

**ARTICLES TO READ FOR LAST 2 CLASSES—SET B, ON CLIMATE CHANGE
AND RELATED ISSUES SINCE ABOUT 2005**

--TABLE OF CONTENTS

1. "Effects of warming have worsened," *Boston Globe*, 11/23/09.
2. "The carbon bathtub," *National Geographic*, Dec. 09 (Diagram)
3. "Per person annual income..." (short table)
4. "CO2 emissions" (short table—on transportation). NOTE: both of these are on the same page.
5. "GDP vs. GPI: 'product' vs. 'progress'" from Al Gore, *Our choices: a plan to solve the climate crisis* (Rodale Press, 2009), p. 324
6. "China fears consumer impact..." *New York Times*, 5 July 2010.
7. "Choosing a clean energy economy: increasing heat-trapping emissions, no action, vs. Climate 2030 blueprint, savings for consumers and businesses." From Union of Concerned Scientists, *Climate 2030*, Executive Summary, p.13 (full report available at www.ucsusa.org.)
8. John MacDougall, "Climate change: some information and resources."
NOTE: I would love to get feedback on this!
9. 350.org, "mission," and "10/10/10 global work party" from www.350.org
10. Naomi Klein, "New climate movement in Bolivia," *The Nation*, 20 May 2010.
11. Mark Hertsgaard, "Regreening Africa," *The Nation*, 7 Dec. 09.
12. Sustainable urban transportation—2 photos (from Institute for Transportation and Development Policy, www.itdp.org)
13. Justin Mog & Amanda Fuller, "Re-rooting in America," *BeFriending Creation*, Nov.-Dec.09.
14. "10 things you can do to shrink your carbon footprint," *The Nation*, 3/15/10

Effects of warming have worsened since Kyoto--Pace around the world has accelerated

article no. 1

By Seth Borenstein, Associated Press | November 23, 2009 (in Boston Globe)

WASHINGTON - Since the 1997 international accord to fight global warming, climate change has worsened and accelerated, beyond some of the grimmest of warnings made then.

As the world has talked for a dozen years about what to do next, new ship passages have opened through the once frozen summer sea ice of the Arctic. In Greenland and Antarctica, ice sheets have lost trillions of tons of ice. Mountain glaciers in Europe, South America, Asia, and Africa have been shrinking faster than before.

And it's not just the frozen parts of the world that have felt the heat in the years leading up to next month's climate summit in Copenhagen:

- The world's oceans have risen by about an inch and a half.
- Droughts and wildfires have turned more severe worldwide, from the US West to Australia to the Sahel desert of North Africa.
- Species now in trouble because of changing climate include not just the polar bear, which has become a symbol of global warming, but also fragile butterflies, colorful frogs, and entire stands of North American pine forests.
- Temperatures over the past 12 years are 0.4 of a degree warmer than in the dozen years leading up to 1997.

The reason is that since an agreement to reduce greenhouse gas pollution was signed in Kyoto, Japan, in December 1997, the level of carbon dioxide in the air has increased 6.5 percent.

"Even the gloomiest climate models back in the 1990s didn't forecast results quite this bad so fast," said Janos Pasztor, climate adviser to UN Secretary General Ban Ki-moon.

Officials from across the world will convene in Copenhagen from Dec. 7 to 18 to seek a follow-up agreement. Sixty-five world leaders so far have said they will attend, including those from Australia, Brazil, France, Germany, Indonesia, Japan, Spain, and the United Kingdom.

When the US Senate balked at the Kyoto Protocol and President George W. Bush withdrew from it, that meant that the top three carbon polluters - the United States, China, and India - were not part of the pact's emission reductions. Developing countries were not covered by the protocol and that will be a major issue in Copenhagen.

From 1997 to 2008, world carbon dioxide emissions from the burning of fossil fuels have increased 31 percent; US emissions of this greenhouse gas rose 3.7 percent. Emissions from China, now the biggest producer of this pollution, have more than doubled in that time period.

In 1997, global warming was an issue for climate scientists, environmentalists, and policy specialists. Now even psychologists are working on global warming.

“We’ve come from a time in 1997 where this was some abstract problem working its way around scientific circles to now when the problem is in everyone’s face,” said Andrew Weaver, a University of Victoria climate scientist.

The changes in the last 12 years that have the scientists most alarmed are happening in the Arctic with melting summer sea ice and around the world with the loss of key land-based ice masses. Back in 1997 “nobody in their wildest expectations,” would have forecast the dramatic sudden loss of summer sea ice in the Arctic that started about five years ago, Weaver said. From 1993 to 1997, sea ice would shrink on average in the summer to about 2.7 million square miles. The average for the last five years is less than 2 million square miles. What’s been lost is the size of Alaska.

Antarctica had a slight increase in sea ice, mostly because of the cooling effect of the ozone hole, according to the British Antarctic Survey. At the same time, large chunks of ice shelves - adding up to the size of Delaware - came off the Antarctic peninsula.

While melting Arctic ocean ice doesn’t raise sea levels, the melting of giant land-based ice sheets and glaciers that drain into the seas do. Those are shrinking dramatically at both poles. Measurements show that since 2000, Greenland has lost more than 1.5 trillion tons of ice, while Antarctica has lost about 1 trillion tons since 2002, according to two scientific studies published this fall.

Worldwide glaciers are shrinking three times faster than in the 1970s and the average glacier has lost 25 feet of ice since 1997, said Michael Zemp, a researcher at World Glacier Monitoring

Service at the University of Zurich. ■

The Carbon Bathhtub

It's simple, really: As long as we pour CO₂ into the atmosphere faster than nature drains it out, the planet warms. And that extra carbon takes a long time to drain out of the tub.

December 2009

No. 2

What if we stop increasing emissions?
 Even at the current emissions rate, CO₂ is released into the atmosphere nearly twice as fast as it is removed—so the bathtub will continue to fill.

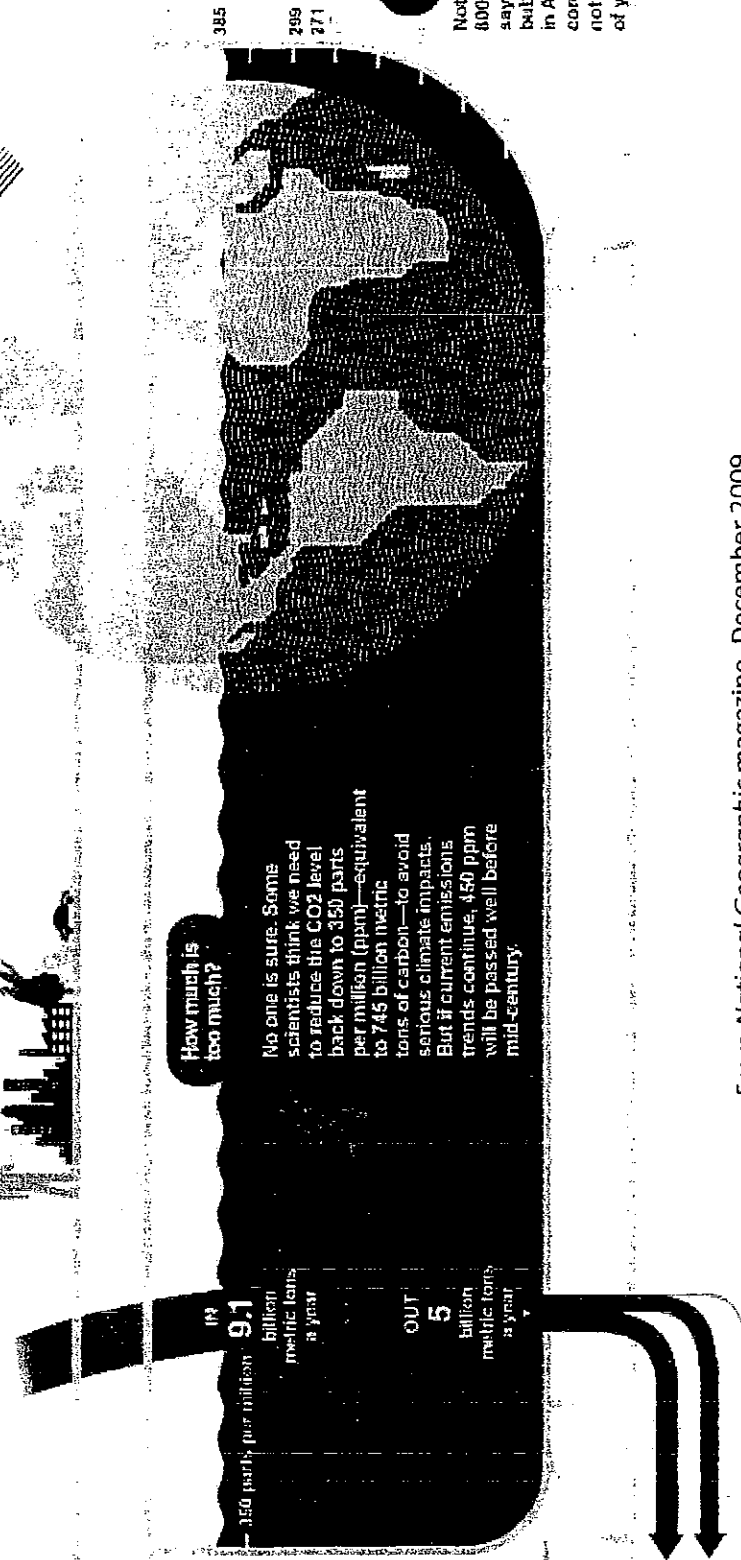
How do we cause CO₂ emissions?
 Four-fifths is from burning fossil fuels. Nearly all the rest is from deforestation and other changes in land use.

How does CO₂ cause warming?
 It absorbs some of the heat radiation coming off Earth's sunbaked surface and reradiates it back downward.

Where does our CO₂ go?
 Plants and soil absorb about a third each year, and ocean surface waters about a quarter. The rest stays airborne for a long time.

- 45% REMAINS IN ATMOSPHERE
- 30% ABSORBED BY PLANTS & SOILS
- 25% ABSORBED BY OCEANS
- <1% ABSORBED BY SEEDMENTS & ROCKS*

How much is too much?
 No one is sure. Some scientists think we need to reduce the CO₂ level back down to 350 parts per million (ppm)—equivalent to 745 billion metric tons of carbon—to avoid serious climate impacts. But if current emission trends continue, 450 ppm will be passed well before mid-century.



2008 AVERAGE
 HIGHEST ICE CORE READING 1333,000 YEARS AGO
 PREINDUSTRIAL LEVEL

Haven't CO₂ been this high before?
 Not for at least 800,000 years, say the oldest air bubbles found in Antarctic ice cores—and probably not for millions of years.

From National Geographic magazine, December 2009

* PERCENTAGES DO NOT ADD UP TO 100 BECAUSE OF ROUNDING.

PER PERSON – ANNUAL INCOME, BARRELS OF OIL USED, AND CO2 GENERATED

	Population	% of Pop	Income per Person	BOE per person	CO ₂ per person
US	300 million	4.5%	\$43,800	57.8 boe	19.6 tne
OECD-L	700 million	1.5%	\$23,915	30.9 boe	9.3 tne
Rest of the World	5,700 million	85.0%	\$5,832	8.3 boe	2.7 tne

No.3

OECD-L: *Western Europe, Canada and the industrial countries of Asia—Japan, South Korea, Australia, and New Zealand*

BOE: *Barrels of Oil Equivalent for all fossil fuels*

TNE: *tonne (metric ton)*

FRIENDS JOURNAL July 2008

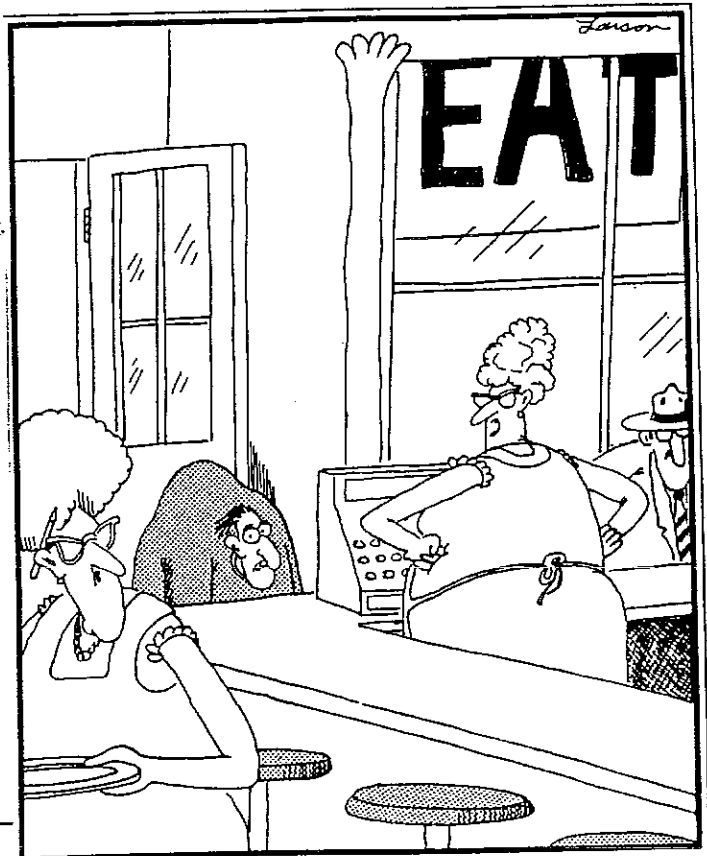
SOURCES: 1) CIA World Factbook, 2) International Energy Agency

CO₂ Emissions

Method of transport	Pounds per passenger mile
Inter-city bus	.18
Light rail	.35
Inter-city rail	.42
Local bus	.66
Plane, long trip	.8
Plane, short trip	1.28
Car, 1 person	
50 mpg	.4
40 mpg	.5
30 mpg	.75
20 mpg	1.0
15 mpg	1.5

Sources:
World Resources Institute employee commuting spreadsheet; Greenhouse Gas Protocol Initiative

No.4



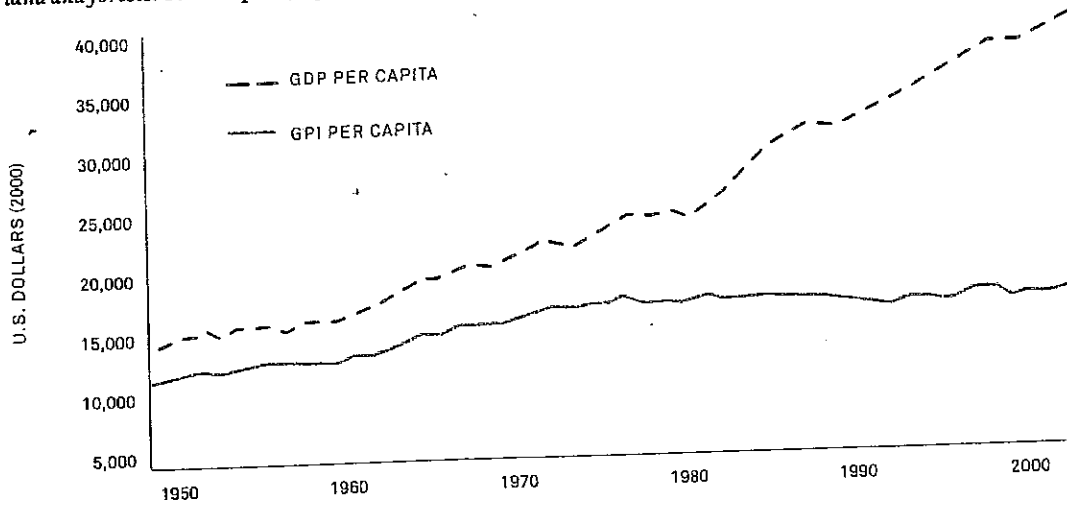
"Well, I don't think so, but I'll ask. Hey, Arlene! Anyone turn in a human brain left here yesterday? ... He says it was medium-sized, sort of pinkish."

FRIENDS JOURNAL November 2009

No. 5

GDP VS. GPI: "PRODUCT" VS. "PROGRESS"

Whereas GDP is the standard measure of a country's economic performance, summing the market value of all goods and services, the genuine progress indicator (GPI) is an attempt to measure the sustainability of income and the socioeconomic well-being of a nation. GPI adjusts the personal-consumption data of GDP by adding the benefits of nonmarket work, like unpaid housework and volunteering, and subtracting social costs like crime, air and water pollution, and the loss of farmland and forests. Over the past 50 years, GPI has increased at a much lower rate than GDP.



SOURCE: Robert Costanza, et. al., *The Pardee Papers*, No. 4, January 2009

The New York Times Reprints

No. 6

www.nytreprints.com

here

Order a reprint of this article now

CONVICTION
Watch The Trailer

China Fears Consumer Impact on Global Warming

By KEITH BRADSHER

GUANGZHOU, China — Premier Wen Jiabao has promised to use an “iron hand” this summer to make his nation more energy efficient. The central government has ordered cities to close inefficient factories by September, like the vast Guangzhou Steel mill here, where most of the 6,000 workers will be laid off or pushed into early retirement.

Already, in the last three years, China has shut down more than a thousand older coal-fired power plants that used technology of the sort still common in the United States. China has also surpassed the rest of the world as the biggest investor in wind turbines and other clean energy technology. And it has dictated tough new energy standards for lighting and gas mileage for cars.

But even as Beijing imposes the world’s most rigorous national energy campaign, the effort is being overwhelmed by the billionfold demands of Chinese consumers.

Chinese and Western energy experts worry that China’s energy challenge could become the world’s problem — possibly dooming any international efforts to place meaningful limits on global warming.

If China cannot meet its own energy-efficiency targets, the chances of avoiding widespread environmental damage from rising temperatures “are very close to zero,” said Fatih Birol, the chief economist of the International Energy Agency in Paris.

Aspiring to a more Western standard of living, in many cases with the government’s encouragement, China’s population, 1.3 billion strong, is clamoring for more and bigger cars, for electricity-dependent home appliances and for more creature comforts like air-conditioned shopping malls.

As a result, China is actually becoming even less energy efficient. And because most of its energy

is still produced by burning fossil fuels, China's emission of carbon dioxide — a so-called greenhouse gas — is growing worse. This past winter and spring showed the largest six-month increase in tonnage ever by a single country.

Until recently, projections by both the International Energy Agency and the Energy Information Administration in Washington had assumed that, even without an international energy agreement to reduce greenhouse-gas emissions, China would achieve rapid improvements in energy efficiency through 2020.

But now China is struggling to limit emissions even to the “business as usual” levels that climate models assume if the world does little to address global warming.

“We really have an arduous task” even to reach China's existing energy-efficiency goals, said Gao Shixian, an energy official at the National Development and Reform Commission, in a speech at the Clean Energy Expo China in late June in Beijing.

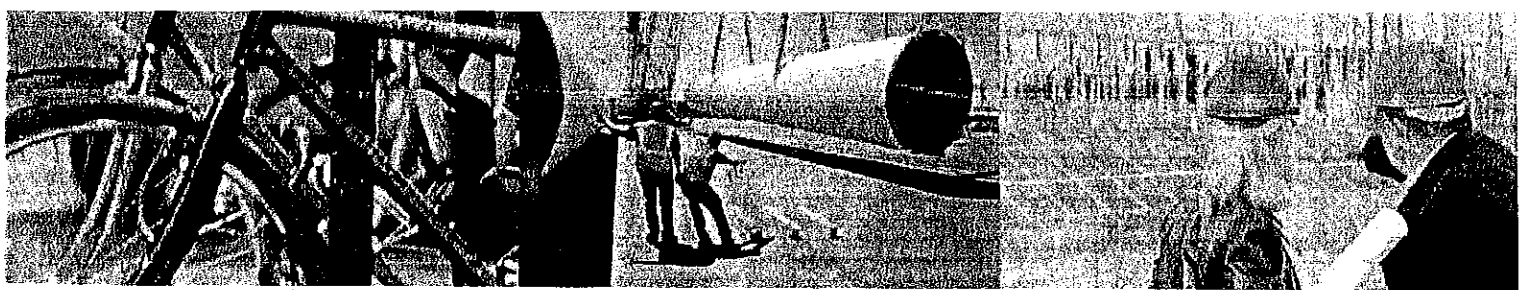
China's goal has been to reduce energy consumption per unit of economic output by 20 percent this year compared with 2005, and to reduce emissions of greenhouse gases per unit of economic output by 40 to 45 percent in 2020 compared with 2005.

But even if China can make the promised improvements, the International Energy Agency now projects that China's emissions of energy-related greenhouse gases will grow more than the rest of the world's combined increase by 2020. China, with one-fifth of the world's population, is now on track to represent more than a quarter of humanity's energy-related greenhouse-gas emissions.

Industry by industry, energy demand in China is increasing so fast that the broader efficiency targets are becoming harder to hit.

¶Although China has passed the United States in the average efficiency of its coal-fired power plants, demand for electricity is so voracious that China last year built new coal-fired plants with a total capacity greater than all existing power plants in New York State.

¶While China has imposed lighting efficiency standards on new buildings and is drafting similar standards for household appliances, construction of apartment and office buildings proceeds at a frenzied pace. And rural sales of refrigerators, washing machines and other large household appliances more than doubled in the past year in response to government subsidies aimed at helping 700 million peasants afford modern amenities.



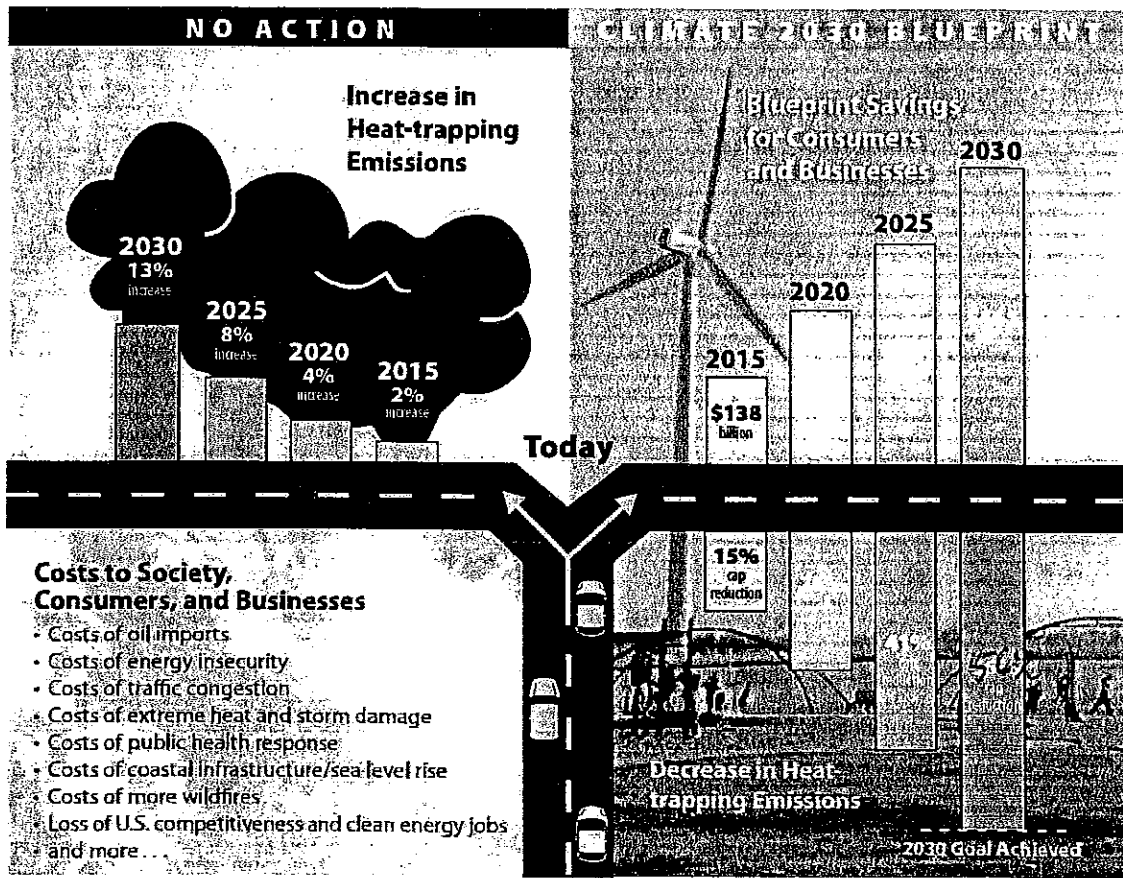
Chicago Department of Environment

Puget Sound Energy

©stockphoto.com

Choosing a Clean Energy Economy

No. 7



Emissions increases and decreases are relative to 2005; Blueprint savings are relative to the Reference case.

NREL

The United States is at a crossroads. We can choose to transition to a clean energy economy that addresses a multitude of challenges (oil dependency, energy security, global warming, air pollution) or we can choose to ignore these problems.

The Climate 2030 Blueprint shows that we can build a competitive clean energy economy that will save consumers money and give our children a healthy future.

Conversely, choosing to ignore our energy problems commits us to continued reliance on dirty fossil

fuels and to damaging costs associated with climate change. These costs include the consequences of sea level rise that threaten our coastal communities, disruptions in food production, and illnesses associated with extreme heat and diminished air quality.

This transition will certainly require some up-front investment costs. However, the Climate 2030 Blueprint will reduce energy use and consumer and business energy bills—even in the early years. These savings more than make up for the costs of building a clean energy economy.

The time to invest in our future is now.

CLIMATE CHANGE AND OTHER ENVIRONMENTAL ISSUES—
SOME INFORMATION AND RESOURCES by John MacDougall

SOME BIG PROBLEMS

Sources of greenhouse gases in US (2005—source, Union of Concerned scientists, “Rebuilding a Revitalized Clean Energy Economy”). Electricity CO₂—34%, Transportation CO₂—30%, Industrial CO₂—11%, Non-CO₂—17%

The role of population—see Hunt text p.424-27. World population doubled between 1960 & 1999.

The role of urbanization (Brown book—for full citation, see list below—p.192). In 1900 there were a “handful” of cities with over a million population; in 2000 there were over 400. The proportion of the world’s population living in cities became over half in 2009 (Brown p. 192).

Peak oil. Experts agree that—WHATEVER WE DO, regarding exploiting new oil sources—world production of oil is bound to start falling in just a few years. That will require radically new assumptions compared to the current one of endlessly increasing oil supplies (Brown p. 27-34)

The role of food. Growing, processing, transporting, storing and selling food has become much more energy-intensive. For example, in 1940 the US food system produced 2.3 calories of food energy from each gallon of fossil-fuel used. But in the early 21st century, 10 calories of fossil-fuel energy are required to create 1 calorie of supermarket food. (Michael Pollan, “Farmer in chief,” *New York Times Magazine*, 9 Oct. 08)

General ecological footprint of humans. Worldwide, we now have a footprint that means we need a quarter of an extra planet to support the human race. This is measured by demands on the earth’s systems, like food, fresh water, forests. (Brown p.11)

SOME SOLUTIONS

Reducing population growth. Solutions include general affluence, improving the status of women, education, economic justice. However some cultural/religious attitudes (e.g. among Catholics) make it very difficult to limit family size.

Sustainable cities—e.g. in Bogota, Colombia. Mayor Penalosa “realized a city that has a pleasant environment for children and the elderly would work for everyone.” (Brown p.193) He transformed the quality of life; among other things:

- 1200 parks were created or renovated
- Car parking was banned on sidewalks
- A very successful bus rapid transit was established
- Hundreds of kilometers of bike paths and pedestrian streets were built
- Rush hour traffic was cut by 40%
- Local citizens were involved in improving their neighborhoods.

SOME RECOMMENDED BOOKS

- Michael T. Klare, *Resource Wars: the New Landscape of Global Conflict* (revised ed., Henry Holt, 2002). Detailed information on connections between dwindling supplies of oil, water, minerals etc. and wars/militarism.
- Lester R. Brown, *Plan B 3.0: mobilizing to Save Civilization* (Norton, 2008). Comprehensive survey of problems and solutions.
- George Monbiot, *Heat: How to Stop the Planet from Burning* (South End Press, 2007). **My personal favorite, along with McKibben, *Deep Economy* (see syllabus, p.4). Honest, often witty examination of all the policies that could really cut greenhouse gas emissions by 90% by 2030.
- Van Jones, *The Green Collar Economy: How one Solution can Fix our two Biggest Problems* (Harper Collins, 2008). About addressing both climate change and social justice in the US, by a major African-American leader.
- Joanna Macy & Molly Young Brown, *Coming Back Home: Practices to Reconnect our Lives, Our World* (New Society Publishers, 1998). Highly recommended for anyone who ever feels despair or hopelessness about global problems—includes practical exercises focusing on emotional and spiritual issues, and discussion of paradigm changes.

SOME QUOTATIONS TO PONDER

"There's a saying 'We haven't inherited the planet from our parents, we've borrowed it from our children.' When you borrow, you plan to pay back. We've been stealing and stealing and stealing. And it's about time we got together and started paying back." Jane Goodall, in interview with Bill Moyers; full text can be found at <http://www.pbs.org/moyers/journal/11272009/watch.html>

"In our every deliberation, we must consider the impact of our decisions on the next seven generations" (Great Law of the Iroquois Confederacy)

"Many people are recognizing the folly of patterning organic processes, such as education, medicine, and farming, on industrial systems. A small but growing number seem to be evolving towards an ecological consciousness, rediscovering Earth as a living, evolving organism and themselves as part of it." Louis Cox, "Climbing to a whole-world view," *Quaker Eco-Bulletin*, Jan.-Feb.2010, p.3.

A RECOMMENDATION—also look at the worldview in Rachel Carson, "Silent Spring," in the Hunt reader, especially p.210.

SOME QUESTIONS TO THINK ABOUT

1. Would US students be willing to increase gas prices to European levels (say, \$10/gallon) through a far bigger gas tax, if the increased tax revenue was all dedicated to huge improvements in public transport?
2. Does addressing the current economic crisis override any other policy concern about the environment—for the US? Worldwide?

350.ORG--Mission

No.9
350.org

350.org is an international campaign that's building a movement to unite the world around solutions to the climate crisis--the solutions that science and justice demand.

Our mission is to inspire the world to rise to the challenge of the climate crisis—to create a new sense of urgency and of possibility for our planet.

Our focus is on the number 350--as in parts per million CO₂. If we can't get below that, scientists say, the damage we're already seeing from global warming will continue and accelerate. But 350 is more than a number--it's a symbol of where we need to head as a planet.

We work hard to organize in a new way--everywhere at once. In October of 2009 we coordinated 5200 simultaneous rallies and demonstrations in 181 countries, what CNN called the 'most widespread day of political action in the planet's history.' This October we're organizing a 'global work party' all over the world. People will put up solar panels, dig community gardens--and send a strong message to our leaders: 'If we can get to work on solutions to the climate crisis, so can you.'

Our theory of change is simple: if an international grassroots movement holds our leaders accountable to the latest climate science, we can start the global transformation we so desperately need.

350.ORG—10/10/10 Global Work Party

With your help, 10/10/10 is going to be the biggest day of practical action to cut carbon that the world has ever seen.

We're calling it "A Day to Celebrate Climate Solutions"--together we'll get to work in our communities on projects that can cut carbon and build the clean energy future.

But we won't stop there--we'll be using the day to pressure our leaders to Get To Work themselves by passing strong climate policies promoting clean energy and reducing emissions.

That very elegant date is still months away, but **over a thousand groups** have already registered their plans, including bike repair workshopers in San Francisco, school insulating teams in London, waste-land-to-veggies-gardeners in New Zealand, and solar panel installers in Kenya. Check out the **map**, or **click here** to register a Work Party in your community.

FOR MORE INFORMATION visit www.350.org

Naomi Klein

A New Climate Movement in Bolivia

1/16.10

Cochabamba, Bolivia

It was 11 AM and Evo Morales had turned a football stadium into a giant classroom, marshaling an array of props: paper plates, plastic cups, disposable raincoats, handcrafted gourds, wooden plates and multicolored ponchos. All came into play to make his main point: to fight climate change, "we need to recover the values of the indigenous people."

Yet wealthy countries have little interest in learning these lessons and are instead pushing through a plan that at its best would raise average global temperatures 2 degrees Celsius. "That would mean the melting of the Andean and Himalayan glaciers," Morales told the thousands gathered in the stadium, part of the World People's Conference on Climate Change and the Rights of Mother Earth. What he didn't have to say is that the Bolivian people, no matter how sustainably they choose to live, have no power to save their glaciers.

Bolivia's climate summit has had moments of joy, levity and absurdity. Yet underneath it all, you can feel the emotion that provoked this gathering: rage against helplessness.

It's little wonder. Bolivia is in the midst of a dramatic political transformation, one that has nationalized key industries and elevated the voices of indigenous peoples as never before. But when it comes to Bolivia's most pressing, existential crisis—the fact that its glaciers are melting at an alarming rate, threatening the water supply in two major cities—Bolivians are powerless to do anything to change their fate on their own.

That's because the actions causing the melting are taking place not in Bolivia but on the highways and in the industrial zones of heavily industrialized countries. In Copenhagen, leaders of endangered nations like Bolivia and Tuvalu argued passionately for the kind of deep emissions cuts that could avert catastrophe. They were politely told that the political will in the North just wasn't there. More than that, the United States made clear that it didn't need small countries like Bolivia to be part of a climate solution. It would negotiate a deal with other heavy emitters behind closed doors, and the rest of the world would be informed of the results and invited to sign on, which is precisely what happened with the Copenhagen Accord. When Bolivia and Ecuador refused to rubber-stamp the accord, the US government cut their climate aid by \$3 million and \$2.5 million, respectively. "It's not a free-rider process," explained US climate negotiator Jonathan Pershing. (Anyone wondering why activists from the global South reject the idea of "climate aid" and are instead demanding repayment of "climate debts" has their answer here.) Pershing's message was chilling: if you are poor, you don't have the right to prioritize your own survival.

When Morales invited "social movements and Mother Earth's

defenders...scientists, academics, lawyers and governments" to come to Cochabamba for a new kind of climate summit, it was a revolt against this experience of helplessness, an attempt to build a base of power behind the right to survive.

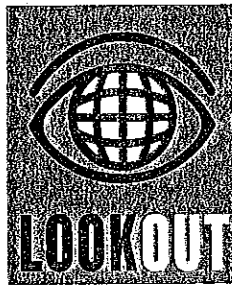
The Bolivian government got the ball rolling by proposing four big ideas: that nature should be granted rights that protect ecosystems from annihilation (a "Universal Declaration of Mother Earth Rights"); that those who violate those rights and other international environmental agreements should face legal consequences (a "Climate Justice Tribunal"); that poor countries should receive various forms of compensation for a crisis they are facing but had little role in creating ("Climate Debt"); and that there should be a mechanism for people around the world to express their views on these topics ("World People's Referendum on Climate Change").

The next stage was to invite global civil society to hash out the details. Seventeen working groups were struck, and after weeks of online discussion, they met for a week in Cochabamba with the goal of presenting their final recommendations at the summit's end. The process is fascinating but far from perfect (for instance, as Jim Shultz of the Democracy Center pointed out, the working group on the referendum apparently spent more time arguing about adding a question on abolishing capitalism than on discussing how in the world you run a global referendum). Yet Bolivia's enthusiastic commitment to participatory democracy may well prove the summit's most important contribution.

That's because, after the Copenhagen debacle, an exceedingly dangerous talking point went viral: the real culprit of the breakdown was democracy itself. The UN process, giving equal votes to 192 countries, was simply too unwieldy—better to find the solutions in small groups. Even trusted environmental voices like James Lovelock fell prey: "I have a feeling that climate change may be an issue as severe as a war," he told the *Guardian* recently. "It may be necessary to put democracy on hold for a while." But in reality, it is such small groupings—like the invitation-only club that rammed through the Copenhagen Accord—that have caused us to lose ground, weakening already inadequate existing agreements. By contrast, the climate change policy brought to Copenhagen by Bolivia was drafted by social movements through a participatory process, and the end result was the most transformative and radical vision so far.

With the Cochabamba summit, Bolivia is trying to take what it has accomplished at the national level and globalize it, inviting the world to participate in drafting a joint climate agenda ahead of the next UN climate gathering, in Cancún. In the words of Bolivia's ambassador to the UN, Pablo Solón, "The only thing that can save mankind from a tragedy is the exercise of global democracy."

If he is right, the Bolivian process might save not just our warming planet but our failing democracies as well. Not a bad deal at all.



REGREENING AFRICA



PETER O. ZIERLEIN

In the dry Sahel, farmers are already adapting to climate change.

by MARK HERTSGAARD

The sun is setting on another scorching hot day in the western African nation of Burkina Faso. But here on the farm of Yacouba Sawadogo, the air is noticeably cooler. A hatchet slung over his shoulder, the gray-bearded farmer strides through his woods and fields with the easy grace of a much younger man. "Climate change is a subject I feel I have something to say about," he says in his tribal language, Moré, which he delivers in a deep, unhurried rumble. Though he cannot read or write, Sawadogo is a pioneer of a tree-based approach to farming that has transformed the western Sahel in recent years, while providing one of the most hopeful examples on earth of how even very poor people can adapt to the ravages of climate change.

Wearing a brown cotton robe and white skullcap, Sawadogo sits beneath acacia and zizyphus trees that shade a pen holding about twenty guinea fowl. Two cows doze at his feet; bleats of goats float through the still evening air. His farm is large by local standards—fifty acres—and much of it has been in his family for generations. The rest of his family abandoned it after the terrible drought of 1972–84, when a 20 percent decline in average annual rainfall slashed food production throughout the Sahel, turned vast stretches of savanna into desert and caused

hundreds of thousands of deaths from hunger.

For Sawadogo, leaving the farm was unthinkable. "My father is buried here," he says simply. In his mind, the droughts of the 1980s marked the beginning of climate change, a term most people here do not recognize. Sawadogo, however, says he has been adapting to a hotter, drier climate for the past twenty years.

"In the drought years, people found themselves in such a terrible situation they had to think in new ways," says Sawadogo, who prides himself on being an innovator. In this case, he revived a technique local farmers had used for centuries, but he adapted it to the new climate conditions he faced. It had long been the practice among Sahelian farmers to dig *zai*—shallow pits—that concentrate scarce rainfall onto the roots of crops. Sawadogo increased the size of his *zai* to capture more rainfall. But his most important innovation, he says, was to add manure to the *zai* during the dry season, a practice his peers derided as wasteful.

Sawadogo's experiments worked: by concentrating water and fertility in pits, he increased crop yields. But the most significant result was one he hadn't anticipated: tiny trees began to sprout amid his rows of millet and sorghum; thanks

to seeds contained in the manure. As one growing season followed another, it became apparent that the trees—now a few feet high—were further increasing crop yields while also restoring soil fertility. “Since I began this technique of rehabilitating degraded land, my family has enjoyed food security in good years and bad,” Sawadogo says.

Sawadogo’s struggle may seem small, but it is part of the most important test humanity now faces. No matter what happens at Copenhagen or beyond, the world is locked in to decades of temperature rise and the associated climate impacts: deeper droughts, fiercer floods, more pests. How populations in the global South adapt to these changes will help decide whether millions of people live or die.

The tree-based farming that Sawadogo and hundreds of thousands of other poor farmers in the Sahel have adopted could help millions of their counterparts around the world cope with climate change. Already these practices have spread across vast portions of Burkina Faso and neighboring Niger and Mali, turning millions of acres of what had become semi-desert in the 1980s into more productive land. The transformation is so pervasive that the new greenery is visible from outer space via satellite pictures. With climate change, much more of the planet’s land will be hot and arid like the Sahel. It only makes sense, then, to learn from the quiet green miracle unfolding there.

This is probably the largest positive environmental transformation in the Sahel and perhaps in all of Africa,” says Chris Reij, a Dutch geographer who has worked in the region for thirty years. Technically, these methods are known as “agroforestry” or “farmer managed natural regeneration” (FMNR). Scientific studies confirm what Sawadogo already knows: mixing trees and food crops brings a range of significant benefits. The trees shade crops from overwhelming heat, act as windbreaks that protect young crops and help the soil retain moisture. When their leaves fall to the ground, they act as mulch, boosting soil fertility and providing fodder for livestock. In emergencies, people can even eat the leaves to avoid starvation. “In the past, farmers sometimes had to sow their fields four or five times because winds would blow the seeds away,” says Reij, who advocates for FMNR with the zeal of a missionary. “With trees to buffer the wind and anchor the soil, farmers need sow only once.”

Equally important, the *zai* and other water-harvesting techniques have helped recharge underground water tables. “In the 1980s water tables were falling by an average of one meter a year,” Reij says. “Since FMNR and the water-harvesting techniques began to take hold, water tables have risen by five meters, despite a growing population.” In some areas, the water table has risen by as much as seventeen meters. Some analysts have

Mark Hertsgaard (markhertsgaard.com), a fellow of The Open Society Institute, is The Nation’s environment correspondent. He has covered climate change for twenty years and is the author of six books, including the forthcoming Generation Hot: Living Through the Storm of Climate Change.

credited increased rainfall beginning in 1994. Reij says that can’t explain it: “The water tables began rising well before that. The effect is felt within one or two years’ time.” Studies have documented the same replenishing effects in Niger.

Over time, Sawadogo grew more and more enamored of trees; now his land looks less like a farm than a forest, albeit one made up of trees that, to my California eyes, often seem rather thin. “In the beginning I mixed trees and crops,” he says. “But later I came to prefer trees, because they provide other benefits.” Trees can be harvested—their branches pruned and sold—and then they grow back, and their benefits for the soil make it easier for additional trees to grow. “The more trees you have, the more you get,” Sawadogo explains.

Wood is still the main source of energy in rural Africa, and as tree cover expanded on his land, Sawadogo was in a position to sell wood for cooking, furniture-making and construction, thus increasing and diversifying his income—a key tactic for adapting to climate change. Trees are also a source of natural medicines; no small advantage in an area where modern health-care is scarce and expensive. And of course, trees keep people and livestock cooler than they otherwise would be in the brutal heat of the Sahel.

“I think trees are at least a partial answer to climate change, and I’ve tried to share this information with others,” Sawadogo adds. “I’ve used my motorbike to visit about a hundred villages, and others have come to visit me and learn. I must say, I’m very proud these ideas are spreading.”

To be clear, these farmers are not planting trees, as Nobel Prize-winning activist Wangari Maathai has promoted in Kenya with her Greenbelt Movement. They are simply growing and nurturing the ones that sprout naturally. Planting trees is much too expensive and risky for really poor farmers. Studies in the western Sahel have found that about 80 percent of planted trees die within a year or two. By contrast, trees that sprout naturally are native species and thus more resilient. And of course they cost nothing.

In Mali, too, I saw trees growing amid cropland seemingly everywhere. For example, in the grindingly poor village of Sokoura, the houses are made of sticks covered in mud; there is no electricity or running water; children wear dirty, torn clothes; and many of them have distended bellies from malnutrition. Yet to hear locals tell it, life is improving, in large part thanks to trees.

It’s a five-minute walk from the village to the land of Oumar Guindo. Missing a front tooth and wearing a black smock over green slacks, Guindo says he owns fifteen acres, where he cultivates millet and sorghum. Ten years ago he began taking advice from Sahel Eco, a Malian-British NGO that promotes agro-forestry. Now Guindo’s land is dotted with trees, one every five meters or so. Most are young, with such spindly branches that they resemble bushes, but there are also a few specimens with trunks the diameter of fire hydrants.

We sit beneath a large tree known as the “Apple of the Sahel,” whose twigs sport inchlong thorns. The soil is sandy in color and consistency—not a farmer’s ideal—but water

availability and crop yields have increased substantially since Guindo began nurturing trees among his crops. "Before, this field couldn't fill even one granary," he says. "Now it can fill one granary and half of another"—roughly a 50 percent increase in production.

Back in the village we examine the oblong granaries, which like the houses are constructed by slathering mud over stick frames. Their sides are six feet wide and fifteen feet tall. A notched tree trunk serves as a ladder to an opening near the top. All contain good amounts of millet, food security until the next harvest or even beyond.

"Twenty years ago, after the drought, our situation here

Tree-based farming has brought a quiet green miracle to the Sahel, turning millions of acres of semi-desert into more productive land.

was quite desperate, but now we live much better," explains one of the farmers. "Before, most families had only one granary each. Now they have three or four, though their land has not increased. We have more livestock as well." He adds that all the farmers in this area are cultivating trees now.

The agro-forestry that is greening the Sahel is not only the product of farmer-to-farmer information-sharing and small-scale NGO assistance. Changes in government policy have also been very important.

In Mali, tree management had been part of traditional agriculture. Salif Guindo (no relation to Oumar), a farmer from the village of Endé, explains how they revived an ancient voluntary association of farmers, called Barahogon, that had encouraged tree stewardship for generations. But using trees was abandoned when cutting wood became a crime. First the French colonial government declared all trees to be state property, enabling government officials to sell timber rights to woodcutters. Similar arrangements continued after independence. Meanwhile, farmers caught pruning or cutting trees were punished. As a result they would uproot seedlings to avoid later hassles. Needless to say, several generations of this left the land denuded and increasingly desiccated.

In the early 1990s, a new Mali government—perhaps mindful that farmers furious about mistreatment had killed Forestry Agency officials in some villages—passed a law giving farmers ownership of trees on their land. Farmers did not hear about the law until Sahel Eco mounted a campaign to inform them via radio and word of mouth. Since then, FMNR has spread rapidly, including across borders. Salif recalls a recent visit from twenty mayors and provincial directors of agricultural and environmental agencies from Burkina Faso. "They seemed astonished to hear our story and see the evidence," Salif says. "They asked, Is this really possible?"

In Niger, too, FMNR had a hard time gaining traction, in part because it involves some counterintuitive elements: name-

ly, to grow trees farmers must be allowed to cut them down as well. Tony Rinaudo, an Australian agronomist and missionary and one of the original champions of FMNR, explains that only after Niger government officials suspended enforcement of regulations against cutting trees did tree-growing gather momentum. "Once farmers felt they owned the trees in their fields, FMNR took off," he says. "They stopped seeing trees as weeds and started seeing them as assets."

The pattern has been the same throughout the western Sahel: FMNR has spread largely by itself, from farmer to farmer and village to village, as people see the results with their own eyes and move to adopt the practice. Thanks to agro-forestry, satellite photos analyzed by the US Geological Survey can now discern the border between Niger and Nigeria. On the Niger side, where farmers are allowed to own trees and FMNR is commonplace, there is abundant tree cover; on the Nigeria side, where big tree-planting schemes have failed dramatically, the land is almost barren.

When these images became available in 2008, even FMNR advocates like Reij and Rinaudo were shocked: they had no idea so many farmers had grown so many trees. Combining the satellite evidence with ground surveys and anecdotal evidence, Reij estimates that in Niger alone farmers have grown 200 million trees and rehabilitated 12.5 million acres of degraded land.

What makes FMNR so empowering, and sustainable, is that Africans themselves own the technology, which is simply the knowledge that growing trees amid crops brings many benefits. What's more, this knowledge is free. It's hard to overstate how important that is to poor farmers—and nations. It means they can use the technology now, without waiting or relying on capital infusions from foreign governments or humanitarian organizations.

This makes FMNR very different, says Reij, from the Millennium Villages model of development promoted by Jeffrey Sachs, the high-profile director of Columbia University's Earth Institute. Millennium Villages provides villages, free of charge, with what are considered the building blocks of development: modern seeds and fertilizer, boreholes for clean water, clinics.

"It's beautiful, their vision of ending hunger in Africa," says Reij. "The problem is, it doesn't work. Millennium Villages require a heavy investment per village, as well as a flow of external support for some years, and that is not a sustainable solution. It's hard to believe the outside world will provide the billions of dollars necessary to create tens of thousands of Millennium Villages in Africa." Indeed, foreign aid flows collapsed after the financial crash of 2008.

Outsiders do have a role, however. They can encourage the necessary policy changes by national governments, such as granting farmers legal ownership of trees. And they can fund, at very low cost, the grassroots information-sharing that has spread FMNR so effectively in western Sahel. Although farmers have done the most to alert their peers to FMNR's bene-





fits, they have received crucial assistance from a handful of activists and NGOs such as Rinaudo, Reij and Sahel Eco. These advocates hope to spread FMNR to other African countries through what is called "African Re-Greening Initiatives," says Reij, who has briefed the president of Ethiopia on the idea. The point is that tree-based crop systems are a win-win: they help farmers adapt to climate change even as they boost food security and reduce rural poverty.

Above all, the world must act in Copenhagen and beyond to reverse the global warming that is making the Sahel such an inhospitable place. Every form of adaptation has limits; if the amount of greenhouse gases in the atmosphere is not reduced,

increasing temperatures will eventually overwhelm even the most ingenious coping mechanisms. Trees help on this front as well: as they grow, they remove carbon dioxide from the air through photosynthesis. Thus the Copenhagen talks must include a strong commitment to protecting and expanding forests under the REDD program (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries, a UN program).

Meanwhile, Sawadogo is putting his faith in trees. "My conviction, based on personal experience, is that trees are like lungs," he says. "If we do not protect them, and increase their numbers, it will be the end of the world." ■

An Inconvenient Solution

In *Our Choice*, Al Gore explains what must be done. But is there the political will to do it?

by BILL MCKIBBEN

Al Gore's *An Inconvenient Truth* was one of the high points not only of the environmental movement but also of the documentary tradition in America. He figured out how to use a new medium, PowerPoint, to take an unavoidably wonkish story of global warming and make it scary, credible and manageable. It was, perhaps, as important as anything he could have done as president, and he deserved not only the Oscar but also the Nobel.



As almost everyone noted at the time, however, there was one problem with the film: the section on what to actually do about the biggest problem we've ever faced was remarkably short, both in duration and on plausible ideas. If the world is coming to an end, changing your light bulb doesn't seem like the obvious response. Or rather, it seems highly obvious but highly insufficient—a gesture, not a solution.

Gore heard those criticisms and spent the next few years convening a series of more than thirty "Solutions Summits" in Nashville and elsewhere, where he picked the brains of virtually everyone who ever thought professionally about climate and energy. He's taken all those data and all those ideas, and with the help of a capable team of researchers he's turned them into a book, *Our Choice*, an ambitious and entirely successful attempt to lay out all that we know about mainstream answers to global warming. (When I say "virtually everyone," mean it; the acknowledgments take up four pages of agate and include even me.) He's got chapters on solar electricity, wind energy, on biofuels, on nuclear power and even on

more recondite topics: geothermal energy, carbon sequestration.

Occasionally, truth be told, the book verges on the nerdy. There are diagrams on topics like "how a turbine works" that could have come from an old-fashioned encyclopedia. Gore has a weakness for statistics: did you know that between 1984 and 1991 nine early concentrated solar thermal power plants were built in the Mojave Desert with a total of 2 million square meters of mirrors? Some of the vast book is taken up with what amounts to more PowerPoint slides—beautiful but

stock images of farmers or roaring hurricanes. (If you like gorgeous windmill porn, this is your book.)

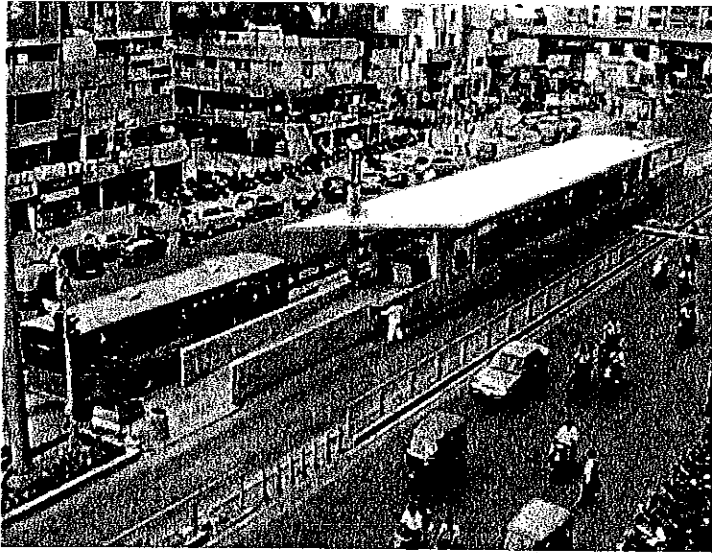
Taken as a whole, however, this is the most comprehensive and well-informed survey anyone has ever done of what we need to do to get off fossil fuel. Gore is judicious and reasoned at every turn, and gets most of the calls exactly right. Building more traditional nuclear power plants will be too expensive to provide much help. Ditto carbon sequestration: it's a good idea to try and take the exhaust from coal-fired power plants and store it underground in old oil wells, but the costs so far seem prohibitive. In fact, to many of these dilemmas Gore applies a wise test: "Put a high price on carbon. When the reality of the need to sharply reduce CO₂ emissions is integrated into all market calculations—including the decisions by utilities and their investors—market forces will drive us quickly toward the answers we need."

Gore, I think, has reasonably answered not only the one apt criticism of *An Inconvenient Truth* but also the good-faith (as opposed to talk-radio) objections of anyone wondering if the world really could exist without fossil fuels. The answer is, not easily, but it's well within the realm of technical possibility. If we followed his advice, we'd make it. What's lacking, of course, is the political will to really do it.

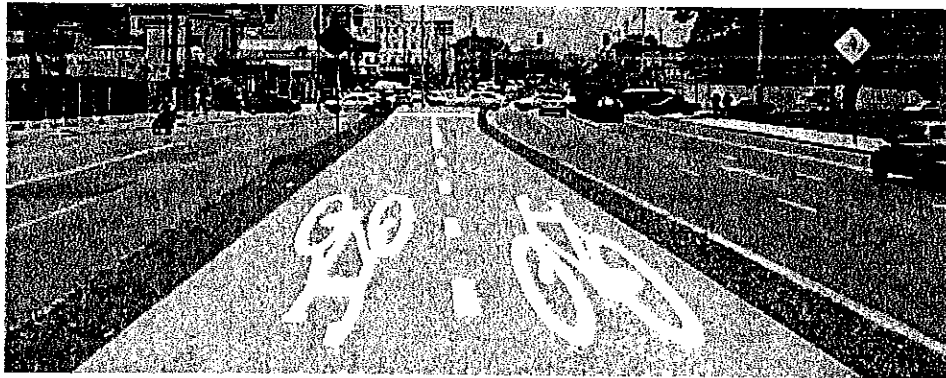
McKibben is the author, most recently, of *The Bill McKibben Reader*. Now in residence at Middlebury College, he is co-founder of 350.org, the largest global grassroots organizing campaign on climate change.

SUSTAINABLE URBAN TRANSPORTATION

No. 12



Bus rapid transit in Ahmedabad, India



Bicycle path in Sao Paulo, Brazil

Both pictures from Institute for Transportation and Development Policy,
www.itdp.org

No. 13

Re-rooting in America

by Justin Mog & Amanda Fuller
Madison (Wis.) Monthly Meeting

AFTER more than three years working to improve agriculture, nutrition, and environmental awareness as Peace Corps volunteers in Paraguay, we find ourselves returning to a very different country than the one we left in 2005. Rather than feeling hopeless and disempowered in the face of economic meltdown, peak oil, climate change, and urban decay, we have observed many people in America taking matters into their own hands and learning how to reinvest in their communities, simplify their lives, grow more of their own food and to eat more locally.

To reconnect with the new wave of hope and change, we have taken to the rails on a five-month journey around the continent on Amtrak. (What better way to rediscover a more sustainable America than on the train? We've also explored lots of public transit and borrowed lots of bicycles on our stops along the way!) While reconnecting with friends and family, we've been keeping an eye out for opportunities to put our knowledge of sustainable agriculture and restoration ecology to good purpose. Here are a few highlights from our travels:

The Greening of Detroit

We know many people who wouldn't be interested in spending a day in Detroit, much less a gray day in February. We had heard from friends, though, that there were strange new rumblings in the Motor City. In fact, our most inspiring visit was with the people at an incredible non-governmental organization called the Greening of Detroit, who helped us see the city in a new light as they shared the news of how people in Detroit have been improving their livelihoods and their neighborhoods. Picture this: the city limits of Detroit encompass an area the size of Boston, San Francisco, and Manhattan combined. Some 27 percent of this land is now vacant, while the city's population has fallen from 2 million to 700,000 in a couple of decades. The Greening of Detroit has been proactive in turning some of this vacant land into a productive asset for the remaining residents. As we toured the city with them, we came to see the rapid depopulation and demolition of abandoned buildings as an unprecedented opportunity for citizens to restore the environment and create a more sustainable city.

With neighbors, youth, and volunteers all over Detroit, the Greening is planting trees on streets and in parks to replace those lost to Dutch elm disease, and they're also planting fruit tree orchards and subsidi-

dizing tree sales to people in neighborhoods most in need. They run an environmental camp for kids in the summer, and provide green jobs for motivated teens. In the past 5 years, the Greening has helped to double the number of community gardens every year and in



Amanda and Justin spent five months traveling by Amtrak in search of a more sustainable America.

2008, supported 169 community gardens just in the city of Detroit! In neighborhoods where we saw little more for sale than fast food and liquor, community gardens and tree nurseries are providing families with healthy food and a little income. Based on these successes, the Greening of Detroit is beginning to work with city planners to develop a vision of a city remade into neighborhoods united around green space instead of divided by fences and concrete.

Future plans include a large downtown tree nursery to meet growing demand, and more community gardens, trainings, and farmers' markets to provide income for vegetable growers. The Greening of Detroit has been around for 20 years, but as far as we can see, they're still ahead of the curve. At the end of a gray February day, we left inspired by these creative and positive responses to a crisis, and wanting to tell everyone we know about their incredible work. Go to www.greeningofdetroit.com. (Thanks to Paul Bairley, Jill Katakowski, and Sal Hansen for spending the day with us!)

Gardening at the White House

In Washington, D.C. we met two dedicated young men who had just spent the last six months traveling the country, meeting and organizing people to advocate for an organic garden at the White House. We joined Daniel Bowman Simon and Casey Gustowarow on classroom visits at a D.C. public school, where they were rallying kids around the cause and getting the next generation excited about the power of gardening! We have Daniel and Casey to thank for their passionate efforts to persuade the Obamas, who broke ground on their organic kitchen garden on the South Lawn March 20th. Read more about them and the White House Organic garden at www.thewhofarm.org.

Of course, they were not the only voices echoing Michael Pollan's public call for such a display of national leadership. Roger Doiron of Kitchen Gardeners International launched a simultaneous "Eat the View" campaign with a clever video of how he dug up his

Ten Things

No. 14

Ten Things You Can Do to Shrink Your Carbon Footprint

Most environmentalists agree that government, with its power to regulate, is critical in finding and enforcing solutions to global warming. But consumers represent 70 percent of US economic activity—indeed, the average American's carbon footprint is twenty metric tons, five times the global average. Individuals can be a powerful engine for change by demanding green products and reducing consumption of fossil fuels. This can make you healthier and save you money too, says Mindy Pennybacker, editor of GreenerPenny.com and author of *Do One Green Thing: Saving the Earth Through Simple, Everyday Choices*, to be published in March. Here are some of her recommendations for small steps that make a big difference.

1 Use less paper, and replace paper towels and napkins with reusable cloths. Buy recycled products containing at least 30 percent postconsumer waste and bearing the Forest Stewardship Council logo, which means they come from well-managed forests (fscus.org/paper).

2 Buy shade-grown, fairly traded coffee and chocolate. According to the Rainforest Alliance (rainforest-alliance.org), tropical deforestation accounts for about 20 percent of worldwide greenhouse gas emissions, more than all vehicles combined. Consumer demand for products grown under the rainforest canopy provides economic incentive to preserve these habitats for migratory birds. Look for products certified by the Rainforest Alliance or labeled "bird friendly" by the Smithsonian Migratory Bird Center (nationalzoo.si.edu/ConservationandScience/MigratoryBirds/Coffee and transfairusa.org).

3 Lower your household thermostat below 70 degrees in winter and raise it above 72 in summer. Heating represents about 41 percent of the energy bill in the average home; lowering your hot-water temperature from the standard 140 degrees to 120 will save 200 pounds of carbon a year, according to the Environmental Defense Fund. For more information, see the American Council for an Energy-Efficient Economy (aceee.org).

4 Replace light bulbs and appliances with Energy Star-approved models. Lighting takes up 15 percent of a home's energy use, and regular incandescent bulbs waste 90 percent of the energy they consume as heat. If you replace five incandescent bulbs with five compact fluorescent or light efficient diode Energy Star bulbs, you'll save at

least \$60 a year, the EPA estimates. If every US household did so, it would save the equivalent of the output of twenty-one power plants and keep smog, particulates and carbon out of the atmosphere.

5 Plug electronics into power strips and switch them off when not in use. Televisions, DVD players, game consoles, computers and cellphone chargers quietly suck electricity out of sockets even when they are turned off. Breaking the connection can save the average household \$100 on its electricity bill and reduce carbon output.

6 Eat more fresh fruits and vegetables and less meat—livestock production is responsible for 18 percent of greenhouse gas emissions. Choose certified organic and/or locally produced foods (localharvest.org) to preserve your regional economy and reduce the burning of fossil fuels.

7 Rid your home and garden of synthetic pesticides—nervous-system toxins that have been linked to lower birth weights and developmental problems. Call 1-800-CLEANUP to find out how to safely dispose of these poisons. For DIY nontoxic pest control, see birc.org and watoxics.org.

8 Water-efficient fixtures like faucet aerators, shower heads and low-flow toilets can save households thousands of gallons a year, the EPA says (epa.gov/watersense).

9 Cut back on plastics. They clutter the environment, and they're made from petroleum, a nonrenewable resource. Many also contain toxic bisphenol-a (BPA) and phthalates, which can migrate into food, water and baby formula. Keep vinyl, which has been linked to reproductive and developmental problems as well as cancer, out of your household. For more information, go to greenerpenny.com.

10 Drive less, and drive sensibly. We can't all afford a hybrid car, but many other cars get nearly as good mileage. Save on fuel and greenhouse gas emissions by following the speed limit and keeping your engine tuned and tires properly inflated. For more information go to the Union of Concerned Scientists (ucsusa.org).



CONCEIVED BY WALTER MOSLEY with research by Rae Gomes

"Ten Things" is a monthly feature. Readers who wish to propose ideas for it should e-mail NationTenThings@gmail.com.