Climate change and migration: an overview

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Climate change refers generally to persistent, identifiable change in the state of the climate in terms of average conditions and/or variability (definition adapted from Solomon et al. 2007). Such changes may be stimulated by natural processes or through alteration of the composition of the atmosphere due to human activities such as energy use and forest clearance (also referred to as *anthropogenic climate change*). Widespread concern among physical scientists about the potential global impacts of anthropogenic climate change on sea level, land and sea ice, precipitation patterns, and extreme weather events first emerged in the 1980s.

By 1990, the Intergovernmental Panel on Climate Change (IPCC – an independent body of scientists established by the World Meteorological Organization and United Nations Environment Program to provide advice on climate change to the world's policy-makers) warned that climate change could become the single most important driver of future human population displacement and migration. The most recent (2007) IPCC report indicates that global temperatures have risen by three-quarters of a degree Celsius over the past century, average sea levels are currently rising at a rate of 3.1 mm (0.12 in.)/year, and that there is evidence that ecosystems across all continents and in most oceans are being affected (Solomon et al. 2007). These biophysical changes present serious consequences for human well-being and will oblige populations in many parts of the world to adapt, in some cases through migration and abandonment of established settlements.

Categories of climate-related migration

Climate-related migration may be categorized according to the nature of the climatic stimulus (sudden-onset climate events versus gradual changes in prevailing conditions) and the nature of the migration response (distress migration versus adaptive or amenity-seeking migration). *Sudden-onset climate events* create sudden localized or regional changes in environmental conditions, and are typically associated with storms and extreme precipitation events. Examples of sudden onset events that have stimulated large population movements in recent years include the flooding of the Yangtze valley in 1998 and Hurricanes Mitch and Katrina (Morris et al. 2002; Yan & Qian 2004; Fussell et al. 2010).

Sudden-onset events are often associated with *distress migration*, where large numbers households may be forced to abandon their place of residence at short notice. Gradual changes in prevailing climatic conditions such as drought require a more extended period of time to emerge and to be recognized by populations exposed to them, may affect large geographic areas, and are changes to which migration is not typically a first-order response. When climatic conditions deviate for extended periods from the traditional norms under which human systems have developed, migration may eventually emerge as other forms of adaptation that are less costly or less disruptive to households fail. Migrations of this type have been observed in recent years in dryland Africa and in South Asia as responses to severe drought (Meze-Hausken 2000; Deshingkar & Start 2003).

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Archaeological evidence indicates that the distribution and movement of human populations

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on the planet has for millennia been influenced by environmental processes, including natural variability and change in climate. Examples of climate-related migration also appear in recorded history, such as descriptions of climatic influences on pastoralist movements found in Chinese official records kept by successive imperial dynasties (Smit & Cai 1996). The expansion and subsequent collapse of Norse colonies in Greenland has been linked to the emergence and disappearance of unusually mild temperatures in the North Atlantic during the Medieval Warm Period (Buckland et al. 1996). Population decline in Mayan cities during that same period has also been linked to regional droughts that exacerbated the effects of deforestation (Haug et al. 2003). A number of 20th-century migration events show that climate continues to play a potentially strong role in human migration, with examples including the 1930s Dust Bowl migrations on the North American Great Plains, drought migration in Sudano-Sahelian Africa, and hurricane-related distress migrations in the Caribbean basin (Roncoli et al. 2001; McLeman & Smit 2006; Gutmann & Field 2010).

Perhaps the greatest potential for stimulating future climate-related migration comes from rapidly changing sea levels. McGranahan et al. (2007) have noted that 10 percent of the world's population lives less than 10 m above mean sea level, a large proportion of whom could be at risk in coming decades as sea levels change. Human settlements on small island states and low-lying coastal plains are particularly at risk, with shoreline communities in locations as diverse as Shishmarref, Alaska and Saoluafata, Samoa already reporting damage to infrastructure attributable to sea-level rise.

Scientists are concerned about the potential for saltwater intrusion into groundwater and greater inland penetration of storm surges in the heavily populated deltas of Egypt and Bangladesh (Bosello et al. 2007). Although the popular media has suggested climate change is already stimulating migration from Pacific island states to Australia and New Zealand, Mortreux and Barnett (2009) did not find any empirical evidence to support this claim.

A wide range of estimates exists of the number of people likely to migrate in coming decades due to anthropogenic climate change. One commonly cited figure suggested by British ecologist Norman Myers (2002) forecasts 200 million by 2050; other studies have put the number much higher (e.g. Christian Aid 2007). The variability in forecasts reflects the considerable uncertainty as to how the impacts of climate change will unfold and how human populations will be affected. Available forecasts tend to focus primarily on involuntary, distress migration, even though amenity-related migration, where migrants are attracted to areas with more favorable climatic conditions, might also emerge. Present examples of the latter include the "snowbird" lifestyle migration of retired people from the north of the USA to the Sun Belt states. Future climate change examples are likely to include the movement of economic migrants into northern environments as retreating sea ice allows increased natural resource exploitation there (McLeman & Hunter 2010).

Without doubt, populations in many regions can be expected to experience adversity as a result of climate change, and distress migration as a result of extreme events will continue to occur. To identify and describe more clearly the human impacts of climate change, scientists use the concept of *vulnerability*, a term which in its simplest terms refers to the potential for loss or harm (Adger 2006). The vulnerability of a given population to climate change is a function of the following:

- the particular biophysical conditions that population is likely to experience as a result of climate change;
- the sensitivity of households and individuals to climate change given the particular social, economic, and livelihood process and systems being practiced; and
- the capacity of individuals and households to adapt to or cope with the changes they experience.

Increases in exposure and/or sensitivity increase vulnerability, while increases in adaptive capacity offset vulnerability. The interac-

tions between natural and human processes that affect vulnerability are constantly changing change over time, and vary from place to place and from one household to the next. Within any given population, the adaptive capacity of households will differ due to differences in income, family configuration, health, social class, and any number of other socioeconomic factors unrelated to climate. Migration is only one possible outcome when vulnerable households and individuals adapt to the impacts of climate change (McLeman & Smit 2006).

Large-scale climate-related migration can consequently be expected to emerge in areas where the exposure to adverse climatic events is greatest or most severe, where livelihood systems are most sensitive to disturbance by climate (such rural and resource-dependent populations), and where human capacity to adapt by other means is limited, particularly those where government institutions are ineffective, torn by conflict, or weakened by corruption. Such places may already experience high rates of internal migration and send large numbers of migrants abroad each year, a situation which climate change may exacerbate.

Two general effects on global migration patterns seem likely. First, regions especially vulnerable to climate change will experience increased levels of rural-to-urban migration, as has been witnessed in recent droughts in the Sudano-Sahelian Africa. Second, there will also be a concurrent increase in international migration between neighboring countries and between those with established migrant networks. Consistent with this second point, Feng and his colleagues (2010), for example, have recently shown that Mexican migration to the United States surges during prolonged drought conditions in rural Mexico.

Current policy framework

One unresolved question is how the world's policy-makers will respond to climate-related migration. No formal recognition is given under existing international law to persons obliged to migrate away from their place of residence due to adverse environmental impacts. People seeking protection under the UN Convention on the Protection of Refugees must have fled their country and be unable to return because of a reasonable fear of persecution. Those who abandon their country of residence due to negative impacts of climate change would not meet such a definition, and there is no apparent appetite among the world's refugee-receiving nations to consider expanding the existing definition of a refugee accordingly. The United Nations' *Guiding Principles on Internally Displaced Persons* do recognize environmentally-displaced individuals as warranting protection, but this non-binding document has yet to be implemented by the international community on any broad basis. In the absence of any change in international regulatory regimes, those displaced by future climate change can be expected to swell the ranks of the global population of people displaced within their own countries and those living outside their country of citizenship, so-called illegal aliens, undocumented workers, and similar groups who lack legal residency status.

In summary, there is considerable historical and contemporary evidence that changes in climatic conditions have the potential to influence human migration patterns. Anthropogenic climate change will oblige human populations to undertake a range of adaptive strategies, which will happen at a variety of scales and levels from the individual or household through to higher-level institutions. The range of adaptation options available to a given population will vary according to the broader social, economic, and political context that determines household well-being. Members of particularly vulnerable populations can be expected to adapt by migrating away from areas at risk (or to areas of greater opportunity/amenity), assuming they have the social networks, physical well-being, and economic means to do so.

The number of climate-change migrants and the overall nature of the migration patterns that will emerge will reflect the speed with which biophysical impacts emerge and

the degree to which these exceed the adaptive capacity of exposed populations. Once started, climate-related migrations may create negative synergies whereby the overall quality of life in the communities that migrants leave behind begins to erode, thereby fueling further out-migration.

SEE ALSO: Climate change, migration, and displacement; Disasters and migration; Ecology and migration

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