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ORIGINAL PAPER

Climate change, environmental degradation and migration

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Abstract Climate change will have a progressively increasing impact on environmental degradation and environmentally dependent socio-economic systems with potential to cause substantial population displacement. The key concerns in Less Developed Countries (LDCs) will include serious threats to food security and health, considerable economic decline, inundation of coastal areas, and degradation of land and fresh water resources (Reuveny in Polit Geogr, 2007). The relationship between environmental change and potential humanitarian crises has been captured by: McGregor (Geography and refugees: patterns and processes of change, Belhaven Press, London, pp 159–70, 1993), Kibreab (Environment and Population Change, International Union for the Scientific Study of Population, Liège, 1994), Kibreab (Disasters 21(1):20–38, 1997), Myers (Bioscience 43:752–761, 1993), Myers and Kent (Environmental exodus: an emergent crisis in the global arena, Climate Institute, Washington, DC, 1995), Black (New Issues in Refugee Research, Working Paper no. 34, 2001), Lee (Environmental matters: conflict, refugees and international relations, World Human Development Institute Press, Seoul and Tokyo, 2001), Castles (Environmental Change and Induced Migration: Making Sense of the Debate Working Paper No. 70, 2002), Christian Aid (Human tide: the real migration crisis, Christian Aid, London, 2007), and Massey et al. (http://www.psc.isr.umich.edu/pubs/pdf/rr07-615.pdf, 2007). However, we know little about the interplay between environmental change and stresses on ecological systems, resulting socio-economic vulnerability

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and potential outcomes in terms of population displacement or induced migration. So far these relationships are poorly conceptualized, lack systematic investigation, and are reduced to simplistic causal explanations. This leads to misleading conclusions that deny the complex multivariate processes—environmental, political, social, and economic—which are the root causes of environmentally induced migration and/or conflict. When people are faced with severe environmental degradation they have one of three options: (1) stay and adapt to mitigate the effects; (2) stay, do nothing and accept a lower quality of life; or (3) leave the affected area. The process of movement and migration is usually subject to a complex set of push and pull forces, where push forces relate to the source area while pull factors relate to the destination. These forces are in constant flux, as much as environmental change, and interact with socio-economic and political conditions including state or government decision making powers, which can tip the balance at any point by either denying movement or the right to settle elsewhere. The paper focuses on how environmental change and environmental hazards contribute to the migration by exploring the mechanisms through which vulnerability and migration are linked—via livelihoods, relocation policies, and other factors. The paper begins by outlining important definitions of what is environmentally induced migration. The paper also considers the question of whether migration is a process that reduces or increases vulnerability. The paper draws on multidisciplinary literature including ecology, environment, and climate change; sociology of migration; anthropology of displacement; and economics; but also on preliminary from various case studies in Egypt, Vietnam, and Mozambique.

Keywords Forced migration · Environmental degradation · Adaptation · Displacement · Remittances · Resettlement · Egypt · Mozambique · Vietnam

1 Introduction

Data compiled annually in the Emergency Events Database (EM-DAT) by the Centre for Research on the Epidemiology of Disasters (CRED 2008) show a continuous increase in the frequency in manifestation of many hazards of natural or anthropological origins throughout the last few decades (although a plateau seemed to have been reached in this century). These events, such as floods, droughts, storm surges, and others are affecting more and more people and are generating increased damages globally, even though reported fatalities are on the decline (CRED 2008). There are many factors that can explain these trends, including improved recording of disasters and their impacts, increased exposure of population to hazards (through for example, natural demographic trends or increased settlement in flood plains) or because of environmental degradation processes including climate change.

Regarding the last point, many recent reports on global environmental trends have highlighted the degradation of the environment and the capacity of our ecosystems to provide or maintain services. The Millennium Ecosystem Assessment (2005a) concluded that 15 of 24 ecosystem services reviewed were being degraded or used unsustainably, affecting in particular poor resource-dependent communities. Particularly highlighted by the Millennium Ecosystem Assessment (2005b) is the fact that 2 billion people living in arid, semi-arid and subhumid regions are extremely vulnerable to the loss of ecosystem services, such as water supply and notes in particular that:

- Ten to twenty percent of drylands are already degraded (there is, however, uncertainty in the measurement of the extent of desertification).
- Pressure is increasing on dry land ecosystems for providing services such as food, and water for humans, livestock, irrigation, and sanitation.
- Climate change is likely to increase water scarcity in regions that are already under water stress as they accommodate close to a third of world population but harbor only 8% of global renewable freshwater resources.
- Droughts are becoming more frequent and their continuous reoccurrence can overcome the coping mechanisms of communities.

Regarding the last point above, a major problem arises when coping mechanisms are exhausted by the extended duration of resource scarcity. When coping mechanisms and adaptation strategies of communities are overwhelmed by the loss of ecosystem services, droughts and loss of land productivity can become important factors triggering the movement of people from drylands to other areas (Millennium Ecosystem Assessment 2005b; Renaud and Bogardi 2007).

The fourth Global Environment Outlook of UNEP (2007) has similar general conclusions than the Millennium Ecosystem Assessment reports in that it highlights in particular the fact that environmental degradation observed worldwide (air pollution, land and water resources degradation, loss of biodiversity) undermines development, human well-being, and the achievement of some of the Millennium Development Goals. The report notes that one of the many consequences of environmental degradation is human migration even though establishing direct links is difficult because of the potentially many push factors at play. However, the link is explicitly noted for two of the seven patterns of vulnerability studied: drylands and small island developing states.

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

Migration—whether permanent or temporary, whether national, regional, or international—has always been a possible coping strategy for people facing environmental changes such as sudden disasters, creeping processes, or cyclical climate conditions. Prehistory and history are marked by (episodic and localized) human movement from one climate zone to another, as people have sought out environments that would support both survival as well as aspirations to a more stable existence. Migration in the past may have been accompanied by some sense of despair that familiar landscapes no longer provided safe or supporting habitats for people. Today, environmental change, including climate change, presents a new threat to human security and a new situation for migration.

Three factors distinguish present era and foreseeable future and add to the complexity of investigating population movement due to environmental factors. First, global scale of environmental change and its potential impact are new phenomena. Second, impacts will

no longer be episodic or localized. And finally, human agency is at the center of environmental change and the potential to respond to it.

By 2050 when human population is projected to peak, the majority of the population will live in urban areas with crushing environmental footprints. Many of these cities are located in areas prone to sea-level rise, while people remaining in rural areas may struggle with increasingly frequent and violent hazards like flooding or drought, or with more gradual but similarly intense changes in regional climates that make livelihoods much more difficult. Faced with an unprecedented scale of environmental change, migration may be an adjustment mechanism of first resort or a survival mechanism of last resort.

Environmentally induced migration has the potential to become a phenomenon of unprecedented scale and scope. Its effects on the global economy, international development, and national budgets could be profound, with significant implications for almost all dimensions of human security, in addition to political and state security. Yet amid these challenges, there is also opportunity. Today, economic migrants are a powerful force driving international development. Their remittances dwarf official development assistance and currently approach 300 billion dollars per annum (Ratha and Xu 2008). In the future, people facing the threat of environmental change and those who have become migrants because of it may help shape effective adaptation to climate change (Fig. 1).

The paper explores the effects of environmental degradation and climate change in greater depth as it relates to migration. The paper discusses vulnerability and the spectrum of environmentally induced migration. Next, the paper examines patterns of environmental stressors and migration worldwide, as well as how to define the phenomena. In the fourth section, the paper introduces the project Environmental Change and Forced Migration Scenarios (EACH-FOR) as well as the methodology used in the frame of the project and the main findings of a selection of field research visits run for that purpose. The fifth section analyzes these case studies. Finally, the paper draws conclusions about the links between environmental degradation and climate change and migration.

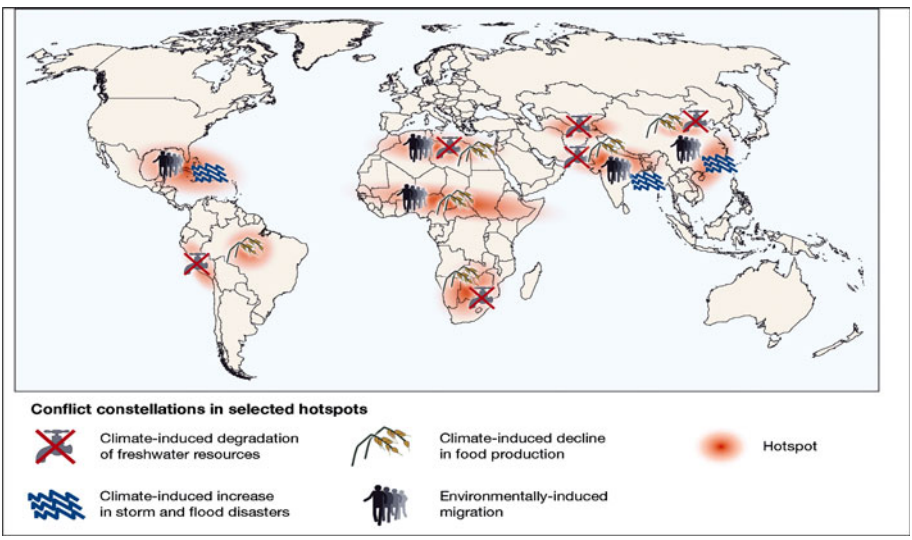

Fig. 1 Environmental hotspots and migration (Source: German Advisory Council on Global Change (WBGU 2007): Climate change as a security risk; reprinted with permission, modifications by authors)

2 In search of a definition—the spectrum of environmentally induced migration

The links between environmental change and migration cause much public and scientific debate. Yet there is no full consensus about how to define the issue. This paper refers to people who have an environmental signal in their reason for migration as "environmentally induced migration," in line with the 2007 working definition provided by IOM. In policy debates, media discussions, and academic literature, many terms are used to refer to this phenomenon. These terms include environmental migrants, environmental refugees, environmentally forced migrants, and a number of other variations. This section focuses particularly on the debate of whether environmentally induced migrants are refugees.

There are three main dimensions to the debate surrounding the notion of environmental migrants/refugees (e.g., Castles 2002), discussed in the remainder of Sect. 2 below:

- *Definitions: refugee or migrant?* There is the definitional debate over the terminology "environmental refugee" and who can be classified under such a definition as has been highlighted above;
- *Is it a measurable phenomenon?* There is a debate over whether environmentally induced migrants even exist, i.e., can environmental factors be identified as a root cause of migration or displacement?
- *Who provides policy direction, protection/assistance?* There is the debate over who will provide protection to such a category of people should they exist. The debate is important because it shapes the way policy makers analyze and address environmental change and human movement.

Renaud et al. (2007) carried out a review of environmental migration definitions and what follows builds on this review. Black (2001, p. 1) noted that Lester Brown of the Worldwatch Institute introduced the concept of environmental refugees in the 1970s. It was subsequently addressed in a November 1984 briefing document of the London-based International Institute for Environment and Development (Black 1998, p. 11; Kibreab 1997, p. 21) and entered into common usage after a 1985 United Nations Environment Programme policy paper written by E. El-Hinnawi entitled 'Environmental Refugees'. There have been several attempts to promote the idea that a new category of refugees (the extreme case of population movement) is needed in order to protect people who have to move because of environmental factors (e.g., Conisbee and Simms 2003). However, the evidence put forward so far to link environmental factors to forced migrants or refugees has not been regarded as convincing. Detractors of the concept criticize the lack of scientific and factual rigor. In addition, there is no accepted definition of what an "environmental migrant/refugee" is. The International Organization for Migration (2007) suggested a working definition of environmentally induced migration, which serves as a baseline for discussion.

The definition for the term refugee is provided under *Article 1A of the 1951 Convention*. This definition relates to the Status of Refugees amended by the 1967 Protocol and the Status of Refugees (hereafter referred to as the Refugee Convention), which states that a refugee is any person who:

> …owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable or, owing to such fear, unwilling to avail himself of the protection of that country; or who, not having a nationality and being outside the country of his former habitual residence as a result of such events, is

unable or, owing to such fear, is unwilling to return to it (United Nations High Commissioner for Refugees (UNHCR) 2006, p. 16).

There are four key parts to this definition:

- the person must be outside the country of nationality or former habitual residence;
- the person must fear for persecution;
- the fear of persecution must be for reasons of one of the five convention grounds (race, nationality, religion, membership of a particular social group, or political opinion); and
- the fear must be well founded.

The 1969 Organization of African Unity/African Union Convention (OAU Convention) governs specific aspects of refugee issues in Africa. The 1984 Cartagena Declaration on Refugees (the Cartagena Declaration) concerns Latin America (Jambor 1992) and is built upon the 1951 Refugee Convention definition of a refugee to also include people who have been compelled to flee their countries due to events, which have seriously disturbed public order (Jambor 1992). This definition of a situation of seriously disturbed public order comes closest to some form of official international recognition, which could potentially encompass those compelled to leave their country of origin due to environmental factors. However, these Conventions only apply to individuals living in Africa and Latin America and do not draw attention to environmental issues specifically.

A key element of refugee recognition is that a person is outside their country of nationality or former habitual residence. Definitions with respect to "environmental refugees" generally have in common the fact that they do not distinguish whether the persons migrating or fleeing have crossed an international border. However, other than this commonality, academic definitions vary widely, including whether displacement of environmental refugees is temporary or permanent in nature. Several examples of academic definitions are presented below.

El-Hinnawi (1985, p. 4 in Bates 2002a, p. 466) defined environmental refugees as:

> Those people who have been forced to leave their traditional habitat, temporarily or permanently, because of a marked environmental disruption (natural and/or triggered by people) that jeopardized their existence and/or seriously affected the quality of their life [sic]. By 'environmental disruption' in this definition is meant any physical, chemical, and/or biological changes in the ecosystem (or resource base) that render it, temporarily or permanently unsuitable to support human life.

Jacobson (1988, pp. 37–38) identified different types of environmental refugees:

- those displaced temporarily due to local disruption such as an avalanche or earthquake;
- those who migrate because environmental degradation has undermined their livelihood or poses unacceptable risks to health; and
- those who resettle because land degradation has resulted in desertification or because of other permanent and untenable changes in their habitat.

Myers (1993, p. 752) defined environmental refugees as:

> …people who can no longer gain a secure livelihood in their erstwhile homelands because of drought, soil erosion, desertification, and other environmental problems. In their desperation, they feel they have no alternative but to seek sanctuary elsewhere, however hazardous the attempt. Not all of them have fled their countries; many are internally displaced. But all have abandoned their homelands on a semi-permanent if not permanent basis, having little hope of a foreseeable return.

Bates (2002, p. 468), taking into account the definitions of others over the preceding years, offers an intentionally vague definition to take account of the transformation of the environment to one less suitable for occupation by humans, stating that environmental refugees are:

> …people who migrate from their usual residence due to changes in their ambient non-human environment.

Even though the term "environmental refugee" is used, the authors encapsulate population movements that are not of the refugee type, at least not as per the definition of 1951 Refugee Convention. In addition, of the four aspects of the 1951 Refugee Convention mentioned above, the one most difficult to define in the context of "environmental refugees" is the fear of persecution. Unless it is assumed that "nature" or the "environment" can be the persecutor, the term refugee does not appear suitable for describing those displaced by environmental factors. In this paper, the term "environmentally induced migrant" is used to characterize cases when people must move—either swiftly because of an environmental stressor or in response to gradual negative environmental change—regardless of whether or not they cross an international border.

In international refugee law, environmental conditions do not constitute a basis for international protection. This paper argues instead that environmental conditions should be considered as one element forcing people to flee their places of origin and as such should be afforded—under certain conditions—similar rights and protection as refugees fleeing because of other causes.

Even critics of the concept of environmentally related migration such as Black (2001) contend that should environment-related refugees be included in a future international convention, the scientific and empirical basis of the fluxes and specific needs will require further elaboration. Similar points of view were elaborated in a brief review on the subject presented by Flintan (2001). Castles (2002) argued that the environmental refugee terminology and conceptualization is inadequate but nevertheless did not dismiss the possibility that environmental factors can be very important for the triggering of migration in certain circumstances This later possibility is also highlighted by Oliver-Smith (2006) who argued that in rare cases nature, that is, the set of natural features and forces characterizing a region (as opposed to the environment, which is understood to be the coconstruction of nature and society) could be a single cause of migration. However, he further asserted that much more frequently, migration is triggered by environmental factors that emerge out of human misuse or distortion of nature. As such natural features and forces in interaction with society become part of a constellation of factors triggering migration.

In summary, no one can disagree that there is a need to address these issues more scientifically and systematically. Yet the lack of a commonly agreed definition presents difficulties in defining and measuring the phenomena. Further, the lack of definition and estimation of numbers does not alleviate institutional inertia about what organizations might have a mandate to address the needs of environmentally induced migrants. In the future, more precise terminology will provide a further platform shaping policy about environmental change and migration, including displacement. In the mean time, an attempt to understand the complexity of both processes—environmental change and migration—and the further complexity of their interaction is of utmost importance until the world agrees on the wording.

3 Migration and vulnerability—addressing complexity

Environmentally induced migration is one example of complex human-environmental systems. This section examines some of the issues surrounding migration and vulnerability. First, the slow and rapid-onset environmental drivers of migration are laid out. Second, attention is turned to the challenges of defining and measuring environmentally induced migration. Third, the dynamics of vulnerability and resilience of migration systems are examined. To conclude this section, the paper looks at environmental and governance factors that affect whether migration could be considered voluntary or forced.

3.1 Slow- or rapid-onset—what drives migration?

Climate-related stressors combined with ecosystem change (e.g., sea-level rise), and rapid-onset events (e.g., flooding) have the potential to drive migration or prompt national governments to plan for the relocation and resettlement of affected populations. Further, as some environments become inhospitable, people are pushed to move elsewhere where their locally specific knowledge may no longer apply to the places where they migrate. Displaced people may not always receive the support they need in places of destination. For those displaced to locations where adequate infrastructure is not available and where they are directly dependent on the environment for survival, there can be an overexploitation of natural resources leading to a lack of potable water, soil degradation, deforestation, but also to pollution and potential epidemics. Under such circumstances, a range of maladaptive activities can drive migrants to further stress ecosystems and may unleash a number of secondary environmental catastrophes.

Over time, slow onset change will give environmental push factors an increasingly important position in the migration "decision." Current projections of temperature and sea-level rise and increased intensity of droughts and storms suggest that population displacement at significant scales will take place within the next 30–50 years, particularly for populations in coastal zones. Although constituting only 2% of the total land surface of the earth, these regions contain 10% of the current world population and 13% of the urban population. Additionally, about 75% of all the people residing in low-lying areas are in Asia, and the most vulnerable are the poor. One of the world's poorest countries, Bangladesh may lose up to one-fifth of its surface area due to rising sea level; this scenario is likely to occur, if the sea level rises by one meter, and no dyke enforcement measures are taken (GermanWatch 2004). Migration is anticipated as a consequence of these trends.

Rapid-onset change is linked with environmentally induced displacement and migration. Temporary displacement from natural catastrophes can lead to permanent migration, as illustrated by the 2004 Indian Ocean tsunami and the 2005 Hurricane Katrina. The Indian Ocean Tsunami in late 2004, displaced slightly over 2 million people, many of whom were still living in refugee camps in the region several months or years after the event (UNHCR 2008).The *U.N. Office of the Special Envoy for Tsunami Recovery* estimates that 1.5 million people lost their livelihoods in the aftermath of the tsunami, further complicating resettlement of migrants (ibid). In the Gulf of Mexico in 2005, Hurricane Katrina resulted in the largest displacement of Americans in the country's history, dwarfing the impacts of the Dust Bowl—another case of environmental degradation and migration—in a period of about 14 days. Although government policies and practices drove the displacement process, Hurricane Katrina ultimately caused about 1.5 million people to be displaced temporarily and an estimated 500,000 people permanently (Grier 2005). Table 1 indicates different terms that have been used to identify environmentally induced migrants.

Table 1 A typology of environmental stressors contributing to environmentally induced migration

Perspective	Terms for environmentally induced migrants	Author
Focus on the nature of the environmental stressors: slow or rapid onset disasters, or chronic environmental stressors like sea-level rise	Environmental emergency migrant Environmentally motivated migrant Environmentally forced migrant	Renaud et al. (2009)
Focus on time scale of the movement: temporal, permanent or progressively displaced	Environmental refugee	El-Hinnawi (1985)
Focus on the nature of the impact: disaster, livelihood displaced, or habitat changes	Environmental refugee	Jacobson (1988)
Initial focus on impact of environmental stressors and associated needs of migrants	Environmentally motivated migrant Environmentally induced migrant Environmental refugee	Renaud et al. (2007)

3.2 Problems with numbers and counting

Estimates of the number of environmentally displaced people range widely and are under academic debate. The United Nations High Commissioner for Refugees (UNHCR 2002, p. 12 and 2007) estimates that today there are approximately 24 million people worldwide who have fled because of floods and other environmental factors. These figures vary if particular phenomena are taken into account: for example, 17 million people may be migrating due to desertification alone (Leighton 2006) and the (1994) *Almeria Statement* mentioned that 135 million people could be at risk of being displaced as a consequence of severe desertification (Bates 2002a). In a 2002 paper by *a Green Party member of the European Parliament*, it was estimated that 30 million people were displaced by climate change in China alone (Lambert 2002).

Myers estimated that by 2010, 50 million people would migrate due to environmental change (Myers 1993, 2002, 2005). Organizations including the International Organization for Migration (IOM) estimate that 200 million people may become environmentally induced migrants by 2050. After 2050, environment-related development displacement (i.e., building dams) could drive the number up to almost 700 million people or almost one in every ten people living on Earth after 2050 (Christian Aid 2007). This huge range in estimates and figures is a clear reflection of the problem of defining environmental migration and who is an environmental migrant. In other words, what it comes down to is: (a) who is being counted; and (b) who is doing the counting.

In attempting to look further into such complexity one main issue stands out. The relationship between environmental degradation and population movement is determined by an extremely complex set of factors. Environmental change does not undermine human security in isolation of broader factors such as poverty, state support to communities, access to economic opportunities, effectiveness of decision-making processes, and the extent of social cohesion within and surrounding vulnerable groups.

Investigating any relationships between environmental factors and displaced population needs to first address a number of questions grouped under four main categories:

Typology of environmental stressors	Slow, rapid onset or acute disasters? (Renaud et al. 2007) Temporal, permanent or progressively displaced? (El-Hinnawi 1985) Disaster, livelihood displaced or habitat changes? (Jacobson 1988) Environmentally motivated, induced or environmental refugee? (Renaud et al. 2007)
Attribution	Is there a continuum from voluntary to forced migration where adaptations to periodic stress become unsustainable? When does environmental degradation impact the social, economic and institutional fabric to the extent of producing significant population displacement? Have regions at risk reached tipping points in the past (i.e., a point that characterizes two distinguishable states of a system)? What are the indicators of an impending tipping point or humanitarian crises?
Conceptualizing environmentally induced migration	Direct or indirect displacement?
Policy agenda	Are the negative consequences of environmental change inevitable? Who has adapted? Why and how? Who has been displaced? Why? What is the role of social capital, governance structures and political economy in mediating environmental change and potential displacement?

Before addressing these questions, it is important first to look into the complexity of migration as a process especially in terms of it being an adaptive and coping mechanism. Who migrates and how are key questions. The interactive dynamics between migration, attempting to reduce vulnerability and increasing resilience need to be explored first before any attempt to look into any linkages between environmental factors and migration.

3.3 Migration, vulnerability, and resilience dynamics

Migration is a complex multidimensional process, as much as vulnerability and resilience are. As a coping strategy, migration may reduce environmental and socio-economic vulnerabilities. In this regard, the nature of the migration stream as well as the embedded social structures and immigration policies will affect the chances for reducing vulnerabilities. Considering the different skill levels, highly skilled migrants generally move to improve income and quality of work, whilst low-skilled migration is typically driven by the expectation to reduce economic insecurity. The former would have higher chances to enter legally to destination countries and with better prospects for a good insertion in the labor market, whilst the latter group would likely be more exposed to undocumented migration and low wages. As a consequence, economic and adaptation processes for both streams will differ. Table 2 shows a significant percentage of skilled migrants from developing countries in OECD countries, while implicitly it reveals an even higher percentage of nonskilled immigrants.

Along these lines, while international migration represents a coping strategy, the same move can also create gaps in daily family ties and income-earning capacities at origins. Thus, migration can create vulnerability—often expected to be transitory—in exchange for resilience built-up through remittances sent to family members.[1] Moreover, the brain drain of skilled persons can generate vulnerabilities at the national level, which has been widely

[1] Remittances can be in-kind and in monetary form. For analytical purposes, this paper only deals with monetary remittances.

Table 2 Highly skilled immigrants from some developing countries in OECD countries

Country	Number of immigrants from country (in '000s)	Percentage of which are highly skilled	Country	Numbers of immigrants from country (in '000s)	Percentage of which are highly skilled
Afghanistan	129	25	Haiti	467	20
Angola	196	20	Indonesia	289	34
Brazil	352	32	Kenya	197	37
Congo	100	37	Mozambique	85	27
Côte d'Ivoire	59	28	South Africa	343	48
DRC	66	33	Sri Lanka	292	30
Ecuador	490	15	Sudan	42	41

Source OECD (2005) Trends in International Migration. SOPEMI 2004 edition

documented, for example, in the medical sector of Caribbean and African countries (Stilwell et al. 2004). For immigrants themselves, the arrival to new cultural milieus and labor markets also represent challenges to face and thus potentially the recreation of new vulnerabilities. Table 3 is an attempt to build a typology for capturing more broadly the dynamic generation of vulnerabilities and resilient threads in the context of high- and low-skilled migration and for countries of origin and destination.

Typically migration is not an individual-driven process, but rather a social one. When traveling costs of migration and new residence can be financed with family support, migrants are expected to reciprocate by sending remittances back. Remittances are often invested in human and physical capital at countries of origin. Basic consumption, health and education expenses as well as durable assets and the set up of microenterprises are among the main uses of remittances (Adams 2006). Remittances contribute to building resilience and is, perhaps the main reason why migrants are able to often endure low wages and precarious working conditions at destinations after leaving insecure livelihoods at origins. In fact, the steady increase in remittance flows over the past two decades suggests the importance of these flows to families in developing countries. For example, for some developing countries in 2006 remittances as a proportion of GDP represented 36% for Tajikistan, 31% for Grenada, 26% for Honduras, 24% for Lesotho, and 22% for Haiti (Ratha and Xu 2008). Overall, at the macro level, the balance of payments and output of these countries are increasingly supported by such flows.

Yet, inequalities can be reinforced at the local level between receiving and nonreceiving remittance families (see Taylor 1992) as well as at the national level between the economic groups with privileged access to the financial surplus allowed by remittances and the majority of the population with often precarious and no access to formal financial services. Similarly, fiscal finances can become 'addicted' to remittances, which are frequently used for closing budget and current account deficits; as, for example, Salvadoran and Guatemalan main authorities often plead to the US Government to extend the granting of legal temporary status to their conationals residing in the United States.

3.4 Migration—forced or voluntary?

How voluntary is migration when environmental factors or disasters affect key aspects of countries' or communities' economic security and social stability? While the literature on

Table 3 Typology of high/low skilled migration and the likelihood of generating vulnerability and resilience

Sphere of influence	High skilled		Low skilled	
	Vulnerability	Threads of resilience	Vulnerability	Threads of resilience
Family	*Lower risk*: temporary reduction of income earners and break up of physical family ties	Increased human and physical capital; diversification of wealth	*Higher risk*: Reduction of income earners and break up of physical family ties for undetermined length of time	Rise of family prestige in the community. Reduction of economic insecurity through remittances.
Local and Regional	Possible minimal negative effect in high- and middle-income communities; larger negative impact in low-income communities	Remittances might have positive effect in high- and middle-income communities; larger economic impact in low-income communities	Loss of potential community leaders. Growth of inequality. *Emulation effect* of increased chain migration	Increased economic growth in communities receiving remittances
National	Brain drain. Loss of productivity and socio-economic return of public investment in countries of origin.	Possibility of increased human capital if migrant returns (temporarily or permanently)	"Addiction" and dependence on remittances to fill gaps in public finance and balance of payments. Delay of sustainable development strategies and distortion of trade policies (e.g., rise of exchange rate)	Possible reduction of unemployment and social unrest pressures in countries of origin. Contribution to economic growth in countries of destination. Positive impact of remittances on national output and reduction of extreme poverty at origins
International	Unbalanced distribution of highly skilled with negative impact on developing countries	Increased financial flows to developing countries through remittances	Issues related to undocumented migration and human trafficking. Overpopulation of global cities	Increased financial flows to developing countries through remittances

migration provides evidence that migrants primarily leave for better wages and work conditions (Kline 2003), the literature has not fully assessed the extent to which the adverse effects of natural hazards on the GDP, employment, and economic growth of these countries, are also affecting the prospects of career development of their educated population. As a pull factor, new immigration legislation in Northern countries and institutional agreements between sending and receiving countries for the past 15 years have increasingly encouraged skilled migration, while discouraging 'family reunion' type of immigration. This change in the institutional framework together with the deterioration of socio-economic prospects in sending countries has been crucial in unleashing larger migration flows from Southern countries to Northern countries.

There is evidence of forced migration in the context of slow-onset events like droughts, as well as on sudden-onset ones such as earthquakes, tsunamis, and floods. Although often

forced migration refers to movement of people ordered legally, for example as part of hurricanes' early warning measures, it can be organized by the same people suffering the effects of some of these hazards, as it is typically the case for droughts. Forced migration can be defined as including relocation from and later return to disaster areas. Yet, the degree of success of relocation plans after disasters during the past 20 years has varied, with many of them ending in failure (ISDR-IRP 2007).

It is often the case that forced migration becomes a momentary stage until the people affected judge the conditions safe enough for returning, even if this turns out not to be the case (Oliver-Smith 1977). Socio-economic and cultural conditions will affect the decision to return in the recovery stage of disasters. Oliver-Smith's study indicates that despite higher vulnerability in disaster areas, the decision of the Yungaínos to return to their homeland after the most devastating earthquake in the Western Hemisphere in 1970 in the northern part of Peru followed their conviction that essential livelihood elements were not found in the areas where they were to be relocated.

In general, access to land, water, and possibilities for employment, income, and asset ownership affect positively the decision to migrate and return. Yang (2007) gives empirical evidence that lack of financing for the costs of international migration after the 2001 earthquake in El Salvador reduced the chances for Salvadorans to migrate internationally. The study outlines that other factors such as family ties and the rise of recovery-led employment were not found to be statistically insignificant.

In summary, this section has examined the dynamic factors that affect how environmental stressors affect the migration decision. First, the characteristics of the environmental stressor—be it slow- or rapid-onset or of a permanent progressive nature such as desertification or sea-level rise—affect the character of environmentally induced migration. Estimates for the numbers of such affected migrants vary widely, in part due to the rich variety of environmental stressors at play and the lack of a standard definition or method to measure them. Third, this section examined the interactions of vulnerability, livelihoods, and environmentally induced migration suggesting the importance of managing and reducing vulnerability. This led to the final part of this section where it was found that effective governance interventions have an important impact on whether and how environmentally induced migration is voluntary or forced.

4 Empirical evidence—Egypt, Mozambique, and Vietnam

Only recently have empirical observations begun to be gathered to underpin policy discussions about how governance of human mobility may need to evolve in coming years, as environmental change is expected to become an increasingly important factor in migration decisions. To contribute to the base of knowledge about the links between environmental change and migration, the European Commission co-sponsored the Environmental Change and Forced Scenarios (EACH-FOR) project to assess the impact of environmental change on migration at the local, national, regional and international level.[2]

EACH-FOR was conceived as an initial study upon which further extensive research would be built. Its case studies were intended to provide insights into the many possible

[2] The **E**nvironment**A**l **CH**ange and **FOR**ced Migration Scenarios Project was a 2 year long research project within the Sixth Framework Programme (Policy-oriented research) of the European Commission (EC). Findings, case study reports, policy briefings, and materials from the 2008 Bonn conference on environment and migration (EFMSV) can be found at the project website http://www.each-for.eu.

hypotheses that could subsequently be formulated and tested. The project did not aim to establish unequivocal attribution and causal relationship of environmental factors and migration—this task may evade researchers for some time to come. Rather the project investigated a variety of environment-migration linkages and patterns relevant for the current discussion of vulnerability to environmental change and migration.

4.1 Research methods

The project selected case study countries where several different types of documented migration and environmental processes, such as extreme flooding, desertification, land degradation, water shortages and drought, the potential of sea level rise, and industrial pollution.[3] Case areas were selected to create a "snapshot" of environmental processes and their possible interactions with migration. This approach allowed the project to identify "hotspot" countries with potentially high descriptive value, but it was noted that multiple environmental processes as well as complex migration processes may be going on in each country.

A set of questions helped test the central hypotheses of the project, and guided the collection of data in desk study and fieldwork activities. These questions were formulated in a way that would avoid drawing a deterministic relationship between environmental degradation and migration. The guiding questions were intended to identify cases where environment plays an important role as a contributor to population movement. Field work took place in 23 case study locations in Europe, Russia, Newly Independent States and Central Asia, Asia, Sub-Saharan Africa, the Middle East and Northern Africa, and Latin America. Figure 2 shows the areas studied.

EACH-FOR researchers tried to find ways to establish whether migration would not have occurred in the absence of environmental change. To test whether there was indeed an impact on migration when the environment became less hospitable; the project had a three-step procedure. Desk research and expert interviews examined historical patterns of both environmental change and migration, and helped capture the dynamics of environmental change and how this might have affected human mobility. Researchers used a questionnaire with migrants, and non-migrants who had stayed behind in areas with documented cases of environmental degradation. The comparison of migrants and non-migrants was hoped to reveal answers to the central question of the project: what role has environmental degradation or change played in the decision of people to migrate or not migrate? For those individuals that remained behind, the project asked what factors intervened to keep people from migrating, even when they faced environmental problems. This set of answers sheds insights into the role of human mobility governance in affecting resilience.

Three of the EACH-FOR case studies are presented briefly here: Mozambique, Vietnam, and Egypt.[4] In Mozambique and Vietnam, people are affected by rapid-onset flooding; in Egypt the slow-onset hazards of desertification today and sea level rise in the future contribute to migration. Environmental change particularly climate change is expected to affect all three areas in serious but differing ways. Increasingly frequent and violent storms will affect Mozambique and Vietnam with a high degree of certainty (IPCC 2007a, b). Sea level rise of one meter would displace upwards of ten percent of the

[3] For an analysis of the EACH-FOR field methodology, see Warner et al. (2009).

[4] We would like to acknowledge the EACH-FOR field researchers upon whose empirical work part of this section is based. We thank these contributing authors for their input in this report: Tamer Afifi (UNU-EHS) conducted fieldwork in Egypt and Niger. Olivia Dun (UNU-EHS) performed her research in the Mekong Delta; Marc Stal (UNU-EHS) worked in Mozambique.

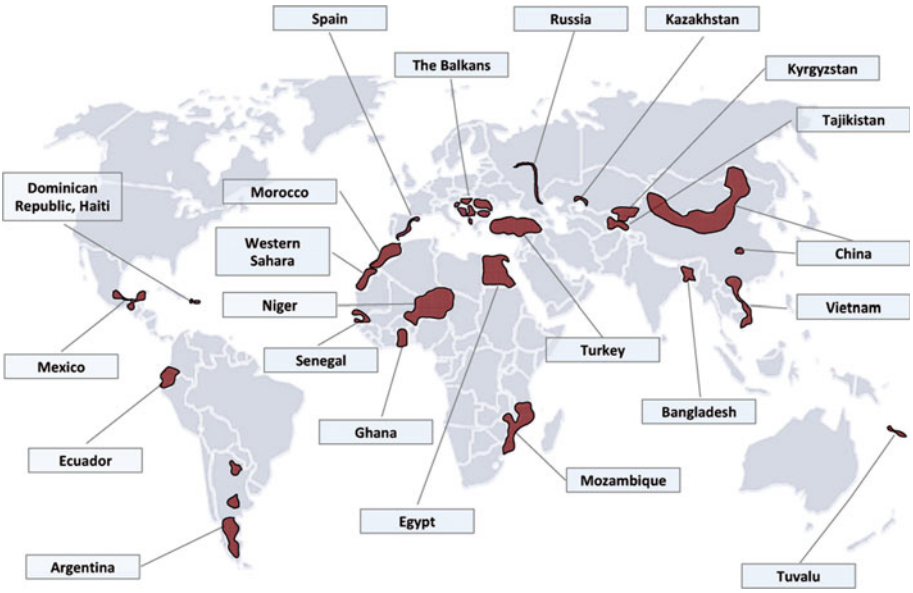

Fig. 2 EACH-FOR case study locations (http://www.each-for.eu)

populations of Egypt and Vietnam due to flooding in the Nile and Mekong Deltas. In all three cases national governments are experimenting with resettlement programs, in which traditional institutions with a mandate to offer humanitarian or other forms of assistance or protection to people on the move have played a role in varying degrees.

These cases are presented to illustrate interactions between governance, migration, and rapid- and slow-onset events as discussed in Sect. 2. These cases also suggest some of the gaps in human mobility governance today, and the implications for resilience or vulnerability of people to environmental change. Table 1 summarizes these interactions and points out how governance (or lack thereof) can affect migration in the face of rapid- and slow-onset environmental stressors.

4.2 Egypt—desertification[5]

In Egypt slow-onset events like sea level rise and desertification affect the Nile Delta[6], which is the most productive area in Egypt yet comprises only 3 percent of total land area. Desertification and soil degradation claim large swaths of land on the Eastern and Western Nile Delta today. Large swaths of land may be rendered unusable by the dual climate change-related forces of desertification and sea level rise. Projected increases in sea levels will pressure a rapidly growing population into more concentrated areas. In the future, sea level rise could affect an additional 16% of the population.[7]

[5] This section on is based on original field work and case study performed by Tamer Afifi in Egypt. For a full case study of these research results see Afifi (2009). Case study report on Egypt for the Environmental Change and Forced Migration Scenarios Project, Available at http://www.each-for.eu/.

[6] Jäger (2009).

[7] ibid.

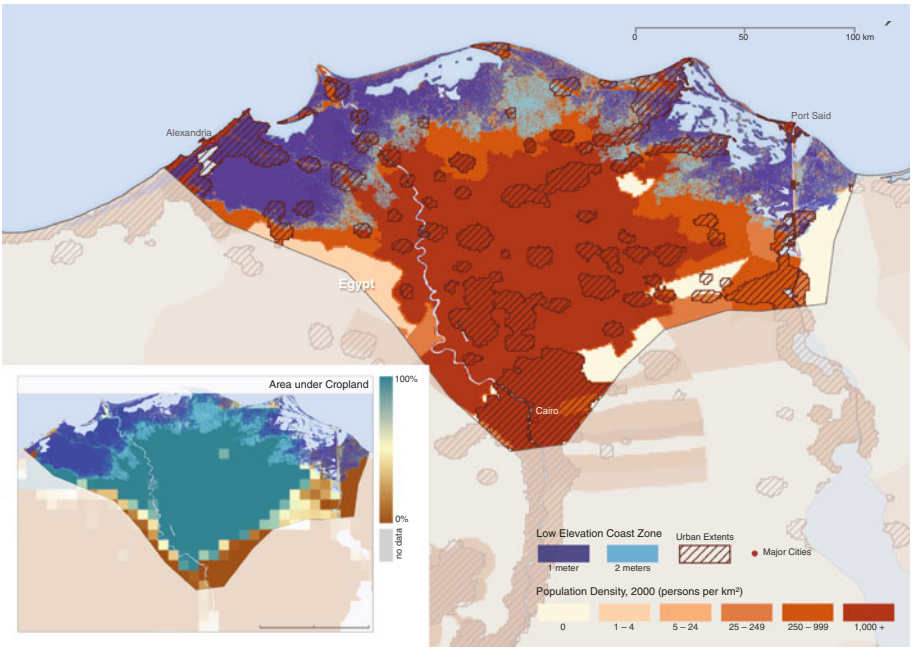

Fig. 3 The Nile Delta: between sea level rise and desertification (Map produced by the Center for International Earth Science Information Network (CIESIN) at Columbia University for the report "In search of shelter: Mapping the effects of climate change on human migration" Warner et al. 2009. Used by permission)

Figure 3 depicts areas of sea level rise at 1 and 2 m (dark and light brown, respectively) on a population density map with urban extents delineated. It also shows the boundary of the Nile delta. The Nile delta supported a population of 40.2 million in 2000, of which 10.7 million lived in areas that would be inundated by a 2 m sea level rise. Desertification and land degradation drive some people to migrate internally in search of livelihoods.

People who were resettled in the Eastern Delta were mainly unemployed young men from urban slums. In contrast, the people who moved to the Western Delta were mainly farmers affected by a law that favored land owners who could easily drive away share croppers from desirable agricultural areas. After eviction, the share croppers were moved by the government to the Western Delta.

The program allocated each sharecropper/farmer in the Eastern and Western Delta a land parcel of 10,500 m^2, and often additional migrants came to work as peasants in these areas. Soon, however, reclaimed areas began to manifest soil and water salinity problems. When it became too expensive to dig new wells for groundwater, many landowners sold their land and evicted the migrant peasants. The new immigrants received shelter and agricultural extension and veterinary services from the government and NGOs. Government funding provided migrants with pesticides and artificial crop pollination. Yet initial investments and incentives to encourage poor people to migrate to new areas tapered off with time. The Western and Eastern Delta lack access to potable water, proper infrastructure, public facilities, schools, health care, and well-functioning sewage systems. Consequently, many migrants did not stay and others are expected to leave either to other regions or to return to their original regions. Today, only half of designated resettlement land has been utilized.

4.3 Mozambique—flooding and relocation[8]

Fieldwork in Mozambique revealed an example of timely international and national governance interventions focused on the physical integrity and assistance to flood-affected people. In 2001, 2007 and 2008 heavy rains caused flooding along the Zambezi River in central Mozambique. Approximately 1 million people live in the flood affected areas of the 2007 floods in the Zambezi River valley. The magnitude and recurrence of the flooding events in the Zambezi river valley have displaced many people over the last decade. The floods of 2007 alone displaced over 100,000 people. An estimated 50,000 people were evacuated to temporary evacuation 'accommodation centres'. In 2007 another tropical cyclone, Cyclone Favio, increased the number of homeless people in Mozambique following the flooding of the Zambezi River.

These low lying river areas are high risk areas for flooding, but also provide the basis for agricultural livelihoods. During the flooding, affected people lost their homes and livelihoods as well access to medical facilities, sanitation and safe drinking water (WHO 2007 in Stal 2009). Repeated and catastrophic flooding led to increased vulnerability as people not only lost their houses and belongings during the flooding; they also lost their harvest and means of livelihood (Stal 2009).

In the immediate aftermath of the 2001 floods, international humanitarian aid reached a theretofore unprecedented level. In subsequent years the government encouraged resettlement away from dangerous flood plains by providing incentives such as infrastructure in a work-for-assistance program. In exchange for making bricks, the government promised to pay for other construction materials and technical assistance for houses and multipurpose community buildings. The relocation plan moved villages together to minimize the impact on social networks. Some livelihood support has been provided by NGOs that offer training for new farming techniques suited to the drought-prone conditions in resettlement areas. Interviewees living in these resettlement centres, and experts, commented that government assistance had prevented the necessity for people to migrate longer distances or across borders. Resettled people remain almost heavily dependent on governmental and international aid. The long-term sustainability of the resettlement centres depends on the availability of international humanitarian assistance and government funding.

Interviews with displaced people living in resettlement centres following the 2007 flooding of the Zambezi River indicated that the floods caused them to move for the first time; before the flooding the respondents had never been migrants but had only temporarily evacuated the flood plains and then returned when waters receded. Most respondents indicated that they had lived in low lying river areas that flooded frequently during the rainy seasons. Their decision to resettle elsewhere was voluntary (in order to move to a flood-safe area) or they had been moved by the government. Most of the respondents indicated that flood-safe areas are prone to drought, but subsequent onward migration is not likely for them, because of lack of alternative livelihoods and dependence on government-provided infrastructure and services. Yet many able-bodied people leave the resettlement areas during the planting and harvesting season in flood plains. Children and elderly remain behind.

Resettlement contributed to other issues like deforestation, soil erosion and water scarcity. Resettlement did not clearly build resilience to environmental change, although it did protect people from drowning. More frequent crop failure due to flooding or drought

[8] This section on is based on original field work and case study performed by Marc Stal in Mozambique. For a full case study of these research results see Stal (2009).

exacerbates the vulnerability of people both in resettlement areas and flood plains. If extreme weather events continue to impact Mozambique in the future, environmental factors will increase as push factors for migration (Stal 2009).

4.4 Viet Nam, Mekong River Delta—sea level rise[9]

Viet Nam was selected as a case study for examination in the context of environmental change and migration because a large portion of the country's population is directly dependent on the environment for their livelihood (Adger et al. 2001), and it is a country prone to water or water-related disasters some of which are thought to be increasing due to the influence of climate change. Further, according to the results of a World Bank study released in February 2007, Viet Nam will be one of the countries most severely impacted by sea-level rise (Dasgupta et. al. 2007).

Environmental degradation, particularly impacts caused by flooding, is a contributing factor to rural out migration and displacement in the Mekong Delta of Vietnam. The Vietnamese portion of the Mekong Delta is home to 18 million people, or 22% of Vietnam's population. It provides 40% of Vietnaḿs cultivated land surface and produces more than a quarter of the country's GDP. Half of Vietnam's rice is produced in the Mekong Delta, 60% of its fish-shrimp harvest, and 80% of Vietnaḿs fruit crop. Ninety percent of Vietnaḿs total national rice export comes from the Mekong.

Flooding plays an important role in the economy and culture of the area. People live with and depend on flood cycles, but within certain bounds. Fieldwork from the EACH-FOR project indicated that lack of alternative livelihoods, deteriorating ability to make a living in the face of flooding, together with mounting debt, can contribute to the migration "decisions" in the Mekong Delta. People directly dependent on agriculture for their livelihood (such as rice farmers) are especially vulnerable when successive flooding events destroy crops. This can trigger a decision to migrate elsewhere in search of an alternative livelihood. During the flooding season, people undertake seasonal labor migration and movement towards urban centers to bolster livelihoods.

Figure 4 shows areas of sea level rise at 1 and 2 m (dark and light gray, respectively) on a population density map with urban extents delineated. It also shows the regions of the EACH-FOR study areas. The Mekong delta supported a population of 28.5 million in 2000, out of which 14.2 million lived in areas that would be inundated by a 2m sea level rise.

The government in Vietnam has a program known as "living with floods" (Dun 2009). This program may become more important as the impacts of climate change become more pronounced. The government, as part of this flood management strategy, is currently resettling people living in vulnerable zones along river banks in the An Giang province. Almost 20,000 landless and poor households in this province are targeted for relocation by 2020. For these people, social networks provide the link to livelihoods—most rely on day-to-day employment as laborers. Although the "residential clusters" are usually located only 1–2 km away from the former residence, moving people out of established social networks threatens their livelihoods and contributes to a sense of isolation. The resettlement clusters are not yet planned in a way that allows participation of potential residents.

The Vietnamese strategy of "living with floods" will combine resettlement, shifting livelihoods (i.e. from rice to fishery-based jobs), and some migration. In the future one out

[9] This section on is based on original field work and case study performed by Olivia Dun in Vietnam. For a full case study of these research results see Dun (2009).

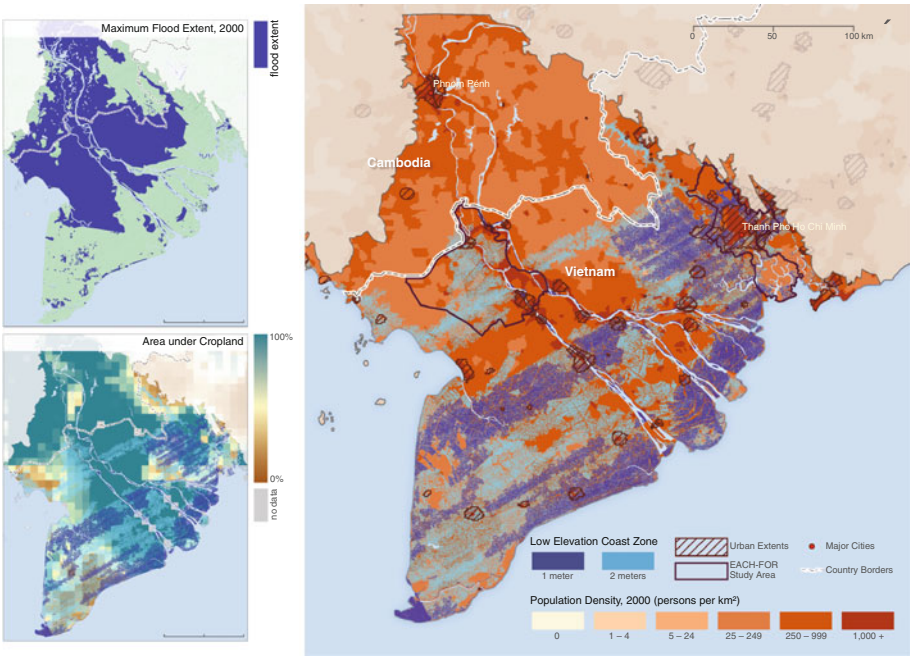

Fig. 4 The Mekong Delta: living with floods and displacement (Map produced by the Center for International Earth Science Information Network (CIESIN) at Columbia University for the report "In search of shelter: Mapping the effects of climate change on human migration" Warner et al. 2009. Used by permission)

of every ten Vietnamese may face displacement by sea level rise in the Mekong Delta (Dasgupta et al. 2007).

5 Analysis

The case studies presented above have commonalities and differences, and the comparison and analysis of the cases reveal three points relevant to future environmentally induced migration. These points are discussed below, highlighting areas where environmental degradation may in the future have an increasing influence on internal displacement, internal migration, and international migration.

5.1 Multifactors in environmentally-influenced migration

It is clear that migration is influenced by complex interactions of multiple push and pull factors. Fieldwork findings indicate that environmental degradation is currently a smaller push factor in migration. While acknowledging that economic and social factors are currently the main drivers of migration in the above described case studies, an environmental signal was detected in each area that contributed to migration. An interesting question is therefore whether environmental stressors will become more prominent factors affecting migration in the future act as underlying trigger point for migration or displacement. In that context, it is necessary to factor into both research and policy the dynamics of global

environmental change. In time, the environmental drivers of migration may become clearer to everyone involved.

The case studies of Egypt, Vietnam, and Mozambique highlight water shortage, land degradation, and floods as significant underlying triggers in human movements. Other stresses such as poverty, high population growth and density, and a low level of economic development exacerbate the situation even further. As these factors are all intertwined, it is difficult to separate one from the other. Also conflict can be traced back to environmental stressors: "[…] there is ample evidence that the lack of clean freshwater has lead to occasionally intense political instability and that, on a small scale, acute violence can result" (Wolf 1998, p. 255).

A central question to all case studies facing environmentally induced migration is the degree to which environmental factors contribute to displacement or migration. Environmental degradation currently seems not to be a *major* cause for migration in the studied cases, however, for the case of the Zambezi River valley, it has been shown after an individual flood event people will be displaced on a temporary basis, generally during the flood emergency period. Following reoccurring flooding events, people tend to be either relocated or migrate on a permanent or semipermanent basis.

Another pressing question involves differential vulnerability to environmentally forced migration. Not everyone is vulnerable in the same degree to environmental change. In some cases, social class or occupation may cushion against the impacts of environmental change. In other cases, the unequal or distorted application of governmental assistance programs may protect some groups and expose others to pressures to migrate. For example, in northeast Brazil, the traditional drought coping strategy involved rural workers taking refuge on a *Patrao's* land, which allowed them to maintain their access to the land they worked. In the 1930s the state took over the task of drought assistance, allegedly replacing paternalism with civil democratic institutions. However, governmental drought relief initiatives were soon corrupted and politicians and top-down NGOs replaced the Patrao, siphoning resources away from the drought stricken and undermining traditional claims to land, thus forcing permanent migration (Kenny 2002).

5.2 Migration and socio-ecological tipping points

Second, current migration patterns manifest "spikes" of migration when the threshold of socio-ecological tipping points has been reached or crossed. However, tipping points are very complex to measure let alone predict. We use the term and concept of tipping points here only to demonstrate the complex interacting multi-stressors involved in generating migration and reaching a potential point of no return in terms of a humanitarian crisis. Tipping points occur in both rapid and slow onset events. In events such as Hurricane Mitch in 1998 and Hurricane Katrina in 2005—both generated thousands of displacees and migrants—the events did not only affect the resource base but also social networks, community structures, etc. Gradual or slow-onset processes such as soil degradation and desertification compounded by political factors (domestic, regional or geo-political) pushed a case like Darfur into a crisis tipping point. Environmental and social monitoring functions, such as famine early warning systems, will prove crucial in predicting and ascertaining when threshold are exceeded and populations will be pressured to migrate.

Clearly, each case study presented here has a different context and set of environmental stressors. As people in Egypt are mainly faced with gradually increasing water scarcity and land degradation, the inhabitants of Mozambique are not only exposed to droughts and coastal soil erosion but also to cyclones, floods and sea level rise. In Vietnam, while floods

are part of the life of any Delta, the impacts are further exacerbated due to rapid population growth in the area. Mozambique fights both flooding and drought. Egypt struggles to maintain viable living areas as desertification advances and sea level rise could threaten large areas of the country's most densely populated area, the Nile Delta. What is common in the three cases is that the adaptive capacity of particular groups of people is stretched to a point that migration becomes one of the few options left for safety and livelihoods in the face of worsening conditions at home. In each case study examined here, current migrants have noted that poor environmental conditions or some rapid onset event such as flooding has been a factor in the migration decision. Interviews with experts and a survey conducted among people who live in areas with documented environmental problems and who have not (yet) migrated add further insights. In some areas upwards of 70% of non-migrant respondents indicated that migration would become necessary for them if their environments become further degraded. By the same token, given properties of ecological resilience or restoration efforts in some contexts of environmental degradation, permanent migration may not be necessary in all cases.

5.3 Government responses

The case studies showed some distinct government approaches to managing environmentally induced migration and to cope with the environmental threats to its population. Government responses vary from incentives to mandated resettlement, with mixed results.

In Egypt, water shortage and land degradation are of increasing threat when combined with a rapid population growth, a lack of access to proper infrastructure, public facilities, schools, health care and well functioning sewage systems. The government gives incentives to people to move to desert areas in order to spread out and ease population pressure on urban centers reaching breaking point. The government's Mobarak National Project was designed to fight desertification by resettling urban poor from Cairo and other cities to the Eastern and Western Delta. Migrants are incentivized by the promise of land ownership to move to desert reclamation project areas. However, heavy water pollution of rivers and canals and salinazation of soils and groundwater threaten the resettlement project. The result of environmental degradation in Egypt is constant internal migration. Farmers and fishermen seek stable livelihoods set against a background of water shortage, pollution, and soil degradation. The governments of Mozambique and Vietnam have taken more direct regulatory control of environmentally related migration. After a decade of increasingly frequent and devastating flooding, the government of Mozambique mandated resettlement of people living in the flood plains to relocation centers in high lying areas.

The government of Mozambique has intervened in the migration process much more drastically, by actually relocating people to flood-safe areas. In Mozambique resettlement has become a policy of last resort to ensure the safety of people living in flood-prone areas. Resettlement centers depend entirely on government and external humanitarian assistance to function. Resettlement centers move people away from physical risks of flooding, with the tradeoff of increasing vulnerability to a number of risks including loss of livelihood, debt, almost complete dependence on humanitarian aid, and disruption of social structure.

Similarly, in Vietnam the government has relocated people living in areas threatened by riverbank erosion, flooding, and storm surges to higher elevation locations. In both cases, the benefits of relocating people include moving them out of harm's way. Resettlement of this kind exposes displaced people to the loss of livelihoods, debt, and social disarticulation. In Vietnam, relocation similarly increases the likelihood of leading households into debt and exposure to other financial stressors. In both cases, the legal standing of

households changes to that of internally displaced people (IDPs). Such groups often face social, cultural, and economic disruption. Traditional social structures may become fragmented, as in the case of Mozambique where mainly young men and women travel from resettlement centers to work in the fields, leaving children and elderly people behind. Internally displaced or relocated people may have conflicts with local populations where they have been resettled, and integration remains an issue.

Besides changing risk exposure and increasing vulnerability of migrants, another problem with resettlement is the reciprocal relationship between conflict and migration. Increasing densities of population in the receiving location can negatively affect the environment (IOM 2007). Resource depletion can contribute to conflicts between migrants/displacees and local inhabitants. Violent conflicts in turn can destroy landscapes and severely damage the environment, which again can lead to further migration flows.

6 Research and policy recommendations

At present, our knowledge about the relationship between environmental change/degradation and migration is relatively scant. We have only just begun to answer the basic questions about who has been displaced by global environmental change and why. Research on adaptation to environmental change is more developed (Adger et al. 2006), but it has not addressed issues of displacement and resettlement at great depth. Since there is currently very little information on environmental displacement, migration, and resettlement, research should draw on the existing knowledge in the fields of disaster, conflict and development forced displacement to guide efforts (Cernea and McDowell 2000; Oliver-Smith 2006). In order to address the specificities of the linkages between environmental change and migration, a knowledge base needs to be established of sufficient breadth to permit generalizations to be drawn and on which appropriate policy can be designed.

To develop research that will generate appropriate policies to address the needs of the displaced, we need to be clear about the phenomena we are attempting to understand. Some level of conceptual clarity regarding who constitutes an environmentally displaced person/community is needed. Numerous definitions exist at various levels of restriction, making arriving at universally applicable standards difficult, whether desirable or not. There has been considerable discussion regarding the difficulty in establishing directly causality of displacement and migration by environmental forces alone, resulting in differing definitions of various degrees of restrictedness in determining environmentally forced migration. The question of causality, thus, requires recognition of the interaction of multiple forces in the uprooting of people. Research thus needs to be directed toward clarifying conceptual approaches and answering basic questions. Policy recommendations, therefore, need to take into account that multiple causality does not eliminate the fact that fundamental environmentally based rights have been violated or lost, thus generating a set of needs and required responses. While succinct definitions are important to determine policy, absolute uniformity limits flexibility in responding to the needs of displaced people, who may not fit exactly within highly restrictive categories.

Some level of conceptual clarity regarding who constitutes an environmentally displaced person/community is needed. Numerous definitions exist at various levels of restriction, making arriving at universally applicable standards difficult, whether desirable or not. Clarification of this issue will itself turn on determining the degree of social vulnerability to specific forms of environmental change that make migration a necessary

response and the relative voluntariness or degrees of coercion or force under which migration takes place. Research on social vulnerability should additionally focus on both individual/kin group and community capacities for effective response (resilience) in the face of environmental change and forced migration.

The definitional issue pertains directly to the recognition and establishment of the human rights of environmentally displaced people and communities. The distribution of the impacts of climate change will likely be unequal and will also likely create new vulnerabilities as well. In addition, adaptations to environmental change also involve questions of environmental justice because they may distribute costs and benefits unequally among populations, establishing security for some and deepening vulnerability for others (Adger et al. 2006, p. 4). Questions of causation of environmental degradation, seen as fundamental to the definitional issue, similarly need to be addressed since they pertain directly to legal responsibility, resettlement assistance, and possible reparations due impacted people and communities.

Mechanisms and strategies of adjustment and adaptation need to be explored in depth. Research efforts should thus be directed toward to establishing the extent possible thresholds at which migration because of environmental change becomes unavoidable. Thresholds or tipping points involve the complex relations that communities have with environments. The fundamental adaptive strategies of communities in nature are based on the carrying capacity of the environment, which is a function of culture (including technology) and natural features. Carrying capacity can be enhanced or diminished, thus supporting more or fewer people, by both cultural and environmental forces. Research should focus on the kinds of environmental change that produce effects in human environment relationships, particularly relating to carrying capacity, that oblige people to migrate.

In the case of radically altered environments, in which carrying capacity has been completely undermined by desertification, or land has become uninhabitable because of environmental threat or has disappeared due to sea-level rise, research efforts should be focused on improving resettlement processes. The process of resettlement is inherently complex, involving a range of interrelated factors of different orders—cultural, social, environmental, economic, institutional, and political—generally taking place in rapidly changing circumstances in an interlinked and mutually influencing process of transformation (de Wet 2005). And further, resettlement schemes are subject to external sources of power as well as the initiatives of local actors. Understanding these dynamics is essential for successful resettlement practices and outcomes. Frequently, government policies frame resettlement as a purely material undertaking and the social and cultural elements of the total process are considered to emerge "naturally" from a physically reconstructed community. The relationship between material reconstruction and social reconstitution is undoubtedly crucial, but resettling a community is fundamentally a process achieved through the reconstituting of social relationships at a multiplicity of levels.

Consonant with the resettlement process, research should also focus on developing alternative livelihood strategies for the environmentally displaced. From both a material and a psychological standpoint, livelihoods or jobs will under gird the process of resettlement. Employment provides needed income to replace or improve upon those personal and household needs not provided by aid, but it is also a form of action that enables people to return to being actors rather than being acted upon as displaced people. Displacement causes people to lose the means of production, whether it may be land, tools, or access to other resources, and they will be unable to resume normal activities until such resources are obtained. Also important will be the strategy of establishing the new livelihoods on the basis of traditional products, skills and technology, allowing the people to continue with

known practices particularly for the initial period of adjustment. Tensions can become acute when the displaced seek to relocate in existing communities and may compete with a dense host population for scarce social and economic resources. However, until people regain livelihoods, they remain dependent on external resources and resettlement remains incomplete.

The displacement and resettlement process as well as the enormous variation that the millions of environmental displaces in their diverse contexts represent, will undoubtedly test the resilience of real communities, the validity of social scientific constructions about community, and the politics and methods employed to assist them in recovery. Existing economic, political, and social policies and standards, particularly those pertaining to property, environment, and representation, will also be severely challenged by massive environmental displacement, if current assessments are accurate.

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