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Climate change and forced migration: Observations, projections and implications

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A background paper for the 2007 Human Development Report,

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Summary

In 1990 the Intergovernmental Panel on Climate Change (IPCC) noted that the greatest single impact of climate change might be on human migration—with millions of people displaced by shoreline erosion, coastal flooding and agricultural disruption. Since then various analysts have tried to put numbers of future flows of climate migrants (sometimes problematically called 'climate refugees')—the most widely repeated prediction being 200 million forced climate migrants by 2050.

But repetition does not make the figure any more accurate. While the scientific argument for climate change is increasingly confident, the impacts of climate change on human population distribution is still unclear and unpredictable. With so many other social, economic and environmental factors at work establishing a linear, causative relationship between climate change and forced migration so far has been difficult.

This is likely to change in future. The available science, summarised in the latest assessment report of the IPCC, translates into a simple fact; on current predictions the 'carrying capacity' of large parts of the world will be compromised by climate change.

The meteorological impact of climate change can be divided into two distinct drivers of migration; *climate processes* such as sea-level rise, salinisation of agricultural land, desertification and growing water scarcity, and *climate events* such as flooding, storms and glacial lake outburst floods. But non-climate drivers, such as government policy, population growth and community-level resilience to natural disaster, are also important. All contribute to more vulnerable people living on marginal land exposed to climate change.

The problem is one of time and scale. But the image of a coastal farmer getting inundated by rising sea levels and being forced to pack up and move to a rich country simply is not typical. On the contrary, as is already the case with traditional refugees, it is likely that the burden of providing for climate migrants will be born by the poorest countries—those least responsible for its origins.

Temporary migration as an adaptive response to climate stress is already apparent in many areas. But the picture is nuanced; the ability to migrate is normally a function both of mobility and resources (both financial and social). In other words, the people most vulnerable to climate change are not necessarily the ones most likely to migrate.

Predicting future flows of forced climate migrants is complex; stymied by a lack of baseline data, distorted by population growth and urbanisation and reliant on the evolution of climate change as well as future emissions. Nonetheless this paper sets out three broad scenarios, based on differing emissions forecasts, for what we might expect. These range from the best case scenario where serious emissions reduction takes place, a 'Marshall Plan' for adaptation is put in place to the 'business as usual' scenario where the large scale migration foreseen by some analysts come true, or are exceeded.

Forced migration hinders development in at least four ways; by increasing pressure on urban infrastructure and services, undermining economic growth, increasing the risk of conflict and leading to worse health, educational and social indicators among migrants themselves.

There has been a collective, and rather successful, attempt to ignore the scale of the problem. Forced climate migrants fall through the cracks of international refugee and immigration policy—and there is considerable resistance to the idea of expanding the definition of political refugees to incorporate climate 'refugees'. Meanwhile, large scale migration is not taken into account in national adaptation strategies which tend to see migration as a 'failure of adaptation'. So far there is no 'home' for forced climate migrants in the international community, both literally and figuratively.

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Abbreviations

IDP	- internally displaced person
IPCC	- Intergovernmental Panel on Climate Change
MDG	- Millennium Development Goal
OECD	- Organisation for Economic Cooperation and Development
SRES	- Emission Scenarios of the IPCC Special Report on Emission Scenarios
UNHCR	- United Nations High Commission for Refugees
UN-IEHS	- United Nations Institute for Environment and Human Security

1/. Introduction

A growing crisis

As early as 1990 the Intergovernmental Panel on Climate Change (IPCC) noted that the greatest single impact of climate change might be on human migration—with millions of people displaced by shoreline erosion, coastal flooding and agricultural disruption.[1] Since then, successive reports have argued that environmental degradation, and in particular climate change, is poised to become a major driver of population displacement—a crisis in the making.

In the mid 1990s it was widely reported that up to 25 million people had been forced from their homes and off their land by a range of serious environmental pressures including pollution, land degradation, droughts and natural disasters. At the time it was declared that these 'environmental refugees', as they were called (see box 1), exceeded all documented refugees from war and political persecution put together.[2]

The 2001 World Disasters Report of the Red Cross and Red Crescent Societies repeated the estimate of 25 million current 'environmental refugees'. And in October 2005 the UN University's Institute for Environment and Human Security warned that the international community should prepare for 50 million environmental refugees by 2010.[3]

A few analysts, of whom Norman Myers of Oxford University is perhaps the best known, have tried to estimate the numbers of people who will be forced to move over the long term as a direct result of climate change. "When global warming takes holds" Professor Myers argues, "there could be as many as 200 million people overtaken by disruptions of monsoon systems and other rainfall regimes, by droughts of unprecedented severity and duration, and by sea-level rise and coastal flooding".[4]

200 million climate migrants by 2050?

Professor Myers' estimate of 200 million climate migrants by 2050 has become the accepted figure—cited in respected publications from the IPCC to the Stern Review on the Economics of Climate Change.[5]

This is an immense figure. If it comes true by 2050 *one in every forty-five people* in the world will have been displaced by climate change. To put the figure in perspective this would be a ten-fold increase over today's entire documented refugee and internally displaced populations.[6] It would also exceed

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[1] Steve Lonergan (1998), "The role of environmental degradation in population displacement", *Environmental Change and Security Project Report*, Issue 4 (Spring 1998): p. 5

[2] Norman Myers (2005) *"Environmental Refugees: An emergent security issue",* 13th Economic Forum, May 2005, Prague

[3] United Nations University (2005) *"As ranks of "Environmental Refugees" swell worldwide, calls grow for better definition, recognition, support",* UN Day for Disaster Reduction, 12th October 2005

[4] Norman Myers (2005) *"Environmental Refugees: An emergent security issue",* 13th Economic Forum, May 2005, Prague

[5] Nicholas Stern (ed.) (2006) *"The Economics of Climate change: the Stern review",* Cambridge University Press, Cambridge, p. 3

[6] In 1975, there were 2.4 million refugees globally but the number of refugees and people of concern to the UNHCR grew ten-folk in the following two decades, peaking at 27.4 million in 1995. Since 1995, the number of political refugees has declined significantly mainly due to several ambitious repatriation programmes and an overall decline in new conflicts. Nevertheless, in early 2005, 19.2 million people were still listed as of refugees and people of concern to the UNHCR. In Dupont, Alan & Pearman, Graeme (2006) *"Heating up the Planet: Climate Change and Security"*, Lowry Institute for International Policy, Paper 12, Sydney, p. 55

the current global migrant population: according to the International Organization for Migration about 192 million people, or 3 percent of the world's population, live outside their place of birth.[7]

But this prediction is still very tentative. Professor Myers himself admits that his estimate, although calculated from the best available data, required some 'heroic extrapolations'.[8] Not that any criticism is implied; the simple fact is that nobody really knows with any certainty what climate change will mean for human population distribution.

A complex, unpredictable relationship

The scientific basis for climate change is increasingly well established. An enormous amount of time and energy have gone into determining the meteorological impacts of climate change in terms of raised sea levels, altered precipitation patterns and more frequent and fierce storms. Much less time, energy and resources, however, have been spent on empirical analysis of the impacts of climate change on human populations.

Partly, this is because the relationship is so unpredictable: the science of climate change is complex enough – let alone its impact on societies of differing resources and varied capacity to adapt to external shocks. Partly, it is because individual migrants' decisions to leave their homes vary so widely: deciding causality between economic 'pull' and environmental 'push' is often highly subjective. And finally, disaggregating the role of climate change from other environmental, economic and social factors requires an ambitious analytical step into the dark. In short, drawing a causative, linear line between climate change and forced migration is very difficult.

For example, Hurricane Katrina, which lashed the Gulf Coast of the United States in August 2005 and temporarily displaced over a million people[9], is often presented (quite rightly) as a preview of the kind of more intense and frequent extreme weather events we can expect from climate change. But the hurricane was more than just a meteorological event: the damage it caused was a product of poor disaster planning, consistent underinvestment in the city's protective levees as well systematic destruction of the wetlands in the Mississippi delta that might have lessened the force of the storm. Labelling it a 'climate change event' over-simplifies both its causes and its effects.

Nevertheless, estimates of future numbers of climate change migrants are repeated almost glibly, either for shock value or for want of a better figure.[10] This paper sets out to challenge the predictions: by trying to pick apart the terminology, the assumptions, the time frame and the degree of uncertainty implicit in them.

Section 2 looks at the ways that climate change might lead to increased forced migration. Section 3 then analyses some predictions for numbers of future climate migrants, examines some of the uncertainties with these predictions and lays out three different tentative scenarios on future numbers of forced migrants. Which (if any) of these comes to pass depends on future population growth, distribution and resilience to environmental pressures as well as the ability of the international community to curb greenhouse gas emissions and help the poorest countries adapt to the impacts of climate change. Section 4 assesses the development implications of forced migration within countries

[7] International Organization for Migration, http://www.iom.int/jahia/page3.html accessed 10th March 2007

[8] Personal communication.

[9] Spencer S. Hsu, *(2006)* "2 Million Displaced By Storms", *Washington Post,* 16th January 2006, http://www.washingtonpost.com/wp-dyn/content/article/2006/01/12/AR2006011201912.html accessed 3 April 2007

[10] Steve Lonergan (1998), "The role of environmental degradation in population displacement", *Environmental Change and Security Project Report*, Issue 4 (Spring 1998): p. 6

and across borders. Finally, section 5 investigates a variety of international and domestic policy responses to the prospect of large scale population movements caused by climate change.

Box 1. Refugee or migrant?

Labels are important. One immediately contentious issue is whether people displaced by climate change should be defined as *'climate refugees'* or as *'climate migrants'*. This is not just semantics—which definition becomes generally accepted will have very real implications for the obligations of the international community under international law.

Campaigners have long used the phrase 'environmental refugee' or 'climate refugee' to convey added urgency to the issue. They argue that, in the most literal sense of the words, such people need to 'seek refugee' from the impacts of climate change. Any other terminology, they maintain, would downplay the seriousness of these people's situation. The word 'refugee' resonates with the general public who can sympathise with the implied sense of duress. It also carries fewer negative connotations than 'migrant' which tends to imply a voluntary move towards a more attractive lifestyle.

However, the use of the word 'refugee' to describe those fleeing from environmental pressures is not strictly accurate under current international law. The United Nations' 1951 Convention and 1967 Protocol relating to the status of refugees are clear that the term should be restricted to those fleeing persecution: "a refugee is a 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 to or, owing to such fear, is unwilling to avail himself of the protection of that country".[11]

There are other problems with using the term 'refugee'. First, categorization as a refugee is reliant on crossing an internationally recognised border: someone displaced within their own country is an 'internally displaced person' (IDP). Given that on current predictions, the majority of people displaced by climate change will stay within their own borders, restricting the definition to those who cross international borders may seriously understate the extent of the problem. Second, the concept of a 'refugee' tends to imply a right of return once the persecution that triggered the original flight has ceased. This is, of course, impossible in the case of sea level rise and so again the term distorts the nature of the problem. Third, and perhaps most importantly, there is concern that expanding the definition of a refugee from political persecution to encompass environmental pressures would dilute the available international mechanisms and goodwill to cater for 'genuine' refugees.

The question of definition makes for a hotly contested debate amongst international human rights lawyers.[12] However, there is considerable resistance among the international community to any expansion of the definition of a 'refugee'. Developed countries fear that accepting the term refugee would compel them to offer the same protections as political refugees; a precedent that no country

[11] Resolution 429 of the United Nations General Assembly, 1951, http://www.cas/com/discoveryguides/refugee/review2.php accessed 14 March 2007

[12] Subsequent actions, conventions and declarations may have nuanced the 1951 Convention and 1967 Protocol – it is the extent of this nuance and the weight of 'soft law' precedence that is the focus of this debate. For example, in 1969, the Organisation of African Unity (now the African Union) released the 'Convention governing the specific aspects of refugee problems in Africa' which cracked open the definition to include "events seriously disrupting public order" (http://www.africa-union.org/Official_documents/Treaties_%20Conventions_%20Protocols/Refugee_Convention.pdf - accessed 4th April 2007). In 1984 the Cartagena Declaration on Refugees expanded it further to encompass "massive violations to human rights and other circumstances which have seriously disturbed public order" and while the Cartagena declaration is not a legally binding document it has heavily influenced domestic law. http://www.asylumlaw.org/docs/international/CentralAmerica.PDF accessed 4th April 2007

has yet been willing to set.[13] Meanwhile, the international institutions currently charged with caring for refugees, principally the UNHCR, are already overstretched and are unable to cope with their current 'stock' of refugees.[14] The UNHCR itself is taking on an expanded role in the provision of care to IDPs and so is highly resistant to any further expansion of its mandate.[15,16]

If the term 'climate refugee' is problematic it is still used, in part, for lack of a good alternative. 'Climate evacuee' implies temporary movement within national borders (as was the case with Hurricane Katrina). 'Climate migrant' implies the 'pull' of the destination more than the 'push' of the source country and carries negative connotations which reduce the implied responsibility of the international community for their welfare.

But for lack of an adequate definition under international law environmental migrants are almost invisible in the international system: no institution is responsible for collecting data on their numbers, let alone providing them with basic services. Unable to prove political persecution in their country of origin they fall through the cracks in asylum law.

How then should we categorize these people? One proposed and rather logical definition from Jeff Crisp of UNHCR is, "People who are displaced from or who feel obliged to leave their usual place of residence, because their lives, livelihoods and welfare have been placed at serious risk as a result of adverse environmental, ecological or climatic processes and events".[17] This definition makes no reference to cross-border movement or whether the movement is temporary or permanent but does describe an element of compulsion with varying degrees of threat (to people's welfare, livelihoods or lives).

For the purpose of this study we have used 'forced migrant' here in the knowledge that it is not a universally accepted term but in the hope that it conveys a reasonably accurate impression of the increasing phenomenon of non-voluntary population displacement likely as the impacts of climate change grow and accumulate.

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[13] Reports that New Zealand has agreed to accept the entire Tuvaluan population once climate change makes their islands uninhabitable (thereby setting such a precedent) are false.

[14] Personal communication with the author

[15] Personal communications with the author. Also in Lonergan S. (1998), "The role of environmental degradation in population displacement", *Environmental Change and Security Project Report*, Issue 4 (Spring 1998): p. 7

[16] UNHCR, (2006) "*UNHCR's contribution to the inter-agency response to IDP needs – supplementary appeal",* UNHCR, May 2006, p. 3

[17] Cited by Jeff Crisp*, "Environmental Refugees: a UNHCR perspective",* 12th June 2006, Lausanne

2/. Climate change and forced migration

Not such a wonderful world

Put simply; climate change will cause population movement by making certain parts of the world much less viable places to live; by causing food and water supplies to become more unreliable and increasing the frequency and severity of floods and storms.

Recent reports from the IPCC and elsewhere set out the parameters for what we can expect:

By 2099 the world is expected to be on average **between 1.8 and 4ºc hotter** than it is now.[18] Large areas are expected to become **drier**—the proportion of land in constant drought expected to increase from 2 percent to 10 percent by 2050.[19] Meanwhile, the proportion of land suffering extreme drought is predicted to increase from 1 percent at present to 30 percent by the end of the 21st century.[20] **Rainfall patterns** will change as the hydrological cycle becomes more intense. In some places this means that rain will be more likely to fall in deluges (washing away top-soil and causing flooding).

Changed rainfall patterns and a more intense hydrological cycle mean that **extreme weather events** such as droughts, storms and floods are expected to become increasingly frequent and severe.[21] For example, it is estimated that the South Asian monsoon will become stronger with up to 20 percent more rain falling on eastern India and Bangladesh by 2050.[22] Conversely, less rain is expected at low to mid-latitudes; by 2050 sub-Saharan Africa is predicted to have up to 10 percent less annual rainfall in its interior.[23]

Less rain would have particularly serious impacts for sub-Saharan African **agriculture** which is largely rain-fed: the 2007 IPCC report of the Second Working Group estimates that yields from rain-fed agriculture could fall by up to 50 percent by 2020.[24] "Agricultural production, including access to food, in many African countries and regions is projected to be severely compromised by climate variability and change" the report notes.[25]

According to the same report **crop yields** in central and south Asia could fall by 30 percent by the middle of the twenty-first century.[26] Some **fish stocks** will migrate towards the poles and colder waters and may deplete as surface water run-off and higher sea temperatures lead to more frequent

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[18] The temperature spread refers to the current best estimates for 21st average temperature rises under low emission (B1) and high emission (A1F1) IPCC Special Report on Emission Scenarios (SRES). The range across both SRES' is from 1.1ºC to 6.4ºC - in IPCC (2007) *"Climate Change 2007: The physical science basis – Summary for Policy Makers",* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Paris, February 2007, p. 10

[19] Tearfund, (2006) *"Feeling the Heat: why governments must act to tackle the impact of climate change on global water supplies and avert mass movement of climate change refugees"*, London, p. 5

[20] Eleanor Burke et al., (2006) *"Modelling the recent evolution of global drought and projections for the twenty-first century with the Hadley Centre climate model",* Journal of Hydrometeorology, Vol. 7, October 2006

[21] Houghton, J. (2005) *"Global warming: the complete briefing"* Cambridge University Press, 2005

[22] Houghton, J. (2005) *"Global warming: the complete briefing"* Cambridge University Press, 2005

[23] Anthony Nyong (2005) "*Impacts of climate change in the tropics – the African experience".* Avoiding Dangerous Climate Change Symposium (Met Office, UK, February 2005) keynote presentation

[24] IPCC (2007) '*Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability'*, April 2007, p. 10

[25] IPCC (2007) '*Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability'*, April 2007, p. 10

[26] IPCC (2007) '*Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability'*, April 2007, p. 11

hazardous algal blooms and coral bleaching.[27] Compounding this, climate change is predicted to worsen a variety of **health problems** leading to more widespread malnutrition and diarrhoeal diseases, and altered distribution of some vectors of disease transmission such as the malarial mosquito.[28]

Meanwhile, **melting glaciers** will increase the risk of flooding during the wet season and reduce dry-season water supplies to one-sixth of the world's population, predominantly in the Indian sub-continent, parts of China and the Andes.[29] Melting glaciers will increase the risk of **glacial lake outburst floods** particularly in mountainous countries like Nepal, Peru and Bhutan.

Global average **sea level**, after accounting for coastal land uplift and subsidence, is projected to rise between 8cms and 13cms by 2030, between 17cms and 29cms by 2050, and between 35cms and 82cm by 2100 (depending on the model and scenario used).[30] Thermal expansion of sea water accounts for nearly two-thirds of this rise with glacial melt providing the rest.[31] Large delta systems are at particular risk of **flooding**.[32]

According to the Hadley Centre for Climate Prediction and Research, **land loss by submergence** could account for 50,000km^2 of land area globally by 2030, 180,000 km^2 by 2050 and 1,130,000 km^2 by 2100 (an area roughly the size of France, Germany and Italy combined).[33] Using a high population growth and emissions scenario the Centre estimated that the number of **people flooded** per year would increase from 21 million per year by 2030, to 55 million per year by 2050 to as many as 370 million per year by 2100.[34]

The avalanche of statistics above translates into a simple fact—that on current trends the 'carrying capacity' of large parts of the world, i.e. the ability of different ecosystems to provide food, water and shelter for human populations, will be compromised by climate change.

Climate processes and climate events

Robert McLeman of Carlton University in Ottawa, unpacks the drivers of forced migration into two distinct groups.[35] First, there are the climate drivers. These themselves are of two types – climate processes and climate events. *Climate processes* are slow-onset changes such as sea-level rise, salinisation of agricultural land, desertification, growing water scarcity and food insecurity. Sea-level rise patently makes certain coastal areas and small island states uninhabitable. Cumulatively they erode livelihoods and change the incentives to 'stick it out' in a particular location. Some women in

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[27] IPCC (2001), *'Climate change: Working Group II: Impacts, adaptation and vulnerability'* http://www.grida.no/climate/ipcc_tar/wg2/561.htm accessed 15 April 2007

[28] IPCC (2007) '*Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability'*, April 2007, p. 9-10

[29] Nicholas Stern (ed.) (2006) *"The Economics of Climate change: the Stern review",* Cambridge University Press, Cambridge, p. 56

[30] Debbie Hemming et al (2007) *"Impacts of mean sea level rise based on current state-of-the-art modelling",* Hadley Centre for Climate Prediction and Research, Exeter

[31] Debbie Hemming et al (2007) *"Impacts of mean sea level rise based on current state-of-the-art modelling",* Hadley Centre for Climate Prediction and Research, Exeter

[32] Debbie Hemming et al (2007) *"Impacts of mean sea level rise based on current state-of-the-art modelling",* Hadley Centre for Climate Prediction and Research, Exeter

[33] Debbie Hemming et al (2007) *"Impacts of mean sea level rise based on current state-of-the-art modelling",* Hadley Centre for Climate Prediction and Research, Exeter

[34] Debbie Hemming et al (2007) *"Impacts of mean sea level rise based on current state-of-the-art modelling",* Hadley Centre for Climate Prediction and Research, Exeter, p. 1

[35] Personal communication

the Sahel, for example, already have to walk up to 25 kilometres a day to fetch water. If their journey gets longer they will simply have to move permanently.[36]

On a national level sea level rise could have serious implications for food security and economic growth. This is a particular concern in countries that have a large part of their industrial capacity under the 'one metre' zone. Bangladesh's Gangetic plain and the Nile Delta in Egypt, which are breadbaskets for both countries, are two such examples. Egypt's Nile Delta is one of the most densely populated areas of the world and is extremely vulnerable to sea level rise. A rise of just 1 metre would displace at least 6 million people and flood 4,500 km² of farmland.[37]

Climate events, on the other hand, are sudden and dramatic hazards such monsoon floods, glacial lake outburst floods, storms, hurricanes and typhoons. These force people off their land much more quickly and dramatically. Hurricanes Katrina and Rita, for example, which lashed the Gulf Coast of the United States in August and September 2005 left an estimated 2 million people homeless.[38] The 2000 World Disasters Report estimated that 256 million people were affected by disasters (both weather-related and geo-physical) in the year 2000, up from an average of 211 million per year during the 1990s – an increase the Red Cross attributes to increased 'hydro-meteorological' events.[39]

Non-climate drivers

Equally important though are the non-climate drivers. It is clear that many natural disasters are, at least in part, 'man-made'. A natural hazard (such as an approaching storm) only becomes a 'natural disaster' if a community is particularly *vulnerable* to its impacts. A tropical typhoon, for example, becomes a disaster if there is no early-warning system, the houses are poorly built and people are unaware of what to do in the event of a storm. A community's vulnerability, then, is a function of its *exposure* to climatic conditions (such as a coastal location) and the community's *adaptive capacity* (the capacity of a particular community to weather the worst of the storm and recover after it).

Different regions, countries and communities have very different adaptive capacities: Pastoralist groups in the Sahel, for example, are socially, culturally and technically equipped to deal with a different range of natural hazards than, say, mountain dwellers in the Himalayas.[40] Farmers in Africa may be particularly vulnerable. More than 70 percent of Africans are reliant on agriculture for their livelihoods, which is mainly rain-fed. Though the growth of some crops may be boosted by the 'fertilization effect' of more atmospheric CO_2, it is likely that the effects of heat and drought will more than cancel out any such benefits.[41]

National and individual wealth is one clear determinant of vulnerability – enabling better disaster risk reduction, disaster education and speedier responses. In the decade from 1994 to 2003 natural

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[36] De Wit, M. & Stanjiewicz, J. (2006) *"Changes in surface water supply across Africa with predicted climate change"* Scient, Vol.311, 31st March 2006 cited in Tearfund (2006), p. 15

[37] Nicholas Stern (ed.) (2006) *"The Economics of Climate change: the Stern review",* Cambridge University Press, Cambridge

[38] S. Hsu, *(2006) "*2 Million Displaced By Storms", *Washington Post,* 16th January 2006, http://www.washingtonpost.com/wp-dyn/content/article/2006/01/12/AR2006011201912.html accessed 3 April 2007

[39] Ward, Christina, (2001) *"World Disasters Report Calls for Improved Aid Programs"* http://www.redcross.org/news/in/ifrc/010702disreport.html accessed 2007

[40] Ced Hesse & Lorenzo Cotula, *"Climate change and pastoralists: investing in people to respond to adversity",* Sustainable Development Opinion, 2006, IIED, London

[41] Tearfund, (2006) *"Feeling the Heat: why governments must act to tackle the impact of climate change on global water supplies and avert mass movement of climate change refugees"*, London, p. 13

disasters in countries of high human development killed an average of 44 people per event, while disasters in countries of low human development killed an average of 300 people each.[42]

On a national scale, Bangladesh has very different adaptive capacities and disaster resilience to the United States. In April 1991 Tropical cyclone Gorky hit the Chittagong district of south-eastern Bangladesh. Winds of up to 260 kilometres per hour and a six metre high storm surge battered much of the country killing at least 138,000 people and leaving as many as 10 million people homeless.[43] But the following year in August 1992, a *stronger* storm, the category five Hurricane Andrew, hit Florida and Louisiana with winds of 280 kilometres per hour and a 5.2 metre storm surge but, while it left $43 billion in damages in its wake, it caused only 65 deaths.[44]

Climate change will challenge the adaptive capacities of many different communities, and overwhelm some, by interacting with and exacerbating existing problems of food security, water scarcity and the scant protection afforded by marginal lands. At some point that land becomes no longer capable of sustaining livelihoods and people will be forced to migrate to areas that present better opportunities.

We can draw out four broad categories of forced climate migration:[45]

1. Those temporarily displaced because of a natural disaster such as a hurricane or flood, and who will likely return to their original homes.
2. Those permanently displaced because of permanent changes to their habitat, such as sea-level rise.
3. Those temporarily displaced as an adaptive response to increasing climate stress, and who will likely return to their original homes.
4. Those permanently displaced because their original habitat no longer provides for their basic needs.

The 'tipping points' will vary from place to place and from individual to individual. Natural disasters might displace large numbers of people for relatively short periods of time, but the slow-onset drivers are likely to displace permanently many more people in a less headline grabbing way.

Population, poverty and governance are key variables

But non-climatic drivers remain a key variable. It is, after all, population growth, income distribution and government policy that push people to live on marginal lands in the first place. In other words a community's vulnerability to climate change is not a constant – it can be increased or decreased for reasons that have nothing to do with greenhouse gas emissions.[46] In this sense the non-climatic drivers (that put vulnerable people in marginal situations) can be as important a determinant of the problem as the strength of the 'climate signal' itself.

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[42] Natural disasters here include both hydro-meteorological disasters and geo-physical ones. However the former outnumber the latter nine to one in frequency. IFRC (2004) *"World Disasters Report 2004: focus on community resilience",* chapter 8, http://www.ifrc.org/publicat/wdr2004/chapter8.asp accessed 20 April 2007

[43] National Oceanic and Atmospheric Administration, *"NOAA's Top Global Weather, Water and Climate Events of the 20th Century"* http://www.noaanews.noaa.gov/stories/images/global.pdf accessed 20 April 2007

[44] In inflation adjusted and wealth normalised 2004 USD. National Oceanic and Atmospheric Administration, http://www.aoml.noaa.gov/hrd/tcfaq/costliesttable3.html accessed 21 April 2007

[45] Loosely modelled on the work of El Hinnawi (1985) as cited in Lonergan, S. (1998), "The role of environmental degradation in population displacement", *Environmental Change and Security Project Report*, Issue 4 (Spring 1998): p. 9

[46] Roger Pielke, Gwyn Prins, Steve Rayner & Daniel Sarewitz (2007) "Lifting the taboo on adaptation: renewed attention to policies for adapting to climate change cannot come too soon" in *Nature*, Vol. 445, 8th February 2007, p. 597

Migration, even forced migration, is not usually just a product of an environmental 'push' from a *climate process* like sea level rise or salinization of agricultural land. Except in cases of *climate events*, where people flee for their lives, it does require some kind of 'pull': be it environmental, social or economic. There has to be the hope of a better life elsewhere, however much of a gamble it might be. Past environmental migratory movements, such as in the US Dust Bowl years in the 1930s (see page 15), suggest that being able to migrate away from severe climatic conditions, in this case prolonged drought, required would-be migrants to have some 'social and financial capital' such as existing support networks in the destination area and the funds to be able to move. [47]

It also should be mentioned, and this is absent from much of the campaigning literature, that climate change will make some places *better able* to sustain larger populations. This is particularly reflected in predictions for less severe total temperature rises i.e. 2-3 degrees Celsius over the 21st century rather than rise of 4-5 degrees or more. This is for three main reasons. First, higher temperatures will likely extend growing seasons and reduce frost risk in mid- to high-latitude areas such as Europe, Australia and New Zealand and make new crops viable (already vineyards are spreading north in Britain).[48] Second, the 'fertilization effect' of more CO^2 in the atmosphere is predicted to increase crop yields and the density of vegetation in some areas.[49] And third, altered rainfall patterns mean that rain might increase in areas previously suffering water stress. A 2005 study, for example, predicts that a warmer north Atlantic and hotter Sahara will trigger more rain for the Sahel.[50]

In other words, climate change might provide both 'push' and 'pull' for some population displacement. This is not to downplay the seriousness of climate change: above 4 or 5 degrees the predicted impacts of climate change become more universally negative.[51] But it is to make that point that the role of climate change in population displacement is not a linear relationship of cause and effect, of environmental 'push' and economic 'pull'.

As Steve Lonergan of the University of Victoria, Canada, noted in 1998, "there is too often an uncritical acceptance of a direct causal link between environmental degradation and population displacement. Implicit in these writings is the belief that environmental degradation—as a possible cause of population displacement—can be separated from other social, economic or political causes. It must be recognized that the degradation of the environment is socially and spatially constructed; only through a structural understanding of the environment in the broader political and cultural context of a region or country can one begin to understand the "role" it plays as a factor in population movement".[52]

Intuitively we can see that climate change will play a role in future movements of people. But putting empirically sound figures on the extent of the problem is complex. And it is hard to persuade decision makers to take the issue seriously without being able to wave concrete figures in front of them. This is the subject of the next section.

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[47] McLeman, Robert & Smit, Barry (2005) "Assessing the security implications of climate change-related migration", presentation to workshop on *Human Security and Climate Change*, 21-23 June 2005, Oslo, pp. 8-9

[48] IPCC (2007) *"Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability",* April 2007, p. 8

[49] USGCRP (2000) *"Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change. Overview: Agriculture",* US Global Change Research Program, http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overviewagriculture.htm accessed 2007

[50] Martin Hoerling et al. (2006) "Detection and Attribution of Twentieth-century Northern and Southern African rainfall change", *Journal of Climate*, Volume 19, Issue 16, August 2006, pp. 3989-4008

[51] IPCC (2007) *"Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability",* April 2007, p. 8

[52] Steve Lonergan (1998), "The role of environmental degradation in population displacement", *Environmental Change and Security Project Report*, Issue 4 (Spring 1998): p. 8

3/. Predictions

'Prediction is very difficult, especially about the future.'
Niels Bohr, *Danish physicist (1885 - 1962)*

Climate migration is not new
Archaeological evidence suggests that human settlement patterns have responded repeatedly to changes in the climate.[53,54] There is evidence that the emergence of the first large, urban societies was driven by a combination of climatic and environmental desiccation. The complex societies of Egypt and Mesopotomia, for example, emerged as people migrated away from desiccating rangelands and into riverine areas. The resulting need to organise densely packed populations in order to manage scarce resources in restricted areas has been identified as one of the main driving forces behind the development of the first civilisations.[55]

Much later, during the fourth century CE, growing aridity and frigid temperatures from a prolonged cold snap caused the Hun and German hordes to surge across the Volga and Rhine into milder Gaul and eventually led to the sack of Rome by the Visigoths. Likewise, the eight-century Muslim expansion into the Mediterranean and southern Europe was, to some extent, driven by drought in the Middle East.[56]

Existing patterns of climate migration
Migration is (and always has been) an important mechanism to deal with climate stress. Pastoralist societies have of course habitually migrated, with their animals, from water source to grazing lands in response to drought as well as part of their normal mode of life.

Temporary migration in times of climate stress can help top-up a family's income (through remittances from paid work elsewhere) and reduce the draw on local resources (fewer mouths to feed). In western Sudan, for example, studies have shown that one adaptive response to drought is to send an older male family member to Khartoum to try and find paid labour to tide the family over until after the drought.[57]

But the picture is nuanced. In West Africa, the distance that people migrate is a function of their family's resources; in really bad drought years they can not afford to travel far and instead try to find paid work in local cities (see Box 2).

The ability to migrate is also a function of mobility. In the 1930s Dustbowl Years in the US migrants from the Great Plains tended to be tenant farmers without strong ancestral or financial ties to the land (see Box 3).[58]

Nor are the poorest necessarily the first to migrate. The decision to migrate is normally taken at a household level (unless the state is clearing an area) – and relies on individual calculations of social

[53] Robert McLeman & Barry Smit (2006) "Migration as an adaptation to Climate Change", *Climate Change,* 2006.
[54] Nick Brooks (2006) *"Climate Change, drought and pastoralism in the Sahel",* Discussion note for the World Initiative on Sustainable Pastoralism, November 2006
[55] Nick Brooks (2006) *"Climate Change, drought and pastoralism in the Sahel",* Discussion note for the World Initiative on Sustainable Pastoralism, November 2006
[56] Dupont, Alan & Pearman, Graeme (2006) *"Heating up the Planet: Climate Change and Security"*, Lowry Institute for International Policy, Paper 12, Sydney, p. 1
[57] Robert McLeman & Barry Smit (2004) *"Climate change, migration and security",* Canadian Security Intelligence Service, Commentary No. 86, Ottawa, p. 8
[58] McLeman, Robert & Smit, Barry (2005) "Assessing the security implications of climate change-related migration", presentation to workshop on *Human Security and Climate Change*, 21-23 June 2005, Oslo, pp. 8-9

and financial capital (see Box 3). In other words, the people most vulnerable to climate change are not always the ones most likely to migrate.[59]

Box 2. Temporary labour migration in West Africa

In the West African Sahel recent studies have cast light on the use of temporary migration as an adaptive mechanism to climate change. The region has suffered a prolonged drought for much of the past three decades.[60] One way that households have adapted is by sending their young men and women in search of wage labour after each harvest. But *how far* they go depends on the success of the harvest.

A good harvest might give the family sufficient resources to send a member to Europe in search of work. While the potential rewards in terms of remittances are high, it is a highly speculative gamble – in addition to dangerous journey, the rewards are uncertain. In addition the chances are the migrant will not be back in time for the next year's planting.

But in drought year, when harvests are poor, the young men and women tend to stay much closer to home, instead travelling to nearby cities for paid work so as to reduce the drain on the household's food reserves and top-up household income. In such years the risk of losing the 'migration gamble' is simply too great.[61]

Migration, especially when it is a response to slower acting climate processes (rather than a sudden climatic event like a hurricane), requires access to money, family networks and contacts in the destination country. But even in the most extreme, unanticipated natural disasters – migrants, if they any choice, tend to travel along pre-existing paths – to places where they have family, support networks, historical ties and so on.

Of course most people displaced by environmental causes will find new homes within the boundaries of their own countries (as they are not fleeing their own government). Evacuees from Hurricanes Rita and Katrina did not stream across the border to Mexico but instead typically found temporary refugee with family members elsewhere in the country.[62]

The image of a coastal farmer getting inundated by rising sea levels and being forced to pack up and move to a rich country simply is not born out by experience. The 2004 Asian Tsunami, for example, killed more than 200,000 people and displaced twice as many. But those people were largely not displaced to OECD countries. Instead the burden of displacement (and of providing for evacuees) is overwhelmingly born by the local region.

And those who cannot, or choose not to, find new homes within their own country tend to seek refuge in places where they have existing cultural or ethnic ties. So Bangladeshis would seek refuge in India or Pakistan, Indonesians from Sumatra would look to Malaysia and so on.[63] Likewise, inter-continental migration is most likely to follow pre-existing paths and old colonial relationships. So the United Kingdom might be an obvious destination for Pakistanis and Bangladeshis, France for would-

[59] Robert McLeman & Barry Smit (2004) *"Climate change, migration and security",* Canadian Security Intelligence Service, Commentary No. 86, Ottawa, p. 10

[60] Science Daily (1999), "Jet Stream Studied in West African Drought", Penn State, 9th June 1999, http://www.sciencedaily.com/releases/1999/06/990607072120.htm accessed 21April 2007

[61] McLeman, Robert (2006) "Global Warming's huddled masses", *The Ottawa Citizen,* 23rd November 2006

[62] Peter Grier (2005) "The Great Katrina Migration", *The Christian Science Monitor*, 12th September 2005 http://www.csmonitor.com/2005/0912/p01s01-ussc.html accessed 3 April 2007

[63] Dupont, Alan & Pearman, Graeme (2006) *"Heating up the Planet: Climate Change and Security"*, Lowry Institute for International Policy, Paper 12, Sydney, p. 59

be migrants from Francophone West Africa and Australia and New Zealand for some groups in the South Pacific.

Box 3. The Dust Bowl Years

During the 1930s, multiple years of below-average rainfall and above-average temperatures in the Great Plains of the United States coincided with a nation-wide economic slump (the Great Depression) and resulted in the widespread failure of small farms, particularly those on marginal lands. It is believed that up to 300,000 'Okies' left the region during the 'Dust Bowl' decade– many of them migrating to California.[64]

Migrants to California from the Great Plains mostly consisted of intact nuclear families of above-average education, from a range of occupational backgrounds, and who had extended family support waiting for them in California. They also tended to be tenant farmers without the same ancestral investment in their land as landowners.[65]

In short, people have had to move for environmental reasons for thousands of years. But recent examples provide useful, albeit sobering, analogues for the likely impact of future climate change. The 1998 monsoon floods in Bangladesh brought some of the worst flooding in living memory, inundating two-thirds of the country for two months, devastating its infrastructure and agricultural base and leading to fears about the country's long-term future in a world of higher ocean levels and more intense cyclones.[66] The floods left an estimated 21 million people homeless.[67] Meanwhile the Yangtze floods of the same year temporarily displaced an estimated 14 million people and triggered the largest ever peace-time deployment of the People's Liberation Army to provide humanitarian aid and rebuild critical infrastructure.[68]

However, it is one thing to reflect on past and present climate-triggered population movements and quite another to predict accurate figures for future population displacement.

The problem of prediction

Although meteorological science and climate modelling techniques have progressed dramatically over the past decade, we still cannot accurately predict the impact of climate change on our weather systems. Amongst much else there is uncertainty about the way rainfall patterns will change and continuing debate on whether global warming will lead to more frequent and fierce hurricanes.[69]

So far, and quite understandably, the focus of the scientific community has been on establishing the extent and nature of anthropogenic climate change. Less time and energy has gone into predicting the impact of future climate change on human societies in any more than the most general terms. The complex interactions between different meteorological and social factors make cause and effect models tricky and often inappropriate. Consequently, the figures that analysts have produced to date

[64] Robert McLeman & Barry Smit (2004) *"Climate change, migration and security",* Canadian Security Intelligence Service, Commentary No. 86, Ottawa, p. 7

[65] McLeman, Robert & Smit, Barry (2005) "Assessing the security implications of climate change-related migration", presentation to workshop on *Human Security and Climate Change*, 21-23 June 2005, Oslo, pp. 8-9

[66] Dupont, Alan & Pearman, Graeme (2006) *"Heating up the Planet: Climate Change and Security"*, Lowry Institute for International Policy, Paper 12, Australia, pp.45-46

[67] UNICEF (2004) http://www.unicef.org/infobycountry/bangladesh_22473.html accessed 10 April 2007

[68] Dupont, Alan & Pearman, Graeme (2006) *"Heating up the Planet: Climate Change and Security"*, Lowry Institute for International Policy, Paper 12, Sydney, p. 45

[69] Pew Centre on Global Climate Change, *"Hurricanes and global warming"* http://www.pewclimate.org/hurricanes.cfm accessed 10 April 2007

are little more than well-educated guesswork. Developing more solid predictions will require a lot of hard number-crunching that is only really starting now.[70]

These predictions are complicated by three factors:

- First, forced climate change migration will take place against unprecedented and dramatic shifts in the world's population. The global population is currently growing at a rate of 1.1 percent and is predicted to reach 9.075 billion by 2050 (from its 2005 level of 6.54 billion). Meanwhile, there is an accelerating move to urban areas. Already 49 percent of the world's population lives in cities, and the growth rate of the urban population is nearly double (2 percent) that of total population growth.[71]

  These trends are even more pronounced in low and middle-income countries. Between 2005 and 2010 Burundi, for example, is expected to have a population growth rate of 3.7 percent and an urban growth rate of 6.8 percent.[72] Meanwhile, the Sahelian region of Northern Nigeria, perhaps the area of the country most susceptible to climate change, is already characterised by high population growth (about 3.1 percent) and rapid urbanisation (about 7 percent).[73] Clearly it would be absurd to attribute the entire urban drift to climate change, but disaggregating what role climate change might play in added rural-urban migration is very hard.

- Second, we have no real base-line figure for current migratory movements. Nor is there much capacity in developing countries or the international community to gather this sort of data, particularly for internal migration. What limited capacity exists is focused on tracking cross-border migration. Given that a majority of forced climate migrants will stay within their own borders (see page 13) the machinery to collect data on these movements simply does not yet exist.

- Third, what happens in the second half of the twenty-first century depends to a great extent on what we do today. Until 2050 the degree of inertia in the climate system that means that climate change over the next fifty years is largely predetermined.[74] However, the extent and nature of climate change after then is reliant on current emissions. Consequently, many analysts think that it is highly speculative to try to push predictions past 2050.[75]

The Climate Canaries

Nonetheless, there has been a somewhat breathless competition in the world's media to find the first conclusive 'victims' of climate change – who, like a miner's canary, will mark the beginning of a period of irreversible climate impacts.

Four cases have been quite extensively highlighted in the past few years: the Cartaret islands in Papua New Guinea, the residents of Lateu village in Vanuatu, the relocation of Shishmaref village on Sarichef island in Alaska, and the submergence of Lohachara island in India's Hooghly river.

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[70] Debbie Hemming, Hadley Centre for Climate Change, personal communication

[71] UNFPA (2006) *"State of the World Population, 2006",* United Nations Population Fund, New York, p. 98

[72] UNFPA (2006) *"State of the World Population, 2006",* United Nations Population Fund, New York, p. 98

[73] Anthony Nyong, Charles Fiki & Robert McLeman (2006) "Drought-related conflicts, management and resolution in the West African Sahel: Considerations for Climate change: Considerations for Climate Change Research" in *Die Erde*, vol. 137, issue 3, pp. 229

[74] IISD (2001) *"Summary of the Eighteenth Session of the Intergovernmental panel on climate change: 24-29 September 2001"* Vol. 12 No. 177, 2 October 2001, http://www.iisd.ca/vol12/enb12177e.html accessed 15 April 2007

[75] Norman Myers, personal communication

In 2005 it was officially decided to evacuate the 1,000 residents of the Carteret Islands, a group of small and low-lying coral atolls administered by Papua New Guinea. Storm-related erosion and salt water intrusion had rendered the population almost entirely dependent on outside aid. Ten families at a time will now be moved to the larger island of Bougainville, 100 kilometres away.[76]

A second group of about a hundred residents of Lateu, on the island of Tegua on Vanuatu, were relocated farther inland, again following storm-damage, erosion and salt damage to their original village. In both cases, the declaration of their status as 'the first climate change refugees' was timed to coincide with the United Nations Climate Convention meeting in November 2005.[77]

Shishmaref village lies on Sarichef island just north of the Bering strait. A combination of melting permafrost and sea-shore erosion, at a rate of up to 3.3 metres a year, have forced the inhabitants to relocate their village several kilometres to the south.[78] It is thought that climate change has directly exacerbated the sea-erosion by thinning the sea ice which used to take the force out of local tides and currents.

In December 2006 there were widespread reports of the first submergence of an inhabited island due to climate change. Researchers reported that Lohachara island in the Hooghly river delta, once home to 10,000 people, and which had first started flooding 20 years ago, had finally been entirely submerged. One of a number of vanishing islands in the delta, the loss of the islands and other coastal land in the delta has left thousands of people homeless. [79]

However, in the interests of balance, its worth noting that there is little scientific consensus that these four cases are definitively the result of anthropogenic climate change. In the case of the Carteret Islands, Fred Terry, director of the UNDP's programme in Bougainville argues that dynamite fishing has destroyed the natural protection offered by the reef. Natural subsidence and tectonic movement might also explain the islands' inundation. In fact plans to evacuate the residents have been discussed since the early 1980s, but were interrupted by the war on the neighbouring Papua New Guinean island of Bougainville.[80] Likewise, Lohachara island, a sandbar in the Hooghly delta, was eroded by river currents, weakened by mangrove destruction, and submerged by tectonic titling and local subsidence.[81]

The urge to grab the headlines has tended to obscure the fact that we know that climate variation has influenced human population distribution for thousands of years. So far the publicised examples of forced migration caused by anthropogenic climate change are more anecdotal than empirical, affecting a few hundred or thousand people at a time.

The evidence for a distinctively anthropogenic 'climate change signal' in forced migration is circumstantial, but it is mounting. And with all available scenarios predicting accelerating climate change impacting growing populations and more people living on marginal land, forced climate migration is certain to increase. The important questions are; By how much? And with what implications for development?

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[76] John Vidal, "Pacific Atlantis: first climate change refugees", *The Guardian,* London, 25th November 2005

[77] McLeman, Robert & Smit, Barry (2006) *"Changement climatique, migrations et sécurité"* Les Cahiers de la sécurité 63(4), 95-120

[78] Artic change *"Human and economic indicators – Shishmaref island"* http://www.arctic.noaa.gov/detect/human-shishmaref.shtml accessed 10 April 2007

[79] http://news.independent.co.uk/environment/article2099971.ece accessed 15 April 2007

[80] John Vidal, (2005) "Pacific Atlantis: first climate change refugees", the Guardian, 25th November 2005. http://www.countercurrents.org/cc-vidal251105.htm accessed 18 April 2007

[81] http://timblair.net/ee/index.php/weblog/island_erased/ accessed 18 April 2007

The Good, the Bad and the (very) Ugly: Climate migrant scenarios

The impact of climate change as a driver of future forced migration depends on several factors:

1. the quantity of future greenhouse gas emissions;
2. the rate of future population growth and distribution;
3. the meteorological evolution of climate change;
4. the effectiveness of local and national adaptation strategies.

The IPCC has devised a series of scenarios, called the Emission Scenarios of the IPCC Special Report on Emission Scenarios (or SRES for short), which set out a range of different future emissions scenarios varied according to demographic, technological and economic developments.

There are six basic 'storylines'; each of which aggregates different rates of population and economic growth as well as the future 'energy mix'. For reference these storylines are described in Annex 1 (page 31). They range from the most greenhouse gas intensive (A1F1 – where energy is mostly derived from fossil fuels and economic growth is rapid) to the less intensive B1 storyline (where the world economy moves towards less resource intensity and cleaner technology). All the scenarios assume no additional climate change initiatives such as the emissions targets under the Kyoto protocol.

We can use three of the SRES scenarios as starting points here to imagine three *highly speculative* scenarios for future climate-induced migration:[82]

The Good

The first (B1) is the best case scenario. Its impact is relatively low but so also is its likelihood. The B1 storyline describes a world whose population peaks mid-century around 9 billion and declines thereafter towards 7 billion. There is a rapid change in economic structures towards a service and information economy with a reduction in material intensity and the introduction of clean and resource efficient technologies. "The emphasis is on global solutions to economic, social and environmental sustainability, including improved equity, but without additional climate initiatives".[83]

In addition (and this is where this scenario diverges from the B1 storyline) we can imagine that a serious post 2012 regime is put in place by the international community to reduce carbon emissions. The BRIC countries (Brazil, Russia, India and China) join as full members and work to cut their own emissions. Atmospheric concentrations of CO_2 stabilise around 600ppm by end of century leading to temperature rise over the century of around 1.8 degrees and sea level rise of from 18 to 38 cms.[84] In addition a 'Marshall plan' for adaptation helps countries deal with the worst impacts of climate change.

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[82] Warning: the following scenarios aggregate the scientific models for future climate change with international action on emissions reduction and some of the emerging models on specific impacts on coastal flooding and crop yields. They make no pretence at being scientific and are meant only to be indicative. They are compiled from existing models and interviews with analysts and experts. An important caveat that should be born in mind with the SRES storylines and many of the numerical predictions of future climate change migrants is that, for clarity, they generally assume that people do nothing to manage long-term climate processes or build resilience to short-term climate events (see Annex 2, page 32)

[83] IPCC (2007) *"Climate Change 2007: The physical science basis – Summary for Policy Makers",* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Paris, February 2007, p. 14

[84] IPCC (2007) *"Climate Change 2007: The physical science basis – Summary for Policy Makers",* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Paris, February 2007, p. 10

Nonetheless, according to the Stern report, such a temperature rise would still lead to a 20-30 percent decrease in water availability in some vulnerable regions such as Southern Africa and the Mediterranean countries. It would also result in declining crop yields in tropical regions. In Africa crop yields could be cut by between 5 to 10 percent.[85] Meanwhile up to 10 million more people would affected by coastal flooding each year.[86] The Hadley Centre estimates, for the B1 scenario (i.e. without additional emissions targets), the numbers of people flooded per year would be 18 million by 2030, 42 million by 2050, and 165 million by 2100.[87]

In this case the headline figure for climate migration (the 200 million 'climate refugees' by 2050) might, in hindsight, seem like an exaggeration. Instead we could expect increased migration of between five and ten percent along existing routes (see page 13). There would be increased rural urban migration but it would prove largely manageable, if not indistinguishable, within existing patterns of migration.

The Bad

Our second scenario uses the 'A1B' storyline as its starting point. A1B envisages a world of very rapid economic growth, with a global population that peaks mid century and declines thereafter, and as well as the swift up-take of new and more efficient technologies. The scenario predicts economic convergence among regions, increased social and cultural interactions and a substantial reduction in regional differences in per capita income. In this scenario the world's energy is sourced from a balance between fossil intensive and non-fossil energy sources.[88]

We can imagine that international efforts to reduce greenhouse gas emissions are delayed, patchy and not particularly effective. Some effort and funds are invested into adaptation, but not enough.

The estimate for temperature rise over the 21st century for the A1B storyline is 2.4ºC (with a likely range from 1.7ºC to 4.4ºC). Atmospheric concentrations of CO_2 by the end of the century are 850 ppm (three times pre-industrial levels).[89]

With higher temperatures the practical implications of climate change are much greater. Under this scenario sea level rise would be between 21cm and 48cm and precipitation in sub-tropical areas would fall by up to 20 percent.[90] According to the Stern report, a 3ºC temperature rise would mean one to four billion people would suffer water shortages and between 150 to 550 additional million people would be at risk of hunger. On the other hand some areas would gain unwelcome water with between 11 and 170 million additional people affected by coastal flooding each year.[91]

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[85] Nicholas Stern (ed.) (2006) *"The Economics of Climate change: the Stern review",* Cambridge University Press, Cambridge, p. 57

[86] Nicholas Stern (ed.) (2006) *"The Economics of Climate change: the Stern review",* Cambridge University Press, Cambridge, p. 57

[87] Hemming, D. et. al, (2007?) *"Impacts of mean sea-level rise based on current state-of-the-art modeling"*, Hadley Centre for Climate Prediction and Research, Exeter

[88] IPCC (2007) *"Climate Change 2007: The physical science basis – Summary for Policy Makers",* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Paris, February 2007, p. 14

[89] IPCC (2007) *"Climate Change 2007: The physical science basis – Summary for Policy Makers",* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Paris, February 2007, p. 14

[90] IPCC (2007) *"Climate Change 2007: The physical science basis – Summary for Policy Makers",* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Paris, February 2007, p. 11-12

[91] Nicholas Stern (ed.) (2006) *"The Economics of Climate change: the Stern review",* Cambridge University Press, Cambridge, p. 57

Marginal lands would become increasingly uninhabitable, with dramatic increases in internal rural to urban migration and also emigration to richer countries, particularly of young, skilled people. Meanwhile, millions of people would be temporarily displaced by individual extreme weather events.

The Ugly

The third scenario uses the A1F1 storyline as its starting point. A1F1 is similar to A1B in that it forecasts rapid economic growth and a global population that peaks mid-century and falls thereafter. However, unlike A1B, energy in the A1F1 world continues to be overwhelming sourced from fossil-fuel supplies – and is a 'business as usual scenario' without any Kyoto emission reductions or serious attempts at adaptation.[92] On this trend, atmospheric concentration of CO^2 by 2099 will be 1,550ppm: five times more than pre-industrial levels and four times current levels.

Such CO_2 levels would result in a temperature rise over the century of 4.0ºC (with a likely range from 2.4ºC to 6.4ºC) and sea level rise from 29cm to 59cm.[93] According to the Stern report a temperature rise of 4.0ºC would result in a 30 to 50 percent decrease in water availability in Southern Africa and Mediterranean. Agricultural yields would decline by 15 to 35 percent in Africa and entire regions, such as parts of Australia, would fall out of production.[94] The Hadley centre, using a similar emissions scenario to A1F1 but with somewhat higher population growth forecast (the SRES A2) predict that the number of people flooded rises to 21 million per year by 2030, 55 million per year by 2050, and 370 million per year by 2100.[95]

Under this scenario predictions of 200 million people displaced by climate change might easily be exceeded. Large areas of Southern China, South Asia and the Sahelian region of sub-Saharan Africa could become uninhabitable on a permanent basis. Climate forced migration would be unmistakeable with tens of millions of people at a time displaced by extreme weather events, such as floods, storms and glacial lake outburst floods, and many millions more displaced by climate processes like desertification, salinisation of agricultural land and sea-level rise.

The above scenarios all assume a roughly linear evolution of climate change. But the picture would change again in the case of abrupt climate change such as the collapse of the Gulf Stream or melting of the Greenland or Antarctic ice sheets. The IPCC estimates that the elimination of the Greenland ice sheet would lead to a contribution to a sea level rise of about 7m.[96] The Stern report estimated that the melting or collapse of the ice sheets would raise sea levels and eventually threaten 4 million km^2 of land which is currently home to 5 percent (around 310 million people) of the world's population.[97]

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[92] IPCC (2007) *"Climate Change 2007: The physical science basis – Summary for Policy Makers",* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Paris, February 2007, p. 14

[93] All projections do not include uncertainties in carbon-cycle feedbacks which could increase or decrease the upper bounds of sea level rise: IPCC (2007) *"Climate Change 2007: The physical science basis – Summary for Policy Makers",* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Paris, February 2007, p. 11

[94] Nicholas Stern (ed.) (2006) *"The Economics of Climate change: the Stern review",* Cambridge University Press, Cambridge, p. 57

[95] Hemming, D. et. al, (2007?) *"Impacts of mean sea-level rise based on current state-of-the-art modeling"*, Hadley Centre for Climate Prediction and Research, Exeter

[96] IPCC (2007) *"Climate Change 2007: The physical science basis – Summary for Policy Makers",* Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Paris, February 2007, p. 13

[97] Nicholas Stern (ed.) (2006) *"The Economics of Climate change: the Stern review",* Cambridge University Press, Cambridge, p. 56

4/. Development implications

There is irony in the fact that it is the developing countries—the least responsible for emissions greenhouse gases—will be the most affected by climate change. If the situation with refugees from war and political persecution is any indication they will also bear the greatest burden of providing for forced climate migrants. For example, in 2000, the twenty countries with the highest ratios of official refugees had an annual per-capita income of just US$850.[98]

Assessing regional vulnerabilities

Numerically and geographically, South and East Asia are particularly vulnerable to large scale forced migration. This is because sea-level rise will have a disproportionate effect on their large populations living in low-lying areas. Six of Asia's ten mega-cities are located on the coast (Jakarta, Shanghai, Tokyo, Manila, Bangkok and Mumbai).[99] China, meanwhile, has 41 percent of its population, 60 percent of its wealth and seventy percent of its megacities in coastal areas.[100]

Millions more are vulnerable in Africa, particularly around the Nile Delta and along the west coast of Africa. Changed patterns of rainfall would have particularly serious impacts for food security in sub-Saharan Africa. According to the latest IPCC report reduced rainfall could lower crop yields by as much as 20 percent by 2020, leading to increased malnutrition.[101]

Small island states around the world are particularly vulnerable to sea level rise because in many cases (the Bahamas, Kiribati, the Maldives and the Marshal; Islands) much of their land is less than three or four metres above present sea level.[102] One 1999 analysis estimated that, by 2080, flood risk for people living in small island states will be 200 times greater than if there had been no global warming.[103] Other island states tend to have high levels of development and high density population around their coasts. Half the population of the Caribbean, for example, lives within 1.5km of the shoreline.[104]

Forced migration and development

Over the short term, climate change forced migration will make the Millennium Development Goals (MDGs) harder to achieve.[105] Over the long term, it is foreseeable that large scale climate change migration could roll back some of the progress that has been made so far. Particularly threatened is the uninterrupted provision of the education and health services that underlie goals 2 (universal

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[98] Norman Myers (2005) "Environmental Refugees: An emergent security issue", 13th Economic Forum, May 2005, Prague 23-27 May 2005

[99] Dupont, Alan & Pearman, Graeme (2006) *"Heating up the Planet: Climate Change and Security"*, Lowry Institute for International Policy, Paper 12, Sydney, p. 58

[100] Zhao Xinhgshu (2007) 'Climate security in Asia: perception and reality', presentation at the RUSI Conference on *Climate Security in Asia*, 24th April 2007

[101] IPCC (2007) '*Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability'*, April 2007, p. 10

[102] IPCC (1997) *"Regional impacts of Climate Change: summary for policy makers",* http://www.grida.no/climate/ipcc/regional/513.htm accessed 20 March 2007

[103] R. Nicholls, F. Hoozemans & M. Marchand, (1999) "Increasing flood risk and wetland looses due to global sea-level rise: regional and global analyses", *Global Environmental Change* 9 (suppl) cited in Dupont, Alan & Pearman, Graeme (2006) *"Heating up the Planet: Climate Change and Security"*, Lowry Institute for International Policy, Paper 12, Sydney, p. 47

[104] Nicholas Stern (ed.) (2006) *"The Economics of Climate change: the Stern review",* Cambridge University Press, Cambridge, p. 77

[105] UNDP, *"Climate change and the MDGs"* http://www.undp.org/gef/adaptation/dev/02a.htm accessed 3 April 2007

primary education) and goals 4 and 5 (reducing child and maternal mortality and combating HIV/Aids, malaria and other diseases).

Forced migration hinders development in at least four ways; by increasing pressure on urban infrastructure and services, undermining economic growth, increasing the risk of conflict and leading to worse health, educational and social indicators among migrants themselves.

What impact climate change migration ultimately has on development depends, of course, on which of the above storylines (page 18) plays out: it is clear that 200 million people displaced by climate change would be much more detrimental to development than 10 million. There is also a large difference in development outcomes between those displaced by long-term climate processes (sea level rise) and short-term climate events (storms). Aggregated figures for forced climate migration mask this distinction.

1/. The urban flood

Increasing food and water scarcity due to climate change in rural areas will accelerate the dramatic rural-urban drift in the developing world. Urban areas offer access to the cash economy (rather than subsistence farming) and can make it easier to provide services. However, rapid and unplanned urbanisation has serious implications for urban welfare and urban service provision.

Already, one third of the world's urban population, about one billion people, lives in slums: in poor quality housing with limited clean water, sanitation and education services.[106] By 2030 it is estimated that this number will rise to 1.7 billion people.[107] High population densities and high contact rates help to spread disease, while health and education services are often inadequate. In India, for example, unplanned urbanisation has been associated with the spread of dengue fever.[108]

2/. Hollowed economies

Mass migration disrupts production systems and undermines domestic markets. In addition, the loss of 'human capital' in the form of the labour force and investment in education undermines economic growth. This can establish a self-reinforcing of limited economic opportunity that contributes to future migration.

The 'brain drain' effect from developing countries is already a serious problem. For example, in 2006 926 Ghanaian doctors were practicing in the OECD alone, representing a much-needed 29 percent of those still practising in Ghana.[109] Climate change could accelerate the brain drain as it is typically those with larger reserves of financial and social capital who are able to move away.

One of the legacies of the 1930s Dust Bowl case was that those who fled the drought were young, skilled families with some money and strong social networks – the very kind of people that are essential components of successful communities. "The places they left behind", says Carlton University's Robert McLeman, "became increasingly polarized between affluent property owners and an impoverished underclass, a downward spiral from which some communities never recovered.

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[106] UN-HABITAT. *"Urbanization: Facts and Figures."* http://www.unhabitat.org/mediacentre/documents/backgrounder5.doc accessed 22 March 2007

[107] Sclar, Elliott D., Pietro Garau and Gabriella Carolini. *The 21st Century Health Challenge of Slums and Cities. The Lancet*. Vol. 365, 5 March 2005. http://www.unmillenniumproject.org/documents/TheLancetSlums.pdf accessed 16 April 2007

[108] Shah, I., G.C. Deshpande, and P.N. Tardeja, 2004: "Outbreak of dengue in Mumbai and predictive markers for dengue shock syndrome". *J. Trop. Pediatrics*, 50, 301-305.

[109] UNECA (2006) *"International Migration and Development: implications for Africa"* A background document for the High Level Dialogue on Migration and Development, UN General Assembly, 14-15 September 2006, p. 2

Future climate-migration holds a similar potential to have negative long-term consequences for socio-economic stability in affected areas".[110]

3/. Political instability and ethnic conflict

Large scale population displacement will redraw the ethnic map of many countries, bringing previously separate groups into close proximity with each other and in competition for the same resources. In the context of poor governance, poverty and easy access to small arms these situations can easily turn violent. In Nigeria, 3,500 km² (1,350 square miles) of land are turning into desert every year, making desertification the country's leading problem. As the desert advances, farmers and herdsmen are forced to move, either squeezing into the shrinking area of habitable or forced into the already overcrowded cities.[111]

Large population movements are already recognised by the UN Security Council as constituting a potential threat to international peace and security, particularly if there are existing ethnic and social tensions.[112] According to John Ashton, the UK's climate change envoy, "Massive migrations, particularly in the arid or semi-arid areas in which more than a third of the world's people live, will turn fragile states into failed states and increase the pressure on regional neighbours – a dynamic that is already apparent in Africa".[113]

4/. Health impacts and welfare of forced migrants

Population displacement undermines the provision of vaccination programmes and medical care, making infectious diseases harder to deal with and more deadly. It is well documented that refugee populations suffer worse health outcomes than settled populations. Forced migrants, especially forced to flee quickly from climate events, are also at greater risk of sexual exploitation, human trafficking and sexual and gender-based violence.[114]

Forced migration in response to climate stresses can also spread epidemic disease. Visceral leishmaniasis (VL) is one example. VL is a widespread parasitic disease with a global incidence of 500,000 new human cases each year. In northeastern Brazil, periodic epidemic waves of VL, have been associated with migrations to urban areas after long periods of drought.[115]

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[110] McLeman, Robert & Smit, Barry (2006) *"Changement climatique, migrations et sécurité"* Les Cahiers de la sécurité 63(4), 95-120

[111] Lester, B. Brown (2004) *"Troubling New Flows of Environmental Refugees"*, Earth Policy Institute, January 28th 2004

[112] Francesco Sindico (2005) "Ex-post and ex-ante [Legal] Approaches to Climate Change – threats to the international community" *New Zealand Journal of Environmental Law*, Vol. 9: 209-238

[113] John Ashton & Tom Burke, (2005) "Climate change and global security", www.opendemocracy.net, 21st April 2005, pp. 1-2

[114] UNHCR (2003) *"Sexual and Gender-Based Violence against Refugees, Returnees and Internally Displaced Persons: Guidelines for prevention and response",* Geneva, 2003, p. 1

[115] Carlos Roberto Franke, Mario Ziller, Christoph Staubach, Mojib Latif, (2002) 'Impact of the El Niño Oscillation on Visceral Leishmaniasis, Brazil' *Emerging Infectious Diseases*, Vol. 8, No. 9, September 2002: pp 914-7

5/. Policy Responses

Heads in the sand

Despite the very serious development implications of large-scale forced climate migration the international capacity for dealing with it systematically is limited. And the appetite to take major steps is even less.[116] Forced climate migrants fall through the cracks of international refugee and immigration policy and are rarely provided for by the international community. There is no 'home' for climate migrants in the international system, both literally and figuratively.

Instead, there is a collective, and rather successful, attempt to ignore the scale of the problem. Until now the international community has largely focused on mitigating climate change by setting emissions targets for OECD countries and agonising about how to bring it new members to a post-Kyoto 2012 framework. More recently, greater attention has been paid to helping countries adapt to the impacts of climate change. But this approach to adaptation is fundamentally based on the idea of adapting 'in situ'. Migration is seen as a failure of adaptation.

Potential progress can be divided into three, quite distinct, areas. I say 'potential' here as there has not been real progress on any front - yet. First is the legal-political approach to expand the definition of a refugee under current international law. Second is the extent to which forced migration is being incorporated into current domestic plans for climate change adaptation. Third is whether the OECD countries are willing to open their 'immigration gate' to climate migrants.

5.1. Expanding the definition of a 'refugee'

There have been some attempts to broaden the existing definition of a political refugee to include those displaced for environmental reasons or to write a new convention that specifically protects such people.[117] The lack of an accepted definition of an environmental refugee means that, unless they're relocated by extreme weather events, their displacement does not trigger any access to financial grants, food aid, tools, shelter, schools or clinics.

This means that there is no structural capacity in the international system to provide for environmental migrants. Climate migrants are not recognised as a problem in any binding international treaty nor is there an international body charged with providing for climate migrants, or even counting them. Instead the default response of OECD donor countries to extreme weather events is to give humanitarian aid and invest in better early warning systems.

In 2005 the Director of the UN University Institute for Environment and Human Security, Janos Bogardi, argued, "there are well-founded fears that the number of people fleeing untenable environmental conditions may grow exponentially as the world experiences the effects of climate change and other phenomena. This new category of 'refugee' needs to find a place in international agreements. We need to better anticipate support requirements, similar to those of people fleeing other unviable situations".[118]

In August 2006 a meeting of NGOs and some affected countries was held in the Maldives to discuss how an expanded definition might be worked into international law. Inclusion within current refugee law would bring the existing weight of international law and precedent to act on the issue – and would trigger certain obligations on the part of other countries being forced to act refugees.

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[116] McLeman, Robert & Smit, Barry (2006) *"Changement climatique, migrations et sécurité"* Les Cahiers de la sécurité 63(4), 95-120

[117] See, for example, Friends of the Earth, Australia, (2005) "A citizen's guide to climate refugees", FOE,

[118] United Nations University (2005) *"As ranks of "Environmental Refugees" swell worldwide, calls grow for better definition, recognition, support",* UN Day for Disaster Reduction, 12th October 2005

However, since then the process has faltered and it is hard to foresee any realistic consensus on an expanded definition (see Box 1, page 6).[119]

5.2 Adaptation in affected countries

As climate change advances, individual countries will have to make a series of cost-benefit decisions on what they want to protect; building sea walls here, staging managed retreats from eroding shorelines there. The resources and foresight at the disposal of national politicians will define how much each country is affected by climate change, including how many of its population are forced to move.

Domestic policy remains a key variable in disaster risk reduction and population distribution (page 11). With the right kind of adaptation countries can reduce their vulnerability to the impacts of climate *events* and manage the evolution of climate *processes*. Cuba, for example, lies directly in a hurricane path but suffers less from hurricanes than its neighbours because of careful preparation, effective early warning systems and widespread storm education.

But few countries are putting any plans in place for the prospect of large-scale forced climate migration. The UNFCCC has supported the development of National Adaptation Programmes of Action (NAPA) which are supposed to help the LDCs identify and rank their priorities for adaptation to climate change.[120] However, none of the fourteen submitted so far (Bangladesh, Bhutan, Burundi, Cambodia, Comoros, Djibouti, Haiti, Kiribati, Madagascar, Malawi, Mauritania, Niger, Samoa, Sénégal) mentions migration or population relocation as a possible policy response.[121]

Of course migration may be the only possible adaptive response in the case of some of the Small Island and low lying states where rising seas will eventually flood large parts of the country. Andrew Simms of the New Economics Foundation points out that domestic level responses are, in some cases, an absurd proposition given that the national level might be under water.[122]

Migration is typically seen as a failure of adaptation, not a form of it (albeit as a worst case scenario). There are precedents though. Between 1984-5 the Ethiopian Government resettled tens of thousands of people from drought-stricken areas.[123] Two decades later the Asian Tsunami gave new impetus to plans in the Maldives to organise a 'staged retreat' from their outlying islands. The plan is to concentrate the islands' 290,000 residents on several dozen, slightly higher islands than the 200 islands that the population is currently spread across.[124]

5.3 Immigration policy in less affected countries

Another determinant of forced migration will be immigration policies in countries less affected by climate change, in particular the OECD countries. It was widely reported that New Zealand has agreed to accept the inhabitants of the South Pacific Island state of Tuvalu if and when climate change leaves their country uninhabitable.[125] However, this is an urban myth: New Zealand only accepts 75 Tuvaluans each year through the immigration service's Pacific Access Category which

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[119] Personal communication

[120] UNFCC, *"National Adaptation Programmes of Action"* http://unfccc.int/adaptation/napas/items/2679.php accessed 10 March 2007

[121] As of April 2007. Links to all the submitted NAPAs can be found here: http://unfccc.int/national_reports/napa/items/2719.php accessed 10 March 2007

[122] Cited in Saleemul Huq & Hannah Reid (2004) "Climate Change and Development – consultation on key researchable issues", IIED, London, p. 6

[123] Helmut Kloos and Adugna Aynalem (1989) "Settler migration during the 1984/85 resettlement programme in Ethiopia", *GeoJournal*, Vol. 19, No. 2, September 1989, pp. 113-127

[124] Christopher Torchia (2005) *"Maldives pushes ahead with relocation plan",* Associated Press, 28th February 2005

[125] Tearfund (2006), p.10

makes no reference to environmental degradation. No other country has yet been willing to set a precedent by explicitly accepting climate migrants under a refugee category.

Sweden is the only country even to get close. Swedish immigration policy mentions environmental migrants as a special category as a 'person in need of protection' who is unable to return to his native country because of an environmental disaster. However, the extent to which this includes climate change impacts has not yet been clarified. In the parliamentary text explaining the category a nuclear disaster is given as an example of an 'environmental disaster' whereas natural disasters are not specifically mentioned.[126]

However, there are increasing examples of immigration concessions for victims of natural disasters – albeit on an ad hoc basis. For example, in 2003 the US immigration service extended for two more years the Temporary Protection Status it granted to 80,000 Hondurans who had fled to the United States after the 1998 Hurricane Mitch which devastated large parts of Central America.[127] After the 2004 Tsunami the Swiss, Canadian and Malaysia temporarily suspended involuntary returns of failed asylum seekers to affected areas of India, Sri Lanka, Thailand and Indonesia. Likewise Australia put a high priority on processing temporary visas for victims and fast-tracking existing applications. The European Union, for its part, proposed offering temporary asylum to child victims of the disaster so as to allow them several months in Europe to recover from the trauma.[128]

Whether or not this adds up to an evolving norm of soft law is highly debateable, but it does show some 'greyness' at the edges of immigration policy. Some analysts are beginning to argue that immigration is a necessary element of global redistributive justice and an important response to climate change; that greenhouse gas emitters should take an allocation of climate migrants in proportion to their historical emissions. Andrew Simms of the New Economics Foundation argues, "'"Is it right that while some states are more responsible for creating problems like global climate change, all states should bear equal responsibility to deal with its displaced people?".[129]

There is a dilemma here. Relaxing immigration rules as part of a concerted policy to 'release the population pressure' in areas affected by climate change could accelerate the brain drain of talented individuals from the developing world to the developed – and worsen the 'hollowing out' of affected economies, which is itself a driver of migration. On the other hand, shutting borders in both source and destination countries undermines remittance economies and denies developing countries the benefits of access to the international labour market.

Box 4. Fencing the border

At the other extreme is India's 4,095 kilometre fence along the Bangladeshi border. In 1985 a fence along the porous Indian-Bangladesh border was first discussed to stop smuggling, trafficking and illegal immigration (which Delhi estimates at 20 million people annually).[130] Construction started in 2002 and was due to finish in mid 2007. The 3.6 metre high, double wire fence, built at a cost 11 billion rupees also serves the purpose of controlling the flow of future forced climate migrants.[131]

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[126] Helené Lackenbauer, IFRC, personal communication

[127] Robert McLeman & Barry Smit (2004) *"Climate change, migration and security",* Canadian Security Intelligence Service, Commentary No. 86, Ottawa, p. 8

[128] Frank Laczko & Elizabeth Collett, (2005) *"Assessing the Tsuanmi's Effects on Migration"*, International Organization for Migration

[129] http://eagle1.american.edu/~sj1580a/haiti-hurricane.htm

[130] BBC (2006) "Villagers left in limbo by border fence" http://news.bbc.co.uk/2/hi/programmes/from_our_own_correspondent/4653810.stm accessed 15 April 2007

[131] Syed Sajjad Ali (2006) "Fencing the Porous Bangladesh Border", *Worldpress.org,* India, 14 December 2006

6/. Conclusions

Environmental, economic and political degradation are connected – though categories are permeable. One analyst argues, 'One classification may cause the other or, more likely, each drives the other in a vicious cycle of reinforcing degradations".[132] Migration to the United States is an example, "though nominally economic migrants, many of the estimated 1 million people who flood illegally into the United States annually from Mexico are in part driven by declining ecological conditions in a country where 60 percent of the land is classified as severely degraded".[133]

Anthropogenic climate change interacts with and exacerbates existing environmental, economic and social vulnerabilities. It follows that adaptation to climate change has to be broader than tackling the marginal increased impact of anthropogenic climate change. Just focusing on the impacts of climate change without factoring in the local context is leading to some bizarre policy distortions. For example, in the Philippines, policy makers have begun to acknowledge the flood threats posed by a projected annual sea level rise from climate change of 1 to 3 millimetres per year. But at the same time they are oblivious to, or ignore, the main reason for increasing flood risk: excessive ground water extraction which is lowering land surface by several centimetres to more than a decimetre per year.[134]

On current climate change scenarios a certain amount of forced climate migration is 'locked in'. But how much depends on the international community's mitigation and adaptation plans now. It is clear that the international community has to face up for the prospect of large scale displacement caused by climate change.

There is a need for international recognition of the problem, a better understanding of its dimensions and a willingness to tackle it. This should take several forms:

The international community needs to formally acknowledge the plight of forced climate migrants. While it is not clear that an expanded definition of a refugee under international law that included environmental degradation as a 'valid' driver of displacement would lead to net benefits for all (traditional and environmental) refugees, some kind of international recognition is required to establish the issue on the international agenda.

Development and adaptation policies in potential source countries of forced climate migrants need to focus on reducing people's vulnerability to climate change, moving people away from marginal areas and supporting more livelihoods that are more resilient. In particular more efficient use of existing resources would offset some of the predicted impacts of climate change. In Pakistan, for example, irrigated agriculture uses 85 percent of the country's fresh water supply but leakage and evaporation means that it is only 50 to 65 percent efficient.[135]

Thirdly, a great deal more research is needed to understand the causes and consequences of climate migration and to monitor numbers. Practitioners, meanwhile, should develop better communication

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[132] Ethan Goffman (2006) "Environmental refugees: How many, How bad?" CSA Discovery Guides http://www.case.com/discoveryguides/discoveryguides-main.php accessed 28 April 2007

[133] Migration and Tourism (200) *Our Planet Magazine,* United Nations Environment Program http://www.ourplanet.com/aaas/pages/population05.html accessed 28 April

[134] Roger Pielke, Gwyn Prins, Steve Rayner & Daniel Sarewitz (2007) "Lifting the taboo on adaptation: renewed attention to policies for adapting to climate change cannot come too soon" in *Nature*, Vol. 445, 8th February 2007, p. 598

[135] Aamir Kabir (2002) "Managing the Water Shortages", IUCN, http://www.waterinfo.net.pk/artmw.htm accessed 30 April 2007

and working relationships between the different human rights, population, environmental and migration organizations that share a mandate to respond to population displacement.[136]

Finally, rather than erecting immigration barriers to forced migrants the international community needs to generate incentives to keep skilled labour in developing countries and capitalise on the benefits that fluid labour markets can bring.

[136] Steve Lonergan, (2000) *"Environmental Degradation and Migration" and "Sustainable Development: A Southern Perspective,"* a two-part meeting in the AVISO Policy Briefing Series, 13th April 2000, Senegal

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Vidal, John (2005) "Pacific Atlantis: first climate change refugees", *The Guardian,* London, 25th November 2005

Annex 1 : The Emission Scenarios of the IPCC Special Report on Emission Scenarios (SRES)[137]

A1. The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis: fossil intensive (A1FI), non fossil energy sources (A1T), or a balance across all sources (A1B) (where balanced is defined as not relying too heavily on one particular energy source, on the assumption that similar improvement rates apply to all energy supply and end use technologies).

A2. The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing population. Economic development is primarily regionally oriented and per capita economic growth and technological change more fragmented and slower than other storylines.

B1. The B1 storyline and scenario family describes a convergent world with the same global population, that peaks in mid-century and declines thereafter, as in the A1 storyline, but with rapid change in economic structures toward a service and information economy, with reductions in material intensity and the introduction of clean and resource efficient technologies. The emphasis is on global solutions to economic, social and environmental sustainability, including improved equity, but without additional climate initiatives.

B2. The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social and environmental sustainability. It is a world with continuously increasing global population, at a rate lower than A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines. While the scenario is also oriented towards environmental protection and social equity, it focuses on local and regional levels.

The SRES scenarios do not include additional climate initiatives, which means that no scenarios are included that explicitly assume implementation of the United Nations Framework Convention on Climate Change or the emissions targets of the Kyoto Protocol.

[137] IPCC (2007) '*Working Group II Contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability*', April 2007, p. 23

Annex 2 : Interviews

1. **Simon Bagshaw**, Protection Officer, Displacement and Protection Support Section, Office for the Co-ordination of Humanitarian Affairs, OCHA United Nations
2. **Philippe Boncour**, Head of International Dialogue on Migration, International Organization for Migration, Geneva
3. **Frédéric Gagnon-Lebrun**, Associate, Climate Change Programme, International Institute for Sustainable Development IISD,
4. **Madeleen Helmer**, Head, Red Cross/Red Crescent Climate Centre, The Hague, the Netherlands
5. **Dr Deborah Hemming**, Climate Impacts Modeller, Met Office Hadley Centre for Climate Change, Exeter
6. **Dr. Saleemul Huq**, Director, Climate Change Programme, International Institute for Environment and Development, IIED, London
7. **Helené Lackenbauer**, Senior Officer, Population Movement, International Federation of the Red Cross and Red Crescent Societies, IFRC
8. **Frank Lazcko**, Chief, Research and Publications Division, International Organization for Migration, Geneva
9. **Dr. Steve Lonergan**, Professor, Department of Geography, University of Victoria, Canada
10. **MJ Mace**, Programme Director, Climate Change & Energy Programme, Foundation for International Environmental Law and Development (FIELD), London
11. **Dr. Robert McLeman**, Assistant Professor, Department of Geography, University of Ottawa, Canada
12. **Ilona Miller**, Staff Lawyer, Climate Change & Energy Programme, FIELD, London
13. **Professor Norman Myers**, Oxford University, Oxford
14. **Damian Ryan**, Policy Officer, Climate Change Team, Environment Division, Ministry of Foreign Affairs and Trade, Government of New Zealand, Wellington
15. **Michael Renner**, Senior Researcher, Director, Global Security Project, Worldwatch Institute, New York
16. **Mike See**, Climate Change Campaigner and Coordinator of Protocol for Environmental Refugees, Singapore
17. **Meera Seethi**, Senior Regional Advisor for Sub Saharan Africa, International Organization for Migration, Geneva