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# Editor's Note

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Advances in paleontology and genetics in recent years allow us to trace our genealogy back some six to seven million years to protohuman species in Africa that themselves had evolved from earlier primates.

A new exhibition at the American Museum of Natural History in New York contains over two hundred casts of prehuman and human fossils and artifacts that illustrate stages in our physical and behavioral evolution. Among the most evocative of the exhibits is the reconstruction of Turkana Boy. Based on one of the most complete ancestral skeletons ever excavated, the fleshed-out "*Homo ergaster*, a species akin to *Homo erectus* that lived in Africa 1.9 to 1.4 million years ago, stands approximately six feet tall, with a body form remarkably like that of modern humans."[1]

We *Homo sapiens* are the survivors of many competing lines of humanity's phylogenetic tree stretching from *Australopithecus anamensis*, the first apes that had evolved into having an upright stance, the various species of which lasted for three million years, through *Homo erectus*, 1.4 million years ago, through various offshoots to that point from which we date ourselves. *Homo sapiens* arrived on the scene in Africa a mere 200,000 years ago, began the trek out of Africa somewhere between 85,000 and 60,000 years ago, and made his way across the strait of Bab el Mandeb at the southern end of the Red Sea.

There are two schools of thought among scientists on what happened next. Both agree that after the Bab el Mandeb crossing the peregrination continued along the coast of eastern Arabia, and from there across the Strait of Hormuz along the coast of Asia to Australia. One school argues that the migration ran into the eruption of Toba about 75, 000 ago. Toba, a volcano in Sumatra, Indonesia, produced the largest volcanic eruption in the last 2 million years. The skies stayed dark for six years. Ash from the eruption—covering an area about half the size of the United States — has been recovered from deep-sea cores taken in the Bay of Bengal and in India, roughly three hundred miles inland and 1,900 miles from Toba. Some scientists suggest the ash may have reached central Asia and the Middle East. Most species were smothered and died and at least one prominent scientist esti-

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mates that the population of *Homo sapiens* may have fallen to about 2,000 individuals.[2]

Toba devastated South and Southeast Asia. The climate changes generated by the Toba eruption altered both the face of the planet and the fate of *Homo sapiens*. Whatever the real story, still being pieced together as science finds ways to delve more deeply into the past, there were survivors.

Also on exhibit are three tubes containing particles of DNA. The analysis of the genetic material in each indicates that human DNA is 98.8 percent identical to that of chimps and bonobos, our closest living relatives. And our DNA is, on average, 96 percent identical to our most distant primate ancestors.[3] One of the DNA samples is from a 40,000-year-old Neanderthal, the extinct close cousin of *Homo sapiens*. When a Neanderthal skull was discovered in 1856, it led to the recognition that different kinds of humans once lived on Earth.[4] The exhibition is extraordinary testimony to our understanding of human evolution and the complexity and connectivity of life.

An odd way, perhaps, to introduce an issue of the *New England Journal of Public Policy* that deals with issues of climate change, oil, and water and the interconnection of the three with the future of the planet.

Initially our topic was conceived as "Oil & Water" only. We planned to present the proceedings of an Institute for Global Leadership symposium held at Tufts University in 2005. There was then still a debate about global warming, although the Kyoto Treaty was in place. But without the world's preeminent manufacturer of greenhouse gas (GHG) emissions, the United States (20 percent of the total emissions with 5 percent of the world's population) as signatory, Kyoto lacks the political muscle to ensure implementation and thus is more often praised for its spirit than for what it has achieved.

## IPCC Report

But with the publication on February 2, 2007, of the final report of the United Nations Intergovernmental Panel on Climate Change (IPCC),[5] "all has changed, changed utterly."[6] The report's findings are "unequivocal,"—the word that six hundred scientists from forty countries used to express their consensus *and* their certainty: Global warming is manmade, due to greenhouse emissions primarily from burning fossil fuels — coal, oil, and gas — that cause the atmosphere to burn and from deforestation. Unless addressed with urgency and at a global level with the cooperation of the world community, *Homo sapiens* could face a Toba of a far greater magnitude than the previous one, putting the future of *Homo sapiens* himself at risk. We are, after all, just a species, and susceptible to the same extinction we have wreaked on others. Perhaps it is fitting, given our disregard for the fate of other species separated from us by miniscule amounts of DNA, that it is *our species* who may allow other more adaptable species to inherit a vastly different earth.

How bad is the situation? Concentration of carbon dioxide in the atmosphere is at its highest levels in 650,000 years — the rise began with the birth of the Industrial Revolution two hundred and fifty years ago. The pre–industrial revolution level was 278 parts per million (ppm) and between 180 and 300 ppm over the previous 650,000 years. In 2005, the level of $CO_2$ concentration stood at 379.[7]

More troublingly, the IPCC report found that the rate of increase of carbon dioxide in the atmosphere is beginning to accelerate. Between 1960 and 2005 the average rate at which carbon dioxide concentrations increased was 1.4 ppm per year. But when the figures are disaggregated it emerges that the rate of increase appreciated to 1.9 ppm per year between 1995 and 2005.

Although the IPCC notes that it is too early to explain the accelerating increase, it does not rule out that it may indicate a change in the way the Earth is responding to global warming. In other words, climate feedbacks may be accelerating the rate of change. More ominously, the IPCC points out that, as the planet gets warmer, the natural ability of the land and the oceans to absorb carbon dioxide from the atmosphere begins to get weaker.

A warmer world is causing more evaporation from the oceans and a rise in water vapor — a powerful greenhouse gas — in the lower atmosphere. Sea ice and snow cover are shrinking at the poles and on mountains, leading to a further increase in local temperatures.

In short, the processes contributing to warming are now part of a reiterative equation, the variables interconnected and feeding on themselves. The problems that the global community is monitoring but as yet have insufficiently addressed are: a) to evaluate the extent to which the accumulated levels of GHG emissions, dating back perhaps to the beginning of industrialization some 250 years ago, will continue to lead to higher levels of warming; b) when current levels of emissions or even reduced levels are added to the aggregate what is the added impact; c) at what level of emissions will the iterative process stabilize; and d) to what levels must emissions be reduced in order to reach a stable equilibrium between sustainable development and greenhouse emissions.

The IPCC lays out four scenarios that, depending on our response or lack thereof, will likely come about by 2100.[8]

> **+2.4°C Coral Reefs Almost Extinct**
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> In North America, a new dust bowl brings deserts to life in the high plains states, centered on Nebraska, but also wipes out agriculture and cattle ranching as sand dunes appear across five U.S. states, from Texas in the south to Montana in the north.
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> Rising sea levels accelerate as the Greenland ice sheet tips into irreversible melt, submerging atoll nations and low-lying deltas. In Peru, disappearing Andean glaciers mean 10 million people face water shortages. Warming seas wipe out the Great Barrier Reef and make

coral reefs virtually extinct throughout the tropics. Worldwide, a third of all species on the planet face extinction.

**+ 3.4° C Rainforest Turns to Desert**

The Amazonian rainforest burns in a firestorm of catastrophic ferocity covering South America with ash and smoke. Once the smoke clears, the interior of Brazil has become desert, and huge amounts of extra carbon have entered the atmosphere, further boosting global warming. The entire Arctic ice cap disappears in the summer months, leaving the North Pole ice-free for the first time in 3 million years. Polar bears, walruses, and ringed seals all go extinct. Water supplies run short in California as the Sierra Nevada snowpack melts away. Tens of millions are displaced as the Kalahari Desert expands across southern Africa.

**+ 4.4° C Melting Ice Caps Displace Millions**

Rapidly rising temperatures in the Arctic put Siberian permafrost in the melt zone, releasing vast quantities of methane and $CO_2$. Global temperatures keep on rising rapidly in consequence. Melting ice-caps and sea-level rises displace more than 100 million people, particularly in Bangladesh, the Nile Delta, and Shanghai. Heatwaves and drought make much of the subtropics uninhabitable: large-scale migration even takes place within Europe, where deserts are growing in southern Spain, Italy, and Greece. More than half of wild species are wiped out in the worst mass extinction since the end of the dinosaurs. Agriculture collapses in Australia.

**+ 5.4° C Sea Levels Rise By Five Meters**

The West Antarctic ice sheet breaks up, eventually adding another five meters to global sea levels. If these temperatures are sustained, the entire planet will become ice-free, and sea levels will be 70 meters higher than they are today. South Asian society collapses due to the disappearance of glaciers in the Himalayas, drying up the Indus River, while in East India and Bangladesh, monsoon floods threaten millions. Super–El Niños spark global weather chaos. Most of humanity begins to seek refuge away from higher temperatures closer to the poles. Tens of millions of refugees force their way into Scandinavia and the British Isles. World food supplies run out.

**+ 6.4° C Most of Life is Exterminated**

Warming seas lead to the possible release of methane hydrates trapped in suboceanic sediments: methane fireballs tear across the sky, causing further warming. The oceans lose their oxygen and turn stagnant, releasing poisonous hydrogen sulphide gas and destroying the ozone layer. Deserts extend almost to the Arctic. “Hypercanes” (hurricanes of unimaginable ferocity) circumnavigate the globe, causing flash floods which strip the land of soil. Humanity reduced to a few survi

> vors eking out a living in polar refuges. Most of life on Earth has been snuffed out, as temperatures rise higher than for hundreds of millions of years.

The six degree world is most probable by about 2100 if GHG emissions continue to rise at their current rates, if the world continues to carry on with rapid economic growth using high levels of fossil fuels. But perhaps the finding with the greatest immediacy was the prediction that if $CO_2$ is allowed to double from the preindustrial revolution level to about 550 parts per million, the Earth's temperature will probably rise by 3 degrees, which, while well short of the worst-case scenario, would make life unsupportable.

Many scientists have been using the 550 ppm figure as a *realistic* level at which the world might aim to stabilize $CO_2$ levels. This is no longer realistic. To many scientists who work in the field, much of the IPC report is now old hat. The scenarios it posed, bleak as they seem, were, in their view not sufficiently bleak. More recent data, not incorporated in the report, indicates that the arctic ice shelf is collapsing more rapidly than the IPC report calculated, that some 200 glaciers held back by the shelf are moving toward the sea about eight times faster than previously thought. Melting glaciers have a greater impact than disintegrating shelves since the ice from the glaciers comes off land. The same thing is beginning to happen to the western Antarctic ice sheet, which is now disintegrating at a rate of 250 cubic kilometers a year. If the entire sheet were to disintegrate, the waters would rise by six meters around the globe, submerging the world's coastal cities.[9]

The British Antarctica Survey (BAS) research has linked the collapses to the hole in the world's protective ozone layer. In October 2006, NASA scientists found that the hole is bigger than ever, and is now 27.5 square kilometers. Glaciers in Greenland are melting even faster than in Antarctica, within the last two years the rate of loss has increased by 250 percent. If the entire ice cap disappears, sea levels will rise by another 7 meters. This melting also sends more fresh water into the North Atlantic disrupting the currents that bring the Gulf Stream to warm Northern Europe.

The primary causes for warming are not in doubt: greenhouse gases, especially carbon emissions, are trapped in the atmosphere, preventing the sun's warmth from reflecting back into space, pushing the global temperature to artificially high levels and altering the climate. We have been warned, sufficiently and repeatedly: if we, the global community, do not *immediately* address climate warming while the costs of adaptation are manageable, though highly inconvenient, costs of adaptation may become irrelevant. If the variables that contribute to global warming begin to interact with each other, compounding their individual impacts and creating the iterative process referred to above, then our inaction will have changed the organic composition of the planet itself, making it perhaps dangerously inhospitable for human life.

Our benign belief that man's ingenuity will create the technology to overcome the devastations that global warming may wreak is ultimate denialism in the face of impending catastrophes. Technologies do exist — solar power and wind — and others such as heat mining (geothermal power that taps steam from underground to turn turbines). We might use biofuel or electricity to fuel our cars. We might drive cars that burn fuel more efficiently or those that are powered by hydrogen. Nuclear fusion may one day become a reality, but can we afford to wait for "one day"?

The history of life on Earth is riddled with examples of species becoming extinct: the great giant reptiles, the dinosaurs, come to mind. That we, as a species, should face a similar fate is, in the context of the millions of years that went into our making, a not unreasonable proposition to entertain. That it should be of our own doing has a certain cosmic justice.

Kyoto excludes developing economies, most conspicuously China and India, both of which, but especially the former, have embarked on massive programs of industrialization, with scant attention to the greenhouse impact. Indeed, as the lobby for more drastic action on the climate front mostly emanates from sectors within the developed world, the developing world, which is now being asked to sign on to carbon emission standards that may curtail their growth prospects, argue, not unreasonably, that the countries largely responsible for climate warming are now looking to countries that have only recently embarked on large-scale industrialization to pay for the hazardous byproducts of the West's success. And since the majority of these countries is mired in chronic unemployment and poverty, their sense of priorities differs profoundly from that of the developed world. The developing world is not yet convinced that they will bear the brunt of the impacts of global warming, and that biting the bullet on emissions is not a question of choice but of necessity.

In this issue of the *New England Journal of Public Policy*, global warming is contextualized in relation to oil and water. Oil (carbon emissions) is the major contributor to warming. Water is the major casualty of warming. Without oil we cannot sustain the global economy; without water we cannot sustain life.

The European Union (EU) has responded far more vigorously than the United States to the challenge with proposals that would cap emissions on an industry-by-industry basis for the twenty-seven member states and promote a vigorous carbon trading market. Its carbon protocol calls for setting 130 grams/km as a cap for carbon dioxide emissions from new cars by 2012, the toughest $CO_2$ emissions cap in the world. (Current levels of average car $CO_2$ emissions are around 162 grams per kilometer.) It also provides for further research to get the level down to 95 grams per kilometer by 2020.

The plan, which also calls for increased use of biofuels and cleaner fossil fuels, is meant to reduce current greenhouse gas emissions by 20 percent by

2020 compared to 1990 levels with a promise to move to 30 percent if other countries follow suit. It urges major investment in carbon capture and sequestration, and stipulates that 20 percent of the EU's energy needs will be met by renewable energy sources by 2020.[10]

In March 2007, the British Government became the first in the world to commit itself to legally binding reductions in carbon dioxide emissions. In a draft bill published on March 13, the government promised to enshrine into law its commitment to cut emissions by 60 percent by 2050. Opposition parties and Labour MPs joined forces in calling for an 80 percent reduction. The bill also sets an interim target of reducing emissions by between 26 percent and 32 percent by 2020. Legally binding five-year "carbon budgets" will be fixed fifteen years ahead to keep the UK on course.

After the congressional elections in November 2006 in the United States, the new Democratic Party leadership introduced a slew of bills to tackle climate change. The model the bills sought to emulate in one form or another is California's plan to reduce carbon emissions by 80 percent from 1990 levels by 2050. There is no question that U.S. attitudes are changing rapidly, but whether they are changing rapidly enough is problematical and the measures proposed by the "best" of the proposed bills are inadequate to curb rising temperatures. A prominent NASA climate scientist calls the bills "baby steps."[11]

World Bank Chief Scientist Robert Watson shares similar concerns. The world, he told a conference organized by the Tyndall Centre for Climate Change, must aim to limit the temperature rise due to global warming to just two degrees Celsius despite the near impossibility of achieving it.[12]

At atmospheric concentrations of 450 ppm carbon dioxide, temperatures will rise by two degrees Celsius. At 550 ppm temperatures will rise by another three degrees. Current levels are already over 400 ppm and rising at around two ppm per year. According to Watson, a ceiling of 450 ppm should be set, but "whether we can get to it is another question," he added. "In practice I don't think we can stabilize at two degrees. It is going to take a major change in the way we generate and use electricity to even stabilize between two and three degrees."

Whatever the case, major investments in new infrastructure and technologies are needed, Watson warned, "to save the planet from devastating and irrevocable change. We first need to use all the technologies that we already have to get to a low carbon economy," Watson said. "Then we need to invest in the new technologies. We have to mitigate as quickly as possible while also having to adapt." Hence the urgency of establishing a long-term global regulatory framework. Nations had to come together to come up with a long-term plan to cut emissions and create a stable price for carbon. "We need something long-term, not Kyoto plus five, not Kyoto plus 10, but something much longer," Watson said. Mitigating as quickly as possible on the one hand, simultaneously adapting on the other.

## The UN "Confronting Climate Change"

On March 1, the United Nations Foundation issued a roadmap for the way forward. "Confronting Climate Change: Avoiding the Unmanageable and Managing the Unavoidable"[13] warns that "to avoid entering a regime of sharply rising danger of intolerable impacts on humans, policy makers should limit temperature increases from global warming to 2–2.5°C above the 1750 pre-industrial level." Yet, it reassures, there is time possibly "to avoid unmanageable changes in the future, but the time for action is now." Temperatures "have already risen about 0.8°C above preindustrial levels and are projected to rise approximately 3–5°C over preindustrial levels by 2100. To avoid temperature increases greater than 2–2.5°C would require very rapid success in reducing emissions of methane and black soot worldwide, and global carbon dioxide emissions must level off by 2015 or 2020 at not much above their current amount, before beginning a decline to no more than a third of that level by 2100."

Again, the report reassures: "The technology to seize significant opportunities . . . already exists." But policy makers must act *immediately* to reduce emissions by: a combination of energy efficient transportation, fuel taxes, rebates that favor purchase of efficient and alternative fuel vehicles, improving design and efficiency of commercial and residential buildings, standards for equipment and appliances, incentives for property developers and landlords to build and manage properties efficiently, and financing for energy-efficiency investments.

Among some of its more far-reaching recommendations: expanding the use of biofuels through energy portfolio standards and incentives to growers and consumers; beginning *immediately*, designing and deploying *only* coal-fired power plants "that will be capable of cost-effective and environmentally sound retrofits for capture and sequestration of their carbon emissions"; and "addressing the adaptation needs of the poorest and most vulnerable nations, which will bear the brunt of climate change impacts."

The report offers two starkly different assessments of possible futures. "Society's current path leads to increasingly serious impacts. . . . The other path leads to a transformation in the way society generates and uses energy [and] creates economic opportunity, and helps reduce poverty. . . . Humanity must act collectively and urgently to change course through leadership at all levels of society. There is no more time for delay."

Hard on the heels of the UN Foundation report came the United States Climate Action Report, which estimated that as a result of the Bush administration's policies on climate, the emission of greenhouse gases contributing to global warming will increase by 11.0 percent in 2012 from their 2002 level compared with 11.6 percent in the previous level. The report also warned of impending threats to the water supply in the Northwest and Southwest.[14]

Clearly, the time to act is now.

The articles in this issue are drawn from four sources, the EPIIC symposium on "Oil & Water" at Tufts University in February 2005, articles published in other journals but brought together here to create a richer understanding of each, extracts from a number of UN publications, and the Stern Review, which was commissioned by the British government to provide a comprehensive overview of the dimensions of climate change.

Many of the articles address questions of supply and demand, the states of geopolitical play, the attendant conflicts and cross interests as developed and developing countries try to balance their dependencies with countervailing dominance. But the policy issues these articles raise and the manner of our response to date are firmly rooted in the old paradigm, the belief that tinkering here and there will reduce climate warming to acceptable levels. But when we re-examine these articles in the context of the new paradigm of a massive global initiative to stabilize global warming at its current levels, the tasks ahead are thrown into sharp relief. One participant at the EPIIC conference, a senior official in the Clinton administration who wished to remain anonymous, related how dumbfounded he was to discover that within the highest levels of government there were no institutional processes in place that were tasked with developing longer-term policy for guiding the country and steering the behavior of the world.

Not that there is an absence of new thinking in the marketplace. In "Scrubbing the Sky," Marcy Murninghan conveys the sense of urgency that is becoming more prevalent in some sections of government, business, and civil society. There are initiatives to develop market-based trading systems that provide incentives to reduce greenhouse emissions. There are research efforts to develop alternative energy sources. But while Murninghan's article articulates many encouraging signs that government and business are beginning to work in harmony, one is, nonetheless, left with the impression that the responses are time-lagged — appropriate, perhaps, for a situation that existed twenty years ago, but not aggressive enough for today.

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Our priorities are skewed, at least in the West where we are bombarded daily with information relating to oil — the price of crude; the price of a gallon at the gas pump; and the strains on reserves exerted by developing countries, especially the two giants in Asia, China, and India with their voracious need for oil to drive their industrial revolutions. Can current reserves be augmented and if so will reserves take us into the twenty-second century? These speculations keep our anxieties on high alert.

There is less public conversation about water. Yet, the world crisis in water is acute, with consequences that go to the heart of our being able to manage a sustainable planet. By 2025 world population will pass the 8 billion mark. Can the earth feed 8 billion people? One of the main factors limiting food production is water. In "Global Water Outlook to 2025:

Averting an Impending Crisis" Mark W. Rosegrant et al. are not reassuring. "This report," he concludes "shows that if current water policies continue, farmers will indeed find it difficult to meet the world's food needs." And hardest hit will be the world's poor. Furthermore, "environmental uses of water, which may be the key to ensuring the sustainability of the Earth's water supply in the long run, often get short shrift." Unless we begin to focus on water-related investments *now,* a severe water crisis looms.

Already over one billion people lack enough safe water to meet minimum levels of health and income. If the present complacency continues "with governments and water users implementing institutional and management reforms in piecemeal fashion," water scarcity will lead to "slower growth in food production and substantial shifts in where the world's food is grown. (Approximately 70 percent of all freshwater is used for irrigation of crops to provide food, 22 percent is used in manufacturing and energy [cooling power stations and producing hydroelectric power] and only 8 percent is used by households and businesses for drinking, sanitation, and recreation)." By 2025 water withdrawal for most uses — domestic and industrial — is projected to increase by at least 50 percent. This will severely limit irrigation water withdrawal, which in turn will constrain food production. "Water is fundamental to our way of life," the report of the Second World Development Forum felt it necessary to remind us, because although it is so obviously true, the implications are so widely discarded. Water is crucial to the preservation of the essential ecosystems upon which our lives depend. Whatever development initiatives are proposed over and above the provision to secure access to water, unless the requisite water services are secured and provided, these initiatives will not succeed. Access to secure water supplies is essential. This seems self evident yet it is clear that the central role of water in development is neither well understood nor appreciated.

Only in recent years has a start been made on understanding the implications of water scarcity and only more recently still have the implications of climate been factored into the supply side of the equation.

In "The Impacts of Climate Change on Growth and Development," the Stern report jars us to come to grips with pending realities: "Melting glaciers will increase flood risk during the wet season and strongly reduce dry season water supplies to one sixth of the world's population, predominantly in the Indian subcontinent, parts of China and the Andes in South America. Declining crop yields especially in Africa will likely leave hundreds of millions without the ability to produce or purchase sufficient food. Rising sea tides will result in tens to hundreds of millions of people flooded each year with warming of 3° to 4°C.

China will probably find itself in a bind of its own making if it continues to drive growth through fossil fuels, relying on its huge deposits of coal, much of it unwashed. It will run into a ceiling as the rate at which fossil fuels are consumed outweighs the rate at which emissions can be controlled.

Increasing water shortages will act as a brake on growth and further exacerbate the inequality between its huge middle class and its even more huge underclass.

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Oil has made the twentieth century the most prosperous century in human history, but at a price that will have to be refunded in part in the twenty-first. Increasing American dependence on foreign oil, especially oil from the Middle East, changed the focus of U.S. foreign policy in the latter part of the last century and in the first part of this century it continues to propel policy. In "Geopolitics Reborn" Michael Klare draws attention to the militarization of the global energy quest: "The U.S. maintains a large military presence in the Persian Gulf region, now being followed by the introduction of American forces in the oil producing areas of the Caspian Sea region, West Africa, and Latin America. Russia and China are behaving in roughly analogous fashion." The stage is being set for recurring conflicts over access to foreign energy supplies. There are many who aver that the Second Iraq war was instigated to secure and protect U.S. oil interests rather than to rid Iraq of Saddam Hussein.

The geopolitics of oil, especially in the uncertainties in supply and the astronomical increase in demand fueled by China's growth, saw the price of crude oil escalate to $78.00 a barrel in 2006 before receding to $50.00 a barrel. The wild swings in price added unpredictability to uncertainty and accounted for swings in 2006 global financial markets, both in developed and emerging markets.

In "Seeking Peace in the Niger Delta" Darren Kew and David L. Phillips capture the dimensions of the explosive situation in the Niger Delta, which earned $45 billion in 2005 and $300 billion in foreign exchange for Nigeria (about 90 percent of Nigeria's total foreign exchange). Yet Delta communities live in abject poverty with 90 percent unemployment. The region is massively polluted, the population malnourished, most with symptoms of oil poisoning. Sophisticated armed militias abound, loyal either to local oil barons/politicians or to rebels like the Movement for the Emancipation of the Niger Delta (MEND), which is capable of disrupting oil production almost at will. The Delta is a cesspool of poverty, shack towns, undrinkable water. It is a backwater of despair.

This, in stark contrast to the huge oil facilities, which are protected around the clock by human and electronic surveillance as they produce billions of dollars of export revenue.

Oil revenues are allocated directly to state governors. But there is little trickle down. The "Big Men" are not dependent on the local population for their election, even though "democratic" elections are held. In oil rich Nigeria, the World Bank estimated that in 2006, over 92 percent of its people were living on less than two dollars a day.

Nigeria has roughly 40 billion barrels of proven oil reserves. Because the oil's sulfur content — "sweet" crude — is low, the oil is in high demand by refineries in the United States, which purchase about 40 percent of current production, providing about 11 percent of American oil imports. Today, Nigeria has the capacity to produce about 2.4 million barrels of oil per day and is projected to reach 4 million barrels per day by 2010. In addition, Nigeria is home to the world's seventh largest supply of natural gas. But so chaotic are conditions in the region that some two million barrels of crude oil have been discharged into the environment. The region has been rated as one of the five most polluted areas on Earth. Unless the central government commits itself to sweeping reforms, the situation there can only deteriorate. For starters, the collusion between the government and the oil companies must cease, state and local elections must be seen to be free and fair, and a legitimate forum created in which the Delta's multiethnic populations can begin to articulate their grievances and seek legitimate redress. "If the Niger Delta is allowed to continue to burn unchecked," Kew and Phillips warn, "the rest of the fragile Nigerian political house may soon ignite, imperiling the entire West African region."

When oil was first discovered, the energy equivalent of one barrel of oil was required to pump 50 barrels; today that ratio is one to five. As the demand for oil continues to soar, exploration becomes more expensive and some estimates put "peak oil" — when production of a barrel of oil will require the energy equivalent of a barrel of oil — at 2040. Whatever the date of peak oil, it is now clear that the world must wean itself.

Pablo Bustelo documents the concerns of China's leadership over the security of its future energy needs in "China and Oil in the Asian Pacific Region." The Chinese, he tells us, are determined to find new sources of supply, and to control purchase and transport lanes, to secure their own energy needs, "while boosting national production at any cost." This, he asserts, "is already causing tension and could lead to further disputes with the United States and other big oil consumers, such as Japan and India as well as other Asian Pacific countries."

The world consumes 84 million barrels of oil a day. The figure is expected to increase to 120 million barrels in the next twenty-five years. In the developed world, especially the United States, which now imports 75 percent of its energy needs, we can discern the first inklings of a revolution to end dependency on foreign suppliers in the shift to the production of ethanol as a substitute for oil. The problem here is that both the energy required to produce ethanol and the $CO_2$ emissions it would generate as a fuel make it almost as lethal as a fossil fuel in terms of its climate impact.

Secretary-General of the United Nations Kofi Annan addressed the six thousand participants from 180 countries, including the 166 signatories to the Kyoto Protocol, attending the United Nations Conference on Climate Change. "On the issue of global warming," he admonished them, more in sorrow than in anger, "there has been a frightening lack of political leader-

ship." One purpose of the conference was to develop protocols to help developing countries — especially in Africa — participate in the Kyoto Protocol's Clean Development Mechanism. An implicit objective of the conference was to jumpstart negotiations to set carbon emission standards to replace the standards mandated by the Kyoto Protocol when it expired in 2012. But that proved too elusive, Annan's observation on the quality of leadership too accurate. Kyoto calls for industrialized countries to cut carbon emissions by 5 percent by 2012 to emission levels of 1990. A first attempt to bring order to the global house, Kyoto was almost insignificant in light of the dimensions of the problem, especially with the worst offender, the United States, refusing to commit itself.

The age of oil is over. Pipelines on the drawing boards that stretch from Central Asia to Europe, and, perhaps, across Iran to seaports in the Gulf, or through Russia, Central Asia, the Caspian Sea Basin, through Pakistan to India or stretching to China will have to be revisited. In the decades ahead, the most important criterion for evaluating such huge investments will be their opportunity cost — whether an expenditure of similar magnitude on nonfossil fuel energy generation might not yield a higher social return.

We have ten years, twenty at most, to make the decisive interventions to move to the new paradigm. The latest IPCC report, April 2007, accentuates the point that within the next two decades hundreds of millions of people will not have enough water, while tens of millions will be flooded out of their homes each year as the earth reacts to rising temperatures and sea levels.[15] Stern concludes that acting now to cut carbon gas emissions would cost roughly one percent of global economic output, with the cost from delaying rising sharply. A reasonable cost by most yardsticks. But what he was unable to take into account were the psychological and human adjustments that will be necessary: the behavioral changes, the new dictates of transport, consensus among nations on what proportion of the costs of change will fall on which countries, altered notions of national sovereignty, adaptation to a world in which much of what we take for granted — a limitless abundance of electricity, for example — is altered.

But if we find ourselves rehashing old arguments in 2017, attempting to move in increments rather than in huge leaps, we will surely begin to reap what we have sown. Rich nations must begin to understand that they will have to shoulder the larger share of the cost of adaptation; developing countries must begin to understand that the trajectories of growth that guide their current policies will have to be modified, that sustainable development must take precedence, that the right to certain consumer goods equated with rising prosperity, such as automobiles, must be radically reconsidered. As a global community we must accept new definitions of what prosperity means. Planet Earth cannot survive another 300 million oil-burning cars in the next twenty years, no matter how efficient.

Almost certainly, countries will redirect their resources to nuclear power, clean, efficient, and free of GHGs. In this regard France already leads the way. Over 75 percent of energy requirements are met by nuclear power. To date the French have met the waste disposal problem in ways that are acceptable to the French people. A nuclear model on the French scale offers alternatives to developing countries, which are dollar poor, but will not be saddled with the costs of replacing the infrastructure or consumption habits of an old paradigm.

South Africa and China have taken the lead in building nuclear pebble bed reactors, which have advanced safety features.

Coal, too, is poised for a comeback. Coal plants produce half of the electricity used in the United States. Coal is cheap and widely available in the United States, China, India, and many other nations. A new study by MIT says technology to capture greenhouse gas emissions from coal-fired plants and store them underground will work. It recommends building ten large coal plants worldwide — including three in the United States — in order to test the technology in different underground conditions.

I have chosen to refer to certain articles and not to others among the many splendid contributions to this issue, not because the others do not merit mention but only because those referred to most explicitly highlight the themes of this editor's note.

As a global community we are facing a future where, for the first time in fifty years perhaps, the threat of nuclear annihilation has temporarily taken second place to the threat of a future environmental devastation. How we meet the challenges of our angry planet will define what lies ahead for humanity in the twenty-first century. The choices are indeed stark. If short sightedness prevails we will head into a Darwinian wilderness. But we do not have to travel that route. We have been warned conclusively of the consequences of our inaction. In the end, the choice is ours. Literally, to be or not to be.

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# Notes

1. http://www.amnh.org/exhibitions/permanent/humanorigins/history/turkana.php
2. "The Proper Study of Mankind: A Survey of Human Evolution," *Economist,* December 24, 2005.
3. Ibid.

4. Ibid.
5. The Intergovernmental Panel on Climate Change, Fourth Assessment Report, "Climate Change 2007, Working Group 1, The Physical Science Basis" WMO and UNEP, Paris 2007.
6. See summary of *Independent/U.K.*
7. "Global Warming: The Final Warning," *Economist*, February 3, 2007.
8. These summaries are reproduced from the *Independent/U.K.*, February 3, 2007.
9. British Antarctic Survey: Go to www.antartica.ac.uk.
10. "EU Seizes Leadership of Climate Fight," *Financial Times,* March 10, 2007.
11. "Political Heat" *New York Times Magazine*, February 18, 2007.
12. Jeremy Lovell, "Aim for Low World Warming Despite Hardship-Scientist" Reuters, February 19, 2007, available at ScientificAmerican.com.
13. "Confronting Climate Change: Avoiding the Unmanageable and Managing the Unavoidable," UN Foundation, Washington, D.C., 2001.
14. "U.S. Predicting Steady Increase for Emissions," *New York Times*, March 3, 2007.
15. *New York Times,* March 12, 2007.