

# Climate Change and Migration in Asia and the Pacific

Draft Edition

Asian Development Bank



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Note:

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## PREFACE

Human displacement resulting from climate change will pose a serious threat to the sustainable growth and stability of Asia and the Pacific unless measures are taken soon to manage a large increase in migration over the coming years. Recognizing the significance of this threat, the Asian Development Bank (ADB) is undertaking a regional research and development technical assistance project to improve understanding of climate-induced migration in selected countries and regions of Asia and the Pacific. The study, *Policy Options to Support Climate-Induced Migration*, is being implemented by ADB's Regional and Sustainable Development Department with the support of a multidisciplinary international team comprising of Bart W. Édes, François Gemenne, Christopher Hawkins, Jonathan Hill, and Diana Reckien.

The project will analyze climate-induced migration and make policy recommendations with respect to the economic and sociopolitical consequences of climate-induced migration; institutional, capacity, and resource gaps; and the feasibility of a financing mechanism to address the costs of climate-induced migration. An active communications program will raise awareness of the complex nature of climate-induced migration, and share knowledge and insights on the topic throughout 2011. This report is the first in a series of outputs envisioned under the project.

## EXECUTIVE SUMMARY

Attention to climate-induced migration has grown considerably in recent years, reinforced by storms and flooding that have stimulated temporary or longer term dislocation of millions of people in countries such as Pakistan, the People's Republic of China, the Philippines, and Sri Lanka. Over time, "climate migrants" have come to incarnate the human face of climate change, though very little is yet known about the way populations will react to changes in the environment and weather.

What is clear is that Asia and the Pacific will be amongst the global regions most affected by the impacts of climate change. Such impacts include significant temperature increases, changing rainfall patterns, greater monsoon variability, sea-level rise, floods, and more intense tropical cyclones. Asia and the Pacific is particularly vulnerable because of its high degree of exposure to environmental risks and high population density. As a result, it could experience population displacements of unprecedented scale in the coming decades.

At the same time, Asia and the Pacific has undergone massive and rapid socioeconomic transformation. It is home to 4 billion people, representing 60% of the world's population. It is also home to the most important source of international migrants worldwide, representing more than 30% of the total migrant population. Migration within countries, especially from rural to urban areas, is another major factor of social transformation.

This report draws upon leading studies of climate-induced migration to yield the most up to date and comprehensive assessment of the phenomenon in Asia and the Pacific, the region that is expected to experience the most significant migration flows due to long-term changes in weather patterns and degrading environmental conditions. The report aims to position climate-induced migration within the broader framework of migration dynamics in Asia and the Pacific.

Estimates of the number of people who could be displaced by climate impacts are subject to many caveats and uncertainties. A key reason for this is that the environmental drivers of migration are often impossible to disentangle from other socioeconomic forces, especially in the case of slow-onset environmental changes. Such forces are extremely difficult to predict, hence the estimates of future climate-induced migration are often assessed against current socioeconomic conditions. This is a major limitation, as the nature and magnitude of migration flows induced by climate change will also depend upon the socioeconomic conditions in which they take place. Yet this is a consideration ignored by projections of future climate-induced migration.

Consequently, climate change is best conceptualized as an additional factor driving migration in an array of existing drivers. One of the most striking demographic trends in Asia and the Pacific in recent decades has indeed been an increase in the level and complexity of population mobility.

Countries and populations of Asia and the Pacific will be affected by climate change in different ways, leading to various migration scenarios. While most climate-induced migration will occur within countries, there is also likely to be an increase in cross-border migration. These migration flows are tied up with the broader trend of rapid urbanization in Asia and the Pacific. Mega cities will often lack the carrying capacity to accommodate the influx of climate migrants on top of those moving for other reasons. Large-scale migration could threaten social cohesion and stability in receiving communities, leading to conflict over resources.

Conversely, the report highlights the possibility that migration be considered as part of the portfolio of adaptation strategies mobilized by migrants themselves, and does not necessarily signal a failure to adapt. Indeed, in many circumstances, out-migration can serve as a way of coping with climate change, as well as a mechanism to reduce poverty and increase resilience in affected areas. In the

near future, migration as a form of adaptation will be a more common response to the impact of climate change than the displacement of entire communities, which will occur as a last resort once adaptation possibilities and community resilience are exhausted as viable options.

Significant funding will be required to utilize migration as an adjustment or coping mechanism in the face of climate change. Bilateral and multilateral mechanisms will have to be developed to facilitate orderly planning, limit the negative social impacts of migration, and avoid tensions that could arise between countries in the case of poorly managed cross-border migration. At present, many developing countries are ill-equipped to deal with these population movements.

There will also be gender dimensions of climate-induced migration that influence its potential role as a tool of adaptation. In this regard, the report draws attention to the fact that the most vulnerable groups, including poor women, often lack the resources that would allow them to migrate, and are thus compelled to stay in their place of residence to confront the risk of climate impacts.

Despite the uncertainties that are still associated with the local impacts of climate change and the number of people who could be displaced, the issue of climate-induced migration will grow in magnitude, and will take different forms. Whether migration can become an adaptation strategy or will be a survival option of last resort depends upon the policy decisions we make today. At present, no international cooperation mechanism has been established to manage these migration flows, and protection and assistance schemes remain inadequate, poorly coordinated, and scattered. Yet these migrations need to be addressed as a global process, and not just locally.

Thus, national governments and the international community must urgently address this issue in a proactive manner. Failure to do so could result in humanitarian crises with great social and economic costs. Bilateral, regional, and international cooperation will be indispensable in addressing this emerging issue.





## I. INTRODUCTION

This report explores how climate change will affect migration patterns in Asia and the Pacific. It is part of a wider Asian Development Bank (ADB) project aimed at designing policy and financing options to address climate-induced migration, and is one of a series of ADB publications shedding light on the effects of global warming on the countries and people of Asia and the Pacific.

Attention to climate-induced migration has grown considerably in recent years, reinforced by storms and flooding that have stimulated temporary or longer-term dislocation of millions of people in countries including Pakistan, the People's Republic of China (PRC), the Philippines, and Sri Lanka. Over time, "climate migrants" have come to incarnate the human face of climate change, though very little is yet known about the way populations will react to changes in the environment and weather. The relationship between climate change and migration flows is often thought to be of a deterministic nature, where all populations living in areas affected by climate change would be forced to relocate. Many empirical studies show, however, that this relationship is far more complex, and is compounded by a wide range of social, economic, and political factors (Jäger et al. 2009; Jonsson 2010).

Though Asia and the Pacific is expected to be profoundly impacted by climate change in the coming decades, it is also expected to undergo other significant social, political, and economic transformations. Thus, migration behaviors are likely to be influenced by this wide range of transformations, ranging from climate change to cheaper travel. Public policies, including adaptation strategies and migration control and management, will also play a determining role in the nature and extent of migration movements.

Thus, this report shall consider climate change as one of a number of driving forces of migration. Migration flows associated with climate change will be part of broader migration dynamics and should not be considered in isolation. Understanding climate-induced migration as part of a global transformation process constitutes a major ambition of this work, as well as a necessary condition for sound migration and adaptation policies.

### A. Why Climate-Induced Migration Matters in Asia and the Pacific

Over the past three decades, Asia and the Pacific has undergone massive and rapid socioeconomic transformations. It is now home to 4 billion people, representing about 60% of the world's population. Though these transformations have brought about many benefits for the people, they have also resulted in an increase of inequalities. Some countries—such as the Brunei Darussalam; Hong Kong, China; Republic of Korea; and Singapore—have experienced rapid economic development and rank amongst the countries with a very high level of human development (Klugman 2010). At the same time, other countries remain constricted by poverty: 1.8 billion people live on less than \$2.00 a day, with about 900 million living on less than \$1.25 a day (ADB 2009a).

Combined with the rapid expansion in the means of communication and cheaper travel options, these inequalities have, amongst other things, induced important migration flows. About 80 million of the estimated 200 million international migrants worldwide live in Asia and the Pacific. The Chinese diaspora globally is estimated at 40 million–50 million people, while 20 million Indians live outside of India (Wihtol de Wenden 2009). The area is characterized by important migration flows with the rest of the world, and also by an increasing mobility between Asian

countries. With regard to migration within Asia and the Pacific, the main countries of origin are Indonesia, the Philippines, and Sri Lanka, while Brunei Darussalam; Japan; Republic of Korea; Malaysia; Singapore; Taipei, China; and Thailand are key destination countries. At the same time, though no official figures exist, internal migration has been rising considerably, mostly from rural to urban areas.

Migration in Asia and the Pacific occurs for a wide variety of reasons, which include working opportunities, armed conflict and civil unrest, diversification of incomes, family reunion, labor mobility, expectations and representations about the destination region, environmental changes, and, most notably, the impacts of climate change and natural disasters.

Within Asia and the Pacific, climate change is expected to take the heaviest toll on the Pacific, South Asia, and Southeast Asia. Major projected impacts include significant temperature increases, changing rainfall patterns, greater monsoon variability, sea-level rise, floods, and more intense tropical cyclones (Cruz et al. 2007). Asia and the Pacific is particularly vulnerable because of its important exposure to environmental risks, e.g., 8 of the 10 countries with the greatest number of people living in low-elevation coastal zones are located here. Climate change has recently been identified by the World Economic Forum (2011) as the greatest global risk by combined likelihood and impact.

Climate change is expected to exacerbate poverty and health problems, but will also interplay with other environmental disruptions, most notably natural disasters. Asia and the Pacific is the region most affected by disasters during the last decade, accounting for 85% of global fatalities due to natural disasters during 2000–2009. The two most deadly disasters during this period were the Indian Ocean tsunami and Cyclone Nargis. The number of catastrophic events has more than doubled since the decade of 1980–1989 (Centre for Research on Epidemiology of Disasters and United Nations International Strategy for Disaster Reduction 2010). Of 2 billion affected people, 75% were affected by floods or droughts. A recent report produced by ADB, the Japan International Cooperation Agency (JICA), and the World Bank (2010) shows that Asian coastal mega cities will endure recurrent flooding due to climate change.

## **B. Background**

ADB has been active in the study and analysis of climate change, including the way that climate change will impact upon migration patterns in Asia and the Pacific. This report draws upon major studies of climate-induced migration to yield the most up to date and comprehensive assessment of the phenomenon in the world's most populous and disaster-prone region. Asia and the Pacific experiences massive migration movements and is the largest source of migration worldwide. This report positions climate-induced migration within the broader framework of migration dynamics. In doing so, it does not consider that climate change induces a distinct category of migrants, but rather interplays with other drivers of migration. Similarly, it considers that migration is one of a number of possible responses to climate change.

## **C. Key Objectives**

The policy responses and normative frameworks that address environmental migration<sup>1</sup> remain scattered and highly inadequate. A key reason for this is the lack of reliable data about the nature and extent of population movements related to environmental changes. In particular, little

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<sup>1</sup> Climate-induced migration is a subset of environmental migration, a concept that encompasses all population movements related to environmental change.

is known about the factors that induce some of those people affected by climate change to migrate while others stay behind. As a result of this lack of information, until recently climate-induced migration had received much less attention than economic or conflict-induced migration from both scholars and policy makers.

Hence, the key objectives of this report are to

- (i) gather the best available data and analyses on climate change and migration in Asia and the Pacific into a concise review;
- (ii) place climate-induced migration within the context of broader migration dynamics;
- (iii) discuss the way climate change influences migration behaviors, and the factors that interact at the environment–migration nexus; and
- (iv) provide a sound foundation for the development of policy and financing options and frameworks that could address climate-induced migration.

#### **D. Intended Audience**

This report is primarily intended for policy makers in Asia and the Pacific. Historically, migration has been given very little weight in environmental policies, while environmental factors have been largely neglected by migration policies. Hopefully this report can be useful to both policy makers working with climate-related as well as migration issues, and help to mainstream environmental factors into migration policies, and vice versa.

Many policy options that can address climate-induced migration, however, will need to be designed and developed among several countries. Regional, international, and nongovernment organizations, such as the International Federation of Red Cross and Red Crescent Societies, will need to play a key role in fostering regional and international cooperation, as well as in establishing protection, assistance, and management schemes. Thus, the report is equally intended for decision makers from these organizations.

Finally, scholars and other interested stakeholders should also find an interest in the report, which could provide a basis for further research.

## **II. METHODOLOGICAL ISSUES AND CAVEATS**

Any assessment of the impacts of climate change is compounded by a set of methodological difficulties. An initial fundamental problem resides in the identification of the flows of “environmental migration,” as there is no single internationally agreed definition to characterize these migration flows. Another problem deals with the quantitative assessment of the number and type of people who are on the move, or could be in the future. This problem of numbers is deeply connected with the definition—the broader the definition, the larger the numbers.

To estimate future flows of migration, one often resorts to a vulnerability assessment. Yet this assessment introduces additional methodological problems and no consensus exists on the relative weight of the different components of vulnerability. Finally, uncertainty remains about the local impacts of climate change and about the way these impacts will interplay with other environmental changes and socioeconomic transformations.

## **A. Definitional Issues**

Among the core issues is the definition of “environmental migration.” Despite numerous attempts and proposals, no internationally agreed definition has emerged, and this void has led to great confusion over the terms used to describe the people displaced by environmental events. “Environmental refugees,” “ecological migrants,” “climate refugees,” and “environmentally displaced people” are all terms frequently used by both scholars and the media to describe what they assume is a common reality. The definitional issue is directly linked to the conceptualization and typologies of environmental migration, its estimates and forecasts, and the policy responses aimed at addressing it. Furthermore, the debate is marked by confusion over different concepts, and environmental migration has eventually become a catch-all term for different migration dynamics that often have little in common.

One of the main reasons for the lack of definition is linked to the difficulty of isolating environmental factors from other drivers of migration. Most authors stress the multi-causality of migration and the intermingling of factors (Black 2001; Castles 2002; Brown 2008; Boano, Zetter, and Morris 2007). Therefore, one can legitimately ask whether isolating environmental drivers is possible, or makes much sense conceptually. Some scholars tend to argue that it does not, and that doing so is a distraction from other more pressing issues (Castles 2002, Kibreab 1997). Others, on the contrary, see the urgency of acknowledging and defining environmental migration. Lassailly-Jacob (2006) rightly questions whether environmental migrants make up an additional category of forced migrants, or are better understood within existing conceptual categories.

The intermingling of migration drivers is far from being the sole obstacle to defining environmental migration. Another major hindrance lies in the confusion between forced and voluntary migration. A common assumption is that environmental disruptions trigger only forced—and often brutal—displacements, an assumption emphasized in the term “environmental refugees.” Suhrke (1994) wonders whether there is “something about the nature of environmental degradation that tends to produce refugee-like movement rather than migration.” Many authors stress, however, that environmental factors also induce voluntary migration (Renaud et al. 2007, Suhrke 1994, Hugo 1996). Though the distinction between forced and voluntary migrants is to an extent blurred, it remains fundamental in migration studies and policies.

Finally, a further difficulty arises from the absence of any legal definition of the concept. Unlike with refugees or internally displaced persons, no specific legal framework exists to address environmental migration. This can be seen as another vicious circle—the development of a legal definition is also impeded by the conceptual fuzziness that prevails.

Definitions and typologies do matter, and not only for the scholarly debate. Environmental migration as a social phenomenon is generally apprehended through its definition, which bears high responsibility for the development of normative framework and policy responses. Without a clear definition, one cannot identify which populations are of concern and require assistance, nor can one accurately estimate the number of people displaced or prompted to migrate because of environmental factors.

Words and typologies also matter for the populations themselves, because of the images and meaning they carry: empirical studies show that many people described as environmental refugees object strongly to the use of this terminology. Thus, getting the wording right is important: in this report, “climate-induced migration” or “climate migrants” will refer to the persons or groups who, for compelling reasons of climate-induced changes in the environment that adversely affect their lives or living conditions, are obliged to move from their habitual homes, or choose to do so, within their country of residence or abroad.

## **B. Limitations and Caveats of a Quantitative Analysis**

Estimates and predictions of people displaced by environmental changes have been highly stimulated by growing media attention to climate-induced migration. Figures ranging from tens of millions of people to 1 billion have been found not only in headlines of the mainstream press but also in official communications and research reports. The current interest for the topic is due not only to the specific nature of these migration flows but also to their potential magnitude.

Yet no consensual estimate exists, let alone a commonly agreed methodology. As a result, predictions and estimates have become one of the most contentious issues in the debates on climate-induced migration. Numerous authors have criticized the existing estimates as artificially inflated, excessively alarmist, or “guesstimates” (Kolmannskog 2008). Crisp (1999) notes that “while all of the standard works on refugees are replete with numbers, few even begin to question the source or accuracy of those statistics.” This applies to many works on environmental migration, as most of them reproduce previous statistics without critically assessing them.

The multi-causality of displacement, as well as the confusion between forced and voluntary migration, makes it difficult to identify an exact number of environmentally displaced persons. Given the lack of comprehensive methodology and empirical studies, the field is wide open for guesses and pessimistic estimates rather than actual numbers. Various scholars and organizations have produced no fewer than 10 different estimates (Boano, Zetter, and Morris 2007). The International Federation of Red Cross and Red Crescent Societies (2001) claims that there are more people displaced by environmental change than by war.

Norman Myers (2002) has forecasted that there could be up to 200 million displaced persons by 2050. This figure gained even wider currency after it was endorsed by Stern, in his highly publicized 2007 report on the economics of climate change (Stern 2007). Some estimates have been even more doom-filled, predicting close to 1 billion people could be displaced by 2050 (Christian Aid 2007). This striking figure, however, included all types of displacement, not only those triggered by environmental changes.<sup>2</sup> Table 1 summarizes some of the commonly cited estimates and forecasts.

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<sup>2</sup> The figure included 250 million people displaced by events related to climate change and 50 million displaced by natural disasters, whereas 645 million people were given as displaced by development projects, such as dams.

**Table 1: Estimates and Forecasts of Global Environmentally Induced Migration**

Source	Current estimates	Forecasts by 2010	Forecasts by 2050
El-Hinnawi (1985)	30 million	50 million	150 million
Myers (1993, 2002)	25 million		150 million, then 200 million
Myers and Kent (1995)	25 million	50 million	212 million
Stern (2007)			200 million
Christian Aid (2007)	25 million		300 million

Note: The estimates and projections include migrants displaced by climate impacts as well as other environmental disruptions. For this reason, the term “environmentally induced migration” has been preferred to “climate-induced migration” here.

Predictions and estimates remain one of the most contentious issues in public debates on climate-induced migration. Some scholars claim that these figures lack any empirical basis, and are put forward simply to raise awareness and garner media attention around the issue of climate change, or environmental degradation in general (Black 2001). Yet generation of estimates and forecasts is unavoidable, as they are requested by policy makers in order to assess the importance of the phenomenon and to develop policy responses. These various numbers have been used to argue for the development of new policies and mechanisms of protection to assist people displaced by climate change. Notwithstanding questions about their robustness, the estimates and forecasts have had a lasting impact in both policy and scholarly debates.

Different factors impede the collection and development of accurate data and forecasts. Some of these factors are common to all displacement-related issues, others are specific to climate-induced migration.

First, the quest for numbers is hampered by the debates about the concept and very definition of environmental migration. The fact that the absence of a clear definition impedes estimating migration caused by environmental factors is worth noting; however, a similar problem is encountered when counting refugees, even though a legal definition exists. In the words of Crisp (1999), “any form of enumeration exercise must be based upon a clearly defined unit of measurement if it is to produce reliable, usable and comparable data. In the case of refugee statistics, however, such clarity does not always exist.”

Most human displacement triggered by environmental factors is intranational, not international. Internally displaced persons have been defined in the United Nations Guiding Principles on Internal Displacement (United Nations 1998) as

persons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters, and who have not crossed an internationally recognized State border.

The absence of reliable data on border crossings poses a further statistical problem, since counting cross-border movements is easier than counting intranational movements: “the

machinery to collect data on these movements simply does not yet exist” (Brown 2008). Crisp (1999) provides a list of questions that are left unanswered when one is attempting to count internally displaced persons:

In the absence of a clear criterion such as the crossing of an international border, how far does a person have to move to be considered ‘internally displaced’? When do internally (displaced) people cease to warrant that status: when they return to their original place of residence, or when they have achieved a certain degree of physical and socio-economic security in the place to which they have fled? Given that a large proportion of the world’s IDPs [internally displaced persons] are thought to live in towns and cities, how can they be differentiated from other rural-to-urban migrants?

Some further problems are specific to the nature of climate-induced migration. When it comes to predictions, figures are usually based on the number of people living in places at risk, and not on the number of people actually expected to migrate. Estimates do not account for adaptation strategies or different levels of vulnerability to change. Further, sex-disaggregated data is generally unavailable.

Predictions also need to take account of demographic changes that are expected to occur over the next decades. While global population growth can be predicted to a certain extent, its ultimate geographic distribution remains uncertain. In recent years, migration to urban areas has accelerated. An increasing number of people live in areas highly exposed to natural risks and hazards, resulting in an increased number of disasters. These evolutions are particularly significant in developing countries, and make estimating potential migrants a challenging task.

In addition, it is expected that societies will also undergo major socioeconomic transformations in the future. Such transformations, however, are extremely uncertain to predict. Hence, the estimates of future climate-induced migration are often assessed against current socioeconomic conditions. This is a major limitation, as the nature and magnitude of migration flows induced by climate change will also depend, to a great extent, upon the socioeconomic conditions in which they take place. Yet this consideration is ignored by projections of future climate-induced migration.

Much uncertainty remains about the actual local impacts of climate change. It is possible to mitigate these impacts through adaptation strategies, and to mitigate climate change itself by reducing greenhouse gas emissions. Thus, the future impacts of climate change on societies will greatly depend on future levels of greenhouse gas emissions and on the amount of funding that is allocated for the development of adaptation strategies in vulnerable regions.

In summary, future displacements depend to a large extent on what we do today. Because of the inertia of the climate system, the impacts of global warming until 2050 are largely predetermined by our past emissions (Hansen et al 2006). Impacts beyond 2050 depend on our current emissions, and this is the reason why projections that go beyond 2050 are much more uncertain. Adaptation strategies can minimize how these impacts affect societies. Hence, future displacements also depend to a great extent upon the adaptation strategies that are implemented today—and proactive migration might actually be part of them.



Finally, the importance of time frames is of crucial importance: do the predicted numbers describe an accumulation of migration flows over a certain period of time, or do they account for a stock of environmental migrants at a certain period of time? Are those who have been able to return home included in the predictions or not? Though these questions are of crucial importance, they are rarely addressed.

Despite these difficulties, getting the numbers right is an important step for developing adequate policies. The programming of assistance and mobilization of resources, including funding, depend on accurate numbers (Crisp 1999). In the absence of reliable statistics, numbers can be easily inflated and manipulated in order to attract attention to some populations, sometimes at the expense of other needy populations.

In order to move forward, Boano et al. (2007) suggest that, instead of drafting global estimates, “a more valuable route to understanding the potential scale of displacement, and thus the scope of policy intervention,” would consist of getting a more nuanced understanding of the different forms of climate-induced migration, and developing a much more empirically grounded approach to the issue. Kniveton et al. (2008) agree that a first step is to “try to understand how people cope with the different types of gradual stresses and sudden shocks brought about by climate change and variability,” and suggest that a second step involves quantitative methods, such as agent-based models, in order to simulate future migration patterns based on current migration behaviors.

The EACH-FOR project (Environmental Changes and Forced Migration Scenarios)<sup>3</sup> also developed a modeling exercise, based on scenarios relating to different policy directions (Jäger et al. 2009). Such a scenario exercise offers an approach to taking into account the different variables that will impact upon the number of people displaced by climate change.

To provide an estimate of the number of people who could be displaced, one often relies on vulnerability assessments; such assessments, however, bring further methodological caveats.

### **C. Assessing Vulnerability**

Vulnerability is a term often used in the development discourse, especially in the context of poor people, who are often referred to as being the “most vulnerable” group. Chambers (2006) defines vulnerability generally as “...exposure to contingencies and stress, and difficulty in coping with them.” He goes on to add: “Vulnerability has thus two sides: an external side of risks, shocks, and stress to which an individual or household is subject; and an internal side which is defenselessness, meaning a lack of means to cope without damaging loss.”

Several recent studies have attempted to conceptualize vulnerability to environmental hazards and climate change. A positive and encouraging trend is that of understanding vulnerability from an interdisciplinary and multidimensional perspective. In addition, the definitions also underscore the need to bring together both biophysical as well as socioeconomic factors to enable a more comprehensive assessment of vulnerability to be formulated. It is found that an individual or group’s vulnerability to climate change and climate-related disasters is influenced by the complex array of social, economic, political, and environmental factors operating at a variety of levels that in combination affect vulnerability (O’Brien et al. 2008).

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<sup>3</sup> EACH-FOR. <http://www.each-for.eu>

Another key learning from these studies is that vulnerability is not evenly distributed across and within countries, and some individuals, households, or groups are likely to be disproportionately affected by climate change or disasters (O'Brien et al. 2008). Even though there is no single definition of vulnerability, we can identify three main elements that constitute the conceptual framework of vulnerability—exposure, sensitivity, and adaptive capacity.<sup>4</sup> Again, however, there are differences in the way these elements have been defined.

Neil Adger (1999) specifically examines social vulnerability to climate change and defines it as

the exposure of groups or individuals to stress as a result of the impacts of climate change and related climate extremes. Stress encompasses disruption to groups or individuals' livelihoods and forced adaptation to the changing physical environment. Vulnerability can therefore be explained by a combination of social factors and environmental risk, where risks are those physical aspects of climate related hazards exogenous to the social system.

He subsequently reviewed the evolution of different traditions of vulnerability to environmental change and conceptualized it as "...the state of susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt" (Adger 2006).

Vulnerability is now generally conceived as a combination of exposure, sensitivity, and adaptive capacity, even though the relative weight of each of these three components remains a subject of considerable debate.

It has also been described as the "degree to which a system is susceptible to injury, damage, or harm...", where vulnerability is "essentially a state variable, determined by the internal properties of a system". The term "social vulnerability" is used in the context of social systems (Brooks, Adger, and Kelly 2005).

The Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report (2001) defines vulnerability as

the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.

## **1. Exposure**

One often cited definition of exposure describes it as "...the nature and degree to which a system experiences environmental or socio-political stress Adger (2006, 270). The

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<sup>4</sup> Disaster risk management uses similar concepts but represents the relationship as risk = hazard x vulnerability / capacity representation. Hazard is similar to exposure and measures the severity, frequency, duration, return period, etc. of the natural disaster. Vulnerability refers to the weakness or resistance of the elements at risk. With reference to impact on population, vulnerability can be measured in terms of population density, poverty profile, and number of children, women, and old people in the affected population, etc. Capacity representation is similar to adaptive capacity and refers to the response capability in terms of institutional measures such as urban planning, expertise, and capacity of local government units; and social measures, such as education, awareness, public information, and participation.

characteristics of these stresses include their magnitude, frequency, duration, and areal extent of the hazard.” Some studies merge exposure and sensitivity (IPCC 2001).

## **2. Sensitivity**

The IPCC (2001, 894) defines sensitivity as “...the degree to which a system is affected by or responsive to climate stimuli.” Another definition holds that it is “the degree to which a system is modified or affected by perturbations” (Adger 2006, 270).

Some researchers choose not to distinguish between exposure and sensitivity, arguing that “exposure and sensitivity are almost inseparable properties of a system (or community) and are dependent on the interaction between the characteristics of the system and on the attributes of the climate stimulus” (Smit and Wandel 2006).

## **3. Adaptive Capacity**

A system or community's coping capacity or capacity to respond to climate change is referred to as its adaptive capacity. Adaptive capacity can be seen as “the ability of a system to evolve in order to accommodate environmental hazards or policy change and to expand the range of variability with which it can cope” (Adger 2006). The IPCC (2001, 982) defines adaptive capacity as “the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities or to cope with the consequences.” Some have made the point that “adaptive capacity is context-specific and varies from country to country, from community to community, among social groups and individuals, and over time” (Smit and Wandel 2006).

Adaptive capacity is often perceived as depending primarily upon the level of development. This view neglects other important determinants, such as social cohesion and governance (Tubiana, Gemenne, and Magnan 2010). In some situations, the ability to migrate will be part of the adaptive capacity, and migration itself will be an adaptation strategy. In other cases, arguably more frequent, migration will be the result of an adaptive capacity unable to cope with climate impacts in situ.

## **D. Local Impacts of Climate Change**

Climate change will affect societies through an extensive range of impacts. The magnitude of these impacts depends to a large extent on the efforts currently undertaken to curb greenhouse gas emissions and to mitigate global warming. Hence, predicting these impacts, particularly on a regional level, is a daunting task, since many uncertainties remain (Barnett 2001, Webster et al. 2003). To account for these uncertainties, the IPCC has classified projections of climate change impacts into different families of scenarios according to the various policies that could be implemented and different hypotheses about climate sensitivity.

Amongst these impacts, three seem most likely to have effects on migration patterns, although these effects are not certain and are highly discussed (Black et al. 2008, Piguat 2008): extreme weather events, water stress and land degradation, and sea-level rise.

It is important to appreciate that the relationship between environmental change and migration is much more complex than an “environmental deterioration equals population displacement” nexus, which is often assumed. It is of fundamental importance to recognize that environmental change is usually not the only, or even the most important, concern for migration in Asian and

Pacific nations. It usually interacts with a range of other economic, social, and demographic factors. This will also be the case where the environment is affected by climate change. Too often it is assumed that all environmental impacts will result in displacement or migration.

For some Pacific atoll countries in particular, the discourse on potential sea-level rise associated with climate change has focused exclusively on resettlement migration as a response, to the extent that other forms of mitigation and adaptation have been neglected (Connell 2003). This is especially the case in projecting the impact of climate change (Black 2001). Population mobility as a response to environmental change can and does take many forms. Moreover, population mobility is often one of several mitigation and adaptation strategies adopted by communities to cope with that change. It is essential, then, that climate-induced population mobility be seen as

- (i) a wide array of mobility types and not just displacement; and
- (ii) only one of the responses among an array of potential mitigation and adaptation strategies.

The impacts of climate change remain difficult to forecast at the local level. Climate models can only project impacts on the global level, and downscaling remains a tricky task in the current state of science. Furthermore, monitoring of climate data is often incomplete at the local level, making it difficult to assess how climate change will affect local livelihoods.

Taken together, these factors make it difficult to predict with any degree of certainty the number of people who will be displaced by climate change. It is possible, however, to identify the processes by which these migrations will occur, as well as the places where they are most likely to happen. This is what this report aims to do, focusing on extreme weather events, water stress, land degradation, and sea-level rise.

### **III. MIGRATION PATTERNS**

International migration to and from Asia and the Pacific has increased steadily over the past few decades as a result of globalization and widening gaps among countries in living standards and the supply and demand for labor. As a result, levels of mobility within and between nations have increased exponentially. Movement (both internal and international) has increasingly been directed toward urban areas, and especially the largest cities.

One of the most striking demographic trends with major implications for economic and social changes in Asia and the Pacific in recent decades has been an increase in the level and complexity of population mobility. Asia is currently the primary source of migration to most of the world's immigrant-receiving countries, and represents about 30% of the world's total migrant population (Klugman 2009).

There are also about 80 million international migrants in Asia and 5 million in Oceania. The PRC, India, and the Philippines are the top three migrant-sending countries, with diasporas estimated at 35 million for the PRC, 20 million for India, and 7 million for the Philippines (International Organization for Migration [IOM] 2010). In the Pacific, migration from the Pacific islands to Australia and New Zealand has been a repeated pattern in the past decades.

## A. Different Drivers of Migration

As previously stated, climate change needs to be conceptualized as an additional factor driving migration in an array of existing drivers. It is not possible in the space available to provide a comprehensive account of contemporary migration in Asia and the Pacific, but it is important to establish its existing patterns before projecting the impact of climate change. The decisions of those impacted by climate change as to whether or not to move, whether to move permanently or temporarily, and to which destination, will all be influenced by the existing patterns. Climate change will add an additional set of drivers of migration to these existing forces shaping movement.

In the coming decades climate change is most likely to exacerbate existing migration patterns more than it will create entirely new flows. This means a crude guide to the geography of future movements is present movements. (Barnett and Webber 2010)

While the focus of attention in the global discussion on climate change and migration has been on international migration, the fact is that most environmentally induced migration in the past has involved internal movement (Hugo 1996), and the majority of mobility related to climate change will also be within countries.

Before considering migration patterns in the different regions of Asia and the Pacific, it is worth pointing out a number of trends that are universal:

- (i) As development has increased, mobility has come within reach of most people as a strategy to adjust to changed circumstances (such as environmental conditions) or to improve their socioeconomic position.
- (ii) The mobility of women has increased such that in many emigration flows they are more numerous than men.
- (iii) Movement (both internal and international) has increasingly been directed toward urban areas, especially the large cities.
- (iv) There has been an increase of both permanent and temporary mobility.

In 1950, for example, only about 17% of the population in Asia and the Pacific was urban (230 million), reaching 39% (1.5 billion) by 2005, and it is expected to hit 50% by 2025. Over the same period (1950 to 2005), the rural population doubled from 1.1 billion to 2.3 billion. But while the rural population will peak at 2.3 billion in 2015 and thereafter begin to decline, the urban population is predicted to grow to 1.8 billion in 2015, 2.5 billion in 2030, and 3.2 billion in 2050.

Permanent resettlement from rural to urban areas has obviously been of fundamental significance, and international migration is an increasingly significant element. Less evident, however, is the large volume of circular migration and commuting from rural to urban areas. This largely involves individuals leaving their villages to work temporarily in the city, creating strong rural–urban network links.

A particular feature of Asian urbanization has been the emergence of “mega cities”—large, complex urban areas of 10 million or more (Table 2), sometimes also called “mega-urban regions” because they cover such large areas and envelop many smaller cities.

**Table 2: Growth and Projected Growth of Asian Mega Cities, 1950–2025**  
(million)

1950		2000		2005		2025	
City	Population	City	Population	City	Population	City	Population
Tokyo	11.3	Tokyo	34.4	Tokyo	35.3	Tokyo	36.4
Shanghai	6.1	Mumbai	16.1	Mumbai	18.2	Mumbai	26.4
		Shanghai	13.2	Delhi	15.1	Delhi	22.5
		Calcutta	13.1	Shanghai	14.5	Dhaka	22.0
				Calcutta	14.3	Calcutta	20.6
				Dhaka	12.6	Shanghai	19.4
				Karachi	11.6	Karachi	19.1
				Osaka-Kobe	11.3	Manila	14.8
				Manila	10.7	Beijing	14.5
				Beijing	10.7	Jakarta	12.4
						Guangzhou	11.8
						Osaka-Kobe	11.4
						Lahore	10.5
						Shenzhen	10.2
						Chennai	10.1
						(Madras)	

Source: United Nations 2008.

The massive growth in mega cities in coastal areas significantly increases the population exposed to the risks posed by climate change. Because of climate change, the frequency of extreme events, especially floods, is likely to increase significantly in coastal mega cities. Due to demographic growth, the number of people exposed to these flooding events will also increase significantly (ADB, JICA, and World Bank 2010).

It should be noted that, in Asia and the Pacific, emigration predominates; of the 30 countries with the most emigrants in other countries, nearly half are Asian and Pacific countries (World Bank 2008).

Yet, despite the increase in the scale of intranational and international migration, measurement has not kept up. Many Asian and Pacific countries have asked a question on intranational migration in their national censuses. Yet such questions fail to detect most short-distance movement, nonpermanent movement, and much rural–urban movement. Very few countries have the means to estimate current (let alone future) intranational migration patterns.

Information on international migration is also lacking (Huguet 2008). No censuses in Asian and Pacific countries ask a direct question on emigration. Similarly, border control statistics are very

poor (Hugo 2006). Furthermore, though women make up roughly half of the migrants, no sex-disaggregated data exist so far. Available data do not provide the basis for realistic projections of future international mobility levels. Again, a major problem is the failure to detect nonpermanent flows.

Meanwhile, while the focus of attention in the global discussion on climate change and migration has been on international migration, the fact is that most environmentally induced migration in the past has involved intranational movement within countries (Hugo 1996), and the majority of mobility related to climate change will also be within countries.

Despite this lack of statistical data, several key points need to be noted:

- (i) As stated earlier, the massive growth in mega cities in coastal areas significantly increases the population exposed to the risks posed by climate change.
- (ii) Previous forced displacements are an important guide to future climate change migration, as they are predominantly rural and agricultural based and there is a time lag between the planning and the actual movement of people.
- (iii) Temporary, cyclical, and permanent rural–urban flows are creating strong rural–urban links. Such migration is generated by real and perceived inequality of opportunity, and increasing impoverishment in rural areas. In contrast to the situation in East and Southeast Asia, urbanization in South and Central Asia is still relatively low, meaning there is still considerable scope for it.
- (iv) Similarly, for many populations, large international diasporas establish networks and contacts for future mobility.
- (v) Most rural frontiers that might have settled large numbers of new migrants have already been settled in Asia and the Pacific. People instead are increasingly settling in areas exposed to significant environmental risks such as storm surges, floods, and droughts.
- (vi) Conflict has periodically been an important cause of population movement, but movements have been primarily contained within Asia and the Pacific. Where refugee migration has been established, people primarily move along corridors established by original refugee flows.
- (vii) Among all the world's regions, the Pacific is the most dependent on the flow of remittances from migrants.

It is important to note that these general patterns vary widely at the national and subnational levels, as well as by sex.

As mentioned above, across Asia and the Pacific migration is driven by a wide array of factors. These factors include labor market segmentation, which induces labor migration. Most labor migration within Asia and the Pacific is intended as temporary by both sending and host countries, but a large number of temporary migrants have become long-term migrants in many receiving Asian and Pacific countries. The proportion of female labor migrants has been increasing, and women constitute a majority of the migrants officially deployed from some countries. Migration may empower both female migrants and those women who stay home when male family members migrate.

However, there are also gendered risks in relation to migration, such as the risk of exploitation and trafficking. There are also differential impacts on men and women left behind, as temporary or permanent absence of a family member can affect gender relations. Access to labor-driven mobility is also often concentrated in gender stereotypes and lower-status occupations.

The demand for workers in the oil-rich countries in the Middle East in the 1970s stimulated large-scale labor migration from and within Asia and the Pacific. Receiving countries adopted the strictly temporary and limited contract migration policy. Initially, migrant workers were mainly from India and Pakistan. In the 1980s, workers from the Philippines, Indonesia, Thailand, the Republic of Korea, and Sri Lanka joined in. In the 1970s, migration involved mostly male workers. Also in the 1980s, as the construction sector was winding down, the demand for other workers—especially domestic household helpers—increased, which contributed to the feminization of migration in Asia and the Pacific. Most domestic workers came from Indonesia and Sri Lanka.

In the 1980s, the newly industrialized countries and areas in East and Southeast Asia—particularly Japan, Republic of Korea, Singapore, and Hong Kong, China—became the new destinations of migration. Malaysia and Thailand are both origin and receiving countries of migration workers. The demand for domestic workers in East and Southeast Asian countries further increased the feminization of migration. Migration workers are mainly from the PRC, South Asia, the Philippines, and Indonesia. While labor migration in Asia and the Pacific primarily involves low-skilled workers, a small proportion of labor flows includes the highly skilled and professionals, including intracompany transfers, information technology workers, nurses and health care workers, teachers, architects, and managers.

Other driving forces for migration include a highly developed migration industry, generating important remittances: in 2006, Asia and the Pacific received \$113 billion in remittances from 50 million emigrants. Countries receiving the largest remittances, relative to their gross domestic product (GDP) are Afghanistan, Bangladesh, Kyrgyz Republic, Lao People's Democratic Republic, the Philippines, Tajikistan, Timor-Leste, and Viet Nam (World Bank 2008). Social networks also play a key driving role, linking origin and destination countries. Social networks are a particularly important migration driver in the Pacific (Mortreux and Barnett 2008).

Finally, environmental factors are an increasingly important migration driver. Although the available data and empirical studies are limited in quality and scope, examples from the PRC, Southeast Asia, Bangladesh, and the Pacific provide important insights into the forms that environmental migration may take. As made clear by the India Ocean tsunami of December 2004, environmental hazards have already caused significant displacement (estimates suggest 1 million–2 million people were forced from their homes), although most people moved nearby or within their own countries.

Flooding in the PRC also displaces many thousands of people annually. And migration (intranational and international) in Bangladesh can be partly attributed to environmental impacts—predominantly flooding and riverbank erosion, storm surges, cyclones, and droughts. It is projected that climate change impacts in Bangladesh will significantly exacerbate these environmental drivers of migration (Walsham 2010). In the Pacific, too, cyclones have led to entire island communities migrating to New Zealand (although the movements were largely temporary and people returned once conditions improved).

Large infrastructure development projects are also a major factor of forced migration in Asia and the Pacific. Though not yet related to climate change, these projects induce radical environmental disruptions and are sometimes associated with environmental factors of migration. Major development projects involve the permanent displacement of large numbers of predominantly rural- and/or agricultural-based populations. Such “mega-projects”, especially dam construction, have become common, especially in less-developed countries where there are escalating demands for electricity and water associated with rapid urbanization. In each



case there are people displaced and forced to move, generating a new dimension of the development–migration relationship (Cernea 1990).

Periodically, environmental degradation has been used to support state-led migration initiatives, which provide important lessons. In the PRC, environmental migration is being used as an explicit state policy to help people defined as impoverished to leave predominantly rural and ecologically fragile areas, and to resettle somewhere else. Agricultural production and water harvesting in the fragile zones are seen as insufficient to sustain local and downstream populations, and these areas are seen as increasingly vulnerable to climate change. Inhabitants of the zones are mostly poor, ethnic minorities, and state-led migration is largely involuntary.

The displacement of large numbers of people by the development of mega-projects in Asia and the Pacific are of particular significance to the present study in that they involve a significant delay between the time it becomes obvious that people have to move and when they actually do move. This will also be the case for much displacement related to climate change since much of the change is gradual until key thresholds are met. This time lag both allows those being displaced to prepare for resettlement and also provides time for planners to make preparations to ensure resettlement takes place with the least possible disruption. Comparative large-scale resettlement programs provide a good indication of the costs of successful relocation.

## **B. East Asia**

In East Asia, rapid economic growth over the last two decades, especially in the PRC, has driven a massive increase in individual mobility. The annual increase in the number of PRC nationals traveling to other countries indicates a new era of personal mobility. Further, millions of people born in the PRC reside in other countries, creating a global social network linking a large ethnic community.

That said, most population mobility in the PRC, as elsewhere, is intranational. At least 130 million people are intranational migrants, most moving from rural areas in the west to urban areas in the east. The All-China Federation of Trade Unions reported in October 2008 that 210 million of 900 million rural registered people in the PRC were rural–urban migrants.

Neighboring Mongolia has been experiencing a rapid increase in mobility while making the transition from a centrally planned to a market-driven economy. There is an increasing flow of migrant workers from Mongolia to the Republic of Korea and Kazakhstan, and rapid urbanization is occurring within the country. The other economies of East Asia are high-income migrant destinations, although the Republic of Korea and Taipei, China are also important sources of skilled migrants to Organisation for Economic Co-operation and Development (OECD) member countries.

## **C. Southeast Asia**

Migration in Southeast Asia is diverse, with several net immigration countries (Brunei Darussalam, Malaysia, Singapore, and Thailand), but also some of the world's major emigration nations (Indonesia, Philippines, and Viet Nam). The dominant mode of movement is temporary and largely involves low-skilled workers; the Philippines is one of the world's major origins of temporary and permanent migrants. Large numbers of Filipinos reside in many countries around the world and represent a substantial network of links. There is also increasingly significant permanent migration of skilled workers to OECD member countries.

Looking at intranational migration, the increasing ease of mobility has also become a factor in Southeast Asia, although there are no comprehensive and accurate data to quantify the changes. Indonesia provides a useful case study where even the most casual observer will have noticed a parametric increase in individual mobility over recent decades. At each census, the proportion of Indonesians who have lived in a different province increases. But mobility is predominantly intraprovincial and nonpermanent and is thus undetected by the census.

At any rate, the key intranational population movement in Southeast Asia is the permanent and circular migration directed from rural to urban areas (Table 3). As in East and South Asia, these data underestimate the urbanization process since there is substantial circular migration and commuting from rural to urban areas.

**Table 3: Urban and Rural Population in Southeast Asia, 1990–2007**

Country	Urban Population			Rural Population			Percent Urban	
	1990 (‘000)	2007 (‘000)	Change (%)	1990 (‘000)	2007 (‘000)	Change (%)	1990 (%)	2007 (%)
Brunei Darussalam	169	290	71.6	88	100	13.6	65.8	74.4
Cambodia	1,222	3,022	147.3	8,476	11,421	34.7	12.6	20.9
Timor-Leste	154	310	101.3	586	845	44.2	20.8	26.9
Indonesia	55,922	116,832	108.9	126,924	114,795	-9.6	30.6	50.4
Lao PDR	629	1,740	176.6	3,447	4,119	19.5	15.4	29.7
Malaysia	9,014	18,484	105.1	9,089	8,088	-11.0	49.8	69.6
Myanmar	9,986	15,575	56.0	30,161	33,224	10.2	24.9	31.9
Philippines	29,863	56,503	89.2	31,363	31,458	0.3	48.8	64.2
Singapore	3,016	4,436	47.1				100.0	100.0
Thailand	15,974	21,021	31.6	38,317	42,863	11.9	29.4	32.9
Viet Nam	13,403	23,888	78.2	52,769	63,487	20.3	20.3	27.3
<b>Total</b>	<b>139,355</b>	<b>262,101</b>	<b>88.1</b>	<b>301,219</b>	<b>310,399</b>	<b>3.0</b>	<b>31.6</b>	<b>45.8</b>

Lao PDR = Lao People’s Democratic Republic.  
Source: United Nations 2008.

Conflict has also periodically been an important cause of population movement within Asian and Pacific countries. In Indonesia, for example, there were significant forced migrations caused by post-independence conflicts, while in the late 1990s unrest caused the displacement of over 1 million people within the country (Hugo 2002). From a migration perspective, it is interesting that many internally displaced persons returned to the origin areas of their parents, grandparents, or even more distant relatives who might have left generations ago.

#### **D. South Asia**

With its vast population, South Asia has become an important source of migrants to other parts of Asia and the Pacific and the world. The Indian and Pakistani diasporas are among the largest and most extensive in the world. And Bangladesh, India, Nepal, Pakistan, and Sri Lanka are

some of the major origins of temporary unskilled labor for the Middle East and elsewhere. Similarly, skilled migration from these countries, especially India, to OECD member countries has accelerated in recent years.

There are also substantial flows between countries, in particular from Bangladesh to India and especially to the far eastern Indian states of West Bengal and Assam. Indeed, some have suggested that this is the largest single international migration flow, with more people involved than estimated for top-ranked Mexico–United States migration fluxes (Dyson, Cassen, and Visaria 2005).

**Table 4: Urban and Rural Population in South and Central Asia, 1990–2007**

Country	Urban Population			Rural Population			Percent Urban	
	1990 (‘000)	2007 (‘000)	Change (%)	1990 (‘000)	2007 (‘000)	Change (%)	1990 (%)	2007 (%)
Afghanistan	2,319	6,410	176.4	10,341	20,735	100.5	18.3	23.6
Bangladesh	22,396	42,191	88.4	90,652	116,474	28.5	19.8	26.6
Bhutan	90	220	144.4	458	439	(4.1)	16.4	33.3
India	219,758	341,247	55.3	640,437	827,768	29.3	25.5	29.2
Iran	31,925	48,410	51.6	24,749	22,798	(7.9)	56.3	68
Kazakhstan	9,301	8,875	(4.6)	7,229	6,547	(9.4)	56.3	57.6
Kyrgyz Republic	1,660	1,918	15.5	2,734	3,399	24.3	37.8	36.1
Maldives	56	112	100	160	194	21.3	25.8	36.6
Nepal	1,692	4,712	178.5	17,422	23,484	34.8	8.9	16.7
Pakistan	34,548	58,487	69.3	78,443	105,415	34.4	30.6	35.7
Sri Lanka	2,943	2,908	(1.2)	14,170	16,391	15.7	17.2	15.1
Tajikistan	1,679	1,777	5.8	3,624	4,959	36.8	31.7	26.4
Turkmenistan	1,653	2,391	44.6	2,015	2,574	27.7	45.1	48.1
Uzbekistan	8,230	10,042	22	12,286	17,330	41.1	40.1	36.7
<b>Total</b>	<b>338,249</b>	<b>529,699</b>	<b>56.6</b>	<b>904,721</b>	<b>1,168,508</b>	<b>29.2</b>	<b>27.2</b>	<b>31.2</b>

Source: United Nations 2008.

Intranational migration is dominant in South Asia, amid rapid urbanization (Table 4), although urbanization remains relatively low and the majority of people in most countries still live in rural areas. There is, however, increasing temporary, circular migration between rural and urban areas. Some have argued that the low level of urbanization is in fact misleading, since many rural populations are dependent on sending family members to work in urban areas (Dyson, Cassen, and Visaria 2005).

Nevertheless, there is a clear difference to the situation in East and Southeast Asia, leaving considerable scope for further rural–urban migration. The movement of refugees, meanwhile, remains a strong form of migration. Although some refugees have been repatriated, it is apparent that refugee migration and other forms of movement have continued to move along the corridors set up by the original refugee flows.

## **E. Central Asia**

Central Asia as a whole is prone to important migration movements, both international and intranational. Its current demographic composition has been heavily impacted by international migration: after the collapse of the Soviet Union, many central Asians returned home, while ethnic Russians fled to Russia. The civil unrest and conflicts that followed the collapse in some areas also induced flows of refugees.

Migration today plays an important role in the development of the region, notably through remittances. The Kyrgyz Republic and Tajikistan have both adopted the 1990 International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families in the 2000s, while Kazakhstan is considering ratification. Labor migration is widely acknowledged as a positive factor for development for the whole region.

Data on internal movements are scarce, but the role of these migration flows should not be underestimated: a study commissioned by the IOM in 2005 found that internal displacements were very important in Central Asia (IOM 2005). It is estimated that about half of the total migrant population has moved internally.

Among internal migrants, different empirical studies, including those from the EACH-FOR project, show that a significant share of migrants move due to environmental reasons (Jäger et al. 2009). Those reasons included mudslides and landslides, floods, hazardous waste, and desertification (particularly around the Aral Sea). The United Nations High Commissioner for Refugees (UNHCR) estimates that about 250,000 people have been forced to leave their homes in the region because of environmental disasters. Sulaimanova (2004) mentions the following examples:

...over 100,000 persons were displaced during the 1980s and 1990s because of the environmental disaster in the Aral Sea region. In addition, over 161,000 persons were forced to leave the Semipalatinsk area, a nuclear testing site. In Kyrgyz Republic, at least 17,000 people had to migrate between 1992 and 1997 because of landslides, mudflows, floods and earthquakes.

If one looks at the historical development of international migration patterns, three different phases can be distinguished: a phase where political motivations were predominant, after the collapse of the Soviet Union and the civil unrest that followed; a phase where economic motives were predominant, with many looking for better job opportunities in Germany, Russia, and increasingly in the United States; and finally a phase where the motivations were increasingly of an environmental nature, this phase being associated with intranational migration.

Finally, it should also be mentioned that Central Asia is also increasingly a region of transit migration, with migrants from Asia transiting en route to Europe or the United States.

## **F. The Pacific**

The Pacific differs massively from the previous regions. Apart from Papua New Guinea, the region comprises a number of island or atoll countries of comparatively small populations. Among the migration trends are movement away from small remote islands, movement down mountains to more accessible coastal locations, urbanization, and international migration to Australia and New Zealand, among other countries. They have also noted that there is considerable variation among the parts of the region, not only in the levels and types of labor

mobility but also the drivers of movement. Hence, there are intraregional differences in the level of access to outside work and residence opportunities between countries and groups in the Pacific (Connell and Brown 1995).

The three subregions of the Pacific—Melanesia, Micronesia, and Polynesia—have become associated with different stories of migration (Bedford and Hugo 2008). Some of these differences are as follows:

- (i) **Melanesia:** The Fiji Islands, New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu have 85% of the region's 9.7 million people. The first three countries have very limited outlets for migration but Fiji Islands has a substantial diaspora.
- (ii) **Micronesia:** Kiribati and Nauru have strong links to Australia and New Zealand, and the remainder of the subregion is linked to the United States.
- (iii) **Polynesia:** Polynesia has strong links to New Zealand, and also, in some cases, to North America.

While the populations in all three Pacific subregions will increase significantly over the coming decades, but in Melanesia there will be an explosion of growth. Several commentators have also pointed to the importance of youth in those population increases (Bedford 2005). In the three subregions, the 15–24 age group make up around 19% of the population, compared with 14% in Australia and New Zealand.

The potential for economic development within Pacific countries varies, but migration has become a significant contributor with the so-called MIRAB (migration, remittances, aid and bureaucracies) countries (Bertram and Watters 1985). While all economies in the region do not fall into this category, it is the case for at least half of them. Therefore, while the extent to which Pacific countries have access to migration outlets for their growing populations varies, of all the world's regions, the Pacific is the most dependent with respect to the flow of remittances from migrants.

The bulk of migration out of the Pacific has involved permanent resettlement abroad. From the perspective of development and the climate change and migration concerns of this study, the size of the diaspora of Pacific island communities is important. The diaspora sends remittances home and assists development in other ways. It can also serve to anchor future generations of migrants, with information and assistance. While there is a focus on international migration in the Pacific, there is also considerable intranational redistribution occurring. Rural-to-urban migration is particularly strong among young adults.

#### IV. CLIMATE CHANGE IMPACTS

Asia and the Pacific ranks amongst the global regions that are projected to be most impacted by climate change. Bangladesh, the Maldives, and Tuvalu have come to epitomize the threat of climate change to local populations. These people are typically presented as “climate refugees” in the making, and are portrayed as the “canaries in the coal mine”—the first witnesses of climate change, alerting the rest of the world to the humanitarian catastrophe to come. Such portrayal, however, confuses exposure and vulnerability, and does not hold up against a deeper analysis of vulnerability, as will be shown here.

The fact remains that Asia and the Pacific will be greatly impacted by climate change, partly because of its high exposure to climate impacts and partly because of the great vulnerability of some areas. The IPCC projects a “significant acceleration of warming over that observed in the

20th century” (Cruz et al. 2007). This warming will be least rapid in Southeast Asia, but stronger in South and East Asia, and stronger in the inner parts of Asia, especially in North Asia.

It is projected that most of Asia and the Pacific will experience an annual increase in precipitation, especially in North and East Asia. An exception is Central Asia, where precipitation is expected to decrease, particularly in winter, and where the frequency of very dry springs, summers, and autumns might increase. South Asia, East Asia, and Southeast Asia will also very likely experience an increase in the occurrence of extreme weather events, such as heat waves and flash floods, as well as a 10%–20% increase in tropical cyclone intensities. Sea-level rise should also be greater than average, at about 3 millimeters per year (Cruz et al. 2007).

Such impacts will have significant socioeconomic consequences. Amongst those is a possibly significant decrease in cereal production, though there will regional differences in the response of maize, wheat, and rice yields. A northwards shift of the arable lands is also likely—currently a large share of arable lands in Asia and the Pacific is put to use. Livestock, fisheries, water resources, and food supply could also be significantly reduced.

These different socioeconomic impacts can affect migration patterns in different ways. The IPCC notes that migration accounts for 64% of urban growth in Asia, even though the figures that it provides for international migration in Asia are widely underestimated (Cruz et al. 2007). In its Fourth Assessment Report, the IPCC states the following:

Climate-related disruptions of human populations and consequent migrations can be expected over the coming decades. Such climate-induced movements can have effects in source areas, along migration routes and in the receiving areas, often well beyond national borders. Periods when precipitation shortfalls coincide with adverse economic conditions for farmers (such as low crop prices) would be those most likely to lead to sudden spikes in rural-to-urban migration levels in PRC and India. Climatic changes in Pakistan and Bangladesh would likely exacerbate present environmental conditions that give rise to land degradation, shortfalls in food production, rural poverty and urban unrest. Circular migration patterns, such as those punctuated by shocks of migrants following extreme weather events, could be expected. Such changes would likely affect not only internal migration patterns, but also migration movements to other western countries. (Cruz et al. 2007)

In addition to these climate impacts, Asia and the Pacific is also the region in the world most prone to disaster. Climate change is likely to aggravate and exacerbate the frequency of natural disasters, including flash floods, glacial lake outbursts, heat waves, cyclones, typhoons, and droughts. Since the start of systematic monitoring of disasters in the 1950s, the number of disasters reported worldwide has been steadily growing, although this can perhaps be attributed in part to better reporting. Although the number of people killed in disasters has been steadily decreasing since the mid-1970s, the number of affected people<sup>5</sup> has been on the rise.

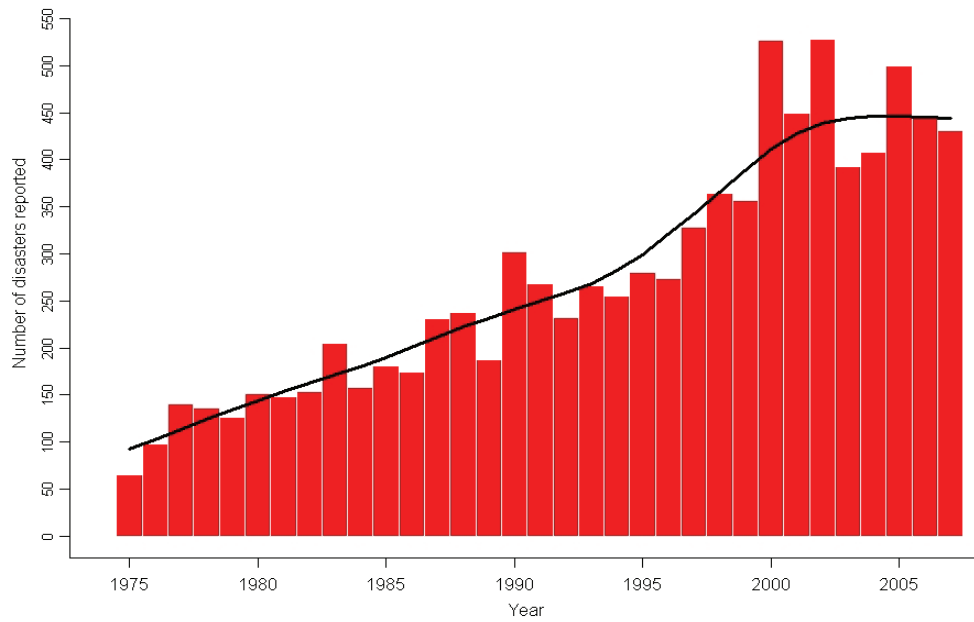
Overall, despite the upward trend in the occurrence of disasters (Figure 1), the number of victims (people killed and people affected) has remained relatively stable (Figure 2), meaning that the average number of victims reported per disaster is decreasing. It is not clear whether this decrease can be attributed to improvement in the reporting of disasters, or to better preparedness of the population; the question remains unanswered as the search for better statistical methods on disaster reporting continues.

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<sup>5</sup> “Affected people” are defined as those requiring assistance during a disaster, including the people displaced and evacuated.

**Figure 1: Number of Natural Disasters Reported Worldwide, 1975–2007**

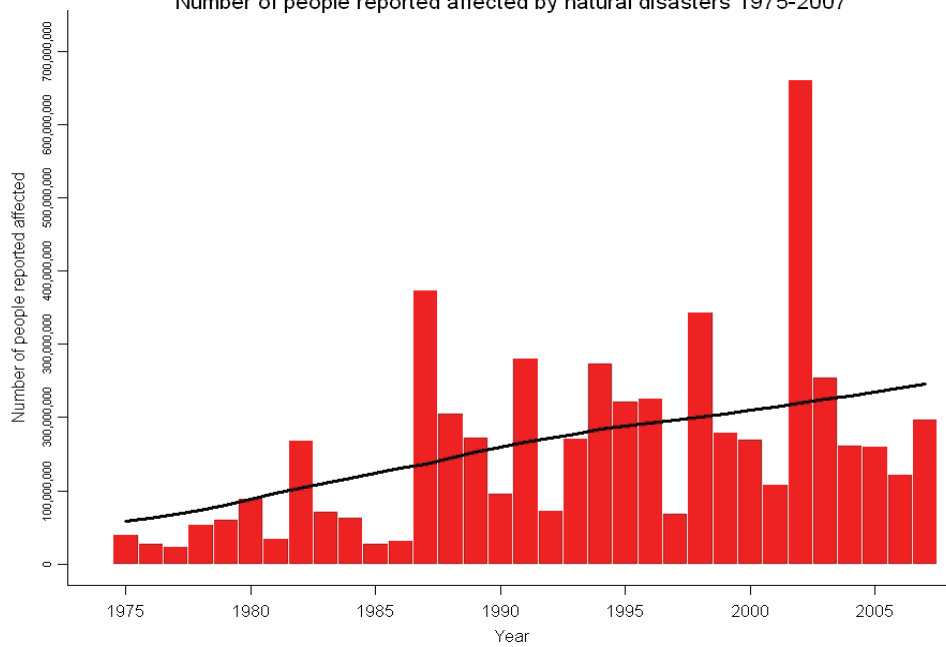
Natural disasters reported 1975-2007



Source: EM-DAT, OFDA/CRED International Disaster Database.

**Figure 2: Number of People Affected by Natural Disasters Worldwide, 1975–2007**

Number of people reported affected by natural disasters 1975-2007



Source: EM-DAT, OFDA/CRED International Disaster Database.

Overall, developing countries are disproportionately affected by disasters, although OECD member countries report the highest economic losses. In developing countries, the poor are the hardest hit by disasters, since they tend to live in more hazard-prone and/or overpopulated areas. This situation will most likely be considerably aggravated because of climate change. Women and children tend to be particularly vulnerable to disasters, and women play a critical role in disaster risk reduction.

Four environmental disruptions induced by climate change are of particular concern in Asia and the Pacific: sea-level rise and storm surge, cyclones and typhoons, riparian flooding, and water stress. The following sections detail these impacts in each of the regions.

## **A. East Asia**

The PRC experiences significant impacts from environmental hazards, largely associated with flooding in densely populated plain regions. The country has many people living in its low-elevation coastal zone, which is likely to be affected by sea-level rise, especially when associated with the combined risk of cyclonic activity. “The projected relative sea level rise, including that due to thermal expansion, tectonic movement, ground subsidence and the trend of rising river water level, is 40 to 60cm [centimeters], 50 to 70cm and 0 to 90cm in the Zhujiang, Changjiang and Huanghe Deltas respectively, by the year 2050.” (Cruz et al. 2007) The northeast plains are seen as being vulnerable, as are coastal cities such as Guangzhou, Haikou, Shanghai, Shenzhen, and Tianjin.

Similarly, the densely populated areas of Seoul in the Republic of Korea and southern Honshu in Japan will be at risk due to sea-level rise. Flood risk is already a major problem along many rivers in the PRC, but especially on the highly populated areas of the Yangtze (Changjiang) River and Lower Yellow (Huanghe) and Pearl River basins, and this could increase with more significant rainfall events in the central part of the country (Hai-Lun and Kang 2009). Landslide risk will increase in association with flood risk in steep terrain, particularly in the Himalaya.

The sustainability of natural resource management has already been brought into question in many parts of Northeast Asia due to high population densities. Whereas water resources in northern PRC constitute a significant environmental management challenge, projections of increased rainfall may reduce the risk (Arnell 2004). On the other hand, projections of glacial melting in the headwaters of the major rivers of the PRC could create a situation of greater intra-annual variability in flow regimes (Vörösmarty et al. 2000). Cruz et al. (2007) note that “between 20 to 40 percent reduction of runoff per capita in Ningxia, Xinjiang and Qinghai Province is likely by the 21st century”. The western part of the PRC may experience a net drying, which could exacerbate water resource issues in that area as well. The melting of glaciers and permafrost in Tibet and the northwestern part of the country, could lead to increased local landslide activity potentially threaten freshwater supplies.

In addition, coastal areas of Taipei, China; Hong Kong, China; and the Republic of Korea are also expected to be affected by coastal inundation due to sea-level rise. Deltas of the Yellow, Yangtze, and Pearl rivers are also identified as being vulnerable to sea-level rise. Riparian floods along these rivers are also expected to increase due to increased precipitation in the area. Mega cities at high risk due to sea-level rise include Guangzhou in the PRC, Seoul in the Republic of Korea, and Osaka and Nagoya in Japan.



## **B. Southeast Asia**

Environmental hazards resulting from sea-level rise and associated storm surges will be a great concern for low-lying areas in Southeast Asia (Yusuf and Francisco 2009). Areas identified as being highly vulnerable include the Mekong, Red, and Irrawaddy river deltas, which already experience regular cyclonic activity. Several mega cities in the region, including Manila, Jakarta, and Bangkok, are situated at or close to sea level, and all are likely to be affected as seas rise. Flooding in coastal areas is generally most intense when storm surges are associated with high river flows.

Significant river flooding along the major river systems, including the Irrawaddy, Salween, Chao Phraya, Mekong, and Red rivers, and local flooding on islands such as Sumatra, Java, and the Philippines archipelago are all projected to become more frequent with increasing extreme precipitation events. However, in association with low pressure systems and coastal storm surges, the impacts of interacting river and coastal flooding are likely to be most significant.

Cyclonic activity is already significant, particularly in the Lao People's Democratic Republic (Lao PDR), the Philippines, and Viet Nam, and the intensity of this hazard may increase. There are some significant concerns for the sustainability of natural resource management due to a reduction in precipitation, or at least the reliability of rainfall, across large parts of Southeast Asia. Early indications are that the onset of rainfall periods and rainfall events is becoming less reliable, which has implications for agricultural production throughout the region.

Although beyond the scope of this study, high population densities heavily reliant on the success of multiple-cropping systems in the Philippines, Indonesia, and Indochina could be of significant concern. The quality of water supplies in delta areas is projected to be significantly affected by the combined impacts of sea-level rise and reduced flows in some river systems during the winter months. Water quality in the major deltas of the river systems described above could thus be at risk of increasing salinization.

Indonesia, the Philippines, Thailand, and Viet Nam are at greatest risk in Southeast Asia due to sea-level rise and coastal flooding as a result of storm surges. The low-lying deltas along the Mekong, Red, and Irrawaddy rivers are expected to be the most vulnerable to sea-level rise. Cyclonic activity is expected to increase in the Philippines, Viet Nam, and Lao PDR in the future. Climate change impacts, along with increased and unplanned urbanization, will threaten mega cities such as Ho Chi Minh City in Viet Nam, Manila in the Philippines, Jakarta in Indonesia, and Bangkok in Thailand.

## **C. South Asia**

According to all vulnerability assessments, South Asia is the region most vulnerable to the impacts of climate change. Many of this region's countries, including Bangladesh, India, Maldives, and Pakistan, are expected to be among the most affected in the world. Environmental harm due to sea-level rise in association with storm surge impacts will be significant in both the Bay of Bengal and the Arabian Sea, where cyclonic activity is projected to intensify. The delta areas of the Ganges-Brahmaputra, Godavari, Indus, Krishna, and Mahanadi rivers also experience cyclonic activity, and these rivers are likely to flood more often with increased monsoonal activity.

The hazard of coastal flooding is likely to be significantly enhanced in Bangladesh, West Bengal, along the coast south to Chennai, and along a coastal strip from Karachi to Mumbai.

River and local flooding will increase in many areas in association with an intensification of the monsoon, including in the Himalaya, northern Pakistan, northern India, Nepal, and Bangladesh. Landslide risk will increase in association with flood risk in steep terrain, particularly in the Himalaya. A proportional lack of natural resources is already impacting on populations across South Asia.

In a manner similar to parts of Southeast Asia, the population densities of some parts of South Asia are so high and directly dependent on intensive cropping systems that changing precipitation regimes are likely to impact significantly on the viability of food supplies, especially in parts of northwest India. Water stress in relation to access to nonpolluted fresh water is already a significant problem across large parts of the region, and these risks could be increased with more variable rainfall, particularly in winter (Vörösmarty et al. 2000). The Ganges and Indus rivers have significant salt-water intrusion and with decreases in winter flows the problems in these systems could become more significant. Similarly, projected drying to the west of the Himalaya could increase water stress in parts of the Indus valley.

Several mega cities of South Asia—such as Dhaka in Bangladesh, Karachi in Pakistan, and Kolkata, Mumbai, and Chennai in India—are at high risk of sea-level rise, prolonged cyclonic activity, and greater salt-water intrusion, which is likely to affect a large number of people due to high population density and poor urban planning. Increased cyclonic activity is expected to affect southern Pakistan.

## **E. The Pacific**

One of the most discussed and analyzed impacts regarding climate change has been the potential implications of environmental hazard due to sea-level rise on small island states. Projections suggest that the low-lying islands and islands that are highly dependent on coastal areas for socioeconomic activity are going to be highly vulnerable to sea-level rise impacts (Klein and Nicholls 1999). The impacts on coastal regions are likely to be exacerbated by an increase in the number of high-intensity cyclones and associated storm surges. Already the South Pacific islands experience relatively short recurrence intervals for cyclones of lower to middle intensity, but with warmer seas more intense systems could become more frequent.

There is also likely to be a drying trend across the southwestern part of the Pacific if the La Niña phase of the Southern Oscillation becomes more dominant, as projected. This will significantly impact on natural resource management in the South Pacific (Preston et al. 2006). Thus, freshwater resources on small islands, many of which are dependent on the positive pressure of freshwater lenses to ensure that salinity does not influence groundwater resources, could also be highly problematic.

If more extreme precipitation events eventuate as projected in places such as Papua New Guinea, local flooding and landslides could become more of a problem. The Food and Agriculture Organization (FAO 2008) suggests that the combined impacts of climate change, including impacts on local agriculture and fisheries, will significantly increase food insecurity throughout the region.

Kiribati and Tuvalu are considered to be at a relatively higher risk than other Pacific island countries from sea-level rise. Papua New Guinea, the Pacific region's largest country, is expected to experience greater risk from both flash flooding across the highlands and coastal flooding along the south coast.

Tables 5–7 summarize the key hot spots in the different regions.

**Table 5: Key Hot Spots of Vulnerability in the Different Regions**

<b>Region</b>	<b>Area</b>	<b>Major Cities</b>
East Asia	<ul style="list-style-type: none"> <li>• Coastal areas of PRC</li> <li>• Deltaic areas of Yellow, Yangtze, and Pearl rivers</li> <li>• Southern Honshu</li> <li>• Qinghai-Tibetan Plateau</li> </ul>	<ul style="list-style-type: none"> <li>• Guangzhou</li> <li>• Nagoya</li> <li>• Osaka</li> <li>• Shanghai</li> <li>• Seoul</li> <li>• Tianjin</li> <li>• Taipei City</li> </ul>
South Asia	<ul style="list-style-type: none"> <li>• Deltaic areas of Ganges-Brahmaputra, Mahanadi, Godavari, Krishna, and Indus rivers</li> <li>• Nepal's Himalayan region</li> <li>• Most of Bangladesh</li> <li>• Southern Parkisan</li> </ul>	<ul style="list-style-type: none"> <li>• Chennai</li> <li>• Dhaka</li> <li>• Kolkata</li> <li>• Mumbai</li> <li>• Karachi</li> </ul>
Southeast Asia	<ul style="list-style-type: none"> <li>• Deltaic areas of Mekong, Red, and Irrawaddy rivers</li> </ul>	<ul style="list-style-type: none"> <li>• Bangkok</li> <li>• Ho Chi Minh City</li> <li>• Jakarta</li> <li>• Manila</li> <li>• Singapore</li> </ul>
Central Asia	<ul style="list-style-type: none"> <li>• Kazakhstan</li> <li>• Tajikistan</li> </ul>	
Pacific	<ul style="list-style-type: none"> <li>• Kiribati, Tuvalu, Papua New Guinea</li> </ul>	

PRC = People's Republic of China.

Source: Generated by Graeme Hugo for ADB, 2009.

## **F. Populations at Risk**

Eight of the top 10 countries in the world that have the greatest number of people living in low-elevation coastal zones are in Asia and the Pacific (Table 6). Among all countries in Asia and the Pacific, Bangladesh and Viet Nam are at the highest risk, with nearly half of their total population living on low-elevation coastal zones.

**Table 6: Countries Ranked by Total Population Living  
in the Low-Elevation Coastal Zones, 2009**

<b>Rank</b>	<b>Country</b>	<b>Overall Population Rank</b>	<b>Actual Population in LECZs (million)</b>	<b>LECZs Population as a Percentage of Total Country Population</b>
1	PRC	1	143.9	11
2	India	2	63.2	6
3	Bangladesh	8	62.5	46
4	Viet Nam	13	43.1	55
5	Indonesia	4	41.6	20
6	Japan	9	30.5	24
7	Egypt	16	25.7	38
8	US	3	22.9	8
9	Thailand	19	16.5	26
10	Philippines	14	13.3	18

LECZ = low-elevation coastal zone, PRC = People's Republic of China, US = United States.  
Source: Balk 2008.

The actual number of people affected by hazards related to climate change varies significantly over years and across countries. Table 7 shows the actual numbers of people affected by climate hazards in selected countries. While the number of people affected in developing countries such as Bangladesh, the PRC, Nepal, and the Philippines has increased significantly, in other countries—including Cambodia, India, Thailand, and Viet Nam—there has been a reduction. Due to the unpredictable nature and scale of disasters, estimating the number of people likely to be affected and migrating due to climate change becomes an even more complex task. As an example, the situation in Pakistan would look drastically different after the 2010 floods than it did in 2009.

**Table 7: Population Affected due to Multiple Hazards Related to Climate Change in Selected Developing Member Countries**

<b>Country</b>	<b>2000</b>	<b>2005</b>	<b>2009</b>
India	100,171,035	28,041,000	8,991,000
PRC	23,173,000	83,024,742	154,163,799
Philippines	6,230,269	213,057	13,599,635
Viet Nam	5,027,505	851,817	3,607,820
Cambodia	3,448,000	600,000	178,000
Thailand	3,351,950	822,770	200,000
Tajikistan	3,000,000	6,327	23,322
Bangladesh	2,739,638	1,163,000	4,886,678
Afghanistan	2,580,000	34,156	102,500
Pakistan	2,200,000	7,523,073	79,000
Mongolia	1,521,000	.	779,106
Sri Lanka	775,000	145,000	395,000
Indonesia	542,437	20,531	27,025
Lao PDR	450,000	.	128,796
Nepal	50,000	31,600	175,000
Malaysia	8,500	30,600	10,875
Kazakhstan	2,500	25,000	23,500

Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.  
Source: Generated by Namrata Chindarkar for ADB, 2010.

Asia and the Pacific includes many mega cities that are climate change hot spots. Among them are some with very high population densities and with large populations living in low-elevation coastal zones. Vulnerability and adaptive capacity of mega cities would be much different from that of other areas. Most mega cities are already centers of large migration inflows, and with the adverse effects of climate change they will face additional risk and capacity stress.

Whether and how each hot spot copes with climate change, and whether migration will be their primary response to climate change, will depend on their vulnerability and adaptive capacity.

## **V. HOW CLIMATE CHANGE WILL AFFECT MIGRATION**

As previously indicated, in the current state of science, and given the wide range of uncertainties about how populations will respond to climate impacts, it is difficult to make reliable predictions of the number of climate-induced migrants. However, with local assessments of migration patterns, climate impacts, and vulnerability, it is possible to identify areas where climate-induced migration could occur, and the processes through which these migration flows would take place.

## **A. Conceptualizing the Climate Change–Migration Nexus**

### **1. A Theoretical Model for Climate-Induced Migration**

Classical models and theories of migration barely address environmental change as a driver for migration. Literature specifically addressing environmental migration, however, has produced a specific explanatory model, first proposed by Richmond (1994) and later systematized by Hugo (1996). The model encompasses all types of environmental migration, of which climate-induced migration is a subset. It is one of the very few models developed specifically to address environmental migration, and is based on the importance of understanding the dynamic and complex interaction of the multiple causes that trigger environmental migration.

The model acknowledges that some environments and contexts are more likely to generate migration than others—fragile environments, areas at risk of natural disaster, or poorer areas and/or countries where people have less resilience to environmental change and fewer possibilities to adapt. Therefore, the predisposing factors are not solely environmental but also economic and social. Overall, these predisposing factors are more present in developing countries and can be understood as variables of social vulnerability.

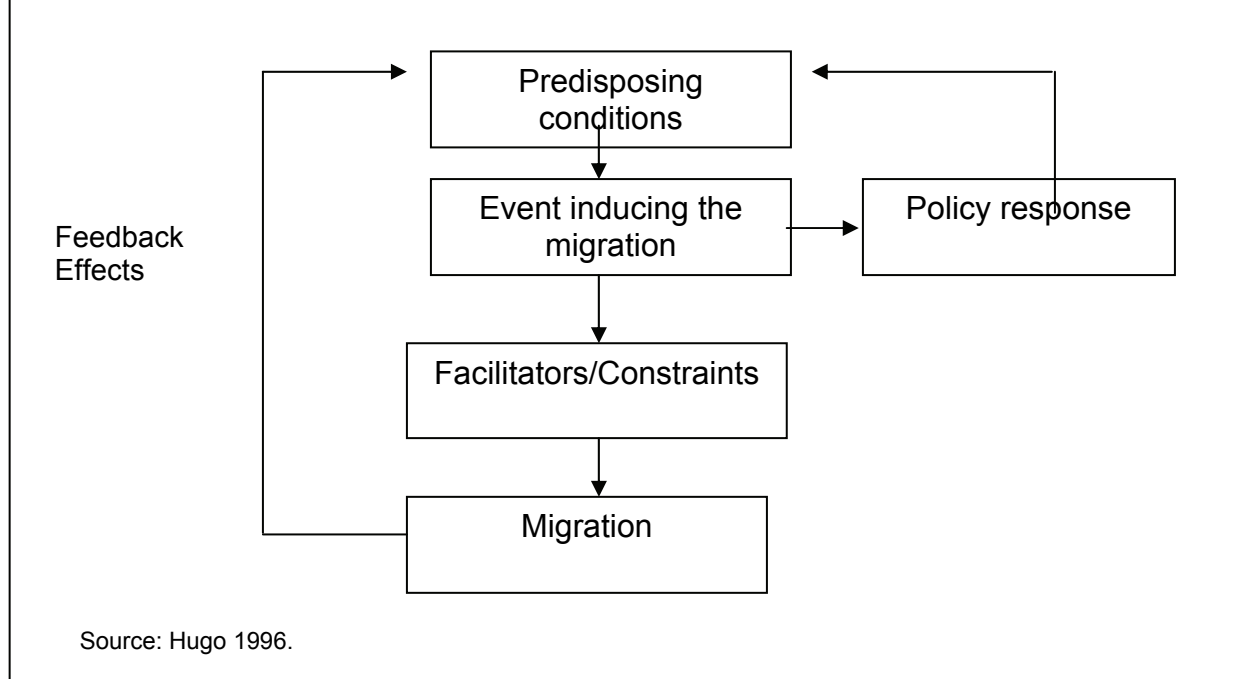
The second element in the chain of migration is the precipitating event, which can be any environmental change or series of changes. Richmond insists that the precipitating event and the predisposing factors are not independent from each other; whether or not a precipitating event triggers migration is dependent on the predisposing factors. This argument relates to theories of natural disasters and vulnerability outlined above, and echoes the structural theory of refugee movements: the precipitating event as such does not create a migration flow unless it coincides with predisposing factors (Zolberg, Suhrke, and Aguayo 1989).

Migration is also influenced by constraints and/or facilitators, such as the preexistence of links and networks, or organized evacuation. These constraints and facilitators will shape the migration flow.

Finally, the feedback to the area of origin is of utmost importance for understanding migration flows. This feedback can be produced by the migration itself, alleviating the pressure on natural resources and thus reducing the likelihood of the occurrence of a disaster. The feedback can also take the form of environmental policies implemented after a disaster, which can also influence migration.

Figure 3 depicts the most comprehensive theoretical model of environmental migration.

**Figure 3: A Theoretical Model of Environmental Migration**



## 2. A Typology of Climate-Induced Migration

A common shortcoming of many typologies is that they try to combine the classification of environmental changes with the classification of migration patterns (Jacobson 1988, Piguet 2008, Masters 2000). Such a combination is rooted in a deterministic perspective, which assumes that certain migration patterns correspond to certain types of environmental change. This report argues that the classifications need to be separated, as migration patterns depend not only upon the type of environmental disruption, but also upon other social, economic, and political factors, as well as individual characteristics. Yet there are at least three key distinctions that need to be made, since not all migration flows are similar—they each demand different policy responses.

### a. International and Intranational Migration

The distinction between international and intranational migration is one for which it is fairly easy to establish clear-cut categories. This distinction bears naturally an essential meaning for normative frameworks and policies: the fundamental building block of international law remains states' sovereignty, thus any international agreement on environmental migration excludes consideration of intranational displacement. Apart from the Guiding Principles on Internal Displacement, adopted in 1998 (Commission on Human Rights 1998), no document of international law offers any protection to those internally displaced people.

Research shows that most people moving because of environmental reasons tend to stay close to their former place of habitat, and travel relatively short distances, within their country (Hugo 1996). When international migration occurs, it is usually because former patterns of migration between two or more countries existed prior to the environmental disruption (Entzinger 2008). Yet most policy proposals to address environmental change are rooted in international law

(Falstrom 2001, Biermann and Boas 2007, Conisbee and Simms 2003), and therefore can hardly apply to internally displaced people.

However, environmental factors are set to become more significant in impelling international movements, and not only intranational movements (Hugo 1996). Sea-level rise is the main reason for the expected increase in international movements in the coming decades. Coastal and deltaic regions are the most densely populated worldwide, and the potential for migration from these areas due to sea-level rise is thus considerable.

For many low-lying island nations, the possibilities of intranational resettlement are extremely limited, so there will be pressure for resettlement abroad, especially when strong social networks exist between the origin and destination countries, as it is the case between many island countries and Australia, New Zealand, and the United States (Moore and Smith 1995).

Some nonclimate drivers also may account for an increase in international environmental movements in the future: the proliferation of migration facilitators, such as social networks between origin and destination countries, as well as the emergence of an international immigration industry. It is possible that “a greater proportion (of environmentally-induced migration) will occur between nations in line with globalization trends and proliferation of migration networks and increasing numbers of institutions, businesses and people facilitating international migration” (Hugo 1996).

#### **b. Voluntary and Forced Migration**

The distinction between voluntary and forced migration is often presented as paramount for the implementation of assistance and protection policies, but the distinction is not easy to make in the case of environmental migration. Climate-induced migrants are often labeled refugees, although they do not fit the legal definition contained in the 1951 Geneva Convention, irrespective of whether their movement is compelled or not.

Though this distinction between forced and voluntary migration is essential, it is also highly controversial, and not as clear-cut as it might seem. Migration that is perceived to be voluntary often conceals a certain level of constraint, whereby migrants have little choice about the conditions of their migration. On the other hand, some cases of forced migration, such as resettlement, may leave some discretion to the displacee as to the time and place of her/his relocation.

For these reasons, “population mobility is probably best viewed as being arranged along a continuum ranging from totally voluntary migration...to totally forced migration”, rather than in clear-cut categories (Hugo 1996). This difficulty of clearly distinguishing between migrants and refugees is not only conceptual but bears practical implications. For example, mixed groups of migrants make it increasingly difficult for states to differentiate between refugees and migrants (Crisp 2007).

Such observations are particularly valid when applied to climate-induced migration: whereas, for example, some people have to flee for their lives when faced with a brutal disaster, most will experience a progressive degradation of their habitat and decide to leave once a threshold has been reached or once migration facilitators make it possible. Though their migration is compelled, those who migrate retain the option of choosing when and where to go. Most often, the line between forced and voluntary migration is blurred, and the distinction between migrants



and displacees is also best understood as a continuum, in which amenity migrants<sup>6</sup> represent one end and people fleeing for their life in a disaster situation the other. The extent to which migration is compelled largely depends upon the time when migration occurs, an aspect that shall now be developed.

### **c. Proactive and Reactive Migration**

Some researchers, such as Kunz (1973), make a fundamental distinction between “anticipatory refugee movements,” in which people flee before the situation deteriorates, and “acute refugee movements,” where the objective is to find a haven of safety at a time of crisis. Others, such as Richmond (1994), go a step further and argue that this distinction is more essential than the distinction between forced and voluntary migration, and it reflects the degree of autonomy of the actors regarding their migration decision. He applies the distinction to environmental migration, and differentiates between “proactive migration” and “reactive migration”. He argues that

Gradual environmental degradation, soil erosion, etc., may initially lead to proactive migration, but eventually result in reactive movements as the process of degradation accelerates. Reactive migration that combines environmental and social determinants occurs when whole communities are forced to move as a consequence of environmental degradation or disaster and re-establish in a new location.

The time when people move actually reflects their degree of autonomy as to their migration, and is often related to its degree of constraint. People leaving a small island state because they are concerned with sea-level rise are considered voluntary migrants if they do so now, proactively. If they flee at a time when the island floods, however, they will be most likely considered to be forced migrants, because they fled reactively. However, the threshold when environmental degradation becomes no longer bearable may vary greatly from one migrant to another, as does the degree of proactivity.

Thus, it appears that the distinction between proactive and reactive migration does not exactly match the distinction between forced and voluntary migration, even though they relate to each other. Also, these two types of migration are not discrete, as “before” and “after” can be, and are thus best perceived as the two ends of a continuum. This continuum influences the policies that are implemented to address migration; reactive migration suggests the development of humanitarian and disaster management policies, whereas proactive migration seems to be best addressed by migration policies and adaptation strategies.

### **d. Short-Term and Long-Term Migration**

At what point is a movement considered a migration? Statistical guidelines usually consider that the duration of the move must be at least 1 year before it can “qualify” as a migration (Bilsborrow et al. 1997). Hence, temporary movements are not considered migrations. Although these guidelines were developed to collect data on international movements, they also apply, to a great extent, to internal movements.

The question of the duration of the movement is of great importance with regard to climate-induced migration. On the one hand, some kinds of environmental changes, such as floods and

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<sup>6</sup> Examples of internal amenity migration include movements to Florida and other southern states from elsewhere in the United States or movements to Queensland from elsewhere in Australia. Examples of international amenity migration include retirees from northern and western Europe moving to Mediterranean countries.

other extreme weather events, are assumed to induce temporary movements and to allow people to return to their home after a short period of time (Piguet 2008), although empirical evidence, such as the displacements induced by Hurricane Katrina, sometimes proves otherwise. On the other hand, although voluntary migration is often perceived as a long-term move (if not a permanent one), studies suggest that seasonal—hence temporary—movement can be an effective adaptation strategy to cope with environmental change (McLeman and Smit 2006).

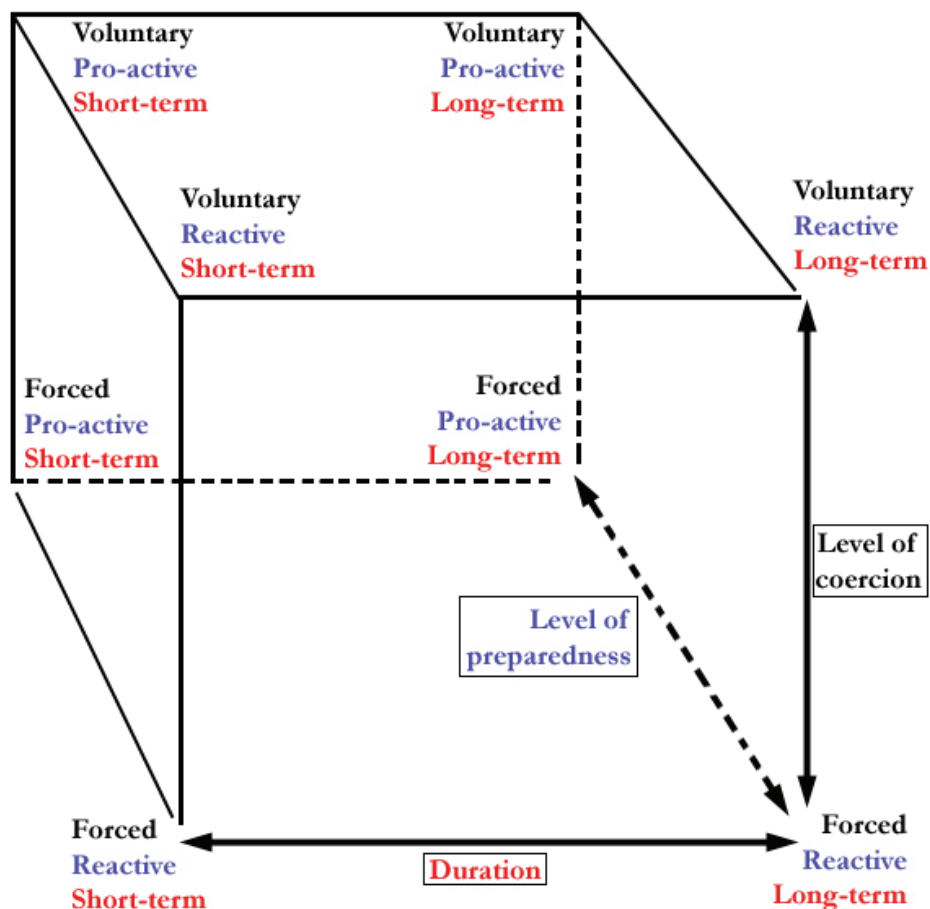
This report argues that the duration of the move is not only dependent on the nature of the event triggering environmental change, but also, and more importantly, on the social and economic characteristics of the migrant and on the policies implemented to address the movement and return of those displaced. Even though some changes such as sea-level rise are irreversible, many of them are reversible and the possibilities for the return of migrants will depend mostly upon social, economic, and political factors.

For those displaced, when does displacement end? It is a long-standing question in refugee studies. The answer usually relates to policies: instead of setting a precise duration, it is considered that the displacement comes to an end when the displaced persons are able to return home, or when they have reached a livelihood level that exceeds or is comparable with the predisplacement level (Cernea 2003). Similarly, setting a cutoff point between short-term and long-term migration makes little sense, and this distinction is best understood along a continuum.

#### **e. A Synthesis**

In addition to the distinction between international and internal migration (which represent discrete categories), the three other important distinctions are best understood as a continuum rather than as clear-cut categories. These distinctions are to a certain extent related to each other and need to be considered jointly in order to provide a comprehensive picture of migration flows, and to allow for the development of appropriate policies. Voluntary and forced migration, proactive and reactive migration, and short- and long-term migration can be shown together in a three-dimensional view (Figure 4).

**Figure 4: A Three-Dimensional View of Environmental Migration Patterns**



Source: Gemenne 2009.

The opposing ends of the three continua are as follows:

- (i) In the forced–voluntary continuum, migration is compelled by a life-threatening event at one end and by an amenity migration at the other.
- (ii) In the short-term–long-term continuum, people are able to return to their homes after a few days at one end and they relocate permanently at the other end.
- (iii) In the proactive–reactive continuum, there is a carefully planned migration associated with a slow-onset environmental change at one end and an emergency evacuation at the other.

This visual representation of the migration patterns, which can be duplicated for both internal and international migration, allows for a comprehensive overview of the main characteristics of the movement, as well as for a visual comparison between different types of movement. We shall now examine the applications of the climate change–migration nexus in the different regions of Asia and the Pacific.

## B. East Asia

The PRC receives particular attention in this section due to its large population, as well as the relative poverty and vulnerability of many of its citizens living in hotspots compared to higher-income economies such as the Republic of Korea and Japan. Several of the PRC's mega cities are located in coastal and inner valley areas vulnerable to coastal and riparian flooding and inundation. These at-risk populations are projected to grow substantially, despite the low overall growth of the national population. In Japan, the number of people at risk will decrease over the period, reflecting a shrinking population due to low fertility and a restrictive immigration policy (Table 10). For similar reasons, only limited urban growth in at-risk numbers is anticipated in the Republic of Korea.

**Table 8: East Asian Hot Spot Populations at High Risk of Climate Change Impact**

Economy	Total	Percentage of the Population at Risk of			
	Population 2000 (‘000)	Coastal Flooding	Cyclone	Riparian Flooding	Water Stress
PRC	1,253,670	16.3	22.3	29.6	4.9
Hong Kong, China	6,804				
Japan	127,095		73.1		
Republic of Korea	46,751		22.6		
Macao, China	237	100.0			
Mongolia	2,540				3.3
Taipei, China	21,640		100.0		
<b>Total</b>	<b>1,480,972</b>				

PRC = People's Republic of China.

Source: Calculated from hot spot analysis and United Nations projections.

The PRC remains highly vulnerable to the impact of climate change. More than half of its workers are still in agriculture and, for those living in hot spots, livelihoods are at significant risk. The large number of people who still live in poverty also contributes to vulnerability.

Given the country's huge population, this means that many people live in areas at risk (Table 8), with more than one-third in cities and several mega cities in the coastal areas and inner valleys vulnerable to coastal and riparian flooding and inundation (the delta of the Yellow River has a population of 25 million, that of the Yangtze River has 43 million, and the Pearl River delta has 76 million). What is of particular note here is that these cities have been recording a massive influx of migrants, fueling rapid industrial and urban development. By 2030 it is expected that more than 1 billion people will live in cities in the PRC, with 221 cities of more than 1 million inhabitants (Roberts 2010).

With regard to climate-induced migration, three areas call for particular attention, as identified by Roberts (2010): First, the upper reaches of the Yangtze and Yellow rivers, "where dams and soil degradation may force local inhabitants towards the Qinghai-Tibet plateau or east coast cities in search of livelihoods." Then the northern and northwestern parts of the PRC, where farmers

could be prompted to move because of droughts and desertification. Finally, the southeastern coastal regions will be affected with increased frequency by typhoons and flooding, which could also induce populations to move northward. Though the destinations of these migrants are difficult to predict, it is likely that they will form a significant proportion of those people migrating to cities.

In Japan, the Republic of Korea, and Taipei, China, it is mainly urban populations that are at the greatest risk of climate change impacts. In Mongolia, by contrast, it is mainly rural populations that are at risk, most significantly through greater water stress.

**Table 9: Number of People at Risk of Weather Events in the People’s Republic of China, 2000 (million)**

Risk	Urban		Rural		Total	
	No.	%	No.	%	No.	%
Coastal Flooding	94.8	24.7	109.9	12.6	204.7	16.3
Cyclones	105.4	27.5	173.7	20	279.1	22.3
Riparian Flooding	155.4	40.6	215.3	24.7	370.7	29.6
Water Stress	13.0	3.4	48.5	5.6	61.5	4.9

Source: Calculated from hot spot analysis and United Nations projections.

At-risk urban populations in the PRC over the next half century will increase more than one and a half times, reflecting high levels of rural–urban migration.

**Table 10: East Asia Projected Totals at Risk Allowing for Multiple Hazards ('000)**

Geographic Area	2000	2020	2030	2050	Percentage Change 2000–2050
PRC	224,947	443,848	516,237	602,893	168.0
Japan	84,537	67,527	67,471	64,178	(24.1)
Republic of Korea	7,191	8,301	8,368	7,613	5.9
Macao, China	237	523	543	524	120.8

PRC = People’s Republic of China

Source: Calculated from hot spot analysis and United Nations projections.

The large populations projected in hot spots can in no way be seen as the number of people likely to migrate or even to be at risk to migrate. But it is certain that climate change will have an impact on migration patterns in the country.

The PRC has the largest number of people (almost 80 million) living in cities at less than 10 meters below current sea level, and this is almost three times the size of the next largest urban population at risk (in India, at about 30 million). While a majority of the population in hot spots in

the PRC is now rural, rapid rural–urban migration means that as early as 2020 urban populations in hot spots will be substantially larger than they are now.

It is therefore crucially important that the major coastal cities adapt to impending climate change effects and identify the groups most at risk. The risk in urban areas is concentrated in low-income households, which are least able to avoid the direct or indirect impacts of climate change because of the poor quality of their housing, their location in the most vulnerable parts of cities, or because they are least able to move if climate change threatens neighborhoods (Huq and Satterthwaite 2008). Within these groups the most vulnerable are the elderly and children, who lack the resources to cope with illness, injury, or loss of income, livelihood, or property.

Table 11 projects the population living in areas within the PRC at risk of coastal and riparian flooding related to climate change. It indicates that it is not only in coastal areas that flooding is likely to have major impact, but also in valleys. Indeed, the numbers influenced by riparian flooding are greater than those in danger of influence by coastal inundation and storm surge. In the three most vulnerable deltas, the populations are 76 million (Pearl River delta in 2003), 42.3 million (Yangtze River delta in 2003), and 24.9 million (Yellow River delta in 2000). A rise of 30 centimeters could inundate 8,000 square kilometers of the densely populated and highly industrialized coastal region unless there is significant in situ adaptation (IPCC 2007).

**Table 11: Projected Population of Areas at Risk of Flooding in the People’s Republic of China, 2030–2050**  
(million)

Year	Coastal Flooding		Riparian Flooding	
	Urban	Rural	Urban	Rural
2000	94.8	109.9	155.4	215.3
2020	187.1	84.0	306.6	164.5
2030	217.6	73.1	356.6	143.2
2050	254.1	48.2	416.5	94.4

Source: Calculated from hot spot analysis and United Nations projections.

It is also important in the PRC to consider the impacts of climate change on cyclones and water stress. By 2050, 10 million people mainly in western PRC are likely to be displaced. Half of them live in ecologically fragile regions or in other areas that lack the basic conditions to support livelihoods.

Box 1 summarizes existing internal and international migration patterns in the PRC. It is clear from this that social networks linking residents with destinations within and outside the country are substantial, and that considerable future migration—including climate-induced migration—will be channeled through these corridors.

## **Box 1: Indicative Scenario of Migration Related to Climate Change in the People's Republic of China**

### **Linear Migration**

1. Environment-related migration in the People's Republic of China (PRC) is more often than not internal, purposeful, planned, organized, and permanent. The stated purpose of this policy is to prevent further environmental deterioration caused by changes in climatic conditions and to combat poverty.
2. Rural-to-urban migration has been the main stream of movement since the mid-1980s and the dominant direction of migrant flow has been from west to east and from north to south. The principal drivers that have stimulated contemporary migration in the PRC are distance, economic factors (especially employment), and demographic factors (including degradation of the environment and natural resources in migrant origin areas).
3. By 2050, 10 million people, who mainly live in western PRC, are likely to be displaced. Half of them live in ecologically fragile regions or in other areas defined by the state as lacking the basic conditions to adequately support livelihoods. The PRC will continue to experience large-scale displacement of people from rural areas, especially when the government encourages and financially compensates environment-related displacement and resettlement.
4. Annual inflows of rural migrants (15 million people in 2007) to urban areas will continue in the coming decade. Under current economic and infrastructure conditions, migrants from the western and central provinces would mainly move to three urban agglomerations in the east: those encircling the Bohai Sea (a gulf of the Yellow Sea east of Beijing), the Yangtze River delta, and the Pearl River delta.
5. Migration to Organisation for Economic Co-operation and Development (OECD) member countries will continue building existing social networks. There could be less emphasis on skill as Chinese communities grow in OECD countries and facilitate family reunion migrations.

### **Main Corridors:**

- Continued rapid rural-to-urban movement to established mega cities in coastal and valley areas.
- Continued environmental migration away from ecologically fragile areas in the north and west.
- Expanded international migration building on family and friendship links in OECD nations.

### **Nonlinear Migration**

1. An increasing number of people will be displaced by hydropower projects related to climate change. In Sichuan alone (the province with the richest hydroelectric resources), reservoir resettlers will total 1.4 million by 2020. The ongoing South-to-North Water Diversion Project (planned to be completed by 2050) will produce around 400,000 migrants.
2. Extensive coastal regions, with 41% of the population and 70% of mega cities, will be particularly vulnerable to large-scale forced relocation, permanently or temporarily, due to greater frequency and severity of climatic hazards, especially floods, cyclones, and rising sea levels. Assessments of future climate change on the supply of and demand for physical infrastructure and social services in urban areas, and adaptive capacity building, need more empirical studies in different areas to help policy makers develop efficient strategies in urban planning and reforms.
3. There will be increased population concentration in the south and southwest due to increased rainfall and therefore freshwater resources in this area for agriculture.
4. Major urban areas away from coast will further develop.
5. The longer-term orientation of coastal growth will be to areas that are above the 5 meter low-elevation coastal zone.

Source: Generated by Graeme Hugo for ADB, 2009.

### C. Southeast Asia

Table 12 shows the population in various Southeast Asian countries residing in hot spots in 2000. As in East Asia, coastal flooding poses the greatest risk induced by climate change, with around one-third of the Southeast Asian population living in areas considered to be at risk. These populations are especially concentrated in Indonesia, Myanmar, Philippines, Thailand, and Viet Nam (including Jakarta, Manila, Bangkok, and Ho Chi Minh City).

**Table 12: Southeast Asia Population in Hot Spots at High Risk of Climate Change Impacts, 2000**

Country	Total Population ('000)	Percentage of national population at risk of			
		Coastal Flooding	Cyclones	Riparian Flooding	Water Stress
Brunei Darussalam	317				
Cambodia	13,145	18.0	1.0	100.0	
Timor-Leste	739				
Indonesia	212,060	25.9			68.2
Lao PDR	5,275		64.2		
Malaysia	22,334	29.3			
Myanmar	47,833	34.1	9.4	32.7	48.9
Philippines	75,652	39.3	100.0	7.7	
Singapore	3,923				
Thailand	62,770	21.3	9.1		65.3
Viet Nam	78,114	67.8	60.5	100.0	

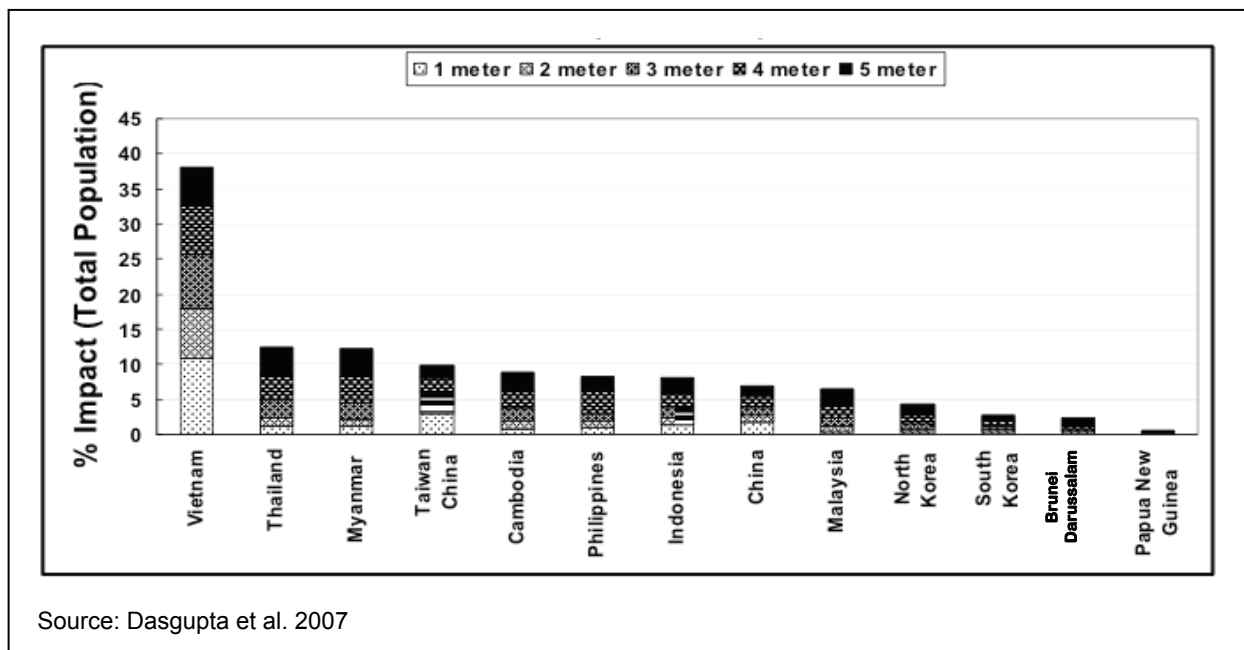
Lao PDR = Lao People's Democratic Republic.

Source: Calculated from hot spot analysis and United Nations projections.

Metropolitan areas have substantial populations living in low-lying areas below 5 meters above sea level. A 1 meter rise in sea level would put more than 15% of Guangzhou's population under water, and more than 10% of Ho Chi Minh City's (Dasgupta et al. 2007).



**Figure 5: Percentage of Population in East Asian Countries Affected by a Sea-Level Rise of 1–5 Meters**



Ho Chi Minh City has become a major focus of not only permanent rural-to-urban migration within Viet Nam but also massive seasonal temporary immigration. A qualitative study in the Mekong subregion has established that environmental factors are already an important element driving migration there (Dun 2009). A recent study by ADB, JICA, and the World Bank (2010) reveals that the city is at high risk of flooding events because of climate change.

Southeast Asian mega cities are growing rapidly due in part to rural–urban migration. Southeast Asian countries figure prominently among countries with the largest numbers of urban dwellers in coastal areas at risk of inundation (with 3 of 10 of the world’s countries with the highest populations in low-elevation coastal zones) as well as in those with the largest proportions of their national populations at risk of coastal inundation.

Meanwhile, a large number of Southeast Asians live in areas likely to be affected by cyclones (Table 13); Indonesia, Myanmar, Philippines, Thailand, and Viet Nam are especially at risk. All of the Philippines, but especially the northern and eastern parts of the country, is exposed to cyclones, and the potential increased intensity of cyclones threatens significant temporary or permanent displacement of people. Areas of densely populated coastal Viet Nam and Cambodia are at high risk of cyclones.

In Indonesia alone the urban population living in hot spots was predicted to be over 200 million in 2000. In the Philippines, the vulnerable urban population will more than quadruple by 2050. In most countries a decline in the rural populations in hot spots are projected, amid expectations that rapid rural–urban migration will continue and through the annexation of surrounding rural areas by metropolitan areas. Cambodia and Viet Nam are exceptions, however, where modest rural population growth is anticipated.

**Table 13: Projected Urban Population in Southeast Asia at Risk of Multiple Hazards ('000)**

<b>Country</b>	<b>2000</b>	<b>2020</b>	<b>2030</b>	<b>2050</b>	<b>Percent Change 2000–2050</b>
Cambodia	2,046	5,358	7,682	13,361	553.0
Indonesia	80,897	139,977	164,536	201,284	148.8
Malaysia	4,225	8,616	9,937	11,940	182.6
Myanmar	5,112	17,247	21,458	28,976	466.8
Philippines	26,137	78,625	93,872	117,851	350.9
Thailand	17,967	23,644	28,341	36,139	101.1
Viet Nam	22,158	35,275	46,159	68,383	208.6

Source: Calculated from hot spot analysis and United Nations projections.

It is important to note that the impact of climate change on these populations will be influenced not just by its nature and severity but also by the ability of those populations to bring resources to bear to adapt to that change. The broader socioeconomic vulnerability of populations in the hot spots is therefore significant.

Box 2 focuses on Thailand, where the main climate change risk is associated with a shift in rainfall from north to south, more frequent extreme weather events, and rising sea levels that will influence closely settled coastal areas, especially in the Bangkok area (ADB 2009b). The focus of the discussion on climate change and migration is on increased pressure to migrate from origin areas. In Thailand, however, as in many other places, climate change will influence the destination areas for over 2 million immigrants, most of them from neighboring Cambodia, Lao PDR, and Myanmar (*Migrant News* 2009).

Climate change in Thailand could influence the agriculture, fishing and, to a lesser extent, forestry industries, where local workers avoid jobs considered dirty, of low status, and poorly paid. The three origin countries will experience significant climate change and have little ability to cope. The recent experience with Cyclone Nargis in Myanmar illustrates the massive impact extreme weather events are already having. Box 3 focuses on the impact of climate change in Cambodia and suggests that increased flooding, drought, and cyclones are likely to increase pressures to move out of hot spots, permanently or temporarily.

### **Box 2: Thailand: Climate Change and Migration Thresholds**

#### **Existing Corridors**

Thailand has experienced considerable internal migration, particular people moving from rural or secondary urban areas to Bangkok. Rapid industrialization since the 1970s has focused on the capital and relied on seasonal and permanent migration from all over the country (Setchell 1995, Garip 2008, Hirsch 2009). “Much of this labor was provided by rural migrants from the northeastern part of the country, where 40% of the population lived in poverty. Most of these migrants were in their teens or early twenties, and half of them were women.” (Garip 2008)

The environment has probably played a significant role in this movement, given the northeast’s limited natural resources relative to the central plains and other areas. In fact, agricultural development in the northeast has until recently been limited by the lack of irrigation (Parnwell 1988). Village migration

networks can also be vital in supporting the movement of young people to urban centers (Garip 2008). Urbanization has therefore been driven by a complex mix of push forces associated with a lack of rural opportunity, particularly in the northeast plateau and the lack of urban development away from a few major centers, and the pull of booming Bangkok.

Thais have moved internationally, meanwhile, but less so than people from other Southeast Asian countries, which experienced an extended period of colonization (Hugué and Punpuing 2005, Numnak 2005). Hugo (2006, 160) suggests that Thailand's skilled workers are less likely to emigrate to Organisation for Economic Co-operation and Development (OECD) member countries than those from other developing countries (Hugo 2006). Only about 150,000 Thai migrants have been deployed legally each year for the last decade.

Indeed, Thailand is just as likely to act as a stepping stone for migrants on their way to other countries, as it is to export Thai workers (Skeldon. 2006). Emigration to Thailand—legal and illegal—is considerable and includes economic migrants from neighboring Cambodia, People's Republic of China, Lao People's Democratic Republic, and Myanmar (over 1,200,000 registered migrants in total); political refugees from Myanmar (over 100,000); and professionals from all over the world including many OECD countries (Hugué and Punpuing 2005, Balbo and Marconi 2006).

Hugo (2006, 165) notes that "Thailand is a hub of illegal migration in the region. It is the destination of substantial illegal migration from Myanmar, and significant numbers from the PRC [People's republic of China], Lao PDR [Lao people's Democratic Republic], Cambodia and South Asia ... Thailand has become a major transit country for Indians, Pakistanis, Bangladeshis, Sri Lankans and Nepalese headed for the United States, Canada, Europe, Japan and [the Republic of] Korea while many stay in Thailand or go to Malaysia. Police estimate that at any one time 50,000 such illegals are in Bangkok." (Hugo 2006)

#### **Linear Impacts**

A number of specific impacts are likely to reduce local opportunities for development, which in turn will enhance migration linearly along established corridors of migration. The variability in the timing and amount of rainfall associated with the monsoon is a significant factor in the viability of dryland rice farming, particularly in northeast and north Thailand (Kundzewicz et al. 2009). If, as projected, rainfall patterns become less predictable and/or reliable, cropping systems in some of the poorest rural areas could become less productive. Already, the northeast provides many workers for urban areas and internationally, and this migration pattern could increase. Flood risk is also significant in the north and central areas. If more extreme rainfall events occur more regularly, a greater number of people may wish to leave hazardous areas (Kundzewicz et al. 2009). Once again, this is likely to be a choice to move made in association with perceived opportunities elsewhere.

#### **Nonlinear Impacts**

One significant nonlinear change to migration patterns could occur as a result the risk of more flooding and/or sea-level rise in Bangkok. The core of the city is built around the Chao Phraya River and associated *klongs* (canals), effectively at sea level and therefore highly vulnerable to sea-level rise (Ericson et al. 2006; McGranahan, Balk, and Anderson 2007; Thaitakoo and McGrath 2008). Syvitski (2008, 27) notes that already "Excess groundwater pumping in the Bangkok area has caused rapid subsidence, to more than 100 millimeters/year, and the delta's surface has subsided by more than 2 meters, not only in the Bangkok metropolitan area, but also in the coastal region south of Bangkok. Between 1970 and 1990, sea level rose 0.5 meters in the coastal region and the shoreline retreated 0.7 km."

The interaction of sea-level rise, storm surges, and riverine flood risk associated with climate change could lead to a significant displacement of people from the low-lying areas of Bangkok, leading to a fundamental change in the role of the city, both as a destination for internal Thai immigrants and a stopover point for future international migrants. Without significant in situ adaptation, thresholds where parts of Bangkok can no longer fulfill these key roles in migration corridors could be surpassed before 2030, leading to nonlinear migration away from the city.

Source: Generated by Graeme Hugo for ADB, 2009,

### **Box 3: Indicative Future Migration Scenarios for Cambodia**

#### **Main Climate Change Hot Spots**

- Southeastern border with Viet Nam adjoining the Mekong Delta: Floods and drought likely to be exacerbated by climate change.
- Tonle Sap: Climate change may cause a reduction in the flow of water into this lake in an important agricultural area.
- Kampot, Koh Kong, and Sihanoukville (coastal provinces): Sea water intrusion and wind storms are an issue.
- Northwest: Subject to drought in Battambang Province. Heightened vulnerability due to
  - a large percentage of the workforce reliant on agriculture (63%), and low income and high poverty rates.

#### **Linear Migration Trends**

- Both temporary and permanent rural-to-urban migration will increase, especially among youth from rural areas.
- Rural-to-rural migration will continue at high levels.
- Labor migration to Thailand will increase.
- Marriage migration, especially of women, will increase.

#### **Nonlinear Migration Trends**

- There may be a significant outflow of people from the densely settled Tonle Sap area (Heinonen 2006).
- New overseas markets for Cambodian labor migrants will be sought (Middle East, Singapore, Malaysia).

Source: Marcia Walton, PhD Candidate, Department of Geographical and Environmental Studies, University of Adelaide.

Box 4 looks at the Mekong delta, where already significant internal and international flows originate. Much internal migration involves permanent and especially seasonal movement into Ho Chi Minh City. One increasing form of international migration is marriage migration.

### **Box 4: Indicative Future Migration Scenarios for the Mekong Delta**

Although a large majority of Viet Nam's population (about 74%) is concentrated in rural areas, the national urbanization rate has grown consistently over the past few years (28.5% as of 2005) (Dun 2009). Agriculture employs more than 56% of the population and the Mekong delta is considered "the rice bowl of the region," with about 3 million hectares of agricultural land. Some 14.2 million people live in areas of the delta that would be prone to complete inundation with a 2-meter rise in sea level (Warner et al. 2009). Almost half of the agricultural area would also face inundation under such environmental change. The increasing risk of sea-level rise and flooding may therefore eventually lead to large-scale population displacement across the region (Dun 2009).

Climate change may also exacerbate soil degradation and logging, water pollution, and overfishing, urban industrialization and related population pressure on the environment (Chinvanno 2003).

#### **Existing Migration Corridors**

##### ***Internal***

Rural-to-urban migration is the most common pattern in Viet Nam, although rural migration (Dun 2009) to other rural areas has also been common due the shortage of arable land, migration to other rural areas or urban towns and cities has been prevalent for a long time. But investment in rural agriculture has been neglected over the last few decades in favor of investment in industrialization, leading to increasing migration from rural areas (Soda 2009, Dun 2009), to Hanoi, southeast Viet Nam, (particularly Ho Chi Minh City), and nearby provinces both seasonally (temporary) and

permanent (Dun 2009). In general, men migrate more than women, although women have increasingly been migrating to urban centers to seek employment in the fast-growing manufacturing and service sectors (Dang, Goldstein, and McNally 1997).

### ***International***

The existing international net rate of migration in Viet Nam is negative with about 70,000 Vietnamese leave their country as labor migrants per year (Dun 2008). More than 2 million (about 2.6% of the population) were already living abroad in 2005 (Ratha and Xu 2008) including about 350,000 labor migrants. Current labor migration is concentrated on Japan, Republic of Korea, Malaysia, Taipei, China, and Persian Gulf countries. Other preferred destinations include OECD member countries (such as Australia, Canada, France, Germany, United Kingdom, and the United States) and Cambodia and Thailand. The Viet Nam–United States corridor (of about 1.1 million migrants) is one of the most significant in the world (Ratha and Xu 2008). Several irregular channels of migration exist from Viet Nam to Cambodia and Guangxi Zhuang Autonomous Region in the PRC (Soda 2009, Dun 2008).

### **Linear and Nonlinear Impacts on Migration**

It is argued that development and urbanization (such as water diversion for irrigation or construction of hydropower dams) undertaken upstream could increase the intensity and frequency of floods and alter the season and track of such disasters in the delta (Dun 2009). These environmental and artificial changes in the natural environment may hinder agricultural activities, affecting local socioeconomic capacities. Although migration from the delta area remains primarily economic and not environmental, continual degradation of the environment and livelihoods dependent on it could trigger widespread internal and international migration through established networks (Warner et al. 2008). Anecdotal evidence from the delta already suggests that “successive flooding events leading to destruction of crops on more than one occasion can drive people to migrate elsewhere in search of an alternative livelihood” (Warner et al. 2008).

Some have also suggest that water and land-related environmental crises have encouraged human trafficking as an adaptation strategy (to seek alternative sources of livelihoods in border areas) (Soda 2009, Dun 2009). In light of these observations, it may be argued that in the absence of suitable policies and strong institutional support to communities vulnerable to climate change, there may be chances of a nonlinear increase in human trafficking across the region.

Source: Generated by Graeme Hugo for ADB, 2009.

As is the case elsewhere, the predominant adaptations to climate change impacts in Southeast Asia will be in situ.

Migration is not mentioned at all as an adaptation option in national adaptation action plans, however. Yet migration has already been an important adaptation to environmental and other changes in Southeast Asia.

Also, in Indonesia, which is one of the countries of Southeast Asia likely to be most impacted by climate change and is the largest and most populated in the region, the national Climate Change Action Plan does not mention migration as an adaptation. Yet it is likely that population mobility will play an important role (Box 5).

### **Box 5: Indicative Future Migration Scenarios for Indonesia**

#### **Linear Migration**

Indonesia has a long history of families and communities responding to economic, social, or environmental adversity by moving on a temporary or permanent basis. Climate change, as is argued throughout this study, is likely to exacerbate existing trends.

- Indonesia is one of the most important sources of low-skilled temporary labor migrants, with recent estimates of the numbers abroad at 5.8 million workers (Asian Migration News 2008), most in the Middle East and more economically developed countries in East and Southeast Asia.

#### **Nonlinear Migration**

- Urban areas such as Jakarta will experience multiple impacts of climate change. Migrants could move toward built-up areas elsewhere in the country less likely to experience the impact of climate change.
- Areas in the outer islands could become important destinations for those displaced from areas likely to experience a high climate change impact. Careful site selection, sensitive resettlement programs, appropriate investment, and other things could make internal resettlement of displaced populations possible, if necessary.

Permanent international migration is likely to increase marginally, but this will be mainly skilled people and their families.

Source: Generated by Graeme Hugo for ADB, 2009.

## **D. South Asia**

South Asia, with around a quarter of the world's population and continuing high levels of poverty, is also an area at risk of being affected by the impacts of climate change. The population is expected to continue to grow at a relatively rapid pace, and a substantial proportion of the region's population lives in vulnerable areas. Moreover, the modeling of the impact of climate change on agricultural production in South Asia points to a substantial decline in both rice production and wheat production.

It has been estimated that climate change could lead to a decline of around 20 million tons (25%) in rice production and over 30 million tons in wheat (30%) in India during 2000–2050 (Rosegrant et al. 2009). India would become a massive net importer with a shortfall of over 100 million tons by 2050, and this would have profound implications for rural populations. It would create significant pressure for rural–urban migration, both permanent and temporary.

Large populations in India live in areas likely to experience increased riparian flooding and water stress as a result of climate change—major factors that will lead to lower agricultural productivity. A significant number will also be affected by coastal flooding, while others will be displaced because of coastal and riverbank erosion. Substantial parts of Mumbai, with around 12 million people, are below sea level and already the city is subject to flooding (a number of structural construction initiatives have already been taken to combat it). In January 2011, flash floods ravaged Sri Lanka, affecting more than 1 million people, with more than 300,000 forced out of their homes.

Table 14 projects populations in South Asian hot spots during 2000–2050. In all but Sri Lanka, substantial population growth is expected, with more than a doubling in Afghanistan, Nepal, and

Pakistan. It is of particular concern that by 2050 it is anticipated that the vast majority of Indians (about 1.4 billion people) will be living in areas experiencing negative climate change impacts. Moreover, there will be over 250 million people in hot spots in both Bangladesh and Pakistan.

Clearly while most people will adapt in situ, the potential for redistribution of population through migration is substantial.

**Table 14: South Asia Projected Population at Multiple Risks from Climate Change, 2000–2050**  
(‘000)

Country	2000	2020	2030	2050	% Change 2000–2050
Afghanistan	21,500	40,500	52,500	78,000	263.5
Bangladesh	137,000	193,500	218,000	254,000	85.5
India	860,500	1,175,500	1,283,500	1,413,500	64.3
Nepal	22,000	34,500	40,000	49,500	124.2
Pakistan	137,000	202,500	234,000	284,500	107.3
Sri Lanka	19,000	20,000	20,000	19,000	(1.1)

Source: Calculated from hot spot analysis and United Nations projections.

Climate change represents an important potential brake on recent rapid economic growth in India. As a vast nation with complex patterns of internal mobility (both permanent and temporary), a booming economy has been accompanied by a significant redistribution of population, especially from rural to urban areas. This trend would be exacerbated by any negative impact on agriculture. India is one of the world’s major origin nations for international migrants, with a diaspora of around 20 million. There are high levels of unskilled migration to the Middle East and rapidly growing skilled migration to OECD member countries.

**Box 6: Indicative Future Migration Scenarios for India**

Some of the most recurrent climate-induced environmental changes in the region will include increasing intensity and frequency of cyclones and floods along important rivers such as the Ganges and Brahmaputra in the north; Mahanadi, Godavari, Krishna in the south; Indus in the west; and along the northeastern and eastern regions from Assam and West Bengal to Andhra Pradesh and Tamil Nadu (Revi 2008).

Over the last few years, northern India—including the states of Bihar and West Bengal and large cities such as Mumbai, Kolkata, and Chennai—have already been exposed to frequent floods and to tsunamis (De Dube and Prakasa Rao 2005). Longer and more frequent droughts and water stress have been recorded in several states, particularly those in western and central India (Mall et al. 2006). Chennai and Mumbai are arguably the most vulnerable districts to sea-level rise (Kelkar and Bhadwal 2007).

Between 1996 and 2005, the agriculture sector employed on average about 67% of the population (Kelkar and Bhadwal 2007), with its high dependence on water (more than 85% of total water usage is for irrigation purposes) (Mall et al. 2006). It is predicted that by 2050, annual runoff in the Brahmaputra will decline by 14% and in the Indus by 27% (Kelkar and Bhadwal, 2007). Given local communities’

dependence on agriculture for daily subsistence and livelihood, more floods, landslides, droughts, and cyclones may increase vulnerability and lead to both internal and international displacement. In the South Asian context, Kelkar and Bhadwal (2007) argue that low-lying coastal cities (including Karachi, Mumbai, and Dhaka) will be at the forefront of impacts, vulnerable to the risks of sea-level rise and storms. As climate change will hurt farm livelihoods, migration to urban areas is likely to increase, putting greater pressure on scarce housing, water, sanitation facilities, and energy services.

### **Existing Migration Corridors**

#### ***Internal***

Most migration within India is rural to urban, particularly to regional urban areas such as Delhi (north), Mumbai (west), Kolkata (east), Ahmedabad (west), Bangalore (south), and Chennai (south) in search of better economic opportunities (Mitra and Murayama 2008).

Due to constantly growing population pressures, living conditions in these cities have deteriorated in terms of jobs, housing availability, sanitation, and other infrastructure demands. One of the most prevalent internal migration corridors includes low-skilled labor migrants from the eastern state of Bihar to Delhi and Kolkata. While socioeconomic factors continue to be the primary motivators for migration, anecdotal evidence suggests the contribution of increasing frequency of floods and loss of agricultural lands figures in migration-related decisions.

#### ***International***

This can be conveniently divided into two streams: low-skilled contractual labor migration to the Middle East, Singapore, and Malaysia; and (generally) high-skilled migration to traditional immigrant Organisation for Economic Co-operation and Development (OECD) member countries such as Australia, Canada, the United Kingdom, and the United States (Ratha and Xu 2008).

### **Linear and Nonlinear Impacts on Migration**

Social and economic issues (including better employment opportunities and improved health and education systems for dependents) remain the primary motivating factors for internal migration. In light of these observations, it may be argued that internal migration from rural to urban centers will continue along established social networks and community links across various parts of the country.

Over time, it could be expected that coastal regions of India will witness a particularly nonlinear change in their vulnerability to climate change impacts for a variety of reasons, including high urbanization, rural–urban migration, and dwindling agricultural productivity. Revi (2008) argues that the fact that population, infrastructure, and industrial investment along India’s coast—especially its western seaboard and stretches along the Bay of Bengal—is expected to grow dramatically in the next two decades implies a nonlinear increase in vulnerability to coastal sea-level rise.

In such cases of successive occurrence of life- and livelihood-threatening changes in local climatic conditions, or if coastal areas are permanently inundated due to sea-level rise, increasing landlessness and loss of livelihoods could lead to more rapid population displacement internally and internationally.

Source: Generated by Graeme Hugo for ADB, 2009.

Bangladesh also figures prominently in global discussions of climate change, given its millions of poor living in the deltaic region and already subject to severe environmental hazard. The country is already at high risk of severe or catastrophic environmental hazards, with flood risk from sea surges, river flow, and local rainfall events, as well as coastal and riverbank erosion.

Moreover, migration is increasingly being used within Bangladesh as a coping mechanism in the face of environmental and economic challenges (Afsar 2005, Siddiqui 2005). In particular, international labor migration of unskilled workers has increased substantially in recent years. Siddiqui (2005) notes that 40% of migrant workers originate from only 5 of 64 districts (Brahmanbaria, Chittagong, Comilla, Dhaka, and Tangail), all in the south of the country



(*Migrant News* 2009). These areas are especially prone to flooding and environmental events. It is clear that environmental factors are working together with economic forces in causing migration.

Fieldwork in Bangladesh and among Bangladeshis in India and an examination of the literature clearly establishes that environmental processes and events have played an important role in shaping migration, although usually in combination with economic, social, and conflict-related factors. Nevertheless, it seems inevitable that climate change will strengthen those environmental forces so that pressure for permanent and temporary migration out of the areas affected will continue. Box 7 presents one set of possible future migration scenarios for Bangladesh.

<b>Box 7: Indicative Future Migration Scenarios for Bangladesh</b>			
<b>Existing International Corridors of Migration</b>			
<b>Region</b>	<b>Major destinations</b>	<b>Approximate numbers</b>	<b>Data source(s)</b>
Other South Asian Countries	India (particularly, West Bengal, Assam, and Tripura)	12 million–17 million ~200,000	Samaddar 1999; Hazarika 2001; Reuveny 2007
	Pakistan		Samaddar 1999
Middle East and Southeast Asia	Bahrain; Brunei Darussalam, Hong Kong, China; Republic of Korea; Kuwait; Libya; Malaysia; Qatar; Saudi Arabia; Singapore; United Arab Emirates	3.3 million (1976–Jan 2002)	Samaddar 1999; Lorente et al. 2005; Siddiqui 2005
Industrialized countries	Australia, Canada, Italy, Japan, United Kingdom, United States	1.1 million (2004)	de Bruyn and Kuddus 2005; Siddiqui 2005
<b>Existing Internal Corridors Of Migration</b>			
<b>Preferred cities/locations</b>	<b>Primary reason for migration</b>	<b>Existing approximate numbers</b>	<b>Data source(s)</b>
Dhaka and suburbs (rural-urban)	Ready-made garment industry.	Total: >1.5 million Female migrant workers: about 65% of total	Alam 2003; Afsar 2005; United Nations 2008
Other urban areas and south eastern Chittagong Hill Tracts	Government-sponsored migration	Total number displaced: 80,000–300,000 (1970s–1990s)	Hazarika 2001; Reuveny 2007
<b>Linear Migration Changes with Climate Change</b>			
<b>International</b>			
<ol style="list-style-type: none"> <li>1. Continued temporary labor migration to the Middle East and Southeast Asia.</li> <li>2. Continued permanent migration along established networks in OECD member countries.</li> <li>3. Both legal and illegal cross-border migration to India's neighboring states (mainly West Bengal, Assam, Tripura), both permanent and temporary (daily laborers).</li> </ol>			

**Internal**

1. Continued rural–urban temporary as well as permanent migration along established social links in search of improved livelihood opportunities in times of flood, cyclones (environmental disasters that are primarily temporary in nature), and crucial socioeconomic pull factors in urban regions.

**Nonlinear Migration Changes with Climate Change**

1. Permanent inundation due to sea-level rise, landlessness, and resulting loss of livelihood. Although a gradual phenomenon, sea-level rise could, over extended periods of time, result in nonlinear changes to the local and regional environment and render it unsuitable for inhabitation.

2. Permanent changes in precipitation and resulting intensification of monsoonal patterns.

**International**

A combination of 1 and 2 above may result in the following:

1. Increased cross-border migration to India.

2. Increased emigration (for permanent resettlement) to meet labor shortage in OECD member countries where the population is aging.

**Internal**

1. Greater frequency and intensity of changes in the climatic situations at the regional and local level may facilitate the development of new semi-urban areas that will provide resettlement options to displaced populations. This will encourage increased migration from both rural and other densely populated urban regions such as Dhaka and Chittagong to these new urban centers. Careful planning and infrastructure development at the institutional level may further encourage displaced communities to settle in these new semi-urban areas rather than exacerbate socioeconomic and environmental pressure on existing mega cities.

2. Increasing drying in winters and resulting water stress (for agriculture as well as home use) will further increase internal displacement, primarily from rural to urban regions.

Source: Generated by Graeme Hugo for ADB, 2009.

The increasing likelihood and impact of abnormal floods, when combined with high population growth, weak governance structures, and widespread poverty, could worsen the socioeconomic situation in Bangladesh and undermine the capacity of communities to adapt. In addition, the emigration of relatively well-educated or wealthy Bangladeshis has been blamed for undermining the nation's development. That "brain drain", generally to more-developed countries, combined with perceptions of environmental risk, is likely to exacerbate that trend.

Similarly, the number of low-skilled, but not impoverished, migrants in search of opportunity is likely to increase over time. Again, as in other regions, response is likely to follow established patterns and networks for some time. Temporary and permanent internal migration due to environmental displacement has a long history in Bangladesh, but it is arguably still the socioeconomic vulnerability of the rural population that has been the primary driver. And it is times of famine, rather than extreme natural hazards, that have led to the greatest movements of people in recent history (Faisal and Parveen 2004).

Projected climate change would significantly increase the numbers and the permanency of those movements. In rural areas facing loss of agricultural productivity due to desertification and river erosion, migration of landless farmers to other rural areas is already common. But is there a threshold of environmental impact that will suddenly cause large numbers of people to move? While linear migration responses will most likely be governable within existing policies and institutions (inasmuch as they are now effectively managed), climate change projections mean

that sudden and dramatic nonlinear changes must be considered in discussions of resettlement and immigration policy.

As elsewhere, meanwhile, a high proportion of internal migration in Bangladesh is associated with a shift from rural to urban areas. Greater congestion of urban areas has already led to severe health, security, and resource issues for a large number of the urban poor. Dhaka is an important destination, but as such this city of over 13 million is itself highly vulnerable to socio-ecological degradation and to the impacts of climate change (Alam and Rabbani 2007). Indeed, Dhaka's vulnerability to flooding and cyclonic events brings into doubt its role as a destination for the displaced, temporary or permanent. Dhaka is 2–13 meters above mean sea level, with most of the urbanized areas at elevations of 6–8 meters (Alam and Rabbani 2007). They note that Dhaka experienced major floods in several years between 1954 and 2004, and that these floods were due not only to natural causes but also to the “infilling of natural channels and lowlands.” With more summer monsoon rainfall projected under climate change in 2050, river flooding is also projected to increase in frequency.

As such urban centers grow, not just through the drawing powers of the city but also because of the underdevelopment of and risks associated with life in rural areas, the infrastructural and planning needs of centers such as Dhaka will increase. The coastal population in Bangladesh grew at about twice the national rate between 1990 and 2000, particularly in Dhaka and Chittagong (McGranahan, Balk, and Anderson 2007). They suggest that “at the national level, measures to support previously disfavored inland urban settlements, away from the large cities on the coast, could not only reduce risks from climate change but also support a more balanced and equitable pattern of urban development.”

Flooding in Dhaka is associated in part with institutional mismanagement and inappropriate development (Alam and Rabbani 2007). Therefore, there is a strong link between climate change adaptation and broader sustainable development goals, which ensure that the urban center has the capacity to provide employment, resources, and accommodation for residents while minimizing environmental risks. Significant improvement of basic services within Dhaka, and an increase in the resilience of emergency response services within the mega city, therefore, would be a key adaptation need to support sustainable internal migration.

With changes in environmental and climatic conditions, Bangladesh will increasingly face the challenge of resettling and rehabilitating the affected population. The country's international networks will, therefore, play a vital role in times of future environmental crises. Bangladeshi migrants have moved internationally in three different broadly defined forms: (i) the movement across the Bangladesh–India border via traditional kinship and cultural ties; (ii) as temporary, working migrants, primarily to countries in the Association of Southeast Asian Nations (ASEAN) and the Middle East; and (iii) permanently to the United Kingdom and traditional immigrant countries such as Australia, Canada, New Zealand, and the United States. All of these forms will be influenced by climate change and will present new challenges.

Finally in South Asia, we consider the landlocked nation of Nepal, which has already experienced substantial environmental degradation (Blaikie and Brookfield 1987) and could see considerably more due to future climate change impacts. Migration—internal and international, permanent and temporary—has been significant in the past, partly in response to environmental pressures. The country's ecosystems are at great risk of freshwater unreliability and degradation. In some communities (e.g., Mustang), people have migrated because of water shortages.

Climate change impacts, such as more extreme monsoon rainfall and associated landslides and floods, would impoverish many Nepalis in the hill and mountain valley regions. Furthermore, glacial lake outburst floods will become more frequent, leading to a potentially significant increase in migration to other areas. The Terai, in the southern part of the country along the Indian border, is expected to be regularly affected by floods. This could lead to population movements to other parts of the country or abroad, particularly across the border to India. Estimates suggest that there could be some half a million migrants by 2030. The social impacts of these migratory movements need to be considered carefully, as they could increase tensions and competition between and within communities.

Since July 2010, Pakistan has experienced some of the worst floods in the country's history. According to official figures, the disaster has killed at least 1,780 people (some figures mention up to 3,000 victims), left 10 million homeless, and affected 21 million people. The flooding area has extended 2,000 kilometers from north to south along the Indus River, affecting about one-quarter of the country's total territory. The flooding is due to monsoon rains of an unprecedented magnitude. These have been attributed to La Niña, the counterpart of El Niño, and to the freezing of an atmospheric jet stream.

Pakistan has long been subject to floods and other major disasters. Significant flood events, though of a lesser magnitude, have been reported for 1973, 1976, 1988, 1995, and 1997. The whole country is highly dependent upon the Indus River, which irrigates the whole territory. Flood events lead to massive population displacements; the July 2010 floods induced the displacement of up to 17 million people, requiring an urgent and massive humanitarian response.

Situated in the Indian Ocean, the very existence of the Maldives could be threatened by sea-level rise. The country is made up of 1,192 islets, of which about 200 are inhabited. The country is the lowest-elevated on the planet, with a peak at only 2.3 meters above sea-level, and an average ground elevation of 1.5 meters. Because of its extreme geographic exposure to sea-level rise, the country is on the frontline of climate change.

In October 2009, President Mohamed Nasheed organized an underwater cabinet meeting to underline the risk that the country's 400,000 inhabitants could one day be forced to flee their islands if nothing is done to keep the average global atmospheric temperature increase below 1.5°C. In addition to sea-level rise, the Maldives are also highly vulnerable to cyclones and typhoons. The 2004 Indian Ocean tsunami ravaged the country, flooding most islands and prompting the evacuation of some, including resort islands, causing great economic damage to the tourism industry.

## **E. Central Asia**

The concept of environment-induced displacement is not new in Central Asia. The region has experienced some of the world's most dramatic environmental crises of recent years, with water problems predominant.

In 1996, about 100,000 people were displaced by the environmental crisis in the Aral Sea region (Small, van der Meer, and Yupshur 2001). Beginning in the late 1990s, a multiyear drought associated with environmental degradation led to widespread unemployment in Karakalpakstan—an autonomous region in western Uzbekistan surrounding the southern end of the Aral Sea—and from 1999 to 2001 saw about 273,000 people (about 20% of the region's

total population) migrate to Kazakhstan and Russia in search of better economic opportunities (Glantz 2005). A study by Médecins Sans Frontières in Karakalpakstan found that nearly half of the respondents wanted to migrate due to poor environmental conditions—almost half of them as a result of loss of livelihood and weak institutional support (Small et al. 2001). Continued poverty and problems of governance further add to the vulnerability of local populations to environmental disasters such as drought, loss of agricultural productivity, and resulting food insecurity.

”Millions of people [in Central Asia] are dependent on soils, water, and air which are often highly contaminated, while agricultural employment opportunities are under pressure in a context of rural population growth, in areas with relatively small areas of cultivated land.” (Spoor 1998) Despite such a complex relationship between environmental degradation and demographic and climatic changes, there is a clear lack of relevant empirical research, particularly in the Aral Sea Basin. This severely limits the region’s national and local capacity to establish timely adaptive mechanisms to address changes in the region’s climatic conditions (Glantz 2005).

A large part of the region’s population lives in areas at high risk of increased water stress due to climate change. Population growth in hot spots in each of the Central Asian countries indicates that, except for Kazakhstan, almost all of the population in the region is living in areas at risk of climate change impact, and the impact is almost entirely increased water stress as a result of reduced rainfall and runoff (Table 15).

**Table 15: Central Asia: Projected Numbers of People Facing Multiple Risks from Climate Change**

Country	% of National Population in Hot Spots	2000	2020	2030	2050	% Change of Population in Hot Spots 2000–2050
		People (millions)				
Kazakhstan	32.1	5.3	5.4	5.5	5.6	6.5
Kyrgyz Republic	99.9	5.0	6.0	6.3	6.6	31.3
Tajikistan	100.0	6.1	8.3	9.4	10.8	77.2
Turkmenistan	80.9	3.9	4.7	5.1	5.5	41.3
Uzbekistan	100.0	24.7	32.4	35.2	38.3	55.4

Source: Calculated from hot spot analysis and United Nations projections.

The impact of climate change is exacerbated by a high degree of socioeconomic vulnerability. Average incomes are low, poverty is high, and governance is often weak, while many are reliant upon agriculture for livelihood. Agricultural modeling suggests there could be a small increase in wheat production in Central Asia over the next four decades despite climate change impacts (Rosegrant et al 2009).

Nevertheless, an increase in migration in the region is very likely as climate change adds to economic, social, and political pressures. Boxes 8 and 9 present some indicative future migration scenarios under climate change for Kazakhstan and Tajikistan.

### **Box 8: Indicative Scenarios for Migration in Kazakhstan**

Kazakhstan—a country of over 15 million people about evenly divided between rural and urban areas (Bulsheva and Jolasov 2008)—has seen considerable rural–urban migration due to agricultural reforms and economic opportunities in the cities. “There is a growing awareness among Kazakhstan’s urban public of the disastrous situation in the countryside resulting from the termination of state subsidies and inconsistency in economic reforms in agriculture. These policies led to dramatic impoverishment of villagers, pushing thousands of them to the city” Yessenova (2005, 664). Rural poverty is a major driving factor in rural–urban migration. For example “the drying out of the Aral Sea, once the fourth largest lake in the world, has had far-reaching consequences for the climate and biodiversity of the surrounding region” (Bulsheva and Jolasov 2008).

Water supplies in general throughout rural areas of Kazakhstan are poor in comparison to urban areas and may also be driving migration (McKee et al. 2006). Zabirova (2004) notes that “most often in the case of rural migrants is that the head of a family moves to the city first, followed, in the space of a few months, by the rest of the members of his family.”

As the Soviet Union broke apart in the 1990s, a large percentage of the Soviet-era Russian and other minority European populations left Kazakhstan, and the cities in particular (Zabirova 2004, Becker et al. 2005). However, subsequent employment opportunities and heritage ties attracted native Kazakhs to the major cities. “The very emergence of a state bearing the ‘Kazakh’ name (that is, the Republic of Kazakhstan) in 1991 was sufficient to catalyse a process of nationalisation and initiate a migration stream of ethnic Kazakhs from diasporic venues throughout the early 1990s” (Diener 2005). In fact, due its relative wealth, Kazakhstan is a destination country for migrants from throughout the region, particularly from the People’s Republic of China, Kyrgyz Republic, Tajikistan, and Uzbekistan (Becker et al. 2005). There have also been urban–urban movements within the country due to changing political and economic influences (Becker et al. 2005).

#### **Linear and Nonlinear Impacts on Migration**

The most important risk from climate change in Kazakhstan is projected to be associated with an ongoing drying trend. The dominant traditional agro-ecosystems were nomadic pastoral systems. Milner-Gulland et al. (2006, 24) note that “pastoralists have migrated between summer steppe or mountain pastures and winter desert pastures for centuries.” During the 20th century grain production became more important, particularly on the relatively humid northern steppe (Robinson et al. 2003). Both systems are highly integrated with the climatic conditions of long cold winters and relatively short summers, when plant growth is vital for maintaining stock numbers or obtaining a yield of wheat.

Stock numbers on Kazakhstan’s rangelands have declined significantly since the end of the Soviet era, so grazing and associated erosion pressures have also become less severe (Robinson et al. 2003). That said, there is the potential that drying induced by climate change will lead to a significant shift in the productivity of these systems, and if agricultural practices are unable to adapt, problems with erosion and desertification may become greater (Vörösmarty et al. 2000, Thomas 2008). This migration could manifest itself as a linear trend along established corridors for some time. However, the decline in the environmental services provided by the Aral Sea and the subsequent decline in population provides a vivid local example of where a threshold of migration has been reached (Bulsheva and Jolasov 2008). Such a threshold that leads to migration from communities dependent upon dryland agricultural systems may lead to a nonlinear increase in rural–urban migration due to climate change.

National records suggest that average temperatures and precipitation in Kazakhstan have already changed significantly over the last century.

Source: Generated by Graeme Hugo for ADB, 2009.

### **Box 9: Indicative Future Migration Scenarios for Tajikistan**

Tajikistan is particularly vulnerable to socioeconomic and environmental crisis due to climate change in and around the region. The country's mountains are Central Asia's main glacial area, while its rivers are the main water sources, and have replenished the Aral Sea for centuries. According to one estimate, "up to 80% of stream flow of the Amudarya River that flows into the Aral Sea is formed in Tajikistan" (Ministry for Nature Protection 2002).

Warming and climatic changes have led to constant retreating of small glaciers and "in the mid- and long-term, a catastrophic reduction of water flow in many rivers is expected" (Ministry for Nature Protection 2002). The glaciers have retreated—both in area and volume—primarily due to higher temperatures and changes in precipitation patterns.

Furthermore, the intensity and frequency of floods has increased over the last few decades. National records suggest that increased rainfall combined with rapid melting of the glaciers led to disastrous floods in 1969, 1981, 1993, 1998, and 2002 (Ministry for Nature Protection 2002, Centre for Ethnic and Migration Studies 2008, Khakimov and Mahmadbekov 2009). Climate modeling predicts that constantly increasing temperatures may further shift the existing patterns of glacial volume, thereby causing widespread decline in water availability by more than 30%.

The 1990s were the warmest decade in the period of instrumental observations, with 1997 and 2001 being the hottest years recorded. Climatic changes altered river flows, thereby affecting local ecology and the country's agriculture sector, which accounts for 32% of the total land area and contributes 25% to gross domestic product (Ministry for Nature Protection 2002, Khakimov and Mahmadbekov 2009).

Constant land degradation, desertification, and various kinds of erosion (water, deflation and irrigation, and gully erosion) are some of the most evident climate-related changes that have reduced agricultural output, thereby increasing vulnerability of particularly large rural populations. The southern and central parts of the country are particularly prone to long dry periods with increasing temperatures that further exacerbate desertification in the region. According to national estimates of agricultural productivity, in the period between 1991 and 2000, extreme weather-related loss (drought, lack of precipitation, heavy rainfall, and floods) in agricultural product yield was more than one-third of the total loss (Khakimov and Mahmadbekov 2009).

Among the direct social impacts of climate change, local access to clean drinking water is particularly vulnerable. Currently, 50% of the country's population lacks access to clean water. This situation is likely to worsen with patterns of further temperature increase and changing precipitation. Lack of water resources, together with decreased stream flow and increased frequency of floods, is also likely to negatively influence Tajikistan's hydropower engineering industry, which is responsible for generating more than 95% of the country's total electricity (Ministry for Nature Protection 2002, Khakimov and Mahmadbekov 2009).

It is also predicted that changes in temperature and local hydrological cycles may further exacerbate the incidence of malaria and choleric-related infectious diseases. Having said this, the country's national action plan to address climate change and related impacts clearly highlights the need to undertake an in-depth investigation of climate change impacts on public health and mortality (Ministry for Nature Protection 2002).

### **Migration Patterns in Tajikistan**

#### ***International***

Tajikistan experiences net out-migration. In 2004, remittances contributed 20% of total gross domestic product (Ratha and Xu 2008). There has been a continuous natural increase in population, but also one of the highest emigration rates in Central Asia. According to United Nations estimates, about 69,000 people (more than 1% of the total) emigrate every year, mainly to Germany, Russia, and other Central Asian countries (Khakimov and Mahmadbekov 2009). Due to the country's civil war in 1992–1997, about 60,000 refugees fled to Afghanistan and almost 13,000 to the neighboring Kyrgyz Republic. Most of these

refugees returned home after the war had ended and socioeconomic living conditions had stabilized (Khakimov and Mahmadbekov 2009).

Starting in 1997, Tajikistan had another wave of emigrants who traveled to other countries as labor migrants. About 95% of Tajikistan is vulnerable to environmental degradation, including floods, mudslides, salinity, water and soil erosion, and desertification. These environmental issues are compounded by low-paid jobs, widespread poverty, and high unemployment, resulting in external labor migration (Khakimov and Mahmadbekov 2009). According to the World Bank, about 83% of the population was considered poor in 1999. Although labor migration remains seasonal or temporary in nature, it has helped reduce poverty to 56% in 2008. It has one of the world's highest proportions of remittances (36.2%) received as a percentage of total gross domestic product (Ratha and Xu 2008, Khakimov and Mahmadbekov 2009).

### ***Internal***

During the civil war there was widespread migration to the politically more stable Sogd region of Tajikistan (Khakimov and Mahmadbekov 2009). Population dynamics changed significantly during the civil war since educated and professional skilled people moved out of the cities to border countries, while the low skilled or unskilled moved into urban areas. Overall, the country's rural areas have maintained negative net migration, particularly during 1995–2003, with most educated employable people moving to the cities (Khakimov and Mahmadbekov 2009). Most rural–urban migration was concentrated in and around the capital, Dushanbe.

Source: Generated by Graeme Hugo for ADB, 2009.

## **F. The Pacific**

The Pacific region faces significant challenges from climate change, especially rising sea levels, cyclones, droughts, and storm surges. Low-lying atolls and coral islands have drawn global attention to the potentially devastating impacts on small nations such as Tuvalu and Kiribati. The situation is exacerbated by a demographic crisis, including high population growth, especially in the Melanesia subregion, and a bulging youth segment. The bulk of population growth from 2008 to 2050 will be in Melanesia (already home to 87.5% of the Pacific population), with Papua New Guinea dominating with 84% of the land and 68% of the people in the Pacific. Significant growth is also anticipated in other large countries such as Solomon Islands and Vanuatu (Table 16).



**Table 16: Pacific Populations, 2008 and 2030**

Country	2008 (‘000)	2030 (‘000)	Annual Growth	% Change
			2008 (%)	2008–2030
<b>Melanesia</b>				
Fiji Islands	839	1,020	0.6	21.6
New Caledonia	246	320	1.6	30.1
Papua New Guinea	6,474	10,042	2.2	55.1
Solomon Islands	521	884	2.7	69.7
Vanuatu	233	388	2.6	66.5
<b>Micronesia</b>				
FSM	110	120	0.4	9.1
Guam	179	242	2.7	35.2
Kiribati	97	138	1.9	42.3
Marshall Islands	53	67	1.0	26.4
Nauru	10	14	2.1	40.0
Northern Mariana Islands	63	68		7.9
Palau	20	23	0.6	15.0
<b>Polynesia</b>				
American Samoa	66	91	1.6	37.9
Cook Islands	16	16	0.4	
French Polynesia	263	321	1.2	22.1
Niue	2	1	(2.4)	(50.0)
Samoa	182	198	0.4	8.8
Tokelau	1	1	(0.1)	
Tonga	103	115	0.4	11.7
Tuvalu	10	11	0.3	10.0
Wallis and Futuna	15	17	0.7	13.3

FSM = Federated States of Micronesia.

Source: Secretariat of the Pacific Community.

The Pacific will also experience a “youth bulge” over the next two decades, as large numbers of children from past periods of high fertility become young adults. As the most mobile age group, this is expected to lead to a substantial increase in migrants (Bedford and Hugo 2009).

The Pacific as a whole will be significantly affected by climate change, especially by sea-level rise and the increased incidence of cyclones. Indeed, with the exception of Papua New Guinea,

virtually the entire national populations of the island states are to be considered hot spots of substantial impact, although the coastal areas are most at risk.

In Papua New Guinea, the southern coast and several low-lying islands are vulnerable to the effects of an increase in sea levels, while substantial inland areas are vulnerable to riparian flooding. Two-thirds of the population at risk from coastal flooding resides in urban areas, while almost all of those at risk of riparian flooding live in rural areas. There has already been some resettlement of people from the Carteret Islands off the coast of Papua New Guinea, due to the threat of inundation from a combination of subsidence, storm surge, and sea-level rise. Resettlement from the islands of Bougainville also began recently.

As discussed, the effects of climate change will be exacerbated by rapid population growth. But the relatively low level of resources available to many governments (and individual families) to mitigate and adapt is also a problem.

In investigating the potential effects of climate change on migration in the Pacific, an important initial point is the adverse environmental events and processes have already caused migration and population displacement within the region.

In 2008 alone the region experienced natural disasters of a kind likely to be exacerbated by climate change...a devastating tropical cyclone (Gene) resulted in substantial damage to agriculture, infrastructure and utilities in Fiji Islands ...Unusually high sea levels and swells have resulted in displacement of people in Kiribati, the Solomon Islands, the Marshall Islands and the Federated States of Micronesia. Saltwater intrusion into field and crops and contamination of freshwater aquifers has been reported in the Solomon Islands. (Boncour and Burson 2009)

It is highly likely that during the next 30–50 years there will be significant migration from the central Pacific to other countries, especially Australia, New Zealand, and the United States. Many Kiribati, Marshallese, Tokelauans, and Tuvaluans work and live overseas. Relocation of entire populations from central Pacific atolls and reef islands may well be required, especially if sea levels rise by more than 1 meter, and there is an increase in sea-surface temperature which causes coral to bleach and die. But this is not going to be the representative Pacific response to climate change in the long run. Much more important in the countries where most of the region's population lives will be adjustment to changing conditions within national boundaries.

The relocation of entire populations overseas, in response to the increasing frequency and intensity of storms, droughts, and changes in sea level, is unlikely to occur voluntarily. Pacific communities have proved to be remarkably resistant to abandoning their islands completely, even when offered the chance to do so after major natural disasters. In Tuvalu and Kiribati the prevailing view is that they want to stay, and it is the responsibility of the international community to reduce carbon emissions and slow the process of climate change.

## **1. Papua New Guinea, Solomon Islands, and Vanuatu**

With much of the region's land and people, Papua New Guinea is also largely rural (80%). While several major urban areas are in coastal locations, most of the country's population lives inland. Significant changes in temperature and rainfall and the incidence of severe storms and associated strong winds causing damage to crops will therefore likely have greater impact on livelihoods than changing sea levels.

Additionally, virtually all contemporary population movement is internal. Unlike many other Pacific countries, Papua New Guinea does not have any special relationships with other jurisdictions relating to access for work or residence, features it shares with its Melanesia neighbors Solomon Islands and Vanuatu, (also around 80% rural).

Estimates of future population growth therefore tend to adopt zero net migration assumptions. The three island countries, together comprising three-quarters of the Pacific population and nine-tenths of its land area, also have the highest projected population growth to 2030, averaging 1.9% a year in Papua New Guinea and 2.2%–2.3% in Solomon Islands and Vanuatu from 2015 to 2030 according to the Statistics and Demography Programme in the Secretariat of the Pacific Community. This would lift the population in the three countries to 11.3 million, 80% of the Pacific's 14.1 million total, with 71% in Papua New Guinea alone.

As already noted, internal migration, mainly to local towns and coastal cities, is the major form of movement on the aforementioned three island countries, leading to long-term relocation of people. Rural–urban migration, coupled with high rates of natural increase in towns, has also been contributing to rapid urban population growth and the expansion of squatter settlements on urban peripheries for the past 30 years. Many of these settlements in coastal towns are in locations prone to flooding or to damage caused by storm surges.

Changes in the incidence of droughts and frosts in the interior of Papua New Guinea, and the impact on coastal areas of storm surges and erosion associated with more intense and frequent cyclones and rising sea levels, will severely disrupt lifestyles. Internal redistribution of population to rural areas within and between islands will be severely constrained, however, by patterns of land ownership and by traditional rivalries.

Where possible, adjusting to changing conditions rather than relocating in large numbers will be the preferred strategy for many. However, food security in semi-subsistence agricultural systems is already being challenged in many parts of rural Melanesia as a result of rising rural population densities, changing patterns of land use, and more frequent and persistent droughts and frosts. In the absence of alternatives, migration to urban areas, especially of young adults, will intensify and contribute to swelling the populations of urban squatter settlements, which are often located in areas prone to flooding or storm damage.

In summary, in Papua New Guinea, Solomon Islands, and Vanuatu, long-term climate change will exacerbate internal migration to urban areas, and stimulate and transform long-established patterns of population circulation and redistribution within rural areas. Significant international migration from these three countries is unlikely to be caused directly by climate variability in the near future—none of the countries has established migration outlets or sizeable diaspora populations in Pacific rim countries. In the longer term, however, pressure for opportunities to work and live overseas are likely to increase amongst the rapidly growing youth populations, especially those based in urban areas.

## **2. Fiji Islands and New Caledonia**

Both of these countries have large nonindigenous populations (ethnic Indian Fijians and Europeans and Polynesians in New Caledonia), and residents live in coastal towns and cities (51% in Fiji Islands, 63% in New Caledonia). These two Melanesian countries have had outlets for international migration for many years. In the case of New Caledonia, the indigenous population has rights of residence in France, even if migration of Kanaks to France has been

much less frequent than migration of Fiji Islanders and ethnic Indian Fijians to Australia and New Zealand.

Extensive emigration of ethnic Indians from Fiji Islands following a series of coups d'état between 1987 and 2006 has limited population growth compared to other Melanesian countries. Average annual rates of economic growth are projected to be between 0.7% and 1.0% a year from 2008 to 2030, according to the Secretariat of the Pacific Community, and the total population is forecast to reach just over 1 million by 2030. Fiji Islands will still have the second-largest population in the region, but it is growing at less than half the rate of Papua New Guinea, Solomon Islands, and Vanuatu. In the case of New Caledonia, immigration from other French territories is contributing to population growth (the crude net migration rate was estimated to be 4.6% in 2008), and its population is projected to increase to 320,000 by 2030.

Migration patterns in New Caledonia and Fiji Islands, with their much more urbanized populations, established outlets for international migration, and (especially for Fiji Islands) their quite sizeable diaspora in Pacific rim countries, are likely to be impacted by long-term climate change in different ways than the other three Melanesian countries. While internal migration to urban areas, particularly Suva (Fiji Islands) and Noumea (New Caledonia), will continue, international migration is likely to be much more significant as an adjustment, especially among the nonindigenous populations.

Indians living in rural areas in Fiji Islands have been finding it increasingly difficult to get access to land for cultivation since existing leases began expiring in the early 1990s. Over 100,000 Indians are estimated to have left the country since the coup in May 1987, and their share of the total population in the country has fallen from 51% of the total in 1966 to 38% in 2007. In New Caledonia a referendum on independence within the next 10 years could result in some significant changes in international migration patterns in the nonindigenous population.

Climate change will accentuate existing migration trends and drivers in Melanesia, rather than transform them in any fundamental way. International migration from Fiji Islands and into New Caledonia will be affected by ongoing political developments, as well as social and economic considerations; climate change is not likely to become a major driver of international migration unless rises in sea level render large parts of Melanesia's major coastal towns uninhabitable. If that happens, many thousands could migrate from the western Pacific seeking a new life overseas, especially in Australia and New Zealand.

### **3. Polynesia**

Anticipated climate change over the next 50 years in the eastern Pacific will encourage large numbers of residents in the islands to move, either from small islands to larger ones, especially those with towns, within their own country, and, for many, to cities overseas. The great majority (over 90%) of the populations of Polynesia's islands live very close to the coast. Their villages, gardens, and cash crops are likely to be impacted severely by more frequent cyclones, as El Niño conditions associated with sustained El Niño Southern Oscillation events become more the norm than the exception.

Largely because of well-established international migration outlets for citizens of all countries in Polynesia, projected population growth in this part of the Pacific through to 2030 is much lower than for Melanesia. The Secretariat of the Pacific Community estimates that Polynesia's population will increase from around 657,700 in June 2008 to 771,900 in June 2030 at an average annual rate of increase of 0.7% between 2015 and 2030. This compares with a

projected average annual growth rate of 1.9% for Melanesia between 2015 and 2030, and an overall increase of 52.0% in the region's population between 2008 and 2030. Climate change will, undoubtedly, further a trend towards movement to cities in the Pacific rim countries of Australia, New Zealand, and the United States. But it will not be the main driver of this migration—the pathways the Polynesians have established to livelihoods overseas are very well-developed and well-trodden in both directions—out to cities on the rim, and back to the islands to maintain connections with the cultural hearths of Polynesia.

#### **4. Relocation Options: Tokelau and Tuvalu**

If “tipping points” that trigger environmental changes, which are difficult or impossible to reverse, occur and the cumulative effects of both slow and abrupt environmental changes and disturbances reach certain thresholds, inhabitants of low-lying islands might need to leave. Tokelau and Tuvalu have sizeable communities in New Zealand, and in both cases it is likely that increasing environmental stress in their atoll and reef island homes will encourage others to leave and settle in New Zealand.

Though the possibility of relocation of the whole population should be considered seriously, different studies have warned against the damaging effects of such rhetoric on local populations, arguing that they failed to capture the resilience of island communities and could undermine their adaptive capacity (Barnett and Campbell 2010, Gemenne 2010 2011).

#### **5. Micronesia**

The plight of Micronesian atolls in an era of rising sea levels and changing weather patterns has attracted international attention. Emphasis is usually placed on the need to recognize the unique natural and cultural assets of each island jurisdiction, the close ties of their peoples through customary land tenure, the role of “extended gift giving” as a mechanism for extended economic family resilience, the decision-making powers of local village communities, and the relative isolation of many communities in these small scattered islands.

Looking ahead, the population of Micronesia is projected to increase by more than 130,000 by 2030, a somewhat larger increase than Polynesia's, mainly because of higher fertility in several jurisdictions, particularly the Marshall Islands and the Federated States of Micronesia. The rates are projected to fall to roughly similar levels between 2015 and 2030. Micronesian countries, except for Guam with its military base, face the same major challenge of providing employment for a burgeoning youth population.

As in Polynesia, residents of most Micronesian countries are able to move to a Pacific rim country using former colonial ties. However, Kiribati and Nauru do not have such access. Given the increasing vulnerability of their island ecosystems to climate change, it is important to ensure that there are suitable pathways to voluntary settlement overseas as one adaptation. For Nauru, with its population of under 15,000, this is not a particularly demanding task. However, for Kiribati, the development of a gradual voluntary resettlement strategy that would absorb a significant share of the current population as well as the projected increase poses quite a challenge, particularly for Australia and New Zealand (Bedford and Hugo 2009).

#### **6. Timor-Leste**

Timor-Leste has about 1 million inhabitants and this number is growing rapidly. Roughly half the population is below the age of 15. Demographic growth has been fuelled by the return of

refugees from West Timor, following independence in 1999. The young country shares environmental threats and challenges similar to those faced by Indonesia, but poverty severely limits the migration options of the population. Though emigration from Timor-Leste is currently very low, about 250,000 people fled the country during the civil war, and a significant share of these refugees have remained in West Timor and Indonesia, but also in Portugal and Australia.

## **VI. INITIATING THE POLICY DISCUSSION ON CLIMATE-INDUCED MIGRATION**

Within Asia and the Pacific there has been little analysis of how governments facilitate migration away from areas that are at risk of economic or environmental problems toward areas that are better endowed. A major issue here is that, in general, the poorest groups have been least able to make such moves due to their limited resources and connections. Yet they are the group most vulnerable to the impacts of climate change. A particular group that requires attention are poorer residents of large cities vulnerable to climate change impacts who often live in urban areas most at risk of experiencing both gradual and sudden environmental hazards.

While most climate-induced migration will occur within countries, there is likely to be an increase in cross-border migration as well. Within Asia and the Pacific there are major cross-border migration corridors, particularly in South Asia and the Greater Mekong Subregion. Countries connected to these primary corridors will at some juncture need to enter into serious discussions on knowledge sharing, risk pooling, and security provision for climate change migrants—both internal and international.

Security concerns are particularly significant in the case of women climate migrants as they are highly exposed to personal security risks such as sexual violence and trafficking. Receiving countries outside the region also need to be engaged in constructive dialogues with countries from which climate-induced migrants originate, including on the role that migrants from climate-affected countries with a younger demographic profile could play in addressing labor needs in countries with an ageing population.

The potential for migration to facilitate economic development in Asia and the Pacific is being hampered by weak governance and institutions and a lack of policy coherence. There is growing evidence that, in the right policy context, migration generates positive impacts on both the economies of destination regions as well as on origin communities through remittances, return migration, and diaspora effects. Indeed, in many circumstances, out-migration can serve as a way of coping with climate change as well as a mechanism to reduce poverty and increase resilience in affected areas.

Climate-induced migration is tied up with the broader trend of rapid urbanization in Asia and the Pacific. Mega cities lack the carrying capacity to accommodate the influx of climate migrants on top of those moving for other reasons. Adaptation policies of most developing countries in Asia and the Pacific have not yet considered the land use and public health risks that such large-scale migration can cause. Improving the legal and regulatory frameworks for managing internal and international migration is an important development priority.

Significant funding will be required to utilize migration as an adjustment or coping mechanism in the face of climate change. Migration-related adaptation within poorer countries will require transfer of resources—human, technological, and financial—from better-off countries and the international community. Bilateral and multilateral mechanisms will have to be developed, and soon, in order to facilitate orderly planning and to limit the negative social impacts of migration.

A major limitation of all policy initiatives is the lack of quality data relevant to climate-induced migration. For example, it would be useful to policy makers to have spatially and temporally specific data about the location, extent, timing, and nature of climate change and its likely impacts. Similarly, it would be important to have sex-disaggregated data to inform gender-responsive adaptation and migration policies. It would also be helpful to have accurate, detailed information on patterns of internal and international mobility. Investments in research, analysis, and modeling at the national and subnational levels can help to generate better quality data.

Another area for regional and international debate is that of ascribing refugee status to climate migrants. While it is difficult to isolate environmental factors from others that might impel people to migrate, the issue is likely to gain greater attention as the impacts of disasters related to climate change are increasingly felt. There are no international legal frameworks that specifically target the people displaced by climate change. How to treat such migrants through international law is a subject that also requires attention.

In addition to the people that will be displaced by climate change are those who are compelled to stay in their place of origin, notwithstanding a willingness to relocate. Migration requires resources that are often not available to the poorest and most vulnerable. Too often, these vulnerable populations are given little attention by decision makers. Any initiative aiming at better assisting those who leave should not forget those who stay behind.

#### **A. Migration as an Adaptation Strategy**

As noted earlier, in situ adaptations will be the most common response to climate change. Policy making therefore needs to address what is needed to allow communities to not migrate. Indeed, most of the adaptation mechanisms currently being canvassed (ADB 2009b) are designed to keep people in place and promote an alternative to migration.

One of the distinctions that can be drawn is the need for the development of new and effective governance systems and policy mechanisms that can cope with (i) the sudden onset of cataclysmic events which destroy or rapidly change livelihoods or displace population on a permanent or temporary basis, and (ii) the longer-term processes which see an incremental decline in the ability of an area to provide livelihood. In both cases, mobility- and nonmobility-based adaptation strategies can be initiated. However, the institutions and strategies needed often differ between countries.

One of the challenges here is the need to convince policy makers to take action on both (i) and (ii). There is a considerable body of experience with disaster response, refugees, and internally displaced persons (as defined by the United Nations High Commissioner for Refugees). This is relevant to responding to sudden impacts induced by climate change. Creating policies, actions, and governance systems to cope with cataclysmic changes is by no means trivial. But it is clear that policy makers need to act with some urgency given the existence of a substantial body of relevant experience and the extreme nature of sudden changes.

On the other hand, longer-term incremental impacts have relatively less immediacy, raising the danger that policy makers will defer action on them. Policy makers must recognize that, while the full impact of these incremental processes will not be evident for several decades, the interventions needed are often very large in scale and will therefore need to be put into operation over time. The crucial point is that the need for action on hazards and long-term processes is urgent.

It is also important when framing policies for migration related to climate change to avoid isolating internal migration responses to climate change from international migration responses, since the two are often strongly linked (Skeldon 2006). While it has long been recognized that migration has been beneficial to most migrants and to most of the economies they move in to, the prevailing view has been that the areas of origin suffer the loss of their best human capital.

The last decade has seen a shift in the dominant paradigm regarding migration and development, however. Whereas in the past out-migration and emigration from areas was seen as “brain drain” inevitably diminishing development potential, recent times have focused on positive impacts on origin communities through the remittances sent back, the return of migrants with newly acquired skills, and diaspora effects whereby expatriate communities assist their home areas through investment, advice, and support. Migration is a way for origin areas to cope with environmental impact and, given an appropriate policy context, to enhance development.

It is important to stress that contemporary drivers of international migration other than climate change are also projected to increase significantly over the next few decades. Policy makers need to recognize that migration can have positive effects on origin communities, in part by making migration policies in destination areas more “development friendly”. This means developing policies and programs with the labor market interests of destinations and impacts in origin communities in mind.

## **B. Resettlement as a Last Resort?**

A distinction is often drawn between environmental risks, which involve a gradual decline in the quality or quantity of natural resources, and the increasing risk of sudden environmental hazards including typhoons, storm surges, flooding, droughts, and associated events such as famines and disease outbreaks. In the discussion on climate change and migration, much attention has been focused on population displacement as a result of linear or gradual deterioration of local environments due to climate change, either in relation to the degradation of natural resource conditions or the gradual increase in the likelihood or severity of hazards.

The underlying idea is that at some point a region becomes unable to sustain the livelihoods of its resident population, or there is a perception of such a condition, and a tipping point or threshold of tolerance is reached after which there is a nonlinear increase in the number of people forced to emigrate (Meze-Hausken 2008). As Heine and Peterson (2008) argue, “Generally, the international adaptation community tends to regard migration as an adaptation failure.”

Yet, migration needs not be conceptualized purely in this manner. While it is of course very important that there are policies and programs in place that give local people the choice to adapt to climate change in situ, it needs equally to be recognized that in some cases resettlement will become necessary when all other avenues have been exhausted.

Some have argued that migration is often less a function of immediate stress undertaken upon the onset of disaster and more frequently a proactive diversification strategy taken in anticipation of such events or to cope with long-term declines in livelihood (Boano, Zetter, and Morris 2007). Certainly, at times, there will also be ongoing or sudden impacts of climate change that lead to thresholds being reached, after which large numbers of people will be forced to migrate as it becomes untenable for a community to remain (Lonergan and Swain



1999). However, migration needs to be seen as both a proactive and reactive response to the onset of climate change impacts and their expectation.

While much of the discussion on climate change and migration to date has exaggerated the likely extent of displacement and resettlement migration due to climate change, the risk is real and considerable. Given the enormous uncertainty but significant risks if systems are not established to manage new orders-of-magnitude of internal or external displacement, the Precautionary Principle should apply (defined under Article 15 of the Rio Declaration on Environment and Development 1992). It is important to put in place mechanisms at national and regional levels which have the capacity to facilitate the process of resettlement of individuals, families, and in some cases entire communities displaced by climate change.

At the outset it is important to recognize that the bulk of climate-induced forced migration will involve poor people since they will be the most vulnerable and will likely have been impoverished further by the deteriorating local situation. Moreover, most of the resettlement will occur within poor countries. One of the clear lessons from decades of resettlement experience (Cernea 2000) is that it requires financial resources. If resettlement is not to lead to further impoverishment, morbidity, or mortality of those displaced, significant investments will need to be made in order to successfully establish the displaced people in new locations and to provide them with security and sustainable livelihoods in these destination areas.

The type of displacement anticipated due to changes in climatic and environmental conditions is, to a large extent, analogous to displacements which have occurred in the past as a result of large-scale infrastructure and development projects for the following reasons:

- (i) Most environmental changes, such as desertification, sea-level rise, and river erosion, are gradual events. In development projects, such as dam or road construction, there is a lead time to plan and prepare for the resettlement of the populations which are expected to be displaced. This is also the case in hot spot areas where the gradual deterioration of environmental conditions is occurring.
- (ii) Both kinds of displacement processes bring about increased powerlessness and vulnerability to the most disadvantaged communities in the areas affected. This is primarily a result of insufficient resources to adapt to or cope with changes to livelihoods by forces beyond their influence.
- (iii) Due to low socioeconomic levels and, therefore, limited capacity of such communities to “raise their voices,” the impact of environmental changes and development projects on these communities is often ignored during planning and policy-making stages at the institutional level.
- (iv) The fundamental nature of displacement in both cases is such that a significant proportion of those involuntarily displaced move within national borders.

There is considerable literature in Asia and the Pacific on the experience of resettlement of people displaced by mega-projects (Cernea and McDowell 2000, Tan 2008), resettlement of refugees and internally displaced people (Hugo 2002), people displaced by environmental events (e.g., Lucardie 1979), and government-sponsored resettlement of people from densely settled to less densely settled areas (e.g., Hardjono 1977, 1986).

One persistent feature in these studies is that underfunding of resettlement programs means that those resettled are often less well-off than they were in their original, now untenable, locations. Therefore, to resettle those families and communities displaced by climate change will be expensive and few countries in the region will be able alone to fund sustainable resettlement. International involvement and support will, therefore, be critical to successfully resettle those

displaced by climate change. Those displaced by climate change cannot be legally considered as refugees, as the 1951 Geneva Convention on the Status of Refugees does not apply to people whose displacement is induced by environmental disruption.

One of the limitations of the existing experience of resettlement is that it overwhelmingly involves displacement from one rural community to another. However, displacement associated with climate change will involve both cities (as areas for resettlement) and city dwellers (as those displaced). Experience in resettlement of displaced communities has hitherto primarily been concerned with displacement within countries. There may be particular cases where international resettlement will be necessary, e.g., where low-lying islands states do not offer any potential resettlement sites within national boundaries. In such circumstances the preservation of the resettled community's social capital is of particular significance.

Given the specific challenges of international forced migration due to climate change, it is important to have in place the international institutional capacity, systems of governance, funding arrangements, and programs to facilitate and support development of mobility as an adaptation and, in extreme cases, resettlement. Such programs will need to complement in situ adaptation and resilience-building mechanisms.

## **VII. CONCLUSIONS**

It is now evident that, depending on the extent, measure, or level of vulnerability, communities and individuals will resort to different adaptation (migration) techniques—permanent migration, temporary migration, or no migration (in situ adaptation). Even in the case of gradual but irreversible changes in the climate, such as rises in sea levels or temperature, migration may not be permanent due to social factors and perceptions of risk.

There is still enormous uncertainty regarding local impacts of climate change, including the scope and scale of impacts and societal responses to mitigate and adapt to changes. The impact will be a complex mix of minor irritations and severe developments that lead to impoverishment and loss of life, requiring responses that are also complex.

Changes to migration patterns might take various forms but are likely to involve an increase in the push forces (those at origin) that lead to emigration pressures. They will probably manifest themselves through three main processes:

- (i) increasing risk of environmental hazards and associated socio-ecological events;
- (ii) changing resource conditions in linear and nonlinear trends that alter access and effective use of natural resources; and
- (iii) perceptions of risk of impacts of climate change, irrespective of real experiences.

Thus, it will not just be the real hazards or depleted resources described above that will potentially lead to greater migration, but also the changes in perception towards environmental risk or resource degradation. As the frequency and severity of hazards increase, the associated importance of perceived risks will increase, and thresholds or tipping points may be reached, after which the normal rules of understanding migration will not apply. Of key interest here will be those impacts of climate change or perceptions of likely future impacts that (i) significantly increase the numbers migrating in a linear manner using established patterns (internal and international), primarily via voluntary mechanisms; and (ii) lead to nonlinear changes to migration that result as thresholds of resilience or tipping points are met.

It is also important to recognize that climate change will not only increase or (in a few cases) decrease the pressure to move out of areas which it influences, but it will also impact on existing and potential destinations to reduce or (in a few cases) increase opportunities for migrants.

Finally, migration as a form of adaptation will be a more common response to the impact of climate change than the displacement of entire communities. The latter will occur as a last resort once adaptation possibilities and community resilience are exhausted.

Natural ecosystems have an important role to play in coastal zone protection and the livelihoods of coastline communities. Coastal mangrove forests have played a crucial role as a buffer and minimized the impacts of the December 2004 Indian Ocean tsunami. Well-managed natural coastal zone ecosystems could contribute to a reduction in the vulnerability of coastal zone communities and therefore the need for migration as an adaptation strategy.

Uncertainties—especially uncertainties regarding the number of potential migrants—should not be an excuse for inaction. The issue of climate-induced migration will grow in magnitude and will take different forms. At present, no international cooperation mechanism has been set up to manage these migration flows, and protection and assistance schemes remain inadequate, poorly coordinated, and scattered. Thus, it is urgent to address this issue proactively. Failure to do so could result in humanitarian crises with great social and economic costs. Bilateral, regional, and international cooperation will be indispensable in addressing this emerging issue.

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## **Climate Change and Migration in Asia and the Pacific**

Climate change will increase the frequency of extreme weather events, making more geographic places inhospitable to human habitation and secure livelihoods. This report presents a detailed picture of the potential impacts of climate change on migration in Asia and the Pacific. It draws upon a wealth of research to provide policy makers with informed analysis of an emerging phenomenon requiring urgent attention by governments and the international community. The report also suggests that climate-induced migration should be seen not only as a threat to human well-being but also as a potential tool to promote human adaptation to climate change.

## **About the Asian Development Bank**

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries substantially reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to two-thirds of the world's poor: 1.8 billion people who live on less than \$2 a day, with 903 million struggling on less than \$1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.