# STUDY OF MIGRATION AS A FORM OF ADAPTATION STRATEGY TO NATURAL HAZARDS. CASE STUDY: FLOOD INDUCED MIGRATION IN RATHNAPURA AREA

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Degree of Master of Science in Town and Country Planning

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Dissertation Submitted in partial fulfillment of the requirements for the Degree Master of Science in Town and Country Planning

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## DECLARATION

I declare that this Research Project Report represents my own work, except where due acknowledgement has been made and that it has not been previously included in a thesis, dissertation or report, submitted to the University of Moratruwa or to any other institution for a degree, diploma or other qualification. I also wish to declare that the total number of words in the body of this report (excluding the Appendices & the Bibliography) is 11477.

Signed :

Name of Student : W. Thushani

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# CERTIFICATION

I herewith certify that W. Thushani index number 108974 C in the Master degree of Town and Country Planning Programme has prepared this research project under my supervision.

| | |
|---|---|
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## Abstract

This research studies migration as a household adaptation strategy to flood in Rathnapura. Environment extremes act as one contributor among many to population movement. There are number of migration theories those explains the factors which contribute to human migration. Existing research on human migration in response to natural hazards tends to be limited. So it is important to study how environment factor act as critical factor in the decision to migrate. It is undisputed that there is indeed a relationship between migration and environment hazards. The topic of migration as adaptation strategy is of growing importance but still in the initial stage. So this research emphasize why some people decide to migrate while others do not. What are the factors affect to people to think to migrate and what are the adaptation strategies employed by people in order to reduce the vulnerability. This research was designed in order to give answers to those questions and to study the migration as one form of adaptation strategy. Data and information was collected through questionnaire and interview. The data was analyzed through chi-square test, one way ANOVA and descriptive statistical method by using SPSS. Results shows that there is statistically significant relationship between occupation, severity of flood and no. of years living in hazardous area with think of migrating. Migration cost, livelihood linked with environment, native place, social ties mainly affect to people to stay in risky area. The factors like recovery cost, scarcity of food, disease and security motivate people to migrate. This study shows that people are more vulnerable for flood like to migrate in order to reduce the vulnerability by reducing exposure to flood.

Key Words: Natural hazard, Vulnerability, Adaptation, migration,

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## LIST OF ABBREVIATIONS

| Abbreviation | Description |
|---|---|
| RMC | Rathnapura Municipal Council |
| UDA | Urban Development Authority |

# CHAPTER ONE
# INTRODUCTION

## 1.1. Background of the Study

Natural disasters in Sri Lanka are commonly caused by floods, cyclones, landslides, droughts, and coastal erosion. The impacts of natural hazards on society are substantial and are clearly on the rise (Abramovitz 2001). Indeed, estimates suggest that between 1/5 and 1/4 of the Earths' human population were affected by natural hazards during the 1970s and 1980s (Abramovitz, 2001). Even so, impacts are expected to increase; during the period 1972–1995, actual calamities increased by 5–7% per year, while the damage resultant of these disasters increased by 5–10% per year (Kondratyev, Krapivin, & Phillips, 2002). Predictions to 2030 suggest a continuation of these trends in addition to their "enhancement" (Kondratyev et al., 2002). Anticipated future increases in human impacts of these extreme events are due to two factors: population growth and resultant increases in the built environment in regions most vulnerable to high impact natural disasters, namely coastal and urban areas (Mileti, 1999).

The threats of natural hazards have caused the disruption of human lives, properties, infrastructure, environment, economy, capital investment, and the development planning processes. Different nations, societies and communities in the world have been paying attention to avoid or to adapt to the impact of the disasters (Abdulharis, 2005).

In order to cope up with environmental problems people can adapt in three ways: stay in place and do nothing, accepting the costs; stay in place and mitigate changes; or leave affected areas (Reuveny,2007). The choice between these options depends on the extent of the problems and mitigation capabilities. Because of the damages cause to people due to the hazards people may migrate to hazard free area. For example, severe floods in China in May 2010, and Pakistan in the summer of 2010, were each reported to have displaced over 10 million people (Zetter, 2015).Migration theory also explains social, political, economic factors act as a migration driver. But

very few studies argue that environmental extreme also affects to leave the vulnerable area (Massey et al.,1994; McLeman and Smit, 2006a).So it is important to argue that environmental factor also act as a migration driver. If affected people practice migration as household strategy it will affect to social structure of areain future. So it essential to study the environment driven migration in order to face the crisis occurred in future.

Natural disasters in Sri Lanka are commonly caused by floods, cyclones, landslides, droughts, and coastal erosion. The Table 1.1 represents the natural disasters that occurred in Sri Lanka between 1957 and 2005.Sri Lanka flood damage level is high with compare to other kind of natural disasters. Rathanapura is the district frequently experience water logging for the last few years. Even a little rain may cause severe problems for certain areas, which are inundated for several days. This creates large infrastructure problems and a huge economical loss together with large damages of existing property and goods. So Sri Lanka need to pay more attention towards hazards as it is exaggerated with climate change also. Now we are also experiencing the multiple hazards during last two years. So it is very important to examine migration as a household strategy to hazards in future. This study focuses to find out is environmental change act as a critical factor in the decision to migrate as an adaptation strategy for flooding.

**Table 1.1level of natural disasters occurred in Sri Lanka between 1957 and 2005**

| Type of disaster | Frequency | Number of deaths | Number of injured | Number of homeless | Number of victims | Total amount of damage (US$ 1,000) |
|---|---|---|---|---|---|---|
| Drought | 8 | 0 | 0 | 0 | 6,256,000 | 0 |
| Infectious disease | 5 | 58 | 0 | 0 | 206,177 | 0 |
| Flood | 37 | 948 | 1000 | 2,964,655 | 6,455,127 | 370,444 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Landslide | 3 | 119 | 0 | 0 | 130 | 0 |
| Tsunami | 1 | 35,399 | 23,176 | 480,000 | 516,130 | 1,316,500 |

Source: DMC: Disaster Management Centre 2005

### 1.2 Research Problem

Extreme natural disasters such as floods and hurricanes can cause huge amounts of damage to life, property and economic activity. Large numbers of people have been displaced by recent weather-related disasters, such as floods in central Europe, Brazil, Mozambique, Thailand and Kenya. Widespread floods also affected millions of people in Pakistan and China in 2010(Zetter, 2015).

However, Easterling (2004) describes that adaptation to environmental change is a fundamental human capability and is not a new concept. Throughout the ages, human societies have shown a strong capacity for adapting to different climatic conditions and environmental changes. Every community has some intrinsic ability to cope with extreme weather events, though only to a certain limit. It's well understood that income and social structure are main assets in coping with disasters. Households with greater income have diversified livelihoods and have different meals, styles and status. Similarly economically better off people can develop suitable mitigation measures and could recover very fast compared to those who are poor in terms of financial resources (Blaikie*et. al.,* 1994). Therefore, when people couldn't cope with extreme weather condition they decide the leave their habitats. Natural hazard acts as a push factor for migration. Few scholars argued that weather environment changes cause the people to migrate.

There is considerable research that reviews general concepts and makes broad-based predictions about environmental refugees and human migration in response to natural hazards. Increasingly, scholars are interested in migration stimulated by environment extremes due to the potential for changes of social structure. Researchers have reviewed the available evidence on population movements associated with extreme

weather events and found that vulnerability to extreme events and the ability to move is related to social, economic and political capital. People with low to medium asset levels often become trapped, in their homes during disasters or find that their vulnerability increases where they have been displaced, following a disaster.

But very few empirical research which explores migration as an adaptation to environment stresses or explains broad relationships between environment and human migration (Massey et al., 1994; McLeman and Smit, 2006a). While there are a number of migration frameworks that offer potential for incorporating the role of environmental factors, it is argued that the literature is far from having a well-developed theoretical or conceptual framework for understanding the relationship between human migration and environmental change (Hay and Beniston, 2001).

Even though human migration is a main research area in social studies but environment studies does not pay attention to migration. Further, there are no adequate studies carried out to examine the relationship between migration and environment extremes. There are no studies done so far in Sri Lanka context. Considering this research gap, this study attempts to study is there is effect of environment hazard on migration. Ultimately this study finds out possibility of migration as one form of adaptation strategy to natural hazards

### 1.3 General Objective

The General objective of the study is to study migration as one form of successful adaptation strategy to natural hazard

### 1.4 Research Questions:

- Didvulnerable people consider migrate to other areas due to floods?
- What are the factors affect to think of migration during flood season?
- Are existing adaptations strategies influence to think of migration?

### 1.5 Scope and Limitations:

Migration is motivated by social, political, economic and environment hazards. The scope of this research covers the Assessment of migration as a potentially successful adaptation strategy to environmental extremes.Human migration affects population patterns and characteristics, social and cultural patternsand processes, economies, and physical environments. As people move, their cultural traitsand ideas diffusealong with them, creating and modifying cultural landscapes. As a result some scholars argue that as result of migration receiving point will have conflict. So the lessons of this research will help planners to avoid the conflict occur in receiving point. This research studies migration as a potentially successful adaptation strategy to flood.

This study has been limited to Batugedara wards in Rathnapura area depend on the time and convenience.

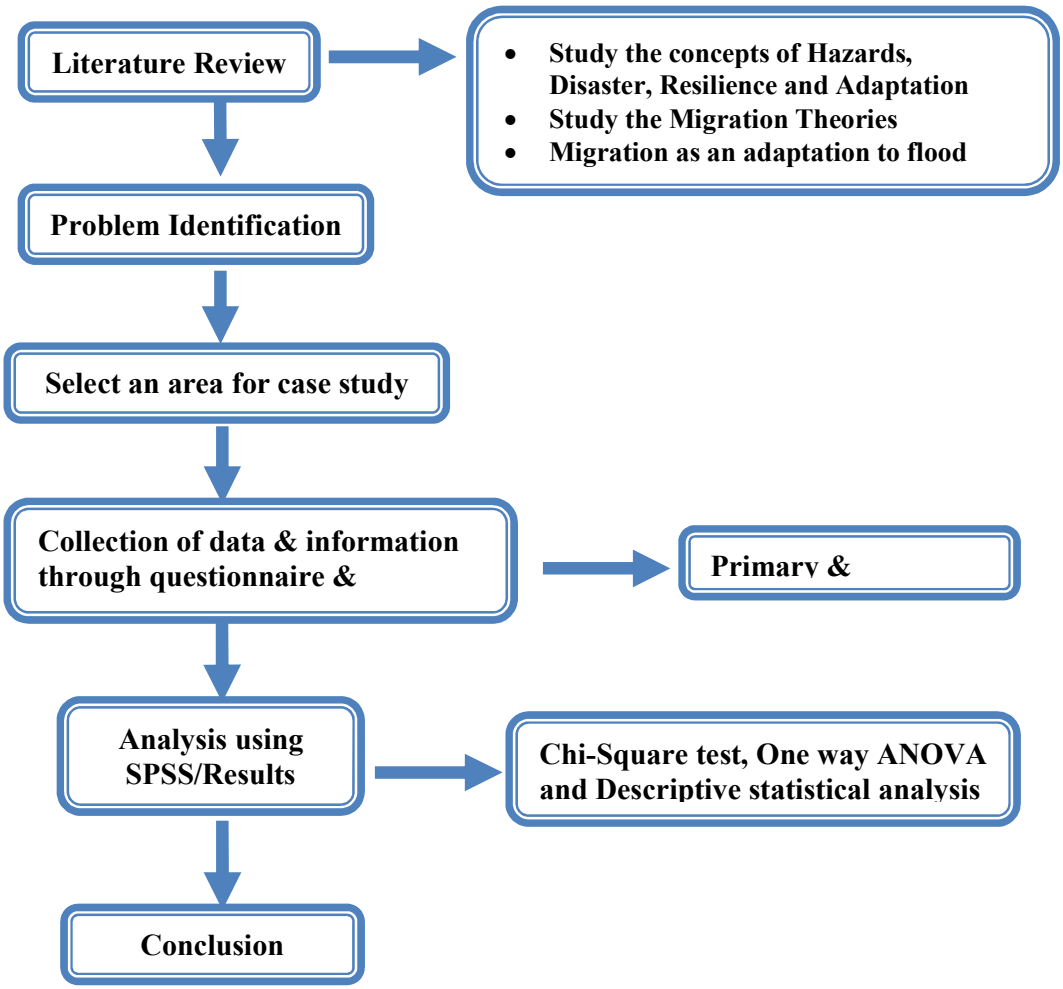



Figure 1.1: Flow of study

# CHAPTER TWO
# LITRETURE REVIEW

## 2.1. Introduction

This chapter discusses the related literature used to support research problem describe in previous chapter. It describes the definitions of the hazard and the disasters, vulnerability, concept of adaptation, concept of resilience, and adaptation to extreme weather event, general theories of migration and migration theory and environmental change. Additionally this chapter tries to discuss the concept of climate change. Finally, this chapter discusses the similar research studies conducted by various scholars in the region.

## 2.2 Defining Hazard and Disaster

Understanding the type and the characteristics of the hazard is important in order to address or to reduce the impact of hazard. There are different definitions for hazards. According to Twigg (2004) **hazard** can be defined as "potentially damaging physical event, phenomenon and or human activity, which may cause loss of life or injury property damage, social or economic disruption or environmental degradation", while **disaster** defines as "what occurs when the impact (causing death, injury, loss of property or economic loss) of the hazards on section of society overwhelms society's capacity to cope". However, Cutter (1993) argued that "hazard is broader concept that incorporates the probability of an event happening, but also includes the impact of the magnitude of the event on the society and the environment". Blaikie (1994) states that hazard refer to "extreme natural events which may affect different places singly or combination at different times over a varying return period". Tobin et. al., (1997) describes that hazard is an "interaction between the human systems and potential events". He further stated that hazard overlaps with disaster where hazard is the potential event and disaster is the consequences of the hazard. Andjelkovic (2001) argues that extreme natural events only become a disaster when it has an

impact on human settlement and its functions. According to Smith et al., (1998) the detailed way to define disaster is “an event concentrated in time and space, in which the community experience severe danger and disruption of its essential functions accompanied by wide spread human, material or environmental losses which often exceeds the ability of the community cope without external assistance”.

All these definitions of disasters have in common is that the difference between hazard and disaster depend on the coping capacity of the community impacted. For an example, floods occurring in well prepared communities with strong organizational structures are less disastrous than the unprepared communities with the existence of loose organizational structures.

## 2.3 Defining Adaptation

The term adaptation, as it is presently used in the world, has originated in natural sciences, particularly evolutionary biology (Futuyama, 1979). Numerous definitions of “adaptation” are found in various literatures published. For an example, “adaptation is the adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (IPCC, 2007). Adaptation is context-specific and varies from community to community among social groups and individuals, and overtime. It varies not only in terms of its value but also according to its nature. The scales of adaptation are not independent or separate (Smit and Pilifosova, 2003).

The definition of adaptation adopted in this thesis is considered below. It reflects the aspects of all above definitions.Adaptation is a process by which vulnerable people seeks to cope with environmental extremes. Within extremes people are capable of adjusting up to threshold level, beyond that they cannot cope. Extremes events significantly influenced the community adaptation. Human beings try with all means available to deal with environmental extremes, but when conditions become too severe they reach a threshold where they cannot make any meaningful adjustments. For an example, with every extreme event, individuals in the community are

compelled to sell their belongings and fixed assets. Thus, with every major disaster the number of poor and landless increases, making them even more vulnerable and unable to cope even moderate or low level flood in the following season. So under this situation people use migration as a risk management strategy.

## 2.4. Resilience

With roots in the sciences of physics and mathematics, the term originally was used to describe the capacity of a material or system to return to equilibrium after a displacement. A resilient material, for example, bends and bounces back, rather than breaks, when stressed (Gordon 1978). In physics, resilience is not a matter of how large the initial displacement is or even how severe the oscillations are but is more precisely the speed with which equilibrium is achieved. The image is a compelling one, capable of sparking human imagination, as it clearly did for Holling (1973) in his original thesis about ‘‘ecological resilience”. The concept of resilience has since been applied to describe the adaptive capacities of individuals (Butler et al. 2007; Werner and Smith 1982), human communities and larger societies (Adger 2000).

## 2.5 Adaptive Capacity

Adaptive capacity, also understood as resilience, is the ability of individuals to cope with exposures by adapting to the impacts of climate change (Smit and Pilifosova 2003; Smit andWandel, 2006). Adger (2006) defines resilience as "the magnitude of disturbance that can beabsorbed before a system changes to a radically different state." Adaptive capacity is influencedby a multitude of interdependent factors such as access to information, technological resources,institutions, infrastructure, and economic, human and social capital (Yohe and Tol, 2002; McLeman and Smit 2006a; Belliveau et al., 2006; Reid et al., 2007).Economic capital represents the availability of financial resources and assets (McLeman, 2006); human capital refers to the skills, education, knowledge and experience of people (Yohe and Tol, 2002; Reid et al., 2007); and social capital is understood to be the informal social networks within a community, based on trust, reciprocity and exchange (Adger, 2003; Reid et

al., 2007).Kates (2000) further investigate that, especially among poor populations, the lack of capacity to adapt to environmental risks or hazards is interconnected with population displacements. That study assume that climate-stimulated migration is not simply a random or wholesale outpouring of people from an exposed area, migration can be seen as one possible manifestation or outcome of adaptive capacity in light of exposure to some form of climatic stress.

So it is clear that people who have more adaptive capacity can adapt to the hazardous environment. Those people are less vulnerable for hazards. However people's adaptive capacity decides strength of people's capacity to adapt to flood.If the community is unable to cope with the changed environment, individual households remain vulnerable and may be obliged to implement their own adaptive strategies. For some households, migration of one or more members away from the community may be an option (R. Mcleman and B. Smit, 2006).

**2.6 Vulnerability**

The vulnerability concept has been widely adopted in the climate change concept. However, the principles underlying the determinants of vulnerability are broadly consistent with those underlying models of resilience (Gunderson and Holling, 2002) and sustainability (Turner *et al.,* 2003). Adger and Kelly (1999) have defined 'vulnerability' as the ability of individuals and social groupings to respond to, cope with, recover from, or adapt to any external stress placed on their livelihoods and well-being while Watts and Bohle (1993) conceptualize vulnerability as a function of exposure, capacity, and potentiality.

The main components of the vulnerability approach of Turner et al. (2003) are exposure, sensitivity, and resilience (or response capacity). McCarthy and Maretello (2005) also frame vulnerability in terms of exposure, sensitivity, and resilience or capacity to adapt. Further such approaches are modified from Smit and Pilifosova (2003), where:

$V\text{slit} = f\,(E\text{slit},\ AC\text{slit})$

where, $V$= vulnerability, $E$ = exposure, $AC$ = adaptive capacity, $s$ = a given system or community, $l$ = a given location, $i$= a given climatic stimulus, $t$ = a given period of time

Vulnerability is dynamic, as it varies over time ($t$) and from place to place ($l$) and system to system ($s$)McLeman and Smit, 2006a; Adger, 2006; Smit and Wandel, 2006). Exposure reflects both the nature of environmental change and the nature of the community. For example, a community's exposure to an adverse environmental change, such as flood, reflects the nature of the flood (frequency, duration, etc.) and the nature of the community (settlement location, livelihoods, land use, etc)

Adaptive capacity ($AC$) refers to the ability of the system to deal with or cope with the conditions or effects to which it is exposed. Different type of adaptation strategies are employed by community depending on the adaptive capacity of the community. Adaptation strategies increase the resilience and decrease the vulnerability.

There is positive relationship between exposure and vulnerability. Any action taken from vulnerable community cause to change the nature of community or nature of flood, affect to vulnerability. If exposure gets eliminated or reduced due to the results of those actions, vulnerability will be reduced or eliminated. As well as people who has more adaptive capacity employed more adaptation strategies in order to cope hazards. So it will reduce vulnerability since there is inverse relationship between vulnerability and adaptation strategies. To reduce risk associate with natural hazards it is important to identify the nature of relationship between exposure and adaptive capacity with vulnerability.

## 2.7 Migration

Migration theories and researchers have identified five main factors which influence people's decision to stay or go (Black, R., Adger, W. N., Arnell, W. N., Arnell, N. W., Dercon, S., Geddes, A. & Thomas, D. 2011). There are known as multiple drivers of migration. They are

1. **Economic**, which includes employment opportunities, income and the price of living.
2. **Social**, which includes the search for educational opportunities or obligations to kin, such as marriage or inheritance practices.
3. **Political**, which includes discrimination or persecution, conflict, levels of security and policy incentives, for example a change in land ownership policy.
4. **Demographic**, which includes population density and structure and risk of disease.
5. **Environmental**, including exposure to hazards and land productivity and habitability.

On smaller scale personal characteristics such as age, sex, education, wealth or marital status may all have an influence to migration.

### 2.7.1 Theories of migration

There are a number of general theories that help explain human migration. These migration theories are each now described in greater detail.

### 2.7.2 Economic theories of migration

The neo-classical macro economists focus on migration occurred due to differential in wages and employee conditions between locations and on migration cost. According to this approach individual migrate from lower wage to the higher wage locations to increase their current and future incomes.

The neo-classical micro economists argue that individual decide individual decide to migrate in order to maximize their income. The past studies aresupporting (Sjaastad 1962; Massey et al. 1993) this idea and said migrants will decide to migrate if they can expect a positive net return from movements.

Extensions to the neo-classical approach explain human migration in terms of "push" and"pull" factors where conditions at an existing place of residence may motivate an

individual toleave, while conditions at a destination may attract a potential migrant (Lee, 1966). Push factorsinclude demographic pressures, political instability, lack of economic opportunities, and morerecently, environmental change (Lonergan, 1998), while pull factors include demand for labour,availability of land, good economic opportunities and political freedoms (Castles and Miller, 2003).

### 2.7.3 New economics of labour migration approach

This approach discussed additional factors that affect the migration decision. It views migration as a household (rather than an individual) strategy. Migration serves to minimize family income risks or to overcome capital. It is not the *individual* who decides to migrate in order to maximize his or her utility. Rather, it is the family or household that decides to migrate in order to its collective utility. Stark and Taylor, 1991 also said, migration can be considered a household survival strategy and a means of spreading risk

### 2.7.4 Migration systems theory and new interdisciplinary approaches

Some critiques of the neo-classical economic model of migration have worked to develop a new approach, known as migration systems theory which theory suggests that linkages, such as trade relations, political ties, or cultural ties between sending and receiving regions play an important role in migratory processes (Castles and Miller, 2003).

The migration systems theory understands migration processes as the result of interacting macroand micro-structures. Macro-structures involve large-scale institutional factors, such asthe political economy of the world market, or interstate relationships, while micro-structuresinvolve the networks, social behavior, practices and beliefs of migrants (Castles and Miller,2003).

## 2.8 Migration Theory and Environmental Change

Environmental conditions have not been considered in above arguments. The existing argument holds that environmental changes remove people of their livelihood and force them to migrate to better environments, usually permanently. This argument does not account for the possibility that environmental changes may the factors determining whether or not people migrate. But Wolpert 1966 forwarded 'stress threshold' model that add environment factors in the form of push and pull factors. From the perspective of this model, environmental problems, such as floods, droughts, desertification, etc., can act as 'stressors' that bring about 'strains' and motivate individuals to consider migration as a response. when these environmental 'stressors' affect to individual's wellbeing and if it is lead to decrease personal income from production, and lower the opportunity for future employment then affected people is more likely to consider migrating to places with better environmental attributes and better income opportunities.

According to the literature, scholars argue that if environmental changes affect to the person income, they decide to migrate. Some scholars argue that environment hazard motivate the people to move from one place to hazard free area. But I argue that people who more vulnerable for hazards may not decide to migrate even hazard affect to the income seriously. Then I can argue the possibility of practicing migration as one form of adaptation strategy to natural hazards in future.

## 2.9 Migration as an Adaptation to Natural Hazard

Hugo (1996) presents an analysis of reports on Asian environmental migrants as presented in the *United Nations Disaster Research Organization News* for the period 1976–1994. The results demonstrate that over the last 2 decades environmental disasters have displaced increasing numbers of people. As an example, in 1994, mass migration to urban areas within China took place as a result of floods and droughts in upland areas (Kaye, 1994). Natural calamities also often "push" migrants from rural to urban areas in Bangladesh, such that "an unusual increase of beggars and people

looking for work in cities and towns is part of the after match of drought and floods." (Population: UNFPA Newsletter, 1984).

Agriculture in Bangladesh is very much dependent on annual flooding and the floods, therefore, take on unique cultural meaning. Although necessary, the persistent floods also change river courses, with many Bangladeshis losing homes and lands to erosion annually (Zaman, 1991). In a survey undertaken in a Bangladesh floodplain in the mid-1980s, nearly 88% of households had remained within 2 miles of their previous residence (Zaman, 1991). Such short distance mobility (perhaps temporary) is a product of lack of resources, presence of kin, and belief that land will re-emerge to be reclaimed (Zaman, 1991). Migration here is a household coping mechanism, with household members typically having little faith in finding permanent residence; displaces often continue to live in fear of eviction, either by governmental authorities or natural forces (Haque&Zaman, 1989; Mutton &Haque, 2004; Zaman, 1991).

Sometimes, however, migration (short- or long-term) as a coping strategy is simply not feasible. Demonstrating the interaction between vulnerability and exposure to environmental hazards, in Peninsular Malaysia, structural factors restrict the residential choices of many inhabitants of risk-prone regions (Chan, 1995). Chan (1995) argues that migration is an option available only to wealthier households, while options are restricted for many others due to poverty, low educational attainment and social mobility, insecure land tenure, a lack of government aid, disaster preparedness and/or relief programs (Chan, 1995). Further, if provided the opportunity to relocate, many vulnerable households do so only to often find themselves on *different* floodplains because these are the least expensive places to live.

As another form of migratory response to environmental hazards, in some cases, particular household members will take on more permanent migration while others stay behind. Multilevel models estimating young adult migration within this context provide evidence for the "new economics of migration," whereby migration of some household members becomes a family strategy for those living in uncertain natural environments. Results suggest that a community's vulnerability to food shortages as

a result of drought contributes significantly to outmigration as a strategy to assist relatives (Ezra and Kiros, 2001).

Research work suggests that millions migrate annually as a result of environmental conditions within developing countries, suggesting that environmental decline may be an important "push" factor fueling urbanization (e.g., Hugo, 1996; Jacobsen, 1988). In some cases, local (perhaps temporary) mobility is a more typical response to regularly occurring natural hazards (e.g., Zaman, 1991). Finally, analytical efforts suggest that the environment as a contextual factor interacts with individual, household and other community characteristics to shape household migration decision-making (e.g., Ezra &Kiros, 2001). Other evidence suggests that, in more developed regions, socio-economically advantaged households may be those least likely to migrate in response to natural hazard impacts (e.g., Morrow-Jones & Morrow-Jones, 1991).

## 2.10 Conclusion

Literature reviewed intends to described that adaptation is a process by which vulnerable people seeks to cope with environmental extremes. Within extreme events, people are capable of adjusting up to threshold level, beyond that they cannot cope. Migrations theories explain what factors make people motivate to migrate.

Table 2.1: summary of migration theory

| **Migration theory** | **Factors which contribute to migration** |
|---|---|
| Economic theory of migration (neo classical approach) | Better employment opportunity, higher wages |
| Push – pull migration theory | Demographic pressure, political instability, lack of economic opportunities, environmental changes |
| New economics of labor migration approach | Secure environment, availability of investment capital, need to manage risk over time |
| Migration systems theory | Trade relations, political ties, cultural ties |

Mainly they have identified four types of factors those affect to decision making process of migration. Social, economic, political and environmental factors affect to migration. Although there are sufficient number of research done to identify how social, economic and political factors affect migration. But few scholars add environment changes to the process of decision of migration. Mainly they argue that if environment extreme affect income generation only they decide to migrate.

In this literature shows gap there is no adequate studies on environmental induced migration. Mainly in Sri Lanka context no studies are carried out to examine how environmental hazards affect to migration.

# CHAPTER THREE
# RESEARCH DESIGN

## 3.1 Introduction

This study was designed to study the relationship between flood and human migration. It will help to study the weather migration as a adaptation strategy the various adaptive strategies employed to cope with flood.This chapter outlines the key questions, conceptual framework, selection of case study locations, and data collection and data analysis method.

## 3.2 Key Questions

In order to address the research gap described in chapter one this study examines three questions. Did vulnerable people consider migrate to other areas due to floods?What are the factors affect to think of migration during flood season?Are existing adaptations strategies influence to think of migration?

## 3.3 Conceptual Frame Work

Vulnerability is often conceptualized as a function of exposure to natural hazards and the adaptive capacity to cope with that exposure (Smit and Pilifosova, 2003; Smit and Wandel, 2006).Figure 3.1 illustrates vulnerability, adaptation strategies and migration as one form of adaptation. Vulnerability is shown to be a function of both exposure and adaptive capacity. Due to the changes of climatic and non-climatic changes both exposure and adaptive capacity are changing over time. That's mean both exposure and adaptive capacity are dynamic. Adaptation strategies reflect the level of vulnerability and can be either *in situ* adaptations or can involve human migration.

The adaptation options presented in this figure represent just a few examples of many potential adaptation options that may alleviate adverse impacts. All adaptation strategies alter the nature of exposure and adaptive capacity, which in turn alters the level of vulnerability. With successful adaptation strategies, vulnerability can be reduced. This diagram shows the feedback loops associated with these concepts.

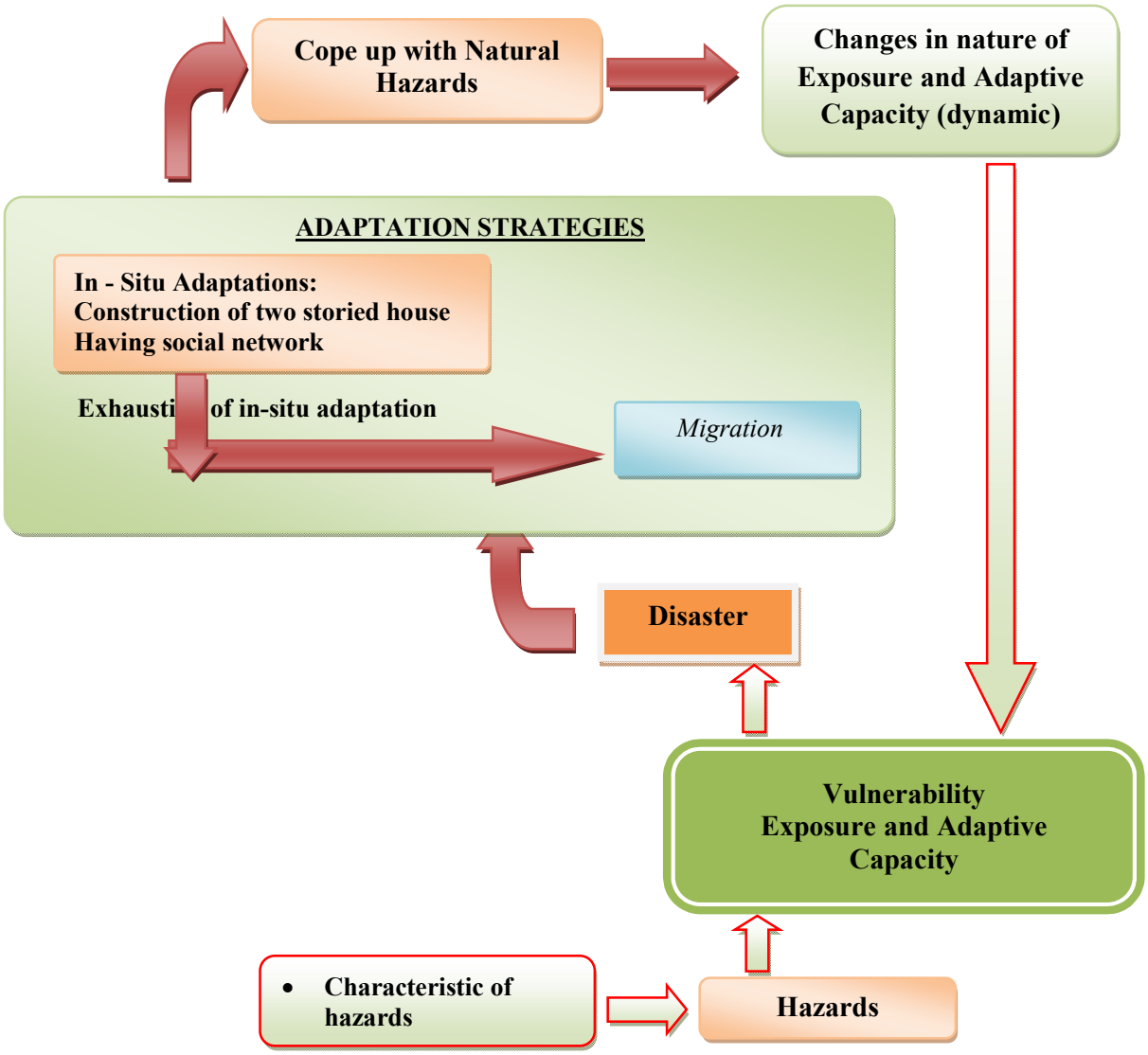



Figure 3.1: Conceptual framework on relationship between hazards, vulnerable community and the community adaptation to hazards

*Source: compiled by author*

### 3.4 Study Area – Rathnapura Municipal Council (RMC)

Ratnapura Town, the capital of Sabaragamuwa Province is located 101 kilometers away from Colombo on the Colombo- Badulla main road as an important intermediary center, is one of the gate way to Uva, Southern and Central Provinces.

Ratnapura Municipal Council area is 22.2 square kilometers in extent. Ratnapura Divisional Secretariat is located within this town. Rathnapura MC Area is located between the northern latitudes 6- $42^0$and 7-$00^0$ and the eastern longitudes of 80-$23^0$ and 80-$24^0$.

As the town is situated within a basin area, it experiences an average annual temperature of 29 Cº. As shown in figure 3.2 the maximum temperature is recorded in the month of March whilst the lowest is in the month of January. The annual average rainfall in the town varies between 3,000 to 4,000 mm. The highest rainfall is experienced during the south west monsoon in May and June and in the inter monsoon of September and October. According the figure 3.3 rain fall has increased slightly. According to the topographic features, the town contain of mountains with steep slopes, rivers, river valleys, low lying lands and plains. It is situated at a range of 18 to 305 meters above MSL. Because of this location Ratnapura town is facing disasters such as landslides, floods occur time to time from the past decades.

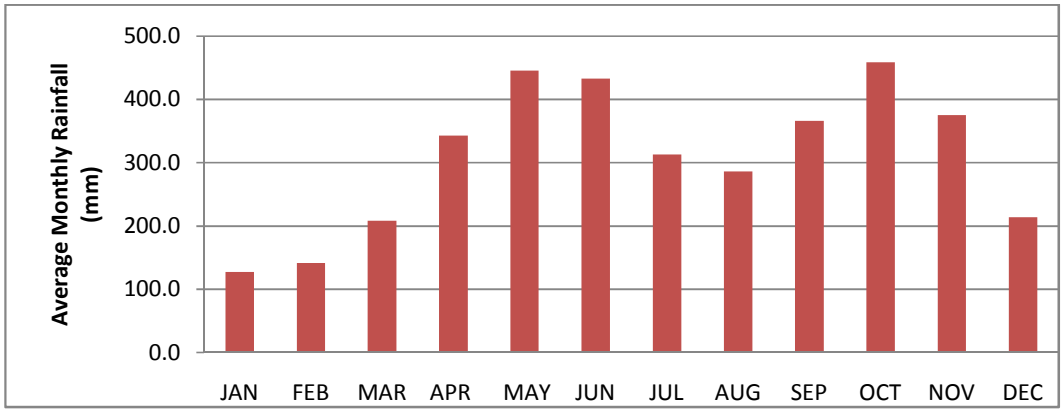



Figure 3.2: Average monthly rainfall (1980 – 2010)

*Source: Based on Meteorological Department Data*

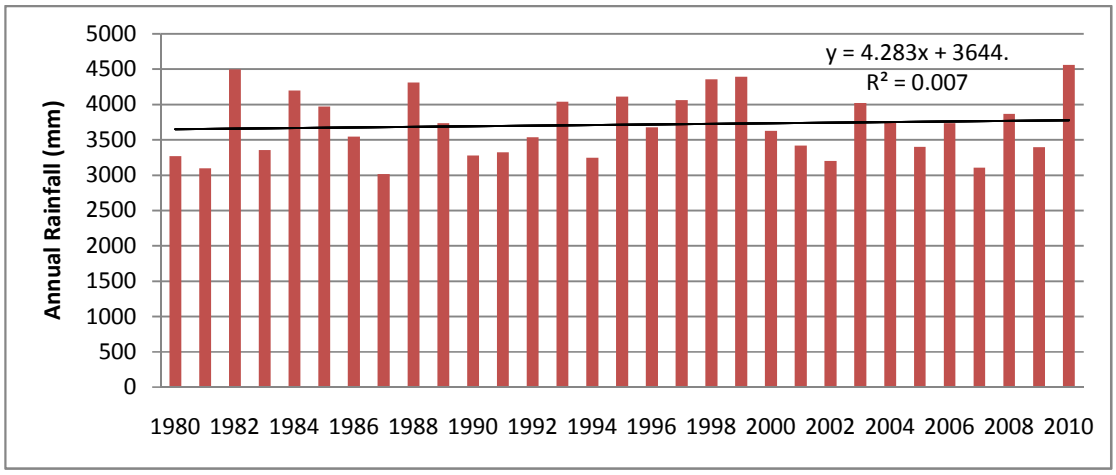
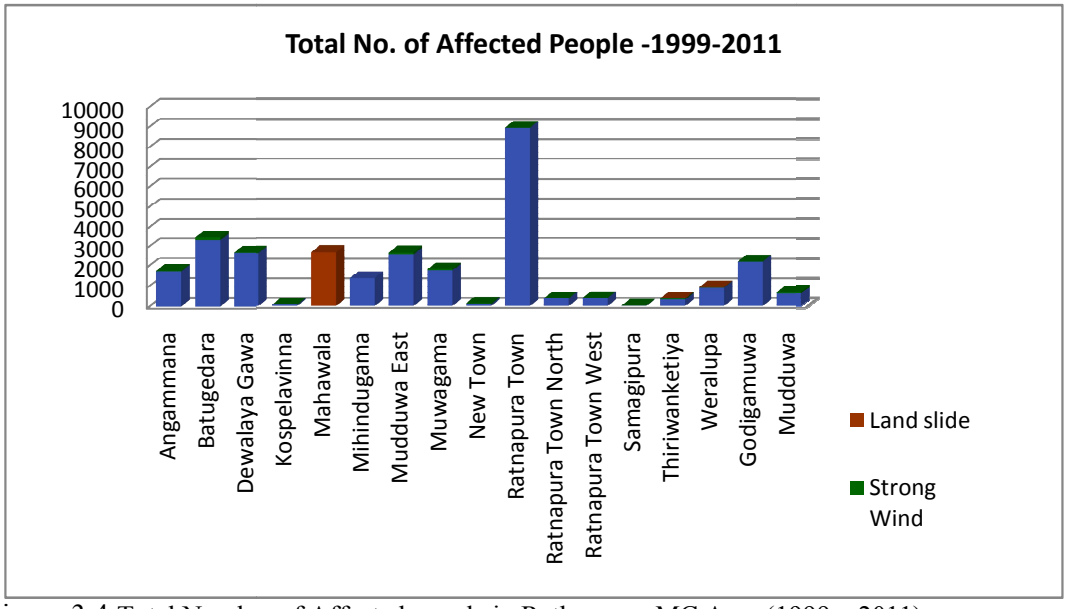



Figure 3.3: Average Annual Rainfall Distributions (1980 – 2010)

*Source: Based on Meteorological Department Data*

### 3.5 Selection of Case Study Area

According to the Sri Lanka's Climate Change Vulnerability Data Book of 2011, most of the emerging townships in the Sabaragamuwa Province are highly vulnerable to landslides and floods. Rathnapura in Sabaragamuwa province experiences multiple hazards as shown in figure 3.4.Geographical positioning of Rathnapura town has increased its vulnerability to frequent and extreme natural hazards. The urban centre is located at the curve of "Kalu" river and the catchment areas with very steep gradients. The geographical characteristic of the surrounding area also further has increased its vulnerability to rapid onset of floods. Figure 3.5 depicted the number of peoples affected from 1999.




igure 3.4:Total Number of Affected people in Rathnapura MC Area (1999 – 2011)

*Source: DRR Vulnerability Report*

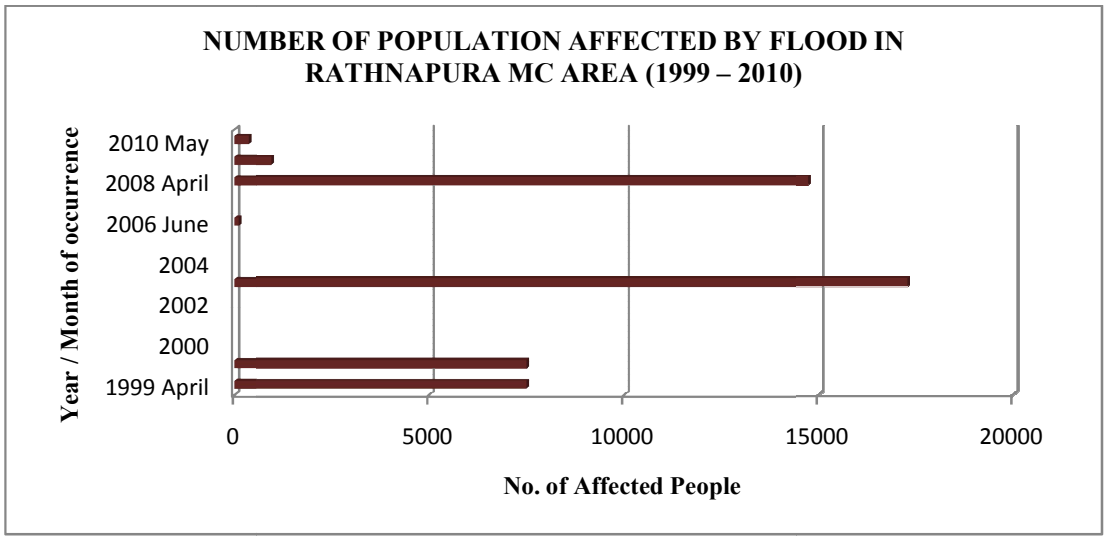



Figure 3.5:Number of population affected by flood in Rathnapura MC Area (1999 – 2010)

*Source: DRR Vulnerability Report*

According theVulnerability and Disaster Risk Assessment for Rathnapura Municipal Council Area report (prepared by university Of Moratuwa) map of the composite risk of Rathnapura MC has developed by adding flood social risk of Rathnapura, flood economic risk of Rathnapura and flood environmental risk of Rathnapura. Figure 3.6

shows the flood composite risk of Rathnapura. According to this map also Batugedara GN division has selected as it is more vulnerable for disasters. Figure 3.7 shows the location of study area.

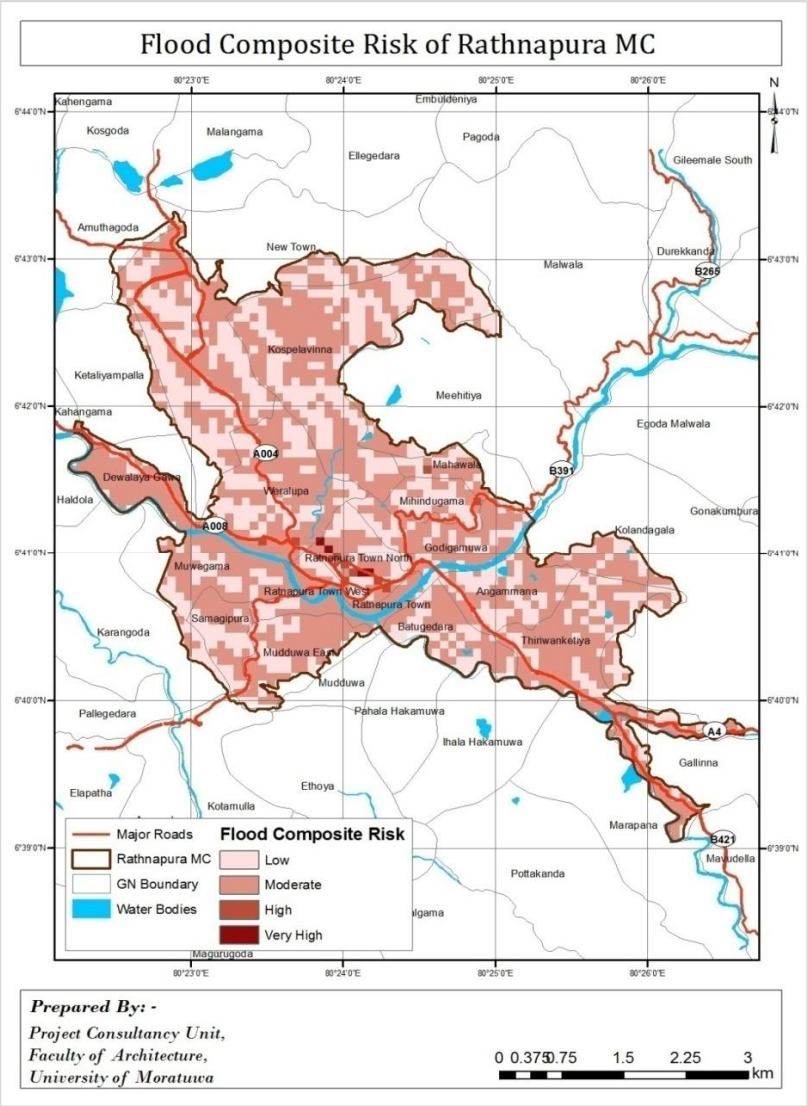



Figure 3.6: Flood composite risk of Rathnapura MC

*Sources:Flood Hazard profile in Sri Lanka*

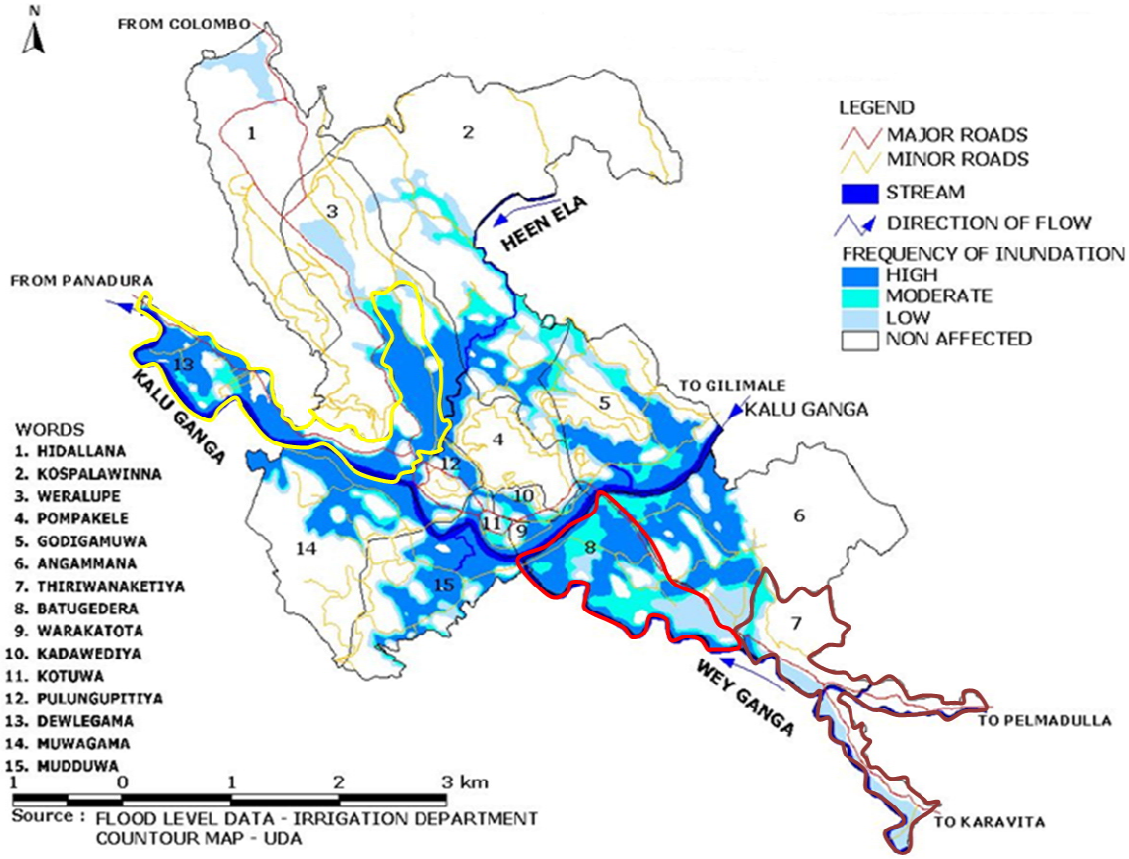



Figure 3.7: Location of the study area

### 3.6 Data Collection and Data Analysis

The main objective study is to study migration as one form of successful adaptation strategy to natural hazard

The research is based on the questionnaire survey and interviews. Random sampling technique is used to select the sample. According the informal discussions conducted with the people residing in the flood prone areas of BatugedaraGN Division to obtain information for the study. These informal discussions and observations provided more information to meet the objectives of the research study.

Table 3.1: Selected GN division for case study

| GN Name | **Total family** | **Total population** | **Population density** |
|---|---|---|---|
| Batugedara | **423** | **1792** | **20** |

*Source: Resource Profile of RMC, 2006*

Among those family about 25 families faced flood three times per year severally. 35 families also faced the flood three times per year severity is low. 45 families faced flood 2 times per year (table 3.2). But other families are inundated occasionally not frequently. Some houses are inundated for 10- 20 years interval (records of Ratnapura Divisional Secretariat) Data collected through interview was analyzed by using SPSS. Mainly Chi-Square and descriptive statistical method was used to analyze the data.

Table 3.2: Sample population

| **Severity of flood** | **Total family** |
|---|---|
| 3 times per year Level is more than three feet | 25 |
| 3 times per year Level is Less than three feet | 35 |
| 2 times per year | 45 |
| **Total** | **105** |

### 3.7 Conclusion

Batugedara municipal ward has been selected in Rathnapura MC Area considering high level of vulnerability. Data is collected from questionnaire survey and informal discussion in order to analyze the how environment hazard mainly flood affect to the migration. Chi –square test, One way ANOVA and descriptive statistical analyze method used to analyze the data. In the next chapter will discuss the what factors affect to think of migration during flood season, frequentlydistribution of those factors, frequently distribution of difficulties faced by people, adaptation behaviors employed by people, reasons affect to think of migration, factors affect to think of migrating, reasons for living in risky area and how people behave in future flood.

# CHAPTER FOUR
# RESULTS & ANALYSIS

## 4.1. Introduction

This chapter discusses the analysis of the data collected through questionnaire survey and interview. This chapter deeply discuss the most critical factors made people more vulnerable and how those affect to the decision of migration, what are the most critical difficulties drive the people to leave the place, why people stay in risky area, what are the differences of type of adaptation strategies employed by two groups (group 1- never thought to migrate and group 2- thought to migrate), strength of peoples' capacity that help them to adapt to future flood and the possibility of practicing migration as a household adaptation strategy.

## 4.2. Analysis and Result

### 4.2.1 Flooding in Rathnapura

In this study, it was aimed to study the historical records of flooding to understand the nature and intensity of flooding in Ratnapura and Batogedara areas. Past records indicate the extreme flood events occurred once in every 5 to 10 years in Rathnapura. Butugedara area is inundated three times per year. People in Batugedara are expecting floodmainly in May, August and December. Major floods were occurred in 1857, 1872, 1893, 1913, 1947, 1957, 1969, 1975, 1978, 1982, 1999, 2001, 2003 Rathnapura during the past and recorded extreme flood events occurred in 1979, 1984, 1993 and most recent extreme flood events occurred in May 2003(Disaster management centre, 2005). Severe flood occurred in 1993 due overflow of "Kalu" River flowing through Rathnapura city affected 2,567 families in Rathnapura MC Area (Disaster management centre, 2005). Heavy flooding occurs generally once in every 10 years inundating about 20% of the total land area. The flood occurred in 2003, caused severe damages, which was the 2$^{nd}$ largest in the history of Ratnapura. It is reported that the flood caused heavy damages to life and property while disrupting the day-to-day activities of the communities for several days. In 2003 floods, the estimated damage to the Ratnapuraarea was Rs. 1,140 Million and 122 people died in the incident (Disaster management centre, 2005).

### 4.2.2 Sample

The sample includes 50 people living in Batugedara area and comprised 26 female and 24 males. Among 50 respondents 44 people are married. Table No. 4.1 indicates age group and table 4.2 indicates sex of the selected sample. All 50 people responded to questionnaire and answered questioned forwarded by interviewer. All 50 people subject to survey are non-migrants. During household survey 3 households who had been migrated due to flood were identified through household interview. These three families were not subjected to survey as they were out of district.

Table 4.1: Age Group and Marital status

| Age group | Marital Status | | Total |
|---|---|---|---|
| | Single | Married | |
| 18-25 | 3 | 2 | 5 |
| 25-35 | 2 | 5 | 7 |
| 35-45 | 1 | 12 | 13 |
| 45-55 | 0 | 19 | 19 |
| >55 | 0 | 6 | 6 |
| Total | 6 | 44 | 50 |

Source: Questionnaire survey

Table 4.2: Sex and Marital status.

| Sex | Marital Status | | Total |
|---|---|---|---|
| | Single | Married | |
| Male | 3 | 21 | 24 |
| Female | 3 | 23 | 26 |
| Total | 6 | 44 | 50 |

Source: Questionnaire survey

### 4.2.3 Factors affect to think of migration during flood season.

Out of 50 interviewees about 17 people had think of migrating due to the flood. That's mean 34% of vulnerable population are likely to migrate whereas 64% of vulnerable population are not willing to migrate. According to past studies,age, occupation, income, education level, no of years living in that area, frequency of flood occurred and level of flood experienced (severity of flood) are likely to affect people to migrate to other areas. The factors that affect to think of migrating can be found by using chi square method. According to the Chi-Square statistics tables 4.3, 4.4, 4.5, 4.6 shows the relationship between age, sex, level of education and income with think of migrating respectively. Significance values (p value) are 0.402, 0.924,0.087, and 0.255 respectively. These p values are greater than alpha level of significance of 0.05 ($p<0.05$). So this analysis clearly shows that there is no statistically significant relationship between age, sex, level of education and income level with desire to migrate risk free area.

Table 4.3:Relationship between age and think of migrating

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 4.033[a] | 4 | .402 |
| agLikelihood Ratio | 5.901 | 4 | .207 |
| Linear-by-Linear Association | .934 | 1 | .334 |
| N of Valid Cases | 50 | | |

a. 7 cells (70.0%) have expected count less than 5. The minimum expected count is 1.70.

Table 4.4:Relationship between sex and think of migrating

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | .009[a] | 1 | .924 | | |
| Continuity Correction[b] | .000 | 1 | 1.000 | | |
| Likelihood Ratio | .009 | 1 | .924 | | |
| Fisher's Exact Test | | | | 1.000 | .581 |
| N of Valid Cases[b] | 50 | | | | |

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 8.16.

b. Computed only for a 2x2 table

Table 4.5: Relationship between level of education and think of migrating

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 6.579[a] | 3 | .087 |
| Likelihood Ratio | 7.209 | 3 | .066 |
| N of Valid Cases | 50 | | |

a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is .68.

Table 4.6: Relationship between income level and think of migrating

**Income - Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 4.057[a] | 3 | .255 |
| Likelihood Ratio | 4.549 | 3 | .208 |
| Linear-by-Linear Association | .497 | 1 | .481 |
| N of Valid Cases | 50 | | |

a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is .34.

Rest of other factors are number of years living in that area, level of flood experienced (severity of flood) and occupation affect to the probability of migration. According to the Chi-Square statistics tables 4.7, 4.8, 4.9, shows the relationship between occupations, number of years living, and severity of flood with think of migrating respectively.

According to the Table 4.7 Chi-Square statistics table, Pearson Chi-Square is 31.032 and significance value is 0.000 (p=0.000). Significance value p=.000 is lower than alpha level of significance of 0.05 (p>0.05). This result demonstrates that there is relationship between occupation and think of migrating. These two variables are dependent.

According to the Table 4.8 and 4.9 Chi-Square statistics tables, Pearson Chi-Square is 13.061 and 4.906 and significance values are (p values) 0.011 , 0.027 respectively. Significance values (p=.0.011, p=0.027) are lower than alpha level of significance of 0.05 (p>0.05). This result demonstrates that there is relationship between number of years living in that area and level of flood experienced (severity of flood) with think of migrating. Results shows that Number of years living in that area, level of flood experienced (severity of flood) and occupation has relationship with migration due to flood.

Table 4.7: Relationship between occupation and think of migrating

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 31.032[a] | 5 | .000 |
| Likelihood Ratio | 36.929 | 5 | .000 |
| Linear-by-Linear Association | 7.242 | 1 | .007 |
| N of Valid Cases | 50 | | |

a. 9 cells (75.0%) have expected count less than 5. The minimum expected count is 1.02.

Table 4.8: Relationship between numbers of years living and think of migrating

**Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) |
|---|---|---|---|
| Pearson Chi-Square | 13.061[a] | 4 | .011 |
| Likelihood Ratio | 14.399 | 4 | .006 |
| Linear-by-Linear Association | 7.799 | 1 | .005 |
| N of Valid Cases | 50 | | |

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is .34.

Table 4.9: Relationship between severity and think of migrating

**Severity of flood Chi-Square Tests**

| | Value | df | Asymp. Sig. (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
|---|---|---|---|---|---|
| Pearson Chi-Square | 4.906[a] | 1 | .027 | | |
| Continuity Correction[b] | 3.268 | 1 | .071 | | |
| Likelihood Ratio | 7.412 | 1 | .006 | | |
| Fisher's Exact Test | | | | .039 | .026 |
| Linear-by-Linear Association | 4.808 | 1 | .028 | | |
| N of Valid Cases[b] | 50 | | | | |

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.72.

b. Computed only for a 2x2 table

Results of the simple descriptive statistics analysis derived through questionnaire survey revealed that how percentage of each occupation category thinks to migrate during flood (Table 4.10)**.**For the easiness of analysis gem and sand mining labour categorized as labour1 and other type of labour such as mason, security guard ...etc. are grouped as labour 2. According to the table 4.10, 95.7% of labour 1 category did not think to migrate. That is because their occupation is mainly link with the environment. But the people who are Drivers, teachers are 100% like to migrate. But farmers 100% are not like to migrate. 70% of labour 2 category and 40% of self-employees are likely to migrate. This results show, which mainly labours 1 category and farmers, did not think to migrate.Since their livelihood is linked with the location. If they move to another area they have lost their income generation source. But the occupation types are not directly linked with the existing environment has possibility to leave the place. They can do their jobs by living in another place also. A three wheeler diver, 45 years old said,

'Even each and every flood event I think 100 times to migrate. During this time I was unable to do my job. I want give protection to my family. But after flooding I had to clean the place without going for job. We do not have savings. But I do not have enough courageous and finance to leave this place If I go to another place I can do my job.'

Table 4.10: Frequencies of type of occupation affect to migration.

| Occupation | | Think of migration | Frequency | Percent |
|---|---|---|---|---|
| Labour 1 | Valid | yes | 1 | 4.3 |
| | | No | 22 | 95.7 |
| | | Total | 23 | 100 |
| Labour 2 | Valid | yes | 7 | 70 |
| | | No | 3 | 30 |
| | | Total | 10 | 100 |
| Teaching | Valid | yes | 4 | 100 |
| Farming | Valid | No | 5 | 100 |
| Self employment | Valid | yes | 2 | 40 |
| | | No | 3 | 60 |
| | | Total | 5 | 100 |
| Driver | Valid | yes | 3 | 100 |

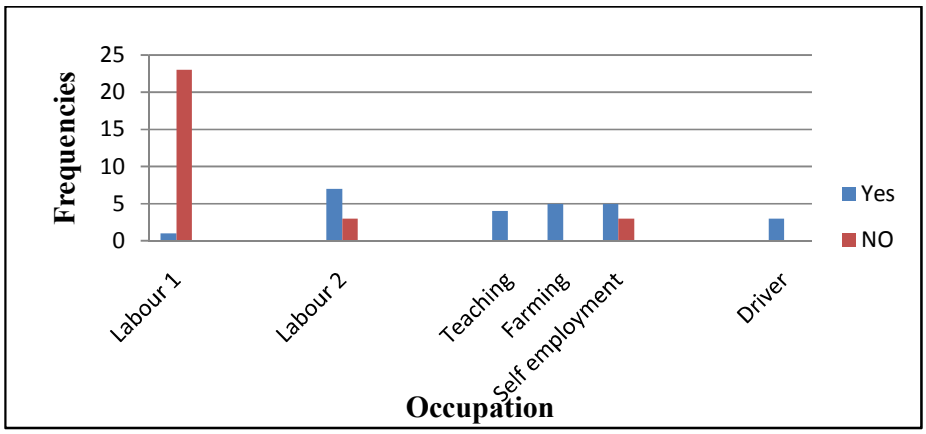



Figure 4.1: Frequencies of type of occupation affect to migration.

Source: Compiled by Author

According to the table 4.11, 66.7% people who live in that area for 10 -20 years has high probability to leave the place. It is very clear that when no. Of years living in the area is increasing the probability of migration has decreased.

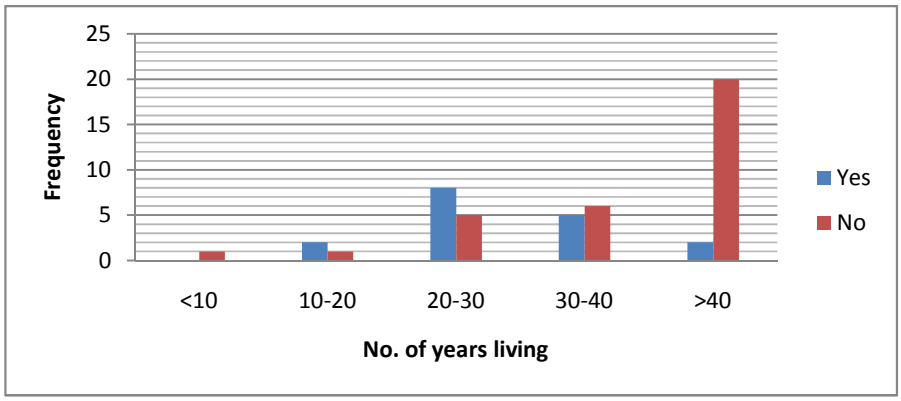



Figure 4.2: Frequencies of number of years living in that area affect to migration.

Source: Compiled by Author

Table 4.11: Frequencies of number of years living that is affect to migration

| **No. of Years Living that Area** | | | **Frequency** | **Percent** |
|---|---|---|---|---|
| <10 | Valid | No | 1 | 100 |
| 10-20 | Valid | **yes** | **2** | **66.7** |
| | | No | 1 | 33.3 |
| | | Total | 3 | 100 |
| 20-30 | Valid | **yes** | **8** | **61.5** |
| | | No | 5 | 38.5 |
| | | Total | 13 | 100 |
| 30-40 | Valid | **yes** | **5** | **45.5** |
| | | No | 6 | 54.5 |
| | | Total | 11 | 100 |
| >40 | Valid | **yes** | **2** | **9.1** |
| | | No | 20 | 90.9 |
| | | Total | 22 | 100 |

Respondent who consider migrating during hazard period has faced severe floods. Table 4.12 depicts severity of flood affects to the people to take the decision to migrate. Severe flood may affect to leave the hazardous place. Most vulnerable people take decision to migrate in order to reduce the risk.

Table 4.12:Frequencies of severity of flood affect to probability of migration

| Consider to migrate | Severity of flood | Frequency | Percentage |
|---|---|---|---|
| Yes | Heavy | 17 | 100 |
| | | | |
| No | Somewhat Heavy | 8 | 24.2 |
| | Heavy | 25 | 75.8 |
| | Total | 33 | 100 |

### 4.2.4 The Difficulties faced by people during flood time

Since occupation and No Of years living in hazard place highly affect to the probability of migration it is important to find out how these factors varies with difficulties faced by people. Because it will help to build the argument: The people who live in place where this type of difficulties present as a result of environmental hazards may leave the place. People who consider migrating dissatisfied with food, accommodation, security and transport. People who are more vulnerable for food scarcity, accommodation security and transport may decide to migrate. During interview how people describe their experience was coded. A Labour (Mason) of 40 years old expressed,

'My house was inundated at least three times per year. Normally after New Year 45 days flooding continuously occurred. Even though there is no rain in our area inundation occurred due to rain in up country. I have two daughters. Now both of them are married. But when they are very young, I faced lot of problem during this time. Because of we had to go to another place during hazards period. Security is the main issue I faced. Foods and transport are less important for me when it compared with security. If I have capacity to go to another place I would definitely leave the place.'

People who had never thought to migrate have ability to fulfill their followings needs at satisfactory level. But most of them are dissatisfied with accessibility of livelihood,

Table 4.13: Frequently distribution of difficulties faced by people

| Type of Difficulties | | Consider Migration | |
|---|---|---|---|
| | | Yes % | NO % |
| Food | Dissatisfied | 70.6 | 24.2 |
| | Somewhat Dissatisfied | 29.4 | 57.6 |
| | Neither Satisfied nor Dissatisfied | 0 | 18.2 |
| | | | |
| Accommodation | Dissatisfied | 70.6 | 30.3 |
| | Somewhat Dissatisfied | 29.4 | 57.6 |
| | Neither Satisfied nor Dissatisfied | 0 | 12.1 |
| | | | |
| Livelihood | Dissatisfied | 41.1 | 75.8 |
| | Somewhat Dissatisfied | 25.3 | 18.2 |
| | Neither Satisfied nor Dissatisfied | 17.7 | 6 |
| | Somewhat satisfied | 5.9 | 0 |
| | | | |
| Sanitary service | Dissatisfied | 58.8 | 15.2 |
| | Somewhat Dissatisfied | 41.2 | 66.7 |
| | Neither Satisfied nor Dissatisfied | 0 | 18.1 |
| | | | |
| Children | Dissatisfied | 53 | 33.3 |
| education | Somewhat Dissatisfied | 29.4 | 48.5 |
| | Neither Satisfied nor Dissatisfied | 17.6 | 18.2 |
| | | | |
| Security | Dissatisfied | 76.5 | 30.3 |
| | Somewhat Dissatisfied | 17.6 | 48.5 |
| | Neither Satisfied nor Dissatisfied | 5.9 | 21.2 |
| | | | |
| Transport | Dissatisfied | 70.6 | 30.3 |
| | Somewhat Dissatisfied | 29.4 | 60.6 |
| | Neither Satisfied nor Dissatisfied | 0 | 9.1 |
| | | | |
| Disease | Dissatisfied | 58.8 | 15.1 |
| | Somewhat Dissatisfied | 41.2 | 78.2 |
| | Neither Satisfied nor Dissatisfied | 0 | 6.1 |

Labour 1 (gem and sand mining) perception on hardship faced during difficulty period is different from other occupation category. (Table 4.15) Since they are highly

depend on the environment high percentage level of dissatisfaction shows in C (access to livelihood). Teachers, farmers, and self-employees are highly dissatisfied with food, security, accommodation, sanitary services, and children education. So it is clear that when people faced that type of difficulties due to natural hazards, there is possibility to occur migration. Table 4.8 shows that there is significant mean difference between two groups (Thought to migrate and never thought to migrate) with reference to the food, accommodation, access to livelihood, sanitary services, drinking water, transport, security and diseases. But children education is not affect to think to migration.

Table 4.14: ANOVA

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Difficulties in Food | Between Groups | 4.672 | 1 | 4.672 | 12.882 | .001 |
| | Within Groups | 17.408 | 48 | .363 | | |
| | Total | 22.080 | 49 | | | |
| Difficulties in Accommodation | Between Groups | 3.081 | 1 | 3.081 | 8.998 | .004 |
| | Within Groups | 16.439 | 48 | .342 | | |
| | Total | 19.520 | 49 | | | |
| Difficulties in Livelihood | Between Groups | 3.766 | 1 | 3.766 | 7.308 | .009 |
| | Within Groups | 24.734 | 48 | .515 | | |
| | Total | 28.500 | 49 | | | |
| Difficulties in sanitary Service | Between Groups | 4.293 | 1 | 4.293 | 13.657 | .001 |
| | Within Groups | 15.087 | 48 | .314 | | |
| | Total | 19.380 | 49 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Difficulties in Drinking Water | Between Groups | 4.317 | 1 | 4.317 | 10.929 | .002 |
| | Within Groups | 18.963 | 48 | .395 | | |
| | Total | 23.280 | 49 | | | |
| Difficulties in Children Education | Between Groups | .455 | 1 | .455 | .836 | .365 |
| | Within Groups | 26.125 | 48 | .544 | | |
| Difficulties in Security | Between Groups | 4.243 | 1 | 4.243 | 9.151 | .004 |
| | Within Groups | 22.257 | 48 | .464 | | |
| | Total | 26.500 | 49 | | | |
| Difficulties in Transport | Between Groups | 2.735 | 1 | 2.735 | 8.727 | .005 |
| | Within Groups | 15.045 | 48 | .313 | | |
| | Total | 17.780 | 49 | | | |
| Difficulties in Diseases | Between Groups | 2.775 | 1 | 2.775 | 12.283 | .001 |
| | Within Groups | 10.845 | 48 | .226 | | |
| | Total | 13.620 | 49 | | | |

Table 4.15: Frequently distribution of difficulties faced by people based on occupation

| Occupation | | A % | B % | C % | D % | E % | F % | G % | H% | I % |
|---|---|---|---|---|---|---|---|---|---|---|
| Labour 1 | dissatisfied | 21.7 | 21.7 | 82.6 | 13 | 17.4 | 26.1 | 30.4 | 34.8 | 21.7 |
| | slightly dissatisfied | 60.9 | 65.2 | 8.7 | 60.9 | 56.5 | 47.8 | 39.1 | 52.2 | 69.5 |
| | Somewhat dissatisfied | 17.4 | 13 | 8.7 | 21.1 | 26.1 | 26.1 | 30.4 | 13 | 8.7 |
| | | | | | | | | | | |
| Labour 2 | dissatisfied | 60 | 60 | 20 | 50 | 30 | 40 | 50 | 30 | 30 |
| | slightly dissatisfied | 20 | 30 | 50 | 50 | 60 | 50 | 40 | 70 | 70 |
| | Somewhat dissatisfied | 20 | 10 | 30 | 0 | 10 | 10 | 10 | 0 | 0 |
| | | | | | | | | | | |
| Teaching | dissatisfied | 50 | 50 | 25 | 75 | 75 | 50 | 100 | 100 | 50 |
| | slightly dissatisfied | 50 | 50 | 50 | 25 | 25 | 50 | 0 | 0 | 50 |
| | Somewhat dissatisfied | | | 25 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | |
| Farming | dissatisfied | 40 | 60 | 80 | 20 | 20 | 60 | 40 | 20 | 100 |
| | slightly dissatisfied | 60 | 40 | 20 | 80 | 80 | 40 | 60 | 80 | 0 |
| | Somewhat dissatisfied | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | |
| Self emplo | dissatisfied | 40 | 60 | 60 | 20 | 20 | 60 | 40 | 60 | 40 |
| yement | slightly dissatisfied | 60 | 40 | 40 | 80 | 40 | 40 | 60 | 40 | 60 |
| | Somewhat dissatisfied | 0 | 0 | 100 | 0 | 40 | 0 | 0 | 100 | 0 |
| | | | | | | | | | | |
| Driver | dissatisfied | 100 | 100 | 100 | 66.7 | 100 | 66.6 | 100 | 100 | 100 |
| | slightly dissatisfied | 0 | 0 | 0 | 33.3 | 0 | 33.3 | 0 | 0 | 0 |
| | Somewhat dissatisfied | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

A-difficulties in food, B- accommodation, C- livelihood, D- sanitary service, E – Drinking water, F –children education, G- security, H- transport, I- Disease

### 4.2.5 Adaptation strategies

Natural hazards such as floods are not new to the people of Rathnapura area .They have been living with the risk of flood disaster for centuries. They have their own skills and resources, as well as their experiences to adapt to the extreme situations over the years. Identification of adaptation behavior employed by the people in the study area throughquestionnaire survey and interview summarized in table 4.16when compare these two groups, people who never thought to migrate employed adaptation strategies and were able to cope up with hazards. Three families who migrated to another place due to flood had identified by this research during interview. A driver of 38 years old said

'The family who came to next door to my house for 4 years ago left place on 2013. Husband is a business man. But they were unable to tolerate the flood. They couldn't capacity to face the damages occurred due to flood.

So it will reveal that people are less adaptation capacity has possibility to migrate.

Table 4.16: Adaptation behaviors employed by people

| Adaptation Strategies | Consider to migrate % | |
|---|---|---|
| | Yes | No |
| Construction of house on stilt (Concrete reinforced) | 47.1 | 82.6 |
| Construction of two storied buildings | 52.9 | 78.3 |
| Closely knit community | 88.2 | 95.2 |
| Draining the flood water | 29.4 | 65.2 |
| Save Rs. 10000 to use during flood season | 88.2 | 60.9 |
| Do nothing during disaster | 17.6 | 26.1 |
| Search for cook meals | 29.4 | 78.3 |
| Repairing the appliances damaged | 94.1 | 86.9 |
| Repairing the house damages | 88.2 | 95.6 |
| Cleaning the surrounding area | 100 | 100 |

| | | |
|---|---|---|
| Evacuating the family (Specially the elderly people and the children, to friends or relative place) | 52.9 | 82.6 |
| Purchasing of food before flood | 47 | 43.5 |
| Decision were taken on traditional knowledge | 88.2 | 91.3 |
| Evacuating essential items to the upper floors | 52.9 | 78.3 |
| Fixing and replacing the damaged items | 94.1 | 82.6 |
| Prepare a storage place at higher place | 35.3 | 78.3 |
| Building dikes using sand bags | 17.6 | 52.2 |
| Keep the bus tube to use for transportation | 35.3 | 78.3 |

### 4.2.6 Reasons affect to think of migrating

Results of the simple descriptive statistical analysis shows cost of recovery is the strong driver that affect to think of migrating (table 4.8).

People had to spend more money on replace damaged items. The housewife of the 35 years old said,

'In 2003 flood, our valuable things were destroyed due to flood. Damages were about five lakes. The flood level was gone up to roof level. I had to pain it again. Electricity also got damaged. So I can't bear this cost. I had to get a loan from my friend to replaces the damage items'.

Food scarcity and security was also extremely considered by people. Recovery cost, spread of diseases, food scarcity and security /protection during flood season highly affect to the decision of migration. If hazard will create these problem people will leave the place as a household strategy.

Table 4.17: Reasons affect to think of migrating

| | Access to livelihood | Cost of recovery | Food Scarcity | B/D of children education | Security | Diseases |
|---|---|---|---|---|---|---|
| Not at all Considered | 5.9 | 0 | 0 | 11.8 | 0 | 0 |
| Slightly Concerned | 17.6 | 0 | 0 | 0 | 5.9 | 0 |
| Somewhat Concerned | 17.6 | 0 | 0 | 5.9 | 0 | 0 |
| Moderately Concerned | 23.5 | 0 | 17.6 | 17.6 | 11.8 | 23.5 |
| Extremely Concerned | 35.3 | 100 | 82.4 | 64.7 | 82.3 | 76.5 |

### 4.2.7 Reasons for living in risky area

Results of the descriptive statistical analysis revealed that, migration cost, access to services, native place, livelihood link with environment and socialites are the factors mainly influence for decision to stay in risky area. Educational facilities have little influence for migration compared to other factors. But there is no influence of government incentives and security to stay in that area (chapter 4.3). The factors mainly affect to probability of migration are identified by using one way ANOVA. The significance value less than 0.05 means there is significance mean difference between two groups. Results of ANOVA (table 4.18) express that livelihood linked with the place, access to service and the native place are the factors mainly affect to the stay in the risky area. So it is clear that if peoples' livelihood, native place and access to service are not connecting with the place there is high possibility to leave the place with the assistance of government.

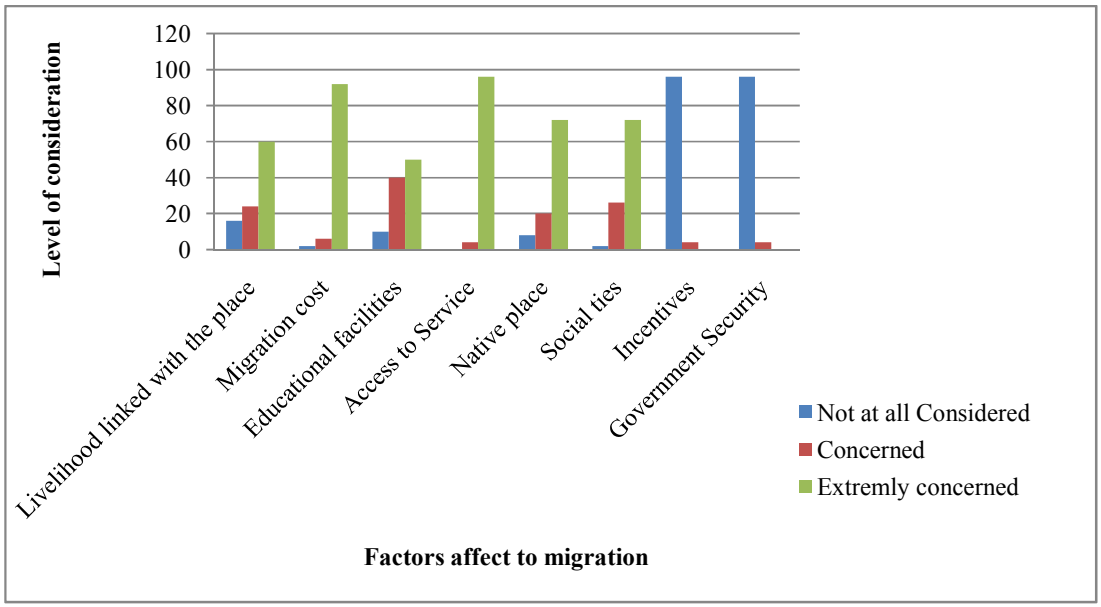



Figure 4.3: Frequency distribution of factors affect to migration

Table 4.18: ANOVA

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Livelihood linked with the Place | Between Groups | 76.305 | 1 | 76.305 | 79.151 | .000 |
| | Within Groups | 46.275 | 48 | .964 | | |
| | Total | 122.580 | 49 | | | |
| Migration Cost | Between Groups | 1.498 | 1 | 1.498 | 2.320 | .134 |
| | Within Groups | 31.002 | 48 | .646 | | |
| | Total | 32.500 | 49 | | | |
| Educational Facilities | Between Groups | 2.140 | 1 | 2.140 | 2.040 | .160 |
| | Within Groups | 50.360 | 48 | 1.049 | | |
| | Total | 52.500 | 49 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Access to Service | Between Groups | 2.916 | 1 | 2.916 | 11.858 | .001 |
| | Within Groups | 11.804 | 48 | .246 | | |
| | Total | 14.720 | 49 | | | |
| Native Place | Between Groups | 8.913 | 1 | 8.913 | 6.018 | .018 |
| | Within Groups | 71.087 | 48 | 1.481 | | |
| | Total | 80.000 | 49 | | | |
| Social Ties | Between Groups | .791 | 1 | .791 | 1.116 | .296 |
| | Within Groups | 34.029 | 48 | .709 | | |
| | Total | 34.820 | 49 | | | |
| Incentives | Between Groups | .093 | 1 | .093 | .942 | .337 |
| | Within Groups | 4.727 | 48 | .098 | | |
| | Total | 4.820 | 49 | | | |
| Security | Between Groups | .041 | 1 | .041 | 1.053 | .310 |
| | Within Groups | 1.879 | 48 | .039 | | |
| | Total | 1.920 | 49 | | | |

### 4.2.8 People behavior to adapt to the flood in future.

The latter part of the questionnaire was designed to analyze migration occur due to floodin future. If the rate and intensity of flooding will significantly increase in the next 5 years, adaptation of people to the changing environment was analyzed using following statements through simple descriptive statistical analysis method.

**Coping Capacity:** if heavy flooding was to occur in my area tomorrow, my household would be able to fully recover from the damage caused by the floods.

- **Financial Capital:** If heavy flooding was to occur in my area tomorrow, my household would have access to sufficient financial resources to ensure that we fully recover from the threats posed by the floods.
- **Social Capital:** If heavy flooding was to occur in my area tomorrow, my household would be able to draw on the support of family and friends to ensure that we fully recover from the threats posed by the floods.
- **Information:** If heavy flooding was to occur in my area tomorrow, my household would have access to early-warning information to ensure that we are fully prepared for the threats posed by the floods.
- .**Iterative learning:** My household has learned considerably from how we have dealt with past flood events. This knowledge is crucial in successfully dealing with future flood events.
- **Migration:** If the flooding is continuing in my area for next five years, I will decide to find an alternative location to settle.

Table 4.19: People behavior to adapt to the flood in future

| | Perception level | Percentage |
|---|---|---|
| Adaptive capacity | Disagree | 80 |
| | Neutral | 4 |
| | Agree | 16 |
| | | |
| Coping capacity | Disagree | 82 |
| | Neutral | 6 |
| | Agree | 12 |
| | | |
| Financial capacity | Disagree | 82 |
| | Neutral | 4 |
| | Agree | 14 |
| | | |
| social capacity | Disagree | 18 |
| | Neutral | 14 |
| | Agree | 68 |
| | | |
| Information | Disagree | 2 |

| | | |
|---|---|---|
| | Neutral | 56 |
| | Agree | 42 |
| | | |
| Iterative learning | Disagree | 2 |
| | Neutral | 32 |
| | Agree | 66 |
| | | |
| Migration | Disagree | 62 |
| | Neutral | 4 |
| | Agree | 34 |

Adaptive capacity, coping capacity and financial capacity of the people are not strong enough to adapt to the changes occurred in environment in future. But they are very rich with social capital, accessibility of good source of information and pass knowledge will help to cope up with natural hazards. So they are not use the migration as adaptation strategy. But there is possibility to 34% of people will leave the place if the flood occurred in future.

**4.3 Conclusion**

Simple descriptive statistical analysis and Chi -Square used to analyze the data collected through questionnaire. The information gathered through also used to interpret the results. The factors affect to think to migrating was identified by using Chi -Square. Occupation, number of years living in that area and severity of the flood mainly affect to the migration. The results shows that labour 2 (mason security guards.....etc), teachers, and drivers are considering migrating during flooding period. So it is clear that people more vulnerable to risk may decide to migrate. Whereas people in labour 1 category (gem mining and sand mining) never thought to migrate .Because of their livelihood is highly linked with place.

Number of years living in that area and think to migrating has inverse relationship. Willing to migrate has decreased with number of years living in that area has increased. People who faced severe flood only have idea to migrate. Only three families were migrated during last 40-50 years. They were new to place. They were

staying the place for 2 to 4 years. So it clear that people who are used or adapt to the place has chance to migrate.

People never thought to migrate perceive the difficulties aroused due to flood differently when compare with people who think to migrate. Dissatisfaction level of food, accommodation, livelihood, sanitary service, children education, security, transport and diseases are representing 70.6%, 70.6%, 41.1%, 58.8%, 53%, 76.5%, 70.6% and 58.8% respectively. But the dissatisfaction level of above difficulties perceived by people think to migrate are 24.2%, 30.3%, 75.8%, 15.2%, 33.3%, 30.3%, 30.3% and 15.1 respectively. The people perception of the above mentioned difficulties also are varying with the occupation. People in two groups (People never thought to migrate and people think to migrate) employed adaptation strategies differently in quantities.

Cost of recovery, food scarcity, children's security and diseases are the factors mainly considered by people to think of migrating. Livelihood linked with the place, migration cost, access to service; native place and social ties are the main factors those influence to people to stay in risky area. Among those factors livelihood linked with location, native place and social ties has less than 0.05 significance differences. Therefore these factors are critically affected to the decision of migration (Table 4.18 ANOVA).

When heavy flood occurred in future; about 80% out of 5o people has adaptive capacity or coping capacity or financial capacity to tolerate the hazards. But sufficient number of people has chance to access to information, use the pass knowledge to adapt to situation and good network of social connection to cope with undesirable conditioned caused by flood in future. But only 34% of people think to leave the place in order to cope with environment stressors.

# CHAPTER FIVE
# CONCLUSION

## 5.1 Conclusion

The main objective of this research was to study to migration as one form of successful adaptation strategy to natural hazard - flooding in the Rathnapura town area. It is generally agreed that vulnerability has a positive relationship to exposure and a negative relationship to adaptive capacity (Ford and Smit, 2004). So in order to reduce the household vulnerability people should employ better adaptation strategy or reduce the exposure. The first research question was that whether people migrate due to flood in order to reduce vulnerability. The results show that, only 17 people out of 50 vulnerable people like to migrate to another place. That is mean 34% of vulnerable people will decide to leave the place and eliminate the exposure to the hazards. So those people will reduce vulnerability by leaving the place.The result further point that more vulnerable people with reference to accessibility to livelihood, food scarcity, problem in accommodation during flood period, sanitary service, and accessibility of children education, security, transport problem and spread of diseases will decide to leave the place as household adaptation strategy to reduce the risk associate with hazard. It further found that people who employee less adaptation strategy or more vulnerable people also are likely to migrate in order to reduce vulnerability.

This study finding further indicates that vulnerable people have barriers to migrate. Strong social ties, native place and livelihood linked with environment may affect to the decision of migration.

That is clear that in order to reduce the risk associate with hazard people decided to migrate risk free area as a household strategy. People who cannot spend money on recovery of damages, recovery of diseases, food and security /protection during flood season are more vulnerable. As well as these people also employee less adaptation strategies with compare to people who never thought to migrate. So it is clear that people are more vulnerable to hazard will decide to leave the place.

## 5.2 Major Findings

1. Type of occupation, number of years living in that area and severity of flood act as migration drivers. Since these factors mainly affect to the vulnerability of people migration will be a form of adaptation in order to reduce the risk.
2. Food, accommodation, access to livelihood, sanitary services, drinking water, transport, security and diseases are main issues decide the vulnerability of the people. People who are severely affected are more vulnerable decide to migrate.
3. Degree of severity of above difficulties varies with the perception of different occupation type. That means vulnerability of people varies with the occupation.
4. Cost of recovery, security and scarcity of food and diseases mainly influence people to think to migrate. That‘s mean people who are not financially strong are more vulnerable.
5. Peoples’ livelihood, native place, migration cost and access to service are the factors motivate the people to stay in risky area. Although people are vulnerable to these factors limit the willingness to migrate.
6. People who are least adapt to changing environment, will leave the place in order to cope up the hazards.

Vulnerability of people on different aspects was studied during this study. It Cleary shows that people who are more vulnerableare likely to leave the place to reduce the risk. Further, the factors that affect to stayin risky area were analyzed. If peoples’ livelihoods were linked with environment, people would not leave the place. Native place and migration cost and social ties also significantly affect to the decision of migration. If the flood will occur in future, there is possibility to migrate from risky area. People will leave to risk free area and reduce exposure to flood. People employing different adaptation strategies cause the vulnerability to reduce. For example,results show that 78% of people who never thought to migrate have two-storied house. They can tolerate the flood level without going to other place. Those people are less vulnerable for flood. Likewise, 53% of people who thought of

migrating have two- storied house. They do not like to go to other place. Most of the people who like to migrate do not have two storied house. Therefore, it appears that they like to leave the place in order to reduce the vulnerability.This indicates that migration can be a form of adaptation with regard to vulnerability.

Confirming the past studies (Rafael, 2007), the results of this study highlight that human migration affects population patterns and characteristics, social, cultural patterns and processes, economies, and physical environments. As people move, their cultural traits and ideas diffusealong with them, creating and modifying cultural landscapesand therefore lessons of this research will help planners and policy makers to avoid the conflict occur in receiving point.

When introducing the relocation projects, the lessons of this study will help to reduce the impacts of these projects. According to this study, willingness to migrate can be categorized in to two groups. They are people who considermigrating and people never thought to migrate. Occupation, number of years living in that area and severity of flood are the main factors critically affect to people to think of migrating. When the numbers of years living are increased, willingness to migrate gets reduced. As well as if people's livelihood linked with environment/location people would not want to leave the place. So planners should have sound knowledge about these factors to reduce negative impacts of the project. People who are willing to migrate face severe difficulties with reference to food, accommodation, sanitary services, security, transport and fear of disease compared to other group. This lesson shows that more vulnerable people will decide to migrate. Planners and policy makers should identify those people correctly.

The nature of livelihood, access to service, native place, social ties and migration costs are the factors motivate the people live in risky area.The people who are not like to migrate extremely consider the accessibility of livelihood. (Appendix 3)If planners relocate them in near the original place they can do their jobs and also not affect to their social ties, native. Planners should consider that people live in risky area for decades and generation has iterative learning to avoid the risks. Results also

show that people who are living for long years do not like to migrate. So planners should consider other alternative options to reduce the vulnerability instead of thinking relocation as the only option.It is a false assumption that all those are vulnerable for flooding are likely to migrate or like to move to alternative locations.

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**APPENDICES** **Appendix - 1**

# Study of migration as one form of adaptation strategy

# fornatural hazards

# Questionnaire

**Sheet No.**

1. Age Group

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 18-25 year | | 25-35 year | | 35-45year | | 45-55 year | | 55> year | |

2. Sex

| | | | |
|---|---|---|---|
| Male | | Female | |

3. Marital Status

| | | | |
|---|---|---|---|
| single | | Married | |

4. Educational Background

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Graduate/Vocational Training | | A/L | | O/L | | Grade 8 or less | |

5. Occupation.....

6. Income

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 - 10,000 | | 10,000-25,000 | | 25,000-50,000 | | >50,000 | |

7. How long do you stay in this place?

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| <10 Years | | 10-20 years | | 20-30 years | | 30-40 | | 40>years | |

8. What types of natural hazard events have you or someone in your household experienced?

| | | | | | |
|---|---|---|---|---|---|
| flood | | Land slides | | Drought | |

9. How many times flood has occurred per year

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | | 2 | | 3 | | >4 | |

10. What is the degree of severity of flood experienced by yourself or your household

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mild (1) | | Somewhat heavy (2) | | Heavy (3) | | | |

11. What hardship did your family face during this season

| **No.** | **Difficulties** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|---|
| 1. | Food | | | | | |
| 2. | Accommodation | | | | | |
| 3. | Access to livelihood | | | | | |
| 4. | Access to sanitary services | | | | | |
| 5. | Drinking water | | | | | |
| 6. | Children education | | | | | |
| 7 | Security | | | | | |
| 8 | Transport problem | | | | | |
| 9 | Diseases | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **1** | Dissatisfied | **3** | Neither satisfied nor dissatisfied | **5** | satisfied |
| **2** | Somewhat dissatisfied | **4** | Somewhat satisfied | | |

12. What coping mechanisms (Adaptation strategies) did your family employ during this time?

| |
|---|
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |

| |
|---|
| 6 |
| 7 |
| 8 |

13. Have you considered migrating due to flood seriously? 1 Yes 2 No

14. If yes What are factors affect for you to consider migration

| **Factor** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| **Economic** | | | | | |
| Access to Livelihood | | | | | |
| Cost of recovery | | | | | |
| Food scarcity | | | | | |
| **Social factors** | | | | | |
| Break down of Children education | | | | | |
| Security | | | | | |
| Spread of disease | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **1** | Not at all considered | **3** | somewhat concerned | **5** | Extremely concerned |
| **2** | Slightly concerned | **4** | Moderately concerned | | |
| | | | | | |

15. what are the factors affect to stay in risky area

| **Factor** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| **Economical** | | | | | |
| Livelihood linked with the place | | | | | |
| Migration cost | | | | | |
| **Social** | | | | | |
| Educational facilities | | | | | |
| Access to services | | | | | |
| Native place | | | | | |
| Social ties | | | | | |
| **Political** | | | | | |
| Incentives | | | | | |
| Security | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **1** | Not at all considered | **3** | somewhat affected | **5** | Extremely affected |

| | | | | | |
|---|---|---|---|---|---|
| **2** | Slightly affected | **4** | Moderately affected | | |

16. If the heavy flood is occurred for next five years

| **Statements** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| My household would have the ability to successfully adapt to the flood | | | | | |
| My household would be able to fully recover from the damage caused by the floods | | | | | |
| My household would have access to sufficient financial resources to ensure that we fully recover from the threats posed by the floods. | | | | | |
| My household would be able to draw on the support of family and friends to ensure that we fully recover from the threats posed by the floods | | | | | |
| My household would have access to early-warning information to ensure that we are fully prepared for the threats posed by the floods. | | | | | |
| Past knowledge is crucial in successfully dealing with future flood events. | | | | | |
| If the flooding is continuing in my area for next five years, I will decide to find an alternative location to settle. | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **1** | Strongly disagree | **3** | Neutral | **5** | Strongly agree |
| **2** | disagree | **4** | agree | | |

**Appendix - 2**

**Table 3.1. Average monthly Rainfall of Rathnapura (January to December).**

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rainfall (mm) | 65 | 80 | 115 | 290 | 315 | 200 | 180 | 100 | 225 | 395 | 335 | 200 |

*Source:* Metrological Department office, Rathnapura District, 2010.

**Table 3.2. Existing Land Use of Pattern of Rathnapura MC Area – 2004**

| **Category** | **Extent (ha.)** | **%** |
|---|---|---|
| Commercial | 49.75 | 2.2 |
| Residential | 821.52 | 37.1 |
| Government & Semi governments | 81.74 | 3.7 |
| Highways & Transport | 116.95 | 5.3 |
| Industries | 10.91 | 0.5 |
| Parks, Play Grounds & Open Areas | 24.27 | 1.1 |
| Urban Forests | 237.55 | 10.7 |
| Religious | 12.14 | 0.6 |
| Water Courses | 95.55 | 4.5 |
| Under developed lands | | |
| Paddy fields | 253.74 | 11.5 |
| Plantations | 244.84 | 11.0 |
| Mixed Cultivation | 114.51 | 5.1 |
| Marshy | 36.42 | 1.6 |
| Cemeteries | 2.83 | 0.1 |
| Open Areas | 111.28 | 5.0 |
| **Total:** | **2,218** | **100.0** |

**Source: UDA, 2006**

**Table 3.3** Population Distribution and Density by Municipal Wards-2001

| **Ward no** | **Municipal Ward** | **Extent (Hectares)** | **Population - 2001** | **Gross Population Density per** |
|---|---|---|---|---|

| | | | | Hectare- 2001 |
|---|---|---|---|---|
| 1. | Hidallana | 280.5 | 5,900 | 21.0 |
| 2. | Kospelawinna | 415.9 | 4,665 | 11.2 |
| 3. | Weralupe | 190.9 | 4,585 | 24.0 |
| 4. | Pompakele | 93.5 | 2,367 | 25.3 |
| 5. | Godigamuwa | 136.2 | 4,885 | 35.0 |
| 6. | Angammana | 296.6 | 2,364 | 8.0 |
| 7. | ThiriwanaKetiya | 167.5 | 2,017 | 12.0 |
| 8. | Batugedera | 153.1 | 2,497 | 16.3 |
| 9. | Warakathota | 18.2 | 650 | 35.7 |
| 10. | Bazaar | 23.3 | 997 | 42.7 |
| 11. | Fort | 21.2 | 1,440 | 67.9 |
| 12. | Pulugupitiya | 46.1 | 1,131 | 24.5 |
| 13. | Dewalegawa | 102.3 | 3,561 | 34.8 |
| 14. | Muwagama | 138.1 | 5,100 | 36.9 |
| 15. | Mudduwa | 137.2 | 4,150 | 30.2 |
| **Total:** | | **2218.0** | **46,309** | **20.9** |

**Source: UDA, 2006**

**Table 3.4. Classification of Houses – 2004**

| Type of Houses | No of Houses | % |
|---|---|---|
| Permanente | 7,743 | 78.35 |
| Semi Permanent | 1,696 | 17.17 |
| Temporary | 439 | 4.46 |
| **Total:** | **9,882** | |

**Source:** Reports from Ratnapura Divisional Secretariat, 2006

**Table 3.6. Damage caused by the Floods – 2003**

| *Particulars* | *No in RMC area* | *No in District* | *% in RMC* |
|---|---|---|---|
| Loss of lives | 03 | 122 | 2 |
| House damages: | | | |
| Partially Damaged | 2879 | 9291 | 31 |
| Totally Damaged | 618 | 3367 | 18 |
| No of Displaced families | 9400 | 34473 | 27 |
| Damaged Paddy lands | 176 ha. | 1369 ha. | 13 |

**Source:**Rathnapura Municipal Council, 2006

**Appendix - 3**

**Table 4.1 Livelihood linked with the Place**

| Thought of migrate | | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|---|
| Yes | Valid | Not at all Considered | 7 | 41.2 | 41.2 | 41.2 |
| | | Slightly Concerned | 3 | 17.6 | 17.6 | 58.8 |
| | | Somewhat Concerned | 6 | 35.3 | 35.3 | 94.1 |
| | | Moderately Concerned | 1 | 5.9 | 5.9 | 100.0 |
| | | Total | 17 | 100.0 | 100.0 | |
| No | Valid | Not at all Considered | 1 | 3.0 | 3.0 | 3.0 |
| | | Slightly Concerned | 1 | 3.0 | 3.0 | 6.1 |
| | | Somewhat Concerned | 2 | 6.1 | 6.1 | 12.1 |
| | | Extremely Concerned | 29 | 87.9 | 87.9 | 100.0 |
| | | Total | 33 | 100.0 | 100.0 | |

**Table 4.2 Migration Cost**

| Thought of migrate | | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|---|
| Yes | Valid | Moderately Concerned | 1 | 5.9 | 5.9 | 5.9 |
| | | Extremely Concerned | 16 | 94.1 | 94.1 | 100.0 |
| | | Total | 17 | 100.0 | 100.0 | |
| No | Valid | Not at all Considered | 1 | 3.0 | 3.0 | 3.0 |
| | | Slightly Concerned | 1 | 3.0 | 3.0 | 6.1 |
| | | Somewhat Concerned | 2 | 6.1 | 6.1 | 12.1 |
| | | Moderately Concerned | 3 | 9.1 | 9.1 | 21.2 |
| | | Extremely Concerned | 26 | 78.8 | 78.8 | 100.0 |
| | | Total | 33 | 100.0 | 100.0 | |

**Table 4.3 Educational Facilities**

| Thought of migrate | | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|---|
| Yes | Valid | Slightly Concerned | 1 | 5.9 | 5.9 | 5.9 |
| | | Somewhat Concerned | 5 | 29.4 | 29.4 | 35.3 |
| | | Moderately Concerned | 11 | 64.7 | 64.7 | 100.0 |
| | | Total | 17 | 100.0 | 100.0 | |
| No | Valid | Not at all Considered | 5 | 15.2 | 15.2 | 15.2 |
| | | Slightly Concerned | 2 | 6.1 | 6.1 | 21.2 |
| | | Somewhat Concerned | 12 | 36.4 | 36.4 | 57.6 |
| | | Moderately Concerned | 11 | 33.3 | 33.3 | 90.9 |
| | | Extremely Concerned | 3 | 9.1 | 9.1 | 100.0 |
| | | Total | 33 | 100.0 | 100.0 | |

**Table 4.4 Access to Service**

| Thought of migrate | | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|---|
| Yes | Valid | Slightly Concerned | 1 | 5.9 | 5.9 | 5.9 |
| | | Somewhat Concerned | 1 | 5.9 | 5.9 | 11.8 |
| | | Moderately Concerned | 15 | 88.2 | 88.2 | 100.0 |
| | | Total | 17 | 100.0 | 100.0 | |
| No | Valid | Moderately Concerned | 22 | 66.7 | 66.7 | 66.7 |
| | | Extremely Concerned | 11 | 33.3 | 33.3 | 100.0 |
| | | Total | 33 | 100.0 | 100.0 | |

**Table 4.5 Native Place**

| Thought of migrate | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| Yes | Valid | Not at all Considered | 3 | 17.6 | 17.6 | 17.6 |
| | | Slightly Concerned | 2 | 11.8 | 11.8 | 29.4 |
| | | Somewhat Concerned | 2 | 11.8 | 11.8 | 41.2 |
| | | Moderately Concerned | 5 | 29.4 | 29.4 | 70.6 |
| | | Extremely Concerned | 5 | 29.4 | 29.4 | 100.0 |
| | | Total | 17 | 100.0 | 100.0 | |
| No | Valid | Not at all Considered | 1 | 3.0 | 3.0 | 3.0 |
| | | Slightly Concerned | 1 | 3.0 | 3.0 | 6.1 |
| | | Somewhat Concerned | 5 | 15.2 | 15.2 | 21.2 |
| | | Moderately Concerned | 6 | 18.2 | 18.2 | 39.4 |
| | | Extremely Concerned | 20 | 60.6 | 60.6 | 100.0 |
| | | Total | 33 | 100.0 | 100.0 | |

**Table 4.6 Social Ties**

| Thought of migrate | | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|---|
| Yes | Valid | Somewhat Concerned | 5 | 29.4 | 29.4 | 29.4 |
| | | Moderately Concerned | 11 | 64.7 | 64.7 | 94.1 |
| | | Extremely Concerned | 1 | 5.9 | 5.9 | 100.0 |
| | | Total | 17 | 100.0 | 100.0 | |
| No | Valid | Not at all Considered | 1 | 3.0 | 3.0 | 3.0 |
| | | Somewhat Concerned | 8 | 24.2 | 24.2 | 27.3 |
| | | Moderately Concerned | 12 | 36.4 | 36.4 | 63.6 |
| | | Extremely Concerned | 12 | 36.4 | 36.4 | 100.0 |
| | | Total | 33 | 100.0 | 100.0 | |

**Table 4.7 Incentives**

| Thought of migrate | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| Yes | Valid | Not at all Considered | 17 | 100.0 | 100.0 | 100.0 |
| No | Valid | Not at all Considered | 31 | 93.9 | 93.9 | 93.9 |
| | | Slightly Concerned | 1 | 3.0 | 3.0 | 97.0 |
| | | Somewhat Concerned | 1 | 3.0 | 3.0 | 100.0 |
| | | Total | 33 | 100.0 | 100.0 | |

**Table 4.8 Security**

| Thought of migrate | | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|---|
| Yes | Valid | Not at all Considered | 17 | 100.0 | 100.0 | 100.0 |
| No | Valid | Not at all Considered | 31 | 93.9 | 93.9 | 93.9 |
| | | Slightly Concerned | 2 | 6.1 | 6.1 | 100.0 |
| | | Total | 33 | 100.0 | 100.0 | |