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**Session 5: Climate Induced Migration & Urbanisation**

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***Climate migration and urban changes in Bangladesh***

The impact on human settlements has been startling, demonstrated by extreme climate events such as Hurricane Katrina in the USA, Cyclones Sidr and Aila in Bangladesh and Nargis in Myanmar. But the results of such climate change induced events are not confined to the immediate effects; they ripple through societies, leading to significant outcomes in terms of human suffering, financial cost and downstream economic and environmental consequences. Worldwide, hundreds of millions of people, mostly in low-lying coastal zones, face forced displacement and will need to migrate in search of alternative livelihoods. In most cases the destinations of such displaced populations are the nearest urban area. On arrival refugees face emotional, social and economic stress as they seek to adjust to changed circumstances. At the same time, receiving urban areas must adapt to an influx of people and the physical and economic demands placed on the existing system. Bangladesh represents a region where a complex set of climate driven outcomes is already evident as land is inundated and populations migrate in large numbers. Using the region as an example, this research seeks to define climate change impact levels from the primary impacts on natural systems, through secondary population displacement and migration due to extreme climate events. Tertiary impacts are defined as social and economic effects on the urban system, so the scope of the thesis is the interconnection between climate change, migration and urbanization.

*Key words:* Climate migration, urbanization, climate change impact levels.

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***Climate Change Induced Migration and Urban Growth in the Himalaya: Need for Climate Smart Livelihood Improvement in Rural Areas and Sustainable Urban Land Use***

In the Himalaya, due to constraints of terrain, subsistence agriculture constitutes the main source of food and livelihood. During recent years, population growth and climate change have stressed natural system resulting into the depletion of natural resources, decline in agricultural productivity and loss of traditional livelihood opportunities in rural areas. Consequently, trends of rural-urban migration has increased accelerating the process of urban-growth in high mountains and rendering urban areas highly susceptible to increasing water and health insecurity and vulnerable to a variety of natural risks. This paper aims at interpreting the inter-linkages among climate change, decline in rural production system and livelihood, rural-urban migration and its contribution to urban growth with a case illustration of Kumaon Himalaya.

Methodology included: (i) observation of rainfall pattern, and monitoring water resources, (ii) analysing agricultural productivity, and (iii) investigating rural-urban migration and its contribution to urban growth. Relevant data was collected through hydro-meteorological monitoring and socio-economic surveys and analyzed using GIS. Study indicated both number of rainy-days and amount of rainfall decreased, respectively 25% and 40% during last 50 years. Consequently, 41% springs dried diminishing stream-discharge (20%) and decreasing irrigation potential (15%). Consequently, agricultural productivity declined (25%) leading to food deficit of 65% and undermining food security

of 75% population. This has increased trends of rural-urban migration by 55% during 1971-2011 increasing urban population from 15% to 35%. In view of this, it is imperative to evolve an integrated rural livelihood improvement framework as well as a sustainable land use policy for increasing resilience and carrying capacity of urban areas.

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***The Influence of Migration on Vulnerability to Extreme Weather Events: A Case Study in Mexico***

Domestic migration represents the largest flow of migration in Mexico, dwarfing international migration with nearly 10 domestic migrants for every international migrant. In contemporary times, this migration is frequently from rural to urban settings with individuals seeking better economic opportunities, education, or other lifestyle amenities. At the same time, urban areas in Mexico are highly vulnerable to impacts related to weather events due to both the low socioeconomic status of many citizens as well as the increasing frequency of extreme weather due to climate change. This paper seeks to examine this relationship, answering the research question: *How do migratory patterns in Mexico influence vulnerability to extreme weather events?* To answer this question, this paper utilizes micro-census data in conjunction with archival and government recorded data on natural disasters. The vulnerability of citizens to extreme weather events is first calculated based on observed disasters and demographic change between 2005 and 2010. This is compared to a hypothetical scenario under which no migration is allowed to occur between 2005 and 2010. We compare these two scenarios on both a global and spatial basis, identifying specific municipalities where migration has or has not contributed to changes in vulnerability. We conclude that while migration has increased overall vulnerability within Mexico, this influence is highly localized to select regions within the country. Further research is examining the characteristics of these regions.

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***Climate Induced Migration and Urban Vulnerability in Eastern Himalayas***

This study is premised on the fact that the Eastern Himalayas has started feeling the impact of climate change in the form of erosion in the resource base, loss of livelihoods and an increase in the natural disaster. This has triggered climate induced migration (CIM) leading to the rise in the population of towns/cities located on the hills that are ecologically fragile and economically less resilient and with a poor urban infrastructure. Moreover, the urban governance in such towns/cities is not equipped to provide basic services to the growing urban population. This study also argues that the process of CIM and its impact on urbanization needs to be placed in the context of larger developmental and environmental issues. Climate induced migration and risk will be high in areas where other form of environmental degradation is high. It is also premised that vulnerability assessment has to be understood in the context of multiple hazards and risk especially in areas like the Eastern Himalayas which are exposed to more than one type's disaster and hazards.

While analysing the adaptation capability of such hill towns/cities to CIM, we observed the deficiencies of current systems for accommodating rapid urbanization, including ineffective land use, inappropriate and poorly implemented regulatory systems, poor disaster resistance of the housing stock, ineffective infrastructure planning and funding, and poorly functioning land markets. Therefore the challenge is to add urgency to the well-understood demand for increased urban investments and planning, which will allow a healthier and more sustainable urban environment to emerge.

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***Addressing urban vulnerability to climate change: Empirical findings from the Ganges-Brahmaputra Basin***

Urbanization has been shown to provide an important means of diversifying rural livelihoods and incomes, thereby reducing poverty and vulnerability to rural environmental stress. However, rapid urbanization also creates enormously complex environmental problems that can easily overwhelm urban institutions, especially in low-income countries. According to the United Nations, the world's urban population is projected to grow by another 3 billion people by the year 2050, putting unprecedented demands on air, water, land and essential public services. Developing policies that can mitigate the ecological footprint of an increasingly urban population is therefore a pressing global priority. This paper explores the social and environmental impact of rapid urbanization in the Ganges-Brahmaputra Basin, a region that is home to an estimated 400 million people and two of the world's largest cities. Drawing upon six months of primary fieldwork, it documents the ways in which changing patterns of land and resource use have affected the livelihoods of vulnerable populations in primarily-wetland areas surrounding Dhaka and Kolkata. In so doing, it outlines a framework for understanding the ways in which rapid urbanization is affecting environmental and climate vulnerability in two of the world's largest mega cities.