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The China Syndrome and the Environmental Kuznets Curve

By Steven F. Hayward

Recent environmental news out of China has lent new momentum to the gloomy view of China's environmental future amidst its headlong rush for economic growth. However, the gloom over China's environment may be overstated. China is an ideal test case of the controversial idea of the "environmental Kuznets Curve," according to which economic growth precedes environmental improvement. The question for China is whether it can trace an abbreviated trajectory along the environment/development curve and avoid some of the environmental damage that the United States and Europe experienced in their industrial revolutions. Although current environmental trends in China are serious and deteriorating in many areas, some unappreciated signs of improvement are appearing.

The chemical spill in the Songhua River in north central China that resulted in shutting off the water supply to the city of Harbin—a city of 3.8 million people—in late November represents the culmination of a series of stories of environmental calamity and fierce public reaction that have taken place over the last year. In April the *New York Times* reported on a riot in the southeastern province of Zhejiang where a crowd of up to 60,000 people burned police cars, smashed windows, and injured more than thirty government workers in protest of pollution from nearby chemical plants.[1] The *Washington Post* followed up on the story in June, reporting that the violent protest, which apparently routed the Chinese government authorities in the region, was at least partially successful: six chemical facilities were shut down or relocated.[2]

This protest is reportedly just one of many that have been occurring in China frequently over the last few years. In July the *New York Times* reported another environmental protest in Xinchang, a city 180 miles south of Shanghai, where an estimated 15,000 people rioted for three days "in a pitched battle with authorities, overturning police cars and throwing stones for hours, undeterred by thick clouds of tear gas."[3] The object of their ire was a ten-year-old pharmaceutical plant, which the protestors want closed or relocated. News of environmental protests spread rapidly through the Internet, spawning imitators throughout the nation on a large—perhaps massive—scale. The *Times* reports that there are "government figures" showing 74,000 incidents of mass protest in China in 2004 (not all of them necessarily environmentally related). In early December, a protest against a proposed wind power project turned deadly, as Chinese security forces fired on a crowd, killing ten people.[4]

All of the slow reflexes of the centralized Chinese government were on display in the aftermath of a massive benzene spill into the Songhua River by the Jilin Petrochemical Corporation in November 2005. Although local officials were informed of the spill within hours of its occurrence, they withheld information from the public because they were awaiting instruction from senior party leaders in Beijing. When attempts to dilute the spill failed and tests showed benzene levels more than 100 times the safe level in Harbin's drinking water, officials told the public the water supply was being shut off "to carry out repair and inspections on the pipe network." The provincial governor was apparently still waiting for permission from Beijing to disclose the spill. Over a week passed before the Chinese government admitted the true story. And once the truth

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did come out, Beijing still tried to keep close control of information, telling reporters to stop asking questions and instructing news organizations to use reports only from the official New China News Agency. In this as in other instances of environmental catastrophe and subsequent popular protest, Chinese officials confiscated notes from Western reporters. But in the Internet age it is impossible to keep all the news from getting out. Several bloggers in Harbin posted photos and provided on-the-scene reporting of the difficulties in the water-deprived city.[5] (The Songhua River spill was not the only such major incident recently. In March 2004, a chemical spill in the Tuojiang River resulted in a cut-off of water to more than a million people for twenty-five days.)

The Harbin episode and the related environmental protests open a window onto several tantalizing issues of environmental politics and policy. As the Chinese government is surely learning, it is impossible to keep information and decisions centrally controlled. China had to issue a rare public apology to Russia, since the Songhua River flows into Russian territory. China also sacked the director of the State Environmental Protection Administration (SEPA) for negligence, in keeping with directives for greater accountability among government officials. (More than 1,000 government officials were reportedly fired in the aftermath of the SARS epidemic in 2003.)

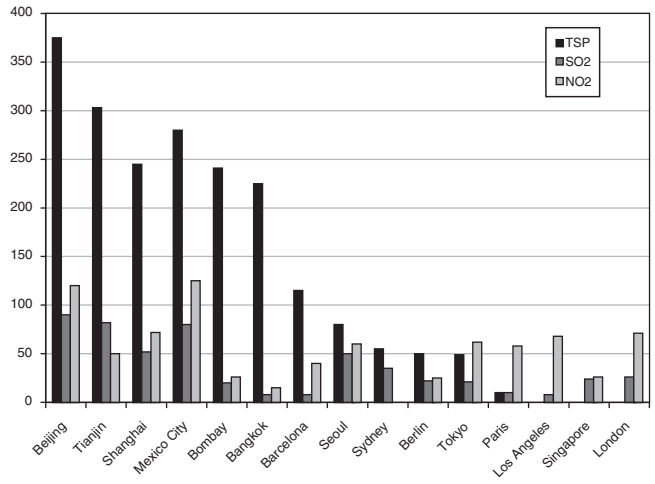
Beyond the political and administrative questions the Harbin episode raises is the issue of China's environmental performance and future course. The conventional wisdom is that China's hyperspeed economic growth is exacting a frightful environmental cost that will dramatically worsen in the next few decades. Although China, India, and other Asian nations have experienced rapid economic growth in recent decades, they still have a long way to go before the majority of their populations will enjoy a middle-class lifestyle. More than half of China's population is still very poor. These nations are not likely to accept constraints on their near-term economic growth because it pleases Western environmentalists. Indeed, China and India have already made this clear in their refusal to join the Kyoto Protocol.

China's "Litany"

The case of China might well be taken as a confirmation of what Bjørn Lomborg dismissed in *The Skeptical Environmentalist* as "the litany"—an unrelenting picture of rising pollution and depleted resources leading ultimately to an ecological collapse. But Western environmentalists worry that ecological catastrophe will spill beyond China's own borders and affect the entire globe. "China's Boom Is Bust for the Environment" is an entirely typical National Geographic News online headline.[6] "China's Next Big Boom Could Be the Foul Air," the *New York Times* reported in late October, just before the Songhua River spill.[7] The Worldwatch Institute website includes a feature called "China Watch" that tracks China's environmental gloom.[8] And the U.S. Environmental Protection Agency (EPA) has taken note of the prospect of air pollution originating in China making its way across the Pacific Ocean and affecting U.S. air quality. There have already been some extraordinary episodes of air pollution from Asia reaching North America.[9]

Nearly two-thirds of China's 343 major cities currently fail to meet the nation's air quality standards, and air pollution is expected to get worse. The World Health Organization reckons that seven of the ten most polluted cities in the world are in China. (See figure 1 for a comparison.) These high levels of air pollution, according to the conventional health effect models, are responsible for thousands of premature deaths per year in China. In 2001 the World Bank estimated that economic losses from air pollution-related mortality and morbidity amounted to as much as 2 to 3 percent of GDP in India and China.[10] If this estimate is accurate,

FIGURE 1
Air Quality Comparison of Some World Cities, Year 2000
(Average Annual Levels, Particulates [TSP], SO_2, and NO_2)



Source: Jiming Hao and Litao Wang, "Improving Air Quality in China: Beijing Case Study," *Journal of the Air & Waste Management Association* 55 (2005): 1300.

it suggests that pollution abatement offers meaningful economic returns.

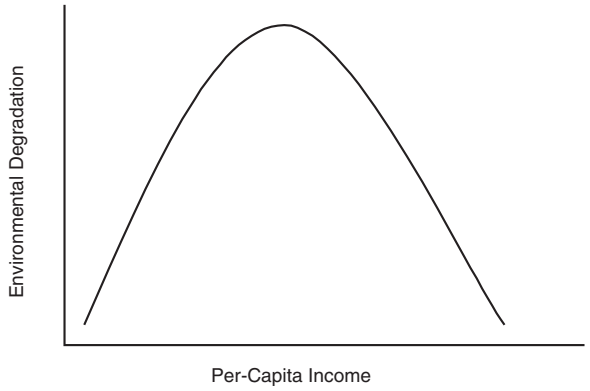
The International Energy Agency forecasts that China's greenhouse gas emissions will rise nearly 120 percent over the next twenty years, by which time China's emissions will exceed those of the United States. Although China receives the most attention, it is not the only Asian nation where this concern is present. India is also growing rapidly, and its major cities experience particulate levels often eight to ten times higher than those in the worst American cities. Its greenhouse gas emissions are forecast to grow 70 percent by 2025. According to a recent report from British Petroleum (BP), China and India have already passed the United States, Europe, and the former Soviet Union in coal consumption.[11]

Beyond air pollution and greenhouse gas emissions, China is also experiencing high levels of water and ocean pollution, soil erosion, and heavy stresses on forest, wetlands, and endangered species. The scarcity of potable water is nearing crisis proportions. Groundwater has been badly depleted, and surface water sources are equally overused. The Yellow River, for example, has run dry every year since 1985 because of diversions; in 1997, it failed to reach the ocean for 226 days. China's State Environmental Protection Agency reported in June that twenty-five out of the twenty-seven largest lakes in China were polluted, some seriously. Chinese industry appears to be sloppy in its practices. SEPA reports as many as 2,500 environmental "accidents" a year over the last decade.

Dismal Future or Turning Point?

As dismal as this picture is, the conventional wisdom about China's environmental future is likely to be wrong. A closer look at facts on the ground and recent trends suggests that China is an excellent test case for the controversial theory known as the "environmental Kuznets Curve" (EKC). The EKC holds that the relationship between economic growth and environmental quality is an inverted U-shape, according to which environmental conditions deteriorate during early stages of economic growth but begin to improve after a certain threshold of wealth is achieved. (See figure 2.) The original Kuznets Curve was named for Nobel laureate Simon Kuznets, who postulated in the 1950s that income inequality first increases and then declines with economic growth. In 1991, economists Gene M. Grossman and Alan B.

FIGURE 2
Stylized Environmental Kuznets Curve 2000



Krueger suggested the Kuznets Curve applied to the environment.[12] It was a powerful counterargument to the once-conventional view, popular in the aftermath of the "limits to growth" enthusiasm of the 1970s, that economic growth was the enemy of the environment, and the EKC gained wide acceptance as a key development concept in the 1990s, including at the World Bank.[13]

There is a burgeoning economic literature about the EKC, with the usual controversy over econometric methodology and the robustness of the models. Most of the empirical and econometric research on the EKC examines air and water pollution, as they offer the best data sets for cross-national analysis. Critics argue that the EKC is not statistically robust, that it does not apply to the full range of environmental impacts, and that it does not account for displacement effects, i.e., the "race to the bottom" whereby richer nations outsource their environmental harmful production functions to poorer nations with weaker environmental controls, resulting in net increases in global pollution.[14]

Defenders of the EKC argue optimistically that the EKC is actually dropping and shifting to the left, meaning that the environmental turning point will be reached sooner in the developing world than in today's wealthy nations. Developing nations, it is thought, will skip over some of the stages of growth and pollution by adopting cleaner technologies earlier and developing regulatory institutions to control pollution.

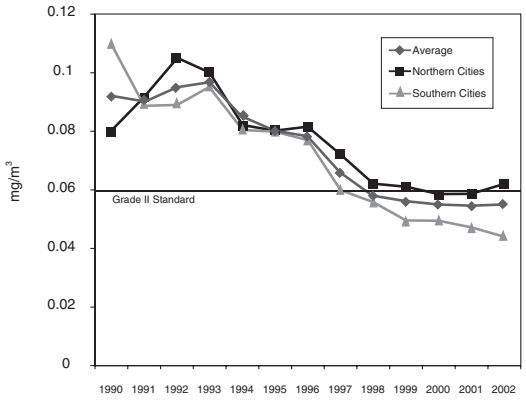
While further empirical research will no doubt advance our understanding of the strengths and weaknesses of the EKC, China has emerged as a real-world test case. Several EKC studies conclude that sulfur dioxide pollution begins to decline at a per-capita income

level in the range of $5,000 to $9,000, and particulates begin to decline at a per-capita income range from $5,000 to $15,000. China is still far from this range, with a current per-capita income of about $3,000. However, by some measures China's SO_2, ozone, and particulate levels may have already peaked and begun declining, offering preliminary evidence that the EKC is dropping and shifting to the left.

Jiming Hao and Litao Wang, researchers at Tsinghua University in Beijing, recently published data in the *Journal of the Air and Waste Management Association* showing declines in the level of ambient air pollution in China from 1990 to 2002, as shown in figures 3–6.[15] (The higher levels of air pollution in northern Chinese cities in figures 3–5 are due mostly to the fact that these areas burn much more coal during the winter. (Unlike most U.S. cities, air quality is worst in Beijing during the winter months.) From 1990 to 2002, the number of motor vehicles in China nearly quadrupled, while total energy consumption increased by one-third. Yet as Hao and Wang observe, "the air pollution emissions did not increase as quickly as economic growth and energy consumption, and air quality in Chinese cities has improved to some extent." China's SEPA reports some progress in improving the number of cities that achieve their grade II ambient air quality standards (which are comparable to U.S. ambient standards), but as the figures show northern Chinese cities especially have a long way to go to meet the standard. As figure 6 shows, Beijing has made substantial improvement in SO_2 levels, but still does not meet China's grade II standard. (Grade II represents the Chinese air quality standards for urban areas. China's grade I standards for rural areas are 30 to 60 percent tougher depending on the pollutant.)

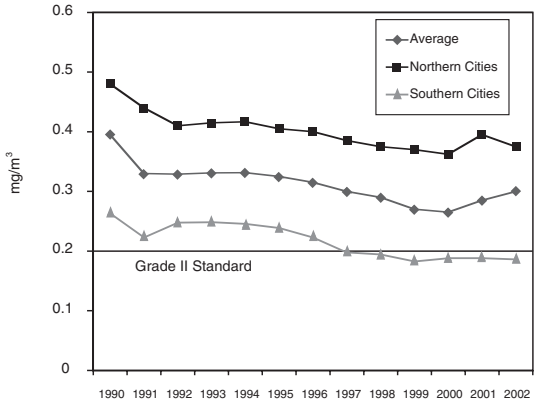
As has been the experience of the United States and Europe, fossil fuel energy consumption can go up while pollution falls if emission control technology is adopted. This is starting to occur in China at a faster rate than Westerners recognize. China has adopted ambient air quality goals that are, in some cases, nominally more ambitious than U.S. Clean Air Act ambient standard. (See table 1.) China is starting to implement the kind of stationary and mobile source control measures that have been common in the United States and Europe for a generation, and China has adopted the EU's tailpipe emissions standards for its growing auto fleet, which are comparable to the U.S. tier II tailpipe standards. Among other indicators of progress, Beijing now has the largest fleet of natural gas buses in the world.

FIGURE 3
Average Annual Ambient SO_2 Levels in Chinese Cities



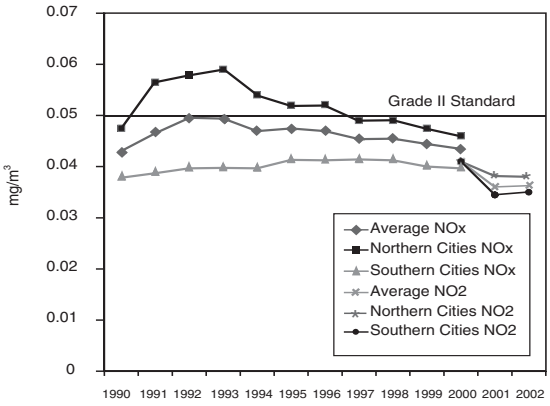
Source: Jiming Hao and Litao Wang, "Improving Air Quality in China," 1300.

Figure 4
Average Annual Ambient Total Suspended Particulates (TSP) Concentrations



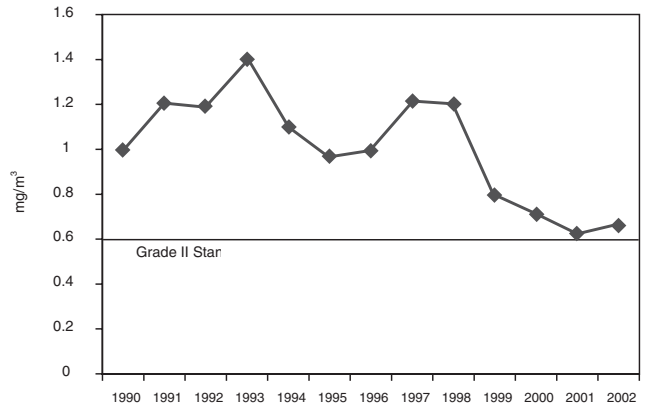
Source: Jiming Hao and Litao Wang, "Improving Air Quality in China," 1300.

FIGURE 5
Average Annual Ambient NOx Levels in Chinese Cities



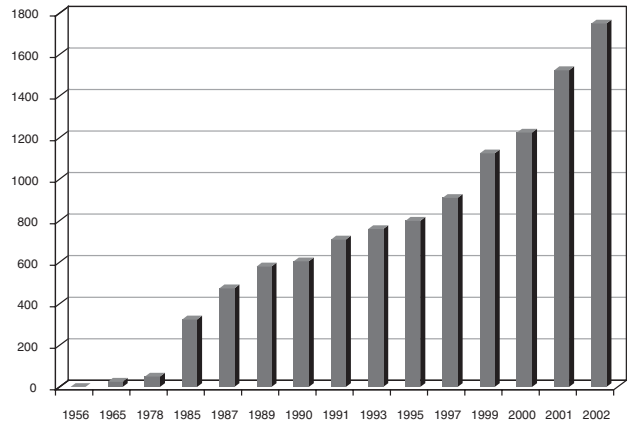
Source: Jiming Hao and Litao Wang, "Improving Air Quality in China," 1300.
Note: In 2000, China began reporting NO_2 instead of NO_x.

FIGURE 6
Average Annual Ambient SO_2 Levels in Beijing



Source: Jiming Hao and Litao Wang, "Improving Air Quality in China," 1300.

FIGURE 7
Total Land Area of Chinese Nature Reserves



Source: SEPA Environmental Information Center, "Analysis Report of the State of the Environment in China" (SEPA report 2004.02), available at http://www.sepa.gov.cn/english/SOE/analysis/.

TABLE 1
Chinese and U.S. Ambient Air Quality Standards (ug/m³)

	China Grade II	United States
SO_2-Annual	0.06	0.08
SO_2-Daily	0.15	0.365
SO_2-Hourly*	0.5	0.655
PM_{10}-Annual	0.1	0.05
PM_{10}-Daily	0.15	0.15
NO_2-Annual	0.08	0.053
NO_2-Hourly	0.04	0.047
CO-Daily**	4	10
CO-Hourly**	10	40
O_3-Hourly	0.16	0.2

* California only.
** Milligrams/m³.

China has been enacting environmental laws that resemble the landmark legislation the United States and Europe enacted in the 1970s, and SEPA reports that spending for environmental projects is increasing at about 15 percent a year. China even has its own version of the American National Environmental Protection Act (NEPA), requiring construction projects to perform an environmental impact assessment (EIA) as a part of the planning and building permit process. In 2004 over 320,000 construction projects went through the EIA review process.

To be sure, China's environmental reviews may not meet the exacting standards of either the U.S. EPA or the Sierra Club, and even if the optimists are right that the EKC for China is dropping and shifting to the left, it still means that some of the environmental news out of China is going to get worse before its gets better. The central point remains, however, that while China has a long way to go, China's environmental news may start improving a lot sooner and a lot faster than people expect.

Already there are signs that the corner has been turned on areas aside from air pollution. Industrial discharge of petroleum-related pollutants and some heavy metals into rivers and oceans has been cut in half over the last decade.[16] Wastewater treatment facilities are being built at breakneck speed; between 2000 and 2005, total wastewater capacity will have doubled. China's reforestation program appears to be taking flight; SEPA reports that 4.8 million hectares of forestland were planted in 2004.[17] And, as figure 7 shows, China is dedicating more land for nature preserves in steadily increasing amounts.

Institutional and Political Reform?

To be sure, there is a *dirigisme* flavor to Chinese environmental policy, with lots of five-year plans for various environmental problems that sound like you-know-what. But there are also examples of Chinese awareness that markets may be more effective than regulation for problems such as water scarcity. One of the key controversies in the EKC literature is the role of institutions and public demand for environmental improvement. These exogenous factors—or political factors as non-economists would say—are perhaps a more important variable in environmental performance than are mere income levels.

This brings us back to the beginning, to the Songhua River spill and the mounting environmental protests occurring in China. Is it possible that the environment might be the catalyst for political reform in China? The

Songhua River spill might be likened to the Cuyahoga River fire of 1969 in Ohio, which was one of the galvanizing events in the rise of the modern environmental movement in the United States. In a nutshell, the public outcry over the Cuyahoga River fire (after previous fires had provoked little public fanfare) showed that the affluent society no longer wished to be the effluent society. Certainly rising middle class consciousness is involved with the popular protests about environmental calamity in China.

But perhaps the better comparison is with the 1986 Chernobyl nuclear accident in the Soviet Union, which helped galvanize political liberalization under Mikhail Gorbachev. As we have written in previous *Environmental Policy Outlooks*, there is a strong correlation between various indices of political freedom and environmental performance.[18] If China responds to its environmental challenges with administrative decentralization and greater use of market mechanisms and property rights, who knows where it might lead.

Notes

1. Jim Yardley, "Thousands of Chinese Villagers Protest Factory Pollution," *New York Times*, April 13, 2005.

2. Edward Cody, "For Chinese, Peasant Revolt Is Rare Victory; Farmers Beat Back Police in Battle over Pollution," *Washington Post*, June 13, 2005.

3. Howard W. French, "Anger in China Rises over Threat to Environment," *New York Times*, July 19, 2005.

4. Edward Cody, "Chinese Police Kill Villagers during Two-Day Land Protest," *Washington Post*, December 9, 2005. Once again, bloggers offered arguably superior news coverage, along with photos. See http://gatewaypundit.blogspot.com/2005/12/china-opens-fire-kills-20-protesters.html.

5. See http://bmcgonigle.blogspot.com/2005/11/water-lieu-resolution.html.

6. See, for example, Stefan Lovgren, "China's Boom Is Bust for Global Environment, Study Warns," National Geographic News, May 16, 2005, available at http://news.nationalgeographic.com/news/2005/05/0516_050516_chinaeco.html.

7. Jim Yardley, "China's Next Big Boom Could Be the Foul Air," *New York Times*, October 30, 2005.

8. See http://www.worldwatch.org/features/chinawatch/.

9. See Jim Szykman, David Mintz, Jack Creilson, and Michelle Wayland, "Impact of the Asian 2001 Dust Event on Particulate Matter Concentrations in the United States," *U.S. EPA National Air Quality and Emissions Trends Report* (2003), Special Studies p. S-1–S-12, available at http://www.epa.gov/airtrends/aqtrnd03/pdfs/1_asiandust.pdf.

10. K. Bolt, K. Hamilton, K. Pandey, and D. Wheeler, "The Cost of Air Pollution in Developing Countries: New Estimates for Urban Areas," (working paper for the World Bank Development Research Group, forthcoming).

11. British Petroleum, "Putting Energy in the Spotlight" (BP statistical review of world energy, June 2005), available at www.bp.com/statisticalreview.

12. Gene M. Grossman and Alan B. Krueger, "Environmental Impact of a North American Free Trade Agreement" (working paper 3914, National Bureau of Economic Research, November 1991). A revised and expanded version of their paper, entitled "Economic Growth and the Environment," was published in the *Quarterly Journal of Economics* 110, no. 2 (May 1995): 353–377.

13. For a good overview of the EKC literature, see Bruce Yandle, Madhusudan Bhattarai, and Maya Vijayaraghavan, "Environmental Kuznets Curves: A Review of Findings, Methods, and Policy Implications" (PERC research study 02-1, April 2004), available at http://www.perc.org/perc.php?subsection=9&id=207.

14. See David I. Stern, "The Rise and Fall of the Environmental Kuznets Curve," *World Development* 32, no. 8 (2004): 1419–1439; see also B. R. Copeland and M. S. Taylor, "Trade, Growth and the Environment," *Journal of Economic Literature* 16 (2002): 147–168; Kenneth Arrow, et al., "Economic Growth, Carrying Capacity, and the Environment," *Ecological Applications* 6, no. 1 (February 1996): 13–15. Responses to these critics can be found in Susmitas Dasgupta, Benoit Laplante, Hua Wang, and David Wheeler, "Confronting the Environmental Kuznets Curve," *Journal of Economic Perspectives* 16, no. 1 (Winter 2002): 147–158. See also Daniel L. Millimet, John A. List, and Thanasis Stegnos, "The Environmental Kuznets Curve: Real Progress or Misspecified Models?" *Review of Economics and Statistics* 85, no. 4 (November 2003): 1038–1047.

15. Jiming Hao and Litao Wang, "Improving Air Quality in China: Beijing Case Study," *Journal of the Air and Waste Management Association* 55 (2005): 1298–1305.

16. See State Environmental Protection Administration, "Analysis Report on the State of the Environment in China 2004" (SEPA report 2004.02), available at http://www.sepa.gov.cn/english/SOE/analysis/.

17. See State Environmental Protection Administration, "Report on the State of the Environment in China 2004," available at http://www.zhb.gov.cn/english/SOE/ soechina2004/forest.htm.

18. See Roger Bate and David Montgomery, "Beyond Kyoto: Real Solutions to Greenhouse Emissions from Developing Countries," AEI's *Environmental Policy Outlook*, July–August 2004, available at www.aei.org/publication20982; and Steven F. Hayward, "Sustainable Development in the Balance," AEI's *Environmental Policy Outlook*, August 2002, available at www.aei.org/publication14200.