

An Uncertain Harvest

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Increasingly **volatile weather patterns** around the world are already causing supermarket prices to rise. But when it comes to **global warming** and the **food supply**, the real losers will be those in developing countries.

A look at how one corner of **Africa is coping.**

Scenes from the frontlines (left to right): A young resident of the Makunda relief camp, in western Kenya's Busia District; more residents of the camp; sand bags where the Nzoia River broke through the dykes; at work in the tea fields of Kericho, where rising temperatures are threatening the Kenyan tea industry.

The night the dykes blew, Calimentina Anyango and her family grabbed what they could and ran for higher ground. For the next three days, the rain pounded down. There was nowhere to hide, nothing to eat. The babies cried till exhaustion gave way to sleep. And when the clouds finally cleared, what was left of the family's ravaged mud home sat in plain view across a decimated field of cassava—a lonely reminder of what little they'd once called their own.

Six weeks later, Anyango and her three sons, three daughters-in-law, and five grandchildren are still sleeping on the skinny ridge in western Kenya that they fled to on that night. Among some 10,000 people who were driven from their homes by the unprecedented downpours that began here in the Busia District, on the border of Uganda, in late November and continued into the New Year, they now take shelter in tents donated by Doctors Without Borders. And every week, one of them makes the three-mile trek to a health-care center where World Vision and the Red Cross distribute

sacks of high-energy Unimix. But they have nothing else: no water for drinking, no charcoal or kerosene for cooking, no blankets, no shoes. They have no crops to harvest and no fields worthy of tilling. And though they are surrounded by stagnant pools of water, they have neither mosquito nets nor anti-malarial medication.

“Especially we need food,” says daughter-in-law Jenna, cradling her 14-month-old son Abraham. Another of Anyango’s grandchildren, James, slumps listlessly in his young mother’s arms. “He’s three months old?” I ask. “One year,” she corrects me.

Anyango expects her family will be here on the ridge for another four or five months, when, she’s hopeful, the ground will have dried up enough to enable rebuilding and replanting. As for the threat of future floods now that the dykes are gone, she doesn’t have the luxury of worrying about that. “We will just go back,” she says of the family’s sodden compound. “We don’t have anywhere else to go. And we don’t have any money.”

“This is the new life,” says John Okello, a local who also fled his home and who now volunteers at another of the seven makeshift relief camps established here in the aftermath of the floods. “We have not experienced anything like it before.”

This past November, in a speech he delivered to the 6,000 delegates gathered in Nairobi for the 2006 United Nations Climate Change Conference, former secretary-general Kofi Annan placed the blame for global warming on “a frightening lack of leadership” and said that it would be developing countries, especially those in tropical regions, that would bear the brunt of rising temperatures. “The impact of climate change will fall disproportionately on the world’s poorest countries, many of them here in Africa,” he said. “Poor people already live on the front lines of pollution, disaster, and the degradation of resources

and the land. For them, adaptation is a matter of sheer survival.”

If anyone still harbored doubts about whether human-driven global warming is a real phenomenon, the February report released by the Intergovernmental Panel on Climate Change likely put an end to them. “February 2nd will be remembered as the date when uncertainty was removed as to whether humans had anything to do with climate change on this planet,” said Achim Steiner, executive director of the United Nations Environment Program (UNEP), which administers the panel. “The evidence is on the table.”

Indeed, by now we’ve all heard about the rising sea levels, the melting ice caps, and the increasing incidences of hurricanes, droughts, heat waves, and floods. Every other day, it seems, some bizarre new detail—whether it be azaleas blooming mid-January in New York’s Central Park, or Russian bears emerging from hibernation weeks ahead of schedule—turns up in the news. But less has been said about the impact that climate change is likely to have on the world’s supply of food. According to the review published last October by Sir Nicholas Stern, the former chief economist of the World Bank, a rise of 2 to 3 degrees Celsius in average global temperatures (equivalent to about 5 degrees Fahrenheit, the increase predicted by many climate models) would put up to 200 million people at risk of hunger. Essentially, says Stern, the entire African continent will become scorched, and famines and disease caused by flooding and water shortages will increase in intensity by 60 percent.

England’s Hadley Centre for Climate Change recently reported that, because of Africa’s particular location and topography, temperature increases over many areas of the continent will likely be double the global average. And given its heavy dependence on agriculture—70 percent of Africans make their living from the land—the resultant changes in weather patterns have the potential to massively compound the continent’s other woes. “Global warming is set to make many of the problems which Africa already deals with much, much worse,” said Andrew Simms, policy director of the London-based New Economics Foundation. As dry areas

AFRICANS “ARE GOING TO BE CAUGHT BETWEEN THE DEVIL OF DROUGHT AND THE DEEP BLUE SEAS OF FLOOD.”

WHY IS AFRICA SO VULNERABLE TO CLIMATE CHANGE?

As former secretary-general Kofi Annan explained at the U.N.’s Climate Change Conference in Nairobi last November, the African continent is in a particularly weak position when it comes to global warming. Here’s why:

WATER SUPPLY

One third of Africans live in drought-prone areas, and as lakes and rivers dry up, competition for water will intensify. This is particularly worrisome in regions where water sources are shared by different communities or nations.

AGRICULTURE

Most of Africa relies on rain-fed crops. As a result, it is highly vulnerable to seasonal shifts and changes in precipitation patterns. Declines in agricultural production threaten the food security of entire populations.

BIODIVERSITY

Given Africa’s heavy dependence on natural resources for everything from food and fuel to shelter, medicine, and tourism, communities will be directly affected by the loss of biodiversity that climate change is expected to cause.

DISEASE

Changes in rainfall will affect the presence of vector- and waterborne diseases. Higher temperatures and flooding, for example, will result in larger populations of disease-carrying mosquitoes. This is of particular concern in areas with inadequate healthcare resources.

RISING SEA LEVELS

Coastal zones around the continent—most of which already lack reliable infrastructures such as bridges, buildings, and paved roads—could be completely wiped out by flooding. Declining numbers of tourists in coastal areas could cripple local economies.

DESERTIFICATION

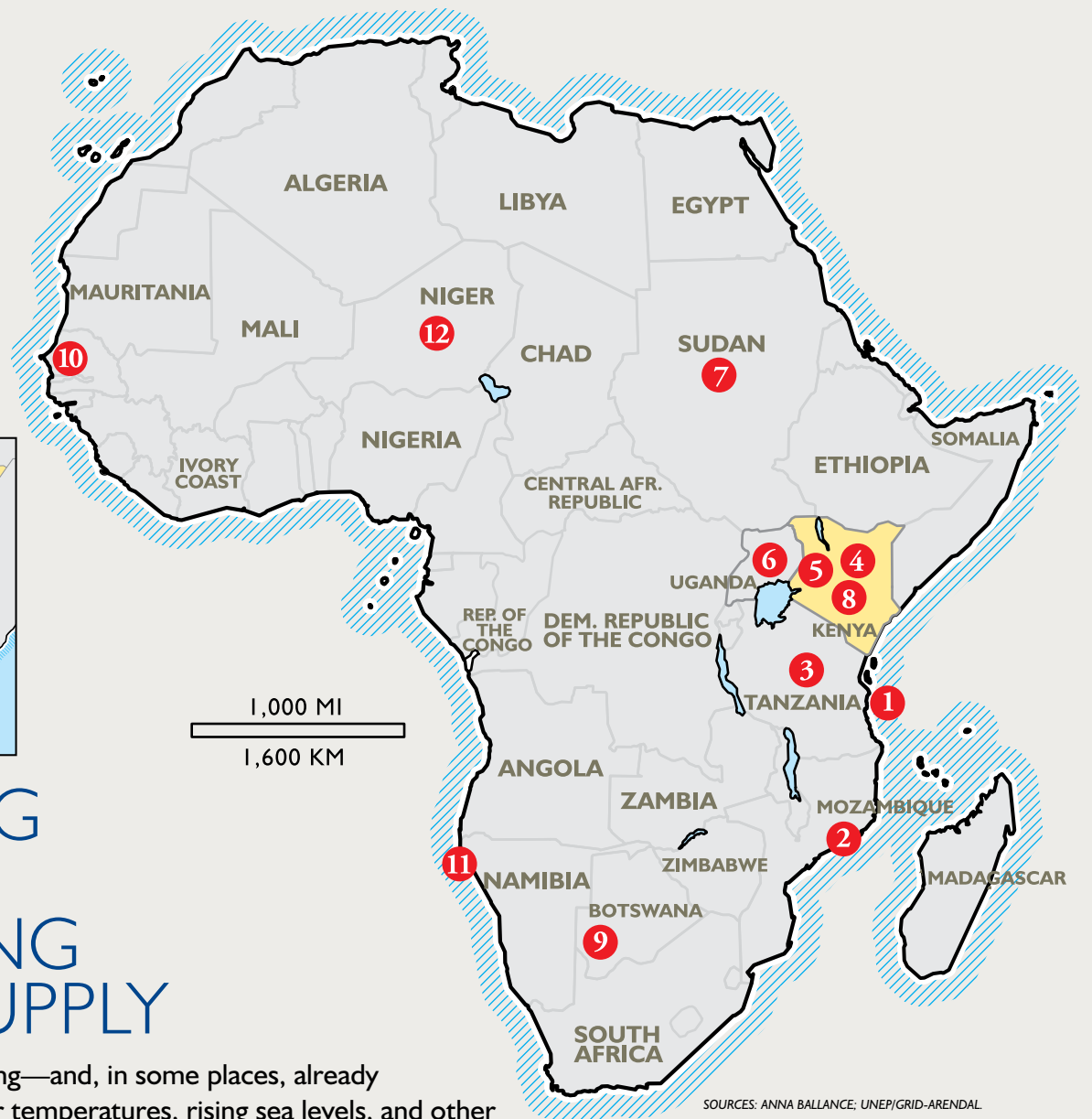
Two thirds of the African continent is comprised of desert or drylands. Rising temperatures and decreasing precipitation affect both the nomadic societies that migrate in response to rainfall variations and the agriculturalists who suffer when soil quality degrades.



WARMING CLIMATE, SHRINKING FOOD SUPPLY

Researchers are predicting—and, in some places, already observing—how warmer temperatures, rising sea levels, and other effects of climate change will impact Africa’s food and water supply.

- Oceans are becoming more acidic as a direct result of rising carbon-dioxide levels in the atmosphere. This acidification will have major effects on marine ecosystems and the fish stocks upon which coastal populations rely.
- The bleaching of coral reefs due to rising temperatures and lower sea levels could result in the extinction of major coral species, with associated losses of local fish stocks.
- Scientists estimate that rising temperatures could result in a 33 percent reduction in maize grown in Tanzania.
- By late January of this year, floods that had blasted northeastern Kenya sparked an epidemic of the mosquito-borne Rift Valley Fever, killing nearly 150 people and hundreds of animals.
- Climbing temperatures in Kericho, Kenya, are threatening the region’s vital tea industry.
- In Uganda, a temperature increase of 2°C would drastically reduce the area suitable for growing Robusta coffee, one of the country’s major exports.
- Studies suggest that Sudan’s sorghum yield could drop by a staggering 82 percent with even a slight rise in local temperatures.
- The level of Kenya’s Lake Nakuru has dropped dramatically in recent years, and by November 2006, more than 800,000 flamingoes had deserted its shores, robbing a lucrative tourist destination of its main attraction.
- Prolonged drying trends in Botswana and elsewhere are adversely affecting nomadic societies that migrate in response to rainfall variations; as a result, both people and livestock are dying.
- In Gambia, where groundnuts (or peanuts) account for 85 percent of exports, changes in rainfall patterns could cripple the national economy.
- Rising sea-surface temperatures off the coast of Namibia may already be contributing to declining fish stocks; on land, scientists expect that warming trends could cause more than 30 percent of threatened plant species to become endangered or extinct by 2080.
- Aridity is on the rise in Niger, which was hit hard in 2004 and 2005 by droughts that drove up the cost of grain and took a heavy toll on livestock.



get drier and wet areas get wetter, he explained, Africans “are going to be caught between the devil of drought and the deep blue seas of flood.”

For Anyango and her family, the abstraction that is global warming has already manifested itself in the form of an empty stomach. And they are not alone. This past November, 1.8 million people were driven from their homes by heavy flooding in northeastern Kenya, Ethiopia, and central and southern Somalia. Coming on the heels of an extended dry period that left the ground unable to soak up the rainfall, the downpours—which were the worst the region has experienced in half a century—proved the death knell to crops already on their last legs. And just a year earlier, severe drought in the same region had left eight million people without food; so many animals were lost that herdsmen aren’t expected to recover their livelihoods for several years.

While it’s true that a warmer earth will mean longer growing seasons for agricultural zones in the northern hemisphere and other regions, the overall result of a world heating up is a food supply wearing down. A series of experiments conducted by the London-based Royal Society in 2005 showed devastating impacts from warming on such international staple crops as maize, rice, soybeans, and wheat. Estimates suggest that climate change will likely reduce crop yields by 10 percent over the whole of Africa, and even more in specific regions.

Because so much of the global economy is rooted in agriculture, it too is set to suffer crushing blows. Worldwide, the reported losses from climate-related disasters rose from \$131 billion in the 1970s to \$629 billion in the 1990s, and it’s estimated that the figure could reach \$150 billion per year in the coming decade. In Africa, where agriculture accounts for half of total exports and represents 40 percent of gross domestic product (GDP), economic viability is inextricably linked with patterns of precipitation. The 1997–1998 El Niño floods and the 1999–2000 drought, for example, are estimated to have cost Kenya alone 40 to 49 percent of its GDP. This past January, Kenya’s *Standard* newspaper reported that the seasonal export of raw cashews had dropped by 95 percent due to low production caused by heavy rains.

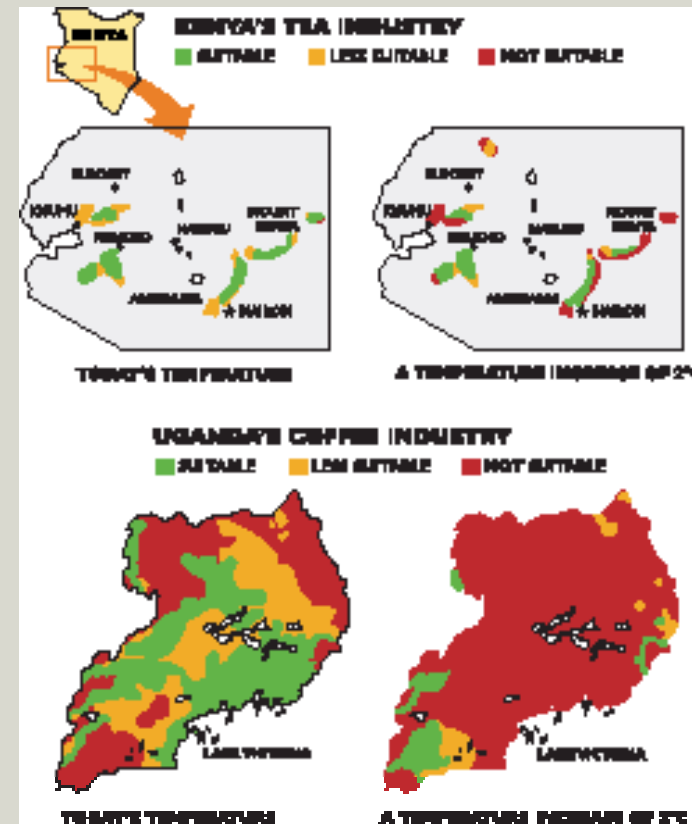
Shocks like these have already trickled down to supermarkets in Europe, where most of Africa’s food exports land. And here in the U.S., we’ve felt the effects of similar upheavals in Central and South America. That’s on top of whatever havoc climate change is wreaking closer to home: This past January, for instance, back-to-back blizzards in the Rocky Mountains threatened the cattle industry to the tune of tens of millions of dollars. (Look for the fallout on your bill the next time you enjoy a steakhouse dinner.)

Of course, heavy, monsoon-like rains are the ultimate breeding ground for disease-carrying mosquitoes, and rising temperatures provide more habitats where they can thrive. According to *Stern*, a 2°C rise would expose up to 60 million additional people in Africa to malaria every year. Out in western Kenya, where the disease has long been a way of life, more sick people and fewer farmers in the fields—not to mention fewer students in the classrooms and fewer traders in the markets—are a constant threat not just to daily meals

CASH CROPS UNDER SIEGE

TEA Kenya’s tea industry employs 10 percent of the country’s population. But average temperatures in the growing area have risen 3.5°C in the past two decades, endangering the industry and putting millions of livelihoods at risk.

COFFEE Uganda is currently home to 500,000 coffee farms, but research has shown that rising temperatures would drastically reduce the area suitable for cultivating this important crop.



SOURCES: OTTO SIMONETT; UNEP/GRID-ARENDAAL



In the aftermath of the flooding, many residents of Kenya’s Busia District walked several miles to pick up relief food.

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but to the local economy itself. And now people in places that were once immune to the disease are also falling ill. “When I was growing up,” says Nairobi native Kevin N’juguna, “I only used to hear about malaria. Now I know lots of people who suffer from it.”

Mosquitoes and the floods they ride in on also attack the food supply itself. Driving around the Busia District, I don’t have to look very hard to see the devastating effects of the virus known as Banana Bacterial Wilt. Believed to be transported over short distances by insects and exacerbated by rain, this previously unheard-of scourge surfaced in Uganda six years ago and has since spread like wildfire through smallholder farms here and in neighboring Tanzania, Rwanda, and the Democratic Republic of Congo. In Uganda, where banana farms account for 28 percent of total cropland, the disease has already resulted in annual losses of \$360 million.

As historian Jared Diamond aptly chronicles in his book *Collapse*, and as the Kenyan environmental activist and Nobel Prize winner Wangari Maathai has long emphasized (see “Strong Roots,” page 51), degradation of the land—whether due to natural disasters, overgrazing, or other conditions—leads to increasing competition for scarce resources, and often to violent conflict. Rising worldwide temperatures seem already to be fueling this phenomenon: Growing pressure on pastureland and water supply was responsible for deepening tensions between nomads and agriculturalists in Niger during the drought of 2005, and the ongoing troubles in Darfur have been blamed in part on competition for land. Now Kenyan pastoralists, too, are coming to blows over the environment.

Back in the early 1990s, when I lived in the country as a Peace Corps volunteer, I made three trips up to Kenya’s hot, dry Lake Turkana region, where, save for the occasional Giacometti-esque figure moving across the shimmering horizon, a visitor in search of solitude could drive for hours and encounter nothing but barren beauty. I have every intention of heading back on this trip, but am told repeatedly that I’d be crazy to go anywhere near the place. In recent years, the 250,000 or so Turkana who inhabit the area—majestic nomads who have long since made their peace with its harsh climate—have faced hardships like none they’ve previously known. The dry spell of 2004, which the local people refer to as *Atiaktiak ng’awiyeyi*, or “the one that divided homes,” because so many families were forced to split up to survive it, was the latest in a series of rain-free periods the Turkana have experienced since 1999, when the drought they dubbed *Kichutanak* (“it has swept away everything, even animals”) hit the region.

Today, as water sources continue to deteriorate (Lake Turkana enjoys only half the inflow it once did) and healthy pasture becomes increasingly hard to find, the strains that have always existed between the Turkana and the neighboring Pokot tribe are intensifying. This past December, *The New York Times* reported that more than a dozen people had been killed and thousands of goats, camels, donkeys, and cows stolen when hundreds of armed warriors from the West Pokot district stormed into the Turkana village of Lorengipi. Though such attacks are nothing new, rarely have they been carried out on such an exaggerated scale. More dis-



At home on the ridge: Calimentina Anyango with her three-year-old grandson, Clinton.

turbingly, whereas in the past the marauders arrived wielding traditional spears, today’s raiders brandish the AK-47s that are available so cheaply and readily across the border in Somalia.

Instead I head back east, stopping in the town of Kisumu, on the shores of Lake Victoria, where Francis Otieno Faraji, helping me into his creaky fishing boat, has his own stories to tell of an ecosystem in distress. “You see those mango trees?” he asks, pointing to a dense grove 150 feet off in the distance. “Three years ago, the lake reached all the way up to them.”

Today, thanks to the receding waters, fishermen like 19-year-old Eric Okoth Odok and 17-year-old Vincent Oduor, whom we encounter a half mile or so out on the lake, are forced to head farther and farther from the shore in pursuit of their catch—often ending up in Ugandan territory and getting themselves arrested in the process. “These Kenyan waters are just a nursery,” for the Nile perch that make up the lion’s share of the fishermen’s catch, explains Faraji. Indeed, the few specimens that Odok and Oduor do

pull in are no bigger than six or seven inches long.

Anyone who's seen the 2004 film *Darwin's Nightmare* knows that the problems surrounding Lake Victoria are by no means limited to climate change. (Invasive species, overfishing, pollution, and AIDS all have their place.) But rising temperatures aren't doing anything to help matters. The level of the lake—which is the main feed for the Nile River as well as a vital source of food, water, transportation, and electric power for some 30 million people—has dropped six feet in the past three years alone. A December 2006 report by the U.S.-based Water Resources and Energy Management International concluded that higher temperatures could cause the evaporation of up to half of Victoria's inflow from rain and rivers, threatening both the immediate community and more than 100 million Egyptians, Sudanese, and others living on the Nile. "People talk about the snows of Kilimanjaro," says Aris P. Georgakakos, the chief author of the report. "We have something much bigger to worry about, and that's Lake Victoria."

The truth is that every one of Africa's major lakes is today in a state of crisis. Lake Chad, once the world's sixth largest, has shrunk to an unimaginable 2 percent of its 1960s size, and the level of central Africa's Lake Tanganyika dropped five feet from the late 1990s to the early 2000s, according to a 2003 article in *Nature*. Its sardine harvest, a major source of dietary protein for the local community, has contracted by half since the 1970s.



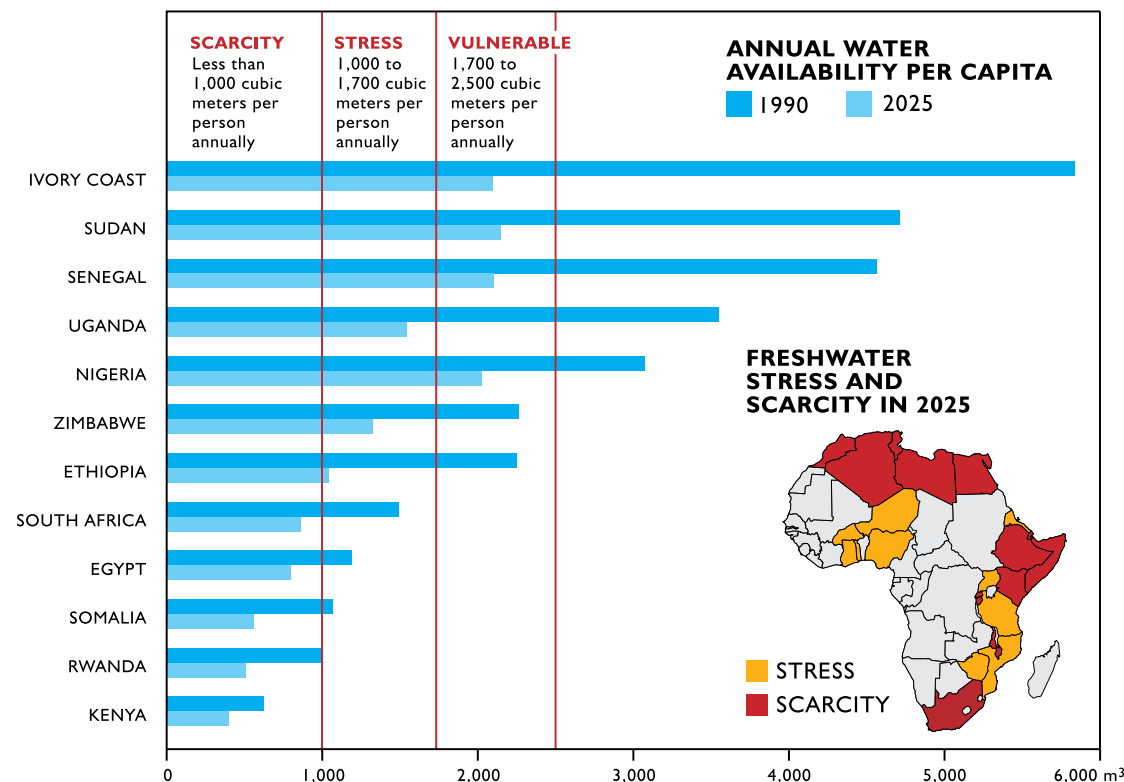
Fishermen Eric Okoth Odok (left) and Vincent Oduor find themselves traveling ever farther into Lake Victoria in pursuit of their catch.

In the face of rising temperatures and increasingly dramatic (and destructive) weather patterns, many local communities have begun taking matters into their own hands. Pulling into the Maasai village of Kisamese, in the drought-stricken Kajiado District about 20 miles south of Nairobi, I hook up with Jane Minisa, a perky 34-year-old mother of four, who proudly leads me across a rocky path to the 1,000-liter water tank that dominates her neighbors' backyard. Backed by UNEP and implemented by a local non-governmental organization, the water-harvesting project that resulted in the tank, which Minisa built with the help of her co-members in the Tubula Women's Group, represents a much bigger vision. In order to receive instruction and funding for it, the women were required to carry out other tasks—digging holes for new trees, preparing a vegetable garden, and fashioning a dam for rainwater harvesting—aimed at sustaining their community.

TROUBLED WATERS

Scientists predict that freshwater, a precious commodity already in short supply in some African nations, will become increasingly scarce in the coming years if global warming (along with population growth and urbanization) continues as expected. This graph looks at the impact of a drier climate on water supply, comparing its availability in 1990 to that projected for 2025. According to UNEP, 18 countries and more than 600 million people could experience water stress within the next 20 years.

SOURCE: UNITED NATIONS ECONOMIC COMMISSION FOR AFRICA (UNECA), ADDIS ABABA; GLOBAL ENVIRONMENT OUTLOOK 2000 (GEO); UNEP EARTHSCAN, LONDON, 1999; DIGOUT, DELPHINE, BASED ON A SKETCH BY PHILIPPE REKACEWICZ; UNEP/GRID-ARENDAAL



“On a personal level, you can make a decision that you want to understand how nature operates, and work with it in your own backyard.”

STRONG ROOTS

Kenyan environmentalist **Wangari Maathai**, winner of the 2004 Nobel Peace Prize, is often called the Tree Woman—and for good reason. In 1977, she founded the Green Belt Movement, an organization dedicated to planting trees and educating people in Kenya—and all over the world—about the importance of conservation. To date, the Green Belt Movement has planted more than 40 million trees, and the organization has played a key role in the creation of the Billion Tree Campaign, a new United Nations initiative to plant one billion trees worldwide by the end of 2007. *Plenty* spoke with Maathai about global warming in Africa, the connection between environmental and humanitarian crises, and the importance of optimism in the fight to save the planet. —Kiera Butler

You've often pointed out that some ancient African traditions—like the ones you grew up with—are actually “green.” Can you give us an example?

There were some trees that were considered sacred. They were never cut, just left to grow and fall on their own. One such tree is the wild fig tree. Because it wasn't cut, it sent a lot of roots very deep, and it fixed itself very firmly into the ground, and it therefore helped to stabilize the soil in these highlands where we lived. Also, because the roots went so deep, they connected with the groundwater system and helped bring water from underground reserves to the upper levels. Quite often, whenever you would find these trees, you would find a stream.

Do you think that modern Africans—and people in general—have lost sight of those traditions?

As people move into the cities, we tend to forget our connection to the earth.

When we congregate in the cities, we build houses, we create concrete, and we literally cut ourselves off from nature and the way nature operates.

How can we begin to remember and implement them?

We can start with something understandable and something that all of us participate in: the creation of greenhouse gases. And on a personal level, you can make a decision that you want to understand how nature operates, and work with it in your own backyard. The Billion Tree Campaign is partly to raise awareness about these issues among ordinary people.

In your opinion, has global warming already begun to affect some parts of the African continent?

Yes, very seriously. We have seen that the glaciers on Mount Kenya and Mount Kilimanjaro have melted. And scientists tell us that they have melted faster this

time than they have in the past 100 years. We have seen with our naked eyes many rivers that used to be big rivers; they are now small, and many streams have dried up. Although this can be attributed to interference with the forest, especially deforestation, it's also attributed to climate change.

What particular challenges do you think Africa will face as climate change intensifies?

For one, we know that it will likely interfere with the availability of freshwater. This will probably create conflict and war among people. Many of the wars we fight in Africa are actually over resources, whether it's between communities themselves, or between Africans and people from outside Africa who are interested in its resources and find it necessary to access them. People fight over water, land, farms, and grazing ground. We know that in Darfur, one issue that causes conflict is grazing ground. This situation can only get worse if the environmental crisis continues.

And it's important to think about this now so we can begin to find solutions.

Absolutely. We have been saying that the pastoral communities, for example, need to cut down on their animals. You cannot have so many animals that you completely degrade your land, and then when drought comes you lose everything you have, including your own life. It's also very important to protect forests, and this is one of the reasons I'm advocating for the protection of the Congo's ecosystem. It's one of the major ecosystems that we need in Africa, but also in the world. It's very highly threatened by both legal and illegal logging.

Even after seeing widespread environmental degradation in Africa, you've remained optimistic. How have you managed to maintain that optimism?

It's important to maintain your optimism because the alternative is to give up. And that would be terrible. So we have to continue telling people that if they don't do something, the result will be much worse. I always believe that people can change. I just hope we will have even more change before it is too late.

And they're not the only ones. At the Nairobi conference, Agnes Mosoni Loirket, the woman responsible for spearheading the initiative, told the delegates that in the past two years alone, women's groups in the region have constructed more than 80 of the tanks. "Before the project," she explained, "women used to leave early and sleep close to the river, leaving children going to school unattended."

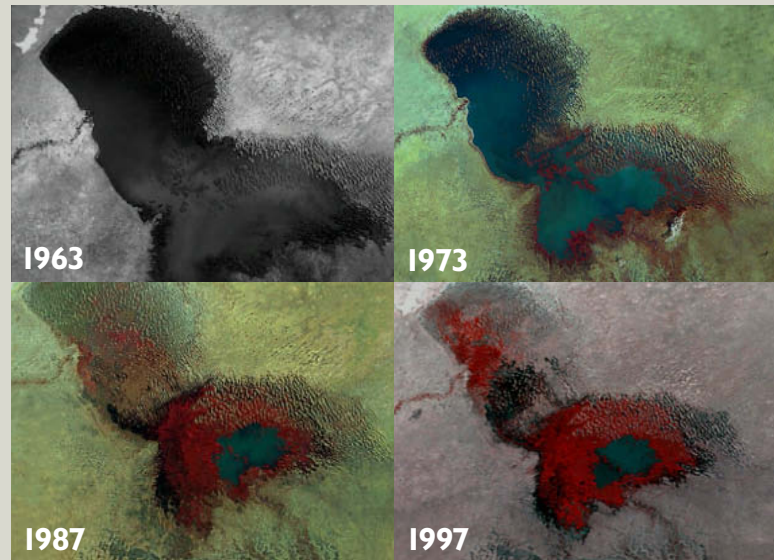
Minisa herself knew that story all too well. But these days she has the time to craft beaded jewelry and run a small shop, earning enough extra cash between the two to send all four of her children to school. She also takes solace in the knowledge that, whatever shocks may result from climatic changes (which she attributes to "the lack of trees and the use of factories"), she and her family have a steady supply of drinking water and an acre and a half planted with beans, maize, and other crops.

Similar water-harvesting initiatives are proliferating across the developing world, and experts say they have the potential to make a big difference in the face of rising temperatures. Kenya, for example, currently gets enough rainfall to supply the needs of six to seven times its population of 40 million. And the beauty of small-scale efforts like Minisa's tank (which required just four days of labor and cost just \$60) is that, unlike big, exposed dams, they lose little water to evaporation. At the close of the November conference, Kenya's water minister announced plans to require all new buildings to include similar structures.

Back in my old stomping grounds out west, I come across other signs of a growing dedication to mitigating the effects—and the causes—of climate change. One afternoon I stop by the Mumias Sugar Factory, a huge compound near my former home that's visible from miles away thanks to the two thick plumes of gray smoke it sends into the air, marring the otherwise idyllic expanse of apple-green fields and periwinkle sky. There, James Luchacha, the head of factory operations, assures me that the plumes will be gone within two years.

NOW YOU SEE IT...

Satellite photos of Lake Chad, which straddles the borders of Nigeria, Cameroon, Niger, and Chad, show its changing shape. Once the world's sixth largest lake, it has shrunk to a mere **2 percent** of its 1960s size—the victim of an increasingly dry climate that forces farmers to use the lake's water for irrigation. In these photos, areas of the lake that have been taken over by vegetation appear in red, and the ripples at the lake's edges represent encroaching sand dunes.



The company recently launched a \$50 million cogeneration project, which involves installing a new environmentally friendly boiler and upgrading the power system to better utilize bagasse, the fiber that remains after the juice has been extracted from sugarcane. By the end of 2008, says Luchacha, the factory will produce enough power to meet its own needs and have some left over to sell to the national grid. In addition,

THE MELTING SNOWS OF KILIMANJARO

The ice cap on Mount Kilimanjaro has shrunk by an astonishing **82 percent** since it was first surveyed in 1912, and several of the rivers that it feeds have begun disappearing during the

summer months. If warming continues at its current rate, scientists predict that the cap could disappear completely in as few as 15 years. Melting snow and ice at high altitudes results

in less snowmelt to feed the rivers during dry periods, when farmers need it most, and creates more runoff during rainy seasons, making flooding more likely to occur.



PHOTOS COURTESY OF NASA



Maasai tribeswomen (from left) Hannah Morio, Jane Minisa, and Grace Solio now all have water-harvesting tanks to call their own.

the company recently signed an agreement to begin selling its carbon emissions reductions to a Japanese firm. (Bagasse is considered a clean fuel under the Kyoto Protocol.) "The only thing I'm getting out of this is legacy," says Luchacha, his face opening into a wide grin, "but I'm really looking forward to it."

Perhaps most significantly, the world community seems finally to be making the connection between global warming and a threatened supply of food. This past December, the consortium of scientists known as the Consultative Group on International Agricultural Research announced a climate-change initiative whose goal is to breed crops capable of withstanding heat, flooding, and drought. And India's Navdanya, the organic farming program led by environmental activist Vandana Shiva, also recently launched a plan to establish seed banks for drought-, saline-, and flood-resistant crops. Increasingly, governments and aid organizations are supporting forward-thinking strategies like agro-forestry, in which trees are cultivated together with food crops, which helps prevent erosion, restores the soil's fertility, and provides shade for the crops (while also sequestering carbon); and conservation farming, a minimum-tillage strategy that traps moisture, improves the quality of the soil, and minimizes erosion, thereby fostering more drought-tolerant growing conditions. Researchers are also aiming to improve climate-change monitoring capacities across the developing world and to implement early warning systems that will give farmers the information they need to protect their harvests. Columbia University, for example, has paired farmers in India and Zimbabwe with

WATER-HARVESTING INITIATIVES ARE PROLIFERATING ACROSS THE DEVELOPING WORLD, AND EXPERTS SAY THEY HAVE THE POTENTIAL TO MAKE A BIG DIFFERENCE IN THE FACE OF RISING TEMPERATURES.

climate and agricultural scientists for just this purpose.

And at the November conference, Annan announced the Nairobi Framework, a U.N. initiative intended to help developing nations get funding to promote clean energy technology and manage the climate threat in general. Included in the Framework is a program that will facilitate carbon finance agreements under the Kyoto Protocol between developing and industrialized countries. The World Bank has estimated that by selling carbon credits, developing nations could earn as much as \$100 billion a year by 2050.

Some have suggested that small-scale farmers themselves ought to be allowed to participate in emissions trading schemes. Given the logistics involved, such an arrangement might prove a little tricky to pull off, but the idea of it alone points up the fact that there's something drastically wrong with this picture. "My people do not drive four-by-fours," a Maasai woman named Sharon Looremata told the delegates at the Nairobi conference. "We don't go on weekends, on holidays by flight. But we are feeling the first and worst of climate change. We had hardly little rains for the last three years. Animals are dying, children are not going to school, women are spending all their time in search of water."

And, of course, people are going hungry. Unless industrialized nations do more to curb their own emissions, factoring climate change into new development and agricultural initiatives can only go so far. As Kofi Annan put it in his address to the delegates, those who would drag their feet on the former "should be seen for what they are: out of step, out of arguments, and out of time." In an increasingly globalized world, after all, it won't be long before the hunger pangs of Calimentina Anyango begin smarting right here at home. ☺