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Climate Change Refugees (extended version)

As global warming tightens the availability of water, prepare for a torrent of forced migrations

By Jeffrey D. Sachs

Human-induced climate and hydrologic change is likely to make many parts of the world uninhabitable, or at least uneconomic. Even if there are some "winners" from climate change—perhaps farmers in high-latitude farm regions where the growing season will be extended by warmer temperatures—there will also be large numbers of undeniable losers. Over the course of a few decades, if not sooner, hundreds of millions of people may be compelled to relocate because of environmental pressures.

To a significant extent, water will be the most important determinant of these population movements. Dramatic changes in the relationship between water and society will be widespread, as emphasized in the new report from Working Group II of the Inter-Governmental Panel on Climate Change. These shifts may include rising sea levels, stronger tropical cyclones, the loss of soil moisture under higher temperatures, more intense precipitation and flooding, more frequent droughts, the melting of glaciers and the changing seasonality of snowmelt. Combined with the human-induced depletion of groundwater sources by pumping, and the extensive pollution of rivers and lakes, mass migrations may be unavoidable.

Impacts will vary widely across the world. It will be important to keep our eye on at least four zones: low-lying coastal settlements which are especially vulnerable to rising sea levels; farm regions which are dependent on rivers fed by glacier melt and snowmelt; sub-humid and arid regions which are likely to experience greater drought frequency; and humid areas in Southeast Asia vulnerable to changes in monsoon patterns.

A significant rise of sea levels, even by a fraction of a meter, much less by several meters, could wreak havoc for tens or even hundreds of millions of people. One recent study by Gordon McGranahan, Deborah Balk, and Bridget Anderson (2007) found that although coastal areas less than 10 meters above sea level constitute only 2 percent of the world's land area, they contain 10 percent of the world's population. (High-density urban settlements are commonly located on coastlines for convenient access to international trade.) These low-elevation coastal zones are highly vulnerable to storm surges and increased intensity of tropical cyclones—call it the New Orleans Effect.

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Regions much further inland will wither. Hundreds of millions of people, including many of the poorest farm households, live in river valleys where irrigation is fed by glacier melt and snowmelt. The glaciers are disappearing, and the annual snowmelt is coming earlier each year, synchronizing it less and less well with the summer growing season.

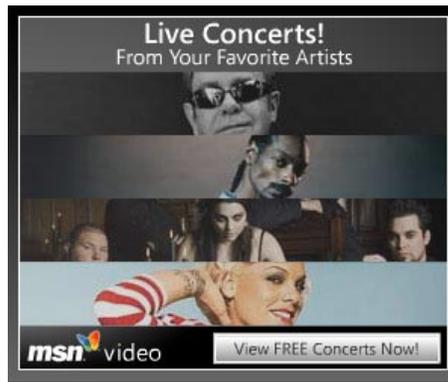
Thus, the vast numbers of farmers in the Indo-Gangetic Plain and in China's Yellow River Basin will most likely face severe disruptions in water availability. Yet those regions are already experiencing profound water stress due to unsustainable rates of groundwater pumping performed to irrigate large expanses of Northern China and Northern India. Surface water bodies in these regions are already over-appropriated and degraded.

In Africa, all signs suggest that currently subhumid and arid areas will dry further, deepening the food crisis for many of the world's poorest and most vulnerable people. The severe decline in precipitation in the African Sahel during the past 30 years seems to be related to both anthropogenic warming and aerosol pollutants. The violence in Darfur and Somalia is fundamentally related to food and water insecurity. Cote d'Ivoire's civil war stems, at least in part, from ethnic clashes after masses of people fled the northern dry lands of Burkina Faso for the coast. Worse chaos could easily arise.

In Southeast Asia, each El Niño cycle brings drying to thousands of islands in the Indonesian archipelago, with attendant crop failures, famine and peat fires. Some climatologists hypothesize that global warming could induce a more persistent El Niño state; if so, the 200 million people in Indonesia and neighboring areas could experience lasting drought conditions.

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Until now, the climate debate has focused on the basic science and the costs and benefits of reducing greenhouse gas emissions. That stage is now ending, with a resounding consensus on the risk of climate change and the need for action. Attention will now increasingly turn to the urgent challenge of adapting to the changes and helping those who are most affected.

Some hard-hit places will be salvaged by better infrastructure that protects against storm surges or economizes on water for agriculture. Others will shift successfully from agriculture to industry and services. Yet some places will be unable to adjust altogether, and populations are likely to suffer and to move. We are just beginning to understand these phenomena in quantitative terms. Economists, hydrologists, agronomists, and climatologists will have to join forces to take the next steps in scientific understanding.

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