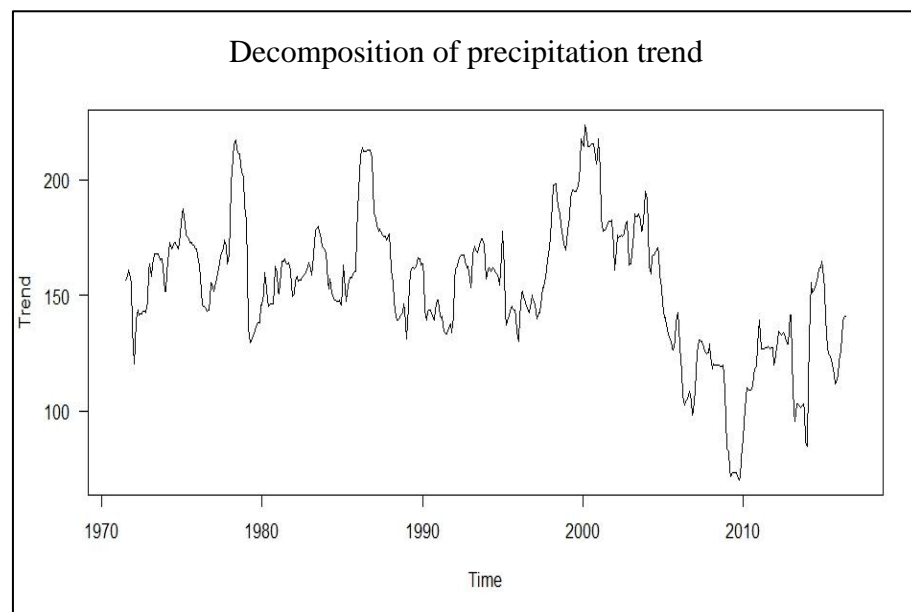
Figure 8: Decomposition of precipitation trend

Decomposed PPT trend shows the overall trend of the series. Cyclic pattern of precipitation increase is observed every decade until 2000 AD, after which precipitation regime is found to be shifting lower than the previous decades.

Annual precipitation trend

This graph (Figure: 9) shows inter annual variability in precipitation. Annual precipitation trend captures the overall trend of the precipitation series. Decreasing trend of annual precipitation is observed. This trend is significant (p=0.010014 as of ManKandall test) and monotonic.
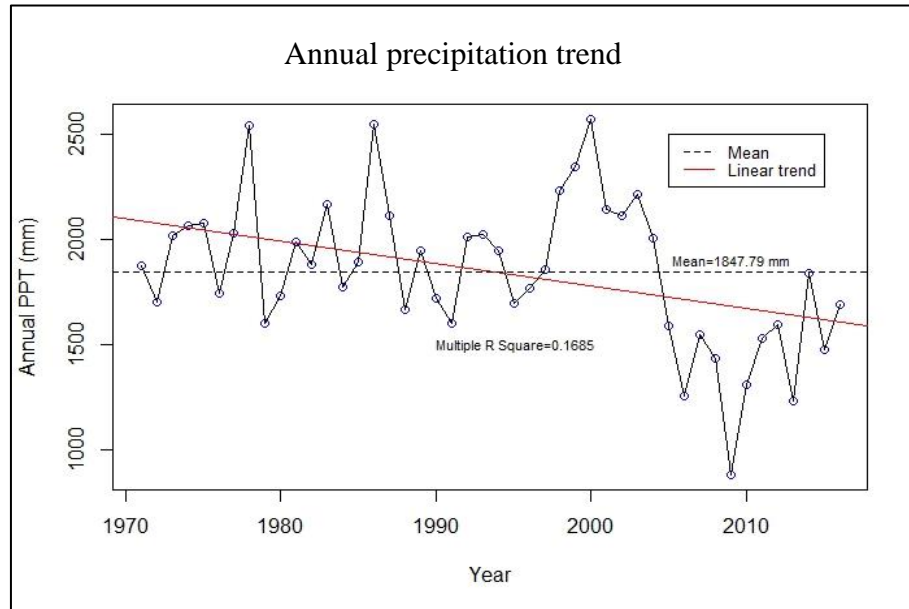
Figure 9: Annual precipitation trend

Residual plot

The residual plot (Figure 10) also indicate that the trend to be significant.
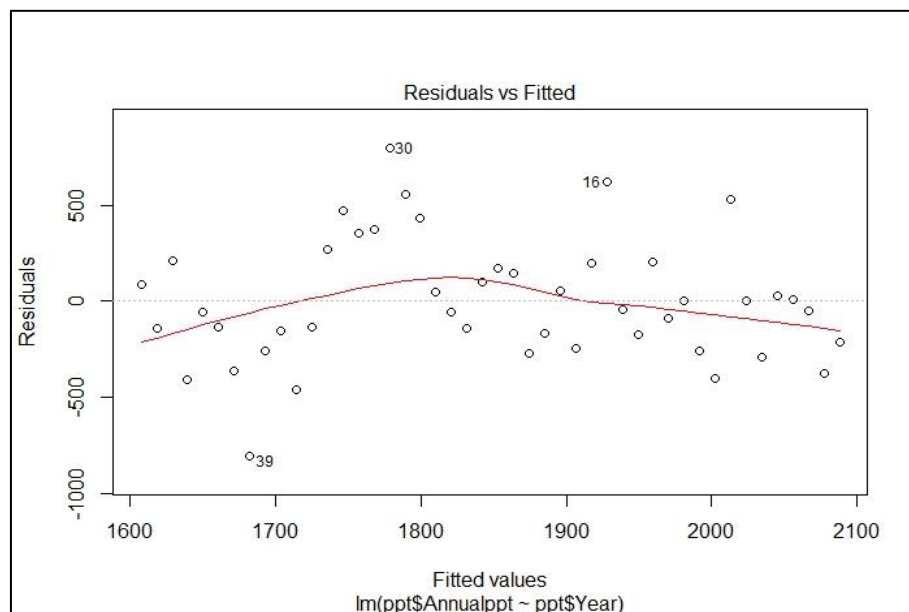
Figure 10: Residual plot against fitted plot

4.1.2 Temperature

Missing data pattern of temperature
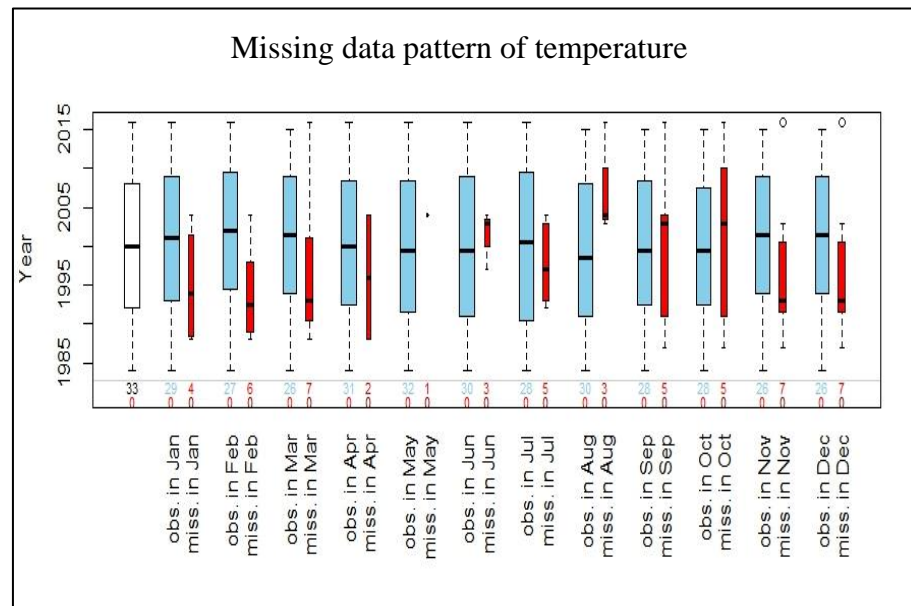
Figure 11: Missing data pattern of temperature

Distribution of monthly temperature
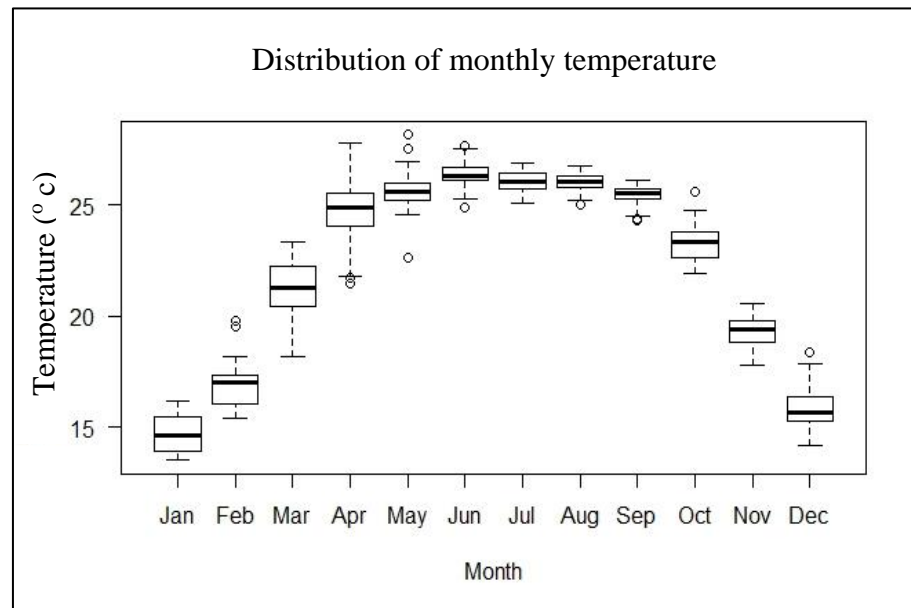
Figure 12: Distribution of monthly temperature

Time series of mean annual temperature
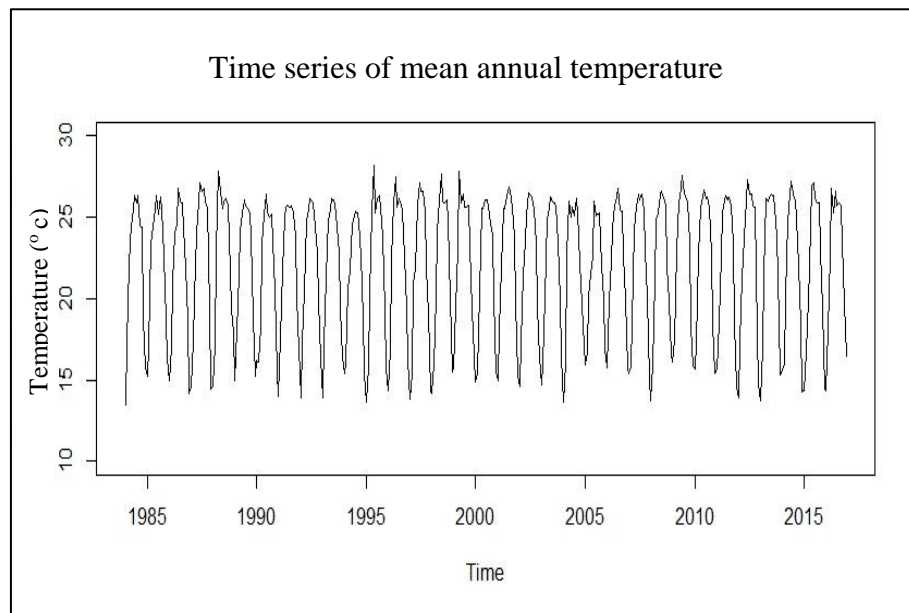
Figure 13: Time series of mean annual temperature

Decomposition of additive time series
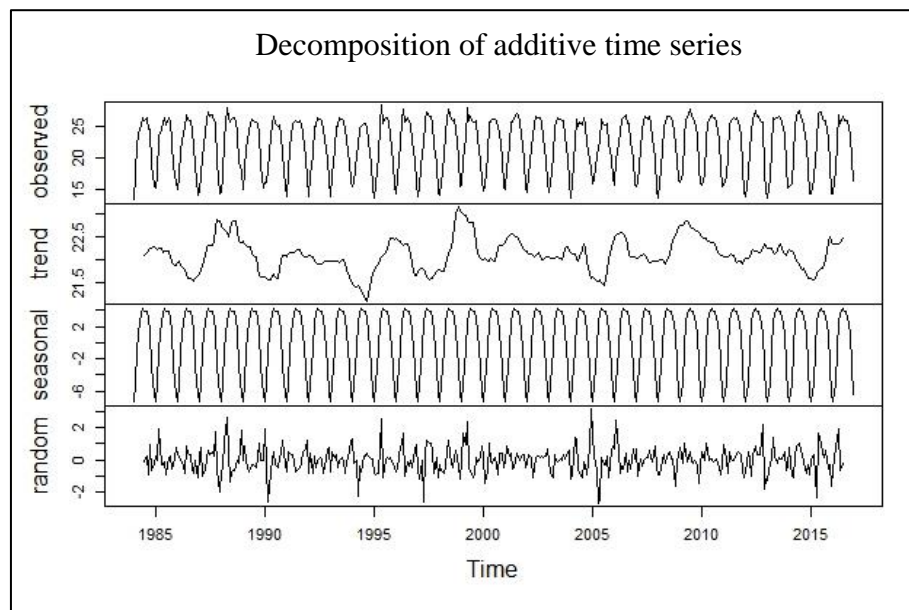
Figure 14: Decomposition of additive time series

Decomposed trend
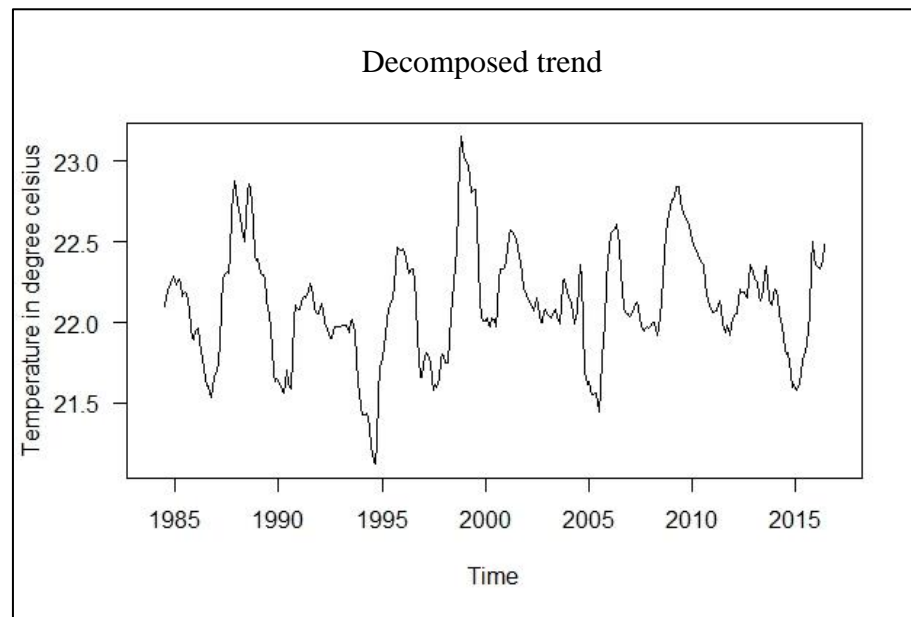
Figure 15: Decomposed trend

Mean annual temperature
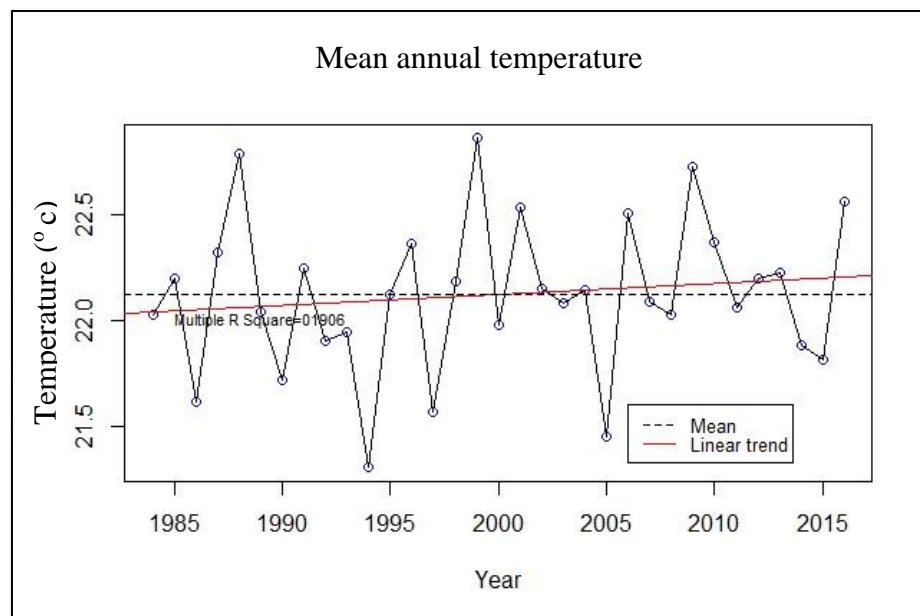
Figure 16: Mean annual temperature trend

Slight increasing trend of Mean Annual Temperature is observed but the trend is not significant. (p =0.48554). Same thing is indicated by residual plot below.

Residual plot against fitted plot
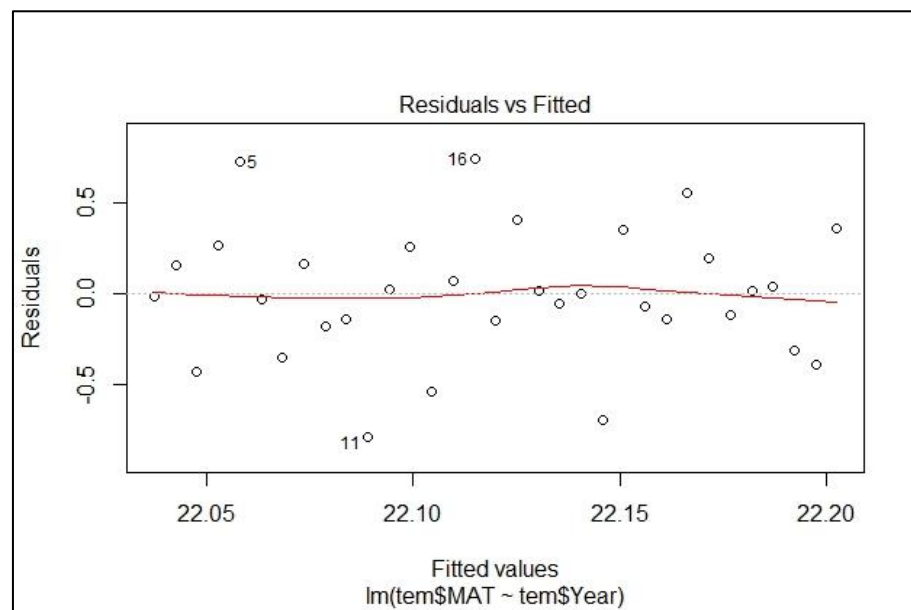
Figure 17: Residual plot against fitted plot

Inter annual variability in precipitation was observed with decreasing trend in precipitation and increasing trend in Mean Annual Temperature was found.

4.2 Historic profile

Belaspur, a beautiful village which is named after a meaningful Nepali phrase, called Belasur (*Belaima suru vayeko*), which literally means 'started earlier'. The settlement in the village started some 100 years ago. The key natural resources such as water was abundant enough to attract households to settle in this very place as compared to the other neighboring villages.

As the population size increased competition for drinking water also increased, which was in turn exacerbated by drying of the springs sources. Spring water was the lifeline for the inhabitant's community, but the uncertainty to comprehend the hydrogeology that governs the occurring and movement of water in underground aquifers is often a difficult thing in the midst of change in the climate, socio-economics, demographics and infrastructure, which has led toward the water insufficiency. As water cannot be substituted by any other sources, migration in response to the water stress was pronounced in the village. The households started to displace since late 70s and the pace of displacement is still continuous.
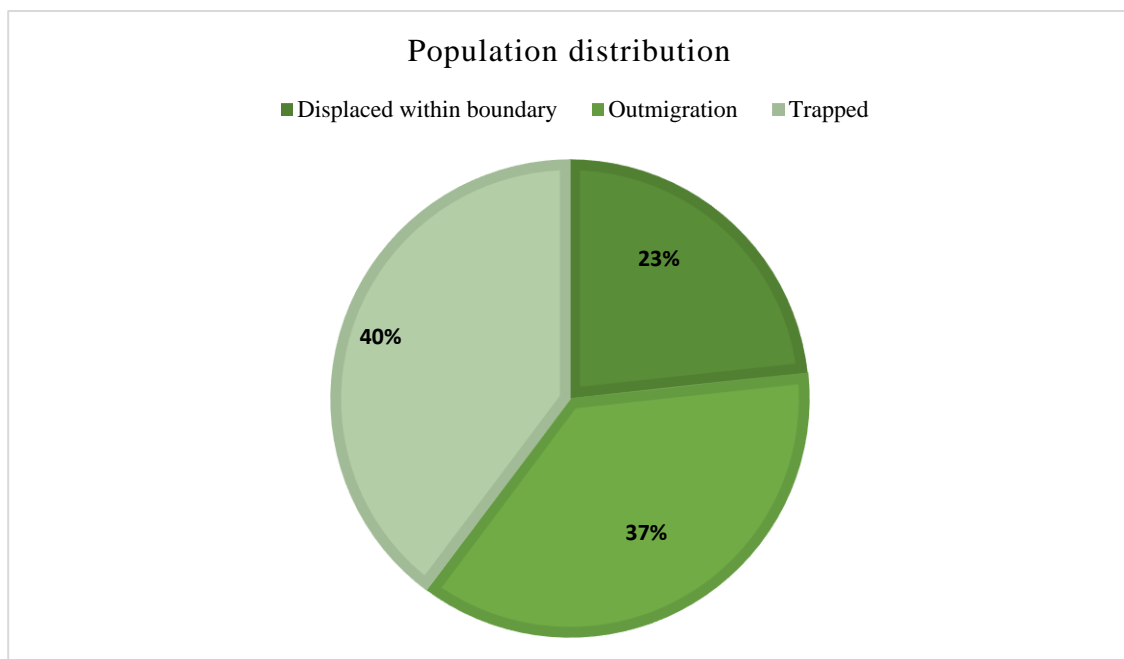
Figure 18: Distribution of migrants and trapped population

73% of houses were displaced within the VDC while 13 % of houses were out migrated toward nearby urban centers like Kathmandu and Chitwan. 14 % of households were compelled to stay in the environmentally stressed place. This trapped population were compelled to stay back in the environmentally stressed area because of the resource constraints (Figure 4) and lack of networks.

4.2.1 Trend of migration

The trend of Migration started from 1974 A.D and it's continuous till date. The trend was peaking during late 90s when country just stepped in the process of economic liberation. The trend was however exacerbated by recent devastating earthquake of 2015 A.D.
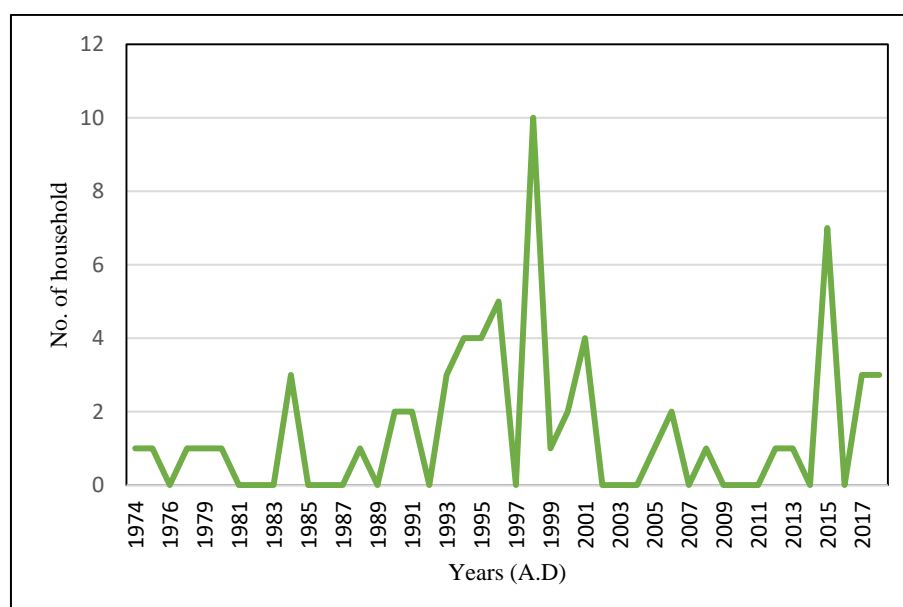
Figure 19: Trend of migration

4.2.2 Socioeconomic profile

The assessment of socioeconomic status is important aspect in the community based studies. Modified Kuppuswami Index (2009) was used to classify the entire community into five socioeconomic classes. Evaluation of the socioeconomic status was done by incorporating major indicator of human well-being such as Education, Profession and Family income. Each of the indicators has sub-indicators which has been indicated in the Table 2 in Chapter III. Large percentage of the community (45%) belonged to lower middle class family while only 6% belonged to upper class family, followed by upper middle by 8%, upper lower by 11% and lower by 9 %.
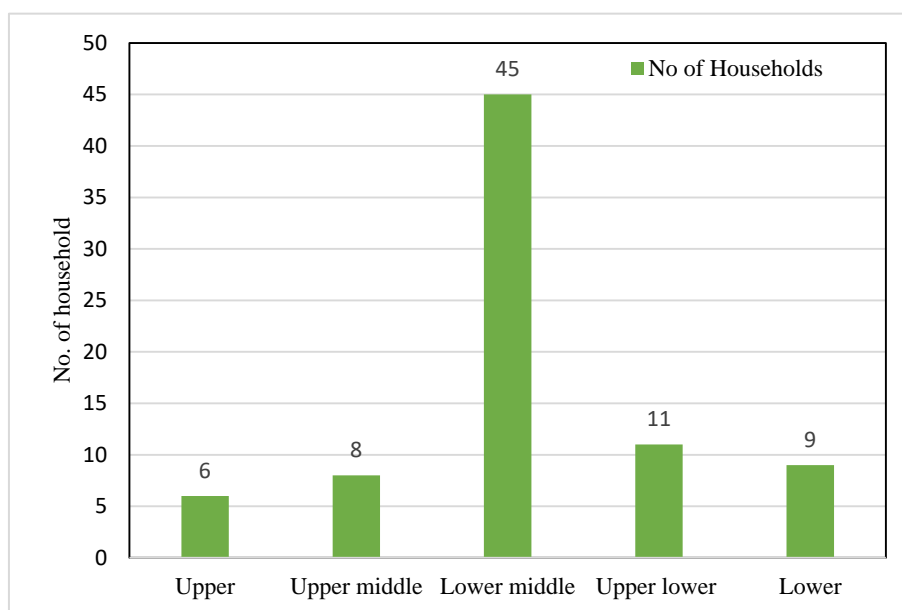
Figure 20: Socioeconomic division of the community

Caste composition

The majority of the village was found to be Brahmin (67 %), followed by Mijar (25 %), Cheetri (4 %) and Newar (4 %). The trapped population in the environmentally stressed area were found to be Mijar (11 household) with only one household of Brahmin.
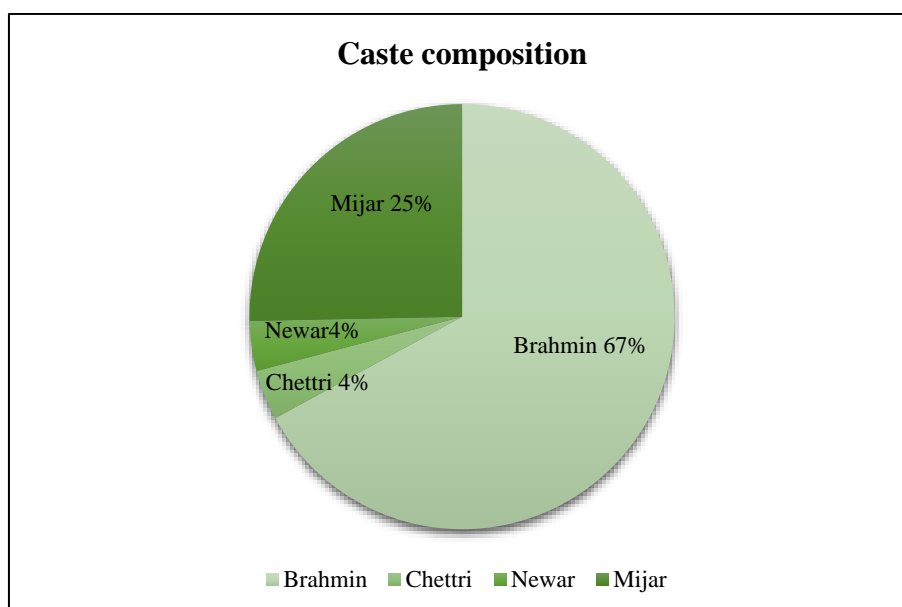
Figure 21: Caste composition of the community

4.3 Drivers of migration

Environmental driver among all other drivers of migration was found to be the initiator of migration decision in the study area. Water scarcity which is a prominent indicator of environmental driver was acknowledged to be dire consequences of environmental change. It led towards the displacement of the entire community from uphill toward low hill within the same administrative boundary. The destination within the boundary had abundance of water resources and hence become a strong pulling factor. The other drivers of migration however stands weak and only as perpetuator of migration decision as they were observed only after few decades of environmental motivation of migration. Though the wide range of migration drivers has been considered in the Foresights framework (Figure 3), the spatial and temporal variability in one or more of these five dimension resulting the condition for migration, either by interacting or overlapping in different ways in different places. The relation of various pull and push factors plays a significant roles to either initiate or perpetuate the migration decision. The relevant indictors among each of the drivers of migration was stressed during the oral history taking (Table: 1).The self-reported motivation of migration is presented in figure 6. The following chart shows the indicators used during the survey which is adopted from Foresights framework.

	Drivers of migration	Relevant indicators adopted from Foresights framework
1	Environmental driver	• Ecosystem services • Habitability • Water stress
2	Social driver	• Seeking education
3	Political driver	• Conflict
4	Demographic driver	• Population size • Population density • Population structure
5	Economic driver	• Employment opportunity • Producer and consumer price (agriculture)

Table 5: Indicators adopted from Foresights Framework for drivers of migration

Self-reported migration motivation
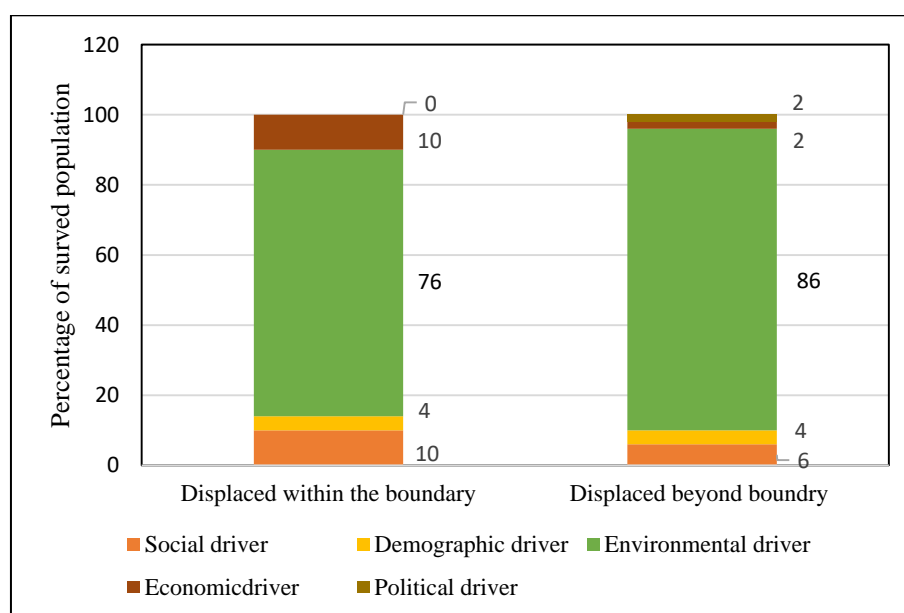
Figure 22: Self-reported motivation for migration

All the above mentioned indicators (Table 1) were incorporated to weigh the various motivation of migration during the oral history taking. Environmental drivers summoned to be the most motivating driver of the migration which represented 76% among those who displaced within the boundary of the Belaspur VDC, and 86% among who out migrated.

Political driver: Conflict

The social conflict, which was among the subtle consequences of the scarcity of water resource, also an unaddressed issues among the drivers of migration even in the Foresights framework was observed in the community. The stress upon the same water resource at same collection time led toward unhealthy relationship among the neighbor. The case was filed in the Central District Office (CDO) to claim for the justice by one family some 16 years ago. Other unofficial conflicts among the family was also seen in the community.

Demographic driver: Family structure

Most of the family, very interestingly got nuclear in family structure while being displaced from uphill toward low hills. Women work load specifically due to water collection in a joint family triggered in restructure of family. Ambika Dhital, now lives in a nuclear family acknowledge work load regarding the water collection in joint family as major decision of migration.

Social driver: Education

Only one school named as Sarva Dev Primary School was in the village. Every students after primary schooling were compelled to walk a distant miles to reach school in another village.

Economic driver: Access to road

The Tokha Galchi highway was constructed in 1980. The irrigable land (khet) lying along the road was always the reason for majority of people to migrate down the hill in the proximity of their khet. The market for the potatoes and other cash crops such as onions and garlics also flourished there.

4.4 Major environmental stress: Water scarcity and its implication

Water is fundamental to people's livelihood and agricultural production and cannot be easily substituted. Almost all the respondent claimed that water scarcity has become the major initiator in the decision of migration.

4.4.1 Gender dimension of water stress

The availability of water in the source was seasonal, and it was only during monsoon when 15-20 minutes of walk was enough for one *gagri* (12-16 liters) of water i.e. in average a family needs 8-10 gagri of water and they have to travel 3 hours per day during monsoon.

While during dry season, when people are compelled to fetch water from distant source, the average time a family spends for water collection becomes 10 hours per day. In addition, the time people spend in queue sometimes varies from 1 hours depending upon the competition in the source. It is women who is responsible for management of household water requirement, and the task associated with water collection is most often their responsibility while male members are responsible for irrigation. Since there is no any irrigation facility in the uphill of Belaspur village, historical work division for men to manage water was not seen.
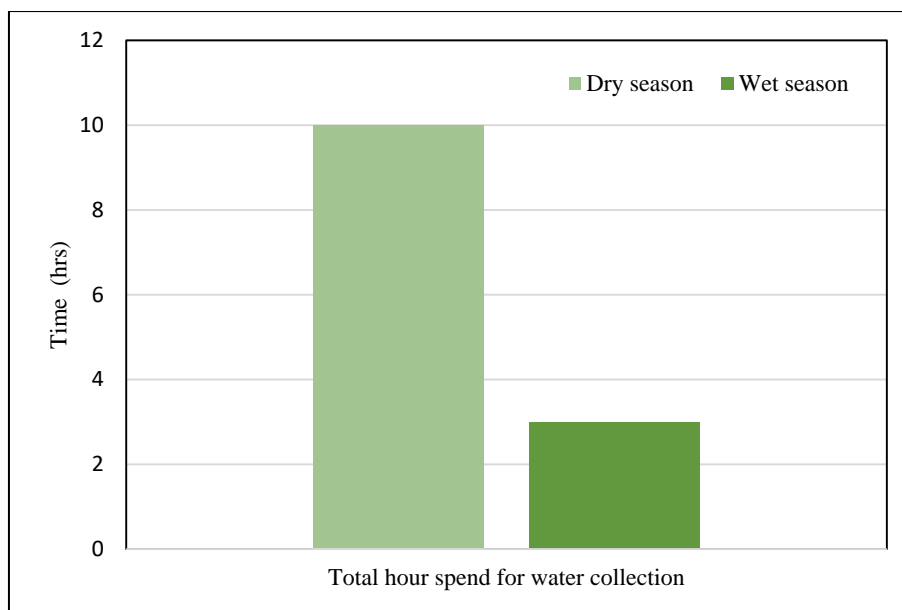
Figure 23: Total hours spend for water collection

4.4.2 Impacts of water drudgery in women

Though the work associated with water collection looks normal, but doing it year after year has left those water collector group, i.e. women to suffer from various health problems like back muscle sprain and strain as long term impacts. The following chart shows the short term problems faced during the course of water collection expressed with relation to the respondent.
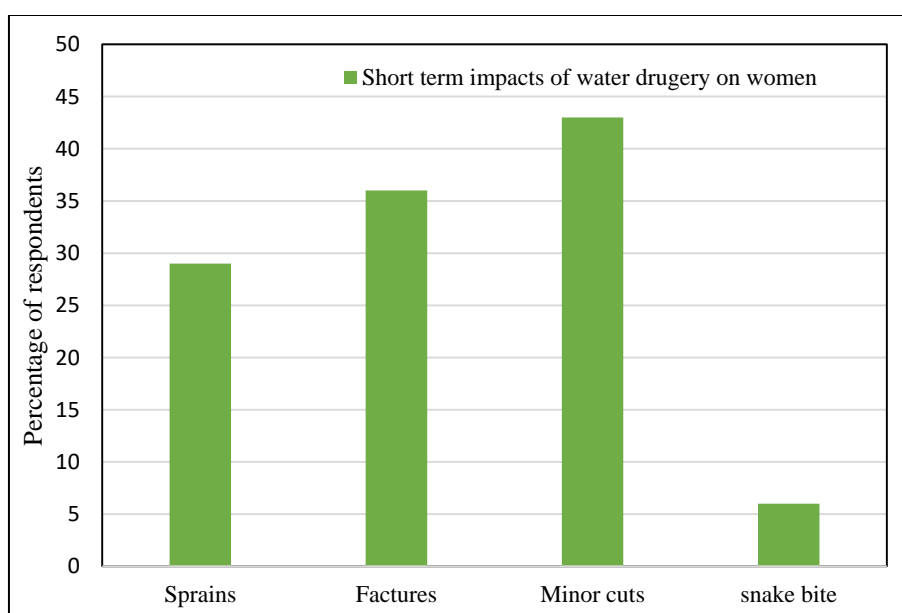
Figure 24: Problems faced during water collection

4.4.2 Lack of sleep and its health implication

An old women, in her 80s shares how hard it used to be to wake up at 2 a.m. in the morning to fetch water. Almost all the responded had to sacrifice their morning sleep and getting up at early hours is the only way to ensure that they will get water for the day. This improper sleeping pattern especially among women had significant health impacts both in long and short term. Since it is still dark and the way to stand water source in mountainous terrain is harsh, walking all the way to fetch water keeping in mind about the competition makes the situation scary.

4.5 Impacts of migration both in destination and origin

4.5.1 Trapped population

The group of eleven households, among which 98 % belong to disadvantage group, were found to be trapped in the environmentally stressed area, being more vulnerable to the environmental changes. Majority of trapped population who already were from the disadvantaged groups had no parcel of land to resettle downstream. Trapped population in other hand had no network to access information about the options they could choose than to live in environmentally stressed area.

Effects on trapped population

Positive

Decrease in the pressure in scarce water: The competitor for scarce resource such as water was decreased amazingly as a consequence of massive displacement, though the time and distance covered for the water collection remained same.

Negative

4.5.2 Human wild-life conflict

The conflict in between human and wildlife, basically monkey, porcupine, wild boar and leopard was found to be increasing. While people choose to move from the origin, they leave behind underutilized land parcels with increased wilderness, the reason which made it more favorable for wild animals to interact with humans. The trapped population who couldn't migrate has to face the jeopardy of the animal conflict along with the vulnerability of environmental stress.

4.5.3 Migration and social cohesion

The society comprises of various ethnic group, which with one another varies in term of socioeconomic status. Though the cohesion within the Brahmin and well-off family

worked together toward the well-being of its member by migrating, the isolated bulk of disadvantage group couldn't.

4.5.4 Demotivation in the development

Sarvadev Madhyamik Vidyalaya is only one primary level school in the community demotivating the children who wants to study further, as the higher education was feasible only in distant location which cost higher amount of money and walk to reach there.

Decrease in the emergency reach: Since the pace of development and access to other facility was found to be concentrated in the downhill of the village, the isolated disadvantage community people had to suffer in lack of adequate health services.

4.5.5 Land underutilization

The large parcel of land around 2000 *ropani* was left underutilized in Belaspur as almost all the households were compelled to leave their native place in search of better livelihood. When the water stress strengthened, people choose to migrate down-hill. The new settlement in the destination area lies along the riverside which made them diversify their agricultural activity. With increased irrigation opportunity in destination area people didn't bother to continue farming in the origin which was already loosing productivity due to lack of water.

4.6 Livelihood diversification in destination

Non-farm option

The perpetuator of migration decision, i.e. access to road has provided the option for the displaced community to start non-farm business such as grocery shop (Photograph 5), canteen, and beauty parlor. The infrastructural and technological development in the destination has widen the network and information flow among them has increased.

Potato farming

Potato farming has become very reliable source of income for the people living along the river, as the land gets abundant irrigation and the area has been developed as pocket area for potato farming.

The decision of migration through its interlinked drivers along with other associated outcome is presented in the following schematic representation.
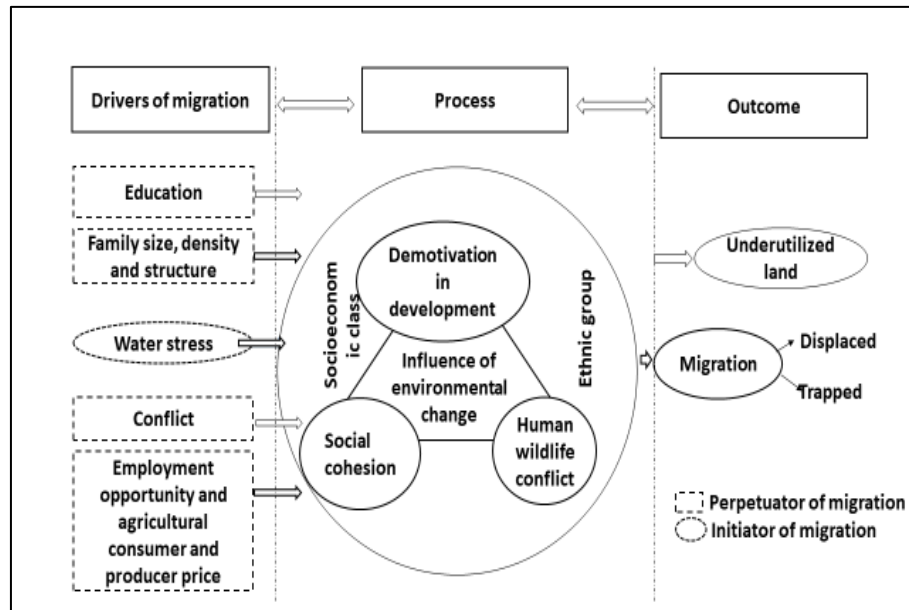
Figure 25: Schematic representation of migration pathway

CHAPTER V: DISCUSSION

5.1 Climatic data analysis

The variability of supply of ecosystem services is cause by the global environmental change. Global environmental change is felt regionally in term of climatic variability like change in rainfall regimes and increase in temperature. Temperature in Nepal is increasing at a high rate in recent years similar to the phenomenon observed globally. The average temperature has increased consistently and continuously, at a rate of 0.05°C/year from 1971 to 2005 (Devkota, 2014). Similarly, the maximum temperature increased by 0.06°C and minimum temperature increased by 0.03°C/year from 1975 to 2005 (Marahatta et. al., 2009). Changes in rainfall regimes was found to follow the national trend in the study area (Figure 9) that lead to changes in the availability of water for domestic and agricultural uses, and also result in direct changes in crop and pasture productivity, leading in some cases to a change in the frequency of crop and pasture failure (Parry et al., 2009). Changing precipitation patterns could reduce or disrupt historic patterns of rainfall and growing cycles, and diminish the water available for irrigation and domestic use resulting to lower agricultural yields and livestock productivity.

Increases in temperature raise the frequency of high-temperature extremes, which can potentially affect land productivity in warmer areas and hence food security by increasing the risk of crop failure (Mendelsohn et al., 2007). Increases in temperature (Figure 16) would increase the frequency of high temperature extremes. Whilst heat-related stress is unlikely to directly drive migration from rural areas, it will affect crop productivity and provisioning ecosystem services (Black et al., 2011).

Vulnerability of a system or group of interest is a dynamic quality that is influenced by the change in the external context, such as rain fall variability (Figure:11 and Figure: 18) as well as internal characteristics, such as the health of household members or the level of individual and household assets (Kirstin et al., 2005). The water scarcity as a major initiator of migration is clearly reflected from the field information, which is supported by the trend analysis result indicating gradual increase in temperature and decrease in precipitation.

5.2 Drivers of migration

Belaspur, the village in Thansing VDC, water scarcity poses a fundamental threat to people's livelihoods resulting slow pace of environmentally motivated displacement leaving behind the large plot of arable land and houses. The pace of transformation of resource abundant village into literally an empty village is accelerated by various socio-environmental factor, with drying off the springs as the most pronounced one. Mountain springs emanating naturally from unconfined aquifers are the primary source of water for rural households in the Himalayan region but due to the impacts of climate change on precipitation patterns such as rise in rainfall intensity, reduction in its temporal spread, and a marked decline in winter rain, coupled with other anthropogenic causes, the problem of dying springs is being increasingly felt across this region (Tambe et al., 2012). Water scarcity, which is an outcome of drying off of the spring and interdependent process of resource competition and land degradation induced by the changing economic strategies of rural households has significant role in the decision of migration. Foresight report exactly emphasis on the role of environmental drivers having quoted as "the environment drives migration through mechanisms characterized as the availability and reliability of ecosystem services and exposure to hazard but individual migration decisions and flows are affected by these drivers operating in combination, and the effect of the environment is therefore highly dependent on economic, political, social and demographic context (Black et al., 2011).

Since, the trend of migration started from early 70s (Figure 1), the trend is still continuous. It was found to be peaking during late 90s and is exacerbated by recent devastating earthquake in 2015 (Figure: 19). The long history of migration in Belaspur comes to peak because of the liberalized economy and political environment of the nation as its only after 1990s labour migration was formalized as an opportunity for employment (Sijapati et. al., 2015). This again supports Foresights theory which acknowledges environmental change to affect migration now and in the future, specifically through its influence on a range of economic, social and political drivers which themselves affect migration. In case of Belaspur, economic driver was found to be functional only after two decades of first migration due to water scarcity while social driver as an aspiration to migrate in seek of education was found to occur lately.

As discussed by Kirstine et. al. (2005) within the same area, people of different social positions, men, women, farmers, herders, foresters may experience different

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consequences as a result of water scarcity. The socio-economic composition of the community was composed of five socio-economic classes (Figure 20), where the upper lower and lower class people were from *dalit,* the community who could not migrate. The socio-economic class of the community was classified based upon the family income, profession and education. The *dalit who* couldn't migrate had no parcel of land down-hill unlike to other households. As discussed by (Black et al., 2011) the scale and direction of movement is linked to the personal circumstances of migrants, such as class, ethnicity, religion, language, education levels and connections with people in planned destinations, mitigated by the intervening effects of migration policies.

5.3 Water scarcity and human displacement

The availability of ample, high-quality water influences rural livelihoods in many ways and the degree of a household or community's vulnerability to water scarcity becomes an important dimension of migration decisions (Kirstin et al., 2005). Majority of the displaced group, within and outside the village boundary were found to claim the environmental driver of migration as an ultimate motivation in the decision of migration followed by other perpetuating factors of destination area such as education and access to the roads. Study carried out in five districts of Nepal vulnerable to floods, drought, or landslides to collect first-hand information about specific environmental stresses and their impact on the displacement by National Planning Commission reveal that environmental stress often displaces people who depended on ecosystem services for their livelihoods (National Planning Commission, 2013).

5.4 Gender dimension of displacement

Unpredictable times for water dispersal, distant water collection sites, and crowded public sources, resulting in long queues at the water site, all affect the time it takes to obtain water (Crow & Mcpike, 2009). It is believed that the effects of climate change on population movements are likely to adversely and disproportionately impact poor and vulnerable population groups, especially women (CIDA, 2002; Hunter & David, 2009). The workload associated with water collection and management led women to spend most of their time and energy. The harsh hilly terrain and competition on water resource together played untangled role to make them more vulnerable. The availability of water in the source in the study area was seasonal, and it was only during monsoon when 15-20 minutes of walk was enough for one *gagri* (12-16 liters) *of* water i.e. in average a family needs 8-10 gagri of water and they have to travel 3 hours per day during monsoon.

While during dry season, when people are compelled to fetch water from distant source, the average time a family spends for water collection becomes 10 hours per day. Buor (2003) found that, on average, women in slums of Ghana spend 2.5 hours a day collecting water during "periods of scarcity" and 0.76 hours a day collecting water during "regular flows". A significant number of women actually spent four or more hours collecting water (Buor, 2003). In slums of India, the findings are similar. Sharma (1999) found examples of women who spend anywhere from two hours (collecting water from a dripping pipe) to four hours (the total time spent waiting in line plus the time spent retrieving water) collecting their daily water supplies. The time spent collecting water is not only the physical act of retrieving the water, but also the time spent waiting in line and the time spent actually getting to and from the water source. Sharma (1999) found that women in slums of Mumbai have to "wake up each day at 4:30 a.m. to be ready to fill water from the community stand posts where water comes for around four hours starting at 5:30 a.m.".

The unequal gender relation and access to the resources makes women more vulnerable because of its interaction with socio-cultural factors and historic labor division in term of gender in Nepal. Most of the women are unknowingly suffering from the consequences of hard time that they faced during water collection in the form of back ache as a long term impact of water drudgery. Most of the respondent shared about the occasional events of injuries such as fractures, cuts, sprain and even a snake bite which is acknowledged as the short term impacts of water drudgery.

She remembers the bitter experience during water collection when she used to stay with her family in the uphill. She then, had to wake up at 2:30 in the morning just to ensure that she collects enough water for a day. Collecting 8 gagri of water before dawn, and getting into other household chores, and

doing it year by year has made her weak and pale. She also has scary experience of getting bitten by poisonous snake while she was on the way to fetch water. She is happy now, as her daughter in law are not compelled to wake up at mid-night and carry loads of water.

5.5 Trapped population

Many studies in a wide range of countries have shown that migration is positively associated with wealth and social capital, while vulnerability to environmental change is negatively correlated with wealth and social capital (Foresight, 2011), the disadvantage group of low class people due to lack of land in the destination area, were found to be trapped in the environmentally stressed area.   Those with lower wealth or capital face a double set of risks from future environmental change: their reduced level of capital means that they are unable to move away from situations of increasing environmental threats, yet, at the same time, this very lack of capital makes them even more vulnerable to environmental change (Appendices 3). These populations are likely to become trapped in places where they are vulnerable to environmental changes. Migration should not be envisaged as the last provided options because usually it is not the poorest that migrate because migration entails certain financial resources, social networks and supporting infrastructure and institutions (ICIMOD, 2012).

The old man in his 81 lives in the uphill of Belaspur village. His family is one among the trapped population. This old man has witnessed the change, in fact, the transformation of the village from resource abundant happy-to-be village into ghost village where only few family lives there in vulnerable condition.

He shares the bitter experience of his unability to move toward down hill in response to the environmental stress, as he has no land parcel to resettle his family else where. He and his wife has hard livilihood in term of water collection and increasing human-wildlife conflicts has worsen their life.. The fragmented social cohesion among have and have-not family has trenched the gap more wider and led them live more vulnerable life.

Positive aspects

Since the trapped populations competition for the scarce resource was reduced because of the large population movement and the hours of time spend for managing water was found to be decreased. However, the amount of water availability was itself in the decreasing phase, and the distance and time nexus was found to be stretching even within eleven households.

Negative aspects

5.5.1 Human-wildlife conflict and migration

An ever-increasing number of monkeys co-habit the fragmented forests along the periphery of the village, raiding the croplands. With the gradual displacement of the households, the availability of the food for the monkey decreased and the large monkey population had to depend upon the limited crops produced by trapped household. The fruit of mango, for example, was found to be an extremely important resource for the monkeys, which was cut down abruptly when people decided to leave the place. Since the mango forest was private plot and people decided not to leave it as it was but to cut down which was the major cause of degradation of natural habitat for the wild animals. Together with mango, other fruits trees upon which monkey used to depend were

Jumuna, Aamba, Thakal, Dumri, Bhalyo, were intentionally cut down as the other trees such as *saal* has more commercial value as compare to those small trees. One of the respondent shares his experience about the abundance of those fruit trees when he used to go to the jungle for fodder collection during his childhood and how those trees have been replaced by other high timber value trees. In additional, the community who used to stay in the foothill of other side of the Belaspur hill now are gradually shifting their settlement, so the buffer for those monkey across Sinduri River is being feeble. For nonhuman primates inhabiting forest-agriculture ecotones, agricultural crops may act as key food sources during periods of food scarcity in the forest (Erin, 2007). So the least available agricultural crops produced by trapped population in the village has become the source of food for those monkey making them more vulnerable.

5.5.2 Demotivation in development

There is a school called Shree Sarvva Dev Primary School, which is a primary level school. As only eleven household are remained in the very area, the number of student has declined and the school is in the phase of descending in its grade. Many of the respondent had education as a reason to migrate when water stress became in its worst condition. Access to education generally increases the ability and aspiration to migrate, and significant numbers of people migrate specifically in pursuit of education (Massey & Kandel, 2002).

As the development pace and pursuits are concentrated in the down hills of the village, the family in the trapped population suffers from various difficulties in their livelihood. An old women in her 80s shares her story about the hardship she faced when she suffered from diarrhea and ambulance refused to give her service as it was night time and the road was not that good for the vehicle to reach there.

5.5.3 Social cohesion (Seeking neighbor)

Eventually when most of the houses started migrating elsewhere, it was a kind of obligation for the remaining houses to choose to migrate. People used to live in cluster on the basis of their caste, for example, *Dhital gaun, Mijar basti* etc. When people decided to migrate they choose to resettle in the group within their community, which means that the social cohesion is subtle driver of migration in a community.

5.5.4 Land underutilization

Land underutilization is a consequence of various drivers working together with the displacement in its top. Migration has been interpreted as closely linked to agrarian change, and a range of causal factors from environmental change (Massey et al., 2010) to geographic differences in wages are reported (Wish & Veltmeyer, 2016). The case of land underutilization, as manifested in specific parcels of the Nepal's rural landscape, as also seen in Belaspur village is indeed a result of a complex socio-environmental process that cuts across several broader domains, such as migration, development, environmental change, political economy, and local politics. While migration is presumed to be a cause of land underutilization, traditionally it has also been assumed that migration from rural areas is driven by poverty and dearth, as migrants and their families strive to improve their living conditions (Ravenstein, 1889; Lee, 1966; Todaro, 1969).

5.6 Migration for adaptation

It is instructive that recent debates on climate change and migration have tended to focus on migration as a problem or threat (Hartmann, 2010). Those among the displaced community had choosen labour migration, both internal as well as international as a coping mechanism to environmental change. Labour migration was also the last resort among those who were trapped in the vulnerable area. The ability of a household to adapt is based on several factors including financial resources, access to information, social resources, human capital, and infrastructure (Barnett & Webber 2009). The remitance flow, shift toward more networking area, off farm business, potato farming, skills and experiences (Chapter 4.6) gained during internal and international migration in the community has become the powerful factors to increase the ability to adapt. Labour migration and remittances can contribute to all of these to moderate the harm caused by water hazards (Banerjee, 2011). The social capital in form of skills and experiences has further enhanced the returnees family to build up their resilence.The diversification of livelihood option in the destination area, (Chapter 4.6), has significant role among the displaced community to enhance their adaptative capacity to cope with economic and environmental uncertanities in the destination.

The case of Thansing VDC shows that the decision of migration has become a far from exceptional phenomenon, in line with the finding of a few other studies done in migration discourse for example by Bie and Broeck (2011) has taken into consideration about the economic model of migration especially for Least Developed Country (LCDs) to

acknowledge economic driver of migration as an utmost driver of migration. Here the reasons are multiple, but environmental driver has become most compelling driver of migration and study advances to discuss these driver on the basis of time and space. Since the water stress, which is an inevitable indicator of environmental drivers has become the initiator of the migration decision which has resulted the other socio-economic component of the area, as a perpetuator of the migration decision. The consequence of the water scarcity and its implication in the change of the social and structural setup of the community is has been considered as the perpetuator of the decision of migration. The evidence presented through the study shows that it is not only always sensible to ask what factors cause migration; rather, attention should also be focused on how such factors emerge and force to migrate, and how these factors become interlinked through other unavoidable indicators of migration and underpinning the pathways or trajectories (Figure: 25) of the outcome such as displacement and trapped population.

CHAPTER VI: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The major environmental stress in the study area was found to be water stress, which is an important indicator of environmental driver of migration. Though water scarcity was found to be initiator of migration decision, other factors like education, access to road, employment opportunity, producer and consumer prices in agriculture, demographic structure, water induced conflicts and human-wildlife conflicts were found to be perpetuator of migration decision. The group of people who couldn't move in response to stress were trapped in the environmentally prone area. The trapped population were found to be vulnerable to such environmental stress because the series of factors such as socioeconomic class was found to be low and personal characteristics of that very group of people was characterized by falling into disadvantaged group. The consequences of displacement was found to be prevalent in the origin in form of Human-wild life conflict and land underutilization. The large parcel of arable land was found to be underutilized which in turn increased the threat of human-wildlife conflict resulting the trapped population to be more vulnerable. The livelihood diversification option among those who were displaced was found to be increased. Off-farm business such as grocery, canteen and potato farming was found to be adopted, which in turn has increased adaptation among them. Both among the displaced and trapped population has used labor migration as income diversification which in turn has enhanced adaptation among them. The rapid alternation to the ecosystem induced by environmental factors will have direct impacts on the societies which, when other coping mechanism are overcome, there will be displacement as a last resort.

6.2 Recommendations

- Water scarcity is pronounced in the study area as a threatening environmental stress which can be minimized by watershed management practices among the community member.
- The investigation covered the small geographical area but there are many other places in Nepal where environmental migrants are reported. Formulation of comprehensive national policy can well address the vulnerability of the trapped population and safe settlement of displaced population can also be ensured.
- Various socio-environmental pathways should be understood for any policy response which requires encouraging interdisciplinary, action oriented and

participatory research to explore the outcome of complex process of social transformation such as land underutilization as a consequences of migration.

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Appendix I: Checklist for data collection

Check list

Household survey: Checklist

Tribhuvan University/ICIMOD

- To identify the environmental stress in the study area
- To test the foresight framework of drivers of migration
- To analyze climatic data (precipitation and temperature) of study area

Time: 45 minutes

Household survey check list for a quantitative study of linkages between human displacement and environmental stresses

Section A

1. Personal identification:

Interviewer

Name:

……………………………………………………………………………………

Village:

………………………………………………………………………………...

Date: ……………………..

2. Basic Household Information

Sn		
1	Household number	
2	When was house established	
3	Name of the respondent	
4	Household owner	Male=1, Female=2

5	Ownership of house	Own=1, Rent=2, Property of Trusts (Guthi)=3, Other=4
6	Relation with household head	
7	Age	
8	Gender	1=Male 2=Female
9	Education	7= Professional or Honors 6= Graduate or Post-Graduate 5= Intermediate or Post-High-School Diploma 4=High School Certificate 3= Middle School Certificate 2= Primary School or Literate 1=Illiterate
10	VDC	
11	Ward no	
13	Mother tongue	
14	Religion	1=Hindu 2=Buddhist 3=Muslim 4=Christian
15	Ethnic group	1=Chhetree 2=Brahman 3=Hill magar 4Tamang 5=Newar 6=Kami 7=Rai 8=Damai/Dholi 9=Sarki 10=Other
16	No of household member	

3. Family Income (Per month)

Score	Range	Source of Income
	12= ≥45751	
	10= 22851 – 45750	
	6= 17151 – 22850	
	4= 11451 – 17150	
	3= 6851 – 11450	
	2= 2301-6850	
	1= <= 2300	

4. Have you moved to the village from elsewhere? If yes,

Migrated from					
District	VDC/Municipality	Ward	Type 1=Permanent 2=Temporary	Cause of migration	How long ago (years)

5. If permanent, what is the reason behind that?

6. Household Member Information

SN	Name	Sex	Age	Education	Occupation
		1=Male 2=Female 3=Others		7= Professional or Honors 6= Graduate or Post-Graduate 5= Intermediate or Post-High-School Diploma 4=High School Certificate 3= Middle School Certificate 2= Primary School or Literate 1=Illiterate	10=Profession 6= Semi-Profession 5= Clerical, Shop-owner, Farmer 4= Skilled worker 3= Semi-skilled worker 2= Unskilled 1= Unemployed

7. Contextual information

1=Mud bonded brick/stone	2=Cement bonded brick/stone	3=RCC with cemented pillars	4=Wooden pillar	5=Others
1=Straw/Thatch	2=Wood/Plank	3=Galvanized	4=Tile/slate	5=Concrete/cement
1=Attached	2=Outside	3=No		

Section B

1. Distance covered to fetch the water?

2. How long did you use to walk to fetch the water?

3. Did you use to stand in the line?

4. Is there any incidence of casualty or illness related with this process?

5. Was there any conflict in between the household related to water? Story.

6. What kind of events had you observe which had not occurred in your village before?

[More than one option possible. Do not read out all options. Just ask question and select the appropriate one. Put "-6" if not applicable.]

Drought		Water scarcity		Flood	
Erratic rainfall		Frost		Hail	
Earthquake		Livestock disease		Landslide/erosion	
Occurrence of new plant species		Strong wind		Typhoon/hurricane	
High temperatures		Low temperatures		Dust storm	
Forest fire		Insect attack		Irrigation problems	

IV

Soil erosion		Fire in settlement		Crop pests	
Occurrence of new animal species (e.g. mosquitoes)		Other, specify:		Land degradation	

Section C

1. What was the structure of your family before displacement? 1=Joint, 2=Nuclear

2. What is the structure now?

3. Was there any sort of disease prevalent in your community then? 1=Yes, 2=No
4. How responsible is that event for your decision to migrate?

5. Is employment opportunity higher in the destination area? 1=Yes 2=No
6. If yes, what sort of employment?

7. Have you been hired as a labor in your neighborhood? 1=Yes, 2=No
8. Is there any differences in the wages you receive?

9. Is there any difference in price of the agricultural product when you produce?

10. Is there any difference in price of the agricultural product when you consume?

11. How far is school/college from your destination area?

12. Is it nearer than prior area?

13. Is there any family obligation for your decision of migration? Story.
14. Was there any sort of conflict in-between the adjoining community regarding water distribution?
15. What are the associated consequences in the origin due to displacement?
16. Have any member of your household living out of the home? 1= Yes 2=No

If yes, response the following question.

Name of the migrant	Type of migration 1= International 2= Internal	Destination	Time period	1= Skilled 2= Unskilled	1=Seasonal 2= Yearly

17. What is the reason of migration?

Sn	Reason	Tick the appropriate
1	Poor economic condition	
2	Less agriculture land	
3	Lack of opportunity	
4	Repeated crop failure/low agriculture production due to environmental stressors	
5	Scarcity of drinking water	
6	Failure in education	
7	Conflict	
8	Family pressure	
9	Experience the developed world	

Appendix II: Schematic representation of trapped population
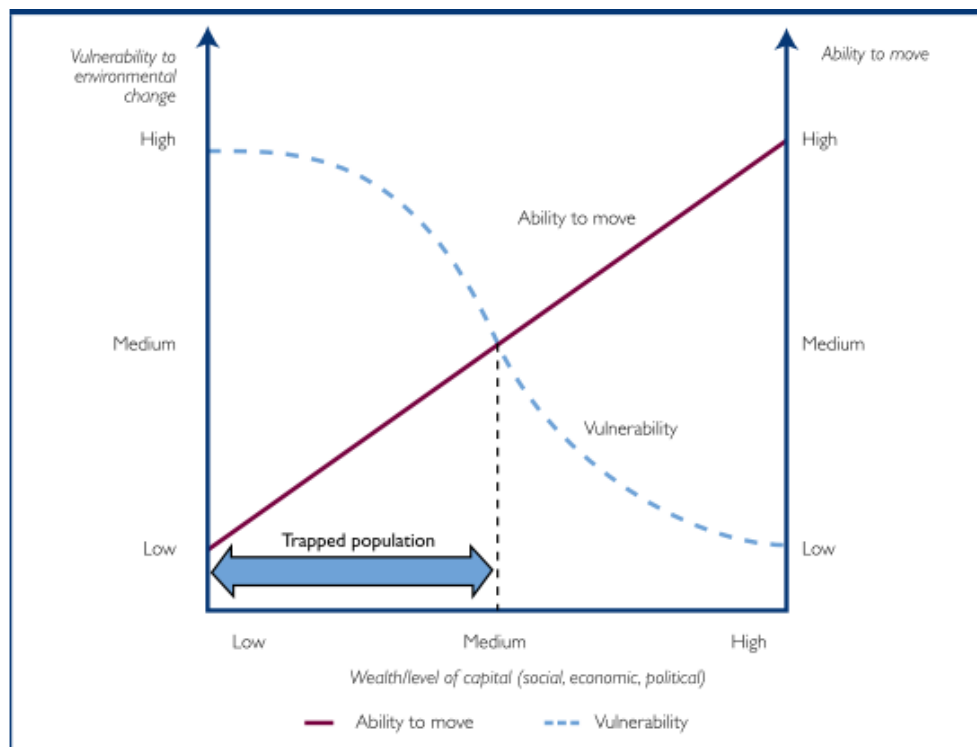

Figure: Schematic representation of trapped population

Appendix III: Photographs

Photograph 1: Underutilized land parcel of Thansing VDC

Photograph 2: Focus group discussion

Photographs

Photograph 3: Key informant interview

Photograph 4: Household survey

Photographs

Photograph 5: Off farm business, grocery store

Photograph 6: Abandoned house