3

Eco-Economy Updates

Some caveats are in order in introducing this section. The following 20 Eco-Economy Updates are printed as they appeared when first released. They have not been revised or updated.

In at least one instance, there has been a dramatic change. "The Rise and Fall of the Global Climate Coalition," was written in July 2000. It describes how leading corporations were abandoning the Global Climate Coalition (GCC) because of philosophical differences and the negative public relations effect of being associated with the group. GCC's massive advertising campaign to prevent the United States from endorsing any meaningful agreement to reduce global carbon emissions, specifically the Kyoto Protocol, was out of sync with the views of many of its leading corporate members. The update describes how Dupont, British Petroleum, then Royal Dutch Shell, and then Ford, DaimlerChrysler, Texaco, General Motors, and other leading corporations were leaving the Coalition.

What we did not anticipate at the time was that in January 2002 the Coalition would close its doors. It no longer exists. We still include the update in the collection because it reflects the evolution of thinking within the

corporate community on global climate issues. At some point, there was simply no longer a place for the Global Climate Coalition.

There is also repetition, both among the updates in this section and between these updates and information in Parts 1 and 2 of *The Reader*. We apologize for this, but again we did not feel it appropriate to rewrite the updates, partly because to exclude some of the repetitive information would have weakened their structure.

One of the key points about wind energy that is repeated, for example, is its enormous potential. To illustrate this we point out that 3 of the 50 states in the United States—Kansas, North Dakota, and Texas—have enough harnessable wind energy to satisfy national electricity needs. If you did not know this when you started to read this book, you will when you finish!

Backup graphs and tables for all the updates, as well as links to additional information, are included on our Web site. At the end of each update we have listed its particular Web address.

With these caveats in mind, we are pleased to present Part 3 of *The Earth Policy Reader*. If you wish to receive future Eco-Economy Updates free of charge you can do so by visiting us at <www.earth-policy.org> and subscribing to our listserv. You can also e-mail your request to <epi@earth-policy.org>.

Energy and Climate

June 2000

U.S. Farmers Double Cropping Corn and Wind Energy

Lester R. Brown

Farmers and ranchers in the United States are discovering that they own not only land but also the wind rights that go with that land. A farmer in Iowa who leases a quarter acre of cropland to the local utility as a site for a wind turbine can typically earn $2,000 a year in royalties from the electricity produced. In a good year, that same plot can produce $100 worth of corn. Wind turbines strung across the farm at appropriate intervals can provide a welcome boost to farm income, yielding a year-round cash flow.[1]

Harnessing the wind has become increasingly profitable. The American Wind Energy Association reports that the cost per kilowatt-hour of wind-generated electricity has fallen from 38¢ in the early 1980s to 3–6¢ today, depending primarily on wind speed at the site. Already competitive with other sources, the cost of wind-generated electricity is expected to continue to decline. These falling costs, facilitated by advances in wind tur-

bine design, help explain why wind power is expanding rapidly beyond its original stronghold in California.[2]

As wind farms have come online in farming and ranching states such as Iowa, Minnesota, Texas, and Wyoming, wind electric generation has soared, pushing U.S. wind generating capacity from 1,928 megawatts in 1998 to 2,490 megawatts in 1999—a gain of 29 percent. Contrary to public perceptions, the potential of wind power is enormous. A U.S. Department of Energy wind resource inventory found that three states—Kansas, North Dakota, and Texas—have enough harnessable wind energy to meet electricity needs for the whole country.[3]

At a time when farmers are struggling with low grain prices, some are now finding salvation in this new "crop," enabling them to stay on the land. It is like striking oil, except that the wind is never depleted.

In the Great Plains, where an acre of rangeland produces only $20 worth of beef a year or an acre in wheat may yield $120 worth of grain, the attraction of wind power is obvious. For ranchers with prime wind sites, income from wind could easily exceed that from cattle sales.[4]

One of the attractions of wind energy is that the turbines scattered across a farm or ranch do not interfere with the use of the land for farming or cattle grazing. Farmers can literally have their cake and eat it too.

Another attraction is that much of the income generated stays in the local community, whereas if electricity comes from an oil-fired power plant, the money spent for electricity may end up in the Middle East. With a single large wind turbine generating $100,000 or more worth of electricity per year, harnessing local wind energy can revitalize rural communities.[5]

And it is not only the wind farms themselves that provide income, jobs, and tax revenue. The first utility-scale

wind turbine manufacturing facility to be built outside of California has recently started operation in Champaign, Illinois, in the heart of the Corn Belt.[6]

Agricultural land values may soon reflect this new source of income. The wind meteorologist who identifies the best sites for turbines is playing a role in the emerging new energy economy comparable to that of the petroleum geologist in the old energy economy. The mere sight of a wind meteorologist installing wind-measuring instruments in a community could raise land prices.

Satisfying the local demand for electricity from wind is not the end of the story. Cheap electricity produced from wind can be used to electrolyze water, producing hydrogen, now widely viewed as the fuel of the future. With automobiles powered by fuel-cell engines expected on the market within a few years and with hydrogen as the fuel of choice for these new engines, a huge new market is opening up. Royal Dutch Shell, a leader in this area, is already starting to open hydrogen stations in Europe. William Ford, CEO of the Ford Motor Company, has said he expects to preside over the demise of the internal combustion engine.[7]

Farms and ranches may one day supply the hydrogen that will power the nation's motor vehicle fleet, giving the United States the energy source needed to declare its independence from Middle Eastern oil.

Concerned about burning fuels that destabilize climate, government at all levels is encouraging the development of climate-benign renewable energy sources. In some states, utility commissions are requiring utilities to offer their customers a "green power" option. Although this usually means a slightly higher monthly electricity bill, many consumers worried about climate change are choosing green power. In Colorado, offering a wind power option to both residential and business electricity

users has already led to the installation of 20 megawatts of wind generating capacity—an amount expected to double soon.[8]

Many state governments are taking the initiative. Minnesota is requiring its largest utility to install 425 megawatts of wind-generating capacity by 2002. In Texas, the legislature has set a goal of 2,000 megawatts of generating capacity from renewable sources by 2009, with most of it expected to come from the Lone Star state's abundant wind power.[9]

At the national level, U.S. Secretary of Energy Bill Richardson is requiring that 7.5 percent of the electricity used in his Department come from renewable sources (excluding hydro) by 2010.[10]

A formidable new alliance is emerging in support of wind energy. In addition to environmentalists, farmers and those consumers who favor green power are now supporting the development of the nation's wind wealth. So, too, are political leaders in the farming and ranching states of the Midwest and the Great Plains, many of whom sponsored legislation in Washington to extend the wind energy production tax credit, which encourages investment in wind power. Aside from the economic benefits of wind power, political interest is being spurred by a steady diet of news stories about the possible effects of global warming, including record heat waves and droughts, melting glaciers, and rising sea level.

Rapid growth in wind energy is not limited to the United States. Worldwide, wind electric generation in 1999 expanded by a staggering 39 percent. Wind already supplies 10 percent of Denmark's electricity. In Germany's northernmost state of Schleswig-Holstein, it supplies some 14 percent of all electricity. Spain's northern industrial province of Navarra gets 23 percent of its electricity from wind, up from zero just four years ago. In

China, which recently brought its first wind farm online in Inner Mongolia, wind analysts estimate that the country's wind potential is sufficient to double national electricity generation.[11]

In Denmark, Germany, and the Netherlands, individual farmers, or organized groups of farmers, are investing in the turbines themselves and selling the electricity to the local utilities, thus boosting the farmers' share of income from wind power.[12]

The world is beginning to recognize wind for what it is—an inexhaustible energy source that can supply both electricity and fuel. In the United States, farmers are learning that two crops are better than one, political leaders are realizing that harnessing the wind can contribute to both energy security and climate stability, and consumers are finding out that they can help stabilize climate. This is a winning combination—one that will help make wind energy a cornerstone of the new energy economy.

For additional information, see <www.earth-policy.org/Alerts/Alert3.htm>.

July 2000

The Rise and Fall of the Global Climate Coalition*

Lester R. Brown

In August 1997, a few months before the Kyoto conference on climate change, the Global Climate Coalition (GCC) helped launch a massive advertising campaign designed to prevent the United States from endorsing any meaningful agreement to reduce global carbon emissions. This group, including in its ranks some of the world's most powerful corporations and trade associations involved with fossil fuels, concentrated its efforts on a series of television ads that attempted to confuse and frighten Americans.[1]

Among other things, the ads indicated that "Americans will pay the price . . . 50¢ more for every gallon of gasoline," even though there was no proposal for such a tax. The campaign was successful. The so-called Carbon Club had effectively undermined public support of U.S. efforts to lead the international effort to stabilize climate.[2]

While the public image of the GCC at the time was that of a unified group, there was already dissent within the ranks. John Browne, Chairman of British Petroleum, in a speech at Stanford University on May 19, 1997, announced that "the time to consider the policy dimensions of climate change is not when the link between greenhouse gases and climate change is conclusively

* The GCC officially closed its doors on 28 January 2002 after most of its leading corporate members had abandoned it.

proven, but when the possibility cannot be discounted and is taken seriously by the society of which we are part. We in BP have reached that point."[3]

Browne's talk shocked other oil companies and pleasantly surprised the environmental community. BP withdrew from the Global Climate Coalition. Dupont had already left. The following year, Royal Dutch Shell announced that it, too, was leaving. Its corporate goals, like those of BP and Dupont, no longer meshed with those of the GCC. Like BP, it no longer viewed itself as an oil company, but as an energy company.[4]

In 1999, Ford withdrew from the GCC. Its young Chairman, William C. Ford, Jr., the great-grandson of Henry Ford, went on record saying, "I expect to preside over the demise of the internal combustion engine." The company was already working on a fuel-cell engine, one where the fuel of choice was hydrogen—not gasoline.[5]

Ford's decision to withdraw was yet another sign of the changes occurring in major industries involved directly and indirectly with fossil fuels. A company spokesman noted, "Over the course of time, membership in the Global Climate Coalition has become something of an impediment for Ford Motor to credibly achieving our environmental objectives."[6]

In rapid succession in the early months of 2000, DaimlerChrysler, Texaco, and General Motors announced that they too were leaving the Coalition. With the departure of GM, the world's largest automobile company, the die was cast. A spokesman for the Sierra Club quipped, "The only question left is whether the last one out of GCC will turn off the light."[7]

The image created by this accelerating exodus of firms from the GCC was that of rats abandoning a sinking ship. It reflected the conflict emerging within GCC ranks between firms that were clinging to the past and

those that were planning for the future.

Some of the exiting companies, such as BP Amoco, Shell, and Dupont, joined a progressive new group, the Business Environmental Leadership Council, now an organization of some 21 corporations. This new outfit, founded by the Pew Center on Global Climate Change, says, "We accept the views of most scientists that enough is known about the science and environmental impacts of climate change for us to take actions to address its consequences."[8]

Other leading companies that have joined the Council are Toyota, Enron, and Boeing. Membership requires individual companies to have their own programs for reducing carbon emissions. BP Amoco, for example, plans to bring its carbon emissions to 10 percent below its 1990 level by 2010, exceeding the Kyoto goal of roughly 5 percent for industrial countries.[9]

Dupont has one of the most ambitious goals of any company, going far beyond that of Kyoto. It has already cut its 1990 greenhouse gas emissions by 45 percent and plans to reduce them by a total of 65 percent by 2010, rendering hollow the claim that lowering carbon emissions to meet the Kyoto goal is not possible.[10]

On the supply side, BP Amoco and Shell are investing heavily in new sources of energy. BP Amoco is now a leading manufacturer of solar cells. Shell, already a major player in both wind and solar cells, is also investing heavily in hydrogen and will likely open the world's first chain of hydrogen stations in Iceland.[11]

To date, the net effect of the various public and private initiatives worldwide has been to check the growth in global carbon emissions. Since 1996, global carbon emissions have leveled off. The burning of coal, the most carbon-intensive fuel, dropped 5 percent in 1999. The next step is to reduce carbon emissions across the board.[12]

Abandonment of the Global Climate Coalition by leading companies is partly in response to the mounting evidence that the world is indeed getting warmer. The 15 warmest years in the last century have occurred since 1980. Ice is melting on every continent. The snow/ice pack in the Rockies, the Andes, the Alps, and the Himalayas is shrinking. The volume of the ice cap covering the Arctic Ocean has shrunk by more than 40 percent over the last 35 years. To deny that the earth is getting warmer in the face of such compelling evidence is to risk a loss of credibility, something that corporations cannot readily afford.[13]

The high price paid by the tobacco industry's continuing denial of a link between smoking and health is all too familiar. This loss of credibility led to a major shift in public opinion, one that is now affecting court proceedings and the decisions of juries considering the claims of plaintiffs against the tobacco industry. And it figured prominently in the agreement by the industry to pay state governments $251 billion to compensate them for the Medicare costs of treating smoking-related illnesses.[14]

In a thinly veiled effort to conceal the real issue—the loss of so many key corporate members—the GCC announced that it was restructuring and would henceforth only include trade associations in its membership. While the companies leaving the GCC are still represented by their trade associations, their loss of confidence in the GCC's ability to represent their corporate interests is all too evident.[15]

Thoughtful corporate leaders now know that our energy future is going to be strikingly different from our energy past. There is a growing acceptance among the key energy players that the world is in the early stages of the transition from a carbon-based to a hydrogen-based

energy economy. In February 1999, ARCO Chief Executive Officer Michael Bowlin said in a talk at an energy conference in Houston, Texas, "We've embarked on the beginning of the Last Days of the Age of Oil." He went on to discuss the need to convert our carbon-based energy economy into a hydrogen-based energy economy.[16]

Whether the GCC will survive as a collection of trade associations or whether it will join the Tobacco Institute, which closed its doors in January 1999, is uncertain. What is clear is that the organization that so effectively undermined U.S. leadership in Kyoto is no longer a dominant player in the global climate debate. The stage is set for the United States to resume leadership of the global climate stabilization effort.

For additional information, see <www.earth-policy.org/Alerts/Alert6.htm>.

August 2000

Climate Change Has World Skating on Thin Ice

Lester R. Brown

If any explorers had been hiking to the North Pole this summer, they would have had to swim the last few miles. The discovery of open water at the Pole by an ice-breaker cruise ship in mid-August surprised many in the scientific community.[1]

This finding, combined with two recent studies, provides not only more evidence that the Earth's ice cover is melting, but that it is melting at an accelerating rate. A study by two Norwegian scientists projects that within 50 years, the Arctic Ocean could be ice-free during the summer. The other, a study by a team of four U.S. scientists, reports that the vast Greenland ice sheet is melting.[2]

The projection that the Arctic Ocean will lose all its summer ice is not surprising, since an earlier study reported that the thickness of the ice sheet has been reduced by 42 percent over the last four decades. The area of the ice sheet has also shrunk by 6 percent. Together this thinning and shrinkage have reduced the Arctic Ocean ice mass by nearly half.[3]

Meanwhile, Greenland is gaining some ice in the higher altitudes, but it is losing much more at lower elevations, particularly along its southern and eastern coasts. The huge island of 2.2 million square kilometers (three times the size of Texas) is experiencing a net loss of some 51 billion cubic meters of water each year, an amount equal to the annual flow of the Nile River.[4]

The Antarctic is also losing ice. In contrast to the North Pole, which is covered by the Arctic Sea, the South Pole is covered by the Antarctic continent, a land mass roughly the size of the United States. Its continent-sized ice sheet, which is on average 2.3 kilometers (1.5 miles) thick, is relatively stable. But the ice shelves, the portions of the ice sheet that extend into the surrounding seas, are fast disappearing.[5]

A team of U.S. and British scientists reported in 1999 that the ice shelves on either side of the Antarctic Peninsula are in full retreat. From roughly mid-century through 1997, these areas lost 7,000 square kilometers as the ice sheet disintegrated. But then within scarcely a year they lost another 3,000 square kilometers. Delaware-sized icebergs that have broken off are threatening ships in the area. The scientists attribute the accelerated ice melting to a regional temperature rise of some 2.5 degrees Celsius (4.5 degrees Fahrenheit) since 1940.[6]

These are not the only examples of melting. Lisa Mastny, who has reviewed some 30 studies on this topic, reports that ice is melting almost everywhere—and at an accelerating rate. The snow/ice mass is shrinking in the world's major mountain ranges: the Rocky Mountains, the Andes, the Alps, and the Himalayas. In Glacier National Park in Montana, the number of glaciers has dwindled from 150 in 1850 to fewer than 50 today. The U.S. Geological Survey projects that the remaining glaciers will disappear within 30 years.[7]

Scientists studying the Quelccaya glacier in the Peruvian Andes report that its retreat has accelerated from 3 meters a year between roughly 1970 and 1990 to 30 meters a year since 1990. In Europe's Alps, the shrinkage of the glacial area by 35–40 percent since 1850 is expected to continue. These ancient glaciers could largely disappear over the next half-century.[8]

Shrinkage of ice masses in the Himalayas has accelerated alarmingly. In eastern India, the Dokriani Bamak glacier, which retreated by 16 meters between 1992 and 1997, drew back by a further 20 meters in 1998 alone.[9]

This melting and shrinkage of snow/ice masses should not come as a total surprise. Swedish scientist Svante Arrhenius warned at the beginning of the last century that burning fossil fuels could raise atmospheric levels of carbon dioxide (CO_2), creating a greenhouse effect. Atmospheric CO_2 levels, estimated at 280 parts per million (ppm) before the Industrial Revolution, have climbed from 317 ppm in 1960 to 368 ppm in 1999—a gain of 16 percent in only four decades.[10]

As CO_2 concentrations have risen, so too has the earth's temperature. Between 1975 and 1999, the average temperature increased from 13.94 degrees Celsius to 14.35 degrees, a gain of 0.41 degrees or 0.74 degrees Fahrenheit in 24 years. The warmest 23 years since recordkeeping began in 1866 have all occurred since 1975.[11]

Researchers are discovering that a modest rise in temperature of only 1 or 2 degrees Celsius in mountainous regions can dramatically increase the share of precipitation falling as rain while decreasing the share coming down as snow. The result is more flooding during the rainy season, a shrinking snow/ice mass, and less snowmelt to feed rivers during the dry season.[12]

These "reservoirs in the sky," where nature stores fresh water for use in the summer as the snow melts, are shrinking and some could disappear entirely. This will affect the water supply for cities and for irrigation in areas dependent on snowmelt to feed rivers.

If the massive snow/ice mass in the Himalayas—which is the third largest in the world, after the Greenlandic and Antarctic ice sheets—continues to melt, it will

affect the water supply of much of Asia. All of the region's major rivers—the Indus, Ganges, Mekong, Yangtze, and Yellow—originate in the Himalayas. The melting in the Himalayas could alter the hydrology of several Asian countries, including Pakistan, India, Bangladesh, Thailand, Viet Nam, and China. Less snowmelt in the summer dry season to feed rivers could exacerbate the hydrological poverty already affecting so many in the region.

As the ice on land melts and flows to the sea, sea level rises. Over the last century, sea level rose by 20–30 centimeters (8–12 inches). During this century, the existing climate models indicate it could rise by as much as 1 meter. If the Greenland ice sheet, which is up to 3.2 kilometers thick in places, were to melt entirely, sea level would rise by 7 meters (23 feet).[13]

Even a much more modest rise would affect the low-lying river floodplains of Asia, where much of the region's rice is produced. According to a World Bank analysis, a 1-meter rise in sea level would cost low-lying Bangladesh half its riceland. Numerous low-lying island countries would have to be evacuated. The residents of densely populated river valleys of Asia would be forced inland into already crowded interiors. Rising sea level could create climate refugees by the million in countries such as China, India, Bangladesh, Indonesia, Viet Nam, and the Philippines.[14]

Even more disturbing, ice melting itself can accelerate temperature rise. As snow/ice masses shrink, less sunlight is reflected back into space. With more sunlight absorbed by less reflective surfaces, temperature rises even faster and melting accelerates.

We don't have to sit idly by as this scenario unfolds. There may still be time to stabilize atmospheric CO_2 levels before continuing carbon emissions cause climate change to spiral out of control. We have more than enough wind, solar, and geothermal energy that can be economically harnessed to power the world economy. If we were to incorporate the cost of climate disruption in the price of fossil fuels in the form of a carbon tax, investment would quickly shift from fossil fuels to these climate-benign energy sources.

The leading automobile companies are all working on fuel-cell engines. DaimlerChrysler plans to start marketing such an automobile in 2003. The fuel of choice for these engines is hydrogen. Even leaders within the oil industry recognize that we will eventually shift from a carbon-based energy economy to a hydrogen-based one. The question is whether we can make that shift before the earth's climate system is irrevocably altered.[15]

For additional information, see <www.earth-policy.org/Alerts/Alert7.htm>.

September 2000

OPEC Has World Over a Barrel Again

Lester R. Brown

On Thursday, September 7, 2000, oil prices on the spot market climbed to $35.39 per barrel, their highest since November 1990, just before the Gulf War. This latest oil price escalation not only threatens a worldwide recession, it also marks another adverse shift in the international terms of trade for the United States, one that will widen further the already huge trade deficit.[1]

On Sunday, OPEC (Organization of Petroleum Exporting Countries) ministers will meet at OPEC headquarters in Vienna to consider a request from oil-importing countries to boost daily oil output by at least 500,000 barrels. But it may be too little too late. With the East Asian economies, including that of China, booming again, and with U.S. oil production falling for eight years in a row, even a production increase of 500,000 barrels may not restore lower oil prices.[2]

For the United States, which pays for its oil imports in part with grain exports, this is not good news. Exports of grain and oil are each concentrated in a handful of countries, with grain coming largely from North America and oil mostly from the Middle East. The United States, which dominates grain exports even more than Saudi Arabia does oil, is both the world's leading grain exporter and its biggest oil importer. Ironically, all 11 members of OPEC are grain importers.[3]

Using the price of wheat as a surrogate for grain prices,

shifts in the grain/oil exchange rate can be easily monitored. (See Table 3–1.) From 1950 through 1972, both wheat and oil prices were remarkably stable. In 1950, when wheat was priced at $1.89 a bushel and oil at $1.71 a barrel, a bushel of wheat could be exchanged for 1.1 barrels of oil. At any time during this 22-year span, a bushel of wheat could be traded for a barrel of oil on the world market.[4]

With the 1973 oil price hike, this began to change. By 1979, the year of the second oil price increase, OPEC's strength had pushed the exchange rate to roughly 4 to 1. By 1982, when the price of oil had climbed past $33 a barrel, the wheat/oil ratio had climbed to 8 to 1. This steep rise in the purchasing power of oil led to one of the greatest international transfers of wealth ever recorded.[5]

Today, 27 years after the first oil price hike, the terms of trade are again shifting in favor of OPEC. With grain prices at their lowest level in two decades and oil prices at the highest level in a decade, the wheat/oil ratio has shifted to an estimated 10 to 1 this year. OPEC has the United States over a barrel once again. With its fast-growing fleet of gas-guzzling SUVs (sport utility vehicles) and falling oil production, the United States is now dependent on imports for a record 57 percent of its oil, making it even more vulnerable to oil price hikes and supply disruptions than it was in 1973.[6]

But this is not the only threat to international security. Climate change from burning oil and other fossil fuels may be an even greater threat to long-term world economic and political stability. Last month's discovery of open water at the North Pole by an ice breaker cruise ship is only one of many recent indications that human activities are altering the earth's climate. The Arctic Ocean ice has thinned by 40 percent in some 35 years. Scientists now believe that summer ice in the Arctic Ocean could disappear entirely within the next 50 years.[7]

Table 3–1. *The Wheat-Oil Exchange Rate, 1950–2000*

Year	Bushel of Wheat	Barrel of Oil	Bushels Per Barrel
	(U.S. dollars[1])		(Ratio)
1950	1.89	1.71	1
1955	1.81	1.93	1
1960	1.58	1.50	1
1965	1.62	1.33	1
1970	1.49	1.30	1
1971	1.68	1.65	1
1972	1.90	1.90	1
1973	3.81	2.70	1
1974	4.89	9.76	2
1975	4.06	10.72	3
1976	3.62	11.51	3
1977	2.81	12.40	4
1978	3.48	12.70	4
1979	4.36	17.26	4
1980	4.70	28.67	6
1981	4.76	32.50	7
1982	4.36	33.47	8
1983	4.28	29.31	7
1984	4.15	28.25	7
1985	3.70	26.98	7
1986	3.13	13.82	4
1987	3.07	17.79	6
1988	3.95	14.15	4
1989	4.61	17.19	4
1990	3.69	22.05	6
1991	3.50	18.30	5

Table 3–1. *continued*

1992	4.11	18.22	4
1993	3.82	16.13	4
1994	4.08	15.47	4
1995	4.82	17.20	4
1996	5.64	20.37	4
1997	4.35	19.27	4
1998	3.43	13.07	4
1999	3.05	17.98	6
2000 (est.)	2.94	29.34	10

[1]Prices in current year dollars.
Source: International Monetary Fund, *International Financial Statistics* (Washington, DC: various years).

Greenland's ice sheet is also starting to melt. If all the ice on this huge island, which is three times the size of Texas and measures over 3,000 meters thick (10,000 feet) in some places, were eventually to melt, sea level would rise by a staggering 7 meters (23 feet). In addition to ice melting and rising sea level, global climate change can bring more extreme weather events—more intense heat waves, more destructive storms, and more severe flooding.[8]

The world is beginning to move beyond oil and coal toward energy sources that do not disrupt climate. Widely varying growth rates of various sources of energy from 1990–99 give a sense of the energy transition under way. Worldwide, wind power generation grew by 24 percent per year, solar cell production by 17 percent, and geothermal power by 4 percent. By contrast, world oil use expanded at 1 percent a year and coal use actually declined by nearly 1 percent.[9]

Even oil company CEOs are talking about shifting from a carbon-based to a solar/hydrogen-based energy

economy. British Petroleum is now the world's leading manufacturer of solar cells. Shell is pioneering the new hydrogen economy. All the major automobile companies are working on fuel-cell engines for which the fuel of choice is hydrogen. The Japanese have developed a photovoltaic roofing material that allows the rooftop to become the power plant for the building.[10]

Denmark now gets 10 percent of its electricity from wind. For Schleswig-Holstein, the northernmost state in Germany, it is 14 percent. For the industrial province of Navarra in Spain, it is 22 percent. We are now getting glimpses of the new energy economy in the solar rooftops in Japan and in the wind turbines scattered across the European countryside.[11]

A nationwide wind resources survey by the U.S. Department of Energy indicates that three states—Kansas, North Dakota, and Texas—have enough harnessable wind energy to satisfy national electricity needs. With new wind farms coming online over the last year or two in Iowa, Minnesota, Texas, and Wyoming, U.S. wind-generation jumped by 29 percent in 1999.[12]

The generation of electricity from wind is exciting because money spent for this electricity typically stays in the community, whereas money spent for electricity generated by oil may end up in the Middle East. Moreover, with cheap wind-generated electricity, hydrogen, the preferred fuel for fuel-cell engines, can be produced during the night when electricity demand is low.

As these examples indicate, the transition to a new energy economy has begun, but it is not moving fast enough. The time has come to restructure the tax system both to reduce the threat of soaring oil prices and to stabilize climate. We can restructure our tax system by lowering the personal and corporate income tax and offsetting it with an increase in a tax on gasoline. OPEC

members know that the cost of producing oil in Saudi Arabia, which has the lion's share of world oil reserves, is roughly $2 a barrel. They also know that if they push the price of oil too high, they will trigger a global recession. This is not in their interest.[13]

If there is a world price for petroleum products beyond which a further rise would be disruptive, then the issue is who gets the difference between the low production cost of oil and this much higher market price. If importing countries push prices of gasoline, fuel oil, jet fuel, and other oil products close to that limit by imposing stiff taxes, then the potential for raising prices by OPEC is lessened. This is why, in a meeting with President Clinton in New York earlier this week, Saudi Crown Prince Abdullah urged importing countries to lower their taxes on gasoline and other oil products.[14]

If we take the initiative and raise gasoline taxes while lowering income taxes, the increase in the gasoline tax will end up in our treasury and individuals will benefit from lower income taxes. But if we don't restructure and let OPEC countries keep increasing the price of oil, and hence of gasoline, the equivalent of the gasoline tax increase will end up in OPEC treasuries. We will eventually pay the same higher price for gasoline, but not get the income tax reduction.

For additional information, see <www.earth-policy.org/Alerts/Alert8.htm>.

May 2001

Wind Power: The Missing Link in the Bush Energy Plan

Lester R. Brown

The eagerly awaited Bush energy plan released on May 17, 2001, disappointed many people because it largely overlooked the potential contribution of raising energy efficiency. It also overlooked the enormous potential of wind power, which is likely to add more to U.S. generating capacity over the next 20 years than coal.[1]

In short, the authors of the plan appear to be out of touch with what is happening in the world energy economy, fashioning an energy plan more appropriate for the early twentieth century rather than the early twenty-first century. They emphasized the role of coal, but world coal use peaked in 1996 and has declined some 11 percent since then as countries have turned away from this climate-disrupting fuel. Even China, which rivals the United States as a coal burning country, has reduced its coal use by 24 percent since 1996.[2]

Meanwhile, world wind power use has multiplied nearly fourfold over the last five years, a growth rate matched only by the computer industry. In the United States, the American Wind Energy Association projects a staggering 60-percent growth in wind-generating capacity this year.[3]

Wind power was once confined to California, but during the last three years, wind farms coming online in Minnesota, Iowa, Texas, Colorado, Wyoming, Oregon,

and Pennsylvania have boosted U.S. capacity by half from 1,680 megawatts to 2,550 megawatts. The 1,500 or more megawatts to be added this year will be located in a dozen states. A 300-megawatt wind farm under construction on the Oregon/Washington border is currently the world's largest.[4]

But this is only the beginning. The Bonneville Power Administration (BPA) indicated in February that it wanted to buy 1,000 megawatts of wind-generating capacity and requested proposals. Much to its surprise, it received enough to build 2,600 megawatts of capacity in five states, with the potential of expanding these sites to over 4,000 megawatts. BPA, which may accept most of these proposals, expects to have at least one site online by the end of this year.[5]

A 3,000-megawatt wind farm in the early planning stages in South Dakota, near the Iowa border, is 10 times the size of the Oregon/Washington wind farm. Named Rolling Thunder, this project, initiated by Dehlsen Associates and drawing on the leadership of Jim Dehlsen, a wind energy pioneer in California, is designed to feed power to the midwestern region around Chicago. This proposed project is not only large by wind power standards, it is one of the largest energy projects of any kind in the world today.[6]

Advances in wind turbine technology, drawing heavily from the aerospace industry, have lowered the cost of wind power from 38¢ per kilowatt-hour in the early 1980s to 3–6¢ today, depending on the wind site. Wind, now competitive with fossil fuels, is already cheaper in some locations than oil or gas-fired power. With major corporations such as ABB, Shell International, and Enron plowing resources into this field, further cost cuts are in prospect.[7]

Wind is a vast, worldwide source of energy. The U.S.

Great Plains are the Saudi Arabia of wind power. Three wind-rich U.S. states—Kansas, North Dakota, and Texas—have enough harnessable wind to meet national electricity needs. China can double its existing generating capacity from wind alone. Densely populated Western Europe can meet all of its electricity needs from offshore wind power.[8]

Today Denmark, the world leader in wind turbine technology and manufacture, is getting 15 percent of its electricity from wind power. For Schleswig-Holstein, the northernmost state of Germany, the figure is 19 percent, and for some parts of the state, 75 percent. Spain's industrial province of Navarra, starting from scratch six years ago, now gets 22 percent of its electricity from wind.[9]

As wind-generating costs fall and as concern about climate change escalates, more and more countries are climbing onto the wind energy bandwagon. In December, France announced it will develop 5,000 megawatts of wind power by 2010. Also in December, Argentina announced a plan to develop 3,000 megawatts of wind power in Patagonia by 2010. In April, the United Kingdom accepted offshore bids for 1,500 megawatts of wind power.[10]

The growth in wind power is consistently outrunning earlier estimates. The European Wind Energy Association, which in 1996 had set a target of 40,000 megawatts for Europe in 2010, recently upped it to 60,000 megawatts.[11]

The Bush plan to add 393,000 megawatts of electricity nationwide by 2020 could be satisfied from wind alone. Money spent on wind-generated electricity tends to remain in the community, providing income, jobs, and tax revenue, bolstering local economies. One large advanced-design wind turbine, occupying a quarter-acre of land, can easily yield a farmer or rancher $2,000 in

royalties per year while providing the community with $100,000 of electricity. U.S. farmers and ranchers, who own most of the wind rights in the country, are now joining environmentalists to lobby for development of this abundant alternative to fossil fuel.[12]

Once we get cheap electricity from wind, we can use it to electrolyze water, producing hydrogen. Hydrogen is the fuel of choice for the new, highly efficient, fuel-cell engine that every major automobile manufacturer is now working on. DaimlerChrysler plans to be on the market with fuel cell-powered cars in 2003. Ford, Toyota, and Honda will probably not be far behind. William Ford, Chairman of Ford Motor Company, says he expects to preside over the demise of the internal combustion engine.[13]

Surplus wind power can be stored as hydrogen and used in fuel cells or gas turbines to generate electricity, leveling supply when winds are variable. Wind, once seen as a cornerstone of the new energy economy, may turn out to be its foundation. The wind meteorologist who analyzes wind regimes and identifies the best sites for wind farms will play a role in the new energy economy comparable to that of the petroleum geologist in the old energy economy.

With the advancing technologies for harnessing wind and powering motor vehicles with hydrogen, we can now see a future where farmers and ranchers can supply not only much of the country's electricity, but much of the hydrogen to fuel its fleet of automobiles as well. For the first time, the United States has the technology and resources to divorce itself from Middle Eastern oil.

In addition to neglecting the potential of wind, the Bush energy strategy pays only lip service to climate stabilization. This is a high-risk strategy. With business as usual, the International Panel on Climate Change recent-

ly projected a global temperature rise during this century of up to 6 degrees Celsius (10 degrees Fahrenheit). If this rise occurs, the rest of the world may hold the United States, the leading carbon emitter, responsible.[14]

What the United States needs now is an energy plan for this century, one that takes into account not only recent technological advances in wind power, fuel cells, and hydrogen generators, but also the need to stabilize climate. Perhaps Congress will bring the energy plan into the twenty-first century and restore U.S. leadership in the fast-changing world energy economy.

For additional information, see <www.earth-policy.org/Alerts/Alert14.htm>.

Population and Health

June 2000

Population Growth Sentencing Millions to Hydrological Poverty

Lester R. Brown

At a time when drought in the United States, Ethiopia, and Afghanistan is in the news, it is easy to forget that far more serious water shortages are emerging as the demand for water in many countries simply outruns the supply. Water tables are now falling on every continent. Literally scores of countries are facing water shortages as water tables fall and wells go dry.

We live in a water-challenged world, one that is becoming more so each year as 80 million additional people stake their claims to the earth's water resources. Unfortunately, nearly all the projected 3 billion people to be added over the next half-century will be born in countries that are already experiencing water shortages. Even now many in these countries lack enough water to drink, to satisfy hygienic needs, and to produce food.[1]

By 2050, India is projected to add 519 million people and China 211 million. Pakistan is projected to add nearly 200 million, going from 151 million at present to 348

million. Egypt, Iran, and Mexico are slated to increase their populations by more than half by 2050. In these and other water-short countries, population growth is sentencing millions of people to hydrological poverty, a local form of poverty that is difficult to escape.[2]

Even with today's 6 billion people, the world has a huge water deficit. Using data on overpumping for China, India, Saudi Arabia, North Africa, and the United States, Sandra Postel, author of *Pillar of Sand: Can the Irrigation Miracle Last?*, calculates the annual depletion of aquifers at 160 billion cubic meters or 160 billion tons. Using the rule of thumb that it takes 1,000 tons of water to produce 1 ton of grain, this 160-billion-ton water deficit is equal to 160 million tons of grain or one half the U.S. grain harvest.[3]

At average world grain consumption of just over 300 kilograms or one third of a ton per person per year, this would feed 480 million people. Stated otherwise, 480 million of the world's 6 billion people are being fed with grain produced with the unsustainable use of water.[4]

Overpumping is a new phenomenon, one largely confined to the last half-century. Only since the development of powerful diesel and electrically driven pumps have we had the capacity to pull water out of aquifers faster than it is replaced by precipitation.

Some 70 percent of the water consumed worldwide, including both that diverted from rivers and that pumped from underground, is used for irrigation, while some 20 percent is used by industry, and 10 percent for residential purposes. In the increasingly intense competition for water among sectors, agriculture almost always loses. The 1,000 tons of water used in India to produce 1 ton of wheat worth perhaps $200 can also be used to expand industrial output by easily $10,000, or 50 times as much. This ratio helps explain why, in the American West, the

sale of irrigation water rights by farmers to cities is an almost daily occurrence.[5]

In addition to population growth, urbanization and industrialization also expand the demand for water. As developing-country villagers, traditionally reliant on the village well, move to urban high-rise apartment buildings with indoor plumbing, their residential water use can easily triple. Industrialization takes even more water than urbanization.

Rising affluence in itself generates additional demand for water. As people move up the food chain, consuming more beef, pork, poultry, eggs, and dairy products, they use more grain. A U.S. diet rich in livestock products requires 800 kilograms of grain per person a year, whereas diets in India, dominated by a starchy food staple such as rice, typically need only 200 kilograms. Using four times as much grain per person means using four times as much water.[6]

Once a localized phenomenon, water scarcity is now crossing national borders via the international grain trade. The world's fastest-growing grain import market is North Africa and the Middle East, an area that includes Morocco, Algeria, Tunisia, Libya, Egypt, and the Middle East through Iran. Virtually every country in this region is simultaneously experiencing water shortages and rapid population growth.[7]

As the demand for water in the region's cities and industries increases, it is typically satisfied by diverting water from irrigation. The loss in food production capacity is then offset by importing grain from abroad. Since 1 ton of grain represents 1,000 tons of water, this becomes the most efficient way to import water.[8]

Last year, Iran imported 7 million tons of wheat, eclipsing Japan to become the world's leading wheat importer. This year, Egypt is also projected to move

ahead of Japan. Iran and Egypt have nearly 70 million people each. Both populations are increasing by more than a million a year and both are pressing against the limits of their water supplies.[9]

The water required to produce the grain and other foodstuffs imported into North Africa and the Middle East last year was roughly equal to the annual flow of the Nile River. Stated otherwise, the fast-growing water deficit of this region is equal to another Nile flowing into the region in the form of imported grain.[10]

It is now often said that future wars in the region will more likely be fought over water than oil. Perhaps, but given the difficulty in winning a water war, the competition for water seems more likely to take place in world grain markets. The countries that will "win" in this competition will be those that are financially strongest, not those that are militarily strongest.

The world water deficit grows larger with each year, making it potentially more difficult to manage. If we decided abruptly to stabilize water tables everywhere by simply pumping less water, the world grain harvest would fall by some 160 million tons, or 8 percent, and grain prices would go off the top of the chart. If the deficit continues to widen, the eventual adjustment will be even greater.[11]

Unless governments in water-short countries act quickly to stabilize population and to raise water productivity, their water shortages may soon become food shortages. The risk is that the growing number of water-short countries, including population giants China and India, with rising grain import needs will overwhelm the exportable supply in grain-surplus countries, such as the United States, Canada, and Australia. This in turn could destabilize world grain markets.

Another risk of delay in dealing with the deficit is that

some low-income, water-short countries will not be able to afford to import needed grain, trapping millions of their people in hydrological poverty, thirsty and hungry, unable to escape.

Although there are still some opportunities for developing new water resources, restoring the balance between water use and the sustainable supply will depend primarily on demand-side initiatives, such as stabilizing population and raising water productivity.

Governments can no longer separate population policy from the supply of water. And just as the world turned to raising land productivity a half-century ago when the frontiers of agricultural settlement disappeared, so it must now turn to raising water productivity. The first step toward this goal is to eliminate the water subsidies that foster inefficiency. The second step is to raise the price of water to reflect its cost. Shifting to more water-efficient technologies, more water-efficient crops, and more water-efficient forms of animal protein offers a huge potential for raising water productivity. The shifts will move faster if the price of water more closely reflects its value.

For additional information, see <www.earth-policy.org/Alerts/Alert4.htm>.

July 2000

Africa Is Dying—It Needs Help

Lester R. Brown

The recent International AIDS conference in Durban, South Africa, reminds us that Africa is dying. The HIV epidemic that is raging across Africa is now taking some 6,030 lives each day, the equivalent of 15 fully loaded jumbo jets crashing—with no survivors. This number, climbing higher each year, is expected to double during this decade.[1]

Public attention has initially focused on the dramatic rise in adult mortality and the precipitous drop in life expectancy. But we need now to look at the longer term economic consequences—falling food production, deteriorating health care, and disintegrating educational systems. Effectively dealing with this epidemic and the heavy loss of adults will make the rebuilding of Europe after World War II seem like child's play by comparison.

While industrial countries have held the HIV infection rate among the adult population to less than 1 percent, in some 16 African countries it is over 10 percent. (See Table 3–2.) In South Africa, it is 20 percent. In Zimbabwe and Swaziland, it is 25 percent. And in Botswana, which has the highest infection rate, 36 percent of adults are HIV-positive. Barring a medical miracle, these latter countries will lose one fifth to one third of their adults by the end of this decade.[2]

Attention in Durban focused on the high cost of treating those already ill, but the virus is continuing to spread. Unless its spread is curbed soon, it will take more lives in Africa than World War II claimed worldwide.

As deaths multiply, life expectancy falls. Without AIDS, countries with high infection rates, like Botswana, Zimbabwe, and South Africa would have a life expectancy of some 70 years or more. With the virus continuing to spread, life expectancy could drop to 30—more like a medieval life span than a modern one.[3]

Whereas infectious diseases typically take their heaviest toll among the eldest and the very young who have weaker immune systems, HIV claims mostly adults, depriving countries of their most productive workers. In the epidemic's early stages, the virus typically spreads most rapidly among the better educated, more socially mobile segment of society. It takes the agronomists, engineers, and teachers on whom economic development depends.

The HIV epidemic is affecting every segment of society, every sector of the economy, and every facet of life. For example, close to half of Zimbabwe's health care budget is used to treat AIDS patients. In some hospitals in Burundi and South Africa, AIDS patients occupy 60 percent of the beds. Health care workers are worked to exhaustion.[4]

This epidemic, now producing thousands of orphans each day, could easily produce 40 million orphans by 2010, a number that could overwhelm the resources of extended families.[5]

Education is also suffering. In Zambia, the number of teachers dying with AIDS each year approaches the number of new teachers being trained. In the Central African Republic, a shortage of teachers closed 107 primary schools, leaving only 66 open. At the college level, the damage is equally devastating. At the University of Durban-Westville in South Africa, 25 percent of the student body is HIV-positive.[6]

Table 3–2. *Countries Where HIV Infection Rate Among Adults Is Greater Than 10 Percent*

Country	Population	Share of Adult Population Infected
	(million)	(percent)
Botswana	2	36
Swaziland	1	25
Zimbabwe	12	25
Lesotho	2	24
South Africa	40	20
Zambia	9	20
Namibia	2	20
Malawi	11	16
Kenya	30	14
Central African Republic	4	14
Mozambique	19	13
Côte d'Ivoire	14	12
Djibouti	1	12
Burundi	7	11
Rwanda	7	11
Ethiopia	61	11

Source: UNAIDS, *Report on the Global HIV/AIDS Epidemic* (Geneva: June 2000).

In addition to the continuing handicaps of a lack of infrastructure and trained personnel, Africa must now contend with the adverse economic effects of the epidemic. AIDS dramatically increases the dependency ratio, the number of young and elderly who depend on productive adults. This in turn makes it much more difficult for a society to save. Reduced savings means reduced investment and slower economic growth or even decline.

At the corporate level, firms in countries with high infection rates are seeing their employee health care insurance costs double, triple, or quadruple. Companies that were until recently comfortably in the black now find themselves in the red. Under these circumstances, investment inflows from abroad are declining and could dry up entirely.

In a largely rural society, food security declines as the epidemic progresses. At the family level, food supplies drop precipitously when the first adult develops full-blown AIDS. This deprives the family not only of this worker in the fields, but also of the work time of the adult caring for the AIDS victim. A survey in Tanzania found that a woman whose husband was sick with AIDS spent 60 percent less time tending the crops.[7]

Food production declines from the epidemic have been reported in Burkina Faso, Côte d'Ivoire, and Zimbabwe. In pastoral economies, such as Namibia, the loss of the male head of household is often followed by the loss of cattle, the family's livelihood.[8]

Sub-Saharan Africa, a region of 600 million people, is moving into uncharted territory. There are historical precedents for epidemics on this scale, such as the smallpox epidemic that decimated New World Indian populations in the sixteenth century or the bubonic plague in Europe in the fourteenth century, but there is no precedent for such a concentrated loss of adults.[9]

The good news is that some countries are halting the spread of the virus. The key is strong leadership from the top. In Uganda, where the epidemic first took root, the active personal leadership of President Yoweri Museveni over the last dozen years has succeeded in reducing the

share of adults infected with the virus from a peak of 14 percent to 8 percent. In effect, the number of new infections has dropped well below the number of deaths from AIDS.[10]

Senegal, alone in Africa, responded early to the threat from the virus. As a result, it prevented the epidemic from gaining momentum and held the infection rate to 2 percent of its adults, a number only slightly higher than that of the industrial countries.[11]

Saving Africa depends on a Marshall Plan–scale effort on two fronts: one to curb the spread of the virus and the other to restore economic progress. Winning the former depends directly on Africa's national political leaders. Unless they personally lead, the effort will fail.

Once the leader outlines the behavioral changes needed to contain the virus—such as young people delaying first intercourse, reducing the number of sexual partners, and using condoms—then others can contribute. This includes the medical establishment within the country, nongovernmental groups working in this area, and international health and family planning agencies.

To compensate for the "missing generation," countries will need assistance across the board in education. This is an area where the U.S. Peace Corps and its equivalents in Europe can play a central role, particularly in supplying the teachers needed to keep schools open. Social workers are needed to work with orphans. A program of financial assistance is necessary for the extended families trying to absorb the millions of orphans projected by 2010.

Given the high cost of doing business in an AIDS-ridden society, special incentives in the form of tax relief are needed to attract corporate investors, incentives that could be underwritten by international development agencies. And it goes without saying, debt relief is essential to the rebuilding of Africa.

It is not possible to outline a detailed rescue effort here. The bottom line is that there is no precedent in international development for the challenge the world now faces in Africa. The question is not whether we can respond to this challenge. We can. We have the resources to do so. If we fail to respond to Africa's pain, we will forfeit the right to call ourselves a civilized society.

For additional information, see <www.earth-policy.org/Alerts/Alert5.htm>.

October 2000

HIV Epidemic Restructuring Africa's Population

Lester R. Brown

The HIV epidemic raging across Africa is a tragedy of epic proportions, one that is altering the region's demographic future. It is reducing life expectancy, raising mortality, lowering fertility, creating an excess of men over women, and leaving millions of orphans in its wake.

This year began with 24 million Africans infected with the virus. In the absence of a medical miracle, nearly all will die before 2010. Each day, 6,000 Africans die from AIDS. Each day, an additional 11,000 are infected.[1]

The epidemic has proceeded much faster in some countries than in others. In Botswana, 36 percent of the adult population is HIV-positive. In Zimbabwe and Swaziland, the infection rate is 25 percent. Lesotho is at 24 percent. In Namibia, South Africa, and Zambia, the figure is 20 percent. In none of these countries has the spread of the virus been checked.[2]

Life expectancy, a sentinel indicator of economic progress, is falling precipitously. In Zimbabwe, without AIDS, life expectancy in 2010 would be 70 years, but with AIDS, it is expected to fall below 35 years. Botswana's life expectancy is projected to fall from 66 years to 33 years by 2010. For South Africa, it will fall from 68 years to 48 years. And for Zambia, from 60 to 30 years. These life expectancies are more akin to those of the Middle Ages than of the modern age.[3]

The demography of this epidemic is not well understood simply because, in contrast to most infectious diseases, which take their heaviest toll among the elderly and the very young, this virus takes its greatest toll among young adults. The effect on mortality is most easily understood. In the absence of a low-cost cure, infection leads to death. The time from infection until death for adults in Africa is estimated at 7 to 10 years.[4]

This means that Botswana can expect to lose the 36 percent of its adult population that is HIV-positive within this decade, plus the additional numbers who will be infected within the next year or two. The HIV toll, plus normal deaths among adults, means that close to half of the adults in Botswana today will be dead by 2010. Other countries with high infection rates, such as South Africa, Swaziland, and Zimbabwe, will likely lose nearly a third of their adults by 2010.[5]

Adults are not the only ones dying from AIDS. In Africa, infants of mothers who are HIV-positive have a 30- to 60-percent chance of being born with the virus. Their life expectancy is typically less than two years. Many more infants acquire the virus through breastfeeding. Few of them will reach school age.[6]

Thus far, attention has focused on the effect of rising mortality on future population trends, but the virus also reduces fertility. Research is limited, but early evidence indicates that from the time of infection onward, fertility among infected women slowly declines. By the time symptoms of AIDS appear, women are 70 percent less likely to be pregnant than those who are not infected.[7]

Females are infected at an earlier age than males because they have sexual relations with older men who are more likely to be HIV-positive. Female infection rates are also higher than those of males. Among 15- to 19-year-olds, five times as many females are infected as males. Because they are infected so early in life, many

women will die before completing their reproductive years, further reducing births.[8]

A demographically detailed study in Kisumu, Kenya, found that 8 percent of 15-year-old girls are HIV-positive. For 16-year-olds, the figure is 18 percent; and by age 19, it is 33 percent. Among the 19-year-olds, the average age of infection was roughly 17 years. With a life expectancy of perhaps nine years after infection, the average woman in this group will die at age 26, long before her childbearing years are over.[9]

Much work remains to be done in analyzing the effects of the HIV epidemic on fertility, but we do know that with other social traumas, such as famine, the effect of fertility decline on population size can equal the effect of rising mortality. For example, in the 1959–61 famine in China, some 30 million Chinese starved to death, but the actual reduction in China's population as a result of the famine was closer to 60 million.[10]

The reasons are well understood. In a famished population, the level of sexual activity declines, many women stop ovulating, and even the women who do conceive often abort spontaneously. In a prolonged famine, the fall in births can contribute as much to the population decline as the rise in mortality. How much the HIV epidemic will eventually reduce fertility no one knows.

One thing is known: The wholesale death of young adults in Africa is creating millions of orphans. By 2010, Africa is expected to have 40 million orphans. Although Africa's extended family system is highly resilient and capable of caring for children left alone when parents die, it will be staggered by this challenge. There is a real possibility that millions of orphans will become street children, trying to survive by whatever means they can.[11]

Africa is also facing a gender imbalance, a unique shortage of women. After wars, countries often face a

severe shortage of males, as Russia did after World War II. This epidemic, however, is claiming more females than males in Africa, promising a future where men will outnumber women 11 to 9. This will leave many males either destined to bachelorhood or forced to migrate to countries outside the region in search of a wife.[12]

The demographic effects of the HIV epidemic on Africa will be visible for generations to come. Until recently, the official projections at the United Nations indicated continuing population growth in all countries in Africa. Now this may be changing as the United Nations acknowledges that populations could decline in some countries. If the new U.N. biennial update of world population numbers and projections, due out before the end of this year, includes the full effect of the epidemic on fertility as well as on mortality, it will likely show future population declines for many African countries, including Botswana, Zimbabwe, South Africa, and Zambia.

There are many unknowns in the effects of the HIV epidemic on the demographic equation. Will health care systems, overwhelmed by AIDS victims, be able to meet the need for basic health care? How will the loss of so many adults in rural communities affect food security? What will be the effect on fertility of women surrounded by death? What will be the social effects of the missing generation of young adults unable to rear their children or to care for their parents?

Even though the HIV epidemic may claim more lives in Africa than World War II claimed worldwide, the epidemic is simply not being given the priority it deserves either within the countries most affected or within the international community. The challenge is to reduce the number of new infections as rapidly as possible. Nothing should deter societies from this goal.

One of the earliest countries hit by the epidemic,

Uganda, has become a model for other countries as the infected share of its adult population has dropped from 14 percent in the early 1990s to 8 percent in 2000, a dramatic achievement. In Zambia, which has mobilized the health, education, agricultural, and industrial sectors, plus church groups, in the effort to curb the spread of the virus, the infected share of young females in some cities has dropped by nearly half since 1993. Zambia may soon turn the HIV tide. If all African countries can do what Uganda has done and what Zambia appears to be doing—namely, reduce the number of new infections below that of AIDS deaths—they may set the stage for ending this history-altering epidemic.[13]

For additional information, see <www.earth-policy.org/Alerts/Alert10.htm>.

December 2000

Obesity Threatens Health in Exercise-Deprived Societies

Lester R. Brown

Obesity is reaching epidemic proportions, afflicting a growing number of people in industrial and developing countries alike. It is damaging human health, raising the incidence of heart disease, stroke, breast cancer, colon cancer, arthritis, and adult onset diabetes. In the United States, the Centers for Disease Control and Prevention estimates that 300,000 Americans now die each year from obesity-related illnesses.[1]

Reducing obesity has traditionally focused on lowering caloric intake by dieting, but there is growing evidence that exercise deprivation is also a major contributor to obesity. With metabolic systems shaped by 4 million years of highly active hunting and gathering, many people may not be able to maintain a healthy body weight without regular exercise.

For the first time in history, a majority of adults in some societies are overweight. In the United States, 61 percent of all adults are overweight. In Russia, the figure is 54 percent; in the United Kingdom, 51 percent; and in Germany, 50 percent. For Europe as a whole, more than half of those between 35 and 65 years of age are overweight.[2]

The number who are overweight is rising in developing countries as well. In Brazil, for example, 36 percent of the adult population is overweight. Fifteen percent of China's adult population is overweight.[3]

Not only are more people overweight than ever before, but their ranks are expanding at a record rate. In the United States, obesity among adults increased by half between 1980 and 1994. Among Americans, 20 percent of men and 25 percent of women are more than 30 pounds (13.6 kilograms) overweight. Surveys in China showed that during the boom years between 1989 and 1992, the share of adults overweight jumped from 9 percent to 15 percent.[4]

Juvenile obesity is rising rapidly. In the United States, where at least 1 out of 10 youngsters 6 to 17 years of age is overweight, the incidence of obesity among children has more than doubled over the last 30 years. Not only does juvenile obesity typically translate into adult obesity, but it also causes metabolic changes that make the disease difficult to treat in adulthood.[5]

Obesity is concentrated in cities. As societies urbanize and people adopt sedentary lifestyles, obesity increases. In both China and Indonesia, the share of people who are obese in cities is double that in the countryside. In the Congo, obesity is six times higher in cities.[6]

In a Worldwatch Paper, *Underfed and Overfed*, Gary Gardner and Brian Halweil report that the number who are overnourished and overweight has climbed to 1.1 billion worldwide, rivaling the number who are undernourished and underweight. Peter Kopelman of the Royal London School of Medicine summarizes the thinking of the medical community: "Obesity should no longer be regarded simply as a cosmetic problem affecting certain individuals, but [as] an epidemic that threatens global well being."[7]

Damage to health from obesity takes many forms. In addition to the illnesses noted earlier, heavier body weight increases resistance to the heart's pumping of blood, elevating blood pressure. It also raises the stress on joints, often causing lower back pain. Those who are obese are four times as likely to have diabetes as those who are not.[8]

As weight goes up, life expectancy goes down. In analyzing this relationship for Americans between the ages of 30 and 42, one broad-based study found that the risk of death within 26 years increased by 1 percent with each additional pound (0.45 kg) of weight.[9]

The estimated 300,000 Americans who die prematurely each year as a result of being overweight is nearing the 400,000 who die prematurely from cigarette smoking. But there is one difference. The number of cigarettes smoked per person in the United States is on the decline, falling some 42 percent between 1980 and 1999, whereas obesity is on the rise. If recent trends continue, it is only a matter of time before deaths from obesity-related illnesses overtake those related to smoking.[10]

Gaining weight is a result of consuming more calories than are burned. With modernization, caloric intake has climbed. Over the last two decades, caloric intake in the United States has risen nearly 10 percent for men and 7 percent for women. Modern diets are rich in fat and sugar. In addition to sugars that occur naturally in food, the average American diet now includes 20 teaspoons of added sugar a day, much of it in soft drinks and prepared foods. Unfortunately, diets in developing countries, especially in urban areas, are moving in this same direction.[11]

While caloric intake has been rising, exercise has been declining. The latest U.S. survey shows that 57 percent of Americans exercise only occasionally or not at all, a number that corresponds closely with the share of the population that is overweight.[12]

Economic modernization has systematically eliminated exercise from our lives. Workers commute by car from home to work in an office or factory, driving quite liter-

ally from door to door. Automobiles have eliminated daily walking and cycling. Elevators and escalators have replaced stairs. Leisure time is spent watching television. In the United Kingdom, the two lifestyle variables that correlate most closely with obesity are television viewing and automobile ownership.[13]

Children who watch television five or more hours a day are five times as likely to be overweight as those who watch less than two hours a day. Time spent playing computer games and surfing the Internet in lieu of playing outside is also contributing to the surge in obesity.[14]

A common impulse of those who are overweight is to go on a diet of some sort, attempting to reduce caloric intake to the level of caloric use. Unfortunately, this is physiologically difficult given the abnormally low calorie use associated with our sedentary lifestyles. Ninety-five percent of Americans who attempt to achieve a healthy body weight by dieting alone fail.[15]

Another manifestation of diet failures is the extent to which people are turning to liposuction to remove body fat. Resorting to this risky surgical procedure, which quite literally vacuums fat from under the skin, is a desperate last measure for those whose diets have failed. In 1998, there were some 400,000 liposuction procedures in the United States.[16]

For many of those who are overweight, achieving a healthy body weight depends on both reducing caloric intake and burning more calories through exercise. Metabolically, we are hunter-gatherers. Given our heritage, exercise may be a genetic imperative.

Restoring exercise in our daily lives will not be easy. Today's cities, designed for automobiles, are leading to a life-threatening level of exercise deprivation. Our health depends on creating neighborhoods that are conducive to walking, jogging, and bicycling.

The challenge is to redesign communities, making public transportation the centerpiece of urban transport, and augmenting it with sidewalks, jogging trails, and bikeways. This also means replacing parking lots with parks, playgrounds, and playing fields. Unless we can design a lifestyle that systematically restores exercise to our daily routines, the obesity epidemic—and the health deterioration associated with it—will continue to spread.

For additional information, see <www.earth-policy.org/Alerts/Alert11.htm>.

December 2001

Iran's Birth Rate Plummeting at Record Pace

Janet Larsen

Iran's population growth rate dropped from an all-time high of 3.2 percent in 1986 to just 1.2 percent in 2001, one of the fastest drops ever recorded. (See Figure 3–1.) In reducing its population growth to 1.2 percent, a rate only slightly higher than that of the United States, Iran has emerged as a model for other countries that want to accelerate the shift to smaller families.[1]

Historically, family planning in Iran has had its ups and downs. The nation's first family planning policy, introduced in 1967 under Shah Reza Pahlavi, aimed to accelerate economic growth and improve the status of women by reforming divorce laws, encouraging female employment, and acknowledging family planning as a human right.[2]

Unfortunately, this promising initiative was reversed in 1979 at the beginning of the decade-long Islamic Revolution led by Shiite Muslim spiritual leader Ayatollah Khomeini. During this period, family planning programs were seen as undue western influences and were dismantled. Health officials were ordered not to advocate contraception. During Iran's war with Iraq between 1980 and 1988, a large population was viewed as a comparative advantage, and Khomeini pushed procreation to bolster the ranks of "soldiers for Islam," aiming for "an army of 20 million."[3]

This strong pronatalist stance led to an annual population growth rate of well over 3 percent. United Nations

data show Iran's population doubling from 27 million in 1968 to 55 million in 1988.[4]

During postwar reconstruction in the late 1980s, the economy faltered. Severe job shortages plagued overcrowded and polluted cities. Iran's rapid population growth was finally seen as an obstacle to development. Receptive to the nation's problems, Ayatollah Khomeini reopened dialogue on the subject of birth control. By December 1989, Iran had revived its national family planning program. Its principal goals were to encourage women to wait three to four years between pregnancies, to discourage childbearing for women younger than 18 or older than 35, and to limit family size to three children.[5]

In May of 1993, the Iranian government passed a national family planning law that encouraged couples to have fewer children by restricting maternity leave benefits after three children. It also called for the Ministries of Education, of Culture and Higher Education, and of

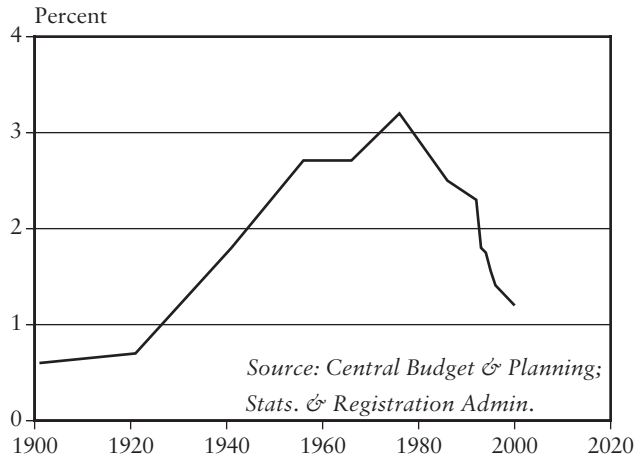

Figure 3–1. *Annual Population Increase in Iran, 1901–2000*

Health and Medical Education to incorporate information on population, family planning, and mother and child health care in curriculum materials. The Ministry of Islamic Culture and Guidance was told to allow the media to raise awareness of population issues and family planning programs, and the Islamic Republic of Iran Broadcasting was entrusted with airing such information. Money saved on reduced maternity leave funds these educational programs.[6]

From 1986 to 2001, Iran's total fertility—the average number of children born to a woman in her lifetime—plummeted from seven to less than three. The United Nations projects that by 2010 total fertility will drop to two, which is replacement-level fertility.[7]

Strong government support has facilitated Iran's demographic transition. Under the current president, Mohammad Khatami, the government covers 80 percent of family planning costs. A comprehensive health network made up of mobile clinics and 15,000 "health houses" provides family planning and health services to four fifths of Iran's rural population. Almost all of these health care centers were established after 1990. Because family planning is integrated with primary health care, there is little stigma attached to modern contraceptives.[8]

Religious leaders have become involved with the crusade for smaller families, citing them as a social responsibility in their weekly sermons. They also have issued fatwas, religious edicts with the strength of court orders, that permit and encourage the use of all types of contraception, including permanent male and female sterilization—a first among Muslim countries. Birth control, including the provision of condoms, pills, and sterilization, is free.[9]

One of the strengths of Iran's promotion of family planning is the involvement of men. Iran is the only country in the world that requires both men and women to take a class on modern contraception before receiving a marriage license. And it is the only country in the region with a government-sanctioned condom factory. In the past four years, some 220,000 Iranian men have had a vasectomy. While vasectomies still account for only 3 percent of contraception, compared with female sterilization at 28 percent, men nonetheless are assuming more responsibility for family planning.[10]

Rising literacy and a national communications infrastructure are facilitating progress in family planning. The literacy rate for adult males increased from 48 percent in 1970 to 84 percent in 2000, nearly doubling in 30 years. Female literacy climbed even faster, rising from less than 25 percent in 1970 to more than 70 percent. Meanwhile, school enrollment grew from 60 to 90 percent. And by 1996, 70 percent of rural and 93 percent of urban households had televisions, allowing family planning information to be spread widely through the media.[11]

As one of 17 countries already facing absolute water scarcity, Iran's decision to curb its rapid population growth has helped alleviate unfolding water shortages exacerbated by the severe drought of the past three years. An estimated 37 million people, more than half the population, do not have enough water.[12]

The lack of water for irrigation has helped push Iran's wheat imports to 6.5 million tons in 2001, well above the 5.8 million tons of Japan, traditionally the world's leading importer. Total grain production dropped steeply between 1998 and 2000, from 17 million to 10 million tons, largely because of the drought. The grain area harvested has decreased steadily since 1993, rapidly shrinking grain production per person.[13]

Dwindling per capita arable land and water supplies reinforce the need for population stabilization through

forward-thinking family planning programs. Had the Iranian population maintained its 1986 growth rate of 3.2 percent, it would have doubled by 2008, topping 100 million instead of the projected 78 million.[14]

Because almost 40 percent of Iran's population is under the age of 15, population momentum is strong and growth in the immediate future is inevitable. To keep growth rates low, Iran needs to continue emphasizing the social value of smaller families.[15]

Among the keys to Iran's fertility transition are universal access to health care and family planning, a dramatic rise in female literacy, mandatory premarital contraceptive counseling for couples, men's participation in family planning programs, and strong support from religious leaders. While Iran's population policies and health care infrastructure are unique, its land and water scarcity are not. Other developing countries with fast-growing populations can profit by following Iran's lead in promoting population stability.

For additional information, see <www.earth-policy.org/Updates/Update4ss.htm>.

Food, Land, and Water

February 2001

Paving the Planet: Cars and Crops Competing for Land

Lester R. Brown

As the new century begins, the competition between cars and crops for cropland is intensifying. Until now, the paving over of cropland has occurred largely in industrial countries, home to four fifths of the world's 520 million automobiles. (See Figure 3–2.) But now, more and more farmland is being sacrificed in developing countries with hungry populations, calling into question the future role of the car.[1]

Millions of hectares of cropland in the industrial world have been paved over for roads and parking lots. Each U.S. car, for example, requires on average 0.07 hectares (0.18 acres) of paved land for roads and parking space. For every five cars added to the U.S. fleet, an area the size of a football field is covered with asphalt. More often than not, cropland is paved simply because the flat, well-drained soils that are well suited for farming are also ideal for building roads. Once paved, land is not easily reclaimed. As environmentalist Rupert Cutler once

noted, "Asphalt is the land's last crop."[2]

The United States, with its 214 million motor vehicles, has paved 6.3 million kilometers (3.9 million miles) of roads, enough to circle the Earth at the equator 157 times. In addition to roads, cars require parking space. Imagine a parking lot for 214 million cars and trucks. If that is too difficult, try visualizing a parking lot for 1,000 cars and then imagine what 214,000 of these would look like.[3]

However we visualize it, the U.S. area devoted to roads and parking lots covers an estimated 16 million hectares (61,000 square miles), an expanse approaching the size of the 21 million hectares that U.S. farmers planted in wheat last year. But this paving of land in industrial countries is slowing as countries approach automobile saturation. In the United States, there are three vehicles for every four people. In Western Europe and Japan, there is typically one for every two people.[4]

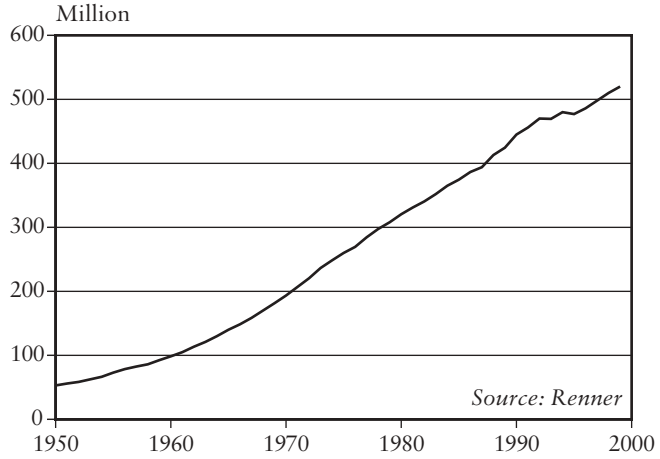

Figure 3–2. *World Automobile Fleet, 1950–99*

In developing countries, however, where automobile fleets are still small and where cropland is in short supply, the paving is just getting under way. More and more of the 11 million cars added annually to the world's vehicle fleet of 520 million are found in the developing world. This means that the war between cars and crops is being waged over wheat fields and rice paddies in countries where hunger is common. The outcome of this conflict in China and India, two countries that together contain 38 percent of the world's people, will affect food security everywhere.[5]

Car-centered industrial societies that are densely populated, such as Germany, the United Kingdom, and Japan, have paved an average of 0.02 hectares per vehicle. And they have lost some of their most productive cropland in the process. Similarly, China and India also face acute pressure on their cropland base from industrialization. Although China covers roughly the same area as the United States, its 1.3 billion people are concentrated in just one third of the country—a thousand-mile strip on the eastern and southern coast where the cropland is located.[6]

If China were one day to achieve the Japanese automobile ownership rate of one car for every two people, it would have a fleet of 640 million, compared with only 13 million today. While the idea of such an enormous fleet may seem farfetched, we need only remind ourselves that China has already overtaken the United States in steel production, fertilizer use, and red meat production. It is a huge economy and, since 1980, also the world's fastest growing economy.[7]

Assuming 0.02 hectares of paved land per vehicle in China, as in Europe and Japan, a fleet of 640 million cars would require paving nearly 13 million hectares of land, most of which would likely be cropland. This figure is over one half of China's 23 million hectares of riceland,

part of which it double crops to produce 135 million tons of rice, the principal food staple. When farmers in southern China lose a hectare of double-cropped riceland to the automobile, their rice production takes a double hit. Even one car for every four people, half the Japanese ownership rate, would consume a substantial area of cropland.[8]

The situation in India is similar. While India is geographically only a third the size of China, it too has more than 1 billion people, and it now has 8 million motor vehicles. Its fast-growing villages and cities are already encroaching on its cropland. Add to this the land paved for the automobile, and India, too, will be facing a heavy loss of cropland. A country projected to add 515 million more people by 2050 cannot afford to cover valuable cropland with asphalt for roads and parking lots.[9]

There is not enough land in China, India, and other densely populated countries like Indonesia, Bangladesh, Pakistan, Iran, Egypt, and Mexico to support automobile-centered transportation systems and to feed their people. The competition between cars and crops for land is becoming a competition between the rich and the poor, between those who can afford automobiles and those who struggle to buy enough food.

Governments that subsidize an automobile infrastructure with revenues collected from the entire population are, in effect, collecting money from the poor to support the cars of the wealthy. In subsidizing the development of an auto-centered transport system, governments are also inevitably subsidizing the paving of cropland. If, as now seems likely, automobile ownership never goes beyond the affluent minority in developing countries, this becomes an ongoing and largely invisible transfer of income from the poor to the rich.

In a land-hungry world, the time has come to reassess

the future of the automobile, to design transportation systems that provide mobility for entire populations, not just affluent minorities, and that do this without threatening food security. When Beijing announced in 1994 that it planned to make the auto industry one of the growth sectors for the next few decades, a group of eminent scientists—many of them members of the Chinese Academy of Sciences—produced a white paper challenging this decision. They identified several reasons the nation should not develop a car-centered transport system, but the first was that the country did not have enough cropland both to feed its people and to provide land for the automobile.[10]

The team of scientists recommended that instead of building an automobile infrastructure of roads and parking lots, China should concentrate on developing state-of-the-art light rail systems augmented by buses and bicycles. This would not only provide mobility for far more people than a congested auto-centered system, but it would also protect cropland.[11]

There are many reasons to question the goal of building automobile-centered transportation systems everywhere, including climate change, air pollution, and traffic congestion. But the loss of cropland alone is sufficient. Nearly all of the 3 billion people to be added to the current world population of 6 billion by mid-century will be born in developing countries where there is not enough land to feed everyone and to accommodate the automobile. Future food security now depends on restructuring transportation budgets—investing less in highway infrastructure and more in rail and bicycle infrastructure.[12]

For additional information, see <www.earth-policy.org/Alerts/Alert12.htm>.

May 2001

Dust Bowl Threatening China's Future

Lester R. Brown

On April 18, scientists at the National Oceanic and Atmospheric Administration laboratory in Boulder, Colorado, reported that a huge dust storm from northern China had reached the United States, "blanketing areas from Canada to Arizona with a layer of dust." They reported that along the foothills of the Rockies, the mountains were obscured by the dust from China.[1]

This dust storm did not come as a surprise. On March 10, 2001, the *People's Daily* reported that the season's first dust storm—one of the earliest on record—had hit Beijing. These dust storms, coupled with those of last year, were among the worst in memory, signaling a widespread deterioration of the rangeland and cropland in the country's vast northwest.[2]

These huge dust plumes routinely travel hundreds of miles to populous cities in northeastern China, including Beijing, obscuring the sun, reducing visibility, slowing traffic, and closing airports. Reports of residents in eastern cities caulking windows with old rags to keep out the dust are reminiscent of the U.S. Dust Bowl of the 1930s.[3]

Eastward-moving winds often carry soil from China's northwest to North Korea, South Korea, and Japan, countries that regularly complain about dust clouds that both filter out the sunlight and cover everything with dust. Responding to pressures from their constituents, a group of 15 legislators from Japan and 8 from South Korea are organizing a tri-national committee with Chinese lawmakers to devise a strategy to combat the dust.[4]

News reports typically attribute the dust storms to the drought of the last three years, but the drought is simply bringing a fast-deteriorating situation into focus. Human pressure on the land in northwestern China is excessive. There are too many people, too many cattle and sheep, and too many plows. Feeding 1.3 billion people, a population nearly five times that of the United States, is not an easy matter.[5]

In addition to local pressures on resources, a decision in Beijing in 1994 to require that all cropland used for construction be offset by land reclaimed elsewhere has helped create the ecological disaster that is now unfolding. In an article in *Land Use Policy*, Chinese geographers Hong Yang and Xiubein Li describe the environmental effects of this offset policy. The fast-growing coastal provinces, such as Guandong, Shandong, Xheijiang, and Jiangsu, which are losing cropland to urban expansion and industrial construction, are paying other provinces to plow new land to offset their losses. This provided an initial economic windfall for provinces in the northwest, such as Inner Mongolia (which led the way with a 22-percent cropland expansion), Gansu, Qinghai, Ningxia, and Xinjiang.[6]

As the northwestern provinces, already suffering from overplowing and overgrazing, plowed ever more marginal land, wind erosion intensified. Now accelerating wind erosion of soil and the resulting land abandonment are forcing people to migrate eastward, not unlike the U.S. westward migration from the southern Great Plains to California during the Dust Bowl years.[7]

While plows are clearing land, expanding livestock populations are denuding the land of vegetation. Following economic reforms in 1978 and the removal of controls

on the size of herds and flocks that collectives could maintain, livestock populations grew rapidly. Today China has 127 million cattle compared with 98 million in the United States. Its flock of 279 million sheep and goats compares with only 9 million in the United States.[8]

In Gonge County in eastern Quinghai Province, the number of sheep that local grasslands can sustain is estimated at 3.7 million, but by the end of 1998, sheep numbers there had reached 5.5 million, far beyond the land's carrying capacity. The result is fast-deteriorating grassland, desertification, and the formation of sand dunes.[9]

In the *New York Times*, Beijing Bureau Chief Erik Eckholm writes that "the rising sands are part of a new desert forming here on the eastern edge of the Quinghai-Tibet Plateau, a legendary stretch once known for grass reaching as high as a horse's belly and home for centuries to ethnic Tibetan herders." Official estimates show 900 square miles (2,330 square kilometers) of land going to desert each year. An area several times as large is suffering a decline in productivity as it is degraded by overuse.[10]

In addition to the direct damage from overplowing and overgrazing, the northern half of China is literally drying out as rainfall declines and aquifers are depleted by overpumping. Water tables are falling almost everywhere, gradually altering the region's hydrology. As water tables fall, springs dry up, streams no longer flow, lakes disappear, and rivers run dry. U.S. satellites, which have been monitoring land use in China for some 30 years, show that literally thousands of lakes in the north have disappeared.[11]

Deforestation in southern and eastern China is reducing the moisture transported inland from the South China Sea, the East China Sea, and the Yellow Sea, writes Wang Hongchang, a Fellow at the Chinese Academy of Social Sciences. Where land is forested, the water is held and evaporates to be carried further inland. When tree cover is removed, the initial rainfall from the inland-moving, moisture-laden air simply runs off and returns to the sea. As this recycling of rainfall inland is weakened by deforestation, rainfall in the interior is declining.[12]

Reversing this degradation means stabilizing population and planting trees everywhere possible to help recycle rainfall inland. It means converting highly erodible cropland back to grassland or woodland, reducing the livestock population, and planting tree shelter belts across the windswept areas of cropland, as U.S. farmers did to end dust storms in the 1930s.[13]

In addition, another interesting option now presents itself—the use of wind turbines as windbreaks to reduce wind speed and soil erosion. With the cost of wind-generated electricity now competitive with that generated from fossil fuels, constructing rows of wind turbines in strategic areas to slow the wind could greatly reduce the erosion of soil. This also affords an opportunity to phase out the use of wood for fuel, thus lightening the pressure on forests.[14]

The economics are extraordinarily attractive. In the U.S. Great Plains, under conditions similar to China's northwest, a large advanced-design wind turbine occupying a tenth of a hectare of land can produce $100,000 worth of electricity per year. This source of rural economic regeneration fits in nicely with China's plan to develop the impoverished northwest.[15]

Reversing desertification will require a huge effort, but if the dust bowl continues to spread, it will not only undermine the economy, but also trigger a massive migration eastward. The options are clear: Reduce livestock populations to a sustainable level or face heavy livestock losses as grassland turns to desert. Return highly erodible

cropland to grassland or lose all of the land's productive capacity as it turns to desert. Construct windbreaks with a combination of trees and, where feasible, wind turbines, to slow the wind or face even more soil losses and dust storms.

If China cannot quickly arrest the trends of deterioration, the growth of the dust bowl could acquire an irreversible momentum. What is at stake is not just China's soil, but its future.

For additional information, see <www.earth-policy.org/Alerts/Alert13.htm>.

October 2001

Worsening Water Shortages Threaten China's Food Security

Lester R. Brown

A little-noticed survey released in Beijing in mid-August reveals that China's water situation is far more serious than realized. The water table under the North China Plain, which produces over half of China's wheat and a third of its corn, is falling faster than thought.[1]

Overpumping has largely depleted the shallow aquifer, reducing the amount of water that can be pumped from it to the amount of recharge from precipitation. This is forcing well drillers to go down to the region's deep aquifer, which, unfortunately, is not replenishable.[2]

The study, conducted by the Geological Environmental Monitoring Institute (GEMI) in Beijing, reported that under Heibei Province in the heart of the North China Plain, the average level of the deep aquifer dropped 2.9 meters (nearly 10 feet) in 2000. Around some cities in the province, it fell by 6 meters.[3]

He Qingcheng, head of the GEMI groundwater monitoring team, believes the fast-deteriorating water situation should be getting far more official attention. He notes that with depletion of the deep aquifer under the North China Plain, the region is losing its last water reserve—its only safety cushion.[4]

His concerns are mirrored in a new World Bank report that says, "Anecdotal evidence suggests that deep

wells [drilled] around Beijing now have to reach 1,000 meters (more than half a mile) to tap fresh water, adding dramatically to the cost of supply." In unusually strong language for a Bank report, it forecasts "catastrophic consequences for future generations" unless water use and supply can quickly be brought back into balance.[5]

Further evidence of the gravity of the water situation in the North China Plain can be seen in the frenzy of well drilling in recent years. At the end of 1996, the five provinces of the North China Plain—Hebei, Henan, Shandong, and the city provinces of Beijing and Tianjin—had 2.6 million wells, the bulk of them for irrigation. During 1997, 99,900 wells were abandoned as they ran dry. Some 221,900 new wells were drilled. The desperate quest for water in China is evident as well drillers chase the water table downward.[6]

The northern half of China is drying out. Demands on the three rivers that flow eastward into the North China Plain—the Hai, the Yellow, and the Huai—are excessive, leading them to run dry during the dry season, sometimes for extended periods of time. The flow of the Yellow River into Shandong Province—the last of the eight provinces it flows through en route to the sea, and China's leading grain-producing province—has been reduced from 40 billion cubic meters (1 cubic meter = 1 ton) a year in the early 1980s to 25 billon cubic meters during the 1990s.[7]

As water tables fall, springs dry up, streams cease to flow, rivers run dry, and lakes disappear. Hebei Province once had 1,052 lakes. Only 83 remain.[8]

The water deficit in the North China Plain, the excess of use over the sustainable supply, may now exceed 40 billion tons per year. At present that deficit is being filled by groundwater mining, but when aquifers are depleted and there is nothing more to mine, the water supply will fall

precipitously. In the Hai River basin—where industry and cities, including Beijing and Tianjin, now get priority—irrigated agriculture could largely disappear by 2010, forcing a shift back to less productive rain-fed agriculture.[9]

Between now and 2010, when China's population is projected to grow by 126 million, the World Bank projects that the country's urban water demand will increase from 50 billion cubic meters to 80 billion, a growth of 60 percent. Industrial water demand, meanwhile, will increase from 127 billion to 206 billion cubic meters, an expansion of 62 percent.[10]

With water worth easily 70 times as much in industry as in agriculture, farmers almost always lose in the competition with cities. As water tables continue to fall, rising pumping costs will make underground water too costly for many farmers to use for irrigation.[11]

In addition to spreading water scarcity, numerous environmental and economic forces are reducing China's grain production. As farmers attempt to maximize their income from small plots, for example, they are shifting from grain to high-value fruit and vegetable crops.[12]

China has been striving valiantly to remain self-sufficient in grain since 1994. It did so by raising support prices of grain well above the world market level, by overplowing land on a scale that helped create the world's largest dust bowl, and by overpumping the aquifers under the North China Plain.[13]

The combination of weak prices, falling water tables, and severe drought dropped the grain harvest in 2001 to 335 million tons, down from the all-time high of 392 million tons in 1998. This will fall short of projected consumption by 46 million tons. The emergence of this deficit—easily the largest in China's history—on the heels of last year's deficit of 34 million tons raises questions about future food security.[14]

The back-to-back grain shortfalls in the last two years at a time when China's imports of grain are negligible have dropped stocks by roughly 81 million tons. With its accessible stocks of grain now largely depleted, another sizable crop shortfall in 2002 would likely force China to import large amounts of grain to avoid rising food prices.[15]

China's grain imports could climb quickly, as its recent experience with soybeans shows. When grain support prices were raised in 1994, resources were diverted from soybeans—the nation's fourth ranking crop after wheat, rice, and corn. As a result, the soybean harvest has fallen 6 percent since 1994 while demand has doubled. In an abrupt turnaround, China has gone from being a small net exporter of soybeans in 1993 to being the world's largest importer in 2001, bringing in 14 million of the 30 million tons it consumes.[16]

If China has another sizable grain harvest shortfall in 2002, it will likely be forced to import grain far in excess of the 7 million tons of wheat and 5 million tons of corn that it must promise to import if it joins the World Trade Organization in late 2001, as expected.[17]

With its aquifers being depleted, China is now reconsidering its options for reestablishing a balance between water use and supply. Three possible initiatives stand out: water conservation, diversion of water from the south to the north, and grain imports. A south/north diversion to transport water from the Yangtze River basin will cost tens of billions of dollars and displace hundreds of thousands of people. A comparable investment in more water-efficient industrial practices, more water-efficient household appliances, and, above all, the use of more-efficient irrigation practices would likely yield more water. Since it takes 1,000 tons of water to produce 1 ton of grain, importing grain is the most efficient way to import water.[18]

Regardless of whether it concentrates solely on conservation or also does a south/north diversion, China will almost certainly have to turn to the world market for grain imports. If it imports even 10 percent of its grain supply—40 million tons—it will become overnight the largest grain importer, putting intense pressure on exportable grain supplies and driving up world prices. If this happens, we probably won't need to read about it in the newspapers. It will be evident at the supermarket checkout counter.

For additional information, see <www.earth-policy.org/Updates/Update1.htm>.

February 2002

World's Rangelands Deteriorating Under Mounting Pressure

Lester R. Brown

In late January, a dust storm originating in northwestern China engulfed Lhasa, the capital of Tibet, closing the airport for three days and disrupting tourism. Such dust storms are no longer uncommon. Dust storms originating in Central Asia, coupled with those originating in Saharan Africa that now frequently reach the Caribbean, remind us that desertification of the world's rangelands is ongoing.[1]

Even though the damage from overgrazing is spreading, the world's livestock population continues to grow, tracking the growth in human population. As world population increased from 2.5 billion in 1950 to 6.1 billion in 2001, the world's cattle herd went from 720 million to 1.53 billion. The number of sheep and goats expanded from 1.04 billion to 1.75 billion.[2]

With 180 million pastoralists worldwide now trying to make a living tending 3.3 billion cattle, sheep, and goats, grasslands are under heavy pressure. As a result of overstocking, grasslands are deteriorating in much of Africa, the Middle East, Central Asia, the northern part of the Indian subcontinent, Mongolia, and much of northern China. Overgrazing of rangelands initially reduces their productivity but eventually it destroys them, leaving desert. Degraded rangeland, worldwide, totals 680 million hectares—five times the U.S. cropland area.[3]

Rangelands, consisting almost entirely of land that is too dry or too steeply sloping to support crop production, account for one fifth of the earth's land surface, more than double the area that is cropped. Tapping the productivity of this vast area depends on ruminants—cattle, sheep, and goats—animals whose complex digestive systems enable them to convert roughage into food, including beef, mutton, and milk, and industrial materials, importantly leather and wool.[4]

Some four fifths of world beef and mutton production, roughly 52 million tons, comes from animals that forage on rangelands. In Africa, where grain is scarce, 230 million cattle, 246 million sheep, and 175 million goats are supported almost entirely by grazing and browsing. The number of livestock, a cornerstone of many African economies, often exceeds grassland carrying capacity by half or more. A study that charted the mounting pressures on grasslands in nine southern African countries found that the capacity of the land to sustain livestock is diminishing.[5]

Fodder needs of livestock in nearly all developing countries now exceed the sustainable yield of rangelands and other forage resources. In India, with the world's largest cattle herd, the demand for fodder in 2000 was projected at 700 million tons, while the sustainable supply totaled just 540 million tons. A report from New Delhi indicates that in states with the most serious land degradation, such as Rajasthan and Karnataka, fodder supplies satisfy only 50–80 percent of needs, leaving large numbers of emaciated, unproductive cattle.[6]

China faces similarly difficult challenges. The northwest of China, where there are no landownership rights and no fences, has become a vast grazing commons. Since the economic reforms of 1978, there has been little incentive for individual families to limit the size of their flocks

and herds. As a result, livestock numbers have soared. The United States, which has a comparable grazing capacity, has 98 million head of cattle while China has 130 million head. But the big difference is in the number of sheep and goats: 9 million in the United States, 290 million in China.[7]

In Gonge County, for example, in eastern Qinghai Province, the local grasslands can support an estimated 3.7 million sheep. But by the end of 1998, the region's flock had reached 5.5 million—far beyond its carrying capacity. The result is fast-deteriorating grassland and the creation of a new desert, replete with sand dunes.[8]

The mounting pressures on rangelands in the Middle East are illustrated by Iran, a country of 71 million people. The 8 million cattle and 81 million sheep and goats that graze its rangelands supply not only milk and meat, but also the wool for the country's fabled rug-making industry. In a land where sheep and goats outnumber humans, and where rangelands are being pushed to their limits, the current livestock population may not be sustainable.[9]

Land degradation from overgrazing is taking a heavy economic toll in lost livestock productivity. In the early stages of overgrazing, the costs show up as lower land productivity. But if the process continues, it destroys vegetation, leading to the erosion of soil and the eventual creation of wasteland. A U.N. assessment of the earth's dryland regions, done in 1991, estimated that livestock production losses from rangeland degradation exceeded $23 billion. (See Table 3–3.)[10]

In Africa, the annual loss of rangeland productivity is estimated at $7 billion, more than the gross domestic product of Ethiopia. In Asia, livestock losses from rangeland degradation total over $8 billion. Together, Africa and Asia account for two thirds of the global loss.[11]

Table 3–3. *Economic Cost of Rangeland Degradation*

Region	Average Annual Income Forgone
	(million U.S. dollars)
Africa	6,966
Asia	8,313
Australia	2,529
Europe	564
North America	2,878
South America	2,084
Total	23,334

Source: H. Dregne et al., "A New Assessment of the World Status of Desertification," *Desertification Control Bulletin*, no. 20, 1991.

Arresting the deterioration of the world's rangelands presents a difficult challenge. One key to slowing the growth in livestock populations is to stop the growth in human numbers. Iran, recognizing the threat of overgrazing and other population-related stresses it was facing some 15 years ago, dropped its population growth from 4 percent a year to scarcely 1 percent in 2001, illustrating what can be done with committed leadership.[12]

Another key to lightening pressure on rangelands is the spreading practice of feeding livestock crop residues that would otherwise be burned, either because they are needed for fuel or because double cropping requires destruction of the residues. India has been uniquely successful in converting crop residues into milk—expanding production from 20 million tons in 1961 to 80 million tons in 2001, and without feeding grain. Its farmers did

so almost entirely by using crop residues and by stall-feeding grass cut and collected by hand.[13]

China also has a large potential to feed corn stalks and wheat and rice straw to cattle or sheep. As the world's leading producer of both rice and wheat and the second-ranked producer of corn, China annually harvests an estimated 500 million tons of straw, corn stalks, and other crop residues. Feeding crop residues in the major crop-producing provinces of east central China—Hebei, Shandong, Henan, and Anhui—has created a "Beef Belt," whose beef output dwarfs that of the northwestern grazing provinces of Inner Mongolia, Qinghai, and Xinjiang.[14]

In rangeland reclamation, where successes are few, a promising low-cost technique for reclaiming overgrazed and exhausted rangeland is being developed at the International Center for Agricultural Research in the Dry Areas (ICARDA) in Syria. ICARDA scientists have developed a simple implement that slightly depresses the soil in double rows 20 centimeters (8 inches) apart. The implement seeds grass in these twin depressions, which follow the contour of the land, enabling them to trap rainwater runoff and restore vegetation.[15]

It will take an enormous effort to stabilize livestock populations at a sustainable level and to restore the world's degraded rangelands. This will be costly, but failing to halt the desertification of rangelands will be even costlier as flocks and herds eventually shrink and as the resulting poverty forces large-scale migration from the affected areas.

For additional information, see <www.earth-policy.org/Updates/Update6.htm>.

Fisheries, Forests, and Disappearing Species

October 2000

Fish Farming May Overtake Cattle Ranching as a Food Source

Lester R. Brown

Aquacultural output, growing at 11 percent a year over the past decade, is the fastest-growing sector of the world food economy. Climbing from 13 million tons of fish produced in 1990 to 31 million tons in 1998, fish farming is poised to overtake cattle ranching as a food source by the end of this decade.[1]

This record aquacultural growth is signaling a basic shift in our diet. Over the last century, the world relied heavily on two natural systems—oceanic fisheries and rangelands—to satisfy a growing demand for animal protein, but that era is ending as both systems are reaching their productive limits. Between 1950 and 1990, beef production, four fifths of it from rangelands, nearly tripled, climbing from 19 million to 53 million tons before plateauing. (See Figure 3–3.) Meanwhile, the oceanic fish catch grew from 19 million to 86 million tons, more than quadrupling, before leveling off. Since 1990, there has been little growth in either beef production or the oceanic fish catch.[2]

Additional production of beef or seafood now depends on placing more cattle in feedlots or more fish in ponds. At this point, the efficiency with which cattle and fish convert grain into protein begins to reshape production trends and thus our diets. Cattle require some 7 kilograms of grain to add 1 kilogram of live weight, whereas fish can add a kilogram of live weight with less than 2 kilograms of grain. Water scarcity is also a matter of concern since it takes 1,000 tons of water to produce 1 ton of grain. But the fish farming advantage in the efficiency of grain conversion translates into a comparable advantage in water efficiency as well, even when the relatively small amount of water for fish ponds is included. In a world of land and water scarcity, the advantage of fish ponds over feedlots in producing low-cost animal protein is clear.[3]

In contrast to meat production, which is concentrated in industrial countries, some 85 percent of fish farming is in developing countries. China, where fish farming began

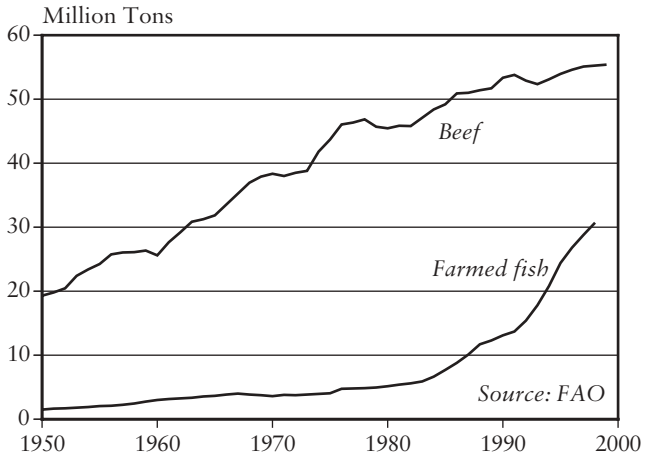

Figure 3–3. *World Aquacultural Production, 1950–98, and Beef Production, 1950–99*

more than 3,000 years ago, accounted for 21 million tons of the 31 million tons of world aquacultural output in 1998. India is a distant second with 2 million tons. Other developing countries with thriving aquacultural sectors include Bangladesh, Indonesia, and Thailand.[4]

Among industrial countries, Japan, the United States, and Norway are the leaders. Japan's output of 800,000 tons consists of high-value species, such as scallops, oysters, and yellowtail. The U.S. output of 450,000 tons is mostly catfish. Norway's 400,000 tons is mostly salmon.[5]

With overfishing now commonplace, developing countries are turning to fish farming to satisfy their growing appetite for seafood largely because the oceanic option is not available to them as it was earlier to industrial countries. For example, as population pressure on the land intensified in Japan over time, it turned to the oceans for its animal protein, using scarce land for rice. Today Japan's 125 million people consume some 10 million tons of seafood each year. If China's 1.25 billion were to eat seafood at the same rate, they would need 100 million tons—the global fish catch.[6]

Although at least 220 species of fin fish, shellfish, and crustaceans are farmed commercially, a dozen or so dominate world output. Among the fin fish, five species of carp—all widely grown in China—lead the way with a combined output of some 11 million tons in 1998, more than a third of world aquacultural output. Among shellfish, the Pacific cupped oyster, at 3.4 million tons (including shell), dominates, followed by the Yesso scallop and the blue mussel.[7]

In China, fish are produced primarily in ponds, lakes, reservoirs, and rice paddies. Some 5 million hectares of land are devoted exclusively to fish farming, much of it in carp polyculture. In addition, 1.7 million hectares of riceland are used to produce rice and fish together.[8]

Over time, China has evolved a fish polyculture using four types of carp that feed at different levels of the food chain. Silver carp and bighead carp are filter feeders, feeding on phytoplankton and zooplankton, respectively. The grass carp, as its name implies, feeds largely on vegetation, while the common carp is a bottom feeder, living on detritus that settles to the bottom. Most of China's aquaculture is integrated with agriculture, enabling farmers to use agricultural wastes, such as pig manure, to fertilize ponds, thus stimulating the growth of plankton. Fish polyculture, which typically boosts the fish yield per hectare over that of monocultures by at least half, also dominates fish farming in India.[9]

As land and water become scarce, China's fish farmers are intensifying production by feeding more grain concentrates to raise pond productivity. Between 1990 and 1996, China's farmers raised the annual pond yield per hectare from 2.4 tons of fish to 4.1 tons.[10]

In the United States, catfish, which require only 1.6 kilograms of feed to gain 1 kilogram of live weight, is the leading aquacultural product. With U.S. catfish production last year at roughly 600 million pounds (270,000 tons), or more than 2 pounds for each American, U.S. consumption of catfish exceeded that of lamb and mutton. Catfish production is concentrated in four states: Mississippi, Louisiana, Alabama, and Arkansas. Mississippi, with some 174 square miles (45,000 hectares) of catfish ponds and easily 60 percent of U.S. output, is the catfish capital of the world.[11]

Among the aquatic species that are widely farmed, two especially wreak extensive environmental havoc—salmon, with production of 700,000 tons per year, and shrimp at 1.1 million tons per year. Salmon are grown mostly in industrial countries, principally in Norway, for consumption in those countries. Shrimp, by contrast, are

grown largely in developing countries, importantly Thailand, Ecuador, and Indonesia, for export to more affluent societies.[12]

Salmon, a carnivorous fish, are fed a diet consisting primarily of fishmeal that is typically made from anchovies, herring, or the remnants of fish processing. In stark contrast to the production of herbivorous species, such as carp and catfish, which lighten the pressure on oceanic fisheries, salmon production actually intensifies pressure because it requires up to 5 tons of landed fish for each ton of salmon produced.[13]

Another concern is that if farmed salmon, which are bred for fast growth and not for survival in the wild, escape because of damage to the pens by storms or attacks by predators, such as harbor seals, they can breed with wild salmon, weakening the latter's capacity to survive. Fish grown in offshore cages or pens, as salmon frequently are, also concentrate large quantities of waste, which itself presents a management problem. For example, the waste produced by farmed salmon in Norway is roughly equal to the sewage produced by Norway's 4 million people.[14]

Shrimp are often produced by clearing coastal mangrove forests, which protect coastlines and serve as nurseries for local fish. Mangrove destruction can cause a decline of local fisheries that will actually exceed the gains from shrimp production, leading to a net protein loss. In addition, because shrimp rations are also high in fishmeal, shrimp, like salmon, put additional pressure on oceanic fisheries.[15]

A world that is reaching the limits with both oceanic fisheries and rangelands while adding 80 million people each year needs efficient new sources of animal protein. Herbivorous species of fish, such as carp grown in polycultures, carp grown in combination with rice, or catfish

grown in ponds, offer a highly efficient way of expanding animal protein supplies in a protein-hungry world. Fish farming is not a solution to the world food problem, but as China has demonstrated, it does offer a potential source of low-cost animal protein for lower-income populations. The forces that have made aquaculture the world's fastest-growing source of animal protein over the last decade are likely to make it the fastest-growing source during this decade as well.[16]

For additional information, see <www.earth-policy.org/Alerts/Alert9.htm>.

March 2002

Our Closest Relatives Are Disappearing

Janet Larsen

After more than a century of no known primate extinctions, scientists recently confirmed the disappearance of a subspecies of a West African monkey. The loss of this monkey, known as Miss Waldron's red colobus, may be a harbinger of future losses of our closest evolutionary relatives.[1]

Out of some 240 known primate species, 19 are critically endangered, up from 13 in 1996. This classification refers to species that have suffered extreme and rapid reductions in population or habitat. Their remaining numbers range from less than a few hundred to, at most, a few thousand individuals. If their populations continue to shrink at recent rates, some species will not survive this decade. This group, according to the World Conservation Union–IUCN's *2000 Red List of Threatened Species*, includes eight monkeys from Brazil's Atlantic rainforest, where 97 percent of the forest has been lost, two apes and a monkey from Indonesia, three monkeys from Viet Nam, one each from Kenya and Peru, and three lemur species from Madagascar.[2]

At the endangered level, IUCN's next degree of threat, there are 46 primate species, up from 29 in 1996. These species face a very high probability of extinction, some within the next 20 years. An additional 51 species are listed as vulnerable. These primates have slightly larger populations but still may disappear within this century.

Critically endangered, endangered, and vulnerable species together total 116, or nearly half of the 240 or so primate species.[3]

When the last Ice Age ended 10,000 years ago, baboons outnumbered humans by at least two to one. If all non-human primate populations were counted together, including the large populations of some of the smaller species, they dwarfed the human population. Now that has changed. The development of agriculture allowed for rapid human population growth, and about 2,000 years ago, humans—numbering 300 million—became the most abundant of the primates. By 1930, the human population of 2 billion likely outnumbered all other primates combined.[4]

Today, at 6.1 billion and climbing, we are threatening the survival of many of our primate cousins, including our closest living relatives, the chimpanzees and bonobos, with which we share over 98 percent of our genome. The other apes are quite close to us as well, not only genetically, but also in observed behavior. Yet with the 300,000 human babies born each day exceeding the total population of the great apes, even our evolutionary proximity may not prevent us from eradicating our near-kin.[5]

While humans now inhabit every corner of the earth, most other primates exhibit strong endemism, meaning that a species is restricted to a particular area. Almost three quarters of all primates live in just four countries: Brazil, the Democratic Republic of the Congo (formerly Zaire), Indonesia, and Madagascar. In each of these countries, forest cover is decreasing. Because habitat loss is a danger to 90 percent of threatened primates, their concentration in a few countries greatly increases their vulnerability.[6]

In Indonesia, diverse forests and wild inhabitants have suffered from logging fueled by corruption and political

instability. Within the past decade, deforestation rates doubled, claiming almost 2 million hectares each year. As deforestation rates doubled, orangutan numbers dropped by half. By 2005, the country faces the loss of all lowland forest from Sumatra, and thus the extinction of the critically endangered Sumatran orangutan, among many other species. The Borneo orangutan, after suffering from logging, hunting, and the catastrophic fires of 1997, is not likely to survive beyond 2010 if current trends continue.[7]

Our closest relative, the bonobo, is endemic to the Congo, a country plagued by civil war and occupation by foreign military and rebel groups. Along with many other primates in the region, the slow-breeding bonobo has seen a rapid decline. In 1980 there were close to 100,000 bonobos; now there may be fewer than 10,000.[8]

Although the civil war has created millions of human refugees and may have elevated the demand for meat from wild animals (bushmeat), the resulting sluggish economic development may have slowed logging in the Congo, the country containing half of Africa's remaining tropical moist forests. If political stability returns, tree cutting could increase severalfold in the next few years, accelerating what could be the first great ape extinction.[9]

Gorilla populations have dropped to dangerously low levels, largely from illegal commercial bushmeat hunting. Fewer than 325 mountain gorillas exist, and all are in one subpopulation spanning Rwanda, the Congo, and Uganda. The rarest, the Cross River Gorilla, is limited to only 150–200 individuals scattered among several lingering subpopulations on the Cameroon/Nigeria border region.[10]

In parts of West and Central Africa, hunting is an even greater threat than forest loss. There the bushmeat trade, consisting primarily of forest antelope, pigs, and

primates, is worth over $1 billion a year. In areas where social turmoil has ravaged traditional economic activities, and the average annual family income is less than $100, the lure of earning $300 to $1,000 each year as a hunter has enticed many. Logging and, to a lesser extent, mining companies have penetrated forests, with their settlements increasing bushmeat demand, while their roads facilitate hunting.[11]

Exploitative hunting is not profitable in the long term, however, because wild populations, especially those of the large and slow-reproducing apes, are soon decimated. Over 1 million tons of wild meat is consumed annually in the Congo Basin, almost six times more than the forests' sustainable yield. Commercial hunting has emptied forests that were once full of animals.[12]

Though rural communities have long subsisted on wild animals and other forest foods, with up to 60 percent of their protein coming from bushmeat, most bushmeat from this region is now consumed in cities. Almost half of the 30 million people living in the forested regions of Central Africa are city-dwellers who are being fed with bushmeat from collapsing wildlife populations. As cities grow and bushmeat hunting accelerates to meet rising demand, it is estimated that hunting could eliminate all viable African ape populations in less than 20 years.[13]

To save other primates from being lost in what is considered the earth's sixth major extinction event, resources are needed to curb illegal logging and hunting. Illegal logging has ruined vast stretches of original primate habitat. Much of the bushmeat hunted comes from protected areas, and international trade in primates is already unlawful under the Convention on International Trade in Endangered Species of Wild Fauna and Flora. But when enforcement is lacking, illegal practices continue.[14]

Large wilderness blocks of biologically rich areas can

be converted to new parks that take into account the needs of wildlife and human populations. Ecotourism endeavors can be used to support primate conservation, and hunters can find alternative income in park protection work once they realize that live animals can be much more valuable than dead ones.

Understanding ourselves better—our biology, psychology, and sociology—depends in part on understanding our closest living relatives better. If we destroy them, we may never fully understand ourselves.

For additional information, see <www.earth-policy.org/Updates/Update7.htm>.

May 2002

Illegal Logging Threatens Ecological and Economic Stability

Janet Larsen

Extensive floods in Indonesia during early 2002 have killed hundreds of people, destroyed thousands of homes, damaged thousands of hectares of rice paddy fields, and inundated Indonesian insurance companies with flood-related claims. Rampant deforestation, much of it from illegal logging, has destroyed forests that stabilize soils and regulate river flow, causing record floods and landslides.[1]

In just 50 years, Indonesia's total forest cover fell from 162 million hectares to 98 million. Roads and development fragment over half of the remaining forests. More than 16 million people depend on fresh water from Indonesia's 15 largest watersheds, which between 1985 and 1997 lost at least 20 percent of their forest cover. Loggers have cleared almost all the biologically diverse lowland tropical forests off Sulawesi, and if current trends continue, such forests will be gone from Sumatra in 2005 and from Kalimantan by 2010.[2]

Domestic wood supply in Indonesia was documented at 20 million cubic meters in 2000, while demand stood at some 60 million cubic meters. Thus legal supplies of wood fiber fall short of demand by up to 40 million cubic meters per year. Illegal logging fills the gap—accounting for almost 70 percent of wood supply. All told, illegal logging alone has destroyed 10 million hectares of Indonesia's rich forests, an area the size of Virginia in the United States.[3]

Indonesia's situation is not unique. The Philippines once held 16 million hectares of forests but is now down to less than 700,000 hectares. In this country where illegal logging runs rampant, forest loss from tree felling and conversion to agriculture is cited as the cause of flooding, acute water shortages, rapid soil erosion, river siltation, and mudslides that have taken lives, destroyed properties, and wreaked environmental damage.[4]

In 1989, Thailand banned the logging of natural forests in direct response to devastating floods and landslides that had taken 400 lives the year before. Though illegal logging is now at lower levels than before the ban, it is still widespread. More recently, massive flooding of China's Yangtze River in 1998, which was linked to the removal of 85 percent of the upper river basin's original tree cover, propelled China to issue a ban on logging in the upper reaches of the Yangtze and Yellow Rivers and to begin a reforestation campaign.[5]

China consumes nearly 280 million cubic meters of timber a year, but domestic supply currently provides only 142 million cubic meters. As production shrinks, China is turning to imports and illegal logging to make up for the shortfall. The International Tropical Timber Organization forecasts that within the next few years China will become the world's largest log importer, edging out the United States and eclipsing Japan, whose massive imports have already destroyed many of the rainforests of the Philippines and much of Borneo.[6]

Fifty-seven percent of the logs brought into China originate in Russia, where poor law enforcement, corruption, and the abandonment of local timber-processing plants have led people to illegally cut trees for companies that send raw materials to China for processing. At least

one fifth of Russia's timber harvest is taken illegally or drastically violates existing legislation.[7]

To China's south, Myanmar (formerly Burma) holds about half of mainland Southeast Asia's forests. These contain a variety of tropical hardwood species that are increasingly drawing interest from China. On paper, Myanmar supplies less than 10 percent of China's log imports, but industry workers say the numbers must be at least twice as high. Burmese log exports to China are growing much faster than the trees, many of which are hundreds of years old, can be replaced. In 1949, tropical forests covered 21 percent of the country's land area, but now less than 7 percent of Myanmar is forested.[8]

In Laos, where the volume of illegal logging is the equivalent of at least one sixth of the legal harvest, the army openly cuts forests. Now less than 40 percent of the country is forested, down from 70 percent in 1940. In Cambodia, over 70 percent of the timber export volume consists of unreported logs. And Viet Nam could lose all substantial forest cover by 2020 if the current rate of deforestation continues.[9]

As the growing Asian timber market has exhausted supplies over much of the continent, wood imports to Asia from Africa have steadily increased. From 1993 to 1999, Europe imported 40 percent of central African logs, but since 1996, rising demand from Asia has made that region the number one importer of African timber.[10]

Forest products are the second largest export for both Cameroon and Gabon, generating about 20 percent and 13 percent of respective export revenues. Between 1990 and 1995, the share of Cameroonian logs going to Asia soared from 7 percent to 50 percent. Unfortunately, only half the logging companies in Cameroon are licensed, and among these companies, violations such as felling

trees smaller than the legal size and cutting outside concession boundaries are common.[11]

These examples cover only a portion of the global timber market. Uncontrolled deforestation abounds in other countries—in Brazil, with the world's highest deforestation rate, where an estimated 80 percent of logging is illegal; in Mexico, which is losing over 1 million hectares each year; and in Ethiopia, where in just 40 years forest cover has plummeted from around 40 million hectares to 2.7 million, only half of which is natural forest. Rarely, though, is deforestation purely a local issue.[12]

The world's eight largest industrial countries plus the rest of the European Union buy 280 million cubic meters of timber and timber products from abroad each year, accounting for 74 percent of the world's timber imports. Most of this wood comes from countries where illegal tree felling is the norm. In 2000, the United States alone imported over $450 million worth of timber from Indonesia, which given Indonesia's illegal logging rate could represent $330 million worth of timber from illegal sources.[13]

If importing countries insist that timber and timber products are certified under internationally recognized environmental and social standards like those of the Forest Stewardship Council, illegal logging becomes more difficult. Exporting countries would profit by protecting the integrity of forest ecosystems, and could secure higher prices for certified wood on international markets. Russia, for instance, which loses $1 billion in export revenues each year because its wood is not certified, is now developing a mandatory certification system for standing forests.[14]

Certification along with existing international agreements, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora, can help to

prevent illegal logs from crossing international borders—if laws and standards are upheld. Recycling and reduced use of throwaway timber products can lower the demand for timber that has made illegal logging profitable. As the Chinese government has recognized, the services that forests provide, such as flood control, can be worth far more than the lumber they contain.

For additional information, see <www.earth-policy.org/Updates/Update11.htm>.

Ecological Economics

April 2002

Green Power Purchases Growing

Bernie Fischlowitz-Roberts

In June 2001, the city of Chicago and 48 city government agencies signed a contract with local utility ComEd to purchase 10 percent of their electricity from renewable sources, a figure due to increase to 20 percent in five years. This is the largest such purchase in the United States, but Chicago is just one example of the many cities, businesses, and individuals who are buying "green power." Utilities in eight states and many other industrial countries now offer such purchases.[1]

In October 1999, Leeds Metropolitan University in the United Kingdom started buying at least 30 percent of its energy from green power. Six months later, Edinburgh University signed an agreement to obtain 40 percent of its energy this way. Since renewable energy sources in the United Kingdom are exempt from a climate change levy enacted in April 2001, making this switch is virtually cost-free and can even save money.[2]

The Netherlands has more than 775,000 green energy customers, which represents 5 percent of the population.

The number of customers has tripled in just one year. This rapid growth is due to an energy tax exemption for green electricity, green energy deregulation, and successful marketing campaigns. With Dutch demand outstripping supply, more than 30 percent of the green power used there is now imported.[3]

Germany has approximately 280,000 green energy customers. Many large German companies are buying green power, helping to create consumer demand to move beyond fossil fuels. Dresdner Bank, Weleda AG, a large homeopathic medicine company, and 23 kindergartens in Lorrach all purchase 100 percent green power.[4]

In March 1999, a comprehensive ecological tax reform law took effect in Germany that reduced income taxes, raised taxes on energy sources tied to carbon emissions, and exempted renewables. In February 2000, the parliament passed a renewable energies law that included payments for excess green energy generation fed back into the power grid; at those times, the meters run backwards, reducing customers' electric bills. These policies, which help make green energy cost-effective, are essential to the ultimate success of green power programs.[5]

Australia's green power sales are evenly divided between 60,000 residential customers and almost 2,500 commercial ones. Most of the green energy supplied to date in Australia is derived from biomass and hydroelectric power, with only 8 percent coming from wind or solar. With wind resource development accelerating, however, wind's share is increasing rapidly.[6]

In Colorado in the United States, the Grassroots Campaign for Wind Power has educated citizens about the benefits of wind power and encouraged a shift in purchasing behavior. As a result, Colorado has 20,000 residential green power subscribers and numerous commercial ones, including IBM, Hewlett-Packard, and

Patagonia, as well as the cities of Denver, Fort Collins, and Aspen. Even the governor's mansion buys green power. At the University of Colorado, students voted overwhelmingly during the spring of 2000 to raise student fees by $1 per semester in order to purchase wind power. This fee increase generates $50,000 per year, enough to buy the output of one wind turbine, or 2 million kilowatt-hours of electricity.[7]

A large number of U.S. businesses and other commercial customers have also signed up. In addition to large, high-profile companies like Toyota and Kinko's, lesser-known companies are aligning their purchasing decisions with their environmental values. Fetzer Vineyards, for example, began buying 5 million kilowatt-hours of renewable energy annually for its organic wine operations in Hopland, California.[8]

In 1996, Salem, Oregon, was the first U.S. city to go completely renewable for all power used in the city. Already getting 83 percent of its electricity from hydropower, it replaced the remaining 17 percent, which was from fossil fuels and nuclear power, with wind energy purchased from the Bonneville Power Administration (BPA). In 2000, Oakland, California, signed up for 9 megawatts of green power to meet its entire electricity load for city agencies. Santa Monica, California, also uses exclusively green power for its city facilities.[9]

Government agencies are also signing up for green power. The U.S. Environmental Protection Agency (EPA) purchases 100 percent green power at five of its facilities across the country. In so doing, EPA currently obtains 9 percent of its overall electricity consumption from green power. In 2000, Secretary of Energy Bill Richardson directed the U.S. Department of Energy to purchase 3 percent of total electricity needs from non-hydro renewable sources by 2005, and 7.5 percent by 2010.[10]

Green power offers an opportunity for citizens and corporations to act on their environmental concerns and to demonstrate support for public policies supporting renewable energy. In Colorado, for example, the demand for green power is driving the investment in wind farms, a fast-growing source of power in the state.

It is clear, however, that green power purchase options alone, even in fully deregulated markets, will not bring about the large-scale changes needed to move the world to a sustainable energy economy. Individual and corporate choices based on environmental concerns cannot replace the role of public policies. Indeed, tax restructuring and renewables portfolio standards, acting in concert with energy efficiency and green power programs, represent the best hope for creating an ecologically sustainable energy economy.

To be certified as a "green-e" product in the United States by the Center for Resource Solutions (CRS), a voluntary program, green power offerings must contain more than half renewable energy. Thus in many cases, almost half of the mix can come from fossil fuels and nuclear power. CRS set up the 50-percent standard mindful of the need for wide acceptance by various stakeholders, and wary of setting the initial standard too high for many companies to meet it. While such concerns are important, the ideal green power products would emphasize wind, solar, and geothermal, since they do not contribute to climate change, air pollution, or acid rain. Fossil fuels and nuclear power would be excluded from such products.[11]

The new green power standard in Illinois, unveiled by environmental and consumer groups in the state, is the greenest in the United States. To qualify, green power in Illinois must be from new renewable sources, must be composed of at least two thirds wind and solar power,

and must create air quality benefits for the state. A similar standard, if adopted nationwide, could yield substantial benefits.[12]

The green power option for consumers and businesses is generating demand, yet its current definitions are flawed. Unless standards require much higher percentages of renewables that are green, customers may be paying a premium for only marginally cleaner power. To address climate change, the global energy economy needs to be fundamentally restructured. Green power purchase options, one instrument among many to do this, can help move us in the right direction.

For additional information, see <www.earth-policy.org/Updates/Update9.htm>.

April 2002

New York: Garbage Capital of the World

Lester R. Brown

The question of what to do with the 11,000 tons of garbage produced each day in New York City has again surfaced, this time with Mayor Michael Bloomberg's budget, which proposes to halt the recycling of metal, glass, and plastic to save money. Unfortunately, this would mean more garbage to dispose of when the goal should be less.[1]

The city's garbage problem has three faces. It is an economic problem, an environmental challenge, and a potential public relations nightmare. When the Fresh Kills landfill, the local destination for New York's garbage, was permanently closed in March 2001, the city found itself hauling garbage to distant landfill sites in New Jersey, Pennsylvania, and Virginia—some of them 300 miles away.[2]

Assuming a load of 20 tons of garbage for each of the tractor trailers used for the long-distance hauling, some 550 rigs are needed to move garbage from New York City each day. These tractor trailers form a convoy nearly nine miles long, impeding traffic, polluting the air, and raising carbon emissions. This daily convoy led Deputy Mayor Joseph J. Lhota, who supervised the Fresh Kills shutdown, to say that getting rid of the city's trash is now "like a military-style operation on a daily basis."[3]

Instead of rapidly reducing the amount of garbage generated as Fresh Kills was filling, the decision was made simply to haul it all elsewhere. Fiscally strapped local communities in other states are willing to take New York's garbage—if they are paid enough. Some see it as a bonanza. For the state governments, however, that are saddled with increased road maintenance costs, the arrangement is not so attractive. They also have to contend with the traffic congestion, noise, increased air pollution, and complaints from nearby communities.

Virginia Governor Jim Gilmore wrote to Mayor Rudy Giuliani in 2001 complaining about the use of Virginia as a dumping ground. "I understand the problem New York faces," he noted. "But the home state of Washington, Jefferson and Madison has no intention of becoming New York's dumping ground."[4]

The new governor of Virginia, Mark Warner, proposed in early April 2002 a tax of $5 per ton on all solid waste deposited in Virginia. This is expected to generate an annual cash flow of $76 million for the Virginia treasury, but it will not help New York with its economic woes.[5]

In Pennsylvania, the General Assembly is considering legislation that would restrict garbage imports from other states. As landfills in adjacent states begin to fill up, there will be progressively fewer sites to take New York's garbage, pushing disposal costs ever higher.[6]

Landfilling garbage uses land. For every 40,000 tons of garbage added to a landfill, at least one acre of land is lost to future use. A large surrounding area is also lost, as the landfill with its potentially toxic wastes must be isolated from residential areas.[7]

Mayor Bloomberg's office has proposed incineration as the solution to the garbage mess. But burning 11,000 tons of garbage each day will only add to air pollution, making already unhealthy city air even worse. Like hauling the garbage to distant sites, incineration treats the

symptoms, not the causes of New York's mountain of garbage.[8]

The amount of garbage produced in the city is a manifestation of a more fundamental problem—the evolution of a global throwaway economy. Throwaway products, facilitated by the appeal to convenience and the artificially low cost of energy, account for much of the garbage we produce.

It is easy to forget how many throwaway products there are until we actually begin making a list. We have substituted facial tissues for handkerchiefs, disposable paper towels for hand towels, disposable table napkins for cloth napkins, and throwaway beverage containers for refillable ones. In perhaps the ultimate insult, the shopping bags that are used to carry home throwaway products are themselves designed to be discarded, becoming part of the garbage flow. The question at the supermarket checkout counter, "Paper or plastic?" should be replaced with, "Do you have your canvas shopping bag with you?"

The challenge we now face is to replace the throwaway economy with a reduce/reuse/recycle economy. The earth can no longer tolerate the pollution, the energy use, the disruption from mining, and the deforestation that the throwaway economy requires. For cities like New York, the challenge is not so much what to do with the garbage as it is how to avoid producing it in the first place.

New York recycles only 18 percent of its municipal waste. Los Angeles recycles 44 percent and Chicago 47 percent. Seattle and Minneapolis are both near 60 percent recycling rates. But even they are not close to exploiting the full potential of garbage recycling.[9]

There are many ways of shrinking the daily mountain of garbage. One is simply to ban the use of one-way beverage containers, something that Denmark and Finland

have done. Denmark, for example, banned one-way soft drink containers in 1977 and beer containers in 1981. If Mayor Bloomberg wants a closer example of this approach, he need only go to Prince Edward Island in Canada, which has adopted a similar ban on one-way containers.[10]

There are other gains from reusing beverage containers. Since refillable containers are simply back-hauled to the original soft drink or brewery bottling sites by the same trucks that deliver the beverages, they reduce not only garbage but also traffic congestion, energy use, and air pollution.

We have the technologies to recycle virtually all the components of garbage. For example, Germany now gets 72 percent of its paper from recycled fiber. With glass, aluminum, and plastic, potential recycling rates are even higher.[11]

The nutrients in garbage can also be recycled by composting organic materials, including yard waste, table waste, and produce waste from supermarkets. Each year, the world mines 139 million tons of phosphate rock and 20 million tons of potash to obtain the phosphorus and potassium needed to replace the nutrients that crops remove from the soil. Urban composting that would return nutrients to the land could greatly reduce this expenditure on nutrients and the disruption caused by their mining.[12]

Yet another garbage-reducing step in this fiscally stressed situation would be to impose a tax on all throwaway products, in effect a landfill tax, so that those who use throwaway products would directly bear the cost of disposing of them. This would increase revenues while reducing garbage disposal expenditures, helping to reduce the city's fiscal deficit.

There are numerous win-win-win solutions that are

both economically attractive and environmentally desirable, and that will help avoid the unfolding public relations debacle created by the image of New York as garbage capital of the world. A response to this situation that treats the causes rather than the symptoms of garbage generation could work wonders for the city.

For additional information, see <www.earth-policy.org/Updates/Update10.htm>.

July 2002

Tax Shifting on the Rise

Bernie Fischlowitz-Roberts

Many countries have implemented taxes on environmentally destructive products and activities while simultaneously reducing taxes on social security contributions or income. The scale of tax shifting has been relatively small thus far, accounting for only 3 percent of tax revenues worldwide. It is increasingly clear, however, that countries are recognizing the power of tax systems not only for raising revenue, but also for shaping economic decisions of individuals and businesses. The German tax shift, one of the most advanced to date, illustrates how countries are modifying tax systems to reach environmental and economic objectives.[1]

Germany has implemented environmental tax reform in several stages by lowering income taxes and raising energy taxes. In 1999, taxes on gasoline, heating oils, and natural gas were increased, and a new tax on electricity was adopted. This revenue was used to decrease employer and employee contributions to the pension fund. Energy tax rises for many energy-intensive industries were substantially lower, however, reflecting concerns about international competitiveness.[2]

The second stage, which began in 2000, involved further reductions in payroll taxes and increases on those on motor fuels and electricity. Germany has shifted 2 percent of its tax burden from incomes to environmentally destructive activities. As a result, fuel sales were 5 percent

lower in the first half of 2001 than in the same period in 1999. Consumption of gasoline decreased by 12 percent over the same time, and carpool agencies reported growth of 25 percent in the first half of 2000.[3]

Though Chancellor Gerhard Schroeder, concerned about the September 2002 elections, recently prevented any additional energy tax increases until 2003, his main opponent, Edward Stoiber, has pledged to continue with environmental tax reforms if elected. The agreement of Schroeder and Stoiber on the need to continue the tax shift is encouraging.[4]

The idea behind tax shifting is that raising taxes on products and activities that society wishes to discourage will encourage more environmentally friendly ways of doing business. For example, one part of the United Kingdom's environmental tax reform involved a steadily increasing fuel tax known as a fuel duty escalator, which was in effect from 1993 until 1999. As a result, fuel consumption from road transportation dropped, and the average fuel efficiency of trucks over 33 tons increased by 13 percent between 1993 and 1998. Ultra-low sulfur diesel had a lower tax rate than regular diesel, which caused its share of domestic diesel sales to jump from 5 percent in July 1998 to 43 percent in February 1999; by the end of 1999, the nation had completely converted to ultra-low sulfur diesel.[5]

The Netherlands has also implemented a series of environmental tax shifts. A general fuel tax, originally implemented in 1988 and modified in 1992, is levied on fossil fuels; the rates are based on both the carbon and the energy contents of the fuel. Between 1996 and 1998, a Regulatory Energy Tax (RET) was implemented, which taxed natural gas, electricity, fuel oil, and heating oil. Unlike the fuel tax, which was designed principally for revenue generation, the RET's goal was to change behaviors by creating incentives for energy efficiency. To maintain

competitiveness, major energy users were exempted from the taxes, so this tax fell mainly on individuals.[6]

Since 60 percent of the revenue from these Dutch taxes came from households, the taxes were offset by decreasing income taxes. The 40 percent of revenue derived from businesses was recycled through three mechanisms: a reduction in employer contributions to social security, a reduction in corporate income taxes, and an increased tax exemption for self-employed people. This tax shift has caused household energy costs to increase, which has resulted in a 15-percent reduction in consumer electricity use and a 5- to 10-percent decrease in fuel usage.[7]

Finland first implemented a carbon dioxide (CO_2) tax in 1990. Between 1990 and 1998, the country's CO_2 emissions decreased by almost 7 percent. Finland's environmental taxes, like those in most countries, are far from uniform: the electricity tax is greater for households and the service sector than for industry.[8]

Sweden's experiment with tax shifting began in 1991, when it raised taxes on carbon and sulfur emissions and reduced income taxes. Manufacturing industries received exemptions and rebates from many of the environmental taxes, and as a result their tax rates were only half of those paid by households. In 2001, the government increased taxes on diesel fuel, heating oil, and electricity while lowering income taxes and social security contributions. Six percent of all government revenue in Sweden has now been shifted. This has helped Sweden reduce greenhouse gas emissions more quickly than anticipated. A political agreement between the government and the opposition required a 4-percent reduction below 1990 levels by 2012. Yet by 2000, emissions were already down 3.9 percent from 1990—in large measure due to energy taxes.[9]

A preliminary assessment of existing environmental tax shifts yields mixed results. Emissions of some taxed

pollutants have decreased: some have declined absolutely, while others are lower than projected but still higher in absolute terms due to increased consumption associated with economic growth. Using price mechanisms to spur changes in consumer and producer behavior can work, but if tax rates are set too low they will not have the desired effect. The myriad exemptions given to industries, especially energy-intensive ones, in existing tax shift programs slow the restructuring. These exemptions, created out of legitimate competitiveness concerns, nonetheless slow the creation of a more effective tax system.[10]

A number of complementary policy measures can help make environmental tax shifts more effective. First, eliminating subsidies to environmentally destructive industries will help the market send the right signals. Worldwide, environmentally destructive subsidies exceed $500 billion annually. As long as government subsidies encourage activities that the taxes seek to discourage, the effectiveness of tax shifting will be limited.[11]

Second, tax harmonization within the European Union, where countries can agree on a framework of environmental tax shifts, might lessen the need for the numerous exemptions for industry that currently plague national environmental tax regimes. Even without harmonization, using border tax adjustments—where companies have environmental taxes rebated to them upon export and have domestic environmental taxes added to imports—can ensure international competitiveness.[12]

Third, when trying to guarantee equitable results of tax shifting, opting for tax refunds for lower-income citizens rather than tax exemptions preserves the incentive effect of the environmental tax. Fourth, for items whose demand does not change appreciably with small changes in price, making tax rates substantially higher—in a predictable and transparent way—will decrease consumption more than many of the limited efforts to date. Finally, expanding the tax base to encompass more products and services with deleterious environmental impacts would greatly enhance the effectiveness of tax shifting.[13]

Aviation fuel, for example, is currently tax-free worldwide, despite causing 3.5 percent of global warming. However, recent European discussions of imposing taxes on jet fuel are a promising development that might slow the projected growth in worldwide consumption by reducing air travel or by producing efficiency improvements that lower jet fuel consumption. Sweden's tax on domestic air transport, for example, prompted the one domestic airline at the time to alter the engines of its Fokker aircraft, which lowered hydrocarbon emissions by 90 percent.[14]

If properly constructed, tax shifts can help make markets work more effectively by incorporating more of the indirect costs of goods and services into their prices and by changing consumer and producer behavior accordingly. The emergence of a world-leading wind turbine industry in Denmark, for example, is one result of Danish taxes on fossil fuels and electricity, which are among the highest in the world. These measures have also spurred sales of energy-efficient appliances and encouraged other energy-saving behavior.[15]

The goal of tax restructuring is to get the market to tell the ecological truth. Thus far, tax shifts have been modest in scope and have produced positive, if modest, results. Creation of an eco-economy calls for tax shifts of much larger magnitude in order for prices to reflect their full costs and to produce the requisite changes in individual and collective behavior.

For additional information, see <www.earth-policy.org/Updates/Update14.htm>.