

DIGITAL DEVELOPMENT DEBATES

As Our Actions Transform Nature, We Begin to Transform Our Actions

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Flood, drought, and water scarcity may seem like specters of the apocalypse, but such events are increasingly caused by [extreme weather linked to climate change](#), according to a report published by the U.N. Intergovernmental Panel on Climate Change in November. We have met the apocalypse, and he is us.

The natural environment that supports the human animal is in a period of rapid transition thanks to our activities. Our actions to provide energy, food, shelter, and wealth for ourselves have brought on pollution, climate change, water scarcity, and biodiversity loss.

Now these impacts we've made on the Earth are beginning to affect us. These changes are particularly manifest in everything to do with water. Precipitation changes have brought floods and droughts, ruining businesses, homes, roads, and infrastructure. Climate change is melting glaciers upon which people in the Himalayas and Andes depend for drinking water. The corresponding sea level rise is threatening the very existence of low-lying countries like Tuvalu and the Maldives. Massive water engineering projects have made possible unsustainable population booms in arid areas like the Persian Gulf and southwestern United States.

We can now choose to be proactive or reactive: look down the road and try to prepare by transitioning to more sustainable habits, or wait until crisis is upon us, forcing more dramatic response. As people's daily lives are beginning to be impacted by the changing environment, behaviors are changing as well. While some are short-term, others are permanent: people have to move or change the way they make their livelihood.

In a paper on [mobility in environmentally fragile areas](#) published last year by the International Institute for Environment and Development, author Cecilia Tacoli wrote:

Although these are typically described as slow-onset or gradual changes, in the worse-affected case study locations people identify "precipitating events" (unusually harsh droughts, epidemics of livestock diseases, the unintended consequences of actions to reduce environmental pressures in neighbouring areas) having a long-term impact on natural resources and, perhaps more importantly, on local economies and livelihoods.

Tacoli theorizes that most climate change will not prompt mass international migrations but, rather, migrations within countries will be more typical.

People tend to think of poor, rural, and subsistence people struggling most with environmental decline. And certainly, they are often more directly dependent on their local environment, with fewer resources to purchase other options if necessary. But we are already beginning to see precipitating events that push people to move in developed countries as well.

Floods

Last year, 2011, saw an uptick in extreme weather around the globe. Floods are becoming more common because climate change is creating greater fluctuations in watershed flows than existing infrastructure was built to withstand.

A series of floods hit Queensland, Australia in winter 2011, forcing the evacuation of thousands. Three-quarters of the state was declared a disaster area.

April 2011 saw catastrophic flooding in six U.S. states. In early May, to save towns in Illinois and Kentucky, the U.S. Army Corps of Engineers blasted a hole in a Missouri levee, sacrificing more than 203 square miles of farmland. Then the Corps opened Louisiana's Morganza Spillway, flooding 4,600 square miles of farmland and thousands of homes to save Baton Rouge and New Orleans – including

numerous chemical plants and oil refineries.

In summer 2011, heavy rains in Montana and North Dakota and snow melt from the Rocky Mountains caused flooding in ten states along the Missouri River. People evacuated; roads, bridges, and railways were closed; the waters even burst a berm protecting the Fort Calhoun nuclear plant near Omaha, Nebraska, shuttering the plant for several days.

In August Hurricane Irene dumped 11 inches of rain on Vermont in 24 hours. Floodwaters washed away roads, homes, bridges, businesses, and the state's emergency operations center, leaving a dozen mountain towns temporarily cut off from the outside world. The costly deluge caused major economic losses from North Carolina to New England.

Late summer floods in China inundated parts of 12 provinces and killed hundreds.

These floods are made worse because many cities have developed their floodplains, putting new businesses and homes in the path of future floods and dam or levee breaks. Lax regulations and perverse incentives that allow such development are misguided and waste resources. Coastal development could also do with a bit of common sense, taking into consideration not just past climate conditions but also those modeled for the next 50 years. For example, San Francisco's plan to redevelop the human-made, Treasure Island into a "green community" at an estimated cost of \$5 billion seems like folly when one considers that the island has an elevation of just three feet above sea level.

Some communities are embracing new types of infrastructure designed for "soft failure" by bending rather than breaking. After Hurricane Katrina, many people questioned whether low-lying areas of New Orleans should be rebuilt at all. But because most of areas in question were historically home to poor people, not rebuilding became a social justice issue. The solution was Katrina Cottages, inexpensive, attractively designed homes that are resistant to hurricanes and mildew caused by future floods.

Philadelphia is building another form of soft infrastructure. Like many cities on the U.S. East Coast and around the Great Lakes, it funnels its stormwater into its sewage treatment plants. However, big storms can inundate the system, overflowing sewage into the streets and waterways. In part to reduce the city's average of 166 such overflows annually, the Philadelphia Water Department Office of Watersheds is expanding the capacity of its wastewater treatment plants while simultaneously increasing on-site stormwater absorption. The latter, an innovation called low-impact development (LID), is achieved by replacing some pavement with permeable surfaces and by restoring streambanks and wetlands. These green infrastructure improvements will serve multiple purposes, creating social, economic, and ecological benefits.

Drought

Australia's Murray-Darling Basin near Adelaide, a breadbasket for about 100 years, recently came out of epic multiyear drought that is forcing many farmers off the land. The story is well told in the [April 2009 issue](#) of *National Geographic*:

The Europeans who descended on the slopes of the Murray-Darling Basin—a vast semiarid plain about the size of Spain and France combined—were lulled by a string of mid-19th-century wet years into thinking they had discovered a latter-day Garden of Eden. Following the habits of their homelands, the settlers felled some 15 billion trees. Unaware of what it would mean to disrupt an established water cycle by uprooting vegetation well adapted to arid conditions, the new Australians introduced sheep, cattle, and water-hungry crops altogether foreign to a desert ecosystem. The endless plowing to encourage Australia's new bounty further degraded its soil.

To make it all work, Australia tapped the Murray River for irrigation. But the drought pushed an already overextended system beyond its limits. Thirsty crops such as rice, cotton, and citrus may not be long for the region. Dairy farmers are selling their cattle. Rural communities are becoming ghost towns. Some farmers are suicidal. Others are retiring early, or finding jobs in the cities.

The river near its mouth is becoming more saline, changing the ecosystem and harming the livelihoods of fishermen as well. Local Aboriginal people can no longer harvest the animals that have sustained them for 30,000 years.

Likewise, during the mega-drought in Texas last summer, ranchers sold emaciated animals for a song,

and agricultural losses topped \$5 billion. Fourteen other U.S. states were also affected, from Florida to Arizona.

And drought isn't just about crops; it harms key infrastructure as well. Coal, nuclear, and natural gas power plants require vast amounts of water for cooling - accounting for 41 percent of U.S. freshwater withdrawals, according to the U.S. Geological Society. This fall, the Texas grid operator ERCOT warned that 3,000 megawatts could go offline by next spring if rains don't come. In the past decade, droughts have led to temporary shutdowns of nuclear plants in Australia, France, Germany, Romania, and Spain.

Likewise, hydraulic fracturing for natural gas requires a lot of water - up to 13 million gallons to open a single well. As the drought wore on in Texas, the fracking boom slowed as energy producers scrambled for insufficient water.

Drought can even parch infrastructure itself. In Houston and Fort Worth, clay soils got so dry that water pipelines burst, house foundations buckled, and asphalt pavement split.

Droughts also threaten drinking water, particularly in coastal areas. When water managers pump groundwater faster than it's replenished, saltwater can flow into aquifers. Saltwater intrusion is already threatening water supplies in San Francisco, Los Angeles, New York, and Miami, according to a 2011 [report from the Natural Resources Defense Council](#), an environmental advocacy group.

Aside from reducing emissions to curb climate change to reduce extreme weather events, communities are also taking steps to manage their water locally. Conservation is key, as is water reclamation in particularly dry regions. Tiered pricing structures, first innovated in Irvine, California, help with conservation: if you use more, you pay more. More than 200 U.S. cities now use tiered pricing.

In 2003, California adopted a policy discouraging freshwater use for power plant cooling. The result: energy developers have designed less water-intensive cooling for new plants.

But the Murray-Darling area of Australia is taking water management to a whole new level, cutting water allocations to farmers in order to leave water in ecosystems to restore failing rivers, lakes, and wetlands, according to Sandra Postel, director of the Global Water Policy Project. She writes:

The Commonwealth is already working to ease the pain by offering up AUS\$12.6 billion over 10 years to aid the transition. Just under half of this funding would go to water efficiency projects – for example, helping farmers get more crop per drop by installing drip irrigation. In addition, a government entity called the Environmental Water Holder will purchase water entitlements from willing sellers and return that water to rivers, lakes, and wetlands.

Melting Ice

Meanwhile, communities in Asia and South America are concerned about the availability of drinking water because they rely on glaciers that are melting due to climate change.

The Himalayan region is the source of ten of Asia's great rivers, which sustain the lives of 85 percent of Asia's population. The Himalayas also have the highest concentration of snow and glaciers outside the polar regions.

In Peru, the tropical glaciers of the Cordillera Blanca are retreating rapidly. [Researchers found](#) (PDF) that "seven of the nine study watersheds have probably crossed a critical transition point, and now exhibit decreasing dry-season discharge," which could be as high as 30 percent.

In the western United States as well, water managers have traditionally relied on the melting mountain snowpack throughout spring and summer to supply nearly three-quarters of the West's water. But now earlier, warmer springs are melting snowpacks more quickly, leaving less for late summer.

Sea Level Rise

Of course, melting glaciers makes sea levels rise, and the rates predicted by climate models are making low-lying countries nervous. In fact, the seas are already rising -- about 3 mm per year since 1993 and a 200 mm increase (7.87 inches) in global averaged sea level since 1870, according to the World Meteorological Organization.

The recently deposed president of the Maldives, Mohamed Nasheed, gained international prominence when he began lobbying Australia to accept his countrymen as climate refugees. His struggle became

the subject of a just released feature film, *The Island President*, by director Jon Shenk.

Tuvalu and Kiribati are also at risk. Some Tuvalu communities have already immigrated to New Zealand. For those who remain, their lives are changing even though seas are not yet submerging their land. According to Mother Jones reporter [Rachel Morris](#):

Already, warmer ocean temperatures are eating away at the coral reefs that form Tuvalu's archipelagic spine. Tuvaluans themselves point to more tangible indicators of trouble — the "king tides" that increasingly sluice their homes, the briny water oozing up into the "grow pits" where they used to cultivate taro and other vegetables.

Kiribati lost two of its uninhabited islands to the sea in 1999 and suffered a king tide in 2005 that washed away farmland, contaminated wells, and flooded buildings.

But it's not just small island nations that should be concerned. More than 70 percent of the world's population lives on coastal plains, and 11 of the world's 15 largest cities are on the coastal estuaries.

The low-lying coastlines of Bangladesh, India, and Myanmar are particularly vulnerable to the increasing severity of cyclones and tidal floods. These disasters are pushing more and more people to leave their homes and livelihoods.

Developed countries are not immune either: extremely low lying are parts of New York, Boston, San Francisco, Seattle, Los Angeles, Miami, New Orleans, London, and Amsterdam, just to name a few.

Engineering Hubris

Massive engineering projects such as long-distance aqueducts and desalination plants have made possible population booms in arid areas like the Persian Gulf and southwestern United States. But there is growing evidence that such growth is unsustainable.

For example, Qatar gets almost 100 percent of its drinking water from desalination. Its arid limestone is not well suited to agriculture, so the country imports about 90 percent of its food, said Tareq Al-Ansari, a graduate trainee at Imperial College in London who gave a presentation at the Qatar Foundation's Annual Research Forum last November. Historically, when people were eking out a subsistence living, Qatar's population was small. But the gas boom and the profits that came with it have enabled the population to boom as well. That trend is expected to continue, with the population set to double between 2009 and 2020. Qatar does have some groundwater, but 25 percent of the aquifers have already been depleted and those remaining are being consumed at six times the renewal rate. The desalination process rejects brine into the Persian Gulf, turning it dramatically more saline. That effect, coupled with groundwater overextraction, makes seawater intrusion a problem as well, said Al-Ansari.

The Colorado River in the U.S. Southwest is another problem area. A [2005 study](#) in the journal *Nature* showed that streamflow from snow runoff in the Colorado River decreased 2 percent during the 20th century. The authors predicted a 10 to 20 percent reduction by 2050. Several other studies show reductions in a similar range. In a region where watersheds are already overallocated, this trend is likely to heighten tensions among farmers, cities, tribes, environmentalists, and industry. Already Lake Mead — created by the Hoover Dam on the Colorado River — is losing 1.2 million acre feet a year, according to the U.S. Bureau of Reclamation. If water levels in Lake Mead fall below 1,000 feet, the site of the lowest water intake for Las Vegas, this city of a half-million people will have no water. [Researchers found](#) a 50 percent probability of this happening by 2017.

It would not be an unprecedented event in human history. Archeologists believe that past civilizations — the Sumerians of Mesopotamia, the Maya of Central America, the ancient Khmer of Cambodia, and the Chacoans and Hohokams of the American Southwest — collapsed partly due to water mismanagement.

Alternatives

Allowing environmental mismanagement to push civilizations to the brink is obviously suboptimal. When people are forced to move, their health and finances can suffer, and they sometimes come into conflict with others already residing in a new area.

But we have the opportunity now to adjust our approach to make the need for such migrations less

frequent. Instead we can transform our lifestyles and economic systems.

In February, the 18 past winners of the Blue Planet prize, a sort of Nobel for the environment, **presented a paper** to the U.N. Environment Programme meeting in Nairobi, Kenya. It urged society to “take dramatic action to avert the collapse of civilization. Either we will change our ways and build an entirely new kind of global society, or they will be changed for us.”

That means recalibrating the definition of economic progress, they said:

Global society [is] infected by the irrational belief that physical economies can grow forever ... [which] promotes the impossible idea that indiscriminate economic growth is the cure for all the world's problems, while it is actually the disease that is at the root cause of our unsustainable global practices.... Indefinite material growth on a planet with finite and often fragile natural resources will ... eventually be unsustainable.

To remedy that problem they called for an end to environmentally damaging subsidies in energy, transportation, and agriculture. Instead, externalized environmental and social costs should be internalized, they said, and the market and nonmarket values of ecosystem goods and services that support human life should be counted.

To that end, they asked governments to replace GDP with measurements of wealth that integrate economic, environmental, and social goals.

Still, markets aren't the answer to everything, they said. Poor people have fewer resources to buffer them against problems and, by necessity, often live closer to the land. Governments should empower marginalized groups to participate in decision making, tapping their knowledge of how energy, water, food, and livelihoods are interdependent and part of a living ecosystem.

Other key areas for reform include reducing rich countries' overconsumption, reducing population pressure by educating women and making contraception available, and investing in knowledge through research and training.

A little foresight - cutting emissions significantly now, moving to more sustainable practices with water, agriculture, energy - would mean less desperation and conflict later. We have a choice: be proactive and prevent some future crises, or pay a high price in property damage and human suffering later.