

Notes

PART 1. THE ECONOMIC COSTS OF ECOLOGICAL DEFICITS

Deserts Invading China (pages 7–28)

1. Howard W. French, “China’s Growing Deserts are Suffocating Korea,” *New York Times*, 14 April 2002.
2. Ibid.
3. Ibid.
4. “Grapes of Wrath in Inner Mongolia,” report from U.S. Embassy in Beijing, May 2001, at <www.usembassy-china.org.cn/english/sandt/MongoliaDust-web.htm>, viewed 6 June 2002.
5. Ibid.
6. “In Brief: Lhasa Dust Storm,” *China Daily*, 29 January 2002; Wang Tao, “The Process and Its Control of Sandy Desertification in Northern China,” seminar on desertification in China, Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences (Lanzhou, China: May 2002).
7. Guo Aibing and Jiang Zhuqing, “Airborne Dust Blankets City,” *China Daily*, 21 March 2002.
8. Yang Youlin, “Dust-Sandstorms: Inevitable Consequences of Desertification—A Case Study of Desertification Disasters in the Hexi Corridor, NW China,” in Yang Youlin, Victor

- Squires, and Lu Qi, eds., *Global Alarm: Dust and Sandstorms from the World's Drylands* (New York: United Nations, 2001), p. 228.
9. *Ibid.*, p. 229.
 10. *Ibid.*, p. 231.
 11. Population from United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001).
 12. "Grapes of Wrath in Inner Mongolia," *op. cit.* note 4.
 13. Feng Jiaping for the State Forestry Administration, second national survey on desertification released in Beijing, cited in "Desertification Area Extends in China," *China Daily*, 29 January 2002.
 14. Wang, *op. cit.* note 6.
 15. Environmental Protection Agency cited in French, *op. cit.* note 1.
 16. *Ibid.*
 17. "Grapes of Wrath in Inner Mongolia," *op. cit.* note 4.
 18. Qu cited in "China Adopts Law to Control Desertification," report from U.S. Embassy in Beijing, November 2001, at <www.usembassy-china.org.cn/sandt/desertification_law.htm>, viewed 6 June 2002.
 19. Hong Yang and Xiubin Li, "Cultivated Land and Food Supply in China," *Land Use Policy*, vol. 17, no. 2 (2000).
 20. U.N. Food and Agriculture Organization (FAO), *FAOSTAT Statistics Database*, at <www.apps.fao.org>, updated 28 May 2002.
 21. "Grapes of Wrath in Inner Mongolia," *op. cit.* note 4.
 22. *Ibid.*
 23. Wood demand from FAO, *op. cit.* note 20, updated 19 December 2001.
 24. Tree loss from Carmen Revenga et al., *Watersheds of the World* (Washington, DC: World Resources Institute and Worldwatch Institute, 1998); Wong Hangchang, "Deforestation and Desiccation in China: A Preliminary Study," study for

- the Beijing Center for Environment and Development, Chinese Academy of Social Sciences (Beijing: 1999).
25. Economist Intelligence Unit, "China Industry: Heavy Usage, Pollution Are Hurting Water Resources," *EIU ViewsWire*, 27 February 2001; Michael Ma, "Northern Cities Sinking as Water Table Falls," *South China Morning Post*, 11 August 2001.
 26. Cited in Lester R. Brown and Brian Halweil, "China's Water Shortages Could Shake World Food Security," *World Watch*, July/August 1998, pp. 11–12.
 27. Water-to-grain conversion based on 1,000 tons of water for 1 ton of grain from FAO, *Yield Response to Water* (Rome: 1979), on world wheat prices from International Monetary Fund (IMF), *International Financial Statistics* (Washington, DC: various years), and on industrial water intensity in Mark W. Rosegrant, Claudia Ringler, and Roberta V. Gerpacio, "Water and Land Resources and Global Food Supply," paper presented at the 23rd International Conference of Agricultural Economists on Food Security, Diversification, and Resource Management: Refocusing the Role of Agriculture?, Sacramento, CA, 10–16 August 1997; Wang Ying, "Rice Cropped for Water," *China Daily*, 9 January 2002.
 28. Ci Longjun, "Disasters of Strong Sandstorms Over Large Areas and the Spread of Land Desertification in China," in Yang, Squires, and Lu, *op. cit.* note 8, p. 215; Lu Qi and Ju Hongbo, "Root Causes, Processes and Consequence Analysis of Sandstorms in Northern China in 2000," in *ibid.*, p. 241.
 29. Chen Xiwen, Deputy Director, Development Research Center of the State Council, and colleagues, discussion in Beijing with author, 16 May 2002.
 30. Yang Jumping, Master Researchist, Inner Mongolia Academy of Forestry Science, Hohhot, Inner Mongolia, and other local officials of the Ministry of Forestry, discussion in Hohhot with author, May 2002.
 31. Data are from discussions with officials of Helin county, Inner Mongolia, 17 May 2002.
 32. *Ibid.*
 33. Wang, *op. cit.* note 6.

34. Ibid.
35. Author's observation confirmed by discussions with scientists at the Cold and Arid Regions Environmental and Engineering Research Institute, Lanzhou, China.
36. "China to Spend Billions on Forests," *Reuters*, 14 May 2002.
37. Shi Yuanchun, China Academy of Sciences, quoted in Frank Langfitt, "Driven by Weather, Waste, Deserts Swallowing China," *Baltimore Sun*, 20 April 2002; Jonathan Ansfield, "Sandstorms Hit China, Threaten Green Olympics Dream," *Reuters*, 21 March 2002.
38. FAO, op. cit. note 20; "Grapes of Wrath in Inner Mongolia," op. cit. note 4.
39. Langfitt, op. cit. note 37; "China Adopts Law to Control Desertification," op. cit. note 18.
40. "China Adopts Law to Control Desertification," op. cit. note 18.
41. Wang, op. cit. note 6; Asian Development Bank, *Technical Assistance to the People's Republic of China For Optimizing Initiatives to Combat Desertification in Gansu Province* (Manila, Philippines: June 2001).
42. "Grapes of Wrath in Inner Mongolia," op. cit. note 4.
43. Ibid.
44. Asian Development Bank, op. cit. note 41.
45. Grain production in 1950 from U.S. Department of Agriculture (USDA), *World Grain Database*, unpublished printout; Figure 1–1 and current levels from USDA, *Production, Supply, and Distribution*, electronic database, updated 10 May 2002.
46. USDA, *Production, Supply, and Distribution*, op. cit. note 45; IMF, op. cit. note 27.
47. Grain import dependence from USDA, *Production, Supply, and Distribution*, op. cit. note 45.
48. Data for China's trade surplus with the United States from the U.S. Department of Commerce; grain prices from *Wall Street Journal*, various issues.

Assessing the Food Prospect (pages 29–58)

1. Output in 1900 from Angus Maddison, *Monitoring the World Economy 1820–1992* (Paris: Organisation for Economic Co-operation and Development, 1995); recent growth from David Malin Roodman, "Economic Growth Falters," in Worldwatch Institute, *Vital Signs 2002* (New York: W.W. Norton & Company, 2002), pp. 58–59, and from International Monetary Fund (IMF), *World Economic Outlook* (Washington, DC: April 2002).
2. United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001).
3. Roodman, op. cit. note 1; World Bank, *World Development Report 2000/2001: Attacking Poverty* (New York: Oxford University Press, 2001), p. 3.
4. Population from United Nations, op. cit. note 2; economy from Roodman, op. cit. note 1; Population Reference Bureau, *World Population Data Sheet* (wall chart) (Washington, DC: 2001).
5. Water use from Peter H. Gleick, *The World's Water 2000–2001* (Washington, DC: Island Press, 2000), p. 52; fish from U.N. Food and Agriculture Organization (FAO), *Yearbook of Fishery Statistics: Capture Production* (Rome: various years); paper from Janet N. Abramovitz and Ashley T. Mattoon, *Paper Cuts: Recovering the Paper Landscape*, Worldwatch Paper 149 (Washington, DC: Worldwatch Institute, December 1999), p. 6; forests products and recent beef and mutton from FAO, *FAOSTAT Statistics Database*, at <apps.fao.org>, with forestry data updated 19 December 2001 and meat data updated 28 May 2002; 1950 meat demand from FAO, *1948–1985 World Crop and Livestock Statistics* (Rome: 1987).
6. Hari Eswaran, Paul Reich, and Fred Beinroth, "Global Desertification Tension Zones," in D. E. Stott, R. H. Mohtar and G. C. Steinhardt (eds.), *Sustaining the Global Farm*, selected papers from the 10th International Soil Conservation Organization Meeting held 24–29 May 1999 at Purdue University and the USDA-ARS National Soil Erosion Research Laboratory (2001), pp. 24–28.

7. Ibid.
8. Kofi A. Annan, United Nations, "Message on World Day to Combat Desertification and Drought," 17 June 2002, at <www.unccd.int/publicinfo/june17/sgmessage-eng.pdf>.
9. L. R. Oldeman, R. T. A. Hakkeling, and W. G. Sombroek, *World Map of the Status of Human-induced Soil Degradation: An Explanatory Note* (Wageningen, Netherlands: International Soil Reference and Information Centre (ISRIC), 1990).
10. Effect of topsoil loss on yields in Leon Lyles, "Possible Effects of Wind Erosion on Soil Productivity," *Journal of Soil and Water Conservation*, November/December 1975, discussed in Lester R. Brown, "Conserving Soils," in Lester R. Brown et al., *State of the World 1984* (New York: W.W. Norton & Company, 1984), pp. 62–65.
11. Rattan Lal, "Erosion-Crop Productivity Relationships for Soils of Africa," *Soil Science Society of America Journal*, May–June 1995.
12. Figure 1–2 from U.S. Department of Agriculture (USDA), *Production, Supply, and Distribution*, electronic database, updated 10 May 2002.
13. Topsoil loss from USDA, Economic Research Service (ERS), *Agri-Environmental Policy at the Crossroads: Guideposts on a Changing Landscape*, Agricultural Economic Report No. 794 (Washington, DC: January 2001), p. 16; wheat yield from USDA, op. cit. note 11.
14. USDA, op. cit. note 13; loss of topsoil from water erosion from USDA, *Summary Report: 1997 Natural Resources Inventory* (Washington, DC: December 1999, rev. December 2000), pp. 46–51; China from Chen Xiwen, Deputy Director, Development Research Center of the State Council, and colleagues, discussion with author in Beijing, 16 May 2002.
15. "Algeria to Convert Large Cereal Land to Tree-Planting," *Reuters*, 8 December 2000.
16. FAO, *The State of Food and Agriculture 1995* (Rome: 1995), pp. 174–95; wheat yields from USDA, op. cit. note 12.

17. Forest Watch Indonesia and Global Forest Watch, *The State of the Forest: Indonesia* (Bogor, Indonesia, and Washington, DC: 2002), p. 42.
18. Brazil's cerrado from "Brazil's Cerrado Land Potential," in Randall D. Schnepf, Erik N. Dohlman, and Christine Bolling, *Agriculture in Brazil and Argentina* (Washington, DC: USDA, ERS, November 2001), p. 12; Kazakhstan from FAO, op. cit. note 16; soybean production from USDA, op. cit. note 12.
19. Gleick, op. cit. note 5, p. 64.
20. Population and water availability from Tom Gardner-Outlaw and Robert Engelman, *Sustaining Water, Easing Scarcity: A Second Update* (Washington, DC: Population Action International, 1997).
21. Sandra Postel, *Pillar of Sand* (New York: W.W. Norton & Company, 1999), p. 255; rule of thumb from FAO, *Yield Response to Water* (Rome: 1979); grain consumption from USDA, op. cit. note 12; population from United Nations, op. cit. note 2.
22. Water usage from Gleick, op. cit. note 5, p. 52; pumping from Postel, op. cit. note 21.
23. Table 1–4 from the following: China from Michael Ma, "Northern Cities Sinking as Water Table Falls," *South China Morning Post*, 11 August 2001; United States from Postel, op. cit. note 21, p. 77, and from Bonnie Terrell and Phillip N. Johnson, "Economic Impact of the Depletion of the Ogallala Aquifer: A Case Study of the Southern High Plains of Texas," presented at the American Agricultural Economics Association annual meeting in Nashville, TN, 8–11 August 1999; Pakistan, India, and Mexico in Tushaar Shah et al., *The Global Groundwater Situation: Overview of Opportunities and Challenges* (Colombo, Sri Lanka: International Water Management Institute, 2000); Postel, op. cit. note 21; Iran from Chenaran Agricultural Center, Ministry of Agriculture, according to Hamid Taravati, publisher, Iran, e-mail to author, 25 June 2002; Christopher Ward, "Yemen's Water Crisis," based on a lecture to the British Yemeni Society in September 2000, at <www.al-bab.com/bys/articles/ward01.htm>, July 2001.

24. Taravati, op. cit. note 23.
25. Population from United Nations, op. cit. note 2; Yemen's water situation from Ward, op. cit. note 23; Christopher Ward, *The Political Economy of Irrigation Water Pricing in Yemen* (Sana'a, Yemen: World Bank, November 1998); Marcus Moench, "Groundwater: Potential and Constraints," in Ruth S. Meinzen-Dick and Mark W. Rosegrant, eds., *Overcoming Water Scarcity and Quality Constraints* (Washington, DC: International Food Policy Research Institute, October 2001).
26. Water table dropping 1.5 meters a year from James Kynge, "China Approves Controversial Plan to Shift Water to Drought-Hit Beijing," *Financial Times*, 7 January 2000.
27. Grain production from USDA, op. cit. note 12; irrigation from FAO, *FAOSTAT Statistics Database*, op. cit. note 5, with irrigation data updated 10 July 2001.
28. Water to grain conversion from FAO, op. cit. note 21.
29. USDA, op. cit. note 12; USDA, *World Agricultural Supply and Demand Estimate* (Washington, DC: 12 June 2002).
30. Overpumping from Postel, op. cit. note 21; population from United Nations, op. cit. note 2.
31. Water value comparison based on ratio of 1,000 tons of water for 1 ton of grain from FAO, op. cit. note 21, on global wheat prices from IMF, *International Financial Statistics* (Washington, DC: various years), and on industrial water intensity in Mark W. Rosegrant, Claudia Ringler, and Roberta V. Gerpacio, "Water and Land Resources and Global Food Supply," paper prepared for the 23rd International Conference of Agricultural Economists on Food Security, Diversification, and Resource Management: Refocusing the Role of Agriculture?, Sacramento, CA, 10–16 August 1997.
32. Grain consumption from USDA, op. cit. note 12; grain prices from IMF, op. cit. note 31; hunger and malnutrition from FAO, *The State of Food Insecurity in the World 2001* (Rome: 2001), p. 2.
33. Population from United Nations, op. cit. note 2.

34. Beef and mutton from FAO, *Crop and Livestock Statistics*, op. cit. note 5; FAO, *FAOSTAT Statistics Database*, op. cit. note 5, with meat production updated 28 May 2002; fish from FAO, *Fishery Statistics*, op. cit. note 5, and from FAO, *Aquaculture Production* (various years).
35. Figure 1–3 and data from FAO, *FAOSTAT Statistics Database*, op. cit. note 5.
36. A. Banerjee, "Dairying Systems in India," *World Animal Review*, vol. 79/2 (Rome: FAO, 1994); S. C. Dhall and Meena Dhall, "Dairy Industry—India's Strength Is in Its Livestock," *Business Line*, Internet Edition of *Financial Daily* from *The Hindu* group of publications, at <www.indiaserver.com/businessline/1997/11/07/stories/03070311.htm>, 7 November 1997; milk production data from FAO, *FAOSTAT Statistics Database*, op. cit. note 5, updated 28 May 2002.
37. China's crop residue production and use from Gao Tengyun, "Treatment and Utilization of Crop Straw and Stover in China," *Livestock Research for Rural Development*, February 2000; USDA, ERS, "China's Beef Economy: Production, Marketing, Consumption, and Foreign Trade," *International Agriculture and Trade Reports: China* (Washington, DC: July 1998), p. 28.
38. Conversion ratio for grain to beef based on Allen Baker, Feed Situation and Outlook staff, ERS, USDA, Washington, DC, discussion with author, 27 April 1992; pork conversion data from Leland Southard, Livestock and Poultry Situation and Outlook Staff, ERS, USDA, Washington, DC, discussion with author, 27 April 1992; feed-to-poultry conversion ratio derived from data in Robert V. Bishop et al., *The World Poultry Market—Government Intervention and Multilateral Policy Reform* (Washington, DC: USDA, 1990); conversion ratio for fish from USDA, ERS, "China's Aquatic Products Economy: Production, Marketing, Consumption, and Foreign Trade," *International Agriculture and Trade Reports: China* (Washington, DC: July 1998), p. 45.
39. USDA, op. cit. note 12.
40. Fish feed requirements from Rosamond L. Naylor et al., "Effect of Aquaculture on World Fish Supplies," *Nature*, 29

- June 2000, p. 1019; poultry feed requirements from Bishop et al., op. cit. note 38.
41. Beef conversion from Baker, op. cit. note 38; grain to pork conversion from Southard, op. cit. note 38.
 42. Aquaculture from FAO, op. cit. note 34; beef from FAO, *FAO-STAT Statistics Database*, op. cit. note 5, with meat updated 28 May 2002.
 43. China's fish farms from K. J. Rana, "China," in *Review of the State of World Aquaculture*, FAO Fisheries Circular No. 886 (Rome: 1997); China's grain area from USDA, op. cit. note 11; U.S. catfish farms from USDA, ERS, National Agriculture Statistics Service, *Catfish Production* (Washington, DC: July 2000), p. 3.
 44. Figure 1–4 from USDA, op. cit. note 12.
 45. Soybean harvest from USDA, Foreign Agricultural Service, *Oilseeds: World Markets and Trade* (Washington, DC: May 2002).
 46. Harvest area from USDA, op. cit. note 12; double cropping from Conservation Technology Information Center (CTIC), "Conservation Tillage Survey Data: Crop Residue Management 1998," CTIC Core 4 Conservation Web site, at <www.ctic.purdue.edu/Core4/CT/CT.html>, updated 19 May 2000.
 47. USDA, op. cit. note 12; animal protein consumption from FAO, *FAOSTAT Statistics Database*, op. cit. note 5, updated 28 May 2002.
 48. U.S. experience in USDA, op. cit. note 13; USDA, op. cit. note 14; China from Chen, op. cit. note 14.
 49. USDA, Natural Resources Conservation Service, *CORE4 Conservation Practices Training Guide: The Common Sense Approach to Natural Resource Conservation* (Washington, DC: August 1999); Rolf Derpsch, "Frontiers in Conservation Tillage and Advances in Conservation Practice," in Stott, Mohtar, and Steinhardt, op. cit. note 6, pp. 248–54.
 50. CTIC, "2000 United States Summary," from *2000 National Crop Residue Management Survey*, at <www.ctic.purdue.edu/Core4/CT/ctsurvey/2000/2000USSummary.html>, updated 20 January 2002.

51. CTIC, "No-Till Adoption in the U.S.," from *2000 National Crop Residue Management Survey*, at <www.ctic.purdue.edu/Core4/CT/ctsurvey/2000/GraphNTAll.html>, updated 20 January 2002.
52. Derpsch, op. cit. note 49.
53. USDA, op. cit. note 12.
54. Sandra Postel, *Last Oasis* (New York: W.W. Norton & Company, 1997), p. 170.
55. Diversion of 70 percent from Gleick, op. cit. note 5, p. 64; Sandra Postel, "Redesigning Irrigated Agriculture," in Lester Brown et al., *State of the World 2000* (New York: W.W. Norton & Company, 2000); Sandra Postel et al., "Drip Irrigation for Small Farmers: A New Initiative to Alleviate Hunger and Poverty," *Water International*, March 2001, pp. 3–13.
56. Postel, op. cit. note 21, pp. 189–92.
57. Population projections in United Nations, op. cit. note 2.

Facing the Climate Challenge (pages 59–80)

1. National Aeronautics and Space Administration, Goddard Institute for Space Studies, "Global Temperature Anomalies in .01 C," at <www.giss.nasa.gov/data/update/gistemp/GLB.Ts.txt>, viewed 20 June 2002.
2. Ibid.
3. Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* (New York: Cambridge University Press, 2001), p. 13.
4. Timothy Egan, "Alaska, No Longer So Frigid, Starts to Crack, Burn and Sag," *New York Times*, 16 June 2002; Andes from Andrew Revkin, "A Message in Eroding Glacial Ice: Humans Are Turning Up the Heat," *New York Times*, 19 February 2001; Himalayas from Robert Marquand, "Glaciers in the

- Himalayas Melting at a Rapid Rate," *Christian Science Monitor*, 5 November 1999.
5. Richard Kerr, "Will the Arctic Ocean Lose All Its Ice?" *Science*, 3 December 1999, p. 1828.
 6. Dorthe Dahl-Jensen, "The Greenland Ice Sheet Reacts," *Science*, 21 July 2000, pp. 404–05.
 7. Munich Re, *Topics Annual Review: Natural Catastrophes 2001* (Munich, Germany: 2002), pp. 16–17.
 8. Jeremy Leggett, "The Emerging Response of the Insurance Industry to the Threat of Climate Change," *UNEP Industry and Environment*, January–March 1994, p. 41; Munich Re, op. cit. note 7.
 9. Munich Re, op. cit. note 7; Doug Rekenhaller, "China Survives Fourth Yangtze Flood Crest as Fifth Begins its Journey," *Disaster Relief*, 11 August 1998; Munich Re, "Munich Re's Review of Natural Catastrophes in 1998," press release (Munich: 19 December 1998); Erik Eckholm, "Chinese Leaders Vow to Mend Ecological Ways," *New York Times*, 30 August 1998.
 10. Munich Re quoted in Leggett, op. cit. note 8, p. 42.
 11. World Bank, *World Development Report 1999/2000* (New York: Oxford University Press, 2000), p. 100.
 12. Rice exports from U.S. Department of Agriculture (USDA), Foreign Agricultural Service, *Grain: World Markets and Trade*, April 2002, p. 13; population from United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001).
 13. USDA, op. cit. note 12.
 14. U.S. coastal property damage from James E. Neumann et al., *Sea-level Rise & Global Climate Change: A Review of Impacts to U.S. Coasts* (Arlington, VA: Pew Center on Global Climate Change, 2000), pp. 4, 31.
 15. Ibid.; coastal counties population from National Oceanic and Atmospheric Administration, *State of the Coast Report*, "Population: Distribution, Density, and Growth," at <state-of-coast.noaa.gov/bulletins/html/pop_01/national.html>, viewed 25 June 2002.

16. "Heat Wave Deaths Top 1,000," *Associated Press*, 23 May 2002; "India: Heat Toll Up to 760," *Agence France-Presse*, 22 May 2002; Islamabad from World Weather Forecast, *Washington Post*, 15 June 2002.
17. USDA, *Production, Supply, and Distribution*, electronic database, Washington, DC, updated May 2002.
18. BP, *BP Statistical Review of World Energy 2001* (London: Group Media & Publishing, June 2001).
19. Coal from *ibid.*
20. Table 1–8 compiled by Earth Policy Institute from BP, *BP Statistical Review of World Energy 2002* (London: Group Media & Publishing, June 2002), from American Wind Energy Association (AWEA), *Global Wind Energy Market Report* (Washington DC: March 2002), from Worldwatch Institute, *Vital Signs 2002* (New York: W.W. Norton & Company, 2002), from Paul Maycock, *PV News*, various issues; and from Geothermal Energy Association, "World Geothermal Power Up 50%, New US Boom Possible," press release (Washington, DC: 11 April 2002).
21. "Power to the Poor," *The Economist*, 10 February 2001, pp. 21–23.
22. International Geothermal Association, *Interactive World Map*, at <iga.igg.cnr.it/index.php>.
23. Hydroelectric from BP, op. cit. note 18.
24. Figure 1–5 from AWEA, op. cit. note 20, from Christopher Flavin, "Wind Energy Surges," in Worldwatch Institute, op. cit. note 20, pp. 42–43, and from *Windpower Monthly*, various issues.
25. "Winds over European Waters Harnessed for Electricity," *Environmental News Network*, 17 December 2001. According to AWEA, Kansas, North Dakota, and Texas would be able to produce 3,470 billion kilowatt-hours (kWh), exceeding the 3,087 billion kWh used by the United States in 2000, as reported by Department of Energy, Energy Information Administration (DOE, EIA); AWEA, *AWEA Wind Energy Projects Database*, at <www.awea.org/projects/index.html> and EIA Country Analysis Brief, DOE, at <www.eia.doe.gov/emeu/

- cabs/usa.html>. According to Debra Lew and Jeffrey Logan, "Energizing China's Wind Power Sector," Pacific Northwest Laboratory, 2001, at <www.pnl.gov/china/ChinaWnd.htm> viewed 25 May 2001, China has at least 250 gigawatts of exploitable wind potential, roughly equal to the current installed electrical capacity in China as reported by EIA.
26. Larry Flowers, National Renewable Energy Laboratory, "Wind Power Update," at <www.eren.doe.gov/wind/poweringamerica/pdfs/wpa/wpa_update.pdf>, viewed 19 June 2002; Glenn Hasek, "Powering the Future," *Industry Week*, 1 May 2000.
 27. Honda and Daimler-Chrysler from Ann Job, "The Hybrids Are Coming," *Associated Press*, 12 March 2002; Ford from *Hydrogen & Fuel Cell Letter*, April 2002, at <www.hfcletter.com/letter/April02/features.html>, viewed 19 June 2002.
 28. Seth Dunn, "The Hydrogen Experiment," *World Watch*, November/December 2000, pp. 14–25; Reykjavik's buses from World Business Council for Sustainable Development, "DaimlerChrysler, Shell, and Norsk Hydro: The Iceland Experiment," at <www.wbcd.ch/casestud/iceland>, viewed 25 June 2002.
 29. "BP to Build Singapore Stations for Hydrogen Cars," *Reuters*, 23 October 2001.
 30. Denmark and Germany from AWEA, op. cit. note 20, pp. 3–4; Navarra from Felix Avia Aranda and Ignacio Cruz Cruz, "Breezing Ahead: The Spanish Wind Energy Market," *Renewable Energy World*, May–June 2000; wind electric capacity in California from AWEA, "California Wind Energy Projects," at <www.awea.org/projects/california.html>, viewed 23 June 2002, and San Francisco's population from Census 2000, City and County of San Francisco, at <census.abag.ca.gov/counties/SanFranciscoCounty.pdf>, viewed 25 June 2002; calculation made from wind capacity of 1,671 megawatts and using conversion factor of 1 megawatt provides energy for 1,000 people, so California has enough wind capacity to produce electricity for 1.67 million people.
 31. South Dakota from Jim Dehlsen, Clipper Wind, discussion with author, 30 May 2001.

32. Salem from Blair Swezey and Lori Bird, "Businesses Lead the 'Green Power' Charge," *Solar Today*, January/February 2001, p. 24.
33. Output in 1900 from Angus Maddison, *Monitoring the World Economy 1820–1992* (Paris: Organisation for Economic Co-operation and Development, 1995); recent growth from David Malin Roodman, "Economic Growth Falters," in Worldwatch Institute, op. cit. note 20, pp. 58–59, and from International Monetary Fund (IMF), *World Economic Outlook* (Washington, DC: April 2002).
34. "Annual Smoking-Attributable Mortality, Years of Potential Life Lost, and Economic Costs—United States, 1995–1999," *Morbidity and Mortality Weekly Report*, 12 April 2002.
35. Panos Institute, *Economics Forever: Building Sustainability into Economic Policy*, Panos Briefing No. 38 (London: March 2000).
36. "Flood Impact on Economy Limited," *China Daily*, 1 September 1998; Rekenhalter, op. cit. note 9; economic losses and deaths from Munich Re, op. cit. note 9; removal of tree cover from Carmen Revenga et al., *Watersheds of the World* (Washington, DC: World Resources Institute and Worldwatch Institute, 1998); "Forestry Cuts Down on Logging," *China Daily*, 26 May 1998; Eckholm, op. cit. note 9; Erik Eckholm, "China Admits Ecological Sins Played Role in Flood Disaster," *New York Times*, 26 August 1998; Erik Eckholm, "Stunned by Floods, China Hastens Logging Curbs," *New York Times*, 27 February 1998.
37. Damage from Munich Re, op. cit. note 9; economy from IMF, op. cit. note 33.
38. Australia in John Tierney, "A Tale of Two Fisheries," *New York Times Magazine*, 27 August 2000.

PART 2. ECO-ECONOMY INDICATORS: TWELVE TRENDS TO TRACK

Population Growing by 80 Million Annually (pages 87–90)

1. United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001).

2. Ibid.; *The Future of Fertility in Intermediate-Fertility Countries*, paper from the Expert Group Meeting on Completing the Fertility Transition (New York: U.N. Department of Economic and Social Affairs, Population Division, 11–14 March 2002).
3. United Nations, op. cit. note 1.
4. Ibid.
5. Ibid.; United Nations, *Views and Policies Concerning Population Growth and Fertility Among Governments in Intermediate Fertility Countries*, paper from the Expert Group Meeting on Completing the Fertility Transition (New York: U.N. Department of Economic and Social Affairs, Population Division, 11–14 March 2002).
6. John Bongaarts and Charles F. Westoff, *The Potential Role of Contraception in Reducing Abortion*, Working Paper 134 (New York: Population Council, 2000).
7. John Caldwell, “The Contemporary Population Challenge,” paper presented at the Expert Group Meeting on Completing the Fertility Transition (New York: U.N. Department of Economic and Social Affairs, Population Division, 11–14 March 2002), p. 9; Lawrence Summers, “The Most Influential Investment,” reprinted in *People and the Planet*, vol. 2, no. 1 (1993), p. 10.
8. U.N. Population Fund (UNFPA), “Meeting the Goals of the ICPD: Consequences of Resource Shortfalls up to the Year 2000,” paper presented to the Executive Board of the U.N. Development Programme and the UNFPA, New York, 12–23 May 1997; UNFPA, *Population Issues Briefing Kit* (New York: Prographics, Inc., 2001), p. 23.
9. United Nations, op. cit. note 1.
10. United Nations, *World Urbanization Prospects: The 2001 Revision* (New York: March 2002).
11. Ibid.
12. United Nations, op. cit. note 1.
13. Figure 2–1 from ibid.

Economic Growth Losing Momentum (pages 91–94)

1. Figure 2–2 from David Malin Roodman, “Economic Growth Falters,” in Worldwatch Institute, *Vital Signs 2002* (New York: W.W. Norton & Company, 2002), pp. 58–59.
2. International Monetary Fund (IMF), *World Economic Outlook* (Washington, DC: April 2002), p. 8.
3. Ibid.
4. Ibid., p. 31.
5. Ibid., p. 49.
6. Ibid., p. 8.
7. Ibid., p. 33.
8. Ibid.
9. Ibid.
10. Ibid., p. 42.
11. Ibid., pp. 43–44.
12. IMF, *World Economic Outlook* (Washington, DC: October 2001), pp. 46–47.
13. Unsustainable use of water from Sandra Postel, *Pillar of Sand* (New York: W.W. Norton & Company, 1999), p. 255; conversion of water to grain from U.N. Food and Agriculture Organization (FAO), *Yield Response to Water* (Rome: 1979); current grain harvest from U.S. Department of Agriculture, *World Agricultural Supply and Demand Estimate* (Washington, DC: 12 June 2002).
14. FAO, *The State of World Fisheries and Aquaculture 2000* (Rome: 2000), p. 10.

Grain Harvest Growth Slowing (pages 95–98)

1. Figure 2–3 from U.S. Department of Agriculture (USDA), *World Agricultural Supply and Demand Estimate* (Washington, DC: 12 June 2002), and from USDA, *Production, Supply, and Distribution*, electronic database, updated 10 May 2002.

2. USDA, *World Agricultural Supply and Demand Estimate*, op. cit. note 1; USDA, *Production, Supply, and Distribution*, op. cit. note 1.
3. Grain prices from International Monetary Fund, *International Financial Statistics* (Washington, DC: various years).
4. Water tables in key areas from Sandra Postel, *Pillar of Sand* (New York: W.W. Norton & Company, 1999); share of China's grain harvest from the North China Plain based on Hong Yang and Alexander Zehnder, "China's Regional Water Scarcity and Implications for Grain Supply and Trade," *Environment and Planning A*, January 2001, pp. 79–95, and on USDA, *Production, Supply, and Distribution*, op. cit. note 1; water tables falling in China and India also from International Water Management Institute, "Groundwater Depletion: The Hidden Threat to Food Security," Brief 2, at <www.cgiar.org/iwmi/intro/brief2.htm>, 2001; Bonnie L. Terrell and Phillip N. Johnson, "Economic Impact of the Depletion of the Ogallala Aquifer: A Case Study of the Southern High Plains of Texas," paper presented at the American Agricultural Economics Association annual meeting in Nashville, TN, 8–11 August 1999.
5. Ratio of 1,000 tons of water for 1 ton of grain from U.N. Food and Agriculture Organization (FAO), *Yield Response to Water* (Rome: 1979).
6. Grain imports from USDA, *Grain: World Markets and Trade* (Washington, DC: May 2002).
7. *Ibid.*; USDA, *Production, Supply, and Distribution*, op. cit. note 1.
8. *Ibid.*; 1 ton equals 1 cubic meter.
9. Water use from Peter H. Gleick, *The World's Water 2000–2001* (Washington, DC: Island Press, 2000), p. 64; grain from irrigated land in Ruth S. Meinzen-Dick and Mark W. Rosegrant, eds., "Overview," in *Overcoming Water Scarcity and Quality Constraints* (Washington, DC: International Food Policy Research Institute, October 2001).
10. USDA, *Production, Supply, and Distribution*, op. cit. note 1.
11. FAO, *FAOSTAT Statistics Database*, at <apps.fao.org>, updated 10 July 2001.

12. Fred Gale et al., "China Grain Policy at a Crossroads," *Agricultural Outlook* (Washington, DC: USDA, Economic Research Service (ERS), September 2001); Hsin-Hui Hsu and Fred Gale, coordinators, *China: Agriculture in Transition* (Washington, DC: USDA, ERS, November 2001).
13. Grain stocks from USDA, *World Agricultural Supply and Demand Estimate*, op. cit. note 1.
14. Population from United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001).

Fish Catch Leveling Off (pages 99–102)

1. Figure 2–4 from U.N. Food and Agriculture Organization (FAO), *Yearbook of Fishery Statistics: Capture Production* (Rome: various years); update from FAO, "2000 Capture Production Respect to the Previous Year," at <www.fao.org/fi/statist/snapshot/00vs99/00vs99.asp>, updated 11 March 2002; FAO, *The State of World Fisheries and Aquaculture 2000* (Rome: 2000), p. 10.
2. Reg Watson and Daniel Pauly, "Systematic Distortion in World Fisheries Catch Trends," *Nature*, 29 November 2001, pp. 534–36.
3. SeaWeb, "North Atlantic Study Reveals Food Fish Catches Have Declined by Half—Despite Tripled Fishing Effort," press release on presentation by Daniel Pauly, Andrew Rosenberg, and Reg Watson, American Association for the Advancement of Science (AAAS) annual meeting, 16 February 2002.
4. North Atlantic from *ibid.*; world subsidies from World Wildlife Fund (WWF), *Hard Facts, Hidden Problems: A Review of Current Data on Fishing Subsidies* (Washington, DC: October 2001), pp. ii, 3, and from FAO, *The State of Food and Agriculture 1993* (Rome: 1993), p. 58.
5. Gareth Porter, *Fisheries Subsidies and Overfishing: Towards a Structured Discussion* (Geneva: U.N. Environment Programme, February 2001), p. vii.
6. Ships from FAO, *World Fisheries and Aquaculture*, op. cit. note 1, p. 12; fuel from SeaWeb, op. cit. note 3; sustainable yields from WWF, op. cit. note 4, p. ii.

7. Aquaculture production from FAO, *Yearbook of Fishery Statistics: Aquaculture Production* (Rome: various years), and from 2000 summary tables, at <www.fao.org/fi/statist/summ tab/default.asp>, updated 2002; poultry from FAO, *FAOSTAT Statistics Database*, at <apps.fao.org>, updated 28 May 2002.
8. Rosamond L. Naylor, "Effect of Aquaculture on World Fish Supplies," *Nature*, 29 June 2000, pp. 1017–24.
9. Aquaculture production from FAO, op. cit. note 7; China from Naylor, op. cit. note 8, and from K. J. Rana, "China," in FAO, *Review of the State of World Aquaculture*, Fisheries Circular No. 886 (Rome: 1997); rice and fish polyculture from Li Kangmin, "Rice Aquaculture Systems in China: A Case of Rice-Fish Farming from Protein Crops to Cash Crops," Proceedings of the Internet Conference on Integrated Biosystems 1998, at <www.ias.unu.edu/proceedings/icibs/li/paper.htm>, viewed 5 July 2000.
10. Naylor, op. cit. note 8; Rosamond L. Naylor et al., "Nature's Subsidy to Shrimp and Salmon Farming," *Science*, 30 October 1998, pp. 883–84; Rebecca J. Goldberg, Matthew S. Elliott, and Rosamond L. Naylor, *Marine Aquaculture in the United States* (Arlington, VA: Pew Oceans Commission, 2001).
11. Benjamin Halpern, "The Impact of Marine Reserves: Do Reserves Work and Does Reserve Size Matter?" *Ecological Applications* (in press).
12. Marine Stewardship Council, at <www.msc.org>.

Forest Cover Shrinking (pages 103–07)

1. Forest worth from Robert Costanza et al., "The Value of the World's Ecosystem Services and Natural Capital," *Nature*, 15 May 1997, pp. 253–60; gross world product from International Monetary Fund, *World Economic Outlook WEO Database*, at <www.imf.org/external/pubs/ft/weo/2002/01/index.htm>, April 2002.
2. U.N. Food and Agriculture Organization (FAO), *Forest Resources Assessment (FRA) 2000*, at <www.fao.org/forestry/fo/fra/index.jsp>, updated 10 April 2001; historical perspective from Emily Matthews et al., *Pilot Analysis of Forest*

- Ecosystems: Forest Ecosystems* (Washington, DC: World Resources Institute (WRI), 2000), p. 16.
3. FAO, *State of the World's Forests 2001* (Rome: 2001), pp. 58–59.
 4. Ibid., pp. 154–57; Mexico from Nick Miles, "Mexico's 'Devastating' Forest Loss," *BBC News*, 4 March 2002, and from "Mexico: Deforestation Progresses, But Not the Measures to Prevent It," *World Rainforest Movement Bulletin*, January 2002.
 5. FAO, op. cit. note 3, pp. 58–59; Indonesia from Forest Watch Indonesia (FWI) and Global Forest Watch (GFW), *The State of the Forest: Indonesia* (Bogor, Indonesia, and Washington, DC: 2002), p. xi.
 6. Matthews et al., op. cit. note 2, p. 3; "Reports Conclude Much of World's Remaining Intact Forests At Risk," press release (Washington, DC: WRI, 3 April 2002).
 7. Matthews et al., op. cit. note 2, pp. 4–5.
 8. Dave Currey et al., *Timber Trafficking: Illegal Logging in Indonesia, South East Asia and International Consumption of Illegally Sourced Timber* (London: Emerson Press, Environmental Investigation Agency and Telapak Indonesia, September 2001), p. 5; Jim Ford and Alexander Sheingauz, "Major Trends and Issues in Forests and Forestry: Globally and in Russia," presentation for Commercial Forestry in the Russian Far East: Opportunities for Sustainable Trade, Conservation and Community Development Conference, Economic Research Institute, Yuzhno-Sakhalinsk, Russia, 18–20 September 2001.
 9. FAO, op. cit. note 3, p. 37; Matthews et al., op. cit. note 2, p. 4.
 10. FWI and GFW, op. cit. note 5, p. xii.
 11. United Nations Environment Programme, *An Assessment of the Status of the World's Remaining Closed Forests* (Nairobi: 2001), p. 1.
 12. Forest Stewardship Council, *Forests Certified by FSC-Accredited Bodies*, at <www.fscoax.org>, updated 30 June 2001.

Water Scarcity Spreading (pages 108–11)

1. Water demand in Peter H. Gleick, *The World's Water 2000–2001* (Washington, DC: Island Press, 2000).
2. Drying of rivers in Sandra Postel, *Pillar of Sand* (New York: W.W. Norton & Company, 1999).
3. Ibid., pp. 261–62; Jim Carrier, “The Colorado: A River Drained Dry,” *National Geographic*, June 1991, pp. 4–32.
4. Lester R. Brown, “The Aral Sea: Going, Going...,” *World Watch*, January/February 1991, pp. 20–27.
5. Lester R. Brown, and Brian Halweil, “China’s Water Shortages Could Shake World Food Security,” *World Watch*, July/August 1998, pp. 10–21.
6. Lake Chad from Michael T. Coe and Jonathan A. Foley, “Human Impacts on the Water Resources of Lake Chad,” *Journal of Geophysical Research-Atmospheres*, 27 February 2001, pp. 3349–56; Hebei Province from Economist Intelligence Unit, “China Industry: Heavy Usage, Pollution Are Hurting Water Resources,” *EIU ViewsWire*, 27 February 2001.
7. Water tables in key food-producing areas from Postel, op. cit. note 2; share of China’s grain harvest from the North China Plain based on Hong Yang and Alexander Zehnder, “China’s Regional Water Scarcity and Implications for Grain Supply and Trade,” *Environment and Planning A*, vol. 33, January 2001, pp. 79–95, and on U.S. Department of Agriculture (USDA), *Production, Supply, and Distribution*, electronic database, updated 10 May 2002; water tables falling in China and India from International Water Management Institute, “Groundwater Depletion: The Hidden Threat to Food Security,” Brief 2, at <www.cgiar.org/iwmi/intro/brief2.htm>, 2001; China from James Kynge, “China Approves Controversial Plan to Shift Water to Drought-Hit Beijing,” *Financial Times*, 7 January 2000; Bonnie L. Terrell and Phillip N. Johnson, “Economic Impact of the Depletion of the Ogallala Aquifer: A Case Study of the Southern High Plains of Texas,” paper presented at the American Agricultural Economics Association annual meeting in Nashville, TN, 8–11 August 1999.
8. Grain imports from USDA, *Grain: World Markets and Trade*

- (Washington, DC: May 2002), and from USDA, op. cit. note 7.
9. Chenaran Agricultural Center, Ministry of Agriculture, according to Hamid Taravati, publisher, Iran, e-mail to author, 25 June 2002.
 10. Ibid.
 11. Population from United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001); Yemen’s water situation from Christopher Ward, “Yemen’s Water Crisis,” based on a lecture to the British Yemeni Society in September 2000, at <www.al-bab.com/bys/articles/ward01.htm>, July 2001; Christopher Ward, *The Political Economy of Irrigation Water Pricing in Yemen* (Sana’a, Yemen: World Bank, November 1998); Marcus Moench, “Groundwater: Potential and Constraints,” Focus 9, in Ruth S. Meinzen-Dick and Mark W. Rosegrant, eds., *Overcoming Water Scarcity and Quality Constraints* (Washington, DC: International Food Policy Research Institute, October 2001); “High and Dry: Why Yemen is Running Out of Water,” *The Economist*, 30 March 2002.
 12. Population and water availability from Tom Gardner-Outlaw and Robert Engelman, *Sustaining Water, Easing Scarcity: A Second Update* (Washington, DC: Population Action International, 1997).
 13. Figure 2–5 from U.N. Food and Agriculture Organization, *FAOSTAT Statistics Database*, at <apps.fao.org>, updated 10 July 2001.

Carbon Emissions Climbing (pages 112–15)

1. Figure 2–6 from Seth Dunn, “Carbon Emissions Reach New High,” in Worldwatch Institute, *Vital Signs 2002* (New York: W.W. Norton & Company, 2002), pp. 52–53; Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* (New York: Cambridge University Press, 2001), p. 7.
2. Dunn, op. cit. note 1.

3. Emission source from IPCC, *op. cit.* note 1; projected usage from U.S. Department of Energy, Energy Information Administration, *International Energy Outlook 2002* (Washington, DC: March 2002), pp. 26, 43, 70; decline calculations from data in British Petroleum, *Statistical Review of World Energy 2001* (London: Group Media & Publishing, June 2001).
4. Carbon dioxide concentrations from Seth Dunn, *Hydrogen Futures: Toward a Sustainable Energy System*, Worldwatch Paper 157 (Washington, DC: Worldwatch Institute, August 2001), p. 25; surface temperature projections from IPCC, *op. cit.* note 1, p. 13.
5. Pew Center on Global Climate Change, *Climate Change: Science, Strategies, & Solutions* (Boston: Brill, 2001), p. 380.
6. Rodger Doyle, "Greenhouse Follies," *Scientific American*, April 2002, p. 29.
7. Kyoto commitments from Hermann E. Ott, "The Kyoto Protocol to the UN Framework Convention on Climate Change—Finished and Unfinished Business," at <www.wupperinst.org/Publikationen/Kyoto_Protokoll.htm>, viewed 23 May 2002; current status from U.N. Framework Convention on Climate Change, "Kyoto Protocol: Status of Ratification," at <unfccc.int/resource/kpstats.pdf>, viewed 11 June 2002.
8. American Council for an Energy-Efficient Economy, "The 2001 Carbon Scorecard: United States Seriously Lags Behind Industrialized World in Controlling Emissions," press release (Washington, DC: 13 May 2002).
9. IPCC, *op. cit.* note 1, p.12.
10. Fossil fuel subsidies from Dunn, *op. cit.* note 4, p. 10.

Global Temperature Rising (pages 116–18)

1. Figure 2–7 from National Aeronautics and Space Administration, Goddard Institute for Space Studies, "Global Temperature Anomalies in .01 C," at <www.giss.nasa.gov/data/update/gistemp/GLB.Ts.txt>, viewed 20 June 2002.
2. *Ibid.*

3. *Ibid.*
4. Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* (New York: Cambridge University Press, 2001), p. 13.
5. *Ibid.*
6. World Bank, *World Development Report 1999/2000* (New York: Oxford University Press, 2000), p. 100.
7. IPCC, *op. cit.* note 4.

Ice Melting Everywhere (pages 119–23)

1. Intergovernmental Panel on Climate Change (IPCC), *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* (New York: Cambridge University Press, 2001). Table 2–2 from the following: Lisa Mastny, "Melting of Earth's Ice Cover Reaches New High," *Worldwatch News Brief* (Washington, DC: Worldwatch Institute, 6 March 2000), updated by Earth Policy Institute with National Snow and Ice Data Center, "Antarctic Ice Shelf Collapses," at <nsidc.org/iceshelves/larsenb2002>, 19 March 2002, with "Breakaway Bergs Disrupt Antarctic Ecosystem," *Environment News Service*, 9 May 2002, and with Lonnie G. Thompson, "Disappearing Glaciers Evidence of a Rapidly Changing Earth," American Association for the Advancement of Science annual meeting proceedings, San Francisco, CA, February 2001. Additional ice melt data from University of Colorado at Boulder, "Global Sea Levels Likely to Rise Higher in 21st Century than Previous Predictions," press release (Boulder, CO: 16 February 2002), from Mark Dyurgerov, *Glacier Mass Balance and Regime: Data of Measurements and Analysis*, Occasional Paper No. 55 (Boulder, CO: Institute of Arctic and Alpine Research, University of Colorado, 2002), and from Mark F. Meier and John M. Wahr, "Sea Level is Rising: Do We Know Why?" *Proceedings of the National Academies of Science*, 14 May 2002.

2. University of Colorado at Boulder, op. cit. note 1.
3. "Alaska Examines Impacts of Global Warming," *National Geographic News*, 21 December 2001; Mastny, op. cit. note 1.
4. American Institute of Physics, "New Research Shows Mountain Glaciers Shrinking Worldwide," press release (Boston: 30 May 2001).
5. Thompson, op. cit. note 1.
6. Mastny, op. cit. note 1.
7. Thompson, op. cit. note 1.
8. National Science Foundation, Office of Polar Programs, "Ice Sheets," at <www.nsf.gov/od/opp/support/icesheet.htm>, updated March 2001.
9. National Snow and Ice Data Center, op. cit. note 1; "Melting of Antarctic Ice Shelves Accelerates," *Environment News Network*, 9 April 1999.
10. D. A. Rothrock et al., "Thinning of the Arctic Sea-Ice Cover," *Geophysical Research Letters*, 1 December 1999, pp. 3469–72; Lars H. Smedsrud and Tore Furevik, "Towards an Ice-Free Arctic?" *Cicerone*, no. 2, 2000.
11. Richard A. Kerr, "Will the Arctic Ocean Lose All Its Ice?" *Science*, 3 December 1999, p. 1828; open water from John Noble Wilford, "Ages-Old Icecap at North Pole Is Now Liquid, Scientists Find," *New York Times*, 19 August 2000.
12. W. Krabill et al., "Greenland Ice Sheet: High Elevation Balance and Peripheral Thinning," *Science*, 21 July 2000, p. 428.
13. Ibid.
14. IPCC, op. cit. note 1.

Wind Electric Generation Soaring (pages 124–28)

1. American Wind Energy Association (AWEA), *Global Wind Energy Market Report* (Washington DC: March 2002).
2. Wind from Christopher Flavin, "Wind Energy Surges," in Worldwatch Institute, *Vital Signs 2002* (New York: W.W. Norton & Company, 2002), pp. 42–43; coal from Seth Dunn, "Fos-

- sil Fuel Use Inches Up," in *ibid.*, pp. 38–39.
3. European Wind Energy Association (EWEA), "Another Record Year for European Wind Power," press release (Brussels: 20 February 2002); AWEA, op. cit. note 1; AWEA, "Wind Energy Grew Globally at Record Clip in 2001, Report Finds," press release (Washington DC: 19 March 2002).
4. "Winds over European Waters Harnessed for Electricity," *Environment News Network*, 17 December 2001. According to AWEA, Texas, North Dakota, and Kansas would be able to produce 3,470 billion kilowatt-hours (kWh), exceeding the 3,087 billion kWh used by the United States in 2000, as reported by U.S. Department of Energy, Energy Information Administration (DOE, EIA); AWEA, *AWEA Wind Energy Projects Database*, at <www.awea.org/projects/index.html>, and EIA Country Analysis Brief, DOE, at <www.eia.doe.gov/emeu/cabs/usa.html>. According to Debra Lew and Jeffrey Logan, "Energizing China's Wind Power Sector," Pacific Northwest Laboratory, 2001, at <www.pnl.gov/china/ChinaWnd.htm>, viewed 25 May 2001, China has at least 250 gigawatts of exploitable wind potential, roughly equal to the current installed electrical capacity in China as reported by EIA.
5. Figure 2–8 from Larry Flowers, National Renewable Energy Laboratory, "Wind Power Update," at <www.eren.doe.gov/windpoweringamerica/pdfs/wpa/wpa_update.pdf>, viewed 19 June 2002, and from Glenn Hasek, "Powering the Future," *Industry Week*, 1 May 2000; tax credit extension from "US Wind Power Industry Gets Tax Credit Boost," *Reuters*, 13 March 2002; new wind farms from AWEA, op. cit. note 4.
6. Ann Job, "The Hybrids Are Coming," *Associated Press*, 12 March 2002.
7. Nordex, "Nordex Asserting Itself Well in a Difficult Environment," press release (Hamburg: 27 May 2002).
8. EWEA, AWEA, and Indian Wind Turbine Manufacturers Association, "Global Windpower Conference Heralds Major Clean Energy Expansion," press release (Paris: 2 April 2002).
9. Norton Rose, "Wind Power in France," briefing paper (London: 2001), p. 4; "Argentina Will Power the Future with Wind," *Environment News Service*, 9 February 2001; "Britain

- Gears Up for Offshore Wind Power,” *Reuters*, 9 April 2001; China from “Wind Wire: The Month in Brief,” *Windpower Monthly*, January 2002, p. 12.
10. Stateline Project and Texas from AWEA, op. cit. note 1, p. 5; South Dakota from Jim Dehlsen, Clipper Wind, discussion with author, 30 May 2001.
 11. “German Onshore Wind Plant Build Seen Peaking in 02,” *Reuters*, 19 June 2002.
 12. AWEA, op. cit. note 1.
 13. Ibid.

Bicycle Production Breaks 100 Million (pages 129–32)

1. Figure 2–9 from Bicycle Retailer and Industry News, “World Market Report” and “Fast Facts,” *Industry Directory 2002* (Santa Fe, NM: Bill Communications, 2002), pp. 4–10, and from Gary Gardner, “Bicycle Production Rolls Forward,” in Worldwatch Institute, *Vital Signs 2002* (New York: W.W. Norton & Company, 2002), pp. 76–77.
2. Bicycle Retailer and Industry News, op. cit. note 1.
3. Ibid.
4. Ibid.; African market from Paul Steely White, “Africa’s Bike Dealers Hold Keys to Livable Cities,” *Sustainable Transport*, fall 2001, pp. 24–29.
5. White, op. cit. note 4; Paul Steely White and Noah Budnick, “A New Bicycle for Africa,” *Sustainable Transport*, fall 2001, pp. 26–27.
6. White and Budnick, op. cit. note 5; Afribike from <www.afribike.org>, viewed 28 May 2002.
7. White, op. cit. note 4, p. 29.
8. Road space from Todd Litman, *Evaluating Transportation Land Use Impacts* (Victoria, BC, Canada: Victoria Transport Policy Institute, 2 April 2002), pp. 9–10; electric and fuel cell bicycles from Mike Byfield, “The Fuel-Cell Bicycle is Here,” *Report Newsmagazine*, 18 February 2002, p. 34.

9. Peter Newman and Jeffrey Kenworthy, *Sustainability and Cities* (Washington, DC: Island Press, 1999), pp. 206–07; City Bikes from Klaus Hildebrandt, City Bike Foundation, e-mail to author, 17 June 2002, and from <www.bycyklen.dk>.
10. Newman and Kenworthy, op. cit. note 9, p. 208; John Pucher and Christian Lefèvre, *The Urban Transport Crisis in Europe and North America* (London: Macmillan, 1996), cited in Todd Litman, *Quantifying the Benefits of Non-Motorized Transport for Achieving TDM Objectives* (Victoria, BC, Canada: Victoria Transport Policy Institute, 1 December 1999), p. 8.
11. World automobile fleet from Ward’s *World Motor Vehicle Data* (Southfield, MI: Ward’s Communications, 2000); China from Philip P. Pan, “Bicycles No Longer King of the Road in China,” *Washington Post*, 12 March 2001.
12. Pucher and Lefèvre, op. cit. note 10.
13. Bicycle production from Gardner, op. cit. note 1; historical automobile production data compiled by Michael Renner, “Vehicle Production Declines Slightly,” in Worldwatch Institute, op. cit. note 1, p. 75.

Solar Cell Sales Booming (pages 133–37)

1. Figure 2–10 derived from Paul Maycock, *PV News*, cited in Molly O. Sheehan, “Solar Cell Use Rises Quickly,” in Worldwatch Institute, *Vital Signs 2002* (New York: W.W. Norton & Company, 2002), p. 45.
2. Top five producers from Michael Schmela, “Beyond Expectations: Market Survey on World Cell Production in 2001,” *Photon International*, March 2002, pp. 38–39; European Photovoltaic Industry Association (EPIA) and Greenpeace, *The Solar Generation* (Washington, DC: September 2001), p. 22.
3. EPIA and Greenpeace, op. cit. note 2, pp. 18–21; Schmela, op. cit. note 2, p. 43.
4. Paul Maycock, *PV Energy Systems*, discussion with author, 24 April 2002.
5. Calculations from *ibid.*, and from Schmela, op. cit. note 2.

6. Current costs from Sheehan, op. cit. note 1, p. 44; Robert H. Williams, "Facilitating Widespread Deployment of Wind and Photovoltaic Technologies," *Energy Foundation 2001 Annual Report*, February 2002, pp. 21–22.
7. EPIA and Greenpeace, op. cit. note 2, p. 7; Williams, op. cit. note 6, p. 22.
8. People without electricity from U.N. Development Programme, "Introduction," in *Energy After Rio: Prospects and Challenges*, at <www.undp.org/seed/energy/chapter1.html>, viewed 21 June 2002; microcredit payoffs from Robert Freling, Solar Electric Light Fund, discussion with author, 1 May 2002.
9. EPIA and Greenpeace, op. cit. note 2, p. 27, gives the figure of up to 350 kilograms of annual carbon dioxide emissions. Calculation was made of carbon's share using the atomic weights of carbon and oxygen.
10. BP pamphlet, "Solar Electricity: Brilliantly Simple," cited in Solar Century, "Solar Homes," at <www.solarcentury.co.uk/homes>, viewed 2 May 2002; calculation on emission reduction was made using the conservative assumption of saving 0.6 kilograms of carbon dioxide per kilowatt-hour of solar output, from EPIA and Greenpeace, op. cit. note 2, multiplied by U.K. electricity consumption of 333 million kilowatt-hours in 1999 (from CIA, "United Kingdom," *World Fact Book*, at <www.cia.gov/cia/publications/factbook/geos/uk.html>, viewed 28 May 2002).
11. Maria Saporta, "'Zero Energy' Homes Are Builder's Pride," *Atlanta Journal-Constitution*, 15 April 2002.
12. Sharp and industry-wide projection from "Japan Solar Cell Makers to Boost Production," *Reuters*, 6 May 2002.

PART 3. ECO-ECONOMY UPDATES

U.S. Farmers Double Cropping Corn and Wind Energy (pages 143–47)

1. For corn, calculations by author from John Dittrich, American Corn Growers Association, "Major Crops: A 27-Year History with Inflation Adjustments," *Key Indicators of the U.S.*

1. *Farm Sector* (Washington, DC: January 2002); wind royalties from Union of Concerned Scientists, "Farming the Wind: Wind Power and Agriculture," at <www.ucsusa.org/energy/fact_wind.html>.
2. Cost reduction history from Glenn Hasek, "Powering the Future," *Industry Week*, 1 May 2000.
3. According to American Wind Energy Association (AWEA), Kansas, North Dakota, and Texas would be able to produce 3,470 billion kilowatt-hours (kWh), exceeding the 3,087 billion kWh used by the United States in 2000, as reported by U.S. Department of Energy (DOE), Energy Information Administration (EIA); AWEA, *AWEA Wind Energy Projects Database*, at <www.awea.org/projects/index.html> and EIA Country Analysis Brief, DOE, at <www.eia.doe.gov/emeu/cabs/usa.html>.
4. Beef from author's personal experience with ranches in southern Wyoming and northern Colorado; wheat from Dittrich, op. cit. note 1.
5. Calculation from Tom Gray, AWEA, e-mail to author, 12 June 2002.
6. "BTM Predicts Continued Growth for Wind Industry," *Renewable Energy Report (Financial Times)*, May 2001, p. 8; figure of 60 percent is based on listed market shares of top wind turbine suppliers; Tom Gray, "Wind is Getting Stronger and is On Course for the Next Decade," *Renewable Energy World*, May 1999.
7. Ford cited in David Bjerklie et al., "Look Who's Trying to Turn Green," *Time*, 9 November 1998.
8. Public Service Company of Colorado, "Electricity Generated by the Wind in Colorado," at <www.pscoco.com/solutions/windsource.asp>.
9. Minnesota from Minnesota Wind Energy Factsheet, at <www.me3.org/projects/seed/windfact.html>; Texas from DOE, Energy Efficiency and Renewable Energy Network, State Energy Alternatives, "Policy Case Study for Texas," at <www.eren.doe.gov/state_energy/policy_casestudies_texas.cfm>.
10. DOE, "Energy Secretary Richardson Directs Department to

Buy More 'Green Power,'" press release (Washington, DC: 20 April 2000).

11. AWEA, *Global Wind Energy Market Report 2000*, at <www.awea.org/faq/global2000.html>, viewed 25 June 2001; Denmark from Christopher Flavin, Worldwatch Institute, *Vital Signs 2001*, press briefing, Washington, DC, 24 May 2001; Germany from AWEA, *Wind Energy Press Background Information* (Washington, DC: February 2001), and from Christian Hinsch, "Wind Power Flying Even Higher," *New Energy*, February 2001, pp. 14–20; Navarra from Felix Avia Aranda and Ignacio Cruz Cruz, "Breezing Ahead: The Spanish Wind Energy Market," *Renewable Energy World*, May–June 2000; Debra Law and Jeffrey Logan, "Energizing China's Wind Power Sector," Pacific Northwest Laboratory, 2001, at <www.pnl.gov/china/ChinaWnd.htm>, viewed 25 May 2001.
12. Author's observations in traveling through countries.

The Rise and Fall of the Global Climate Coalition (pages 148–52)

1. William Drozdiak, "U.S. Firms Become 'Green' Advocates," *Washington Post*, 24 November 2000.
2. PR Watch, "Impropaganda Review: Global Climate Coalition," <www.prwatch.org/improp/gcc.html>.
3. John Browne, Chief Executive, BP, speech delivered at Stanford University, Stanford, CA, 19 May 1997.
4. Ibid.; Martha M. Hamilton, "Shell Leaves Coalition That Opposes Global Warming Treaty," *Washington Post*, 22 April 1998.
5. Ford cited in David Bjerklie et al., "Look Who's Trying to Turn Green," *Time*, 9 November 1998.
6. "Ford Motor Co. Leaves Anti-Kyoto Coalition," *Environment News Service*, 7 December 1999.
7. Keith Bradsher, "Ford Announces Its Withdrawal From Global Climate Coalition," *New York Times*, 7 December 1999; David Goodman, "GM Joins DaimlerChrysler, Ford, Quits Global Warming Lobby Group," *Associated Press*, 14 March 2000; "Texaco Leaving Anti-Global Warming Treaty Group,"

- Reuters*, 29 February 2000; statement of Daniel Becker in Sierra Club, "Sierra Club Applauds General Motors' Exit from Global Warming Front Group," press release (Washington, DC: 14 March 2000).
8. Pew Center on Global Climate Change, Business Environmental Leadership Council, "Joint Statement of the Business Environmental Leadership Council," at <www.pewclimate.org>.
 9. Pew Center on Global Climate Change, Business Environmental Leadership Council, "BP Amoco," at <www.pewclimate.org/belc/amoco.cfm>.
 10. Dupont will cut emissions by 65 percent by 2010, according to their position statement, "Global Climate Change" (Wilmington, DE: 5 June 2001).
 11. Seth Dunn, "The Hydrogen Experiment," *World Watch*, November/December 2000, p. 21.
 12. Seth Dunn, "Fossil Fuel Use in Flux," in Lester R. Brown et al., *Vital Signs 2000* (New York: W.W. Norton & Company, 2000), pp. 52–53.
 13. Lisa Mastny, "Melting of Earth's Ice Cover Reaches New High," *Worldwatch News Brief* (Washington, DC: 6 March 2000); John Noble Wilford, "Ages-Old Icecap at North Pole Is Now Liquid, Scientists Find," *New York Times*, 19 August 2000; 50-year projection in Lars H. Smedsrud and Tore Furevik, "Towards an Ice-Free Arctic?" *Cicerone*, no. 2, 2000.
 14. U.S. Department of Agriculture, Economic Research Service, "Cigarette Price Increase Follows Tobacco Pact," *Agricultural Outlook*, January–February 1999.
 15. PR Watch, op. cit. note 2.
 16. Michael Bowlin, speech to Cambridge Energy Research Associates, 18th annual meeting, 9 February 1999.

Climate Change Has World Skating on Thin Ice (pages 153–57)

1. John Noble Wilford, "Ages-Old Icecap at North Pole Is Now Liquid, Scientists Find," *New York Times*, 19 August 2000.

2. Fifty-year projection in Lars H. Smedsrud and Tore Furevik, "Towards an Ice-Free Arctic?" *Cicerone*, no. 2, 2000; W. Krabill et al., "Greenland Ice Sheet: High Elevation Balance and Peripheral Thinning," *Science*, 21 July 2000, p. 428.
3. Lisa Mastny, "Melting of Earth's Ice Cover Reaches New High," *Worldwatch News Brief* (Washington, DC: 6 March 2000); Wilford, op. cit. note 1.
4. Krabill et al., op. cit. note 2; usable flow of the Nile River from Sandra Postel, *Pillar of Sand* (New York: W.W. Norton & Company, 1999), pp. 71, 146.
5. "Melting of Antarctic Ice Shelves Accelerates," *Environment News Network*, 9 April 1999.
6. Ibid.
7. Mastny, op. cit. note 3.
8. Ibid.
9. Ibid.
10. Fossil-fuel-related carbon emissions figure from Seth Dunn, "Carbon Emissions Continue Decline," in Worldwatch Institute, *Vital Signs 2001* (New York: W.W. Norton & Company, 2001), p. 53.
11. National Aeronautics and Space Administration, Goddard Institute for Space Studies, "Global Temperature Anomalies in .01 C," at <www.giss.nasa.gov/data/update/gistemp>, viewed 8 June 2001; Seth Dunn, "Global Temperature Steady," in Worldwatch Institute, op. cit. note 10, pp. 50–51.
12. Christopher B. Field et al., *Confronting Climate Change in California: Ecological Impacts on the Golden State* (Cambridge, MA: Union of Concerned Scientists, 1999), pp. 2–3, 10.
13. Mastny, op. cit. note 3; Dorthe Dahl-Jensen, "The Greenland Ice Sheet Reacts," *Science*, 21 July 2000, p. 404–05.
14. World Bank, *World Development Report 1999/2000* (New York: Oxford University Press, 2000), p. 100.
15. Seth Dunn, "The Hydrogen Experiment," *World Watch*, November/December 2000, pp. 14–25.

OPEC Has World Over a Barrel Again (pages 158–63)

1. Neela Banerjee, "As Prices Rise, Nations Ask for More Oil," *New York Times*, 8 September 2000.
2. Kenneth Bredemeier, "Oil Prices Hit A 10-Year High," *Washington Post*, 7 September 2000.
3. Trade in oil from BP Amoco, *BP Amoco Statistical Review of World Energy 2000* (London: Group Media & Publishing, June 2000); grain from U.S. Department of Agriculture, *Production, Supply, and Distribution*, electronic database, Washington, DC, updated August 2000.
4. Wheat and oil prices from International Monetary Fund, *International Financial Statistics* (Washington, DC: various years).
5. Ibid.
6. Ibid.; oil imports from BP Amoco, op. cit. note 3.
7. John Noble Wilford, "Ages-Old Icecap at North Pole Is Now Liquid, Scientists Find," *New York Times*, 19 August 2000; Lisa Mastny, "Melting of Earth's Ice Cover Reaches New High," *Worldwatch News Brief* (Washington, DC: 6 March 2000); 50-year projection in Lars H. Smedsrud and Tore Furevik, "Towards an Ice-Free Arctic?" *Cicerone*, no. 2, 2000.
8. Mastny, op. cit. note 7; Dorthe Dahl-Jensen, "The Greenland Ice Sheet Reacts," *Science*, 21 July 2000, p. 404–05.
9. Lester R. Brown, "The Acceleration of Change," in Lester R. Brown et al., *Vital Signs 2000* (New York: W.W. Norton & Company, 2000), p. 18.
10. International Energy Agency, "Japan: Overview of Renewable Energy Policy," in *Renewable Energy Policy in IEA Countries, Volume 2: Country Reviews* (Paris: 1998).
11. Denmark from Christopher Flavin, "Wind Power Booms," in Brown et al., op. cit. note 9, pp. 56–57; Germany from American Wind Energy Association (AWEA), *Wind Energy Press Background Information* (Washington, DC: February 2001), and from Christian Hinsch, "Wind Power Flying Even Higher," *New Energy*, February 2001, pp. 14–20; Navarra from Felix Avia Aranda and Ignacio Cruz Cruz, "Breezing Ahead:

The Spanish Wind Energy Market,” *Renewable Energy World*, May–June 2000.

12. According to AWEA, Kansas, North Dakota, and Texas would be able to produce 3,470 billion kilowatt-hours (kWh), exceeding the 3,087 billion kWh used by the United States in 2000, as reported by U.S. Department of Energy (DOE), Energy Information Administration (EIA).
13. Cost of Saudi Arabian oil production from DOE/EIA, “Saudi Arabia,” at <www.eia.doe.gov/emeu/cabs/saudi.html>.
14. John J. Fialka, “Clinton Seeks Saudi Help on Oil Output,” *Wall Street Journal*, 8 September 2000.

Wind Power: The Missing Link in the Bush Energy Plan (pages 164–68)

1. National Energy Policy Development Group, *National Energy Policy* (Washington, DC: U.S. Government Printing Office, May 2001).
2. Coal consumption from John Pomfret, “Research Casts Doubt on China’s Pollution Claim,” *Washington Post*, 15 August 2001.
3. Christopher Flavin, “Wind Energy Growth Continues,” in Worldwatch Institute, *Vital Signs 2001* (New York: W.W. Norton & Company, 2001), pp. 44–45; American Wind Energy Association (AWEA), “President’s Energy Plan is Useful First Step, Wind Energy Association Says,” press release (Washington, DC: 17 May 2001).
4. AWEA, “US Installed Capacity (MW) 1981–2001,” at <www.awea.org/faq/instcap.html>, viewed 25 June 2001; “World’s Largest Wind Plant to Energize the West,” Pacific-Corp and FPL Energy, press release (Salt Lake City, UT, and Juno Beach, FL: 10 January 2001).
5. George Darr, “Astonishing Number of Wind Proposals Blows into BPA,” Bonneville Power Administration, press release (Portland, OR: 26 April 2001).
6. Jim Dehlsen, Clipper Wind, discussion with author, 30 May 2001.

7. Cost reduction history from Glenn Hasek, “Powering the Future,” *Industry Week*, 1 May 2000.
8. According to AWEA, Kansas, North Dakota, and Texas would be able to produce 3,470 billion kilowatt-hours (kWh), exceeding the 3,087 billion kWh used by the United States in 2000, as reported by U.S. Department of Energy (DOE), Energy Information Administration (EIA); AWEA, *AWEA Wind Energy Projects Database*, at <www.awea.org/projects/index.html> and EIA Country Analysis Brief, DOE, at <www.eia.doe.gov/emeu/cabs/usa.html>. According to Debra Lew and Jeffrey Logan, “Energizing China’s Wind Power Sector,” Pacific Northwest Laboratory, 2001, at <www.pnl.gov/china/ChinaWnd.htm>, China has at least 250 gigawatts of exploitable wind potential, roughly equal to the current installed electrical capacity in China as reported by EIA.
9. Denmark from Christopher Flavin, Worldwatch Institute, *Vital Signs 2001* press briefing, Washington, DC, 24 May 2001; Germany from AWEA, *Wind Energy Press Background Information* (Washington, DC: February 2001), and from Christian Hinsch, “Wind Power Flying Even Higher,” *New Energy*, February 2001, pp. 14–20; Navarra from Felix Avia Aranda and Ignacio Cruz Cruz, “Breezing Ahead: The Spanish Wind Energy Market,” *Renewable Energy World*, May–June 2000.
10. Dominique Magada, “France Sets Ambitious Target for Renewable Power,” *Reuters*, 10 December 2000; Argentina from “Under Spanish Proposal, 15 Percent of Total Would be Eolic Energy,” *Agencia EFE*, 7 February 2001; “UK Makes Leap into Offshore Wind Big Time,” *Renewable Energy Report (Financial Times)*, May 2001.
11. European Wind Energy Association, “Wind Energy in Europe,” at <www.ewea.org/src/europe.htm>.
12. Lester R. Brown, “U.S. Farmers Double-Cropping Corn and Wind Energy,” *Earth Policy Alert* (Washington, DC: Earth Policy Institute, 7 June 2001).
13. “DaimlerChrysler Unveils Fuel Cell Vehicle,” *Environmental News Network*, 18 March 1999; “Honda Has New Fuel-Cell Car, Toyota Expands Hybrids,” *Reuters*, 29 September 2000;

Ford cited in David Bjerklie et al., "Look Who's Trying to Turn Green," *Time*, 9 November 1998.

14. Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change* (New York: Cambridge University Press, 2001).

Population Growth Sentencing Millions to Hydrological Poverty (pages 169–73)

1. World population growth from United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001).
2. Ibid.
3. Sandra Postel, *Pillar of Sand* (New York: W.W. Norton & Company, 1999); rule of thumb from U.N. Food and Agriculture Organization (FAO), *Yield Response to Water* (Rome: 1979); U.S. Department of Agriculture (USDA), *Production, Supply, and Distribution*, electronic database, Washington, DC, updated May 2001.
4. USDA, op. cit. note 3.
5. Irrigation water information from World Resources Institute (WRI), *World Resources 2000–2001* (Washington, DC: 2001), p. 64; calculation based on 1,000 tons of water for 1 ton of grain from FAO, op. cit. note 3, on global wheat prices from International Monetary Fund, *International Financial Statistics* (Washington, DC: various years), and on industrial water intensity in Mark W. Rosegrant, Claudia Ringler, and Roberta V. Gerpacio, "Water and Land Resources and Global Food Supply," paper prepared for the 23rd International Conference of Agricultural Economists on Food Security, Diversification, and Resource Management: Refocusing the Role of Agriculture?, Sacramento, CA, 10–16 August 1997.
6. Average grain consumption per person derived from USDA, op. cit. note 3, and from United Nations, op. cit. note 1.
7. WRI, op. cit. note 5, p. 274.

8. FAO, op. cit. note 3.
9. USDA, op. cit. note 3.
10. Ibid.; this shows grain imports alone into the region of over 63 million tons, equivalent to 63 billion tons (63 billion cubic meters) of water, nearly the usable flow of the Nile River reported in Postel, op. cit. note 3, p. 146.
11. Total harvest from USDA, op. cit. note 3.

Africa Is Dying—It Needs Help (pages 174–79)

1. Joint United Nations Programme on HIV/AIDS (UNAIDS), *Report on the Global HIV/AIDS Epidemic* (Geneva: June 2000).
2. Ibid.
3. Ibid.
4. Ibid.
5. "AIDS, Diseases to Leave 44 Million Orphans by 2010," *Reuters*, 13 July 2000.
6. UNAIDS, op. cit. note 1, p. 29; university study from Prega Govender, "Shock AIDS Test Result at Varsity," (Johannesburg) *Sunday Times*, 25 April 1999; "South Africa: University Finds 25 Percent of Students Infected," *Kaiser Daily HIV/AIDS Report*, 27 April 1999.
7. UNAIDS, op. cit. note 1, pp. 32–33.
8. Ibid.
9. Ibid.
10. Ibid.
11. Ibid.

HIV Epidemic Restructuring Africa's Population (pages 180–84)

1. Joint United Nations Programme on HIV/AIDS (UNAIDS), *Report on the Global HIV/AIDS Epidemic* (Geneva: June 2000).

2. Ibid.
3. Ibid.
4. Ibid.
5. Ibid.
6. Desmond Cohen, *Socio-Economic Causes and Consequences of the HIV Epidemic in Southern Africa: A Case Study of Namibia*, Issues Paper No. 31 (New York: United Nations Development Programme, HIV and Development Programme, 1998).
7. Elizabeth Pisani, *Data and Decision-making: Demography's Contribution to Understanding AIDS in Africa*, Policy and Research Paper No. 14 (Paris: International Union for the Scientific Study of Population, 1998).
8. UNAIDS, op. cit. note 1, p. 11.
9. Ibid., p. 48.
10. George Tseo, "The Greening of China," *Earthwatch*, May/June 1992.
11. "AIDS, Diseases to Leave 44 Million Orphans by 2010," *Reuters*, 13 July 2000.
12. Cohen, op. cit. note 6; Richard Ingham, "Demographic Effect of AIDS South of Sahara Will Be Like Black Death," *Agence France-Presse*, 10 July 2000.
13. UNAIDS, op. cit. note 1, pp. 32–33.

Obesity Threatens Health in Exercise-Deprived Societies (pages 185–89)

1. William H. Dietz, "Battling Obesity: Notes from the Front," National Center for Chronic Disease Prevention and Health Promotion, *Chronic Disease Notes & Reports*, winter 2000, p. 2; Ali H. Mokdad et al., "The Continuing Epidemic of Obesity in the United States," *Journal of the American Medical Association*, 4 October 2000, p. 1650.
2. National Center for Health Statistics, Centers for Disease Control and Prevention (CDC), "Prevalence of Overweight

- and Obesity Among Adults," at <www.cdc.gov/nchs/products/pubs/pubd/hestats/obese/obse99.htm>, 11 December 2000; Gary Gardner and Brian Halweil, *Underfed and Overfed: The Global Epidemic of Malnutrition*, Worldwatch Paper 150 (Washington, DC: Worldwatch Institute, March 2000), p. 11; Peter G. Kopelman, "Obesity as a Medical Problem," *Nature*, 6 April 2000, p. 636; Barry M. Popkin and Colleen M. Doak, "The Obesity Epidemic is a Worldwide Phenomenon," *Nutrition Reviews*, April 1998, pp. 106–14.
3. Kopelman, op. cit. note 2, p. 636; World Health Organization (WHO), *Obesity: Preventing and Managing the Global Epidemic, Report of a WHO Consultation on Obesity* (Geneva: 1997).
 4. WHO, op. cit. note 3.
 5. National Center for Chronic Disease Prevention and Health Promotion, "Preventing Obesity Among Children," *Chronic Disease Notes & Reports*, winter 2000, p. 1.
 6. Barry M. Popkin, "Urbanization and the Nutrition Transition," *Achieving Urban Food and Nutrition Security in the Developing World, A 2020 Vision for Food, Agriculture, and the Environment*, Focus 3, Brief 7 (Washington, DC: International Food Policy Research Institute, August 2000).
 7. Gardner and Halweil, op. cit. note 2, p. 11; Kopelman, op. cit. note 2, p. 635.
 8. Kopelman, op. cit. note 2, p. 635–43; Ron Winslow, "Why Fitness Matters," *Wall Street Journal*, 1 May 2000.
 9. Kopelman, op. cit. note 2, p. 635.
 10. Deaths from smoking from CDC, *Targeting Tobacco Use: The Nations' Leading Cause of Death* (Washington, DC: 2000); cigarette consumption from U.S. Department of Agriculture (USDA), Foreign Agricultural Service, *World Cigarette Electronic Database*, December 1999, and from USDA, Economic Research Service, *Tobacco: Situation and Outlook Report* (Washington, DC: April 2001).
 11. Winslow, op. cit. note 8; Judy Putnam and Shirley Gerrior, "Trends in the U.S. Food Supply, 1970–97," in Elizabeth Frazao, ed., *America's Eating Habits: Changes and Consequences*

(Washington, DC: USDA, Economic Research Service, May 1999), p. 152.

12. Winslow, op. cit. note 8.
13. Kopelman, op. cit. note 2, p. 638.
14. Ibid.
15. J.M. Friedman, "Obesity in the New Millennium," *Nature*, 6 April 2000, pp. 632–34.
16. Denise Grady, "Doctor's Review of Five Deaths Raises Concern About the Safety of Liposuction," *New York Times*, 13 May 1999.

Iran's Birth Rate Plummeting at Record Pace (pages 190–94)

1. Figure 3–1 from Central Budget and Planning Organization, and Statistics and Registration Administration of Iran, cited by Farzaneh Bahar, Former General Director of Family Planning in Iran's Khorasan state, 23 December 2001, e-mail to author; Abubakar Dungus, "Iran's Other Revolution," *Populi*, September 2000.
2. Homa Hoodfar and Samad Assadpour, "The Politics of Population Policy in the Islamic Republic of Iran," *Studies in Family Planning*, March 2000, pp. 19–34.
3. Khomeini quoted in Doug Schwartz, "Iran: Islam Embraces Contraception," *ForeignWire.com*, 18 July 1998.
4. United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001).
5. Farzaneh Roudi, "Iran's Revolutionary Approach to Family Planning," *Population Today*, July/August 1999, p. 4.
6. "Law of 23 May 1993 Pertaining to Population and Family Planning," *National Report on Population, the Islamic Republic of Iran* (Tehran, Iran: Government of Iran, 1994), pp. 20–21, at <cyber.law.harvard.edu/population/policies/IRAN.htm>.
7. Akbar Aghajanian and Amir H. Mehryar, "Fertility Transition in the Islamic Republic of Iran: 1976–1996," *Asia-Pacific Pop-*

- ulation Journal*, vol. 14, no. 1 (1999), pp. 21–42; Population Reference Bureau (PRB), *2001 World Population Data Sheet*, wall chart (Washington, DC: 2001).
8. Eighty percent from Roudi, op. cit. note 5; Dungus, op. cit. note 1.
 9. Robin Wright, "Iran's New Revolution," *Foreign Affairs*, January/February 2000.
 10. Roudi, op. cit. note 5; Schwartz, op. cit. note 3.
 11. Literacy from PRB, "Iran: Demographic Highlights," fact sheet (Washington, DC: 2001); school enrollment from World Bank, *World Development Indicators 2000* (Washington, DC: 2000); television from Roudi, op. cit. note 5, p. 5.
 12. Absolute water scarcity from David Seckler, David Molden, and Randolph Barker, "Water Scarcity in the Twenty-First Century," *International Water Management Institute Water Brief 1* (Sri Lanka, March 1999); "Thirst Grips Half the Population of Iran," *Environment News Service*, 4 August 2000.
 13. U.S. Department of Agriculture, *Production, Supply, and Distribution*, electronic database, updated November 2001.
 14. Projection for 2008 from United Nations, op. cit. note 4.
 15. PRB, op. cit. note 7.

Paving the Planet: Cars and Crops Competing for Land (pages 195–99)

1. Figure 3–2 from Michael Renner, "Vehicle Production Increases," in Lester R. Brown et al., *Vital Signs 2000* (New York: W.W. Norton & Company, 2000), pp. 86–87.
2. Calculations for paved area by Janet Larsen, Earth Policy Institute, using U.S. Department of Transportation, Federal Highway Administration (FHWA), *Highway Statistics 1999* (Washington, DC: 2001); Mark Delucchi, "Motor Vehicle Infrastructure and Services Provided by the Public Sector," cited in Todd Litman, *Transportation Land Valuation* (Victoria, B.C., Canada: Victoria Transport Policy Institute, November 2000), p. 4; *Ward's World Motor Vehicle Data* (Southfield,

- MI: Ward's Communications, 2000); Jeffrey Kenworthy, Associate Professor in Sustainable Settlements, Institute for Sustainability and Technology Policy, Murdoch University, Australia, e-mail message to author; David Walterscheid, FHWA Real Estate Office, discussion with author.
3. Larsen, *op. cit.* note 2.
 4. *Ibid.*; grain area from U.S. Department of Agriculture (USDA), *Production, Supply, and Distribution*, electronic database, updated January 2001.
 5. Automobile production from *Ward's World Motor Vehicle Data*, *op. cit.* note 2; population from United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001).
 6. Larsen, *op. cit.* note 2; population from United Nations, *op. cit.* note 5.
 7. Larsen, *op. cit.* note 2; economy from International Monetary Fund, *World Economic Outlook* (Washington, DC: October 1999).
 8. Larsen, *op. cit.* note 2; grain area from USDA, *op. cit.* note 4.
 9. Population from United Nations, *op. cit.* note 5; vehicle fleet from *Ward's World Motor Vehicle Data*, *op. cit.* note 2.
 10. Ding Guangwei and Li Shishun, "Analysis of Impetuses to Change of Agricultural Land Uses in China," *Bulletin of the Chinese Academy of Sciences*, vol. 13, no. 1 (1999).
 11. *Ibid.*
 12. Population from United Nations, *op. cit.* note 5.

Dust Bowl Threatening China's Future (pages 200–04)

1. "China Dust Storm Strikes USA," *NOAA News* (National Oceanic and Atmospheric Administration), 18 April 2001; Ann Schrader, "Latest Import From China: Haze," *Denver Post*, 18 April 2001.
2. "Drought Promotes Sandstorms in North China," *People's Daily*, 10 March 2001.

3. Dust storms in China from National Center for Atmospheric Research, "Scientists, Ships, Aircraft to Profile Asian Pollution and Dust." press release (Boulder, CO: 20 March 2001); U.S. Dust Bowl from William K. Stevens, "Great Plains or Great Desert? The Sea of Dunes Lies in Wait," *New York Times*, 28 May 1996.
4. Chang Jae-soon, "Korea, Japan to Cope with 'Yellow Dust'," *Korea Herald*, 7 September 2000; BBC Monitoring, "South Korea, China, Japan to Launch Joint Environmental Campaign," *Yonhap News Agency*, 27 March 2001.
5. Population from United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001).
6. Hong Yang and Xiubin Li, "Cultivated Land and Food Supply in China," *Land Use Policy*, vol. 17, no. 2 (2000).
7. Robert Henson, Steve Horstmeyer, and Eric Pinder, "The 20th Century's Top Ten U.S. Weather and Climate Events," *Weatherwise*, November/December 1999, pp. 14–19.
8. Livestock data from U.N. Food and Agriculture Organization (FAO), *FAOSTAT Statistics Database*, at <apps.fao.org>, updated 2 May 2001.
9. Erik Eckholm, "Chinese Farmers See a New Desert Erode Their Way of Life," *New York Times*, 30 July 2000.
10. *Ibid.*
11. Economist Intelligence Unit, "China Industry: Heavy Usage, Pollution Are Hurting Water Resources," *EIU ViewsWire*, 27 February 2001.
12. Wang Hongchang, "Deforestation and Desiccation in China: A Preliminary Study," study for the Beijing Center for Environment and Development, Chinese Academy of Social Sciences, 1999.
13. Micael C. Runnström, "Is Northern China Winning the Battle Against Desertification?" *Ambio*, December 2000, pp. 468–76.
14. Wood used for fuel from FAO, *op. cit.* note 8.
15. Calculation from Tom Gray, American Wind Energy Association, e-mail to author, 12 June 2002.

Worsening Water Shortages Threaten China's Food Security (pages 205–09)

1. Michael Ma, "Northern Cities Sinking as Water Table Falls," *South China Morning Post*, 11 August 2001; share of China's grain harvest from the North China Plain based on Hong Yang and Alexander Zehnder, "China's Regional Water Scarcity and Implications for Grain Supply and Trade," *Environment and Planning A*, vol. 33 (2001), and on U.S. Department of Agriculture (USDA), *Production, Supply and Distribution*, electronic database, updated September 2001.
2. Ma, op. cit. note 1.
3. Ibid.
4. Ibid.
5. World Bank, *China: Agenda for Water Sector Strategy for North China* (Washington, DC: April 2001), pp. vii, xi.
6. Hong and Zehnder, op. cit. note 1, p. 85.
7. Lester R. Brown and Brian Halweil, "China's Water Shortages Could Shake World Food Security," *World Watch*, July/August 1998, pp. 11–12.
8. Economist Intelligence Unit, "China Industry: Heavy Usage, Pollution Are Hurting Water Resources," *EIU ViewsWire*, 27 February 2001.
9. World Bank, op. cit. note 5; Zhang Qishun and Zhang Xiao, "Water Issues and Sustainable Social Development in China," *Water International*, vol. 20 (1995), pp. 122–28.
10. Population projection from United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001); water demand from Albert Nyberg and Scott Rozelle, *Accelerating China's Rural Transformation* (Washington, DC: World Bank, 1999).
11. Calculation based on 1,000 tons of water for 1 ton of grain from U.N. Food and Agriculture Organization (FAO), *Yield Response to Water* (Rome: 1979), on world wheat prices from International Monetary Fund, *International Financial Statistics* (Washington, DC: various years), and on industrial water

- intensity in Mark W. Rosegrant, Claudia Ringler, and Roberta V. Gerpacio, "Water and Land Resources and Global Food Supply," paper presented at the 23rd International Conference of Agricultural Economists on Food Security, Diversification, and Resource Management: Refocusing the Role of Agriculture?, Sacramento, CA, 10–16 August 1997.
12. For more information see Fred Gale, *China's Food and Agriculture: Issues for the 21st Century* (Washington, DC: Economic Research Service, April 2002).
13. Ibid.
14. Grain harvest from USDA, op. cit. note 1.
15. Ibid.
16. Ibid.
17. John Wade and Zhang Jianping, *China: Grain and Feed Grain Update* (Beijing, USDA Foreign Agricultural Service, 19 July 2001). At the end of 2001, China became an official member of the World Trade Organization.
18. FAO, op. cit. note 11.

World's Rangelands Deteriorating Under Mounting Pressure (pages 210–14)

1. "Desert Area Rises to 28 Percent," *Deutsche Presse-Agentur*, 29 January 2002.
2. Human population from United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001); livestock data from U.N. Food and Agriculture Organization (FAO), *FAOSTAT Statistics Database*, at <apps.fao.org>, updated 2 May 2001.
3. Number of pastoralists from "Investing in Pastoralism," *Agriculture Technology Notes* (Rural Development Department, World Bank), March 1998, p. 1; livestock numbers from FAO, op. cit. note 2; land area estimate from Stanley Wood, Kate Sebastian, and Sara J. Scherr, *Pilot Analysis of Global Ecosystems: Agroecosystems* (Washington, DC: International Food Policy Research Institute and World Resources Institute, 2000), p. 3.

4. Land from Wood, Sebastian, and Scherr, op. cit. note 3.
5. Africa's 3 million buffalo are included in the estimate for cattle, found in FAO, op. cit. note 2; Southern African Development Coordination Conference, *SADCC Agriculture: Toward 2000* (Rome: FAO, 1984).
6. Edward C. Wolf, "Managing Rangelands," in Lester Brown et al., *State of the World 1986* (New York: W.W. Norton & Company, 1986); Government of India, "Strategies, Structures, Policies: National Wastelands Development Board," New Delhi, mimeographed, 6 February 1986.
7. FAO, op. cit. note 2.
8. Erik Eckholm, "Chinese Farmers See a New Desert Erode Their Way of Life," *New York Times*, 30 July 2000.
9. FAO, op. cit. note 2; United Nations, op. cit. note 2.
10. H. Dregne et al., "A New Assessment of the World Status of Desertification," *Desertification Control Bulletin*, no. 20, 1991, cited in Lester R. Brown and Hal Kane, *Full House* (New York: W.W. Norton & Company, 1994), p. 95.
11. Ibid.; gross domestic product from International Monetary Fund, *World Economic Outlook (WEO) Database*, at <www.imf.org/external/pubs/ft/weo/2000/02/data/index.htm>, September 2000.
12. Central Budget and Planning Organization, and Statistics and Registration Administration of Iran, cited by Farzaneh Bahar, Former General Director of Family Planning in Iran's Khorasan state, 23 December 2001, e-mail to Janet Larsen, Earth Policy Institute; Abubakar Dungus, "Iran's Other Revolution," *Populi*, September 2000.
13. FAO, op. cit. note 2; A. Banerjee, "Dairying Systems in India," *World Animal Review*, vol. 79/2 (Rome: FAO, 1994); S. C. Dhall and Meena Dhall, "Dairy Industry—India's Strength Is in Its Livestock," *Business Line*, Internet Edition of *Financial Daily* from *The Hindu* group of publications, at <www.india.server.com/businessline/1997/11/07/stories/03070311.htm>, 7 November 1997.
14. China's crop residue production and use from Gao Tengyun,

"Treatment and Utilization of Crop Straw and Stover in China," *Livestock Research for Rural Development*, February 2000; China's "Beef Belt" from U.S. Department of Agriculture, Economic Research Service, "China's Beef Economy: Production, Marketing, Consumption, and Foreign Trade," *International Agriculture and Trade Reports: China* (Washington, DC: July 1998), p. 28.

15. See <www.icarda.cgiar.org>.

Fish Farming May Overtake Cattle Ranching As a Food Source (pages 215–220)

1. U.N. Food and Agricultural Organization (FAO), *Yearbook of Fishery Statistics: Capture Production and Aquaculture Production* (Rome: various years).
2. In Figure 3–3, fish catch from *ibid.* and beef production from FAO, 1948–1985 *World Crop and Livestock Statistics* (Rome: 1987); FAO, *FAOSTAT Statistics Database*, at <apps.fao.org>, updated 2 May 2001.
3. Conversion ratio for grain to beef based on Allen Baker, Feed Situation and Outlook staff, U.S. Department of Agriculture (USDA), Economic Research Service (ERS), Washington, DC, discussion with author, 27 April 1992; conversion ratio for fish from USDA, ERS, "China's Aquatic Products Economy: Production, Marketing, Consumption, and Foreign Trade," *International Agriculture and Trade Reports: China* (Washington, DC: July 1998), p. 45.
4. FAO, *Yearbook of Fishery Statistics: Aquaculture Production 1998*, vol. 86/2 (Rome: 2000).
5. Ibid.
6. Ibid; population from United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001).
7. FAO, op. cit. note 4.
8. K. J. Rana, "China," in *Review of the State of World Aquaculture*, FAO Fisheries Circular No. 886 (Rome: 1997), at <www.fao.org/fi/publ/circular/c886.1/c886-1.asp>; information on rice and fish polyculture from Li Kangmin, "Rice

- Aquaculture Systems in China: A Case of Rice-Fish Farming from Protein Crops to Cash Crops," *Proceedings of the Internet Conference on Integrated Biosystems 1998* at <www.ias.unu.edu/proceedings/icibs/li/paper.htm>, viewed 5 July 2000.
9. Information on China's carp polyculture from Rosamond L. Naylor et al., "Effect of Aquaculture on World Fish Supplies," *Nature*, 29 June 2000, p. 1022; polyculture in India from W. C. Nandeesha et al., "Breeding of Carp with Oviprim," in Indian Branch, Asian Fisheries Society, *Special Publication No. 4* (Mangalore, India: 1990), p. 1.
 10. Krishen Rana, "Changing Scenarios in Aquaculture Development in China," *FAO Aquaculture Newsletter*, August 1999, p. 18.
 11. Catfish feed requirements from Naylor et al., op. cit. note 9, p. 1019; U.S. catfish production data from USDA, ERS, National Agriculture Statistics Service, *Catfish Production* (Washington, DC: July 2000), p. 3.
 12. FAO, op. cit. note 4.
 13. Naylor et al., op. cit. note 9.
 14. Rosamond L. Naylor et al., "Nature's Subsidies to Shrimp and Salmon Farming," *Science*, 30 October 1998, pp. 883–84.
 15. Ibid.
 16. Population from United Nations; op. cit. note 6.

Our Closest Relatives Are Disappearing (pages 221–25)

1. John F. Oates et al., "Extinction of a West African Red Colobus Monkey," *Conservation Biology*, 5 October 2000, pp. 1526–32.
2. Species Survival Commission (SSC), Craig Hilton-Taylor, compiler, *2000 IUCN Red List of Threatened Species* (Gland, Switzerland, and Cambridge, U.K.: World Conservation Union–IUCN, 2000).
3. Ibid.

4. John Tuxill, "Death in the Family Tree," *World Watch*, September/October 1997, p. 14.
5. Human population from United Nations, *World Population Prospects: The 2000 Revision* (New York: February 2001).
6. Russell Mittermeier, "Biodiversity Issues Affecting Primates," keynote paper from *The Apes: Challenges for the 21st Century*, Brookfield Zoo, Chicago, May 2000; habitat loss from SSC, op. cit. note 2.
7. Deforestation and fires from Forest Watch Indonesia and Global Forest Watch, *The State of the Forest: Indonesia* (Bogor, Indonesia, and Washington, DC: 2002), p. xi; orangutan numbers from Carel P. van Schaik, "Securing a Future for the Wild Orangutan," keynote paper from *The Apes: Challenges for the 21st Century*, op. cit. note 6.
8. Danna Harman, "Bonobos' Threat to Hungry Humans," *Christian Science Monitor*, 7 June 2001.
9. Kari Lydersen, "Congo War Threatens a Pacifist Human Relative," *Washington Post*, 5 June 2000; Gay Reinhartz and Inogwabini Bila Isia, "Bonobo Survival and a Wartime Conservation Mandate," keynote paper from *The Apes: Challenges for the 21st Century*, op. cit. note 6.
10. SSC, op. cit. note 2.
11. Bushmeat Crisis Task Force (BCTF), *Eco-Economics Fact Sheet* (Silver Spring, MD: April 2000); David S. Wilkie and Julia F. Carpenter, "Bushmeat Hunting in the Congo Basin: An Assessment of Impacts and Options for Mitigation," paper from *The Apes: Challenges for the 21st Century*, op. cit. note 6.
12. BCTF, op. cit. note 11; sustainable yield from John Robinson, Wildlife Conservation Society, speech at Bushmeat Crisis Task Force Capitol Hill Event, 18 May 2000.
13. Bushmeat consumption from BCTF, op. cit. note 11; African ape extinction from Jane Goodall, speech at Bushmeat Crisis Task Force Capitol Hill Event, op. cit. note 12.
14. Convention on International Trade in Endangered Species of Wild Fauna and Flora available at <www.cites.org>.

Illegal Logging Threatens Ecological and Economic Stability (pages 226–30)

1. “Jakarta Floods Uncover System Faults: Illegal Logging, Judicial Bias Compound Indonesia’s Woes,” *Nikkei Weekly* (Japan), 18 February 2002.
2. Forest Watch Indonesia and Global Forest Watch, *The State of the Forest: Indonesia* (Bogor, Indonesia, and Washington, DC: 2002), pp. xi, 3.
3. *Ibid.*, pp. xi, 36.
4. Michael Bengwayan, “Illegal Logging Wipes Out Philippine Forests,” *Environment News Service*, 11 October 1999; Chris Brown, Patrick B. Durst, and Thomas Enters, *Forests Out of Bounds: Impacts and Effectiveness of Logging Bans in Natural Forests in Asia-Pacific* (Bangkok: U.N. Food and Agriculture Organization, Asia-Pacific Forestry Commission, October 2001).
5. Thailand from Brown, Durst, and Enters, *op. cit.* note 4; Yangtze river basin deforestation from Carmen Revenga et al., *Watersheds of the World* (Washington, DC: World Resources Institute and Worldwatch Institute, 1998); John Pomfret, “China’s Lumbering Economy Ravages Border Forests,” *Washington Post*, 26 March 2001.
6. China’s timber balance from Sun Xiufang and Ralph Bean, *China: Solid Wood Products Annual, 2001* (Beijing: U.S. Department of Agriculture (USDA), Foreign Agricultural Service (FAS), Global Agriculture Information Network (GAIN) Report, 18 July 2001); International Timber Trade Organization projection from Pomfret, *op. cit.* note 5; Japan from Fred Pearce, “Logging Ban Backfires,” *New Scientist*, 3 March 2001.
7. Sun and Bean, *op. cit.* note 6; “G-7 Nations and China Must Halt the Import of Illegal Timber from the Russian Far East,” press release (Gland, Switzerland: World Wide Fund for Nature, 27 February 2002).
8. Pomfret, *op. cit.* note 5.
9. Laos and Viet Nam from “The Fight Against Illegal Loggers,”

- The Economist*, 3 April 1999, and from Dave Currey et al., *Timber Trafficking: Illegal Logging in Indonesia, South East Asia and International Consumption of Illegally Sourced Timber* (London: Emerson Press, Environmental Investigation Agency and Telapak Indonesia, September 2001), pp. 9–10; Cambodia from Jim Ford and Alexander Sheingauz, “Major Trends and Issues in Forests and Forestry: Globally and in Russia,” Conference on Commercial Forestry in the Russian Far East: Opportunities for Sustainable Trade, Conservation and Community Development (Yuzhno-Sakhalinsk, Russia: Forest Trends, Economic Research Institute, 18–20 September 2001).
10. Susan Minnemeyer, *An Analysis of Access Into Central Africa’s Rainforests* (Washington, DC: Global Forest Watch and World Resources Institute, 2002), p. 11.
 11. *Ibid.*; Mark Jaffe, “Logging Fuels Crime, Corruption in Cameroon,” *Philadelphia Inquirer*, 21 May 2001; Minnemeyer, *op. cit.* note 10; Ford and Sheingauz, *op. cit.* note 9.
 12. Brazil from Currey et al., *op. cit.* note 9; Mexico from Nick Miles, “Mexico’s ‘Devastating’ Forest Loss,” *BBC News*, 4 March 2002; Ethiopia from Dechassa Lemessa and Matthew Perault, *Forest Fires in Ethiopia: Reflections on Socio-Economic and Environmental Effects of the Fires in 2000* (Addis Ababa: United Nations Development Programme–Emergencies Unit for Ethiopia, 7 December 2001), p. 1.
 13. Currey et al., *op. cit.* note 9, p. 4.
 14. Michael Smith and Mikhail Maximenko, *Russian Federation Solid Wood Products Annual, 2002* (Moscow: USDA, FAS, GAIN Report, 22 February 2002), p. 5.

Green Power Purchases Growing (pages 231–35)

1. City of Chicago, Office of the Mayor, “City Selects ComEd to Provide Clean Power,” press release (Chicago: 6 June 2001); Green Power Network, “States with Competitive Green Power Offerings,” at <www.eren.doe.gov/greenpower/dereg_map.html>, updated May 2001.
2. “Making the Switch: Why Britain’s Universities Must Switch to Green Electricity,” *People & Planet Online*, at <www.eren.doe.gov/greenpower/dereg_map.html>.

- peopleandplanet.org/climatechange/switch.asp#no7>, viewed 14 February 2002.
3. "Number of Green Energy Customers in The Netherlands Tripled in 2001," *Greenprices*, 28 January 2002, at <www.greenprices.com/nl/newsitem.asp?nid=283>.
 4. "Greenprices: Green Energy in Germany," at <www.greenprices.com/de/index.asp>, viewed 15 February 2002, and at <www.greenprices.com/de/usertop.asp>, viewed 20 February 2002.
 5. "Greenprices: Green Energy in Germany—Policy on Renewable Energy," at <www.greenprices.com/de/greenpol.asp>, viewed 20 February 2002.
 6. "Green Power: Frequently Asked Questions," at <www.greenpower.com.au/GPFaq.shtml#GP7>, viewed 20 February 2002; sources of green energy from "Approved Green Power Generators—January 2002," at <www.greenpower.com.au/images/dl/GPGensJan02.pdf>, viewed 20 February 2002.
 7. Grassroots Campaign for Wind Power, at <www.cogreenpower.org/Parade.htm>, updated December 2000; "University of Colorado Students Vote 'Yes' for Wind Power!" press release (Boulder, CO: 17 April 2000).
 8. Green Power Network, "U.S. Green Marketing Activities: Customers," at <www.eren.doe.gov/greenpower/mkt_customer.html>, viewed 28 February 2002.
 9. Blair Swezey and Lori Bird, "Businesses Lead the 'Green Power' Charge," *Solar Today*, January/February 2001, p. 24.
 10. Environmental Protection Agency, *Green Power: Fueling EPA's Mission With Renewable Energy* (Washington, DC: December 2001), p. 5; Green Power Network, op. cit. note 7.
 11. Center for Resource Solutions, "Green-e Standard," at <www.green-e.org/ipp/standard_for_marketers.html>, revised 16 August 2001; Gabe Petlin, Center for Resource Solutions, discussion with author, 7 March 2002.
 12. "Illinois Initiates Green Power Standard," *SolarAccess.com Daily News*, 25 March 2002.

New York: Garbage Capital of the World (pages 236–40)

1. Kirk Johnson, "The Mayor's Budget Proposal: Recycling; Glass, Metal and Plastic May Become Plain Trash," *New York Times*, 14 February 2002; Kirk Johnson, "To City's Burden, Add 11,000 Tons of Daily Trash," *New York Times*, 28 February 2002.
2. Eric Lipton, "The Long and Winding Road Now Followed by New York City's Trash," *New York Times*, 24 March 2001.
3. Calculations by author; Lhota quoted in Lipton, op. cit. note 2.
4. Gilmore quoted in Lipton, op. cit. note 2.
5. "Virginia Gov. Proposes Plan to Add Solid Waste Fee," *Reuters*, 10 April 2002.
6. Johnson, "To City's Burden," op. cit. note 1.
7. Columbia University's Earth Institute, *Life After Fresh Kills: Moving Beyond New York City's Current Waste Management Plan* (New York: Earth Engineering Center and Urban Habitat Project, 1 December 2001), p. B-31.
8. Kirk Johnson, "As Options Shrink, New York Revisits Idea of Incineration," *New York Times*, 23 March 2002.
9. Columbia University's Earth Institute, op. cit. note 7, p. A-12.
10. International examples from Brenda Platt and Neil Seldman, *Wasting and Recycling in the United States 2000* (Athens, GA: GrassRoots Recycling Network, 2000).
11. Janet N. Abramovitz and Ashley T. Mattoon, *Paper Cuts: Recovering the Paper Landscape*, Worldwatch Paper 149 (Washington, DC: Worldwatch Institute, December 1999), p. 39.
12. U.S. Department of the Interior, U.S. Geological Survey, *Mineral Commodity Summaries 2001* (Washington, DC: 2001).

Tax Shifting on the Rise (pages 241–45)

1. David Roodman, "Environmental Tax Shifts Multiplying," in

- Lester R. Brown et al., *Vital Signs 2000* (New York: W.W. Norton & Company, 2000), pp. 138–39.
2. J. Andrew Hoerner and Benoît Bosquet, *Environmental Tax Reform: The European Experience* (Washington, DC: Center for a Sustainable Economy, February 2001), pp. 17–18.
 3. Figure of 2 percent from Kai Schlegelmilch, German Ministry of the Environment, e-mail to author, 2 June 2002; fuel sales, gas consumption, and carpool growth from German Ministry of the Environment, “Environmental Effects of the Ecological Tax Reform,” at <www.bmu.de/english/topics/oekosteuer/oekosteuer_environment.php>, viewed 20 May 2002.
 4. Hoerner and Bosquet, op. cit. note 2; European Environmental Bureau Campaign on Environmental Fiscal Reform—Germany, at <www.ecotax.info/germany.htm>, viewed 17 May 2002.
 5. European Environment Agency (EEA), *Environmental Taxes: Recent Developments in Tools for Integration* (Copenhagen: November 2000), pp. 75–77; complete conversion to ultra-low sulfur diesel from Andrew Field, U.K. Treasury, e-mail to author, 24 June 2002.
 6. EEA, op. cit. note 5, pp. 68–69; Hoerner and Bosquet, op. cit. note 2, p. 20.
 7. European Environmental Bureau Campaign on Environmental Fiscal Reform—Netherlands, at <www.ecotax.info/netherlands.htm>, viewed 20 May 2002.
 8. EEA, op. cit. note 5, p. 65.
 9. European Environmental Bureau Campaign on Environmental Fiscal Reform—Sweden, at <www.ecotax.info/sweden.htm>, viewed 20 May 2002; “Sweden Makes Major Reductions in GHGs,” *Xinhua News Agency*, 16 January 2002.
 10. Organisation for Economic Co-operation and Development (OECD), *Environmentally Related Taxes in OECD Countries: Issues and Strategies* (Paris: 2001), p. 124.
 11. David Malin Roodman, *Paying the Piper: Subsidies, Politics, and the Environment*, Worldwatch Paper 133 (Washington,

- DC: Worldwatch Institute, December 1996), p. 58.
12. Harmonization from EEA, op. cit. note 5, p. 11; border tax adjustments from OECD, op. cit. note 10, p. 28.
 13. Tax refunds from OECD, op. cit. note 10, p. 11.
 14. Aviation fuel from Sujata Rao, “Europe Targets Aviation Industry for Pollution Levy,” *Reuters*, 16 May 2002; Sweden’s air transport tax from EEA, op. cit. note 5, p. 73.
 15. EEA, op. cit. note 5, pp. 59–61.

ABOUT THE AUTHORS

Lester R. Brown has been described as “one of the world’s most influential thinkers” by the *Washington Post*. He is President of Earth Policy Institute, a non-profit, interdisciplinary research organization based in Washington, D.C., which he founded in May 2001. Twenty-five years ago, he helped pioneer the concept of environmentally sustainable development, a concept he uses in his design of an eco-economy. He is widely known as the Founder and former President of the Worldwatch Institute.

During a career that started with tomato farming, Brown has been awarded over 20 honorary degrees and has authored or coauthored 48 books (including his most recent one, *Eco-Economy: Building an Economy for the Earth*), 19 monographs, and countless articles. He is also a MacArthur Fellow and the recipient of many prizes and awards, including the 1987 United Nations Environment Prize, the 1989 World Wide Fund for Nature Gold Medal, and the 1994 Blue Planet Prize for his “exceptional contributions to solving global environmental problems.” In 1995, Marquis *Who’s Who*, on the occasion of its fiftieth edition, selected Lester Brown as one of 50 Great Americans.

Janet Larsen graduated from Stanford University with a degree in Earth Systems. Janet manages the research program with Lester, planning new projects and coordinating the efforts of the research team. Her interdisciplinary background is invaluable for her work at Earth Policy, where she has written on primate decline, illegal logging, and population. Other research interests include agriculture, biodiversity, climate change, natural resource management, and urban design. She has spent time studying the rainforest and the amphibians of the Peruvian Amazon.

Bernie Fischlowitz-Roberts graduated with honors in Political Science from Haverford College, where his senior thesis examined the politics of enacting environmental tax reform in the United States. Since joining Earth Policy, Bernie has written on green power, solar cell production, and green taxes. Other research interests include climate change, renewable energy, and consumerism.