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Environmental Refugees: The Rising Tide

In late August 2005, as Hurricane Katrina approached the U.S. Gulf Coast, more than 1 million people were evacuated from New Orleans and the small towns and rural communities along the coast. The decision to evacuate was well taken. In some Gulf Coast towns, Katrina's powerful 28-foot-high storm surge did not leave a single structure standing. New Orleans survived the initial hit, but it was flooded when the inland levies were breached and water covered large parts of the city—in many cases leaving just the rooftops exposed, where thousands of people were stranded.[1]

Once the storm passed, it was assumed that the million or so Katrina evacuees would, as in past cases, return to repair and rebuild their homes. Some 700,000 did return, but close to 300,000 did not. Nor do they plan to do so. Most of them have no home or job to return to. They are no longer evacuees. They are climate refugees. Interestingly, the first large wave of modern climate refugees emerged in the United States—the country most responsible for the rise in atmospheric carbon dioxide that is warming the earth. New Orleans is the first modern coastal city to be partly abandoned.[2]

One of the defining characteristics of our time is the swelling flow of environmental refugees: people displaced by rising seas, more-destructive storms, expanding deserts, water shortages, and dangerously high levels of toxic pollutants in the local environment.

Over the longer term, rising-sea refugees will likely dominate the flow of environmental refugees. The prospect for this century is a rise in sea level of up to 6 feet. Even a 3-foot rise would inundate parts of many low-lying cities, major river deltas, and low-lying island countries. Among the early refugees will be millions of rice-farming families from Asia's low-lying river deltas, those who will watch their fields sink below the rising sea.[3]

The flow of rising-sea refugees will come primarily from coastal cities. Among those most immediately affected are London, New York, Washington, Miami, Shanghai, Kolkata (Calcutta), Cairo, and Tokyo. If the rise in sea level cannot be checked, cities soon will have to start either planning for relocation or building barriers that will block the rising seas.

The movement of millions of rising-sea refugees to higher elevations in the interior of their countries will create two real estate markets—one in coastal regions, where prices will fall, and another in the higher elevations, where they will rise. Property insurance rates are already rising in storm- and flood-prone places like Florida.[4]

River deltas contain some of the largest, most vulnerable populations. These include the deltas of the Mekong, Irrawaddy, Niger, Nile, Mississippi, Ganges-Brahmaputra, and Yangtze Rivers. For example, a 6-foot sea level rise would displace 15 million Bangladeshis living in the densely populated Ganges-Brahmaputra delta.[5]

The London-based Environmental Justice Foundation reports that "a one meter [3 foot] sea-level rise would affect up to 70 percent of Nigeria's coastline affecting over 2.7 million hectares. Egypt would lose at least 2 million hectares in the fertile Nile Delta, displacing 8 to 10

million people, including nearly the entire population of Alexandria."[6]

Low-lying islands will also be hit hard. The 39 members of the Alliance of Small Island States stand to lose part or all of their territories as sea level rises. Among the most immediately threatened are Tuvalu, Kiribati, and the Marshall Islands in the Pacific Ocean and the Maldives in the Indian Ocean. Well before total inundation, islanders face salt water intrusion that can contaminate their drinking water and make it impossible for deep-rooted crops to survive. Eventually, all crops will fail.[7]

Some 3,000 of Tuvalu's 10,000 people have already migrated to New Zealand, seeking work under a labor migration program. Larger populations, such as the 300,000 people in the Maldives, will find it more difficult to migrate elsewhere. The president of the Maldives is actively pursuing the possibility of purchasing land for his people to migrate to as the sea level inches upward and makes island life untenable.[8]

Meanwhile, following the 2004 tsunami that so memorably devastated Indonesia, the government of the Maldives decided to organize a "staged retreat" by moving people from the lower-lying islands, some 200 in total, to a dozen or so slightly higher islands. But even the highest of these is only about 8 feet above sea level. And in anticipation of higher seas, the Papua New Guinea government moved the 1,000 residents of the Carteret Islands to the larger island of Bougainville.[9]

Aside from the social upheaval and the personal devastation of people losing their country to the rising sea, there are also legal issues to be resolved. When does a country cease to exist legally, for example? Is it when there is no longer a functioning government? Or when it has disappeared beneath the waves? And at what point does a country lose its vote in the United Nations? In any event, rising sea level is likely to shrink U.N. membership as low-lying island states disappear.

How far might the sea level rise? Rob Young and Orrin Pilkey note in *The Rising Sea* that planning panels in Rhode Island and Miami assume a minimum rise of 3.5 feet by 2100. A California planning study uses a 4.6-foot rise by century's end. The Dutch, for their coastal planning purposes, are assuming a 2.5-foot rise for 2050.[10]

If the Greenland ice sheet, which is well over a mile thick in places, were to melt completely, sea level would rise 23 feet. And if the West Antarctic ice sheet were to break up entirely, sea level would rise 16 feet. Together, the melting of these two ice sheets, which scientists believe to be the most vulnerable, would raise sea level 39 feet. And this does not include thermal expansion as ocean water warms, an important contributor to sea level rise.[11]

A study published by the International Institute for Environment and Development has analyzed the effect of a 10-meter (33-foot) rise in sea level. The study begins by noting that 634 million people currently live along coasts at 10 meters or less above sea level, in what they call the Low Elevation Coastal Zone.[12]

The most vulnerable country is China, with 144 million potential climate refugees. India and Bangladesh are next, with 63 million and 62 million respectively. Viet Nam has 43 million vulnerable people, and Indonesia 42 million. Also in the top 10 are Japan with 30 million, Egypt with 26 million, and the United States with 23 million. Some of the refugees could simply retreat to higher ground within their own country. Others—facing extreme crowding in the interior regions of their homeland—would seek refuge elsewhere.[13]

The second category of environmental refugees is also closely related to elevated global temperatures. A higher surface water temperature in the tropical oceans means there is more energy to drive tropical storm systems,

which can lead to more-destructive storms. The combination of more-powerful storms and stronger storm surges can be devastating, as New Orleans discovered. The regions that are most at risk for more-powerful and destructive storms are Central America, the Caribbean, and both the Atlantic and Gulf coasts of the United States. In Asia, where hurricanes are called typhoons, it is East and Southeast Asia, including Japan, China, Taiwan, the Philippines, and Viet Nam, that are most vulnerable. The other region in danger is the Bay of Bengal, particularly Bangladesh.

In the fall of 1998, Hurricane Mitch—one of the most powerful storms ever to come out of the Atlantic, with winds approaching 200 miles per hour—hit the east coast of Central America. As atmospheric conditions stalled the normal northward progression of the storm, more than 6 feet of rain fell on parts of Honduras and Nicaragua within a few days. The deluge collapsed homes, factories, and schools, leaving them in ruins. It destroyed roads and bridges. Seventy percent of the crops in Honduras were washed away, as was much of the topsoil. Huge mudslides destroyed villages, sometimes burying local populations.[14]

The storm left 11,000 dead. Thousands more were never found. The basic infrastructure—the roads and bridges in Honduras and Nicaragua—was largely destroyed. President Flores of Honduras summed it up this way: "Overall, what was destroyed over several days took us 50 years to build." The cost of the damage from this storm exceeded the annual gross domestic product of the two countries and set their economic development back by 20 years.[15]

The first decade of this century has brought many other destructive storms. In 2004, Japan experienced a record 10 typhoons that collectively caused $10 billion worth of losses. The 2005 Atlantic hurricane season was

the worst on record, bringing 15 hurricanes, including Katrina, and $115 billion in insured losses.[16]

A third source of refugees is advancing deserts, which are now on the move almost everywhere. The Sahara desert is expanding in every direction. As it advances northward, it is squeezing the populations of Morocco, Tunisia, and Algeria against the Mediterranean coast.

The Sahelian region of Africa—the vast swath of savannah that separates the southern Sahara desert from the tropical rainforests of central Africa—is shrinking as the desert moves southward. As the desert invades Nigeria, Africa's most populous country, from the north, farmers and herders are forced southward, squeezed into a shrinking area of productive land. Some desert refugees end up in cities, many in squatter settlements, others migrate abroad. A 2006 U.N. conference on desertification in Tunisia projected that by 2020 up to 60 million people could migrate from sub-Saharan Africa to North Africa and Europe.[17]

In Iran, villages abandoned because of spreading deserts or a lack of water number in the thousands. In the vicinity of Damavand, a small town within an hour's drive of Tehran, 88 villages have been abandoned.[18]

In Latin America, expanding deserts are forcing people to move in both Brazil and Mexico. In Brazil, some 250,000 square miles of land are affected, much of it concentrated in the country's northeast. In Mexico, many of the migrants who leave rural communities in arid and semiarid regions of the country each year are doing so because of desertification. Some of these environmental refugees end up in Mexican cities, others cross the northern border into the United States. U.S. analysts estimate that Mexico is forced to abandon 400 square miles of farmland to desertification each year.[19]

In China, desert expansion has accelerated in each successive decade since 1950. Desert scholar Wang Tao

reports that over the last half-century or so some 24,000 villages in northern and western China have been abandoned either entirely or partly because of desert expansion.[20]

China's Environmental Protection Agency reports that from 1994 to 1999 the Gobi Desert grew by 20,240 square miles, an area half the size of Pennsylvania. With the advancing Gobi now within 150 miles of Beijing, China's leaders are beginning to sense the gravity of the situation.[21]

The U.S. Dust Bowl of the 1930s, which was caused by overplowing and triggered by drought, forced more than 2 million "Okies" to leave the land, many of them heading west from Oklahoma, Texas, and Kansas to California. But the dust bowl forming in China is much larger and so is the population: during the 1930s the U.S. population was only 150 million, compared with China's 1.3 billion today. Whereas U.S. migration was measured in the millions, China's may measure in the tens of millions. And as a U.S. embassy report entitled *Grapes of Wrath in Inner Mongolia* noted, "unfortunately, China's twenty-first century 'Okies' have no California to escape to—at least not in China."[22]

The fourth group of people who will be forced to leave their homes are those in places where water tables are falling. With the vast majority of the 3 billion people projected to be added to the world by 2050 being born in such countries, water refugees are likely to become commonplace. They will be most common in arid and semiarid regions where populations are outgrowing the water supply and sinking into hydrological poverty. Villages in northwestern India are being abandoned as aquifers are depleted and people can no longer find water. Millions of villagers in northern and western China and in northern Mexico may have to move because of a lack of water.[23]

Thus far the evacuations resulting from water shortages have been confined to villages, but eventually whole cities might have to be relocated, such as Sana'a, the capital of Yemen, and Quetta, the capital of Pakistan's Baluchistan province. Sana'a, a fast-growing city of more than 2 million people, is literally running out of water. Wells that are 1,300 feet deep are beginning to go dry. In this "race to the bottom" in the Sana'a valley, oil drilling equipment is being used to dig ever deeper wells. Some are now over half a mile deep.[24]

The situation is bleak because trying to import water into this mountain valley from other provinces would generate tribal conflicts. Desalting sea water on the coast would be expensive because of the cost of the process itself, the distance the water would have to be pumped, and the city's altitude of 7,000 feet. Sana'a may soon be a ghost city.[25]

Quetta, originally designed for 50,000 people, now has a population exceeding 1 million, all of whom depend on 2,000 wells pumping water from what is believed to be a fossil aquifer. In the words of one study assessing its water prospect, Quetta will soon be "a dead city."[26]

Two other semiarid Middle Eastern countries that are suffering from water shortages are Syria and Iraq. Both are beginning to reap the consequences of overpumping their aquifers, namely irrigation wells going dry.[27]

In Syria, these trends have forced the abandonment of 160 villages. Hundreds of thousands of farmers and herders have left the land and pitched tents on the outskirts of cities, hoping to find work. A U.N. report estimates that more than 100,000 people in northern Iraq have been uprooted because of water shortages. Hussein Amery, a Middle East water expert from the Colorado School of Mines, puts it very simply: "Water scarcity is forcing people off the land."[28]

The fifth category of environmental refugee has

appeared only in the last 50 years or so: people who are trying to escape toxic waste or dangerous radiation levels. During the late 1970s, Love Canal—a small town in upstate New York, part of which was built on top of a toxic waste disposal site—made national and international headlines. Beginning in 1942, the Hooker Chemical Company had dumped 21,000 tons of toxic waste, including chlorobenzene, dioxin, halogenated organics, and pesticides there. In 1952, Hooker closed the site, capped it over, and deeded it to the Love Canal Board of Education. An elementary school was built on the site, taking advantage of the free land.[29]

But during the 1960s and 1970s people began noticing odors and residues from seeping wastes. Birth defects and other illnesses were common. Beginning in August 1978, families were relocated at government expense and reimbursed for their homes at market prices. By October 1980, a total of 950 families had been permanently relocated.[30]

A few years later, the residents of Times Beach, Missouri, began complaining about various health problems. A firm spraying oil on roads to control dust was using waste oil laden with toxic chemical wastes. After the U.S. Environmental Protection Agency discovered dioxin levels well above the public health standards, the federal government arranged for the permanent evacuation and relocation of the town's 2,000 people.[31]

Another infamous source of environmental refugees is the Chernobyl nuclear power plant in Kiev, which exploded in April 1986. This started a powerful fire that lasted for 10 days. Massive amounts of radioactive material were spewed into the atmosphere, showering communities in the region with heavy doses of radiation. As a result, the residents of the nearby town of Pripyat and several other communities in Ukraine, Belarus, and Russia were evacuated, requiring the resettlement of 350,400

people. In 1992, six years after the accident, Belarus was devoting 20 percent of its national budget to resettlement and the many other costs associated with the accident.[32]

While the United States has relocated two communities because of health-damaging pollutants, the identification of 459 "cancer villages" in China suggests the need to evacuate hundreds of communities. China's Ministry of Health statistics show that cancer is now the country's leading cause of death. The lung cancer death rate, also boosted by smoking, has risen nearly fivefold over the last 30 years.[33]

With little pollution control, whole communities near chemical factories are suffering from unprecedented rates of cancer. The World Bank reports that liver cancer death rates among China's rural population are four times the global average. Their stomach cancer death rates are double those for the world. Chinese industrialists build factories in rural areas where there is cheap labor and little or no enforcement of pollution control laws. Young people are leaving for the city in droves, for jobs and possibly for better health. Yet many others are too sick or too poor to leave.[34]

Separating out the geneses of today's refugees is not always easy. Often the environmental and economic stresses that drive migration are closely intertwined. But whatever the reason for leaving home, people are taking increasingly desperate measures. The news headlines about refugees who try to cross the Mediterranean tell the story: a 2009 BBC story entitled "Hundreds Feared Drowned off Libya," a 2008 *Guardian* piece with the headline "Over 70 Migrants Feared Killed on Crossing to Europe," and an Associated Press story from 2008—"Spain: 35 Reported Dead in Migrant Ordeal."[35]

Some of the stories are heartrending beyond belief. In mid-October 2003, Italian authorities discovered a boat bound for Italy carrying refugees from Africa. After

being adrift for more than two weeks and having run out of fuel, food, and water, many of the passengers had died. At first the dead were tossed overboard. But after a point, the remaining survivors lacked the strength to hoist the bodies over the side. The dead and the living shared the boat, resembling what a rescuer described as "a scene from Dante's Inferno."[36]

The refugees were believed to be Somalis who had embarked from Libya, but the survivors would not reveal their country of origin lest they be sent home. We do not know whether they were political, economic, or environmental refugees. Failed states like Somalia produce all three. We do know that Somalia is a lawless entity and an ecological basket case, with overpopulation, overgrazing, and the resulting desertification destroying its pastoral economy.[37]

In April 2006, a man fishing off the coast of Barbados discovered a 20-foot boat adrift with the bodies of 11 young men on board, bodies that were "virtually mummified" by the sun and salty ocean spray. As the end drew near, one passenger left a note tucked between two bodies: "I would like to send my family in Basada [Senegal] a sum of money. Please excuse me and goodbye." The author of the note was apparently one of a group of 52 who had left Senegal on Christmas Eve aboard a boat destined for the Canary Islands, a jumping off point for Europe.[38]

Each day Mexicans risk their lives in the Arizona desert, trying to reach jobs in the United States. Some 400–600 Mexicans leave rural areas every day, abandoning plots of land too small or too eroded to make a living. They either head for Mexican cities or try to cross illegally into the United States. Many of those who try to cross the Arizona desert perish in its punishing heat; scores of bodies are found along the Arizona border each year.[39]

The potentially massive movement of people across national boundaries is already affecting some countries. India, for example, with a steady stream of migrants from Bangladesh and the prospect of millions more to come, is building a 10-foot-high fence along their shared border. The United States is erecting a fence along the border with Mexico. The current movement of Chinese across the border into Siberia is described as temporary, but it will likely become permanent. Another major border, the Mediterranean Sea, is now routinely patrolled by naval vessels trying to intercept the small boats of African migrants bound for Europe.[40]

In the end, the question is whether governments are strong enough to withstand the political and economic stress of extensive migration flows, both internal and external. Some of the largest flows will be across national borders and they are likely to be illegal. As a general matter, environmental refugees will be migrating from poor countries to rich ones, from Africa, Asia, and Latin America to North America and Europe. In the face of mounting environmental stresses, will the migration of people be limited and organized or will it be massive and chaotic?

People do not normally leave their homes, their families, and their communities unless they have no other option. Maybe it is time for governments to consider whether it might not be cheaper and far less painful in human terms to treat the causes of migration rather than merely respond to it. This means working with developing countries to restore their economy's natural support systems—the soils, the grasslands, the forests—and it means accelerating the shift to smaller families to help people break out of poverty. Treating symptoms instead of causes is not good medicine. Nor is it good public policy.