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RESEARCH ARTICLE

LIVELIHOOD OF PEOPLE IN DEVELOPING COUNTRIES AS AFFECTED BY CLIMATE CHANGE: A REVIEW

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ABSTRACT

This review paper explores coping patterns of poor people affected by natural hazards in developing countries. One of the major coping patterns is migration. People migrate from one place to another if they are not able to adjust at the place where disaster occurs. Several factors cause this migration. People migrate due to safety concerns, for income recovery, or for meeting their family needs. The purpose of migration varies from person to person and depends on the financial condition of the family. This paper also briefly reviews the literature on the impact of climate change on people's health and on the agricultural and livestock sector, on which many vulnerable households depend for their income. Finally, necessary adaptation actions to adjust to hazards in the future are considered.

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INTRODUCTION

Climate change is considered to be one of the most serious threats to sustainable development of a country. It has adverse impacts on the environment, people's health, economic activity, housing, education, food security, and physical infrastructure. Global warming affects, both developed and developing countries, as it changes temperature, changes rainfall pattern, and create other natural hazards which hampers peoples livelihood patterns (Dore, 2005). A natural disaster can be defined as a serious disruption of the functioning of a community or society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources (UNISDR, 2009). Least-developed countries (LDC) in general and Sub-Saharan Africa in particular will be more vulnerable due to climate change and increased climate variability than the developed countries (Thornton *et al.*, 2009; Conway and Schipper, 2011). Natural hazards have a larger impact in rural areas than in urban areas because rural people have less coping capacity due to lack of employment for the landless (Penning-Rowsell *et al.*, 2012). Most of the people in developing countries live in rural areas. If a natural disaster occurs in one year, it has an impact on the next year or sometimes many years which may hampers development of that country.

As many people are living in rural areas and many development activities depend on them, it is important to know their coping patterns during natural hazards and how to improve their condition. Without improving the livelihood patterns of poor people, the overall development of that country is impossible. Floods, hurricanes, cyclones, drought, and excessive temperatures etc. are very common natural threats in developing countries. During these threats different people have different coping patterns as their capacities like resources and financial conditions vary from person to person. For adapting, sometimes they migrate from one place to another for getting better opportunities such as jobs, safety and education or for some other purposes. In Sub-Saharan Africa, due to annual drought, peoples are displaced from one place to another. Similarly, floods affected millions of people in Pakistan and China in 2010 (Black, 2013). A developing country like Bangladesh also faces a serious problem due to climate change. Poor people suffer a lot during natural hazards and face some difficulty to adjust at that time. Communities have adapted and developed resilience for normal flood. However, very severe events can have adverse impact on the economy and can cause major loss in life (Penning-Rowsell *et al.*, 2012). The overall objective of this paper is to document the coping patterns of poor people through revising the previous researches: how they adjust and what type of strategies they follow to cope during natural hazards? The specific objectives of the article are i) to document the climate change impacts on peoples movement; ii) to estimate the hazards impact on people's health; iii) to evaluate the impacts of hazards on agriculture and livestock sector through which

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poor people's earn money and iv) to explore poor people's adaptation strategy and future policy options.

MATERIALS AND METHODS

This review paper is based on reviewing some articles related to climate change. For preparing this review paper, at first the researchers selected one specific title about climate change on which they are interested to review. After selecting title, the researchers searched some articles of climate change in *Google scholar* and in university library of Gent University, Belgium. Among the articles, the researchers reviewed those articles which are very relevant with the title and recently published.

Natural Hazards and their Impacts

Both developed and developing countries has always faced natural hazards, climate change merely increases their frequency and severity. The assessment of the Intergovernmental Panel on Climate Change (IPCC, 2007) have demonstrated that the climate is changing and the future will see higher sea levels, more heat waves, intense storms and heavy precipitation events and extension of drought areas. These climate hazards are having impacts on human settlements causing major loss of life, social disruption and economic hardship. The response of people during hazards in developing countries is more challenging than developed countries as they have less capacity to adapt and less financial resources to reduce risk (McBean and Ajibade, 2009).

Floods, drought, cyclones, riverbank erosion and earthquakes etc. are very common natural hazards. These disasters cause widespread displacement among the human population. People's houses, roads, schools, bridges might be affected. Communication from one place to another and from one person to another person becomes difficult at that time. Power supplies are often seriously disrupted. The last 200 years in Bangladesh, there have been 70 major cyclones hitting the coastal belt, and nearby 900,000 people are estimated to have died in these events during the last 35 years (Mallick and Vogt, 2009). Natural hazard also reduce the economic growth of the country. Natural hazards are responsible for making already poor people even more vulnerable (McBean and Ajibade, 2009). There are two major competing paradigms of vulnerability to hazards (Cutter, 2003; Adger, 2006). The behaviouralist paradigm, suggests that natural disasters are a failure of planning response and rationality. They suggest that natural disasters occur due to lack of planning and foresight from actors in the public and private sphere. An alternative paradigm, sometimes labeled as a political ecology or structuralist view, suggests that it is deep seated structures in society that explain who and what is vulnerable to natural and human made disasters (Black, 2013). The vulnerability of poor people due to climate change can be explained through the impacts of climate on people's migration, health and agriculture and livestock.

Impact on migration

Natural hazards have impacts on people's migration (Black, 2012). Sometimes they are willingly migrated or sometimes they are forced to migrate due to adverse effect of hazards. This migration happened may be for short time for some person or for long time or permanent for another person.

Penning- Rowsell *et al.* (2012) focused that different kinds of "push" and "pull" factors are responsible for creating hazard related migration. They conducted a study on some hazard prone villages in Bangladesh and focused on hazards related population movement. By using the method of focus group discussion they found that people's short term and permanent movement happened due to hazards. This movement occurred for safety or for income recovery after hazards. They also found that there is little permanent movement from hazard prone areas. Rural populations are more vulnerable and this vulnerability is increasing as their saving reduced. Comparatively, males are migrated more than female, leaving their women and children behind. Population movement and migration appears generally to be the "last resort" despite seriousness of the risks that are faced by the people. On the other hand, Black (2013) used a new framework for identifying five drivers which affect migration decision. These drivers are economic, political, social, demographic and environmental. Environmental change has the potential to affect directly the hazardousness of place. Environmental change also creates migration indirectly through economic driver such as changing livelihood pattern and through political drivers which affect conflict over resources.

Temperature is another very important factor which creates migration. Due to global warming peoples are forced to migrate because it reduces the productivity and hamper economic growth. But higher temperature reduce economic growth in poor countries but not rich countries (Dell *et al.*, 2008). Petkovic and Thordarson (2012) predict that in Europe mean annual temperature will rise by 1° to 5.5°. As a result, sea level in some areas will rise up to 0.9 m by the end of the century. In 1996-2000, about 5 million peoples in Sub-Saharan Africa are displaced due to temperature and rainfall anomalies. They predict that by the end of 21st century, annual displacement will occur of about 11.8 million people (Marchiori *et al.*, 2012).

Leal- Arcas (2012) also focus on people's migration due to climate change. The prediction is that about a billion people moving during middle of 21st century due to climate change impacts such as rising sea level, drought, desertification or other weather events. People may also move from Mexico to the United States as a result of climate change. Sometimes it causes a widespread displacement of population. Climate change creates migration suddenly or sometimes it creates slow migration. Instant river erosion, severe flood, storm etc. are responsible for taking peoples migration decision instantly. Due to drought and severe floods, peoples are forcing from one place to another place frequently (Xu *et al.*, 2012). Another study found that movements of people for one month or longer while homes are rebuilt. When disasters destroy local livelihood opportunities, at that time seasonal migration of household members for work have occurred and longer or permanent migration occur when household lost their homes and employment or land (Banerjee, 2010). Flood in Mozambique and Vietnam, desertification and sea level rise in Egypt contribute to migration and all these factors have effect on peoples livelihood pattern (Warner, 2010). While in Bangladesh, out migration did not increase after tornado in Bangladesh and the availability and effective distribution of aid served to stem outflows (Paul, 2005). Rainfall is also responsible for creating internal migration within district and sometimes in another district in Bangladesh.

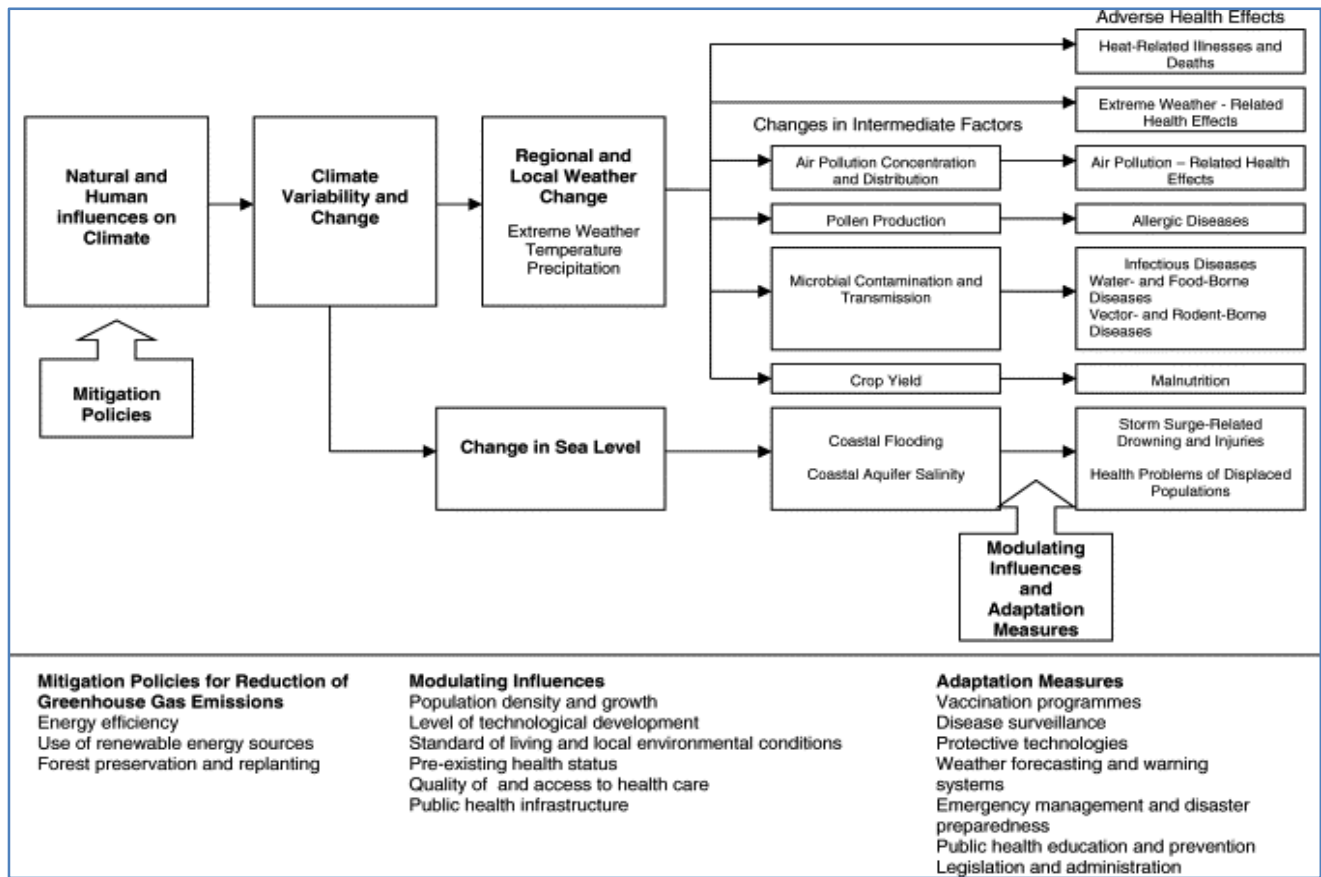


Figure 1. Potential health effects of climate variability and change from Haines and Patz, 2004

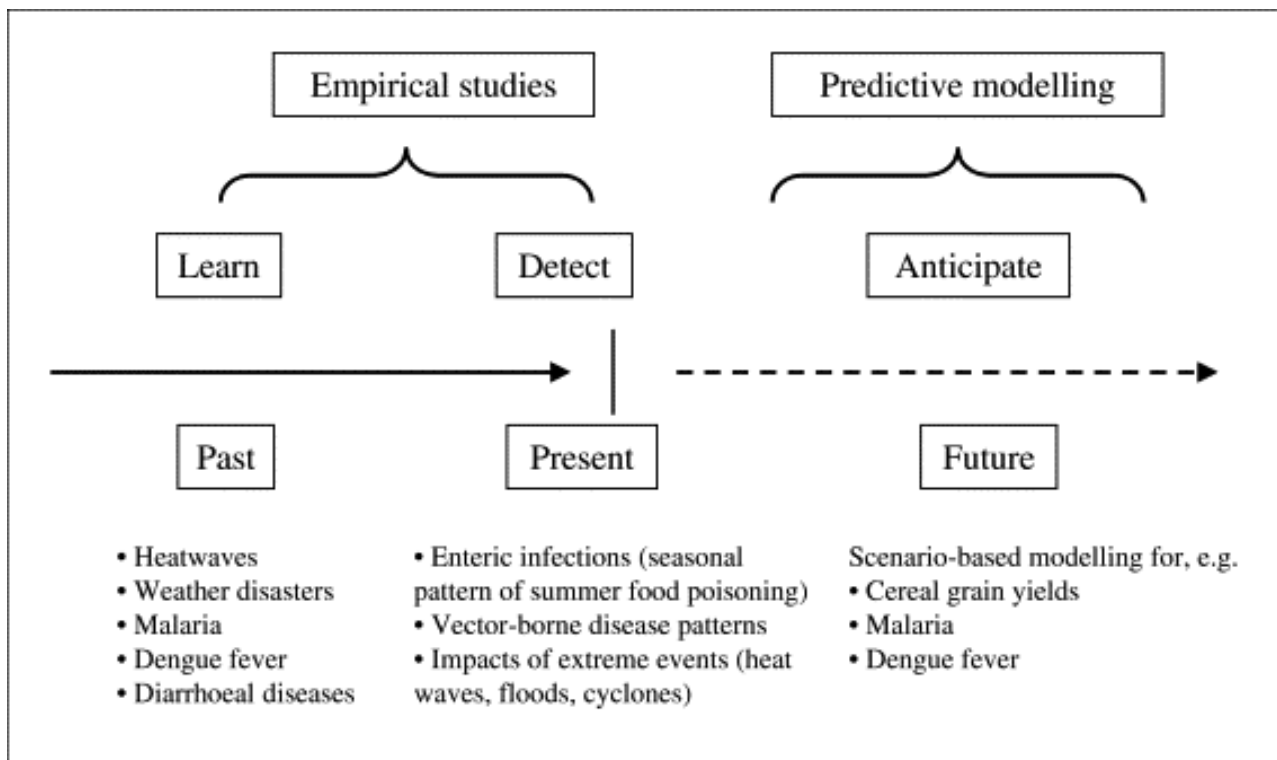


Figure 2. Three important research paths (McMichael AJ, 2002)

During deficit of rainfall, most of the peoples who are involved in farming wait for rain water for operating their farming activities or they use other neighbor water source who preserve water in exchange of money. If there is severe drought, soil losses it's all fertility and at that time poor people have no work in their field.

This situation is happened in many northern parts of Bangladesh every year. During that time they migrate to nearby district for searching work in order to maintain their family needs. This situation may be different in other developing countries. Rainfall shocks increase both the probability of people leaving the village and the distance

moved in Northern Tanzania (Beegle *et al.*, 2011). Proper rainfall reduces the movement of people from origin to other destination. Due to fluctuation in harvest, local and internal migrations are found to significantly increase but not international migration (Gray, 2009). By using IPCC climate prediction, Marchiori *et al.* (2011) found in Sub-Saharan Africa, there will be large climate induced migration outflows. Internal migration is larger than international migration due to shortage of rainfall. Erosion is also responsible for migration of rural peoples. Erosion is a long-term or permanent loss of land along with any immovable property on that land: 'staying put' is not an option (Haque and Zaman, 1989). In the erosion prone- areas of Hatia Island in Bangladesh, households threatened with loss of their houses, as a result, they moved to in laws' houses, away from the immediate threat (Parvin *et al.*, 2008). In the short term, this movement may be to nearby relatives homesteads or public lands. In the long term, those who have lost both homestead and cultivable land due to river bank erosion, they generally shelter on other people's land or on public land which is close to their original homes, or they move to urban areas, where work facility is available (Penning-Rowell *et al.*, 2012).

Impacts on health

Natural hazards have several kinds of impacts on people's health such as disease, scarcity of drinking water, adequate health care services, and sanitation. Many people's died at that time especially women and children suffer a lot. Due to mixture of dead body of peoples, birds and animals, water becomes polluted. Trees, woods are also rotten in the river water. As a result, water losses its purity and poor people have no resources to buy pure water from nearby shop as a drinking purposes and other cooking activities or for bathing. They use that polluted water for different kind of activities which creates different types of disease in their health. Malaria, diarrhea, dengue, allergic disease etc. are very common type of diseases during that time. Khasnis and Nettleman (2005) reported that global warming will cause changes in the epidemiology of infectious diseases and the vector-borne disease like malaria transmission is influenced as the earth warms. Warm, moist climates are most conducive to mosquito propagation and survival. Global warming provides conditions conducive to the spread of malaria. Climate change has the impact on the economy which induced changes in human health, viz. cardiovascular and respiratory disorders, diarrhea, malaria, dengue fever and schistosomiasis (Bosello *et al.*, 2008). Air quality is also deteriorating due to climate change impact which affects human health. Changes in the global atmospheric composition, changes in the regional air quality and the organization of the thematic issue of near surface pollutants that determine the air quality (Vautard and Hauglustaine, 2007). Household financial condition and age differentiations are also responsible for creating health problems in the affected populations because of adjusting capacity and purchasing power and other related issues depend on those factors. Due to low income, gender and age differentiation, households suffer different kinds of diseases than those household who have higher income. Adjusting capacity among poor people during hazards also depends on the financial support from inside and outside the country. The people, who get proper support, will suffer less health and other related problems than those who do not get proper support. Among 277 Sidr survivor respondents in Bangladesh,

only 52 persons suffered Sidr-related illnesses and their illnesses were significantly associated with low household income and gender. This is due to efficient distribution of food and safe drinking water as well as timely health care services. Comparatively, females suffer more than male due to climate change (Penning Rowell *et al.*, 2012). Impacts of climate change of malaria distribution are likely to be largest in Africa and Asia (Van Lieshout *et al.*, 2004). Especially children and old aged people suffer a lot due to climate change because they have less coping capacity. Children's health affect through weather related disasters, air pollution, excessive heat, food shortage and greater exposure to toxicants. As a result, children experience greater risk of mental disorders, malnutrition, infectious diseases, allergic diseases and respiratory diseases (Xu *et al.*, 2012).

Stern *et al.* (2007) reported that climate change could cause an additional 40,000 to 160,000 children's death in South Asia and Sub-Saharan Africa in every year. High rates of sleep disturbance, sadness and other mental health related problems among children's are associated with weather related disasters (Ahern, 2005). After weather related disasters, high stress for adults have implication on children as adults are not able to take care their children properly. Sometimes they neglect their children (Xu *et al.*, 2012). In Ethiopia and Kenya, children aged under six years who were born during drought season were more likely to be malnourished than those born in non drought years (UNDP, 2007). Every year, water borne diseases such as cholera and other diarrheal diseases are responsible for causing deaths of millions of children in the developing world, a number that will increase as climate change (Back and Cameron, 2008).

Impacts Agriculture and livestock

In rural areas of developing countries most of the people depends on agriculture (Maohua, 2001). Agriculture plays a major source of poor people's earning income. When flood, cyclone, storm and other natural hazards occur, this sector is affected largely than other sectors. Peoples are falling into poverty because their agriculture and livestock are destroying due to climate change through which they earn money. Hertel and Rosch (2010) explore how climate change affects poverty (or income) through the effect on agricultural crop production, profit and factor markets. They distinguish between three different methodologies for estimating the agricultural impacts of climate change: crop growth simulation models, statistical models and hedonic models. The crop growth simulation models are typically used for predicting impacts of future climate scenarios based on data intensive calibrations. They are field- and crop- specific and therefore not built to take into account the perspective of small subsistence farmers in less LDCs who employ a variety of different crop and livestock mixes for diversification purposes, as part of their adaptive strategies. These crop simulation studies suggest that strong impact asymmetries of climate change on agricultural yields between the developed and developing countries may deepen the current consumption and production gap (which could increase the income differential) and that increased climate variability will increase yield risks (which could increase income variability). The hedonic models assume that the value of agricultural production and thus any change therein, will be directly reflected in local land values through perfect factor markets.

Thus, economic impacts of climate change on the agricultural sector can be estimated by changes in land values, where the value of all adaptive strategies is taken into account. These models have been substantially criticized. Among three models, statistical model is the most relevant for analyzing the impact of climate change and increased climate variability on income level in LDCs (Lilleørland Van Den Broeck, 2011).

Schilling (2012) in his article focused on the interaction of climate change to socioeconomic and agricultural development in North Africa. Precipitation in North Africa is decreasing between 10% and 20%. This situation is happened in north-western parts in northern Africa. Climate change will likely have the strongest effect on Morocco where agriculture plays a most important sector for the country's economy particularly for poor people. The study of climate change impacts and adaptation options in Morocco suggests that the agricultural incentives used in the past are inadequate to buffer drought effect. To increase resilience against climate change, agricultural policies should shift from maximizing agricultural output to stabilizing it. In Tanzania climate change hamper yield production (Rowhani *et al.*, 2011). Barrios *et al.* (2010) explores a relationship between temperature and Gross Domestic Product (GDP) growth. In Sub-Saharan Africa, there is relatively large positive effect of rainfall on GDP growth. These mean that they are reliable on rainfall for their agricultural activities. This situation is not found in other LDCs. In contrast, there is a negative effect of temperature on GDP and no significant effect of rainfall among poor countries (Dell *et al.*, 2008).

People follow different kinds of farming system in developing countries. So, climate change has several kinds of impact as they have different kinds of farming system. If rainfall is good for one country, it is not good for another country. Morton (2007) reported that it is difficult to predict the impact as around the world there exists different kinds of complex, diverse and risk prone farming system which features a variety of crop and livestock species in any one household. He also found that there is lack of research that is needed to understand how climate change will impact this farming system as farmers have different kinds of adaptive strategy like changing production technology, adjusting crop mix, changing land use pattern etc. Soil fertility and productivity of crops are also decreasing by flood and drought. Standing crops and livestock sector are also affected by flood (Penning Rowsell *et al.*, 2012). In Bangladesh, rice productivity fell during flood years such as 1987-1988 and 1988-1989 (Banerjee, 2010). Due to cyclone Sidr in (2007) in Bangladesh, 1.2 million livestock animals were killed and 2.5 million acres of crops were destroyed (Oxfam, 2008). Natural hazards are also responsible for creating price fluctuation of agricultural products.

Adaptation and action

Some of the adaptation options are needed especially for vulnerable people how to cope with changing climate. Different kinds of adaptive responses are available such as technological (more drought tolerant crops), behavioral (changes in dietary choices), managerial (different farm management practices) and policy options such as planning regulation and infrastructure development. Adaptation options to climate change have been summarized by Kurukulasuriya

and Rosenthal (2003), who define typology of adaptation options that includes the following:

- Technological developments such as the development and promotion of new crop varieties and livestock feeds, improvement in water and soil management and improved animal health technology;
- Income related responses that are potentially effective adaptation measures to climate change, such as crop, livestock and flood insurance schemes, credit schemes and income diversification opportunities;
- Farm production adjustments such as diversification and intensification of crop and livestock production, changing land use and irrigation and altering the timing of operations;
- Institutional changes, including pricing policy adjustments such as the removal or putting in place of subsidies, the development of income stabilization options, agricultural policy including agricultural support and insurance programs and improvement in local agricultural markets.

How to create on and off farm income source in different situation, it is also needed as an adaptive strategy (Thornton *et al.*, 2009). The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as the natural or human system adjustment in response to climate stimuli or their effects (Parry, 2007). Different kinds of barriers and limits to adaptation have physical, ecological, technological, financial, informational, cognitive and socio-cultural elements. For proper climate monitoring and forecasting additional financial resources are needed. Proper development of institutional arrangement is also needed to drive to development (Burley *et al.*, 2012). Not only planning tools but also planning process is important to adapt. In Latin America, switching to mixed farming system rather than sticking to a specialized crop or livestock system can be a preferred strategy as a response to climate change. Similarly out migration of one or more household members for even larger diversification of income source may also see as an adaptive or compensatory strategy of farming households (Seo, 2010). In Morocco, farmers used barley instead of wheat because barley needs less water and it ripens faster, which increases the capacity of resistance against water deficit (Kuhn *et al.*, 2010). They also used drought prone wheat during drought season which was supported by many governmental initiatives (FAO, 2010).

Also rural peoples in developing countries, as they have low awareness, low education, and low training facility, so it is necessary to create awareness about how to overcome these problems. Proper training facility of how to cope during natural hazards is helpful for protecting rural people against danger. In high risk areas, people should move to nearby shelters before cyclone. But existing cyclone centre is not enough to accommodate all people. In many places cyclone shelters are very far from their houses. As a result, they don't able to reach that shelter during hazards. In high risk zone areas, it is also necessary to build additional cyclone centre. How to prepare plan for future shelter (height of shelter house) is also very important to take into consideration (Karim and Mimura, 2008). Sometimes many poor peoples, due to their less awareness don't interest to go to shelters. During cyclone in 2007, around 20% peoples used cyclone shelters and around 12% people; they used markets, schools and mosques as their

shelter during that time. The remaining percentage of people (around 70%), they didn't use anything as their shelter purpose (Paul *et al.*, 2010). In 2010, Bangladesh had more than 2400 emergency shelters of various kinds (Dasgupta *et al.*, 2010), although Paul *et al.*, (2010) state the number as 3976 at the time of the Sidr landfall. Another article found that it is necessary to stabilize agricultural sector rather than maximizing agricultural output. Their own bio-economic model suggests that for sustaining pastoral productivity, it is necessary to replace firewood by electric energy (Schilling, 2012). Reduction of poverty and wealth disparity, sustainable economic development, food security, education and improvement in health condition are the best forms of climate change adaptation. Where resource are limited, different kinds of awareness programs relating to school, home and communities can contribute as adaptation options and help children during disasters (UN, 2008). An integrated approach relating to climate change adaptation and disaster risk reduction is very relevant and valuable to vulnerable cities and coastal communities seeking to enhance their adaptive capacity and build resilience against a rapidly changing climate (McBean and Ajibade, 2009). During drought season better water access, irrigation, drought resistant crops can be helpful as adaptation actions (Lilleørand Vanden Broeck, 2011). Radio, television also plays a very important role especially for poor people for getting weather related any information (Paul *et al.*, 2010). Mobile phone is another very important adaptive action for transferring weather related information among poor people (Penning-Rowsell *et al.*, 2012). Diversified agriculture and diversified income source can play a very important role for maintaining livelihood pattern during natural hazards.

Adaptation to climate change requires changes to or modifications to behavior. Research cannot effectively contribute to the improvement of adaptive capacity without a comprehensive understanding of the context in which decisions about adaptation are made (Thornton *et al.*, 2009).

RESULTS AND DISCUSSION

Climate change has a large impact on people's migration. Also due to climate change people's health, agriculture and livestock sector influenced through which poor people earn money. Flood, cyclone, storm negatively influence agricultural crop and animal sector. As climate change destroys that sector, poor people are falling from poor to more poor. In rural areas housing condition of the rural people is also not good. Strong wind and storm destroy their houses. In that situation how they cope, this focus is very limited. From reviewing articles, we have learned that during natural hazards, very few people go to cyclone shelter to protect themselves. Also cyclone shelter is not enough in many developing countries.

It is important to take into considerations that how big are the shelters and how many people they are expected to accommodate. For this appropriate policy is needed in future. People migrate from one place to another during natural hazards. This migration pattern may be permanent or for short time basis. Some people remain there origin place despite unusual condition because they have no capacity to migrate or because of less social network. Proper attention is not given regarding the coping pattern of the people who do not migrate in that situation. Sometimes they sell their land and livestock or they borrow from rich neighbor or relatives for meeting their family needs.

Table 1. Summary of EM-DAT Statistics by Disaster* (Adapted from Raleigh et al., 2008 p8)

Disaster	Breakdown	Population	All Countries			Low Income Countries			Unstable Countries
			Population	Population	Population	Population	Population	Population	Population Affected
		Affected	Killed	Homeless	Affected	Killed	Homeless		
Drought	Overall:332	10%	<1%	<1%	13%	<1%	<1%	8.5%	
	LowIncome:261	St. Dev. 21	St. Dev. 0.7	St. Dev. 0.02	St. Dev. 22	St. Dev. 0.08	St. Dev. 0.02	St. Dev.18.87	
	Unstable: 43	(0-100%)	(0-1%)	(0-4%)	(0-100%)	(0-1%)	(0-4%)	(0-100%)	
Extreme Temperature	Overall:324	<1%	<1%	<1%	<1%	<1%	<1%	1.5%	
	LowIncome:148	St. Dev. 2.5	St. Dev. 0.6	St. Dev. 0.002	St. Dev. 3.39	St. Dev. 0.01	St. Dev. 0.002	St. Dev. 7	
	Unstable: 117	(0-40%)	(0-.05%)	(0-.05%)	(0-40%)	(0-.01%)	(0-.05%)	0-40%	
Flood	Overall:2839	<1%	<1%	<1%	<1%	<1%	<1%	1%	
	LowIncome:1801	St. Dev. 3	St. Dev. 0.02	St. Dev. 0.5	St. Dev. 3.64	St. Dev. 0.01	St. Dev. 0.7	St. Dev.4.21	
	Unstable: 117	(0-48%)	(0-.12%)	(0-27%)	(0-48%)	(0-.038%)	(0-27%)	(0-48%)	
Slides	Overall:451	<1%	<1%	<1%	<1%	<1%	<1%	<1%	
	LowIncome:311	St. Dev. 0.14	St. Dev. 0.004	St. Dev. 0.8	St. Dev. 0.17	St. Dev. 0.005	St. Dev. 0.8	St. Dev.0.03	
	Unstable: 117	(0-2.5%)	(0-.1%)	(0-2%)	(0-2.5%)	(0-.09%)	(0-2%)	(0-1%)	
Wave/Surge	Overall:34	<1%	<1%	<1%	<1%	<1%	<1%	<1%	
	LowIncome:25	St. Dev. 1.21	St. Dev. 0.03	St. Dev. 0.7	St. Dev. 0.5	St. Dev. 0.03	St. Dev. 0.5	St. Dev. 0.00	
	Unstable: 117	(0-6%)	(0-1%)	(0-4%)	(0-3%)	(0-.18%)	(0-2.5%)	(0-1%)	
Wind Storms	Overall:2311	1.1%	<1%	<1%	2%	<1%	<1%	1.77	
	LowIncome:519	St. Dev. 7.5	St. Dev. 0.01	St. Dev. 4.48	St. Dev. 10	St. Dev. 0.02	St. Dev. 6.31	St. Dev. 10	
	Unstable: 117	(0-100%)	(0-.42%)	(0-100%)	(0-100%)	(0-.42%)	(0-100%)	(0-100%)	

*Population Affected: Affected people are those requiring immediate assistance during a period of emergency, i.e. requiring basic survival needs such as food, water, shelter, sanitation and immediate medical assistance and includes the appearance of a significant number of cases of an infectious disease introduced in a region or a population that is usually free from that disease

Population Killed: Persons confirmed dead and those presumed dead.

Population Homeless: People needing immediate assistance of shelter.

Low Income Countries: Countries with an annual GDP per capita less than \$3000.

Unstable Countries: Countries whose POLITY score assessment has moved more than two places (positive or negative) over the period of one year.

Table 2. Summary of EM-DAT Disaster Statistics by Region (Adapted from Raleigh *et al.*, 2008 p9)

Region	Sub-Region***	Droughts	Extreme Temperatures	Floods	Slides	Wave/Surges	Wind Storms
America	Caribbean (283)	268,636(12%)	n/a	42,304 (1%)	512 (<1%)	n/a	104,241 (5%)
	North (612)	30,000 (<1%)	200 (0%)	200,035 (<1%)	1,531 (<1%)	n/a	5,000,047(2%)
	Central (356)	58933 (2%)	1052 (<1%)	26,198 (<1%)	708 (<1%)	1,720 (<1%)	103,808 (2%)
Africa	South (599)	1,905,980(7%)	131927 (<1%)	136,544 (<1%)	7425 (<1%)	931 (<1%)	15,545 (<1%)
	East (401)	1,765,088 (14%)	n/a	108,167 (2%)	562 (<1%)	27556 (2%)	118,167 (3%)
	Middle (88)	374,726 (9%)	n/a	25,990 (<1%)	73 (<1%)	n/a	9,645 (<1%)
	North (145)	1,700,243 (7%)	40 (<1%)	98,628 (<1%)	3323 (<1%)	12 (<1%)	24,402 (<1%)
	South (94)	295,531 (15%)	21 (<1%)	24,111(1%)	34 (<1%)	n/a	48,314 (4%)
Asia	West (200)	967,841 (22%)	333,359 (13%)	52,944 (<1%)	519 (<1%)	n/a	4,822 (<1%)
	Central (65)	n/a	200,008 (1.5%)	33,735 (<1%)	3502 (<1%)	n/a	2,505 (<1%)
	Eastern (856)	9,934,389 (1%)	3,132 (<1%)	6,413,745 (1%)	1580 (<1%)	9,693 (<1%)	999,417 (<1%)
	South East (864)	974,805 (7%)	n/a	258,548 (1%)	10490 (<1%)	64,640 (<1%)	369,193 (<1%)
	Southern (1,051)	32,600,000 (11%)	5,248 (<1%)	2,461,976 (1%)	58129 (<1%)	294,222 (2%)	423,754 (<1%)
Europe	Western (209)	302,900 (6%)	652 (<1%)	57,770 (1%)	240 (<1%)	n/a	4,293 (<1%)
	East (288)	0 (0%)	14,508 (<1%)	49,474 (<1%)	281 (<1%)	n/a	48,356 (1%)
	North (103)	n/a	37 (<1%)	n/a	38 (<1%)	n/a	n/a
	Russian Fed (46)	n/a	n/a	6,084 (<1%)	1,411 (<1%)	n/a	2,610 (<1%)
	South (270)	1,023,333 (13%)	1,417 (<1%)	26,601 (<1%)	1,262 (<1%)	n/a	12,904 (<1%)
Oceania	West (221)	n/a	1,406 (<1%)	5,646 (<1%)	715 (<1%)	13 (<1%)	39,868 (<1%)
	Aust/NZ (197)	1,011,429 (6%)	920,161 (5%)	1,556 (<1%)	243 (<1%)	n/a	40662 (<1%)
	Melanesia (126)	139,149 (8%)	n/a	25,830(2%)	2,029 (<1%)	6096 (<1%)	18336 (4%)
	Micronesia (18)	56400 (5%)	n/a	n/a	n/a	n/a	1334 (1%)
	Polynesia (46)	n/a	n/a	4 (<1%)	178 (<1%)	n/a	11213 (15%)

**Each disaster total is the total affected people (including killed and homeless) by disaster. In parentheses is the percent by region and disaster as proportion of population.

***These are the EM-DAT designated sub regions with the total number of EM-DAT disaster entries in parentheses.

Appropriate future research is needed in that case for improving their livelihood pattern. Focus group discussion, case study, individual interview method will be helpful for knowing their present situation after hazards. Sometimes, migration is not good. It creates different kinds of problems in the place where people migrate. Also it creates problems for those people who migrate. They face different kinds of problems like work, health, education etc. For facing different kinds of problem in new environment, the poor people fall from poor to more poor. It should also need to take into consideration, how to maximize the benefit due to human migration. It is necessary to improve the local situation of the country. If the local situation of the country like agricultural sector and industrial sector is improved, no need migration. Improved disaster prevention measure including improved forecasting and warning system is necessary.

Due to past experience of false warning, people sometimes don't want to migrate. In official storm warning, there is still lack of clarity. So, it is necessary to improve the institutional arrangements. Further research is also needed to investigate the plight of those women and children who are left behind by permanently migrating men. Only young women, they can find work in their local rurality. But old aged women and children, they need to rely on their relatives for subsistence (Penning-Rowsell *et al.*, 2012). There are some researches which give strong evidence that climate change is influencing and will increasingly affect children health which creates vulnerability. Nevertheless, substantial information gaps remain regarding the risk climate change poses to children's health and child specific protection measures (Xu *et al.*, 2012). Institutional arrangement plays a very important role for improving the condition of the poor people. Proper institutional arrangement helps peoples to overcome their problems during hazards.

There is also lack of research into how climate change and increased climate variability affect economic drivers of migration. Much information is needed about the on-and off-farm income sources in different situation. For adaptation, people used different kinds of options such as new technology, alternative crops etc. But with this, it is necessary to see the capacity of peoples for adapting new options. Also the amount of cultivated land of rural people is very limited. Diversified agriculture will be helpful for meeting the needs of rural people. The review will also be helpful for those countries that face similar kinds of natural hazards. The method which is good for one country may not be good for another country. Poor people need to understand what type of method is appropriate for them. In this case, it is necessary to create awareness among poor people. Also appropriate microfinance facility will help people to adjust during hazards.

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