

Notes

Chapter 1. Entering a New World

1. David Adam, "Ice-Free Arctic Could be Here in 23 Years," *Guardian* (London), 5 September 2007.
2. Ibid.
3. Paul Brown, "Melting Ice Cap Triggering Earthquakes," *Guardian* (London), 8 September 2007.
4. Ibid.
5. Ibid.
6. Alister Doyle, "Sea Rise Seen Outpacing Forecasts Due to Antarctica," *Reuters*, 23 August 2007.
7. Emily Wax, "A Sacred River Endangered By Global Warming," *Washington Post*, 17 June 2007.
8. Clifford Coonan, "China's Water Supply Could be Cut Off as Tibet's Glaciers Melt," *The Independent* (London), 31 May 2007; "Glacier Study Reveals Chilling Prediction," *China Daily*, 23 September 2004.
9. U.N. Environment Programme (UNEP), *Global Outlook for Ice and Snow* (Nairobi: 2007), p.103; J. Hansen et al., "Climate Change and Trace Gases," *Philosophical Transactions of the Royal Society A*, vol. 365 (15 July 2007), pp. 1949–50.
10. Gordon McGranahan et al., "The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones," *Environment and Urbanization*, vol. 18, no. 1 (April 2007),

- pp. 17–37; U.N. Population Division, *World Population Prospects: The 2006 Revision Population Databases*, at esa.un.org/unpp, updated 2007.
11. Lester R. Brown, *Outgrowing the Earth* (New York: W. W. Norton and Company, 2004), pp.101–02; U.N. Population Division, op. cit. note 10.
 12. Fund for Peace and Carnegie Endowment for International Peace, “The Failed States Index,” *Foreign Policy*, July/August 2005, July/August 2006, and July/August 2007.
 13. Nicholas Stern, *The Stern Review on the Economics of Climate Change* (London: HM Treasury, 2006).
 14. Agnus Maddison, “World Population, GDP, and Per Capita GDP, 1-2003 AD,” at www.ggd.net/maddison, viewed 8 August 2007; U.N. Population Division, op. cit. note 10.
 15. Costs of burning coal from DSS Management Consultants Inc. and RWDI Air Inc., *Cost-Benefit Analysis: Replacing Ontario’s Coal-Fired Electricity Generation* (Ontario, Canada: April 2005), p. v.
 16. U.S. Department of Energy (DOE), Energy Information Administration, “Weekly Retail Gasoline and Diesel Prices,” at tonto.eia.doe.gov/dnav/pet/pet_pri_gnd_dcus_nus_w.htm, viewed 8 August 2007.
 17. International Center for Technology Assessment (ICTA), *The Real Cost of Gasoline: An Analysis of the Hidden External Costs Consumers Pay to Fuel Their Automobiles* (Washington, DC: 1998); ICTA, *Gasoline Cost Externalities Associated with Global Climate Change: An Update to CTA’s Real Price of Gasoline Report* (Washington, DC: September 2004); ICTA, *Gasoline Cost Externalities: Security and Protection Services: An Update to CTA’s Real Price of Gasoline Report* (Washington, DC: January 2005); Terry Tamminen, *Lives Per Gallon: The True Cost of Our Oil Addiction* (Washington, DC: Island Press, 2006), p. 60; adjusted to 2007 prices with Bureau of Economic Analysis, “Table 3—Price Indices for Gross Domestic Product and Gross Domestic Purchases,” *GDP and Other Major Series, 1929–2007* (Washington, DC: August 2007); DOE, op. cit. note 16.
 18. Munich Re, *Topics Annual Review: Natural Catastrophes 2001* (Munich, Germany: 2002), pp. 16–17; value of China’s wheat and rice harvests from USDA, *Production, Supply and Distribution*, electronic database at www.fas.usda.gov/psdonline, updated 12 July 2007, using prices from International Monetary Fund (IMF), *International Financial Statistics*, electronic database, at ifs.apdi.net/imf.
 19. “Forestry Cuts Down on Logging,” *China Daily*, 26 May 1998; Erik Eckholm, “China Admits Ecological Sins Played Role in Flood Disaster,” *New York Times*, 26 August 1998.
 20. Eric Pfanner, “Failure Brings Call for Tougher Standards: Accounting for Enron: Global Ripple Effects,” *International Herald Tribune*, 17 January 2002; share price data from www.marketocracy.com, viewed 9 August 2007.

21. World Business Academy, “Interface’s Ray Anderson: Mid-Course Correction,” *Global Reconstruction*, vol. 19, issue 5 (2 June 2005); Ray Anderson, “A Call for Systemic Change,” speech at the National Conference on Science, Policy, & the Environment: Education for a Secure and Sustainable Future, Washington, DC, 31 January 2003.
22. Jared Diamond, *Collapse: How Societies Choose to Fail or Succeed* (New York: Penguin Group, 2005).
23. Sandra Postel, *Pillar of Sand* (New York: W. W. Norton & Company, 1999), pp. 13–21.
24. Ibid.
25. Ibid.
26. Robert McC. Adams quoted in Joseph Tainter, *The Collapse of Complex Societies* (Cambridge, U.K.: Cambridge University Press, 1988), p. 1.
27. “Maya,” *Encyclopedia Britannica*, online encyclopedia, viewed 13 September 2007.
28. Guy Gugliotta, “The Maya: Glory and Ruin,” *National Geographic*, August 2007.
29. Maddison, op. cit. note 14; IMF, *World Economic Outlook Database 2007*, electronic database, at www.imf.org/external/pubs, updated April 2007.
30. Mathis Wackernagel et al., “Tracking the Ecological Overshoot of the Human Economy,” *Proceedings of the National Academy of Sciences*, vol. 99, no. 14 (9 July 2002), pp. 9,266–71; Global Footprint Network, WWF, and Zoological Society of London, *Living Planet Report 2006* (Oakland, CA: Global Footprint Network, 2006), p. 14.
31. Brown, op. cit. note 11, pp.101–02; Peter H. Gleick et al., *The World’s Water 2004–2005* (Washington, DC: Island Press, 2004), p. 88; U.N. Population Division, op. cit. note 10.
32. Millennium Ecosystem Assessment (MA), *Ecosystems and Human Well-Being: Synthesis* (Washington, DC: Island Press, 2005); MA, *Ecosystems and Human Well-Being: Policy Responses* (Washington, DC: Island Press, 2005), p. 180.
33. Geoffrey Lean, “A Disaster to Take Everyone’s Breath Away,” *Independent* (London), 24 July 2006; Daniel Nepstad, “Climate Change and the Forest,” *Tomorrow’s Amazonia: Using and Abusing the World’s Last Great Forests* (Washington, DC: The American Prospect, September 2007).
34. Lean, op. cit. note 33.
35. Ibid.; Nepstad, op. cit. note 33.
36. U.N. Food and Agriculture Organization (FAO), *ForesSTAT*, electronic database, at faostat.fao.org, updated 22 December 2006; Patrick B. Durst et al., *Forests Out of Bounds: Impacts and Effectiveness of*

- Logging Bans in Natural Forests in Asia-Pacific* (Bangkok: FAO, Asia-Pacific Forestry Commission, 2001); Eckholm, op. cit. note 19; Andy White et al., *China and the Global Market for Forest Products: Transforming Trade to Benefit Forests and Livelihood* (Washington, DC: Forest Trends, March 2006), p. 12.
37. FAO, *The State of World Fisheries and Aquaculture 2004* (Rome: 2004), pp. 24, 30–32; Ted Williams, “The Last Bluefin Hunt,” in Valerie Harms et al., *The National Audubon Society Almanac of the Environment* (New York: Grosset/Putnam, 1994), p. 18; Konstantin Volkov, “The Caviar Game Rules,” Reuters-IUCN Environmental Media Award winner, 2001; Camillo Catarci, *World Markets and Industry of Selected Commercially-Exploited Aquatic Species* (Rome: FAO, 2004).
 38. The New Road Map Foundation, “All-Consuming Passion: Waking up from the American Dream,” factsheet, *EcoFuture*, updated 17 January 2002.
 39. USDA, op. cit. note 18; International Iron and Steel Institute, *Steel Statistical Yearbook 2006* (Brussels: 2006), pp. 77–79.
 40. IMF, op. cit. note 29; U.N. Population Division, op. cit. note 10.
 41. U.N. Population Division, op. cit. note 10; FAO, op. cit. note 36.
 42. Ward’s Automotive Group, *World Motor Vehicle Data 2006* (Southfield, MI: Ward’s Automotive Group, 2006); area for paving calculated using 0.02 hectare per car from Lester R. Brown, “Paving the Planet: Cars and Crops Competing for Land,” *Issue Alert* (Washington, DC: Earth Policy Institute, 14 February 2001); USDA, op. cit. note 18.
 43. BP, *Statistical Review of World Energy 2007* (London: 2007); U.N. Population Division, op. cit. note 10; International Energy Agency (IEA), *Oil Market Report* (Paris: July 2007).
 44. U.N. Population Division, op. cit. note 10.
 45. Carlotta Gall, “Opium Harvest at Record Levels in Afghanistan,” *New York Times*, 3 September 2006; Ania Lichtarowica, “Conquering Polio’s Last Frontier,” *BBC News*, 2 August 2007.
 46. Fund for Peace and Carnegie Endowment, July/August 2005, op. cit. note 12.
 47. World Bank, *Global Monitoring Report 2007: Millennium Development Goals* (Washington, DC: 2007) p. 5; Department for International Development, *Why We Need to Work More Effectively in Fragile States* (London: January 2005), pp. 27–28.
 48. Fund for Peace and Carnegie Endowment, July/August 2005, 2006, and 2007, op. cit. note 12.
 49. Fund for Peace and Carnegie Endowment, July/August 2005, op. cit. note 12.
 50. Fund for Peace and Carnegie Endowment, July/August 2005, 2006, and 2007, op. cit. note 12.

51. Table 1–1 from Ibid.
52. U.N. Population Division, op. cit. note 10; Fund for Peace and Carnegie Endowment, July/August 2007, op. cit. note 12.
53. U.N. Population Division, op. cit. note 10; Fund for Peace and Carnegie Endowment, July/August 2007, op. cit. note 12; Richard Cincotta and Elizabeth Leahy, “Population Age Structure and Its Relation to Civil Conflict: A Graphic Metric,” *Woodrow Wilson International Center for Scholars Environmental Change and Security Program Report*, vol. 12 (2006–07), pp. 55–58.
54. Lydia Polgreen, “In Congo, Hunger and Disease Erode Democracy,” *New York Times*, 23 June 2006; Richard Brennan and Anna Husarska, “Inside Congo, An Unspeakable Toll,” *Washington Post*, 16 July 2006; Lydia Polgreen, “Hundreds Killed Near Chad’s Border With Sudan,” *New York Times*, 14 November 2006.
55. Postel, op. cit. note 23, pp. 13–21; Gugliotta, op. cit. note 28.
56. UNAIDS, “HIV and AIDS Estimates and Data, 2003 and 2005,” *2006 Report on the Global Aids Epidemic* (Geneva: May 2006).
57. U.N. Population Division, op. cit. note 10.
58. Colin J. Campbell, “Short Written Submission to the National Petroleum Council,” e-mail to Frances Moore, Earth Policy Institute, 14 August 2007, p. 5; “Iceland Launches Energy Revolution,” *BBC News*, 24 December 2001; John Vidal, “Sweden Plans to be World’s First Oil-Free Economy,” *The Guardian* (London), 8 February 2006.
59. USDA, op. cit. note 18; Chicago Board of Trade, “Market Commentaries,” for wheat and corn, at www.cbot.com, viewed various dates September 2007; historical commodity prices from futures.tradingcharts.com, viewed 3 October 2007.
60. Ethanol requirement in 2008 from Renewable Fuels Association, “Ethanol Biorefinery Locations,” at www.ethanolrfa.org, updated 28 September 2007; 2008 grain harvest from Interagency Agricultural Projections Committee, *Agricultural Projections to 2016* (Washington, DC: USDA, February 2007); 2006 corn used for ethanol from USDA Economic Research Service, *Feed Grains Database*, at www.ers.usda.gov/Data/FeedGrains, updated 28 September 2007; 2006 grain harvest from USDA, op. cit. note 18.
61. John B. Rae, *The American Automobile Industry* (Boston: Thwayne Publishers, 1984), pp. 87–97.
62. James Brooke, “Japan Squeezes to Get the Most of Costly Fuel,” *New York Times*, 4 June 2005; hybrid mileage based on new EPA estimates at www.fueleconomy.gov, viewed 23 August 2007; fleet average from Robert M. Heavenrich, *Light Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2006* (Washington, DC: EPA Office of Transportation and Air Quality, July 2006), updated using EPA Office of Transportation and Air Quality, “EPA Issues New Test Method for Fuel Economy Window Stickers,” regulatory announce-

- ment (Washington, DC: EPA, December 2006).
63. Share of wind power generation in Denmark calculated using BP, op. cit. note 43, and Global Wind Energy Council, *Global Wind 2006 Report* (Brussels: 2007), p. 4, with capacity factor from National Renewable Energy Laboratory, *Power Technologies Energy Data Book* (Oak Ridge, TN: DOE, August 2006); Flemming Hansen, "Denmark to Increase Wind Power to 50% by 2025, Mostly Offshore," *Renewable Energy Access*, 5 December 2006; Global Wind Energy Council, "Global Wind Energy Markets Continue to Boom-2006 Another Record Year," press release (Brussels: 2 February 2007), with European per person consumption from European Wind Energy Association, "Wind Power on Course to Become Major European Energy Source by the End of the Decade," press release (Brussels: 22 November 2004); China water heaters calculated from Renewable Energy Policy Network for the 21st Century, *Renewables Global Status Report, 2006 Update* (Washington, DC: Worldwatch Institute, 2006), p. 21, and from Bingham Kennedy, Jr., *Dissecting China's 2000 Census* (Washington, DC: Population Reference Bureau, June 2001); Iceland National Energy Authority and Ministries of Industry and Commerce, *Geothermal Development and Research in Iceland* (Reykjavik, Iceland: April 2006), p. 16.
 64. FAO, *FAOSTAT*, electronic database, at faostat.fao.org, updated 30 June 2007.
 65. FAO, *FISHSTAT Plus*, electronic database, at www.fao.org, updated March 2007.
 66. Se-Kyung Chong, "Anmyeon-do Recreation Forest: A Millennium of Management," in Patrick B. Durst et al., *In Search of Excellence: Exemplary Forest Management in Asia and the Pacific*, Asia-Pacific Forestry Commission (Bangkok: FAO Regional Office for Asia and the Pacific, 2005), pp. 251–59.
 67. Daniel Hellerstein, "USDA Land Retirement Programs," in USDA, *Agricultural Resources and Environmental Indicators 2006* (Washington, DC: July 2006); USDA, Economic Research Service, *Agri-Environmental Policy at the Crossroads: Guideposts on a Changing Landscape*, Agricultural Economic Report No. 794 (Washington, DC: January 2001); USDA, op. cit. note 18.
 68. City of Amsterdam, "Bike Capital of Europe," at www.iamsterdam.com/visiting_exploring, viewed 23 August 2007; Molly O'Meara, *Reinventing Cities for People and the Planet*, Worldwatch Paper 147 (Washington, DC: Worldwatch Institute, June 1999), p. 47; population from U.N. Population Division, *World Urbanization Prospects: The 2005 Revision Population Database*, electronic database, at esa.un.org/unup, updated 2006; Serge Schmemmann, "I Love Paris on a Bus, a Bike, a Train and in Anything but a Car," *New York Times*, 26 July 2007; Randy Kennedy, "The Day The Traffic Disappeared," *New York Times Magazine*, 20 April 2003, pp. 42–45.
 69. CalCars, "All About Plug-In Hybrids," at www.calcars.org, viewed 22

- August 2007.
70. Tim Johnston, "Australia Is Seeking Nationwide Shift to Energy-Saving Light Bulbs," *New York Times*, 21 February 2007; Rob Gillies, "Canada Announces Greenhouse Gas Targets," *Associated Press*, 25 April 2007; Matthew L. Wald, "A U.S. Alliance to Update the Light Bulb," *New York Times*, 14 March 2007; Ian Johnston, "Two Years to Change EU Light Bulbs," *Scotsman* (U.K.), 10 March 2007; Deborah Zabarenko, "China to Switch to Energy-Efficient Lightbulbs," *Reuters*, 3 October 2007; energy savings from lighting efficiency calculated by Earth Policy Institute using IEA, *Light's Labour's Lost: Policies for Energy-Efficient Lighting* (Paris: February 2006), and IEA, *World Energy Outlook 2006* (Paris: 2006).

Chapter 2. Deteriorating Oil and Food Security

1. Oil production data from International Energy Agency (IEA), *Oil Market Report* (Paris: August 2001), includes oil, natural gas liquids, and processing gains; historical data from U.S. Department of Defense, Twentieth Century Petroleum Statistics (Washington, DC: 1945), cited in Christopher Flavin and Seth Dunn, "Reinventing the Energy System," in Lester R. Brown, Christopher Flavin, and Hilary French, *State of the World 1999* (New York: W. W. Norton & Company, 1999), p. 25; coal from Seth Dunn, "Coal Use Continues Rebound," in Lester R. Brown et al., *Vital Signs 1998* (New York: W. W. Norton & Company, 1998), pp. 52–53.
2. U.N. Population Division, *World Urbanization Prospects: The 2005 Revision* (New York: 2006), p. 1; U.N. Population Division, *World Population Prospects: The 2006 Revision Population Database*, at esa.un.org/unpp, updated 2007; grain production in 1900 is author's estimate based on historic trends.
3. IEA, *Oil Market Report* (Paris: October 2007); Colin J. Campbell, "Short Written Submission to the National Petroleum Council," e-mail to Frances Moore, Earth Policy Institute, 14 August 2007.
4. Michael T. Klare, "Entering the Tough Oil Era," *TomDispatch.com*, 16 August 2007; Campbell, op. cit. note 3.
5. Historic data from International Monetary Fund, International Financial Statistics, on-line database, at ifs.apdi.net, updated July 2007; recent wheat prices from Chicago Board of Trade, "Market Commentaries," at www.cbot.com, viewed various dates in September and October 2007.
6. Gary Schnitkey, Darrel Good, and Paul Ellinger, "Crude Oil Price Variability and Its Impact on Break-Even Corn Prices," *Farm Business Management*, 30 May 2007; 2006 grain used for ethanol from U.S. Department of Agriculture (USDA), Economic Research Service (ERS), *Feed Grains Database*, at www.ers.usda.gov, updated 28 September 2007; 2006 grain harvest from USDA, *Production, Supply and Distribution*, electronic database at www.fas.usda.gov/psdonline,

- updated 12 September 2007; 2008 ethanol requirement from Renewable Fuels Association, "Ethanol Biorefinery Locations," at www.ethanolrfa.org, updated 28 September 2007; 2008 grain harvest from Interagency Agricultural Projections Committee, *Agricultural Projections to 2016* (Washington, DC: USDA, February 2007).
7. U.S. Department of Energy (DOE), Energy Information Administration (EIA), "Select Crude Oil Spot Prices," at www.eia.doe.gov/emeu/international/crude1.html, updated 20 October 2007; John Vidal, "The End of Oil Is Closer Than You Think," *Guardian* (London), 21 April 2005; Alfred J. Cavallo, "Oil: Caveat Empty," *Bulletin of the Atomic Scientists*, vol. 61, no. 3 (May/June 2005), pp. 16–18.
 8. Vidal, op. cit. note 7; M. King Hubbert, "Nuclear Energy and the Fossil Fuels," paper presented at the spring meeting of the Southern District Division of Production, American Petroleum Institute, March 1956.
 9. DOE, EIA, "Table 4.1: World Crude Oil Production, 1970–2006, Selected Countries," at www.eia.doe.gov/emeu/international/oilproduction.html, viewed 14 September 2007.
 10. Production figures are for crude oil, including lease condensate, from DOE, op. cit. note 9; Vidal, op. cit. note 7; DOE, EIA, "Petroleum (Oil) Production," *International Petroleum Monthly*, at www.eia.doe.gov/ipm/supply.html, updated 12 July 2007.
 11. DOE, op. cit. note 9; Klare, op. cit. note 4; Paula Dittrick, "CGES: OPEC Pushing Limits of Oil Production Capacity," *Oil and Gas Journal*, 20 October 2004.
 12. Neil Chatterjee, "'Peak Oil' Gathering Sees \$100 Crude This Decade," *Reuters*, 26 April 2005; Adam Porter, "Expert Says Saudi Oil May Have Peaked," *Al Jazeera*, 20 February 2005; James D. Hamilton, "Running Dry?" *The Atlantic*, October 2007; IEA, op. cit. note 3.
 13. DOE, op. cit. note 9; Vidal, op. cit. note 7; Walter Youngquist, geologist, letter to author, 12 September 2007.
 14. Michael T. Klare, "The Energy Crunch to Come," *TomDispatch.com*, 22 March 2005; Jad Mouawad, "Big Oil's Burden of Too Much Cash," *New York Times*, 12 February 2005; Mark Williams, "The End of Oil?" *Technology Review*, February 2005; Vidal, op. cit. note 7.
 15. Peter Maass, "The Breaking Point," *New York Times Magazine*, 21 August 2005.
 16. James Picerno, "If We Really Have the Oil," *Bloomberg Wealth Manager*, September 2002, p. 45; Klare, op. cit. note 14; Kenneth S. Deffeyes, *Beyond Oil: The View from Hubbert's Peak* (New York: Hill and Wang, 2005); Richard C. Duncan and Walter Youngquist, "Encircling the Peak of World Oil Production," *Natural Resource Research*, vol. 12, no. 4 (December 2003), p. 222; A. M. Samsam Bakhtiari, "World Oil Production Capacity Model Suggests Output Peak by 2006–07," *Oil and Gas Journal*, 26 April 2004, pp. 18–20.

17. IEA, op. cit. note 3; IEA, *Oil Market Report* (Paris: May 2007).
18. Fredrik Robelius, *Giant Oil Fields—The Highway to Oil* (Uppsala, Sweden: Uppsala University Press, 9 March 2007).
19. IEA, op. cit. note 3; IEA, *Oil Market Report* (Paris: July 1993); U.N. Population Division, *World Population Prospects*, op. cit. note 2; IEA, *World Energy Outlook 2006* (Paris: 2006), pp. 85, 492.
20. Robert Collier, "Canadian Oil Sands: Vast Reserves Second to Saudi Arabia Will Keep America Moving, But at a Steep Environmental Cost," *San Francisco Chronicle*, 22 May 2005; Vidal, op. cit. note 7; Walter Youngquist, "Survey of Energy Resources: Oil Shale," *Energy Bulletin*, 24 April 2005.
21. Gargi Chakrabarty, "Shale's New Hope," *Rocky Mountain News*, 18 October 2004; Walter Youngquist, "Alternative Energy Sources," in Lee C. Gerhard, Patrick Leahy, and Victor Yannacone, eds., *Sustainability of Energy and Water through the 21st Century*, Proceedings of the Arbor Day Farm Conference, 8–11 October 2000 (Lawrence, KS: Kansas Geological Survey, 2002), p. 65; Cavallo, op. cit. note 7.
22. Collier, op. cit. note 20; Alberta Energy and Utilities Board, *Alberta Energy Resource Industries Monthly Statistics*, at www.eub.ca, viewed 8 August 2007; BP, *BP Statistical Review of World Energy* (London: June 2007).
23. "Exxon Says N. America Gas Production Has Peaked," *Reuters*, 21 June 2005; Collier, op. cit. note 20; Richard Heinberg, "The End of the Oil Age," *Earth Island Journal*, vol. 18, no. 3 (Fall 2003).
24. Youngquist, op. cit. note 20; Youngquist, op. cit. note 21, p. 64; Vidal, op. cit. note 7; WWF-Canada, "Oil Sands Pushing Canada Further from Kyoto, WWF and UK Think-Tank Warn," press release (Toronto: 6 June 2007).
25. Danielle Murray, "Oil and Food: A Rising Security Challenge," *Eco-Economy Update* (Washington, DC: Earth Policy Institute, 9 May 2005); "Energy Use in Agriculture," in USDA, *U.S. Agriculture and Forestry Greenhouse Gas Inventory: 1990–2001*, Technical Bulletin No. 1907 (Washington, DC: Global Change Program Office, Office of the Chief Economist, 2004), p. 94.
26. James Duffield, USDA, e-mail to Danielle Murray, Earth Policy Institute, 31 March 2005; James Duffield, USDA, e-mail to Frances Moore, Earth Policy Institute, 17 August 2007; USDA, *Production, Supply and Distribution*, op. cit. note 6.
27. Conservation Technology Information Center, "Conservation Tillage and Other Tillage Types in the United States—1990–2004," in *2004 National Crop Residue Management Survey* (West Lafayette, IN: Purdue University, 2004); Duffield, e-mail to Murray, op. cit. note 26; tractor use and horse stocks from U.N. Food and Agriculture Organization (FAO), *FAOSTAT Statistics Database*, at apps.fao.org, updated 4 April 2005.

28. Fertilizer energy use data from Duffield, e-mail to Murray, op. cit. note 26; USDA, *Production, Supply and Distribution*, op. cit. note 6.
29. DOE, EIA, *Annual Energy Outlook 2003* (Washington, DC: 2004); "Table 20: Energy Expenses for On-Farm Pumping of Irrigation Water by Water Source and Type of Energy: 2003 and 1998," in USDA, National Agricultural Statistics Service, *2003 Farm & Ranch Irrigation Survey, Census of Agriculture* (Washington, DC: 2004); Fred Pearce, "Asian Farmers Sucking the Continent Dry," *New Scientist.com*, 28 August 2004.
30. Murray, op. cit. note 25; DOE, EIA, "Total Primary Energy Consumption, All Countries, 1980–2004," at www.eia.doe.gov/emeu/international/energyconsumption.html, viewed 2 August 2007.
31. Murray, op. cit. note 25; M. Heller and G. Keoleian, *Life-Cycle Based Sustainability Indicators for Assessment of the U.S. Food System* (Ann Arbor, MI: Center for Sustainable Systems, University of Michigan, 2000), p. 42.
32. U.S. Department of Transportation (DOT), Bureau of Transportation Statistics (BTS), *Freight Shipments in America* (Washington, DC: 2004), pp. 9–10; Andy Jones, *Eating Oil—Food in a Changing Climate* (London: Sustain and Elm Farm Research Centre, 2001), p. 2 of summary.
33. "Shipment Characteristics by Three-Digit Commodity and Mode of Transportation: 2002," in BTS and U.S. Census Bureau, *2002 Commodity Flow Survey* (Washington, DC: December 2004); Jones, op. cit. note 32; James Howard Kunstler, author of *Geography of Nowhere*, in *The End of Suburbia: Oil Depletion and the Collapse of The American Dream*, documentary film (Toronto, ON: The Electric Wallpaper Co., 2004).
34. Heller and Keoleian, op. cit. note 31, p. 42; food energy content and packaging content calculated by Danielle Murray, Earth Policy Institute, using USDA nutritional information and packaging energy costs from David Pimentel and Marcia Pimentel, *Food, Energy and Society* (Boulder, CO: University Press of Colorado, 1996).
35. Center for American Progress, *Resources for Global Growth: Agriculture, Energy and Trade in the 21st Century* (Washington, DC: 2005); USDA, ERS, "Price Spreads from Farm to Consumer," at www.ers.usda.gov/Data, updated 22 June 2007.
36. Murray, op. cit. note 25, pp. 1, 3; Duffield, e-mail to Murray, op. cit. note 26; John Miranowski, "Energy Demand and Capacity to Adjust in U.S. Agricultural Production," presentation at Agricultural Outlook Forum 2005, Arlington, VA, 24 February 2005, p.11.
37. 1950–59 data from Worldwatch Institute, *Signposts 2001*, CD-Rom (Washington, DC: 2001); 1960–2006 data from USDA, *Production, Supply and Distribution*, op. cit. note 6.
38. 1950–59 grain data from Worldwatch Institute, op. cit. note 37; 1960–2006 data from USDA, *Production, Supply and Distribution*, op. cit. note 6.

39. Worldwatch Institute, *Signposts 2002*, CD-Rom (Washington, DC: 2002); USDA, *Production, Supply and Distribution*, op. cit. note 6.
40. Lester R. Brown, *Outgrowing the Earth* (New York: W. W. Norton & Company, 2004), pp. 60–69.
41. USDA, *Production, Supply and Distribution*, op. cit. note 6; U. N. Population Division, *World Population Prospects*, op. cit. note 2; FAO, *FAOSTAT Food Security*, electronic database, at www.fao.org/faostat, updated 30 June 2006.
42. USDA, *Production, Supply and Distribution*, op. cit. note 6; Brown, op. cit. note 40, p. 50.
43. USDA, *Production, Supply and Distribution*, op. cit. note 6; Kelly Day Rubenstein et al., *Crop Genetic Resources: An Economic Appraisal* (Washington, DC: USDA Economic Research Service, May 2005), p. 19.
44. USDA, *Production, Supply and Distribution*, op. cit. note 6; U.N. Population Division, *World Population Prospects*, op. cit. note 2.
45. USDA, *Production, Supply and Distribution*, op. cit. note 6; U.N. Population Division, *World Population Prospects*, op. cit. note 2; 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 USDA, *Production, Supply and Distribution*, op. cit. note 6.
46. Shaobing Peng et al., "Rice Yields Decline with Higher Night Temperature from Global Warming," *Proceedings of the National Academy of Sciences*, 6 July 2004, pp. 9971–75; Intergovernmental Panel on Climate Change, *Summary for Policymakers in Climate Change 2007: Impacts, Adaptation, and Vulnerability* (New York: Cambridge University Press, 2007), pp. 15–16.
47. F.O. Licht, "Too Much Too Soon? World Ethanol Production to Break Another Record in 2005," *World Ethanol and Biofuels Report*, vol. 3, no. 20 (21 June 2005), pp. 429–35; DOE, World Crude Oil Prices, and U.S. All Grades All Formulations Retail Gasoline Prices, at tonto.eia.doe.gov, viewed 31 July 2007; Renewable Fuels Association, op. cit. note 6.
48. F.O. Licht, "World Ethanol Production 2007 to Hit New Record," *World Ethanol and Biofuels Report*, vol. 5, no. 17 (8 May 2007); corn used for ethanol in 2007 marketing year, from September 2007 to August 2008, from USDA, ERS, op. cit. note 6; corn ethanol conversion is author's estimate, based on Keith Collins, chief economist, USDA, statement before the U.S. Senate Committee on Environment and Public Works, 6 September 2006, p. 8; energy content of ethanol relative to gasoline from Oak Ridge National Laboratory (ORNL), "Bioenergy Conversion Factors," at bioenergy.ornl.gov/papers/misc/energy_conv.html, viewed 3 August 2007; U.S. gasoline con-

- sumption in 2007 from “Table 2: Energy Consumption by Sector and Source,” in DOE, EIA, *Annual Energy Outlook 2007* (Washington, DC: February 2007); USDA, *Production, Supply and Distribution*, op. cit. note 6.
49. Sergio Barros, *Brazil-Sugar-Annual Report-2006*, GAIN Report BR6002 (Washington, DC: USDA, Foreign Agricultural Service, April 2006); CEPEA, Indicadores de Preços—Açúcar Cristal, at www.cepea.esalq.usp.br/acucar, viewed 31 July 2007.
 50. F.O. Licht, op. cit. note 48; “Stung by Bad Experience, Dutch Propose Tough Criteria for Importing Sustainable Biofuels,” *International Herald Tribune*, 26 April 2007; “EU Ministers Agree Biofuel Target,” *BBC News*, 15 February 2007.
 51. F.O. Licht, op. cit. note 48; corn ethanol conversion author’s estimate based on Collins, op. cit. note 48; F.O. Licht, “E-5 Mandate to be Introduced by May,” *World Ethanol and Biofuels Report*, vol. 4, no. 15 (7 April 2006), p. 355; Eric Unmacht, “Faced with Soaring Oil Prices, Indonesia Turns to Biodiesel,” *Christian Science Monitor*, 5 July 2006; Naveen Thukral, “Malaysia Approves 52 Biodiesel Plants So Far,” *Reuters*, 16 August 2006.
 52. USDA, *Production, Supply and Distribution*, op. cit. note 6.
 53. Ibid.; USDA, *Crop Production 2006 Summary* (Washington, DC: 2007).
 54. Robert Wisner, e-mail to Janet Larsen, Earth Policy Institute, 2 January 2007, data updated 29 December 2006 in preparation for Iowa State University Crop Advantage seminar, Cedar Rapids and Burlington, IA, 4–5 January 2007; historical corn production data for Iowa at USDA, National Agricultural Statistics Service, “Quick Stats,” *Agricultural Statistics Database*, at www.nass.usda.gov, viewed 27 December 2006.
 55. Madelene Pearson and Danielle Rossing, “Wheat Price Rises to Record \$9 a Bushel on Global Crop Concerns,” *Bloomberg*, 12 September 2007; wheat, soybeans, and corn from Chicago Board of Trade, op. cit. note 5; historical commodity prices from futures.tradingcharts.com, viewed 3 October 2007.
 56. Ronald Buchanan, “Mexico Protest Prompts Food Price Assurance,” *Financial Times*, 1 February 2007; Carolyn Said, “Nothing Flat about Tortilla Prices: Some in Mexico Cost 60 Percent More, Leading to a Serious Struggle for Low-Income People,” *San Francisco Chronicle*, 13 January 2007; “Italy Urged to go on Pasta Strike,” *BBC News*, 13 September 2007; Karen Atwood, “Rising Price of Wheat Signals End of Low-Cost Food, Warns Premier Chief,” *The Independent* (London), 5 September 2007.
 57. Lester R. Brown, “Distillery Demand for Grain to Fuel Cars Vastly Understated: World May be Facing Highest Grain Prices in History,” *Eco-Economy Update* (Washington, DC: Earth Policy Institute, 4 January 2007); corn ethanol conversion is author’s estimate, based on

- Collins, op. cit. note 48; energy content of ethanol relative to gasoline from ORNL, op. cit. note 48; U.S. gasoline consumption in 2007 from DOE, op. cit. note 48; USDA, *Production, Supply and Distribution*, op. cit. note 6.
58. Ward’s Communications, *Ward’s World Motor Vehicle Data 2006* (Southfield, MI: 2006), p. 240; income calculations from World Bank, “GNI Per Capita 2006, Atlas Method and PPP,” *World Development Indicators*, at siteresources.worldbank.org, updated 1 July 2007, and from U.N. Population Division, *World Population Prospects*, op. cit. note 2.
 59. Corn used for ethanol in 2007 from USDA, *Feed Grains Database*, op. cit. note 6; corn ethanol conversion author’s estimate based on Collins, op. cit. note 48; energy content of ethanol relative to gasoline from ORNL, op. cit. note 48; U.S. gasoline consumption in 2007 from DOE, op. cit. note 48.
 60. California Cars Initiative (CalCars), “All About Plug-In Hybrids (PHEVs),” at www.calcars.org/vehicles.html, viewed 27 December 2006.
 61. Patrick Barta, “Jatropha Plant Gains Steam in Global Race for Biofuels,” *Wall Street Journal*, 24 August 2007.
 62. Ibid.
 63. Ibid.; Ben Macintyre, “Poison Plant Could Help to Cure the Planet,” *The Times* (London), 28 July 2007.
 64. Barta, op. cit. note 61; Rebecca Renner, “Green Gold in a Shrub: Entrepreneurs Target the Jatropha Plant as the Next Big Biofuel,” *Scientific American*, June 2007.
 65. IEA, op. cit. note 3; 2030 from DOE, EIA, *International Energy Outlook 2007* (Washington, DC: May 2007), p. 29, and from IEA, *World Energy Outlook 2006*, op. cit. note 19, p. 86; Thomas Wheeler, “It’s the End of the World as We Know It,” *Baltimore Chronicle*, 3 August 2004.
 66. “Table 1–12: U.S. Sales or Deliveries of New Aircraft, Vehicles, Vessels, and Other Conveyances,” in BTS, *National Transportation Statistics 2005* (Washington, DC: DOT, 2005).
 67. Darrin Qualman, “‘Peak Oil’: The Short, Medium, and Long-Term,” *Union Farmer Monthly*, vol. 56, no. 4 (August 2005).
 68. Oliver Prichard, “SUV Drivers Reconsider,” *Philadelphia Inquirer*, 1 June 2005; Danny Hakim and Jonathan Fuerbringer, “Fitch Cuts G.M. to Junk, Citing Poor S.U.V. Sales,” *New York Times*, 24 May 2005; Fitch Corporate Ratings, at fitchratings.com, viewed 8 August 2007.
 69. U.N. Human Settlements Programme, *The State of the World’s Cities 2004/2005* (London: Earthscan, 2004), pp. 24–25; U.N. Population Division, *Urban Agglomerations 2005*, wall chart (New York: March 2006).

70. U.S. Census Bureau, "American Spend More Than 100 Hours Commuting to Work Each Year, Census Bureau Reports," press release (Washington, DC: 30 March 2005).
71. Wheeler, op. cit. note 65.
72. Micheline Maynard, "Surging Fuel Prices Catch Most Airlines Unprepared, Adding to the Industry's Gloom," *New York Times*, 26 April 2005; "Revealed: The Real Cost of Air Travel," *The Independent* (London), 29 May 2005; DOT and FAA, *FAA Aerospace Forecasts—Fiscal Years 2006–2017* (Washington, DC: 2006), p. 63.
73. "Table 1–4: Public Road and Street Mileage in the United States by Type of Surface," in BTS, *National Transportation Statistics 2007* (Washington, DC: DOT, 2007).
74. Gerhard Metschies, "Pain at the Pump," *Foreign Policy*, July–August 2007.
75. Edith M. Lederer, "U.N.: Hunger Kills 18,000 Kids Each Day," *Associated Press*, 17 February 2007; Iraq Coalition Casualty Count, icasualties.org/oif, updated 31 July 2007.
76. Loganaden Naiken, "Keynote Paper: FAO Methodology for Estimating the Prevalence of Undernourishment," at www.fao.org/docrep/005/y4249e/y4249e06.htm, viewed 1 August 2007; FAO, op. cit. note 41.
77. C. Ford Runge and Benjamin Senauer, "How Biofuels Could Starve the Poor," *Foreign Affairs*, May/June 2007.
78. Missy Ryan, "Commodity Boom Eats into Aid for World's Hungry," *Reuters*, 5 September 2007.
79. FAO, Crop Prospects and Food Situation, no. 3, May 2007; Fund for Peace and Carnegie Endowment for International Peace, "The Failed States Index 2007," *Foreign Policy*, July/August 2007; U.N. Population Division, *World Population Prospects*, op. cit. note 2.
80. Lederer, op. cit. note 75.

Chapter 3. Rising Temperatures and Rising Seas

1. U.N. Environment Programme (UNEP), *Global Outlook for Ice and Snow* (Nairobi: 2007).
2. Ibid.
3. U.S. Department of Agriculture (USDA), *Production, Supply and Distribution*, electronic database, at www.fas.usda.gov/psdonline, updated 11 June 2007; Janet Larsen, "Record Heat Wave in Europe Takes 35,000 Lives," *Eco-Economy Update* (Washington, DC: Earth Policy Institute, 9 October 2003); USDA, National Agricultural Statistics Service, "Crop Production," news release (Washington, DC: 12 August 2005).
4. Janet Larsen, "Setting the Record Straight: More than 52,000 Europeans Died from Heat in Summer 2003," *Eco-Economy Update*

- (Washington, DC: Earth Policy Institute, 26 July 2006); National Commission on Terrorist Attacks Upon the United States, *The 9/11 Commission Report* (Washington, DC: U.S. Government Printing Office, 2004).
5. "Awful Weather We're Having," *The Economist*, 2 October 2004; Richard Milne, "Hurricanes Cost Munich Re Reinsurance," *Financial Times*, 6 November 2004.
6. J. Hansen, NASA's Goddard Institute for Space Studies (GISS), "Global Temperature Anomalies in 0.1 C," at data.giss.nasa.gov/gistemp/tabledata/GLB.Ts.txt, updated June 2007; climate monitoring stations from Reto A. Ruedy, GISS, e-mail to Janet Larsen, Earth Policy Institute, 14 May 2003.
7. Temperature change calculated from Hansen, op. cit. note 6; crops from USDA, op. cit. note 3; USDA, *Grain: World Markets and Trade* (Washington, DC: various months).
8. Carbon dioxide data from Pieter Tans, "Trends in Atmospheric Carbon Dioxide—Mauna Loa," NOAA/ESRL, at www.cmdl.noaa.gov, viewed 16 October 2007, with historical estimate in data from Seth Dunn, "Carbon Emissions Dip," in Worldwatch Institute, *Vital Signs 1999* (New York: W. W. Norton & Company, 1999), pp. 60–61; fossil fuel emissions calculated from International Energy Agency, *World Energy Outlook 2006* (Paris: 2006), p. 493; deforestation emissions from Vattenfall, *Global Mapping of Greenhouse Gas Abatement Opportunities up to 2030: Forestry Sector Deep-Dive* (Stockholm: June 2007), p. 27.
9. Intergovernmental Panel on Climate Change (IPCC), *Summary for Policymakers*, in *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge and New York: Cambridge University Press, 2007), p. 13; IPCC, "Intergovernmental Panel on Climate Change and Its Assessment Reports," fact sheet, at www.ipcc.ch/press, viewed 27 July 2007.
10. IPCC, *Summary for Policymakers*, op. cit. note 9, p. 15.
11. National Center for Atmospheric Research and UCAR Office of Programs, "Drought's Growing Reach: NCAR Study Points to Global Warming as Key Factor," press release (Boulder, CO: 10 January 2005); Aiguo Dai, Kevin E. Trenberth, and Taotao Qian, "A Global Dataset of Palmer Drought Severity Index for 1870–2002: Relationship with Soil Moisture and Effects of Surface Warming," *Journal of Hydrometeorology*, vol. 5 (December 2004), pp. 1117–30.
12. Donald McKenzie et al., "Climatic Change, Wildfire, and Conservation," *Conservation Biology*, vol. 18, no. 4 (August 2004), pp. 890–902.
13. Camille Parmesan and Hector Galbraith, *Observed Impacts of Global Climate Change in the U.S.* (Arlington, VA: Pew Center on Global Climate Change, 2004); DeNeen L. Brown, "Signs of Thaw in a Desert of Snow," *Washington Post*, 28 May 2002; IPCC, *Summary for Policymakers*, op. cit. note 9, p. 13.

14. Patty Glick, *Fish Out of Water: A Guide to Global Warming and Pacific Northwest Rivers* (Seattle: National Wildlife Federation, March 2005); Elizabeth Gillespie, "Global Warming May Be Making Rivers Too Hot: Cold-Water Fish Will Struggle, Report Says," *Seattle Post-Intelligencer*, 24 March 2005.
15. Douglas B. Inkley et al., *Global Climate Change and Wildlife in North America* (Bethesda, MD: The Wildlife Society, December 2004); J. R. Pegg, "Global Warming Disrupting North American Wildlife," *Environment News Service*, 16 December 2004.
16. John E. Sheehy, International Rice Research Institute, e-mail to Janet Larsen, Earth Policy Institute, 1 October 2002; Pedro Sanchez, "The Climate Change–Soil Fertility–Food Security Nexus," speech, Sustainable Food Security for All by 2020, Bonn, Germany, 4–6 September 2002; USDA, op. cit. note 3.
17. Mohan K. Wali et al., "Assessing Terrestrial Ecosystem Sustainability," *Nature & Resources*, October–December 1999, pp. 21–33.
18. Sheehy, op. cit. note 16; Sanchez, op. cit. note 16.
19. Shaobing Peng et al., "Rice Yields Decline with Higher Night Temperature from Global Warming," *Proceedings of the National Academy of Sciences*, 6 July 2004, pp. 9971–75; *Proceedings of the National Academy of Sciences*, "Warmer Evening Temperatures Lower Rice Yields," press release (Washington, DC: 29 June 2004).
20. K. S. Kavi Kumar and Jyoti Parikh, "Socio-Economic Impacts of Climate Change on Indian Agriculture," *International Review for Environmental Strategies*, vol. 2, no. 2 (2001), pp. 277–93; U.N. Population Division, *World Population Prospects: The 2006 Revision Population Database*, at esa.un.org/unpp, updated 2007.
21. UNEP, op. cit. note 1, p. 131.
22. Emily Wax, "A Sacred River Endangered by Global Warming," *Washington Post*, 17 June 2007; UNEP, op. cit. note 1, p. 131.
23. Clifford Coonan, "China's Water Supply Could be Cut Off as Tibet's Glaciers Melt," *The Independent* (London), 31 May 2007; UNEP, op. cit. note 1, p. 131; rice irrigation from "Yangtze River–Agriculture," *Encyclopedia Britannica*, online encyclopedia, viewed 25 July 2007.
24. Jonathan Watts, "Highest Icefields Will Not Last 100 Years, Study Finds: China's Glacier Research Warns of Deserts and Floods Due to Warming," *Guardian* (London), 24 September 2004; "Glacier Study Reveals Chilling Prediction," *China Daily*, 23 September 2004.
25. UNEP, op. cit. note 1, p. 131.
26. Lonnie G. Thompson, "Disappearing Glaciers Evidence of a Rapidly Changing Earth," American Association for the Advancement of Science Annual Meeting, San Francisco, February 2001; "The Peak of Mt Kilimanjaro As It Has Not Been Seen for 11,000 Years," *Guardian* (London), 14 March 2005; Bancy Wangui, "Crisis Looms as Rivers

- Around Mt. Kenya Dry Up," *East Africa Standard*, 1 July 2007.
27. Eric Hansen, "Hot Peaks," *OnEarth*, fall 2002, p. 8.
28. Leslie Josephus, "Global Warming Threatens Double-Trouble for Peru: Shrinking Glaciers and a Water Shortage," *Associated Press*, 12 February 2007; *Citation World Atlas* (Union, NJ: Hammond World Atlas Corporation, 2004).
29. Josephus, op. cit. note 28; U.N. Population Division, op. cit. note 20.
30. James Painter, "Peru's Alarming Water Truth," *BBC News*, 12 March 2007; U.N. Population Division, *Urban Agglomerations 2005 Wall Chart*, at www.un.org/esa/population, viewed 28 September 2007.
31. Michael Kiparsky and Peter Gleick, *Climate Change and California Water Resources: A Survey and Summary of the Literature* (Oakland, CA: Pacific Institute, 2003); Timothy Cavagnaro et al., *Climate Change: Challenges and Solutions for California Agricultural Landscapes* (Sacramento, CA: California Climate Change Center, 2006).
32. John Krist, "Water Issues Will Dominate California's Agenda This Year," *Environmental News Network*, 21 February 2003.
33. Michael J. Scott et al., "Climate Change and Adaptation in Irrigated Agriculture—A Case Study of the Yakima River," in UCOWR/NIWR Conference, *Water Allocation: Economics and the Environment* (Carbondale, IL: Universities Council on Water Resources, 2004); Pacific Northwest National Laboratory, "Global Warming to Squeeze Western Mountains Dry by 2050," press release (Richland, WA: 16 February 2004).
34. UNEP, op. cit. note 1, p. 131; Mehrdad Khalili, "The Climate of Iran: North, South, Kavir (Desert), Mountains," *San'ate Hamlo Naql*, March 1997, pp. 48–53.
35. UNEP, op. cit. note 1, p. 103; IPCC, *Summary for Policymakers*, op. cit. note 9, p. 13; Paul Brown, "Melting Ice Cap Triggering Earthquakes," *Guardian* (London), 8 September 2007.
36. Arctic Climate Impact Assessment (ACIA), *Impacts of a Warming Arctic* (Cambridge, U.K.: Cambridge University Press, 2004); ACIA Web site, at www.acia.uaf.edu, updated 13 July 2005; "Rapid Arctic Warming Brings Sea Level Rise, Extinctions," *Environment News Service*, 8 November 2004; UNEP, op. cit. note 1, p. 103.
37. J. R. Pegg, "The Earth is Melting, Arctic Native Leader Warns," *Environment News Service*, 16 September 2004.
38. ACIA, op. cit. note 36; Steven Armstrup et al., "Recent Observations of Intraspecific Predation and Cannibalism among Polar Bears in the Southern Beaufort Sea," *Polar Biology*, vol. 29, no. 11 (October 2006), pp. 997–1002.
39. Julianne Stroeve et al., "Arctic Sea Ice Decline: Faster than Forecast," *Geophysical Research Letters*, vol. 34 (May 2007); National Snow and Ice Data Center (NSIDC), "Arctic Sea Ice Shatters all Previous Record

- Lows,” press release (Boulder, CO: 1 October 2007); Stroeve quoted in “Arctic Ice Retreating 30 Years Ahead of Projections,” *Environment News Service*, 30 April 2007.
40. Marc Kaufman, “Decline in Winter Arctic Ice Linked to Greenhouse Gases,” *Washington Post*, 14 September 2006; Joséfino C. Comiso, “Abrupt Decline in the Arctic Winter Sea Ice Cover,” *Geophysical Research Letters*, vol. 33, 30 September 2006.
 41. David Adam, “Meltdown Fear as Arctic Ice Cover Falls to Record Winter Low,” *Guardian* (London), 15 May 2006.
 42. NSIDC, “Processes: Thermodynamics: Albedo,” at nsidc.org/seaice/processes/albedo.html, viewed 26 July 2007.
 43. UNEP, op. cit. note 1.
 44. H. Jay Zwally et al., “Surface Melt-Induced Acceleration of Greenland Ice-Sheet Flow,” *Science*, vol. 297 (12 July 2002), pp. 218–22.
 45. J. L. Chen, C. R. Wilson, and B. D. Tapley, “Satellite Gravity Measurements Confirm Accelerated Melting of Greenland Ice Sheet,” *Science*, vol. 313 (29 September 2006), pp. 1958–60; Isabella Velicogna and John Wahr, “Acceleration of Greenland Ice Mass Loss in Spring 2004,” *Nature*, vol. 443 (21 September 2006), pp. 329–31; S. B. Luthke et al., “Recent Greenland Ice Mass Loss from Drainage System from Satellite Gravity Observations,” *Science*, vol. 314 (24 November 2006), pp. 1286–89; “Gravity Measurements Confirm Greenland’s Glaciers Precipitous Meltdown,” *Scientific American*, 19 October 2006.
 46. U.S. Department of Energy, Energy Information Administration, “Antarctica: Fact Sheet,” at www.eia.doe.gov, September 2000.
 47. University of Colorado at Boulder, “NASA, CU-Boulder Study Shows Vast Regions of West Antarctica Melted in Recent Past,” press release (Boulder: 15 May 2007).
 48. “Breakaway Bergs Disrupt Antarctic Ecosystem,” *Environment News Service*, 9 May 2002; “Giant Antarctic Ice Shelves Shatter and Break Away,” *Environment News Service*, 19 March 2002.
 49. NSIDC, “Antarctic Ice Shelf Collapses,” at nsidc.org/iceshelves/larsenb2002, 19 March 2002; “Breakaway Bergs Disrupt Antarctic Ecosystem,” op. cit. note 48; “Giant Antarctic Ice Shelves Shatter and Break Away,” op. cit. note 48.
 50. “Giant Antarctic Ice Shelves Shatter and Break Away,” op. cit. note 48; Vaughan quoted in Andrew Revkin, “Large Ice Shelf in Antarctica Disintegrates at Great Speed,” *New York Times*, 20 March 2002.
 51. Michael Byrnes, “New Antarctic Iceberg Split No Threat,” *Reuters*, 20 May 2002.
 52. Gordon McGranahan et al., “The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones,” *Environment and Urbanization*, vol. 18, no. 1 (April 2007), pp. 17–37.

53. Ibid.
54. Ibid.; U.N. Population Division, op. cit. note 20.
55. International Institute for Environment and Development, “Climate Change: Study Maps Those at Greatest Risk from Cyclones and Rising Seas,” press release (London: 28 March 2007); Catherine Brahic, “Coastal Living—A Growing Global Threat,” *New Scientist.com*, 28 March 2007; UNEP, op. cit. note 1.
56. Thomas R. Knutson and Robert E. Tuleya, “Impact of CO₂-Induced Warming on Simulated Hurricane Intensity and Precipitation: Sensitivity to the Choice of Climate Model and Convective Parameterization,” *Journal of Climate*, vol. 17, no. 18 (15 September 2004), pp. 3477–95.
57. Lester R. Brown, “Global Warming Forcing U.S. Coastal Population to Move Inland,” *Eco-Economy Update* (Washington DC: Earth Policy Institute, 16 August 2006); water and power from Connie Kline, “New Orleans Looks Like Katrina Hit Yesterday; U.S. Needs to Step Up,” *Ventura County Star*, 6 August 2006; garbage collection from Susan Saulny, “Despite a City’s Hopes, an Uneven Repopulation,” *New York Times*, 30 July 2006; telecommunications from Gary Rivlin, “Patchy Recovery in New Orleans,” *New York Times*, 5 April 2006; sewer system from “Katrina Recovery Deemed a Mixed Bag,” *Associated Press*, 15 August 2006.
58. Peter Grier, “The Great Katrina Migration,” *Christian Science Monitor*, 12 September 2005; Louisiana Recovery Authority, *Migration Patterns: Estimates of Parish Level Migrations Due to Hurricanes Katrina and Rita* (Baton Rouge, LA: August 2007), pp. 7–9.
59. National Weather Service National Hurricane Center, *NHC Archive of Hurricane Seasons*, at www.nhc.noaa.gov, updated June 2007; Kevin E. Trenberth, “Warmer Oceans, Stronger Hurricanes,” *Scientific American*, July 2007; Joseph Treaster, “High Winds, Then Premiums,” *New York Times*, 26 September 2006.
60. Janet N. Abramovitz, “Averting Unnatural Disasters,” in Lester R. Brown et al., *State of the World 2001* (New York: W. W. Norton & Company, 2001) pp. 123–42.
61. Storm death toll from National Climatic Data Center, National Oceanic & Atmospheric Administration, “Mitch: The Deadliest Atlantic Hurricane Since 1780,” at www.ncdc.noaa.gov, updated 1 July 2004; Flores quoted in Arturo Chavez et al., “After the Hurricane: Forest Sector Reconstruction in Honduras,” *Forest Products Journal*, November/December 2001, pp. 18–24; gross domestic product from International Monetary Fund (IMF), *World Economic Outlook Database*, at www.imf.org, updated April 2003.
62. Michael Smith, “Bad Weather, Climate Change Cost World Record \$90 Billion,” *Bloomberg*, 15 December 2004; “Insurers See Hurricane Costs as High as \$23 Billion,” *Reuters*, 4 October 2004.
63. “Awful Weather We’re Having,” op. cit. note 5; Munich Re, *Topics*

- Geo Annual Review: Natural Catastrophes 2006* (Munich: 2007), p. 47.
64. "Disaster and Its Shadow," *The Economist*, 14 September 2002, p. 71; "Moody's Downgrades Munich Re's Ratings to 'Aa1,'" *Insurance Journal*, 20 September 2002; Moody's Investor Service, "Issuer Research" for Munich Re, Hanover Re, and Swiss Re, at www.moodys.com, viewed 26 July 2007.
 65. Tim Hirsch, "Climate Change Hits Bottom Line," *BBC News*, 15 December 2004.
 66. Munich Re, "Natural Disasters: Billion-\$ Insurance Losses," in Louis Perroy, "Impacts of Climate Change on Financial Institutions' Medium to Long Term Assets and Liabilities," presented to the Staple Inn Actuarial Society, 14 June 2005; Munich Re, *Topics Geo Significant Natural Catastrophes in 2004, 2005, and 2006* (Munich: 2005, 2006, and 2007).
 67. Munich Re, *Topics Annual Review: Natural Catastrophes 2001* (Munich: 2002), pp. 16-17; value of China's wheat and rice harvests from USDA, op. cit. note 3, using prices from IMF, *International Financial Statistics*, electronic database, at ifs.apdi.net/imf, updated June 2007.
 68. Munich Re, "Natural Disasters," op. cit. note 66; Munich Re, *Significant Natural Catastrophes in 2005 and 2006*, op. cit. note 66.
 69. Andrew Dlugolecki, "Climate Change and the Financial Services Industry," speech delivered at the opening of the UNEP Financial Services Roundtable, Frankfurt, Germany, 16 November 2000; "Climate Change Could Bankrupt Us by 2065," *Environment News Service*, 24 November 2000.
 70. Sir Nicholas Stern, *The Stern Review on the Economics of Climate Change* (London: HM Treasury, 2006), pp vi-ix.
 71. S. Pacala and R. Socolow, "Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies," *Science*, vol. 305 (13 August 2004), pp. 968-72.
 72. Ibid.
 73. "Earth's Climate Approaches Dangerous Tipping Point," *Environment News Service*, 1 June 2007; James Hansen et al., "Climate Change and Trace Gases," *Philosophical Transactions of the Royal Society A*, vol. 365 (2007), pp. 1925-54.
 74. Wax, op. cit. note 22; Coonan, op. cit. note 23; Watts, op. cit. note 24; "Glacier Study Reveals Chilling Prediction," op. cit. note 24.
 75. World Bank, *World Development Report 1999/2000* (New York: Oxford University Press, September 1999).
 76. Brown, op. cit. note 35.
 77. Ibid.

78. Adam, op. cit. note 41.
79. IPCC, *Summary for Policymakers*, op. cit. note 9, p. 33; Sergey A. Zimov et al., "Permafrost and the Global Carbon Budget," *Science*, vol. 312, no. 3780 (16 June 2006), pp. 1612-13.
80. Figure of 400 ppm calculated using fossil fuel emissions from G. Marland et al., "Global, Regional, and National CO₂ Emissions," in *Trends: A Compendium of Data on Global Change* (Oak Ridge, TN: Carbon Dioxide Information and Analysis Center, Oak Ridge National Laboratory, 2007), and land use change emissions from R. A. Houghton and J. L. Hackler, "Carbon Flux to the Atmosphere from Land-Use Changes," in *Trends: A Compendium of Data on Global Change* (Oak Ridge, TN: Carbon Dioxide Information and Analysis Center, Oak Ridge National Laboratory, 2002), with decay curve cited in J. Hansen et al., "Dangerous Human-Made Interference with Climate: A GISS ModelE Study," *Atmospheric Chemistry and Physics*, vol. 7 (2007), pp. 2287-312.

Chapter 4. Emerging Water Shortages

1. U.N. Environment Programme (UNEP), *Africa's Lakes: Atlas of Our Changing Environment* (Nairobi: 2006); M. T. Coe and J. A. Foley, "Human and Natural Impacts on the Water Resources of the Lake Chad Basin," *Journal of Geophysical Research (Atmospheres)*, vol. 106, no. D4 (2001), pp. 3349-56; population information from U.N. Population Division, *World Population Prospects: The 2006 Revision Population Database*, at esa.un.org/unpp, updated 2007.
2. Water use tripling from I. A. Shiklomanov, "Assessment of Water Resources and Water Availability in the World," *Report for the Comprehensive Assessment of the Freshwater Resources of the World* (St. Petersburg, Russia: State Hydrological Institute, 1998), cited in Peter H. Gleick, *The World's Water 2000-2001* (Washington, DC: Island Press, 2000), p. 52; grain production from U.S. Department of Agriculture (USDA), *Production, Supply and Distribution*, electronic database, at www.fas.usda.gov/psd/psdonline, updated 11 June 2007.
3. Emily Wax, "A Sacred River Endangered by Global Warming," *Washington Post*, 17 June 2007; Clifford Coonan, "China's Water Supply Could be Cut Off as Tibet's Glaciers Melt," *The Independent* (London), 31 May 2007.
4. Jacob W. Kijne, *Unlocking the Water Potential of Agriculture* (Rome: U.N. Food and Agriculture Organization (FAO), 2003), p. 26; water use from Shiklomanov, op. cit. note 2, p. 53.
5. 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 USDA, op. cit. note 2.

6. Ma, op. cit. note 5.
7. World Bank, *China: Agenda for Water Sector Strategy for North China* (Washington, DC: April 2001), pp. vii, xi.
8. John Wade, Adam Branson, and Xiang Qing, *China Grain and Feed Annual Report 2002* (Beijing: USDA, 21 February 2002).
9. Wheat production from USDA, op. cit. note 2.
10. World Bank, op. cit. note 7, p. viii; calculations based on 1,000 tons of water to produce 1 ton of grain in FAO, *Yield Response to Water* (Rome: 1979).
11. Number of farmers and well investment from Peter H. Gleick et al., *The World's Water 2006–2007* (Washington, DC: Island Press, 2006), p. 148; number of wells and rate of aquifer depletion from Fred Pearce, “Asian Farmers Sucking the Continent Dry,” *New Scientist.com*, 28 August 2004.
12. Pearce, op. cit. note 11; Tamil Nadu population from 2001 census, “Tamil Nadu at a Glance: Area and Population,” at www.tn.gov.in.
13. Pearce, op. cit. note 11.
14. Grain production and imports from USDA, op. cit. note 2; John Briscoe, *India's Water Economy: Bracing for a Turbulent Future* (New Delhi: World Bank, 2005); population data from U.N. Population Division, op. cit. note 1.
15. Energy used for groundwater pumping from Tingju Zhu et al., “Energy Price and Groundwater Extraction for Agriculture: Exploring the Energy-Water-Food Nexus at the Global and Basin Level,” presented at Linkages Between Energy and Water Management for Agriculture in Developing Countries, Hyderabad, India, January 2007; coal from U.S. Department of Energy, Energy Information Administration, *Country Analysis Briefs: India and Country Analysis Briefs: China* (Washington, DC: updated January 2007 and August 2006).
16. USDA, *Agricultural Resources and Environmental Indicators 2000* (Washington, DC: February 2000), Chapter 2.1, p. 6; irrigated share calculated from FAO, *ResourceSTAT*, electronic database, at faostat.fao.org/site/405/default.aspx, updated 30 June 2007; harvest from USDA, op. cit. note 2; Sandra Postel, *Pillar of Sand* (New York: W. W. Norton & Company, 1999), p. 77.
17. USDA, “Table 10: Irrigation 2002 and 1997,” *2002 Census of Agriculture*, vol. 1 (Washington, DC: June 2004), pp. 319–26.
18. U.N. Population Division, op. cit. note 1; fall in water table from “Pakistan: Focus on Water Crisis,” *U.N. Integrated Regional Information Networks News*, 17 May 2002.
19. “Pakistan: Focus on Water Crisis,” op. cit. note 18; Garstang quoted in “Water Crisis Threatens Pakistan: Experts,” *Agence France-Presse*, 26 January 2001.
20. Sardar Riaz A. Khan, “Declining Land Resource Base,” *Dawn* (Pak-

- istan), 27 September 2004.
21. USDA, op. cit. note 2.
22. U.N. Population Division, op. cit. note 1; overpumping from Chenaran Agricultural Center, Ministry of Agriculture, according to Hamid Taravati, publisher, Iran, e-mail to author, 25 June 2002.
23. U.N. Population Division, op. cit. note 1; Craig S. Smith, “Saudis Worry as They Waste Their Scarce Water,” *New York Times*, 26 January 2003; grain production from USDA, op. cit. note 2.
24. Smith, op. cit. note 23.
25. Ibid.
26. U.N. Population Division, op. cit. note 1; Yemen's water situation from Christopher Ward, “Yemen's Water Crisis,” based on a lecture to the British Yemeni Society in September 2000, July 2001; Christopher Ward, *The Political Economy of Irrigation Water Pricing in Yemen* (Sana'a, Yemen: World Bank, November 1998).
27. 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).
28. U.N. Population Division, op. cit. note 1; Yemen's water situation from Ward, *Political Economy of Irrigation Water Pricing*, op. cit. note 26; grain production and imports from USDA, op. cit. note 2, updated 13 September 2005; Fund for Peace and Carnegie Endowment for International Peace, “The Failed States Index 2007,” *Foreign Policy*, July/August 2007, p. 57.
29. Deborah Camiel, “Israel, Palestinian Water Resources Down the Drain,” *Reuters*, 12 July 2000.
30. U.N. Population Division, op. cit. note 1; Tushaar Shah et al., *The Global Groundwater Situation: Overview of Opportunities and Challenges* (Colombo, Sri Lanka: International Water Management Institute, 2000); Karin Kemper, “Groundwater Management in Mexico: Legal and Institutional Issues,” in Salman M. A. Salman, ed., *Groundwater: Legal and Policy Perspectives*, Proceedings of a World Bank Seminar (Washington, DC: World Bank, 1999), p. 117; U.N. Development Programme (UNDP), *Human Development Report 2006* (Gordonsville, VA: Palgrave Macmillan, 2006), p. 146.
31. Colorado, Ganges, Indus, and Nile rivers from Postel, op. cit. note 16, pp. 59, 71–73, 94, 261–62; Yellow River from Lester R. Brown and Brian Halweil, “China's Water Shortages Could Shake World Food Security,” *World Watch*, July/August 1998, p. 11.
32. Water use tripling from Shiklomanov, op. cit. note 2, p. 52.
33. Sandra Postel, *Last Oasis* (New York: W. W. Norton & Company, 1997), pp. 38–39; World Commission on Dams, *Dams and Development: A New Framework for Decision-Making* (London: Island Press, 2000), p. 8.

34. Postel, op. cit. note 16, pp. 261–62; Jim Carrier, “The Colorado: A River Drained Dry,” *National Geographic*, June 1991, pp. 4–32.
35. UNEP, *Afghanistan: Post-Conflict Environmental Assessment* (Geneva: 2003), p. 60.
36. Brown and Halweil, op. cit. note 31.
37. Postel, op. cit. note 16, pp. 71, 146.
38. Ibid., pp. 56–58; U.N. Population Division, op. cit. note 1; Fund for Peace and Carnegie Endowment, op. cit. note 28, p. 57.
39. Moench, op. cit. note 27; U.N. Population Division, op. cit. note 1.
40. Curtis J. Richardson et al., “The Restoration Potential of the Mesopotamian Marshes of Iraq,” *Science*, vol. 307 (25 February 2005), pp. 1307–10.
41. Janet Larsen, “Disappearing Lakes, Shrinking Seas,” *Eco-Economy Update* (Washington, DC: Earth Policy Institute, 7 April 2005).
42. Megan Goldin, “Israel’s Shrinking Sea of Galilee Needs Miracle,” *Reuters*, 14 August 2001; Jordan River diminishing from Annette Young, “Middle East Conflict Killing the Holy Water,” *The Scotsman*, 12 September 2004.
43. Caroline Hawley, “Dead Sea ‘to Disappear by 2050,’” *BBC*, 3 August 2001; Gidon Bromberg, “Water and Peace,” *World Watch*, July/August 2004, pp. 24–30.
44. Quirin Schiermeier, “Ecologists Plot to Turn the Tide for Shrinking Lake,” *Nature*, vol. 412 (23 August 2001), p. 756.
45. “Sea to Disappear within 15 Years,” *News 24*, 22 July 2003; Caroline Williams, “Long Time No Sea,” *New Scientist*, 4 January 2003, pp. 34–37.
46. Fred Pearce, “Poisoned Waters,” *New Scientist*, 21 October 1995, pp. 29–33; Williams, op. cit. note 45.
47. Larsen, op. cit. note 41; NASA, Earth Observatory, “Aral Sea,” at earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=16277, viewed 25 January 2005; Alex Kirby, “Kazakhs ‘to Save North Aral Sea,’” *BBC*, 29 October 2003.
48. Li Heng, “20 Natural Lakes Disappear Each Year in China,” *People’s Daily*, 21 October 2002; “Glaciers Receding, Wetlands Shrinking in River Fountainhead Area,” *China Daily*, 7 January 2004.
49. Jim Carlton, “Shrinking Lake in Mexico Threatens Future of Region,” *Wall Street Journal*, 3 September 2003; U. N. Population Division, *World Urbanization Prospects: 2005 Revision*, electronic database, at esa.un.org/unup, updated October 2006.
50. Water to make steel from Postel, op. cit. note 33; 1,000 tons of water for 1 ton of grain from FAO, op. cit. note 10; price of steel from International Monetary Fund, *International Financial Statistics*, at ifs.apdi.net, July 2007; wheat prices from Chicago Board of

- Trade, “Market Commentaries,” various dates, at www.cbots.com.
51. Noel Gollehon and William Quinby, “Irrigation in the American West: Area, Water and Economic Activity,” *Water Resources Development*, vol. 16, no. 2 (2000), pp. 187–95; Postel, op. cit. note 33, p. 137.
52. R. Srinivasan, “The Politics of Water,” *Info Change Agenda*, issue 3 (October 2005); U. N. Population Division, op. cit. note 49.
53. Srinivasan, op. cit. note 52; Pearce, op. cit. note 11.
54. “China Politics: Growing Tensions Over Scarce Water,” *The Economist*, 21 June 2004.
55. Shah et al., op. cit. note 30.
56. Gollehon and Quinby, op. cit. note 51; *The Water Strategist*, various issues, at www.waterstrategist.com; Jedidiah Brewer et al., “Water Markets in the West: Prices, Trading and Contractual Forms,” *Arizona Legal Studies Discussion Paper No. 07-07* (8 February 2007).
57. Arkansas River basin from Joey Bunch, “Water Projects Forecast to Fall Short of Needs: Study Predicts 10% Deficit in State,” *Denver Post*, 22 July 2004.
58. Dean Murphy, “Pact in West Will Send Farms’ Water to Cities,” *New York Times*, 17 October 2003; Tim Molloy, “California Water District Approves Plan to Pay Farmers for Irrigation Water,” *Associated Press*, 13 May 2004.
59. U.N. Population Division, op. cit. note 1.
60. FAO, op. cit. note 10.
61. Grain from USDA, op. cit. note 2.
62. Grain from USDA, Foreign Agricultural Service, *Grain: World Markets and Trade* (Washington, DC: various years).
63. U.N. Population Division, op. cit. note 1; grain from USDA, op. cit. note 2.
64. Nile River flow from Postel, op. cit. note 16, p. 77; grain imports from USDA, op. cit. note 2; calculation based on 1,000 tons of water for 1 ton of grain from FAO, op. cit. note 10.
65. U.N. Population Division, op. cit. note 1; grain from USDA, op. cit. note 2.
66. David Seckler, David Molden, and Randolph Barker, “Water Scarcity in the Twenty-First Century,” *Water Brief 1* (Colombo, Sri Lanka: International Water Management Institute, 1999), p. 2.
67. USDA, op. cit. note 2; FAO, op. cit. note 16.
68. UNDP, op. cit. note 30, p. 135.
69. FAO, *AQUASTAT*, electronic database, at www.fao.org/nr/aquastat, updated 11 February 2003.
70. Country averages from ibid.; World Resources Institute, *Annual*

Renewable Water Supply per Person by River Basin, 1995, at earth trends.wri.org/maps_spatial, updated 2000.

71. "World Conflict Chronology," table in Gleick et al., op. cit. note 11, pp. 192–213; UNDP, op. cit. note 30, pp. 177–78; "At Least 14 Killed as Kenyan Tribes Clash over Scarce Water Supplies," *Associated Press*, 25 January 2005; "Pakistanis Clash Over Water, 12 Hurt," *Reuters*, 20 June 2006.
72. Naser I. Faruqi, "Responding to the Water Crisis in Pakistan," *Water Resources Development*, vol. 20, no. 2 (June 2004), pp. 177–92.
73. Pete Harrison, "Iraq Calls for Water Treaty to Avert Crisis," *Reuters*, 23 August 2007.
74. UNDP, op. cit. note 30, p. 216.
75. Population projection from U.N. Population Division, op. cit. note 1.

Chapter 5. Natural Systems Under Stress

1. Walter C. Lowdermilk, *Conquest of the Land Through 7,000 Years*, USDA Bulletin No. 99 (Washington, DC: U.S. Department of Agriculture (USDA), Natural Resources Conservation Service, 1939).
2. *Ibid.*, p. 10.
3. U.N. Food and Agriculture Organization (FAO), "FAO/WFP Crop and Food Assessment Mission to Lesotho Special Report," at www.fao.org, viewed 29 May 2002; Michael Grunwald, "Bizarre Weather Ravages Africans' Crops," *Washington Post*, 7 January 2003.
4. FAO, *Number of Undernourished Persons*, at www.fao.org/faostat/foodsecurity, updated 30 June 2006.
5. Species Survival Commission, *2000 IUCN Red List of Threatened Species* (Gland, Switzerland, and Cambridge, U.K.: World Conservation Union–IUCN, 2000), p. 1.
6. Teresa Cerojano, "Decades of Illegal Logging Blamed for High Death Toll in Philippine Storm," *Associated Press*, 1 December, 2004; Thailand from Patrick B. Durst et al., *Forests Out of Bounds: Impacts and Effectiveness of Logging Bans in Natural Forests in Asia-Pacific* (Bangkok: FAO, Asia-Pacific Forestry Commission, 2001); Munich Re, "Munich Re's Review of Natural Catastrophes in 1998," press release (Munich: 19 December 1998); Harry Doran, "Human Activities Aid Force of Nature: Massive Destruction Has Worsened the Floods Which Have Struck Throughout History, But Lessons Are Being Learned," *South China Morning Post*, 24 July 2003.
7. World forested area from FAO, *Global Forest Resources Assessment 2005* (Rome: 2006), p. 16.
8. *Ibid.*, pp. xii–xvi.
9. Forest Frontiers Initiative, *The Last Frontier Forests: Ecosystems and Economies on the Edge* (Washington, DC: World Resources Institute

(WRI), 1997).

10. FAO, *ForesSTAT*, electronic database, at faostat.fao.org, updated 22 December 2006.
11. Alain Marcoux, "Population and Deforestation," in *Population and the Environment* (Rome: FAO, 2000); March Turnbull, "Life in the Extreme," *Africa Geographic Online*, 4 April 2005.
12. Nigel Sizer and Dominiek Plouvier, *Increased Investment and Trade by Transnational Logging Companies in Africa, the Caribbean, and the Pacific* (Belgium: World Wide Fund for Nature (WWF) and WRI Forest Frontiers Initiative, 2000), pp. 21–35; Lester R. Brown, "Nature's Limits," in Lester R. Brown et al., *State of the World 1995* (New York: W. W. Norton & Company, 1995), p. 9.
13. Peter S. Goodman and Peter Finn, "Corruption Stains Timber Trade," *Washington Post*, 1 April 2007; Evan Osnos, "China Feeds U.S. Demand for Wood as Forests Suffer," *Chicago Tribune*, 18 December 2006.
14. Goodman and Finn, op. cit. note 13.
15. Andy White et al., *China and the Global Market for Forest Products* (Washington, DC: Forest Trends, 2006).
16. Atlantic forest loss from World Land Trust, "REGUA Project, Brazil," at www.worldlandtrust.org/projects/brazil.htm, viewed 6 September 2007; remaining Amazon calculated from WWF, "Amazon Deforestation," at www.panda.org/about_wwf/where_we_work/latin_america_and_caribbean, viewed 6 September 2007, and from Raymond Colitt, "Amazon Deforestation Drops Sharply: Brazilian Gov't," *Reuters*, 10 August 2007.
17. Christian Tsoumou, "Britain Gives US\$98 Mln to Protect Congo Forests," *Reuters*, 29 March 2007.
18. Mario Rautner, Martin Hardiono, and Raymond J. Alfred, *Borneo: Treasure Island at Risk* (Frankfurt: WWF Germany, June 2005), p. 7.
19. U.N. Population Division, *World Population Prospects: The 2006 Revision Population Database*, at esa.un.org/unpp, updated 2007; FAO, op. cit. note 7, p. 193.
20. U.N. Population Division, op. cit. note 19; "Madagascar's Rainforest Faces Destruction," *Guardian* (London), 29 June 2003.
21. Eneas Salati and Peter B. Vose, "Amazon Basin: A System in Equilibrium," *Science*, vol. 225 (13 July 1984), pp. 129–38.
22. Philip Fearnside quoted in Barbara J. Fraser, "Putting a Price on the Forest," *LatinamericaPress.org*, 10 November 2002; Philip M. Fearnside, "The Main Resources of Amazonia," paper for presentation at the Latin American Studies Association XX International Congress, Guadalajara, Mexico, 17–19 April 1997; Geoffrey Lean, "Dying Forest: One Year to Save the Amazon," *The Independent*, 23 July 2006; Geoffrey Lean, "A Disaster to Take Everyone's Breath Away," *The*

- Independent*, 24 July 2006.
23. U.N. Population Division, op. cit. note 19; Malawi Ministry of Mines, Natural Resources, and the Environment, *State of the Environment Report for Malawi 2002* (Lilongwe, Malawi: 2004); FAO, op. cit. note 7, p. 196.
 24. Anscombe quoted in Charles Mkoka, "Unchecked Deforestation Endangers Malawi Ecosystems," *Environment News Service*, 16 November 2004.
 25. Patrick B. Durst et al., *Forests Out of Bounds: Impacts and Effectiveness of Logging Bans in Natural Forests in Asia-Pacific* (Bangkok: FAO, Asia-Pacific Forestry Commission, 2001); Zhu Chunquan, Rodney Taylor, and Feng Guoqiang, *China's Wood Market, Trade and Environment* (Monmouth Junction, NJ, and Beijing: Science Press USA Inc. and WWF International, 2004).
 26. One third is author's estimate.
 27. Yang Youlin, Victor Squires, and Lu Qi, eds., *Global Alarm: Dust and Sandstorms from the World's Drylands* (Bangkok: Secretariat of the U.N. Convention to Combat Desertification, 2002), pp. 15–28.
 28. John Steinbeck, *The Grapes of Wrath* (New York: Viking Penguin, Inc., 1939).
 29. FAO, *The State of Food and Agriculture 1995* (Rome: 1995), p. 175.
 30. Ibid.; USDA, *Production, Supply and Distribution*, electronic database, at www.fas.usda.gov/psdonline, updated 12 July 2007; yield from FAO, *ProdSTAT*, electronic database, at faostat.fao.org, updated 30 June 2007.
 31. U.N. Environment Programme (UNEP), *Mongolia: State of the Environment 2002* (Pathumthani, Thailand: Regional Resource Centre for Asia and the Pacific, 2001), pp. 3–7; USDA, op. cit. note 30; U.N. Population Division, op. cit. note 19.
 32. National Aeronautics and Space Administration (NASA) Earth Observatory, "Dust Storm off Western Sahara Coast," at earthobservatory.nasa.gov, viewed 9 January 2005.
 33. Paul Brown, "4x4s Replace the Desert Camel and Whip Up a Worldwide Dust Storm," *Guardian* (London), 20 August 2004.
 34. Ibid.
 35. Asif Farrukh, *Pakistan Grain and Feed Annual Report 2002* (Islamabad, Pakistan: USDA Foreign Agricultural Service, 2003).
 36. UNEP, *Africa Environment Outlook: Past, Present, and Future Perspectives* (Nairobi: 2002), at www.unep.org/dewa/Africa.
 37. 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 WRI, 2000), p. 3; livestock counts from FAO, op. cit. note 30.

38. Number of pastoralists from FAO, *The State of Food Insecurity in the World 2003* (Rome 2003), p.15; FAO, op. cit. note 30.
39. FAO, op. cit. note 30; U.N. Population Division, op. cit. note 19.
40. Robin P. White, Siobhan Murray, and Mark Rohweder, *Pilot Analysis of Global Ecosystems: Grassland Ecosystems* (Washington, DC: WRI, 2000); FAO, op. cit. note 30; U.N. Population Fund (UNFPA), *State of World Population 2006* (New York: 2006), p. 98; Southern African Development Coordination Conference, *SADCC Agriculture: Toward 2000* (Rome: FAO, 1984).
41. U.N. Population Division, op. cit. note 19; FAO, op. cit. note 30.
42. FAO, op. cit. note 30.
43. B. S. Sathe, "Dairy/Milk Production," in *Livestock Investment Opportunities in India*, FAO Web site, at www.fao.org/DOCREP/ARTICLE/AGRIPPA/657_en00.htm, viewed 9 September 2005.
44. H. Dregne et al., "A New Assessment of the World Status of Desertification," *Desertification Control Bulletin*, no. 20, 1991.
45. U.N. Population Division, op. cit. note 19.
46. "Case Studies of Sand-Dust Storms in Africa and Australia," in Yang Youlin, Victor Squires, and Lu Qi, eds., *Global Alarm: Dust and Sandstorms from the World's Drylands* (Bangkok: Secretariat of the U.N. Convention to Combat Desertification, 2002), pp. 123–66.
47. Government of Nigeria, *Combating Desertification and Mitigating the Effects of Drought in Nigeria*, Revised National Report on the Implementation of the United Nations Convention to Combat Desertification (Nigeria: April 2002); U.N. Population Division, op. cit. note 19; livestock from FAO, op. cit. note 30.
48. Iranian News Agency, "Official Warns of Impending Desertification Catastrophe in Southeast Iran," *BBC International Reports*, 29 September 2002.
49. UNEP, *Afghanistan: Post-Conflict Environmental Assessment* (Geneva: 2003), p. 52.
50. Wang Tao et al., "A Study on Spatial-temporal Changes of Sandy Desertified Land During Last 5 Decades in North China," *Acta Geographica Sinica*, vol. 59 (2004), pp. 203–12.
51. Wang Tao, Cold and Arid Regions Environmental and Engineering Research Institute (CAREERI), Chinese Academy of Sciences, e-mail to author, 4 April 2004; Wang Tao, "The Process and Its Control of Sandy Desertification in Northern China," CAREERI, Chinese Academy of Sciences, seminar on desertification, held in Lanzhou, China, May 2002.
52. Ann Schrader, "Latest Import From China: Haze," *Denver Post*, 18 April 2001; Brown, op. cit. note 33.
53. Howard W. French, "China's Growing Deserts Are Suffocating

- Korea,” *New York Times*, 14 April 2002.
54. For number of dust storms in China, see Table 1–1 in Lester R. Brown, Janet Larsen, and Bernie Fischlowitz Roberts, *The Earth Policy Reader* (New York: W. W. Norton & Company, 2002), p. 13.
 55. U.S. Embassy, “Desert Mergers and Acquisitions,” *Beijing Environment, Science, and Technology Update* (Beijing: 19 July 2002), p. 2.
 56. See Table 5–2 in Lester Brown, *Outgrowing the Earth* (New York: W. W. Norton & Company, 2005), pp. 86–87.
 57. FAO, *FishStat Plus*, electronic database, at www.fao.org, updated March 2007.
 58. FAO, *The State of World Fisheries and Aquaculture 2006* (Rome: 2007), p. 29.
 59. Ransom A. Myers and Boris Worm, “Rapid Worldwide Depletion of Predatory Fish Communities,” *Nature*, vol. 432 (15 May 2003), pp. 280–83; Charles Crosby, “‘Blue Frontier’ is Decimated,” *Dalhousie News*, 11 June 2003.
 60. Myers and Worm, op. cit. note 59; Crosby, op. cit. note 59.
 61. Myers and Worm, op. cit. note 59.
 62. Stephen Leahy, “Atlantic Bluefin Going Way of Northern Cod,” *Interpress Service News Agency*, 24 August 2007; Ted Williams, “The Last Bluefin Hunt,” in Valerie Harms et al., *The National Audubon Society Almanac of the Environment* (New York: Grosset/Putnam, 1994), p. 185; Callum Roberts, *The Unnatural History of the Sea* (Washington, DC: Island Press, 2007), p. 280; Konstantin Volkov, “The Caviar Game Rules,” Reuters-IUCN Environmental Media Award winner, 2001; 2007 quota from UNEP, “2006 Ban on Caviar Lifted,” press release (Geneva: 2 January 2007).
 63. Harvests from National Marine Fisheries Service, National Oceanic and Atmospheric Administration, *Annual Commercial Landing Statistics*, electronic database, at www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html, updated 12 February 2007.
 64. Caroline Southey, “EU Puts New Curbs on Fishing,” *Financial Times*, 16 April 1997.
 65. Alex Kirby, “UK Cod Fishing ‘Could be Halted,’” *BBC News*, 6 November 2000; ; Norway Ministry of Fisheries and Coastal Affairs, “Norway and EU Agree Fish Quotas for 2006,” press release (Oslo, Norway: 2 December 2005); European Commission, “Council Decision on 2007 Fish Quotas Confirms Gradual Approach to Sustainable Fisheries,” press release (Brussels: 21 December 2006); European Commission, “Outcome of the Fisheries Council of 16-20 December 2002,” at ec.europa.eu/fisheries/press_corner, updated 23 December 2002; Indrani Lutchman et al., *Indicators of Environmental Integration: Final Report* (London: Institute for European Environmental Policy, June 2006).

66. Diadie Ba, “Senegal, EU Prepare for Fisheries Deal Tussle,” *Reuters*, 28 May 2001; Charles Clover, *The End of the Line: How Overfishing is Changing the World and What We Eat* (London: Ebury Press, 2004), pp. 37–46.
67. Clover, op. cit. note 66, p. 38.
68. John W. Miller, “Global Fishing Trade Depletes African Waters,” *Wall Street Journal*, 23 July 2007.
69. Lauretta Burke et al., *Pilot Analysis of Global Ecosystems: Coastal Ecosystems* (Washington, DC: WRI, 2001), pp. 19, 51; coastal wetland loss in Italy from Lester R. Brown and Hal Kane, *Full House* (New York: W. W. Norton & Company, 1994).
70. Clive Wilkinson, ed., *Status of Coral Reefs of the World: 2004* (Townsville, Australia: Global Coral Reef Monitoring Network, 2004), p. 9.
71. Lauretta Burke and Jonathan Maidens, *Reefs at Risk in the Caribbean* (Washington, DC: WRI, 2004), pp. 12–14, 27–31.
72. Mohammed Kotb et al., “Status of Coral Reefs in the Red Sea and Gulf of Aden in 2004,” in Wilkinson, op. cit. note 70, pp. 137–39.
73. UNEP and Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities, *The State of the Marine Environment: Trends and Processes* (The Hague: 2006); Nancy Rabalais and Gene Turner, “Dead Zone Size Near Top End,” press release (Cocodrie, LA: Louisiana Universities Marine Consortium, 28 July 2007).
74. UNEP, “Further Rise in Number of Marine ‘Dead Zones,’” press release (Beijing and Nairobi: 19 October 2006); UNEP, *GEO Yearbook 2003* (Nairobi: 2004), p. 58.
75. Organisation for Economic Co-operation and Development, *OECD Environmental Outlook* (Paris: 2001), pp. 109–20.
76. David Quammen, “Planet of Weeds,” *Harper’s Magazine*, October 1998.
77. Species Survival Commission, *2007 IUCN Red List of Threatened Species*, at www.iucnredlist.org, updated 12 September 2007.
78. Ibid.; TRAFFIC, *Food for Thought: The Utilization of Wild Meat in Eastern and Southern Africa* (Cambridge, U.K.: 2000).
79. Danna Harman, “Bonobos’ Threat: Hungry Humans,” *Christian Science Monitor*, 7 June 2001; “Video: New Bonobo Ape Population Discovered,” *National Geographic News*, 6 March 2007.
80. Species Survival Commission, op. cit. note 77; “Great Indian Bustard Facing Extinction,” *India Abroad Daily*, 12 February 2001; Çagan Sekercioglu, Gretchen C. Daily, and Paul R. Ehrlich, “Ecosystem Consequences of Bird Declines,” *Proceedings of the National Academy of Sciences*, vol. 101, no. 52 (28 December 2004).

81. Michael McCarthy, "Mystery of the Silent Woodlands: Scientists Are Baffled as Bird Numbers Plummet," *Independent* (London), 25 February 2005; British Trust for Ornithology, "Tough Time for Woodland Birds," press release (Thetford, Norfolk, U.K.: 25 February 2005); J. A. Thomas et al., "Comparative Losses of British Butterflies, Birds, and Plants and the Global Extinction Crisis," *Science*, vol. 303 (19 March 2004), pp. 1879–81.
82. Dennis Van Engelsdorp et al., "An Estimate of Managed Colony Losses in the Winter of 2006–2007: A Report Commissioned by the Apiary Inspectors of America," *American Bee Journal* (July 2007), pp. 599–603; Alexei Barrionuevo, "Bees Vanish, and Scientists Race for Reasons," *New York Times*, 24 April 2007.
83. Joel Garreau, "Honey, I'm Gone," *Washington Post*, 1 June 2007; Erik Stokstad, "Puzzling Decline of U.S. Bees Linked to Virus from Australia," *Science*, vol. 317, issue 5843 (7 September 2007), pp. 1304–05.
84. Species Survival Commission, *2004 IUCN Red List of Threatened Species* (Gland, Switzerland, and Cambridge, U.K.: IUCN, 2004), p. 89; Species Survival Commission, op. cit. note 77.
85. James R. Spotila et al., "Pacific Leatherback Turtles Face Extinction," *Nature*, vol. 405 (1 June 2000), pp. 529–30; "Leatherback Turtles Threatened," *Washington Post*, 5 June 2000; Pilar Santidrián Tomillo et al., "Reassessment of the Leatherback Turtle (*Dermochelys coriacea*) Nesting Population at Parque Nacional Marino Las Baulas, Costa Rica: Effects of Conservation Efforts," *Chelonian Conservation and Biology*, vol. 6, no. 1 (2007), pp. 54–62.
86. David Kaimowitz et al., *Hamburger Connection Fuels Amazon Destruction* (Jakarta, Indonesia: Center for International Forestry Research, 2004).
87. Conservation International, "The Brazilian Cerrado," at www.biodiversityhotspots.org, viewed 19 July 2007; Center for Applied Biodiversity Science, "Hotspots Revisited: Cerrado," at www.biodiversityscience.org/publications/hotspots/Cerrado.html, viewed 19 July 2007; butterfly diversity from Helena C. Morais et al., "Caterpillar Seasonality in a Central Brazilian Cerrado," *Revista de Biología Tropical*, vol. 47, no. 4 (1999), pp. 1025–33.
88. Species Survival Commission, op. cit. note 77.

Chapter 6. Early Signs of Decline

1. U.N. Population Division, *World Population Prospects: The 2002 Revision—Volume III: Analytical Report* (New York: 2004), pp. 136–58, 169.
2. Cancer in China from World Health Organization (WHO), "Death by Causes, Sex and Mortality Stratum in WHO Regions, Estimates for 2002," *World Health Report 2004* (Geneva: May 2004); U.N. Population Division, *World Population Prospects: The 2006 Revision Popula-*

- tion Database*, electronic database, at esa.un.org/unpp, updated 2007; "Number of Inmates in State or Federal Prisons and Local Jails by Gender, Race, Hispanic Origin, and Age, June 30, 2006," Bureau of Justice Statistics, U.S. Department of Justice, at www.ojp.gov/bjs/prisons.htm, updated 18 July 2007; U.S. Environmental Protection Agency (EPA), "Ag 101: Agricultural Demographics," fact sheet, at www.epa.gov/oecaagct, viewed 3 September 2007.
3. Life expectancy from WHO, *World Health Statistics 2007* (Geneva: 2007), pp. 22–31; hunger from U.N. Food and Agriculture Organization (FAO), *Number of Undernourished Persons*, at www.fao.org/faostat/foodsecurity, updated 30 June 2006.
 4. FAO, op. cit. note 3; WHO, "Obesity and Overweight," fact sheet (Geneva: September 2006).
 5. FAO, *The State of Food Insecurity in the World 2006* (Rome: 2006), pp. 8, 32, 33; FAO, *The State of Food Insecurity in the World 2002* (Rome: 2002); U.N. Population Division, op. cit. note 2.
 6. FAO, *The State of Food Insecurity in the World 2005* (Rome: 2005), p. 33.
 7. FAO, *The State of Food Insecurity in the World 2004* (Rome: 2004).
 8. Gary Gardner and Brian Halweil, "Nourishing the Underfed and Overfed," in Lester R. Brown et al., *State of the World 2000* (New York: W. W. Norton & Company, 2000), pp. 70–73.
 9. WHO and UNICEF, *Global Water Supply and Sanitation Assessment 2000 Report* (New York: 2000), pp. v, 2; WHO, op. cit. note 2.
 10. Stable populations compiled from Population Reference Bureau, *Datafinder*, electronic database, at www.prb.org/DataFind/datafinder7.htm, updated 2007; doubling projections from U.N. Population Division, op. cit. note 2.
 11. "Population That Has Attained Tertiary Education (2003)," in Organisation for Economic Co-operation and Development (OECD), *Education at a Glance 2005* (Paris: 2005); children not enrolled from United Nations, *Millennium Development Goals Report 2007* (New York: 2007), p. 11; adult illiteracy from UNESCO, *EFA Global Monitoring Report 2007: Strong Foundations* (Paris: 2006), p. 2.
 12. Hilaire A. Mputu, *Literacy and Non-Formal Education in the E-9 Countries* (Paris: UNESCO, 2001), pp. 5–13; UNESCO Institute for Statistics, "National Illiteracy Rates Youths (15–24) and Adults (15+)," at www.uis.unesco.org, updated 19 June 2007.
 13. Gene B. Sperling, "Toward Universal Education," *Foreign Affairs*, September/October 2001, pp. 7–13.
 14. Access to safe water from World Bank, *Global Monitoring Report 2007: Millennium Development Goals* (Washington, DC: 2007), p. 13; Peter H. Gleick, *Dirty Water: Estimated Deaths from Water-Related Disease 2000–2020* (Oakland, CA: Pacific Institute, 2002); U.N. Population Division, op. cit. note 2.

15. Deaths calculated from U.N. Population Division, *World Population Prospects: The 2004 Revision* (New York: 2005), and from WHO/UNICEF, *World Malaria Report 2005* (Geneva: 2005); Sachs from Center for International Development at Harvard University and London School of Hygiene and Tropical Medicine, "Executive Summary for Economics of Malaria," at www.rbm.who.int, viewed 3 August 2005.
16. More deaths from AIDS than wars from Lawrence K. Altman, "U.N. Forecasts Big Increase in AIDS Death Toll," *New York Times*, 3 July 2002.
17. Total deaths and historical estimates calculated using UNAIDS statistics in Worldwatch Institute, *Signposts 2004*, CD-Rom (Washington, DC: 2004) and in UNAIDS, *AIDS Epidemic Update* (Geneva: various years); sub-Saharan Africa from UNAIDS, *2006 AIDS Epidemic Update* (Geneva: December 2006), p. 10.
18. UNAIDS, *2006 Report on the Global AIDS Epidemic* (Geneva: May 2006), pp. 2–6, 320, 488.
19. UNAIDS, *2004 Report on the Global AIDS Epidemic* (Geneva: 2004), pp. 39–66; FAO, "The Impact of HIV/AIDS on Food Security," 27th Session of the Committee on World Food Security, Rome, 28 May–1 June 2001.
20. UNAIDS, op. cit. note 18, p. 95.
21. UNAIDS, UNICEF, and U.S. Agency for International Development, *Children on the Brink 2004: A Joint Report on New Orphan Estimates and a Framework for Action* (Washington, DC: 2004), p. 29; Michael Grunwald, "Sowing Harvests of Hunger in Africa," *Washington Post*, 17 November 2002.
22. Stephen Lewis, press briefing, New York, 8 January 2003; Edith M. Lederer, "Lack of Funding for HIV/AIDS is Mass Murder by Complicity, Says U.N. Envoy," *Associated Press*, 9 January 2003.
23. Alex de Waal, "What AIDS Means in a Famine," *New York Times*, 19 November 2002.
24. Sarah Janssen, Gina Solomon, and Ted Schettler, *Chemical Contaminants and Human Disease: A Summary of Evidence* (Boston: Alliance for a Healthy Tomorrow, 2004); Geoffrey Lean, "US Study Links More than 200 Diseases to Pollution," *Independent News* (London), 14 November 2004.
25. Jonathan Watts, "Beijing Blames Pollutants for Rise in Killer Cancers," *Guardian* (London), 22 May 2007.
26. Ibid.
27. Pan Yue, "View: China's Green Debt," *Daily Times* (Pakistan), 1 December 2006.
28. Kent Ewing, "Behind the Hysteria About China's Tainted Goods," *Asia Times*, 18 July 2007; EPA, "About EPA," at www.epa.gov, viewed

- 25 July 2007.
29. Jane Houlihan et al., *Body Burden: The Pollution in Newborns* (Washington, DC: Environmental Working Group, 2005).
30. Bernie Fischlowitz-Roberts, "Air Pollution Fatalities Now Exceed Traffic Fatalities by 3 to 1," *Eco-Economy Update* (Washington, DC: Earth Policy Institute, September 2002), citing WHO, "Air Pollution," *Fact Sheet 187* (Geneva: revised September 2000); traffic accident deaths from WHO, "Estimated Total Deaths, by WHO Member State, 2002," table downloaded from WHO Web site, "Burden of Disease Statistics," www.who.int/healthinfo; U.S. deaths from Joel Schwartz, quoted in Harvard School of Public Health, "Air Pollution Deadlier Than Previously Thought," press release (Cambridge, MA: 2 March 2000).
31. C. Pritchard, D. Baldwin, and A. Mayers, "Changing Patterns of Adult (45–74 years) Neurological Deaths in the Major Western World Countries 1979–1987," *Public Health*, vol. 118, issue 4 (June 2004), pp. 268–83; Juliette Jowit, "Pollutants Cause Huge Rise in Brain Diseases: Scientists Alarmed as Number of Cases Triples in 20 Years," *The Observer* (London), 15 August 2004; A. Ascherio et al., "Pesticide Exposure and Risk for Parkinson's Disease," *Annals of Neurology*, vol. 60, issue 2 (August 2006), pp. 197–203.
32. Global Environment Facility, U.N. Development Programme (UNDP), and United Nations Industrial Development Organization, "Removal of Barriers to the Introduction of Cleaner Artisanal Gold Mining and Extraction Technologies," *UNDP Global Mercury Project Inception Document GLO/01/G34* (Washington, DC: April 2002), p. 8; Ilan Levin and Eric Schaeffer, *Dirty Kilowatts: America's Most Polluting Power Plants* (Washington, DC: Environmental Integrity Project, July 2007), p. 2; EPA, "EPA Decides Mercury Emissions from Power Plants Must Be Reduced," press release (Washington, DC: 15 December 2000).
33. EPA, Office of Science and Technology, "National Listing of Fish Advisories: 2005–06 National Listing," fact sheet (Washington, DC: July 2007); Kathryn Mahaffey, EPA, Methylmercury: Epidemiology Update, presentation at The National Forum on Contaminants in Fish, San Diego, CA, January 2004, at www.epa.gov/waterscience.
34. Anne Platt McGinn, *Why Poison Ourselves? A Precautionary Approach to Synthetic Chemicals*, Worldwatch Paper 153 (Washington, DC: Worldwatch Institute, 2000), p. 7; 200 chemicals in body from Pete Myers, plenary discussion on Emerging Environmental Issues, at USAID Environmental Officers Training Workshop, "Meeting the Environmental Challenges of the 21st Century," Airlie Center, Warrenton, VA, 26 July 1999.
35. EPA, "Toxics Release Inventory (TRI) Program," fact sheet, at www.epa.gov/tri, updated 9 June 2006; EPA, "EPA Issues New Toxics Report, Improves Means of Reporting," press release (Washington, DC: 11 April 2001).

36. Calculated from U.S. Geological Survey, *Mineral Commodity Summaries 2007* (Washington, DC: U.S. Government Printing Office, 2007).
37. Eric Lipton, "The Long and Winding Road Now Followed by New York City's Trash," *New York Times*, 24 March 2001.
38. Lester R. Brown, "New York: Garbage Capital of the World," *Eco-Economy Update* (Washington, DC: Earth Policy Institute, April 2002); calculations by author, updated with The City of New York Department of Sanitation, "DSNY-Fact Sheet," updated 27 October 2003; Kirk Johnson, "To City's Burden, Add 11,000 Tons of Daily Trash," *New York Times*, 24 March 2001; Lhota quoted in Lipton, op. cit. note 37.
39. Gilmore quoted in Lipton, op. cit. note 37.
40. Joel Kurth, "N.J. Piles Demolition Trash on Michigan," *Detroit News*, 28 December 2004; City of Toronto, Canada, Solid Waste Management Division, "Facts about Toronto's Trash," Fact Sheet, at www.toronto.ca/garbage/facts.htm, updated 10 August 2006; Lipton, op. cit. note 37.
41. Niki Kitsantonis, "Athens Is in the Grip of a Garbage Crisis," *International Herald Tribune*, 28 January 2007.
42. "Fast Urbanization Dumps Garbage in Chinese Cities," *Xinhua News Agency*, 18 August 2006.
43. Günther Baechler, "Why Environmental Transformation Causes Violence: A Synthesis," *Environmental Change and Security Project Report*, Issue 4 (spring 1998), pp. 24–44.
44. U.S. Department of Agriculture (USDA), *Production, Supply, and Distribution Country Reports* (Washington, DC: October 1990); 2007 grainland area from USDA, *Production, Supply and Distribution*, electronic database, at www.fas.usda.gov/psdonline, updated 10 August 2007; U.N. Population Division, op. cit. note 2.
45. "Time for Action on Sudan" (editorial), *New York Times*, 18 June 2004; "A First Step to Save Darfur" (editorial), *New York Times*, 3 August 2007; Coalition for International Justice, "Estimates from Retrospective Mortality Surveys in Darfur and Chad Displacement Camps, Circa February 2003–April 2005," at www.cij.org, April 2005; "Sudan," in U.S. Central Intelligence Agency, *The World Fact Book*, at www.cia.gov/library/publications, updated 6 September 2007.
46. U.N. Population Division, op. cit. note 2; livestock from FAO, *Prod-STAT*, electronic database, at faostat.fao.org, updated 30 June 2007.
47. Somini Sengupta, "Where the Land is a Tinderbox, the Killing Is a Frenzy," *New York Times*, 16 June 2004; U.N. Population Division, op. cit. note 2; Government of Nigeria, *Combating Desertification and Mitigating the Effects of Drought in Nigeria*, National Report on the Implementation of the United Nations Convention to Combat Desertification (Nigeria: November 1999).

48. Sengupta, op. cit. note 47.
49. Ibid.
50. James Gasana, "Remember Rwanda?" *World Watch*, September/October 2002, pp. 24–32.
51. Ibid.
52. U.S. Census Bureau, Population Division, International Programs Center, *International Database*, at www.census.gov/ipc/www/idbacc.html, updated 26 April 2005; Gasana, op. cit. note 50.
53. Gasana, op. cit. note 50; Emily Wax, "At the Heart of Rwanda's Horror: General's History Offers Clues to the Roots of Genocide," *Washington Post*, 21 September 2002.
54. U.N. Population Division, op. cit. note 2.
55. Ibid.; Gasana, op. cit. note 50.
56. U.N. Population Division, op. cit. note 2; Sandra Postel, *Pillar of Sand* (New York: W. W. Norton & Company, 1999), pp. 141–49.
57. U.N. Population Division, op. cit. note 2, p. 43; Postel, op. cit. note 56, pp. 141–49.
58. Postel, op. cit. note 56, pp. 141–49; U.N. Population Division, op. cit. note 2.
59. O'Hara quoted in Michael Wines, "Grand Soviet Scheme for Sharing Water in Central Asia is Foundering," *New York Times*, 9 December 2002.
60. "Scientists Meeting in Tunis Called for Priority Activities to Curb Desertification," *UN News Service*, 21 June 2006.
61. Alan Cowell, "Migrants Found off Italy Boat Piled With Dead," *International Herald Tribune*, 21 October 2003.
62. Ibid.
63. Miranda Leitsinger, "African Migrants Die an Ocean Away," *Washington Post*, 2 June 2006; Mar Roman, "A New Record For Africans Risking Boat Route to Europe," *Washington Post*, 4 September 2006.
64. Ginger Thompson, "Mexico Worries About Its Own Southern Border," *New York Times*, 18 June 2006.
65. "Mexico's Immigration Problem: The Kamikazes of Poverty," *The Economist*, 31 January 2004.
66. Frank Bruni, "Off Sicily, Tide of Bodies Roils Immigrant Debate," *New York Times*, 23 September 2002; Flora Botsford, "Spain Recovers Drowned Migrants," *BBC News*, 25 April 2002; "Boat Sinks Off Coast of Turkey: One Survivor and 7 Bodies Found," *Agence France-Presse*, 22 December 2003; Mary Jordan and Kevin Sullivan, "Trade Brings Riches, But Not to Mexico's Poor," *Washington Post*, 22 March 2003; Robert McLeman and Barry Smit, "Climate Change, Migration and Security," *Commentary No. 86* (Ottawa: Canadian Security Intel-

- ligence Service, 2 March 2004); Arizona desert deaths from “Humane Approach to Border,” *Denver Post*, 24 April 2003.
67. Abandoned villages in India from Tushaar Shah et al., *The Global Groundwater Situation: Overview of Opportunities and Challenges* (Colombo, Sri Lanka: International Water Management Institute, 2000); U.N. Population Division, op. cit. note 2, p. 42.
 68. Wang Tao, *Cold and Arid Regions Environmental and Engineering Research Institute* (CAREERI), Chinese Academy of Sciences, e-mail to author, 4 April 2004; Wang Tao, “The Process and Its Control of Sandy Desertification in Northern China,” CAREERI, Chinese Academy of Sciences, seminar on desertification, held in Lanzhou, China, May 2002.
 69. Iranian News Agency, “Official Warns of Impending Desertification Catastrophe in Southeast Iran,” *BBC International Reports*, 29 September 2002; Government of Nigeria, op. cit. note 47, p. 6.
 70. Fund for Peace and Carnegie Endowment for International Peace, “The Failed States Index,” *Foreign Policy*, July/August 2005, pp. 56–65.
 71. Fund for Peace and Carnegie Endowment for International Peace, “The Failed States Index,” *Foreign Policy*, July/August 2007, pp. 54–63.
 72. Fund for Peace and Carnegie Endowment, op. cit. note 70.
 73. Fund for Peace and Carnegie Endowment, op. cit. note 71.
 74. Ibid.; U.N. Population Division, op. cit. note 2.
 75. U.N. Population Division, op. cit. note 2.
 76. Richard Cincotta, Robert Engelman, and Daniele Anastasion, *The Security Demographic: Population and Civil Conflict After the Cold War* (Washington, DC: Population Action International, 2003).
 77. Ginger Thompson, “A New Scourge Afflicts Haiti: Kidnappings,” *New York Times*, 6 July 2005; Madeleine K. Albright and Robin Cook, “The World Needs to Step It Up in Afghanistan,” *International Herald Tribune*, 5 October 2004; Desmond Butler, “5-Year Hunt Fails to Net Qaeda Suspect in Africa,” *New York Times*, 14 June 2003.
 78. Abraham McLaughlin, “Can Africa Solve African Problems?” *Christian Science Monitor*, 4 January 2005; Marc Lacey, “Beyond the Bullets and Blades,” *New York Times*, 20 March 2005; “World Refugee Day: Testimony of Anne C. Richard, International Rescue Committee,” before US House of Representatives Committee on Foreign Affairs Subcommittee on Africa and Global Health, Washington, DC, 20 June 2007.
 79. “Afghanistan: The Ignored War,” in Christy Harvey, Judd Legum, and Jonathan Baskin, *The Progress Report* (Washington, DC: American Progress Action Fund, 2005); Fund for Peace and Carnegie Endowment, op. cit. note 71; McLaughlin, op. cit. note 78; “A Failing State:

- The Himalayan Kingdom Is a Gathering Menace,” *The Economist*, 4 December 2004.
80. United Nations, “United Nations Peacekeeping Operations,” background note, at www.un.org/Depts/dpko/dpko/bnote.htm, 31 July 2007; “US Official Calls for NATO Flexibility in Afghanistan,” *Agence France-Presse*, 6 September 2007; Marc Lacey, “Congo Tribal Killings Create a New Wave of Refugees,” *New York Times*, 6 March 2005.
 81. U.N. World Food Programme (WFP), “New Operation Provides WFP Food Aid to 550,000 Haitians,” news release (Rome: 5 May 2005); WFP, “India Helps WFP Feed Afghan Schoolchildren,” news release (Rome: 17 May 2005).
 82. Stephanie McCrummen, “In an Eastern Congo Oasis, Blood amid the Greenery,” *Washington Post*, 22 July 2007.
 83. Roland Ogbonnaya, “Polio Pandemic...Is Nigeria Winning the Fight?” *This Day* (Lagos), 22 July 2007.
 84. David Brown, “A Blow to Anti-Polio Campaign,” *Washington Post*, 10 May 2005; Donald G. McNeil, Jr., “Muslims’ New Tack on Polio: A Vaccine en Route to Mecca,” *New York Times*, 20 August 2005; Nigerian polio cases tripling from “Wild Poliovirus 2000–2007,” in WHO Global Polio Eradication Initiative, “Wild Poliovirus Weekly Update,” at www.polioeradication.org, updated 2 October 2007.
 86. “Wild Poliovirus 2000–2007,” op. cit. note 84; number of polio-free countries estimated from Celia W. Dugger, “Nigeria and India Cited in Rise of Polio Cases,” *New York Times*, 13 October 2006.

Chapter 7. Eradicating Poverty, Stabilizing Population

1. U.N. General Assembly, “United Nations Millennium Declaration,” resolution adopted by the General Assembly, 8 September 2000; World Bank, *Global Monitoring Report 2007: Millennium Development Goals* (Washington, DC: 2007), p. 39; International Monetary Fund (IMF), World Economic Outlook, electronic database, www.imf.org, updated March 2007.
2. World Bank, *World Development Report 2005* (New York: Oxford University Press, 2004); Jeffrey D. Sachs, “India Takes the Lead,” *Korea Herald*, 4 August 2004.
3. United Nations, “Poverty, Percentage of Population Below \$1 (PPP) Per Day, Percentage,” *Millennium Development Goals Indicators Database*, updated 27 July 2007; World Bank, op. cit. note 1, pp. 1, 3.
4. U.N. Population Division, *World Population Prospects: The 2006 Revision Population Database*, at esa.un.org/unpp, updated 2007; G-8 leaders, “Gleneagles Communiqué on Africa, Climate Change, Energy and Sustainable Development,” document from G-8 Summit, Gleneagles, Scotland, July 2005; fragile states from World Bank, op. cit. note 1, p. 4.

5. U.N. General Assembly, op. cit. note 1.
6. World Bank, op. cit. note 1, pp. 1–6; U.N. Food and Agriculture Organization (FAO), *Number of Undernourished Persons*, at www.fao.org/faostat/foodsecurity, updated 30 June 2006; UNICEF, *Excluded and Invisible: The State of the World's Children 2006* (New York: 2005), pp. vii, 114–17.
7. All Party Parliamentary Group on Population Development and Reproductive Health, *Return of the Population Growth Factor: Its Impact on the Millennium Development Goals* (London: Her Majesty's Stationery Office, January 2007), pp. 1, 3–9; Martha Campbell et al., “Return of the Population Growth Factor,” *Science*, vol. 315 (16 March 2007), pp. 1501–02.
8. Campbell et al., op. cit. note 7; Martha Campbell, discussion with Janet Larsen, Earth Policy Institute, 8 October 2007; All Party Parliamentary Group, op. cit. note 7, p. 4.
9. United Nations, Millennium Development Goals Report 2007 (New York: 2007), p. 11; Hilaire A. Mputu, Literacy and Non-Formal Education in the E-9 Countries (Paris: UNESCO, 2001), p. 5; Polly Curtis, “Lack of Education ‘a Greater Threat than Terrorism’: Sen,” *Guardian* (London), 28 October 2003.
10. Paul Blustein, “Global Education Plan Gains Backing,” *Washington Post*, 22 April 2002; World Bank, “World Bank Announces First Group of Countries for ‘Education For All’ Fast Track,” press release (Washington, DC: 12 June 2002); Gene Sperling, “The G-8—Send 104 Million Friends to School,” *Bloomberg News*, 20 June 2005.
11. World Bank, op. cit. note 1, pp. 5, 24.
12. Gene Sperling, “Toward Universal Education,” *Foreign Affairs*, September/October 2001, pp. 7–13.
13. Gene Sperling, “Educate Them All,” *Washington Post*, 20 April 2002.
14. UNESCO, *EFA Global Monitoring Report 2007: Strong Foundations* (Paris: 2006), p.2; U.N. Commission on Population and Development, Thirty-sixth Session, Population, Education, and Development, press releases, 31 March–4 April 2003; UNESCO, “Winners of UNESCO Literacy Prizes 2003,” press release, 27 May 2003.
15. U.K. Treasury, *From Commitment to Action: Education* (London: Department for International Development, September 2005).
16. George McGovern, *The Third Freedom: Ending Hunger in Our Time* (New York: Simon & Schuster: 2001), chapter 1.
17. Jeffrey Sachs, “A New Map of the World,” *The Economist*, 22 June 2000; George McGovern, “Yes We CAN Feed the World's Hungry,” *Parade*, 16 December 2001.
18. McGovern, op. cit. note 17.
19. Ibid.

20. Ibid.
21. Countries with stable or declining populations retrieved from Population Reference Bureau (PRB), *Datafinder*, electronic database, at www.prb.org/DataFind/datafinder7.htm, updated 2007; U.N. Population Division, op. cit. note 4.
22. U.N. Population Division, op. cit. note 4; United Nations, “Total Population (Both Sexes Combined) By Major Area, Region and Country, Annually for 1950–2050,” table in *World Population Prospects: The 2006 Revision, Extended Dataset*, CD-ROM (Rome: 15 June 2007).
23. U.N. Population Division, op. cit. note 4.
24. Program for Appropriate Technology in Health (PATH) and U.N. Population Fund (UNFPA), *Meeting the Need: Strengthening Family Planning Programs* (Seattle: 2006), pp. 5–11; quote from All Party Parliamentary Group, op. cit. note 7, p. 22.
25. Janet Larsen, “Iran’s Birth Rate Plummeting at Record Pace,” in Lester R. Brown, Janet Larsen, and Bernie Fischlowitz-Roberts, *The Earth Policy Reader* (New York: W. W. Norton & Company, 2002), pp. 190–94; see also 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, and Farzaneh Roudi, “Iran’s Family Planning Program: Responding to a Nation’s Needs,” *MENA Policy Brief*, June 2002; Iran population growth rate from United Nations, *World Population Prospects: The 2004 Revision* (New York: 2005).
26. Larsen, op. cit. note 25.
27. Ibid.
28. Ibid; population growth rates from PRB, *2005 World Population Data Sheet*, wall chart (Washington, DC: August 2005), and from U.N. Population Division, op. cit. note 4.
29. Pamela Polston, “Lowering the Boom: Population Activist Bill Ryerison is Saving the World—One ‘Soap’ at a Time,” *Seven Days*, at www.populationmedia.org/archives/archives2.html, viewed 5 October 2007.
30. Ibid.
31. Ibid.
32. Ibid.
33. Additional spending from J. Joseph Speidel et al., *Family Planning and Reproductive Health: The Link to Environmental Preservation* (San Francisco: Bixby Center for Reproductive Health and Research Policy, University of California, 2007), p. 10, and from J. Joseph Speidel, discussion with J. Matthew Roney, Earth Policy Institute, 16 October 2007.
34. PATH and UNFPA, op. cit. note 24, p. 18.

35. “Bangladesh: National Family Planning Program,” *Family Planning Programs: Diverse Solutions for a Global Challenge* (Washington, DC: PRB, 1994); gaps from Speidel et al., op. cit. note 33, p. 10, and from Speidel, op. cit. note 33.
36. World Bank, op. cit. note 1, p. 5.
37. Lack of access to safe water from *ibid.*, p. 13.
38. Mustaque Chowdhury, *Health Workforce for TB Control by DOTS: The BRAC Case, Joint Learning Initiative Working Paper 5-2* (Global Health Trust, 2004).
39. Jeffrey D. Sachs and the Commission on Macroeconomics and Health, *Macroeconomics and Health: Investing in Health for Economic Development* (Geneva: World Health Organization (WHO), 2001); “UNICEF Lists Top Causes of Child Deaths,” *Reuters*, 13 September 2007; Ruth Levine and the What Works Working Group, *Millions Saved: Proven Successes in Global Health* (Washington, DC: Center for Global Development, 2004).
40. Bill and Melinda Gates Foundation, “Vaccine-Preventable Diseases,” at www.gatesfoundation.org/GlobalHealth, viewed 13 September 2007.
41. John Donnelly, “U.S. Seeks Cuts in Health Programs Abroad,” *Boston Globe*, 5 February 2003.
42. Sachs and Commission on Macroeconomics and Health, op. cit. note 39; WHO, “Smallpox,” fact sheet at www.who.int, viewed 10 October 2005.
43. WHO, “Polio Eradication: Now More Than Ever, Stop Polio Forever,” at www.who.int/features/2004/polio/en, viewed 17 September 2007; Rotary International, “About PolioPlus,” at www.rotary.org/foundation/polioplus/index.html, viewed 17 September 2007.
44. Polio cases from “Wild Poliovirus 2000–2007,” in WHO Global Polio Eradication Initiative, “Wild Poliovirus Weekly Update,” at www.polioeradication.org, updated 2 October 2007; Nigeria from WHO, *Global Polio Eradication Initiative: Annual Report 2006* (Geneva: 2007), p. 6.
45. “Pakistan Polio Drive is Suspended,” *BBC News*, 8 August 2007.
46. Michele Barry, M.D., “The Tail of Guinea Worm-Global Eradication Without a Drug or Vaccine,” *New England Journal of Medicine*, vol. 356, no. 25 (21 June 2007), pp. 2561–64.
47. *Ibid.*; country information from “Reported Cases of Dracunculiasis by Country, 1972–2005,” in Peter H. Gleick, *The World’s Water 2006–2007* (Washington, DC: Pacific Institute, 2006), pp. 293–97.
48. Tobacco deaths from WHO, “Chronic Obstructive Pulmonary Disease (COPD),” fact sheet (Geneva: November 2006); “The Tobacco Epidemic: A Crisis of Startling Dimensions,” in Message From the Director-General of the World Health Organization for World No-

- Tobacco Day 1998, at www.who.int; air pollution from WHO, “Air Pollution,” fact sheet 187 (Geneva: rev. September 2000).
49. Alison Langley, “Anti-Smoking Treaty Is Adopted by 192 Nations,” *New York Times*, 22 May 2003; information on WHO Tobacco Free Initiative at www.who.int/tobacco/index.cfm; treaty goals and Bloomberg from Alexi A. Wright and Ingrid T. Katz, “Tobacco Tightrope—Balancing Disease Prevention and Economic Development in China,” *New England Journal of Medicine*, vol. 356, no. 15 (12 April 2007), pp. 1493–96.
50. Cigarette consumption from U.S. Department of Agriculture (USDA), *Production, Supply and Distribution*, electronic database, at www.fas.usda.gov/psdonline, updated 31 August 2006, and from Tom Capehart, *Tobacco Outlook* (Washington, DC: USDA Economic Research Service, 24 April 2007); per capita estimates made with population from U.N. Population Division, op. cit. note 4; Daniel Yee, “Smoking Declines in U.S.—Barely,” *CBS News*, 10 November 2004.
51. USDA, op. cit. note 50; per capita estimates made using population from U.N. Population Division, op. cit. note 4.
52. Smoking Bans Around the World,” *Reuters*, 10 January 2005; “New Zealand Stubs Out Smoking in Bars, Restaurants,” *Reuters*, 13 December 2004.
53. “Bangladesh Bans Smoking in Many Public Places,” *Reuters*, 15 March 2005; Italy from “Europeans Back Public Smoking Ban,” *BBC News*, 31 May 2006; “England Smoking Ban Takes Effect,” *BBC News*, 1 July 2007; France from Howard K. Koh et al., “Making Smoking History Worldwide,” *New England Journal of Medicine*, vol. 356, no. 15 (12 April 2007), pp. 1496–1498.
54. Bernard Wysocki, Jr., “Companies Get Tough With Smokers, Obese to Trim Costs,” *Wall Street Journal*, 12 October 2004.
55. Sachs and Commission on Macroeconomics and Health, op. cit. note 39.
56. Joint United Nations Programme on HIV/AIDS (UNAIDS) and WHO, *2006 AIDS Epidemic Update* (Geneva: December 2006), p. 3; total deaths calculated using UNAIDS statistics in Worldwatch Institute, *Signposts 2004*, CD-Rom (Washington, DC: 2004), and in UNAIDS and WHO, *AIDS Epidemic Update* (Geneva: various years).
57. Nita Bhalla, “Teaching Truck Drivers About AIDS,” *BBC*, 25 June 2001; C. B. S. Venkataramana and P. V. Sarada, “Extent and Speed of Spread of HIV Infection in India Through the Commercial Sex Networks: A Perspective,” *Tropical Medicine and International Health*, vol. 6, no. 12 (December 2001), pp. 1040–61, cited in “HIV Spread Via Female Sex Workers in India Set to Increase Significantly by 2005,” *Reuters Health*, 26 December 2001.
58. Mark Covey, “Target Soldiers in Fight Against AIDS Says New Report,” press release (London: Panos Institute, 8 July 2002); “Free Condoms for Soldiers,” *South Africa Press Association*, 5 August

- 2001; HIV prevalence rate from UNAIDS, *2006 Report on the Global AIDS Epidemic* (Geneva: May 2006), p. 421.
59. Condoms needed from UNFPA, *Donor Support for Contraceptives and Condoms for STI/HIV Prevention 2005* (New York: 2005); cost per condom from UNFPA, *Achieving the ICPD Goals: Reproductive Health Commodity Requirements 2000–2015* (New York: 2005); Nada Chaya and Kai-Ahset Amen, with Michael Fox, *Condoms Count: Meeting the Need in the Era of HIV/AIDS* (Washington, DC: Population Action International, 2002).
 60. Chaya and Amen, with Fox, op. cit. note 59; cost per condom from UNFPA, *Achieving the ICPD Goals*, op. cit. note 59.
 61. “Who Pays for Condoms,” in Chaya and Amen, with Fox, op. cit. note 59; Communications Consortium Media Center, “U.N. Special Session on Children Ends in Acrimony,” *PLANetWIRE.org*, 14 May 2002; Adam Clymer, “U.S. Revises Sex Information, and a Fight Goes On,” *New York Times*, 27 December 2002.
 62. UNAIDS, *Report on the Global HIV/AIDS Epidemic* (Geneva: June 2000), pp. 9–11; UNAIDS, op. cit. note 58, pp. 20, 446, 487; UNAIDS, “Uganda: Country Situation Analysis,” at www.unaids.org/en/Regions_Countries, viewed 14 September 2007.
 63. UNAIDS and WHO, op. cit. note 56, p. 10; treated patients in 2005 from UNAIDS and WHO, *Progress on Global Access to HIV Antiretroviral Therapy: An Update on “3 by 5”* (Geneva: 2005), pp. 7, 13.
 64. Clive Bell, Shantayanan Devarajan, and Hans Gersbach, “The Long-run Economic Cost of AIDS: Theory and an Application to South Africa,” Policy Research Working Paper Series (Washington, DC: World Bank, 2003); “AIDS Summit: The Economics of Letting People Die,” *Star Tribune*, 16 July 2003; Deborah Mitchell, “HIV Treatment: 2 Million Years of Life Saved,” *Reuters Health*, 28 February 2005.
 65. “AIDS Summit,” op. cit. note 64.
 66. Organisation for Economic Co-operation and Development (OECD), *Agricultural Policies in OECD Countries: At a Glance 2006* (Paris: 31 July 2006), pp. 18, 19; OECD, “Development Aid from OECD Countries Fell 5.1% in 2006,” press release (Paris: 3 April 2007); “The Hypocrisy of Farm Subsidies,” *New York Times*, 1 December 2002.
 67. European Commission, *General Budget of the European Union for the Financial Year 2007: The Figures* (Brussels: February 2007), p. 4; OECD, *Agricultural Policies*, op. cit. note 66, pp. 18–22; “The Hypocrisy of Farm Subsidies,” op. cit. note 66.
 68. OECD, “Development Aid,” op. cit. note 66; “South Africa: Weaning States Off Subsidies,” *Africa News*, 19 August 2005.
 69. See Chapter 2 for further discussion of oil prices and ethanol.
 70. Number of farmers from Oxfam International, “Oxfam Dismisses US Cotton Market Access Offer as ‘Empty Promise,’” press release (London: 15 December 2005); Julian Alston et al., *Impacts of Reductions*

- in US Cotton Subsidies on West African Cotton Producers* (Boston: Oxfam America, 2007); OECD, *OECD Statistics*, electronic database, at stats.oecd.org/wbos, updated 25 September 2007; U.N. Population Division, op. cit. note 4.
71. Elizabeth Becker, “Looming Battle Over Cotton Subsidies,” *New York Times*, 24 January 2004; Elizabeth Becker, “U.S. Will Cut Farm Subsidies in Trade Deal,” *New York Times*, 31 July 2004; Randy Schnepf, *U.S. Agricultural Policy Response to WTO Cotton Decision* (Washington, DC: Congressional Research Service, updated 8 September 2006).
 72. Schnepf, op. cit. note 71; Mark Drajem and Carlos Caminada, “WTO Rules Against U.S. in Cotton Dispute With Brazil (Update 1),” *Bloomberg News*, 27 July 2007; Alan Bjerga, “Bush’s Opposition to ‘Soviet’ Farm Bill May Get Plowed Under,” *Bloomberg News*, 23 July 2007.
 73. “Ending the Cycle of Debt,” *New York Times*, 1 October 2004; debt servicing from World Bank, *Little Data Book on External Debt in Global Development Finance 2007* (Washington, DC: 2007), p. 8; health care spending calculated from IMF, *World Economic and Financial Surveys: Regional Economic Outlook—Sub-Saharan Africa* (Washington, DC: September 2006), pp. 36, 43, from David Goldsbrough, “IMF Programs and Health Spending,” presented at Global Conference on Gearing Macroeconomic Policies to Reverse the HIV/AIDS Epidemic, Brasilia, Brazil, 20 November 2006, and from U.N. Population Division, op. cit. note 4.
 74. “G8 Finance Ministers’ Conclusions on Development,” Pre Summit Statement by G-8 Finance Ministers, London, 10–11 June 2005; Oxfam International, “Gleneagles: What Really Happened at the G8 Summit?” *Oxfam Briefing Note* (London: 29 July 2005).
 75. Oxfam International, “The View From the Summit—Gleneagles G8 One Year On,” briefing note (Oxford, U.K.: June 2006).
 76. Abid Aslam, “18 Poor Countries to See Debt Slate Wiped Clean, Saving \$10 Million Per Week,” *One World US*, 26 September 2005; Oxfam International, op. cit. note 75.
 77. UNFPA, *The State of World Population 2004* (New York: 2004), pp. 14–15.
 78. United Nations, *World Population Prospects: The 2004 Revision* (New York: 2005); UNFPA, op. cit. note 77, p. 39.
 79. Costs of meeting social goals in Table 7–1 based on the following sources: universal primary education from U.K. Treasury, op. cit. note 15; adult literacy campaign is author’s estimate; school lunch program from McGovern, op. cit. note 17; assistance to preschool children and pregnant women is author’s estimate of extending the U.S.’s Women, Infants, and Children program, based on *ibid.*; reproductive health and family planning from Speidel et al., op. cit. note 33, p. 10, and from Speidel, op. cit. note 33; universal basic health care from Sachs

and Commission on Macroeconomics and Health, op. cit. note 39; closing the condom gap estimated from UNFPA, *Donor Support for Contraceptives and Condoms*, op. cit. note 59, and from UNFPA, *Achieving the ICPD Goals*, op. cit. note 59.

80. Sachs and Commission on Macroeconomics and Health, op. cit. note 39.
81. Ibid.; Wu Xiaoling, "Statement of Madam Wu Xiaoling, Deputy Governor of the People's Bank of China," speech delivered at the 39th Annual Meeting of the Board of Governors of the African Development Bank (Group), Kampala, Uganda, 25–26 May 2004.

Chapter 8. Restoring the Earth

1. Craig A. Cox, "Conservation Can Mean Life or Death," *Journal of Soil and Water Conservation*, November/December 2004.
2. Remaining forests from "Table 2.1. Distribution of Forests by Subregion 2005," in U.N. Food and Agriculture Organization (FAO), *Forest Resources Assessment (FRA) 2005* (Rome: 2006).
3. FAO, *ForesSTAT Statistics Database*, at faostat.fao.org, updated 22 December 2006; U.S. Environmental Protection Agency, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2005* (Washington, DC: 2005).
4. Fuelwood as a proportion of total harvested wood from FAO, op. cit. note 3; Daniel M. Kammen, "From Energy Efficiency to Social Utility: Lessons from Cookstove Design, Dissemination, and Use," in José Goldemberg and Thomas B. Johansson, *Energy as an Instrument for Socio-Economic Development* (New York: U.N. Development Programme, 1995).
5. Kevin Porter, "Final Kakuma Evaluation: Solar Cookers Filled a Critical Gap," in Solar Cookers International, *Solar Cooker Review*, vol. 10, no. 2 (November 2004); cost from "Breakthrough in Kenyan Refugee Camps," at solarcooking.org/kakuma-m.htm, viewed 30 July 2007.
6. FAO, *Agriculture: Towards 2015/30, Technical Interim Report* (Geneva: Economic and Social Department, 2000), pp. 156–57.
7. Johanna Son, "Philippines: Row Rages Over Lifting of Ban on Lumber Exports," *InterPress Service*, 17 April 1998; John Aglionby, "Philippines Bans Logging After Fatal Floods," *Guardian* (London), 6 December 2004; Republic of the Philippines, "President Okays Selective Lifting of Log Ban," press release (Manila: 7 March 2005).
8. Alliance for Forest Conservation and Sustainable Use, "WWF/World Bank Forest Alliance Launches Ambitious Program to Reduce Deforestation and Curb Illegal Logging," press release (New York: World Bank/WWF, 25 May 2005); certified area from Alliance for Forest Conservation and Sustainable Use, "World Bank/WWF Alliance for Forest Conservation & Sustainable Use: Questions & Answers," World Bank/WWF, at www.worldwildlife.org/alliance, viewed 30 July 2007; new protected area from Alliance for Forest Conservation and Sustainable Use, "WWF/World Bank Alliance Targets," at www.worldwildlife.org/alliance, viewed 30 July 2007.
9. Forest Stewardship Council, *FSC Certified Forests* (Bonn, Germany: 2005), pp. 34, 40, 53; Forest Stewardship Council, "FSC Certification: Maps, Graphs, and Statistics (July 2007)," PowerPoint Presentation, at www.fsc.org/en/whats_new/fsc_certificates/maps, viewed 30 July 2007.
10. A. Del Lungo, J. Ball, and J. Carle, *Global Planted Forests Thematic Study: Results and Analysis* (Rome: FAO Forestry Department, December 2006); grain area from U.S. Department of Agriculture (USDA), *Production Supply and Distribution*, electronic database, at www.fas.usda.gov/psdonline, updated 10 August 2007.
11. R. James and A. Del Lungo, "Comparisons of Estimates of 'High Value' Wood With Estimates of Total Forest Plantation Production," table in *The Potential for Fast-Growing Commercial Forest Plantations to Supply High Value Roundwood* (Rome: FAO Forestry Department, February 2005), p. 24; FAO, op. cit. note 3.
12. Plantation area in "Table 4. Total Planted Forest Area: Productive and Protective—61 Sampled Countries," in Del Lungo, Ball, and Carle, op. cit. note 10, pp. 66–70; Ashley T. Mattoon, "Paper Forests," *World Watch*, March/April 1998, pp. 20–28.
13. Plantation yields from Mattoon, op. cit. note 12; corn yields from USDA, op. cit. note 10.
14. FAO, op. cit. note 6, p. 185; Chris Brown and D. J. Mead, eds., "Future Production from Forest Plantations," *Forest Plantation Thematic Paper* (Rome: FAO, 2001), p. 9.
15. Reed Funk, letter to author, 9 August 2005.
16. M. Davis et al., "New England—Acadian Forests," in Taylor H. Rickerts et al., eds., *Terrestrial Ecoregions of North America: A Conservation Assessment* (Washington, DC: Island Press, 1999); David R. Foster, "Harvard Forest: Addressing Major Issues in Policy Debates and in the Understanding of Ecosystem Process and Pattern," LTER Network News: The Newsletter of the Long Term Ecological Network, spring/summer 1996; U.S. Forest Service, "2006 Forest Health Highlights," various state sheets, at fhm.fs.fed.us, viewed 2 August 2007.
17. C. Csaki, "Agricultural Reforms in Central and Eastern Europe and the Former Soviet Union: Status and Perspectives," *Agricultural Economics*, vol. 22 (2000), pp. 37–54; Igor Shvytov, *Agriculturally Induced Environmental Problems in Russia*, Discussion Paper No. 17 (Halle, Germany: Institute of Agricultural Development in Central and Eastern Europe, 1998), p. 13.
18. Se-Kyung Chong, "Anmyeon-do Recreation Forest: A Millennium of Management," in Patrick B. Durst et al., *In Search of Excellence: Exemplary Forest Management in Asia and the Pacific*

- Forestry Commission (Bangkok: FAO Regional Office for Asia and the Pacific, 2005), pp. 251–59.
19. Ibid.
 20. Turkish Foundation for Combating Soil Erosion (TEMA), at english.tema.org.tr, viewed 31 July 2007.
 21. U.S. Embassy, Niamey, Niger, “Niger: Greener Now Than 30 Years Ago,” reporting cable circulated following national FRAME workshop, October 2006; Chris Reij, “More Success Stories in Africa’s Drylands Than Often Assumed,” presentation at Network of Farmers’ and Agricultural Producers’ Organisations of West Africa (ROPPA) Forum on Food Sovereignty, 7–10 November 2006.
 22. U.S. Embassy, op. cit. note 21; Reij, op. cit. note 21.
 23. Secretariat of the U.N. Convention to Combat Desertification, “The Great North American Dust Bowl: A Cautionary Tale,” *Global Alarm Dust and Sandstorms from the World’s Drylands* (Bangkok: 2002), pp. 77–121.
 24. Jeffrey Zinn, Conservation Reserve Program: Status and Current Issues (Washington, DC: Congressional Research Service, 8 May 2001); USDA, Economic Research Service, *Agri-Environmental Policy at the Crossroads: Guideposts on a Changing Landscape* (Washington, DC: 2001).
 25. 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 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, at Purdue University and USDA-ARS National Soil Erosion Research Laboratory, 24–29 May 1999 (Washington, DC: 2001), pp. 248–54.
 26. Conservation Technology Information Center, Purdue University, “National Tillage Trends (1990–2004),” from the *2004 National Crop Residue Management Survey Data*; FAO, *Intensifying Crop Production with Conservation Agriculture*, at www.fao.org/ag, viewed 20 May 2003; Brazil, Argentina, and Australia from Rolf Derpsch, no-tillage consultant, e-mails to J. Matthew Roney, Earth Policy Institute, 6 and 11 August 2007; Canada from Doug McKell, Soil Conservation Council of Canada, “No-till Census Data-Canada,” presented at meeting of Confederation of American Associations for the Production of Sustainable Agriculture, Bella Vista, Paraguay, 12–14 September 2007.
 27. FAO, op. cit. note 26.
 28. “Algeria to Convert Large Cereal Land to Tree-Planting,” *Reuters*, 8 December 2000; Souhail Karam, “Drought-Hit North Africa Seen Hunting for Grains,” *Reuters*, 15 July 2005.

29. Godwin Nnanna, “Africa’s Message for China,” *China Dialogue*, 18 April 2007; International Institute for Sustainable Development, “African Regional Coverage Project,” Eighth African Union Summit—Briefing Note, vol. 7, issue 2 (Geneva: 7 February 2007), p. 8; Federal Republic of Nigeria, Ministry of Environment, “Green Wall Sahara Programme,” at www.greenwallsahara.org, viewed 17 October 2007.
30. Evan Ratliff, “The Green Wall of China,” *Wired*, April 2003; Wang Yan, “China’s Forest Shelter Project Dubbed ‘Green Great Wall,’” *Xinhua News Agency*, 9 July 2006; Sun Xiufang and Ralph Bean, *China Solid Wood Products Annual Report 2002* (Beijing: USDA, 2002).
31. Author’s discussion with officials of Helin County, Inner Mongolia (Nei Monggol), 17 May 2002.
32. Ibid.
33. U.S. Embassy, *Grapes of Wrath in Inner Mongolia* (Beijing: May 2001).
34. India’s dairy industry from A. Banerjee, “Dairying Systems in India,” *World Animal Review*, vol. 79/2 (Rome: FAO, 1994).
35. Andrew Balmford et al., “The Worldwide Costs of Marine Protected Areas,” *Proceedings of the National Academy of Sciences*, vol. 101, no. 26 (29 June 2004), pp. 9694–97; “Costs of a Worldwide System of Marine Parks,” press release (York: The University of York, 12 July 2004); current protected area from World Wildlife Fund (WWF), “Problems: Inadequate Protection,” at www.panda.org, viewed 9 August 2007.
36. Balmford et al., op. cit. note 35; Tim Radford, “Marine Parks Can Solve Global Fish Crisis, Experts Say,” *Guardian* (London), 15 June 2004.
37. Balmford et al., op. cit. note 35; Radford, op. cit. note 36.
38. Radford, op. cit. note 36; Richard Black, “Protection Needed for ‘Marine Serengetis,’” *BBC News*, 6 August 2003; Balmford et al., op. cit. note 35.
39. American Association for the Advancement of Science (AAAS), “Leading Marine Scientists Release New Evidence that Marine Reserves Produce Enormous Benefits within Their Boundaries and Beyond,” press release (Washington, DC: 12 March 2001); “Scientific Consensus Statement on Marine Reserves and Marine Protected Areas,” presented at the AAAS annual meeting, 15–20 February 2001.
40. AAAS, op. cit. note 39; “Scientific Consensus Statement,” op. cit. note 39, p. 2.
41. R. J. Diaz, J. Nestlerode, and M. L. Diaz, “A Global Perspective on the Effects of Eutrophication and Hypoxia on Aquatic Biota,” in G. L. Rupp and M. D. White, eds., *Proceedings of the 7th Annual Symposium on Fish Physiology, Toxicology and Water Quality, Estonia, 12–15 May 2003* (Athens, GA: U.S. Environmental Protection Agency,

- Ecosystems Research Division, 2004); U.N. Environment Programme (UNEP), *GEO Yearbook 2003* (Nairobi: 2004).
42. WWF, *Hard Facts, Hidden Problems: A Review of Current Data on Fishing Subsidies* (Washington, DC: 2001), pp. ii; Balmford et al., op. cit. note 35; Radford, op. cit. note 36; fishery subsidy value includes “bad” subsidies and fuel subsidies as estimated in Fisheries Center University of British Columbia, *Catching More Bait: A Bottom-Up Re-Estimation of Global Fisheries Subsidies* (2nd Version) (Vancouver, BC: The Fisheries Center, 2006), p. 21.
 43. U.N. Population Division, *World Population Prospects: The 2006 Revision Population Database*, at esa.un.org/unpp, updated 2007.
 44. WWF, op. cit. note 35.
 45. Conservation International, “Biodiversity Hotspots,” at www.biodiversityhotspots.org, viewed 31 July 2007.
 46. U.S. Fish and Wildlife Service, “The Endangered Species Act of 1973,” at www.fws.gov/endangered, viewed 31 July 2007; Mark Clayton, “New Tool to Fight Global Warming: Endangered Species Act,” *Christian Science Monitor*, 7 September 2007; U.S. Fish and Wildlife Service-Alaska, “Polar Bear Conservation Issues,” at alaska.fws.gov/fisheries/mmm/polarbear/issues.htm, updated 5 October 2007.
 47. Vattenfall, *Global Mapping of Greenhouse Gas Abatement Opportunities up to 2030: Forestry Sector Deep-Dive* (Stockholm: June 2007), p.1.
 48. Ibid., p. 6; World Resources Institute, *Climate Analysis Indicator Tool*, electronic database at cait.wri.org, updated 2007.
 49. “Forestry Cuts Down on Logging,” *China Daily*, 26 May 1998; 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 September 1998; 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, Thailand: FAO Regional Office for Asia Pacific, 2001); John Aglionby, “Philippines Bans Logging After Fatal Floods,” *Guardian* (London), 6 December 2004.
 50. Geoffrey Lean, “A Disaster to Take Everyone’s Breath Away,” *The Independent* (London), 24 July 2006; Daniel Nepstad, “Climate Change and the Forest,” *Tomorrow’s Amazonia: Using and Abusing the World’s Last Great Forests* (Washington, DC: The American Prospect, September 2007); S. S. Saatchi et al., “Distribution of Above-ground Live Biomass in the Amazon Rainforest,” *Global Change Biology*, vol. 13, no. 4 (April 2007), pp. 816–37.
 51. Vattenfall, op. cit. note 47, p. 16; sequestration per tree calculated assuming 500 trees per hectare, from UNEP Billion Tree Campaign, “Fast Facts,” at www.unep.org/billiontreecampaign, viewed 10 October 2007; growing period from Robert N. Stavins and Kenneth R. Richards, *The Cost of U.S. Forest Based Carbon Sequestration* (Arlington, VA: Pew Center on Global Climate Change, January 2005), p. 10.

52. Vattenfall, op. cit. note 47, pp. 1, 16; Dollar to Euro exchange rate of 1.4, from “Benchmark Currency Rates,” at www.bloomberg.com/markets, viewed 17 October 2007.
53. UNEP Billion Tree Campaign, at www.unep.org/billiontreecampaign, viewed 12 October 2007; “Mexico Celebrates Día del Arbol with a Commitment to Plant 250 Million Trees,” at www.unep.org/billiontreecampaign/CampaignNews, viewed 26 October 2007; Ethiopia pledge from Daniel Wallis, “UN Wins Pledges to Plant a Billion Trees,” *Reuters*, 22 May 2007; Senegal pledge from “Global Tree Planting Campaign Puts Down a Billion Roots on International Biological Diversity Day,” at www.unep.org/Documents.Multilingual, viewed 12 October 2007.
54. “The State of Parana in Brazil Undertakes a Major Reforestation Project,” at www.unep.org/billiontreecampaign/CampaignNews, viewed 12 October 2007; “31 July—The Greenest Day of the Calendar in India and a Tree Planting Record by 600,000 Volunteers,” at www.unep.org/Documents.Multilingual, viewed 12 October 2007; carbon sequestration assuming that three fourths of trees will be in tropics and one fourth in temperate regions, using Vattenfall, op. cit. note 47, p. 16.
55. Ministry for the Environment, *New Zealand’s Climate Change Solutions: An Overview* (Wellington, New Zealand: September 2007), p. 19; U.N. Population Division, op. cit. note 43; calculations assume a mature stand density of 500 trees per hectare.
56. Chang-Ran Kim, “Tokyo Turns to Rooftop Gardens to Beat the Heat,” *Reuters*, 7 August 2002; Washington, D.C., program from Casey Trees, at www.caseytrees.org, viewed 12 October 2007.
57. Kathy Wolf, “Urban Forest Values: Economic Benefits of Trees in Cities,” fact sheet (Seattle, WA: Center for Urban Horticulture, November 1998); Greg McPherson et al., “Municipal Forest Benefits and Costs in Five US Cities,” *Journal of Forestry*, December 2005, pp. 411–16.
58. Patrick Barta, “Jatropha Plant Gains Steam in Global Race for Bio-fuels,” *Wall Street Journal*, 24 August 2007.
59. Rattan Lal, “Soil Carbon Sequestration Impacts on Global Climate Change and Food Security,” *Science*, vol. 304 (11 June 2004), pp. 1623–27.
60. Table 8–1 from the following: planting trees to reduce flooding and conserve soil and protecting topsoil on cropland from Lester R. Brown and Edward C. Wolf, “Reclaiming the Future,” in Lester R. Brown et al., *State of the World 1988* (New York: W. W. Norton & Company, 1988), p. 174, using data from FAO, *Fuelwood Supplies in the Developing Countries*, Forestry Paper 42 (Rome: 1983); planting trees to sequester carbon from Vattenfall, op. cit. note 47, p. 16; restoring rangelands from UNEP, *Status of Desertification and Implementation of the United Nations Plan of Action to Combat Desertification*

- (Nairobi: 1991), pp. 73–92; restoring fisheries from Balmford et al., op. cit. note 35; protecting biological diversity from World Parks Congress, *Recommendations of the Vth IUCN World Parks Congress* (Durban, South Africa: 2003), pp. 17–19, and from World Parks Congress, “The Durban Accord,” at www.iucn.org/themes/wcpa, viewed 19 October 2007; stabilizing water tables is author’s estimate.
61. Se-Kyung Chong, “Anmyeon-do Recreation Forest: A Millennium of Management,” in Durst et al., op. cit. note 18.
 62. Brown and Wolf, op. cit. note 60, p. 175.
 63. Runsheng Yin et al., “China’s Ecological Rehabilitation: The Unprecedented Efforts and Dramatic Impacts of Reforestation and Slope Protection in Western China,” in Woodrow Wilson International Center for Scholars, China Environment Forum, China Environment Series, Issue 7 (Washington, DC: 2005), pp. 17–32.
 64. Brown and Wolf, op. cit. note 60, p. 176.
 65. Vattenfall, op. cit. note 47, p. 16; Amy Belasco, *The Cost of Iraq, Afghanistan and Other Global War on Terror Operations Since 9/11* (Washington, DC: Congressional Research Service, 16 July 2007).
 66. Brown and Wolf, op. cit. note 60, pp. 173–74.
 67. Ibid., p. 174.
 68. Ibid.
 69. Ibid.
 70. UNEP, op. cit. note 60, with dollar figures converted from 1990 to 2004 dollars using implicit price deflators from U.S. Department of Commerce, Bureau of Economic Analysis, “Table C.1. GDP and Other Major NIPA Aggregates,” in *Survey of Current Business*, September 2005, p. D–48.
 71. H. E. Dregne and Nan-Ting Chou, “Global Desertification Dimensions and Costs,” in *Degradation and Restoration of Arid Lands* (Lubbock, TX: Texas Tech. University, 1992); UNEP, op. cit. note 60.
 72. Balmford et al., op. cit. note 35.
 73. World Parks Congress, *Recommendations of the Vth IUCN World Parks Congress*, op. cit. note 60; World Parks Congress, “The Durban Accord,” op. cit. note 60.
 74. Irrigated cropland from FAO, *FAOSTAT Statistics Database*, at apps.fao.org, land data updated 4 April 2005.
 75. Jordan from Tom Gardner-Outlaw and Robert Engelman, *Sustaining Water, Easing Scarcity: A Second Update* (Washington, DC: Population Action International, 1997); Mexico from Sandra Postel, *Last Oasis* (New York: W. W. Norton & Company, 1997), pp. 150–51.
 76. Sandra Postel, *Pillar of Sand* (New York: W. W. Norton & Company, 1999), pp. 230–35; Postel, op. cit. note 75, pp. 167–68.

Chapter 9. Feeding Eight Billion Well

1. “Last Food Shipment Signals End of 25-Year WFP Aid to China,” *Asian Economic News*, 8 April 2005; U.S. Department of Agriculture (USDA), *Production, Supply and Distribution*, electronic database, at www.fas.usda.gov/psdonline, updated 10 August 2007; U.N. World Food Programme, “China Emerges as World’s Third Largest Food Aid Donor,” press release (Rome: 20 July 2006).
2. Xie Wei and Christian DeBresson, *China’s Progressive Market Reform and Opening* (Geneva: U.N. Industrial Development Organization, 2001); USDA, op. cit. note 1.
3. U.N. Food and Agriculture Organization (FAO), *The State of Food Insecurity in the World 2006* (Rome: 2006), p. 8; Madelene Pearson and Danielle Rossingh, “Wheat Price Rises to Record \$9 a Bushel on Global Crop Concerns,” *Bloomberg*, 12 September 2007.
4. Thomas R. Sinclair, “Limits to Crop Yield,” paper presented at the 1999 National Academy Colloquium, Plants and Populations: Is There Time? Irvine, CA, 5–6 December 1998; Patrick Heffer, *Short-Term Prospects for World Agriculture and Fertilizer Demand 2005/06-2007/08* (Buenos Aires, Argentina: International Fertilizer Industry Association, January 2007); 1950–1960 data from USDA, in Worldwatch Institute, *Signposts 2001*, CD-Rom (Washington, DC: 2001); USDA, op. cit. note 1.
5. U.N. Population Division, *World Population Prospects: The 2006 Revision Population Database*, at esa.un.org/unpp, updated 2007.
6. USDA, op. cit. note 1.
7. Ibid.; Worldwatch Institute, op. cit. note 4.
8. USDA, National Agricultural Statistics Service (NASS), *Crop Production 2006 Summary* (Washington, DC: January 2007); USDA, NASS, *QuickStats*, electronic database, at www.nass.usda.gov/Data_and_Statistics/Quick_Stats, viewed 28 September 2007.
9. USDA, op. cit. note 1; Worldwatch Institute, op. cit. note 4.
10. John Wade, Adam Branson, and Xiang Qing, *China Grain and Feed Annual Report 2002* (Beijing: USDA, 2002); USDA, op. cit. note 1.
11. Double-cropping yields from USDA, *India Grain and Feed Annual Report 2003* (New Delhi: 2003); U.N. Population Division, op. cit. note 5; USDA, op. cit. note 1.
12. Richard Magleby, “Soil Management and Conservation,” in USDA, *Agricultural Resources and Environmental Indicators 2003* (Washington, DC: February 2003), Chapter 4.2, p. 14.
13. USDA, op. cit. note 1; Randall D. Schnepf et al., *Agriculture in Brazil and Argentina* (Washington, DC: USDA Economic Research Service (ERS), 2001), pp. 8–10.
14. FAO, *ResourceSTAT*, electronic database, at faostat.fao.org/site/405/default.aspx, updated 30 June 2007; USDA, op. cit. note 1.

15. Pedro Sanchez, "The Climate Change–Soil Fertility–Food Security Nexus," summary note (Bonn: International Food Policy Research Institute, 4 September 2001).
16. Edward Cody, "Chinese Lawmakers Approve Measure to Protect Private Property Rights," *Washington Post*, 17 March 2007; Jim Yardley, "China Nears Passage of Landmark Property Law," *New York Times*, 9 March 2007; Zhu Keliang and Roy Prosterman, "From Land Rights to Economic Boom," *China Business Review*, July–August 2006.
17. Worldwatch Institute, op. cit. note 4; USDA, op. cit. note 1; water use for grain production from FAO, *Crops and Drops* (Rome: 2002), p. 17.
18. Water requirements for grain production from FAO, *Yield Response to Water* (Rome: 1979); water use from I. A. Shiklomanov, "Assessment of Water Resources and Water Availability in the World," *Report for the Comprehensive Assessment of the Freshwater Resources of the World* (St. Petersburg, Russia: State Hydrological Institute, 1998), cited in Peter H. Gleick, *The World's Water 2000–2001* (Washington, DC: Island Press, 2000), p. 53.
19. Sandra Postel and Amy Vickers, "Boosting Water Productivity," in Worldwatch Institute, *State of the World 2004* (New York: W. W. Norton & Company, 2004), pp. 51–52.
20. Wang Shucheng, discussion with author, Beijing, May 2004.
21. FAO, op. cit. note 17, p. 17; Alain Vidal, Aline Comeau, and Hervé Plusquellec, *Case Studies on Water Conservation in the Mediterranean Region* (Rome: FAO, 2001), p. vii.
22. FAO, op. cit. note 17, p. 17; Vidal, Comeau, and Plusquellec, op. cit. note 21, p. vii.
23. Postel and Vickers, op. cit. note 19, p. 53.
24. Sandra Postel et al., "Drip Irrigation for Small Farmers: A New Initiative to Alleviate Hunger and Poverty," *Water International*, March 2001, pp. 3–13.
25. Ibid.
26. "Punjab's Depleting Groundwater Stagnates Agricultural Growth," *Down to Earth*, vol. 16, no. 5 (30 July 2007).
27. For more information on water users associations, see R. Maria Saleth and Ariel Dinar, *Water Challenge and Institutional Response: A Cross-Country Perspective* (Washington, DC: World Bank, 1999), p. 26.
28. Ibid., p. 6.
29. World Bank and Swiss Agency for Development and Cooperation, Summary Report, Middle East and North Africa Regional Water Initiative Workshop on Sustainable Groundwater Management, Sana'a, Yemen, 25–28 June 2000, p. 19.
30. Peter Wonacott, "To Save Water, China Lifts Price," *Wall Street*

- Journal*, 14 June 2004.
31. USDA, op. cit. note 1; USDA, Foreign Agricultural Service (FAS), "Egyptian Rice Acreage Continues to Exceed Government-Designated Limitations," Foreign Countries' Policies and Programs, *FASonline*, viewed 28 September 2007; "Rice Cropped for Water," *China Daily*, 9 January 2002.
 32. U.N. Population Division, op. cit. note 5; grain consumption from USDA, op. cit. note 1; water calculation based on 1,000 tons of water for 1 ton of grain from FAO, op. cit. note 18.
 33. USDA, op. cit. note 1.
 34. FAO, *FAOSTAT*, electronic database at faostat.fao.org, updated 30 June 2007; 1950 data from Worldwatch Institute, op. cit. note 4.
 35. 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 of grain to beef based on Allen Baker, Feed Situation and Outlook staff, ERS, USDA, discussion with author, 27 April 1992; pork data from Leland Southard, Livestock and Poultry Situation and Outlook staff, ERS, USDA, discussion with author, 27 April 1992; fish from Rosamond L. Naylor et al., "Effect of Aquaculture on World Fish Supplies," *Nature*, vol. 405 (29 June 2000), pp. 1017–24.
 36. USDA, op. cit. note 1.
 37. FAO, *FishStat Plus*, electronic database, at www.fao.org, updated March 2007; Naylor et al., op. cit. note 35.
 38. Naylor et al., op. cit. note 35; FAO, op. cit. note 37; Taija-Riitta Tuominen and Maren Esmark, *Food for Thought: The Use of Marine Resources in Fish Feed* (Oslo: WWF-Norway, 2003).
 39. FAO, op. cit. note 37.
 40. S. F. Li, "Aquaculture Research and Its Relation to Development in China," in *World Fish Center, Agricultural Development and the Opportunities for Aquatic Resources Research in China* (Penang, Malaysia: 2001), p. 26; FAO, op. cit. note 37.
 41. FAO, op. cit. note 37; FAO, op. cit. note 34.
 42. Naylor et al., op. cit. note 35; W. C. Nandeesha et al., "Breeding of Carp with Oviprim," in Indian Branch, Asian Fisheries Society, *India, Special Publication No. 4* (Mangalore, India: 1990), p. 1.
 43. "Mekong Delta to Become Biggest Aquatic Producer in Vietnam," *Vietnam News Agency*, 3 August 2004; "The Mekong Delta Goes Ahead with the WTO," *Vietnam Economic News Online*, 8 June 2007; FAO, op. cit. note 37.
 44. Naylor et al., op. cit. note 35; U.S. catfish production data from USDA, NASS, *Catfish Production* (Washington, DC: February 2003), p. 5.
 45. USDA, op. cit. note 1; Suzi Fraser Dominy, "Soy's Growing Impor-

- tance,” *World Grain*, 13 April 2004.
46. USDA, FAS, *Oilseeds: World Markets and Trade* (Washington, DC: August 2007).
 47. USDA, op. cit. note 1.
 48. Ibid.
 49. Historical statistics in Worldwatch Institute, op. cit. note 4; USDA, op. cit. note 1.
 50. FAO, op. cit. note 34.
 51. S. C. Dhall and Meena Dhall, “Dairy Industry—India’s Strength in Its Livestock,” *Business Line*, Internet Edition of *Financial Daily* from The Hindu group of publications, 7 November 1997; see also Surinder Sud, “India Is Now World’s Largest Milk Producer,” *India Perspectives*, May 1999, pp. 25–26; A. Banerjee, “Dairying Systems in India,” *World Animal Review*, vol. 79, no. 2 (1994).
 52. USDA, op. cit. note 1; U.N. Population Division, op. cit. note 5.
 53. Dhall and Dhall, op. cit. note 51; Banerjee, op. cit. note 51; FAO, op. cit. note 34.
 54. Wade, Branson, and Xiang, op. cit. note 10; 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.
 55. USDA, ERS, “China’s Beef Economy: Production, Marketing, Consumption, and Foreign Trade,” *International Agriculture and Trade Reports: China* (Washington, DC: July 1998), p. 28.
 56. FAO, op. cit. note 34; U.N. Population Division, op. cit. note 5.
 57. China’s economic growth from International Monetary Fund (IMF), *World Economic Outlook Database*, at www.imf.org/external/pubs/ft/weo, updated 11 April 2007; U.N. Population Division, op. cit. note 5; FAO, op. cit. note 34.
 58. Micronutrient Initiative, *Double Fortification of Salt: A Technical Breakthrough to Alleviate Iron and Iodine Deficiency Disorders Around the World* (Ottawa, Canada: 2005); Alan Berg, former World Bank nutrition program manager, discussion with author, 13 March 2007.
 59. Ibid.
 60. Author’s calculations from USDA, op. cit. note 1; U.N. Population Division, op. cit. note 5.
 61. USDA, op. cit. note 1; U.N. Population Division, op. cit. note 5; FAO, op. cit. note 34.
 62. Organisation for Economic Co-operation and Development, “Total Expenditure on Health Per Capita, US\$ PPP,” table, *OECD Health Data 2007-Frequently Requested Data*, at www.oecd.org, July 2007; FAO, op. cit. note 34.

63. Gidon Eshel and Pamela A. Martin, “Diet, Energy, and Global Warming,” *Earth Interactions*, vol. 10, no. 9 (April 2006), pp. 1–17; USDA, op. cit. note 1; U.N. Population Division, op. cit. note 5.
64. Pearson and Rossingh, op. cit. note 3; Chicago Board of Trade, “Market Commentaries,” at www.cbot.com, various dates; IMF, *International Financial Statistics* (Washington, DC: 2007); Missy Ryan, “Commodity Boom Eats Into Aid for World’s Hungry,” *Reuters*, 5 September 2007.
65. USDA, ERS, Natural Resources and Environment Division, *Agricultural Resources and Environmental Indicators, 1996–1997*, Agricultural Handbook No. 712 (Washington, DC: 1997).

Chapter 10. Designing Cities for People

1. U.N. Population Division, *World Urbanization Prospects: The 2005 Revision Population Database*, electronic database, at esa.un.org/unup, updated 2006.
2. Urban population in 1900 from Mario Polèse, “Urbanization and Development,” *Development Express*, no. 4, 1997; U.N. Population Fund (UNFPA), *State of World Population 2007* (New York: 2007), p. 1.
3. Molly O’Meara, *Reinventing Cities for People and the Planet*, Worldwatch Paper 147 (Washington, DC: Worldwatch Institute, June 1999), pp. 14–15; U.N. Population Division, *World Population Prospects: The 2006 Revision Population Database*, electronic database, at esa.un.org/unpp, updated 2007; “The 30 Largest Urban Agglomerations Ranked By Population Size,” Table A.11, in U.N. Population Division, *World Urbanization Prospects: The 2005 Revision* (New York: October 2006).
4. Christopher Flavin, “Hearing on Asia’s Environmental Challenges: Testimony of Christopher Flavin,” Committee on International Relations, U.S. House of Representatives, Washington, DC, 22 September 2004; Subir Bhaumik, “Air Pollution Suffocates Calcutta,” *BBC News*, 3 May 2007; David Schrank and Tim Lomax, *2005 Urban Mobility Study* (College Station, TX: Texas Transportation Institute, May 2005).
5. Francesca Lyman, “Twelve Gates to the City: A Dozen Ways to Build Strong, Livable, and Sustainable Cities,” *Words and Pictures Magazine*, Issue 5 (2007); Lisa Jones, “A Tale of Two Mayors: The Improbable Story of How Bogota, Colombia, Became Somewhere You Might Actually Want To Live,” *Grist Magazine*, 4 April 2002.
6. Claudia Nanninga, “Energy Efficient Transport—A Solution for China,” *Voices of Grassroots*, November 2004; Enrique Peñalosa, “Parks for Livable Cities: Lessons from a Radical Mayor,” keynote address at the Urban Parks Institute’s Great Parks/Great Cities Conference, Chicago, 30 July 2001; Susan Ives, “The Politics of Happiness,” *Trust for Public Land*, 9 August 2002; Jones, op. cit. note 5.

7. Peñalosa, op. cit. note 6.
8. Jones, op. cit. note 5; O'Meara, op. cit. note 3, p. 47.
9. O'Meara, op. cit. note 3, p. 47; Walter Hook, "Bus Rapid Transit: The Unfolding Story," in Worldwatch Institute, *State of the World 2007* (New York: W. W. Norton & Company, 2007), pp. 80–81; U.N. Population Division, op. cit. note 1.
10. Los Angeles from Sandra Postel, *Last Oasis*, rev. ed. (New York: W. W. Norton & Company, 1997), p. 20; Mexico City from Joel Simon, *Endangered Mexico* (San Francisco: Sierra Club Books, 1997); Chinese Ministry of Water Resources, *Country Report of the People's Republic of China* (Marseilles, France: World Water Council, 2003), pp. 60–61.
11. U.S. Department of Agriculture, Foreign Agricultural Service, *Grain: World Markets and Trade and Oilseeds: World Markets and Trade* (Washington, DC: various issues).
12. Richard Register, "Losing the World, One Environmental Victory at a Time—And a Way to Solve That Problem," essay (Oakland, CA: Ecocity Builders, Inc., 31 August 2005); Richard Register, *Ecocities: Rebuilding Cities in Balance with Nature: Revised Edition* (Gabriola Island, BC: New Society Publishers, 2006).
13. Register, "Losing the World, One Environmental Victory at a Time," op. cit. note 12.
14. Ibid.; population estimate from U.S. Census Bureau, *Population Finder*, electronic database, at factfinder.census.gov, viewed 16 August 2007.
15. Register, "Losing the World, One Environmental Victory at a Time," op. cit. note 12.
16. See Chapter 12 for further discussion of the energy economy.
17. Jay Walljasper, "Unjamming the Future," *Ode*, October 2005, pp. 36–41; Bus Rapid Transit Policy Center, *Transport Innovator* (newsletter), vol. 3, no. 4 (July/August 2007); BRT Information Clearinghouse, "Existing BRT Programs," at path.berkeley.edu/informationclearinghouse/brt/existing.html, viewed 27 September 2007; Yingling Liu, "Bus Rapid Transit: A Step Toward Fairness in China's Urban Transportation," *China Watch* (Washington, DC: Worldwatch Institute, 9 March 2006).
18. Walljasper, op. cit. note 17; Bus Rapid Transit Policy Center, op. cit. note 17; BRT Information Clearinghouse, op. cit. note 17.
19. Molly O'Meara Sheehan, "Making Better Transportation Choices," in Lester R. Brown et al., *State of the World 2001* (New York: W. W. Norton & Company, 2001), p. 116.
20. William D. Eggers, Peter Samuel, and Rune Munk, *Combating Gridlock: How Pricing Road Use Can Ease Congestion* (New York: Deloitte, November 2003); Tom Miles, "London Drivers to Pay UK's

- First Congestion Tax," *Reuters*, 28 February 2002; Randy Kennedy, "The Day the Traffic Disappeared," *New York Times Magazine*, 20 April 2003, pp. 42–45; James Savage, "Congestion Charge Returns to Stockholm," *The Local*, 1 August 2007; British sterling to dollars conversion on 16 October 2007, from www.bloomberg.com/invest/calculators/currency.html.
21. Transport for London, *Central London Congestion Charging: Impacts Monitoring—Second Annual Report* (London: April 2004), pp. 2, 39; Transport for London, *Central London Congestion Charging: Impacts Monitoring—Fifth Annual Report* (London: July 2007), pp. 21, 22, 47.
22. Transport for London, *Fifth Annual Report*, op. cit. note 21, pp. 3, 7.
23. "Milan to Impose 'Pollution Charge' on Cars," *Reuters*, 23 July 2007; "Congestion Charging Sweeps The World—A Rash of Cities Round the Globe is Set to Travel the Same Road as London," *Guardian* (London), 15 February 2004; Aaron O. Patrick, "Life in the Faster Lane: How London Car Curbs Inspired U.S. Cities," *Wall Street Journal*, 20 July 2007.
24. Serge Schmemmann, "I Love Paris on a Bus, a Bike, a Train and in Anything but a Car," *New York Times*, 26 July 2007; Katrin Bennhold, "A New French Revolution's Creed: Let Them Ride Bikes," *New York Times*, 16 July 2007.
25. Bennhold, op. cit. note 24; Alexandra Topping, "Free Wheeling: Paris's New Bike System," *Washington Post*, 23 September 2007.
26. Schmemmann, op. cit. note 24; La Fédération de Paris du Parti Socialiste, ed., *Ce Que Nous Avons Fait Ensemble* (Paris: Office of Mayor Bertrand Delanoë, 2007), pp. 20–25.
27. John Ritter, "Narrowed Roads Gain Acceptance in Colo., Elsewhere," *USA Today*, 29 July 2007; John Ritter, "'Complete Streets' Program Gives More Room for Pedestrians, Cyclists," *USA Today*, 29 July 2007.
28. National Complete Streets Coalition, "Complete the Streets: Who We Are," at www.completestreets.org/whoweare.html, viewed 16 August 2007; AARP, "AARP: Creating a New Health Care Paradigm," at www.aarp.org/about_aarp/new_paradigm.html, viewed 16 August 2007; Ritter, "Narrowed Roads," op. cit. note 27.
29. Ritter, "Narrowed Roads," op. cit. note 27; Ritter, "'Complete Streets' Program," op. cit. note 27.
30. Car trip reduction is author's estimate.
31. O'Meara, op. cit. note 3, p. 45.
32. Chinese bicycle production compiled from United Nations, *Yearbook of Industrial Statistics* (New York: various years) and from *Industrial Commodity Statistics Yearbook* (New York: various years); "World Players in the Bicycle Market," table in John Crenshaw, *Bicycle Retailer and Industry News*, e-mail to Janet Larsen, Earth Policy

- Institute, 8 October 2007; bicycle owners from Song Mo and Wen Chihua, "Turning Full Cycle," *China Daily*, 28 September 2006; cars in China from Ward's Automotive Group, *Ward's World Motor Vehicle Data 2006* (Southfield, MI: 2006), p. 16.
33. Percent of police forces calculated from Matthew Hickman and Brian A. Reaves, *Local Police Departments, 2003* (Washington, DC: U.S. Department of Justice, Bureau of Justice Statistics, May 2006), pp. 3, 13; arrest rate from a member of the Washington, DC, police force, discussion with author.
 34. Glenn Collins, "Old Form of Delivery Thrives in New World of E-Commerce," *New York Times*, 24 December 1999.
 35. O'Meara, op. cit. note 3, pp. 47–48.
 36. Ibid.; Barbara McCann, "Complete the Streets!" *Planning Magazine: Special Transportation Issue*, May 2005.
 37. Walljasper, op. cit. note 17; Interface for Cycling Expertise (I-ce), *Locomotives: Annual Report 2006* (Utrecht, The Netherlands: December 2006), pp. 3–4; I-ce, "Locomotives," at www.cycling.nl/frameset.htm, viewed 21 August 2007.
 38. O'Meara, op. cit. note 3, pp. 47–48; Japan from author's personal observation.
 39. Sunita Narain, "The Flush Toilet is Ecologically Mindless," *Down to Earth*, 28 February 2002, pp. 28–32; dead zones from U.N. Environment Programme, "Further Rise in Number of Marine 'Dead Zones'," press release (Nairobi: 19 October 2006).
 40. Narain, op. cit. note 39.
 41. Ibid.
 42. World Health Organization, *World Health Report 2007* (Geneva: 2007), p. 4; U.N. Food and Agriculture Organization (FAO), *The State of Food Insecurity in the World 2005* (Rome: 2005).
 43. U.S. Environmental Protection Agency (EPA), "Water Efficiency Technology Factsheet—Composting Toilets," fact sheet (Washington, DC: September 1999); Jack Kieffer, Appalachia—Science in the Public Interest, *Humanure: Preparation of Compost from the Toilet for Use in the Garden* (Mount Vernon, KY: ASPI Publications, 1998).
 44. EPA, op. cit. note 43; EPA, "Wastewater Virtual Tradeshow Technologies," at www.epa.gov/region1/assistance/ceitts/wastewater/techs.html, updated 10 September 2007.
 45. EcoSanRes (ESR) and Stockholm Environment Institute (SEI), *EcoSanRes Phase 2 Project Document: 2006–2010* (Stockholm: 22 February 2006), p. 14; ESR, "Conferences," at www.ecosanres.org/news-publications.htm, updated 21 September 2007; ESR, "Ecological Sanitation Research," at www.ecosanres.org, updated 21 September 2007.
 46. ESR, "China-Sweden Erdos Eco-Town Project, Dong Sheng, Inner Mon-

- golia, China," at www.ecosanres.org/asia.htm, updated 21 September 2007; ESR, "Sweden-China Erdos Eco-Town Project, Dongsheng, Inner Mongolia," Fact Sheet 11 (Stockholm: May 2007); nutrients in urine from *Innovative Practices to Enhance Implementation of WSSD Targets-Swedish Initiative for Ecological Sanitation, Water and Sanitation*, Background Paper No. 20, presented at 8th Special Session of the Governing Council/ Global Ministerial Environment Forum, Jeju, South Korea, 29–31 March 2004; people lacking sanitation from U.N. Development Programme, *Human Development Report 2006* (New York: 2006), p. 33.
47. Number of compost toilets from *Innovative Practices*, op. cit. note 46; ESR and SEI, op. cit. note 45.
 48. Tony Sitathan, "Bridge Over Troubled Waters," *Asia Times*, 23 August 2002; "Singapore Opens Fourth Recycling Plant to Turn Sewage into Water," *Associated Press*, 12 July 2005.
 49. Peter H. Gleick, *The World's Water 2004–2005: The Biennial Report on Freshwater Resources* (Washington, DC: Island Press, 2004), p. 149.
 50. Ibid.
 51. "Farming in Urban Areas Can Boost Food Security," *FAO Newsroom*, 3 June 2005.
 52. Ibid.
 53. Jac Smit, "Urban Agriculture's Contribution to Sustainable Urbanisation," *Urban Agriculture*, August 2002, p. 13; Hubert de Bon, "Dry and Aquatic Peri-urban and Urban Horticulture in Hanoi, Vietnam," in René van Veenhuizen, ed., *Cities Farming for the Future—Urban Agriculture for Green and Productive Cities* (Philippines: ETC-Urban Agriculture, 2006), pp. 338–39.
 54. Smit, op. cit. note 53, p. 13; pond coverage from Nitai Kundu et al., "Planning for Aquatic Production in East Kolkata Wetlands," in van Veenhuizen, op. cit. note 53, pp. 408–09; fish production from Stuart Bunting et al., "Urban Aquatic Production," in van Veenhuizen, op. cit. note 53, p. 386.
 55. Smit, op. cit. note 53, p. 12.
 56. "Gardening for the Poor," *FAO Newsroom*, 2004; P. Bradley and C. Marulanda, "A Study on Microgardens That Help Reduce Global Poverty and Hunger," *Acta Horticulturae (ISHS)*, vol. 742 (2007), pp. 115–23.
 57. Katherine H. Brown and Anne Carter, *Urban Agriculture and Community Food Security in the United States: Farming from the City Center to the Urban Fringe* (Venice, CA: Community Food Security Coalition, October 2003), p. 10; U.N. Population Division, *World Urbanization Prospects*, op. cit. note 3.
 58. Brown and Carter, op. cit. note 57, p. 7.
 59. Ibid.

60. U.S. Department of Agriculture, Agricultural Monitoring Service, "Farmers Market Growth," at www.ams.usda.gov/farmersmarkets/FarmersMarketGrowth.htm, viewed 17 August 2007; 2007 figure based on past growth to 2006.
61. U.N. Population Division, *World Population Prospects*, op. cit. note 3; U.N. Population Division, *World Urbanization Prospects*, op. cit. note 3, pp. 1–5.
62. Hari Srinivas, "Defining Squatter Settlements," Global Development Research Center Web site, www.gdrc.org/uem/define-squatter.html, viewed 9 August 2005.
63. Ibid.
64. O'Meara, op. cit. note 3, p. 49.
65. Rasna Warah, *The Challenge of Slums: Global Report on Human Settlements 2003* (New York: U.N. Human Settlements Programme, 2003).
66. Srinivas, op. cit. note 62.
67. E. O. Wilson, *Biophilia* (Cambridge, MA: Harvard University Press, 1984); S. R. Kellert and E. O. Wilson, eds., *The Biophilia Hypothesis* (Washington, DC: Island Press, 1993).
68. Theodore Roszak, Mary Gomes, and Allen Kanner, eds., *Restoring the Earth, Healing the Mind* (San Francisco: Sierra Club Books, 1995).
69. Public transport ridership growth rate calculated from American Public Transportation Administration, "Unlinked Passenger Trips By Mode, Millions," in *2007 Public Transportation Factbook* (Washington, DC: 2007), p. 12.
70. Ding Guangwei and Li Shishun, "Analysis of Impetuses to Change of Agricultural Land Resources in China," *Bulletin of the Chinese Academy of Sciences*, vol. 13, no. 1 (1999).
71. Molly O'Meara Sheehan, *City Limits: Putting the Brakes on Sprawl*, Worldwatch Paper 156 (Washington, DC: Worldwatch Institute, June 2001), p. 11; Schrank and Lomax, op. cit. note 4.
72. Jim Motavalli, "The High Cost of Free Parking," *E: The Environmental Magazine*, March–April 2005; Donald Shoup, *The High Cost of Free Parking* (Chicago: American Planning Association Planners Press, 2005), p. 591; Daniel B. Klein, "Free Parking Versus Free Markets," *The Independent Review*, vol. XI, no. 2 (Fall 2006), pp. 289–97.
73. O'Meara, op. cit. note 3, p. 49; Donald C. Shoup, "Congress Okays Cash Out," *Access*, Fall 1998, pp. 2–8.
74. "Paris To Cut City Centre Traffic," *BBC News*, 15 March 2005; J. H. Crawford, "Carfree Places," at www.carfree.com, viewed 17 August 2007; see also J. H. Crawford, *Carfree Cities* (Utrecht, Netherlands: International Books, July 2000).
75. Lyndsey Layton, "Mass Transit Popularity Surges in U.S.," *Washing-*

ton Post, 30 April 2000; Bruce Younkin, manager of fleet operations, Penn State University, State College, PA, discussion with Janet Larsen, Earth Policy Institute, 4 December 2000.

Chapter 11. Raising Energy Efficiency

1. Figure of 400 ppm calculated using fossil fuel emissions from G. Marland et al., "Global, Regional, and National CO₂ Emissions," in *Trends: A Compendium of Data on Global Change* (Oak Ridge, TN: Carbon Dioxide Information and Analysis Center, Oak Ridge National Laboratory, 2007), and land use change emissions from R. A. Houghton and J. L. Hackler, "Carbon Flux to the Atmosphere from Land-Use Changes," in *Trends: A Compendium of Data on Global Change* (Oak Ridge, TN: Carbon Dioxide Information and Analysis Center, Oak Ridge National Laboratory, 2002), with decay curve cited in J. Hansen et al., "Dangerous Human-Made Interference with Climate: A GISS ModelE Study," *Atmospheric Chemistry and Physics*, vol. 7 (2007), pp. 2287–312; 384 ppm from Pieter Tans, "Trends in Atmospheric Carbon Dioxide—Mauna Loa," NOAA/ESRL, at www.esrl.noaa.gov/gmd/ccgg/trends, viewed 16 October 2007.
2. International Energy Agency (IEA), *World Energy Outlook 2006* (Paris: 2006), p. 493; electricity consumption per U.S. home from U.S. Department of Energy (DOE), Energy Information Administration (EIA), *Regional Energy Profile—U.S. Household Electricity Report* (Washington, DC: July 2005).
3. IEA, op. cit. note 2; coal reduction from DOE, EIA, *International Energy Annual 2005* (Washington, DC: June–October 2007), Table E.4.
4. Bill Moore, "California Bans Future Purchase of Coal-Generated Power," *EV World*, 28 June 2007; Rebecca Smith, "Coal's Doubtters Block New Wave of Power Plants," *Wall Street Journal*, 25 July 2007; California Energy Commission, "California's Major Sources of Energy," at www.energy.ca.gov, updated 10 October 2007; Matthew L. Wald, "Citing Global Warming, Kansas Denies Plant Permit," *New York Times*, 20 October 2007.
5. Steven Mufson, "Coal Rush Reverses, Power Firms Follow Plans for New Plants Stalled by Growing Opposition," *Washington Post*, 4 September 2007; James Hansen, "Why We Can't Wait," *The Nation*, 7 May 2007; Martin Griffith, "Reid Opposes New Coal-fired Power Plants Worldwide," *Las Vegas Sun*, 18 August 2007.
6. IEA, *Light's Labour's Lost: Policies for Energy-efficient Lighting* (Paris: 2006), pp. 25, 29; Larry Kinnery, *Lighting Systems in Southwestern Homes: Problems and Opportunities*, prepared for DOE, *Building America Program through the Midwest Research Institute*, National Renewable Energy Laboratory Division (Boulder, CO: Southwest Energy Efficiency Project, June 2005), pp. 4–5.
7. U.S. Environmental Protection Agency (EPA) and DOE, "Energy Star

- Change a Light, Change the World: 2006 Campaign Facts and Assumptions Sheet,” fact sheet (Washington, DC: 23 April 2007).
8. Ministry for the Environment and Natural Resources, “World First! Australia Slashes Greenhouse Gases from Inefficient Lighting,” press release (Canberra, Australia: 20 February 2007); Rob Gillies, “Canada Announces Greenhouse Gas Targets,” *Associated Press*, 25 April 2007.
 9. “Alliance Calls for Only Energy-Efficient Lighting in U.S. Market By 2016, Joins Coalition Dedicated to Achieving Goal,” press release (Washington, DC: Alliance to Save Energy, 14 March 2007).
 10. Information on proposed and enacted legislation on light bulbs compiled from state governments by Earth Policy Institute, October 2007.
 11. Ian Johnston, “Two Years to Change EU Light Bulbs,” *Scotsman* (U.K.), 10 March 2007; Matt Prescott, “Light Bulbs: Not Such a Bright Idea,” *BBC News*, 3 February 2006; U.K. Ban the Bulb campaign at www.banthebulb.org; James Kilner, “Moscow Tells Residents to Change Their Light Bulbs,” *Reuters*, 28 February 2007.
 12. IEA, op. cit. note 6, p. 375; Deborah Zabarenko, “China to Switch to Energy-Efficient Lightbulbs,” *Reuters*, 3 October 2007.
 13. “Greenpeace Urges India to Ban the Bulb,” *Reuters*, 17 April 2007; Greenpeace India, “Greenpeace Launches a Signature Drive Against the Inefficient Bulbs in India,” press release (New Delhi: 19 April 2007).
 14. Philips, “Philips Calls for Action to Replace Incandescent Bulbs with Energy Saving Lamps,” press release (Brussels: 7 December 2006); European Lamp Companies Federation, “European Lamp Industry Commits to a Government Shift to Energy Efficient Lighting in the Home,” press release (Brussels: 1 March 2007).
 15. Wal-Mart, “With Consumers Facing High Utility Costs and Environmental Challenges, Retailer Offers Simple Solution,” press release (Bentonville, AR: 29 November 2006); Wal-Mart as world’s biggest retailer from “Sales for World’s Top 250 Retailers Show 6 Percent Gain Over Previous Year,” press release (New York: Deloitte & Touche USA LLP, 11 January 2007); Hillary Osborne, “Currys to Stop Selling Incandescent Bulbs,” *Guardian* (London), 13 March 2006.
 16. DOE, “Energy Efficiency of White LEDs,” fact sheet (Washington, DC: October 2006).
 17. “Company Profile: Expanding LED Possibilities at Samsung Electromechanics,” *LEDs Magazine*, April 2007; Anthony DePalma, “It Never Sleeps, but It’s Learned to Douse the Lights,” *New York Times*, 11 December 2005.
 18. Energy savings from lighting efficiency calculated using IEA, op. cit. note 6, and IEA, op. cit. note 2; coal-fired power plant equivalents calculated by assuming that an average plant has a 500-megawatt capacity and operates 72 percent of the time, generating 3.15 billion kilowatt-hours of electricity per year.
 19. IEA, op. cit. note 6, p. 38.

20. Steven Nadel, *The Federal Energy Policy Act of 2005 and Its Implications for Energy Efficiency Program Efforts* (Washington, DC: American Council for an Energy-Efficient Economy (ACEEE), September 2005).
21. Steven Nadel et al., *Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards* (Washington, DC: ACEEE, March 2006), p. v.
22. Jiang Lin, “One Rice-cooker, Two Cell Phones, and Three TVs: Consumer Appliances and the Energy Challenge for China,” *BusinessForum China*, November/December 2005, p. 19.
23. Jiang Lin, “Appliance Efficiency Standards and Labeling Programs in China,” *Annual Review of Energy and the Environment*, vol. 27 (2002), pp. 349–67.
24. U.N. Population Division, *World Population Prospects: The 2006 Revision Population Database*, at esa.un.org/unpp, updated 2007; Greenpeace, “Your Energy Savings,” at www.greenpeace.org/international/campaigns/climate-change.
25. Marianne Haug et al., *Cool Appliances: Policy Strategies for Energy Efficient Homes* (Paris: IEA, 2003).
26. Ibid.; Alan K. Meier, *A Worldwide Review of Standby Power Use in Homes* (Berkeley, CA: Lawrence Berkeley National Laboratory, 2002).
27. Lloyd Harrington et al., *Standby Energy: Building a Coherent International Policy Framework—Moving to the Next Level* (Stockholm: European Council for an Energy Efficient Economy, March 2007).
28. Meier, op. cit. note 26.
29. Projected coal-fired electricity generation in 2020 is 4,352 billion kilowatt-hours more than in 2006, from IEA, op. cit. note 2, p. 493.
30. U.S. Green Building Council (USGBC), “Buildings and Climate Change,” fact sheet (Washington, DC: 2007); USGBC, “Green Building Facts,” fact sheet (Washington, DC: August 2007).
31. Building lifetime from Edward Mazria, “It’s the Architecture, Stupid! Who Really Holds the Key to the Global Thermostat? The Answer Might Surprise You,” *World and I*, May/June 2003; retrofit energy savings from Clinton Foundation, “Energy Efficiency Building Retrofit Program,” fact sheet (New York: May 2007).
32. Davis Langdon, *The Cost & Benefit of Achieving Green Buildings* (Sydney: 2007).
33. USGBC, “About LEED,” fact sheet (Washington, DC: 2007).
34. USGBC, “Green Building Facts,” op. cit. note 30; USGBC, “LEED for New Construction” (Washington, DC: 2007).
35. USGBC, *Green Building Rating System for New Construction and Major Renovations*, Version 2.2 (Washington, DC: October 2005).
36. Ibid.

37. USGBC, “Green Building Facts,” op. cit. note 30.
38. Ibid.
39. National Renewable Energy Laboratory, “The Philip Merrill Environmental Center—Highlighting High Performance” (Golden, CO: April 2002); “Toyota Seeks Gold for New Green Buildings,” *GreenBiz.com*, 23 April 2003; “The Green Stamp of Approval,” *Business Week*, 11 September 2006.
40. Nick Carey and Ilaina Jonas, “Feature—Green Buildings Need More Incentives in US,” *Reuters*, 15 February 2007; Taryn Holowka, “World Trade Center Going for LEED Gold,” *USGBC News*, 12 September 2006.
41. Carey and Jonas, op. cit. note 40.
42. Barnaby J. Feder, “Environmentally Conscious Development,” *New York Times*, 25 August 2004.
43. Information on World Green Building Council at www.worldgbc.org; USGBC, op. cit. note 33.
44. Ibid.; “Clinton Unveils \$5 Billion Green Makeover for Cities,” *Environment News Service*, 16 May 2007.
45. “Clinton Unveils \$5 Billion Green Makeover for Cities,” op. cit. note 44.
46. Mazria, op. cit. note 31; information on the 2030 Challenge at www.architecture2030.org.
47. Mazria, op. cit. note 31.
48. U.N. Population Division, op. cit. note 24; Ward’s Automotive Group, *World Motor Vehicle Data 2006* (Southfield, MI: 2006), p. 202.
49. U.N. Population Division, *World Urbanization Prospects: The 2005 Revision Population Database*, at esa.un.org/unup, updated 2006; Ward’s Automotive Group, op. cit. note 48.
50. U.S. Bureau of the Census, “Most of Us Still Drive to Work Alone—Public Transportation Commuters Concentrated in a Handful of Large Cities,” press release (Washington, DC: 13 June 2007).
51. Ken Livingstone, “Clear Up the Congestion-Pricing Gridlock,” *New York Times*, 2 July 2007; pounds to dollars conversion on 16 October 2007.
52. Sara Kugler, “NYC’s Taxi Fleet Going Green by 2012,” *Associated Press*, 22 May 2007; City and County of San Francisco, Office of the Mayor, “Mayor Newsom Urges Taxi Commission to Approve Resolution Requiring Taxi Emissions to be Reduced by 50% Over Next Four Years,” press release (San Francisco: 12 June 2007).
53. David Schrank et al., *The 2007 Urban Mobility Report* (College Station, TX: Texas Transportation Institute, September 2007).
54. Hiroki Matsumoto, “The Shinkansen: Japan’s High Speed Railway,”

- testimony before the Subcommittee on Railroads, Pipelines and Materials (Washington, DC: Committee on Transportation and Infrastructure, 19 April 2007).
55. Ibid.
56. Ibid.
57. Inaki Barron, “High Speed Rail: The Big Picture,” testimony before the Subcommittee on Railroads, Pipelines and Materials (Washington, DC: Committee on Transportation and Infrastructure, 19 April 2007).
58. Ibid.
59. “A High-Speed Revolution,” *The Economist*, 5 July 2007.
60. John L. Mica, “Opening Statement of Rep. Shuster from Today’s Hearing on High Speed Rail,” press release (Washington, DC: Committee on Transportation and Infrastructure, 19 April 2007).
61. “Bullet Time,” *The Economist*, 17 May 2007.
62. “The People’s Vote: 100 Documents that Shaped America,” *U.S. News and World Report*, 22 September 2003.
63. Gerhard Metschies, “Pain at the Pump,” *Foreign Policy*, July/August 2007; Ward’s Automotive Group, op. cit. note 48, pp. 202, 244.
64. Fleet average from U.S. Department of Transportation, *Summary of Fuel Economy Performance* (Washington, DC: October 2006), updated to new MPG estimates using EPA, Office of Transportation and Air Quality, “EPA Issues New Test Method for Fuel Economy Window Stickers,” regulatory announcement (Washington, DC: December 2006).
65. Ernst Ulrich von Weizsäcker, Amory B. Lovins, and L. Hunter Lovins, *Factor Four: Doubling Wealth, Halving Resource Use* (London: Earthscan, 1997); Friedrich Schmidt-Bleek et al., *Factor 10: Making Sustainability Accountable, Putting Resource Productivity into Praxis* (Carnoules, France: Factor 10 Club, 1998), p. 5.
66. William McDonough and Michael Braungart, *Cradle to Cradle: Remaking the Way We Make Things* (New York: North Point Press, 2002); Rebecca Smith, “Beyond Recycling: Manufacturers Embrace ‘C2C’ Design,” *Wall Street Journal*, 3 March 2005.
67. Claude Mandil et al., *Tracking Industrial Energy Efficiency and CO₂ Emissions* (Paris: IEA, 2007), pp. 39, 59–61.
68. International Iron and Steel Institute (IISI), “Crude Steel Production by Process,” *World Steel in Figures 2007* at www.worldsteel.org, viewed 16 October 2007; Mandil et al., op. cit. note 67, pp. 95–96.
69. U.S. Geological Survey (USGS), “Iron and Steel Scrap,” in *Mineral Commodity Summaries* (Reston, VA: U.S. Department of the Interior, 2007), pp. 86–87; “Steel Recycling Rates at a Glance,” fact sheet (Pittsburgh, PA: Steel Recycling Institute, 2007); Mississippi Department of

- Environmental Quality, "Recycling Trivia," at www.deq.state.ms.us, viewed 17 October 2007.
70. One fourth the energy from Mandil et al., op. cit. note 67, p. 106; cut in energy use calculated from IISI, op. cit. note 75; McKinsey Global Institute, *Curbing Global Energy Demand Growth: The Energy Productivity Opportunity* (Washington, DC: May 2007).
 71. Mandil et al., op. cit. note 67, pp. 139–142; energy savings by adopting Japanese technologies from U.N. Environment Programme, *Buildings and Climate Change: Status, Challenges and Opportunities* (Paris: 2007), p. 19; energy saving from adopting dry-kiln process calculated from Mandil et al., op. cit. note 67.
 72. Bus weight from John Shonsey et al., *RTD Bus Transit Facility Design Guidelines and Criteria* (Denver, CO: Regional Transportation District, February 2006); car weight from Stacy C. Davis and Susan W. Diegel, *Transportation Energy Data Book: Edition 26* (Oak Ridge, TN: Oak Ridge National Laboratory, DOE, 2007), p. 415; car-to-bus ratio from American Public Transportation Association, *The Benefits of Public Transportation—An Overview* (Washington, DC: September 2002).
 73. Energy savings from using scrap instead of iron ore from Mandil et al., op. cit. note 67, p. 106.
 74. "New Hampshire Town Boosts Recycling with Pay-As-You-Throw," *Environment News Service*, 21 March 2007; population data from Town of Lyme Web site, at www.lymenh.gov.
 75. "New Hampshire Town Boosts Recycling with Pay-As-You-Throw," op. cit. note 74.
 76. Sue McAllister, "Commercial Recycling Centers: Turning Debris into Treasure," *San Jose Mercury News*, 10 April 2007.
 77. Ibid.
 78. Junko Edahiro, Japan for Sustainability, e-mail to Janet Larsen, Earth Policy Institute, 16 October 2007; Tim Burt, "VW is Set for \$500m Recycling Provision," *Financial Times*, 12 February 2001; Mark Magner, "Disassembly Lines Hum in Japan's New Industry," *Los Angeles Times*, 13 May 2001.
 79. Brian Hindo, "Everything Old is New Again," *BusinessWeek Online*, 25 September 2006.
 80. Daniel Michaels, "Boeing and Airbus Compete to Destroy What They Built," *Wall Street Journal*, 1 June 2007.
 81. Ibid.
 82. "FT Report—Waste and the Environment: EU Tackles Gadget Mountain," *Financial Times*, 18 April 2007; Nokia example from Jeremy Faludi, "Pop Goes the Cell Phone," *Worldchanging*, 4 April 2006.
 83. Rick Ridgeway, Vice President, Environmental Initiatives and Special Media Projects, Patagonia, Inc., discussion with author, 22 August 2006.

84. Finland in Brenda Platt and Neil Seldman, *Wasting and Recycling in the United States 2000* (Athens, GA: GrassRoots Recycling Network, 2000); Prince Edward Island Government, "PEI Bans the Can," at www.gov.pe.ca, viewed 15 August 2005.
85. Brenda Platt and Doug Rowe, *Reduce, Reuse, Refill!* (Washington, DC: Institute for Local Self-Reliance, 2002); energy in David Saphire, *Case Reopened: Reassessing Refillable Bottles* (New York: INFORM, Inc., 1994).
86. Gold production from USGS, "Gold," in *Mineral Commodity Summaries* (Reston, VA: U.S. Department of the Interior, 2005), pp. 72–73, 84–87; gold ore data calculated from New Jersey Mining Company Reserves & Resources, "Estimated Ore Reserves," at www.new-jerseymining.com, updated 31 December 2006; steel ore from Mandil et al., op. cit. note 67, p. 115; CO₂ emissions calculated using Gavin M. Mudd, "Resource Consumption Intensity and the Sustainability of Gold Mining," 2nd International Conference on Sustainability Engineering and Science, Auckland, New Zealand, 20–23 February 2007; USGS, *Mineral Commodity Summaries*, electronic database at minerals.usgs.gov/products/index.html, updated January 2007; EPA, *Emission Facts: Average Annual Emissions and Fuel Consumption for Passenger Cars and Light Trucks* (Washington, DC: April 2000).
87. Catherine Ferrier, *Bottled Water: Understanding a Social Phenomenon* (Surrey, U.K.: WWF, 2001).
88. Charles Fishman, "Message in a Bottle," *Fast Company*, Issue 117 (July 2007), p. 110; Solomon quoted in Paula Hunt, "Why are We Still Guzzling that Bottled Water?" *San Antonio Express*, 8 August 2007.
89. Oil consumption calculated using number of plastic water bottles from Jennifer Gitlitz et al., *Water, Water Everywhere: The Growth of Non-carbonated Beverages in the United States* (Washington, DC: Container Recycling Institute, February 2007), and from Pacific Institute, "Bottled Water and Energy," fact sheet, (Oakland, CA: 2007).
90. Bill Marsh, "A Battle Between the Bottle and the Faucet," *New York Times*, 15 July 2007; Cecilia M. Vega, "Mayor to Cut Off Flow of City Money for Bottled Water," *San Francisco Chronicle*, 22 June 2007; Doug Smeath, "Rocky Wants to Deep-Six H₂O Bottles," *Deseret Morning News*, 22 June 2007; Ross C. Anderson, Salt Lake City Mayor, national press telephone conference, Think Outside the Bottle Campaign, 9 October 2007.
91. IEA, op. cit. note 2, p. 492; IEA, op. cit. note 6.
92. Mandil et al., op. cit. note 67, pp. 39, 59–61, 95–96, 139–42.

Chapter 12. Turning to Renewable Energy

1. Christoph Podewils, "There's a Lot of Water in the Wine: Renewable Energy Lobby Criticizes the EU's Highly Praised Goal for Alternative Energy," *PHOTON International*, April 2007, p. 14; Global Wind

- Energy Council (GWEC) and Greenpeace, *Global Wind Energy Outlook 2006* (Brussels: 2006); U.S. Department of Energy (DOE), Energy Information Administration (EIA), *Electric Power 2006* (Washington, DC: October 2007), p. 26.
2. "Texas Decision Could Double Wind Power Capacity in the U.S.," *Renewable Energy Access*, 4 October 2007; coal-fired power plant equivalents calculated by assuming that an average plant has a 500-megawatt capacity and operates 72 percent of the time, generating 3.15 billion kilowatt-hours of electricity per year; an average wind turbine operates 36 percent of the time; Iceland geothermal usage from Iceland National Energy Authority and Ministries of Industry and Commerce, *Geothermal Development and Research in Iceland* (Reykjavik, Iceland: April 2006), p. 16; European per person consumption from European Wind Energy Association (EWEA), "Wind Power on Course to Become Major European Energy Source by the End of the Decade," press release (Brussels: 22 November 2004); China's solar water heaters calculated from Renewable Energy Policy Network for the 21st Century (REN21), *Renewables Global Status Report, 2006 Update* (Washington, DC: Worldwatch Institute, 2006), p. 21, and from Bingham Kennedy, Jr., *Dissecting China's 2000 Census* (Washington, DC: Population Reference Bureau, June 2001); Philippines from Geothermal Energy Association (GEA), "World Geothermal Power Up 50%, New US Boom Possible," press release (Washington, DC: 11 April 2002).
 3. International Telecommunications Union, "Mobile Cellular Subscribers per 100 People," *ICT Statistics Database*, at www.itu.int/ITU-D/ict/eye, updated 2007; Molly O. Sheehan, "Mobile Phone Use Booms," Worldwatch Institute, *Vital Signs 2002* (New York: W. W. Norton & Company, 2002), p. 85.
 4. Personal computer data from Computer Industry Almanac Inc, "25-Year PC Anniversary Statistics," press release, at www.c-i-a.com, 14 August 2006; solar cell production (sales) from Worldwatch Institute, *Vital Signs 2005*, CD-Rom (Washington, DC: 2005); Paul Maycock, Prometheus Institute, *Photovoltaic News*, vol. 26, no. 3 (March 2007), p. 6, and previous issues.
 5. Cristina L. Archer and Mark Z. Jacobson, "Evaluation of Global Windpower," *Journal of Geophysical Research*, vol. 110 (30 June 2005); Jean Hu et al., "Wind: The Future is Now," *Renewable Energy World*, July–August 2005, p. 212.
 6. D. L. Elliott, L. L. Wendell, and G. L. Gower, *An Assessment of the Available Windy Land Area and Wind Energy Potential in the Contiguous United States* (Richland, WA: Pacific Northwest Laboratory, 1991); C. L. Archer and M. Z. Jacobson, "The Spatial and Temporal Distributions of U.S. Winds and Wind Power at 80 m Derived from Measurements," *Journal of Geophysical Research*, 16 May 2003.
 7. W. Musial and S. Butterfield, *Future of Offshore Wind Energy in the United States* (Golden, CO: DOE, National Renewable Energy Labo-

- ratory (NREL), June 2004); U.S. electricity consumption from DOE, EIA, *Electric Power Annual 2005* (Washington, DC: November 2006); Garrad Hassan and Partners, *Sea Wind Europe* (London: Greenpeace, March 2004).
8. "Wind Market Global Status 2007," *Windpower Monthly*, March 2007, p. 37; GWEC, "Global Wind Energy Markets Continue to Boom—2006 Another Record Year," press release (Brussels: 2 February 2007).
 9. GWEC, *Global Wind 2006 Report* (Brussels: 2007), p. 7; share of wind generated electricity in Denmark calculated using BP, *Statistical Review of World Energy 2007* (London: 2007), and GWEC, op. cit. this note, p. 4, with capacity factor from NREL, *Power Technologies Energy Data Book* (Golden, CO: DOE, August 2006); Germany statistics from Janet L. Sawin, "Wind Power Blowing Strong," in Worldwatch Institute, *Vital Signs 2006–2007* (New York: W. W. Norton & Company, 2006).
 10. Flemming Hansen, "Denmark to Increase Wind Power to 50% by 2025, Mostly Offshore," *Renewable Energy Access*, 5 December 2006.
 11. GWEC, op. cit. note 9.
 12. Laurie Jodziewicz, American Wind Energy Association (AWEA), e-mail to author, 16 October 2007; GWEC and Greenpeace, op. cit. note 1.
 13. A 2-megawatt wind turbine operating 36 percent of the time generates 6.3 million kilowatt-hours of electricity per year; capacity factor from NREL, op. cit. note 9; wholesale electricity price from DOE, *Wholesale Market Data*, electronic database at www.eia.doe.gov/cneaf/electricity, updated 4 October 2007; wind royalties are author's estimates based on Union of Concerned Scientists, "Farming the Wind: Wind Power and Agriculture," at www.ucsusa.org/clean_energy.
 14. Renewable Fuels Association (RFA), *Homegrown for the Homeland: Ethanol Industry Outlook 2005* (Washington, DC: 2005); corn per acre and ethanol per bushel approximated from Allen Baker et al., "Ethanol Reshapes the Corn Market," *Amber Waves*, vol. 4, no. 2 (April 2006), pp. 32, 34.
 15. Godfrey Chua, "Wind Power 2005 in Review, Outlook for 2006 and Beyond," *Renewable Energy Access*, 6 January 2006.
 16. United States and Spain from GWEC, op. cit. note 9; "Spanish Wind Power Industry Attacks New Rules," *Reuters*, 2 February 2007; "EWEA Aims for 22% of Europe's Electricity by 2030," *Wind Directions* (November/December 2006), p. 34; a 1-megawatt wind turbine operating 36 percent of the time generates 3.15 million kilowatt-hours and the average U.S. home consumes 10,000 kilowatt-hours per year; average energy consumption per U.S. home from DOE, EIA, *Regional Energy Profile—U.S. Household Electricity Report* (Washington, DC: July 2005); capacity factor from NREL, op. cit. note 9.
 17. Carl Levesque, "Wind Companies Make \$10 Billion Investment Com-

- mitment,” *Wind Energy Weekly*, vol. 25, no. 1211 (6 October 2006); “Texas Decision Could Double Wind Power Capacity in the U.S.,” op. cit. note 2.
18. Paul Klein, Media Relations Group, Southern California Edison, discussion with Jonathan Dorn, Earth Policy Institute, 22 October 2007; Jim Dehlsen, Clipper Wind, discussion with author, 30 May 2001; wind farm proposals from Kathy Belyeu, AWEA, discussion with Jonathan Dorn, Earth Policy Institute, 22 October 2007.
 19. “British Columbia,” *WT News*, Wind Today, 1st Quarter 2007, p. 30; “UK Plans World’s Biggest Offshore Windfarm,” *Reuters*, 18 May 2007; Yang Jianxiang, “China Showing All Signs of Major Market Status,” *Windpower Monthly*, March 2007, p.38; Germany offshore wind from EWEA, *Wind Force 12* (Brussels: 2002); “China to Build Offshore Wind Complex,” *Associated Press*, 15 August 2005.
 20. Mike Jacobs, “U.S. States Hatch Solution to Transmission ‘Chicken-Egg’ Dilemma,” *Renewable Energy Access*, 7 May 2007.
 21. Ibid.; Leonard Anderson, “Western U.S. States Plan Major Power System,” *Reuters*, 5 April 2005; Carl Levesque, “SPP Study Envisions Transmission Project Linking 13,000 MW of Wind with East,” *Wind Energy Weekly*, vol. 26, no. 1247 (6 July 2007); Carl Levesque, “Now Proposed at PUC, CAPX 2020 Transmission Project Would Have Big Wind Implications,” *Wind Energy Weekly*, vol. 26, no. 1253 (17 August 2007).
 22. “Pan-European Wind Energy Grid Proposed,” *Renewable Energy Access*, 10 May 2006; “Airtricity and ABB Push for European Offshore Supergrid,” *Wind Directions*, July/August 2006, p. 7; Chris Veal, *European Offshore Supergrid Proposal: Vision and Executive Summary* (Dublin: Airtricity, 2006); an average European home consumes 5,000 kilowatt-hours of electricity per year, from *State of the Environment in the South West 2006* (Rotherham, U.K.: Environment Agency, 2006), p. 22.
 23. Wind capacity from GWEC, op. cit. note 9, pp. 4, 8; population data from U.N. Population Division, *World Population Prospects: The 2006 Revision Population Database*, at esa.un.org/unpp, updated 2007.
 24. Ward’s Automotive Group, *World Motor Vehicle Data 2006* (Southfield, MI: Ward’s Automotive Group, 2006), p. 218; price of installed wind turbine from Windustry, “How Much Do Wind Turbines Cost?,” at www.windustry.org, viewed 21 October 2007; “Trillions in Spending Needed to Meet Global Oil and Gas Demand, Analysis Shows,” *International Herald Tribune*, 15 October 2007.
 25. Harry Braun, *The Phoenix Project: Shifting from Oil to Hydrogen with Wartime Speed*, prepared for the Renewable Hydrogen Roundtable, World Resources Institute, Washington, DC, 10–11 April 2003, pp. 3–4.
 26. Christian Parenti, “Big is Beautiful,” *The Nation*, 7 May 2007.
 27. Prius mileage based on new Environmental Protection Agency (EPA)

- estimates at www.fueleconomy.gov, viewed 23 August 2007; fleet average from Robert M. Heavenrich, *Light Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2007* (Washington, DC: EPA, Office of Transportation and Air Quality, September 2007).
28. Fuel savings are author’s estimates updated from Lester R. Brown, “The Short Path to Oil Independence,” *Eco-Economy Update* (Washington, DC: Earth Policy Institute, 13 October 2004); Lionel Laurent, “Boeing’s Dreamliner, Airbus’s Nightmare,” *Forbes*, 9 July 2007; cost of electricity equivalent to a gallon of gas from Roger Duncan, “Plug-In Hybrids: Pollution-Free Transport on the Horizon,” *Solar Today*, May/June 2007, p. 46.
 29. Amory B. Lovins et al., *Winning the Oil Endgame: Innovation for Profits, Jobs, and Security* (Snowmass, CO: Rocky Mountain Institute, 2004), p. 64.
 30. Michael Kintner-Meyer et al., *Impacts Assessment of Plug-in Hybrid Vehicles on Electric Utilities and Regional U.S. Power Grids —Part 1: Technical Analysis* (Richland, WA: DOE, Pacific Northwest National Laboratory, 2006).
 31. Randy Swisher, AWEA, e-mail to author, 16 October 2007.
 32. Joseph Romm and Peter Fox-Penner, *Plugging into the Grid: How Plug-in Hybrid Electric Vehicles Can Help Break America’s Oil Addiction and Slow Global Warming* (Washington, DC: Progressive Policy Institute, 2007); Roger Duncan, “Plug-In Hybrids: Pollution-Free Transport on the Horizon,” *Solar Today*, May/June 2007, p. 47.
 33. Martin Crutsinger, “U.S. Trade Deficit a Record 6.5% of Economy,” *Associated Press*, 15 March 2007.
 34. Lisa Braithwaite, Plug-In Partners National Campaign, e-mail to Jonathan Dorn, Earth Policy Institute, 19 October 2007.
 35. Ben Hewitt, “Plug-in Hybrid Electric Cars: How They’ll Solve the Fuel Crunch,” *Popular Mechanics*, May 2007; Pacific Gas and Electric Company, *Greening Fleets with New Technologies*, at www.pge.com/about_us/environment, viewed 20 October 2007.
 36. General Motors (GM), “Fuel Solutions,” at www.chevrolet.com/electrincar, viewed 23 October 2007; percent of Americans who live within 20 miles of their workplace from Plug-In Partners National Campaign, *Building a Market for Gas-Optional Flexible-Fuel Hybrids*, brochure (Austin, TX: 2007).
 37. China water heaters calculated from REN21, op. cit. note 2, p. 21; Kennedy, Jr., op. cit. note 2; Ryan Hodum, “Kunming Heats Up as China’s ‘Solar City’,” *China Watch* (Washington, DC: Worldwatch Institute and Global Environmental Institute, 5 June 2007); tripling of solar water heaters from Emma Graham-Harrison, “China Solar Power Firm Sees 25 Percent Growth,” *Reuters*, 4 October 2007.
 38. Rooftop solar water heaters have a capacity of 0.7 kilowatts per square meter and a capacity factor similar to rooftop photovoltaics

- (22 percent); nominal capacity from European Solar Thermal Industry Federation (ESTIF), "Worldwide Capacity of Solar Thermal Energy Greatly Underestimated," *ESTIF News* (10 November 2004); capacity factor from NREL, op. cit. note 9.
39. Ole Pilgaard, *Solar Thermal Action Plan for Europe* (Brussels, Belgium: ESTIF, 2007); Janet L. Sawin, "Solar Industry Stays Hot," in Worldwatch Institute, op. cit. note 9, p. 38.
 40. Pilgaard, op. cit. note 39; Sawin, op. cit. note 39.
 41. Uwe Brechlin, "Study on Italian Solar Thermal Reveals a Surprisingly High Contribution to EU Market: 130 MWth in 2006," press release (Brussels: ESTIF, 24 April 2007); Sawin, op. cit. note 39; Les Nelson, "Solar-Water Heating Resurgence Ahead?" *Solar Today*, May/June 2007, p. 28; Pilgaard, op. cit. note 39.
 42. Nelson, op. cit. note 41, p. 27.
 43. Japan solar heating from Sawin, op. cit. note 39; population data from U.N. Population Division, op. cit. note 23.
 44. Population data from U.N. Population Division, op. cit. note 23; China calculated from REN21, *Renewables 2005 Global Status Report* (Washington, DC: REN21 Secretariat and Worldwatch Institute, 2006); REN21, op. cit. note 2, p. 21; Turkey from Sawin, op. cit. note 39; nominal capacity from ESTIF, op. cit. note 38.
 45. Nelson, op. cit. note 41, p. 26.
 46. *Ibid.*, p. 28.
 47. Solar cell installations and growth rate calculated from Worldwatch Institute, op. cit. note 4; Maycock, op. cit. note 4; Anne Kreutzmann et al., "Exceeding Expectations: Survey Indicates more than 1 GW Installed in Germany in 2006," *PHOTON International*, April 2007.
 48. Travis Bradford, "23rd Annual Data Collection—Final," *PV News*, vol. 26, no. 4 (April 2007), p. 9; Travis Bradford, "World Cell Production Grows 40% in 2006," *PV News*, vol. 26, no. 3 (March 2007), pp. 6–8.
 49. International Energy Agency (IEA), *World Energy Outlook 2006* (Paris: 2006); "Power to the Poor," *The Economist*, 10 February 2001, pp. 21–23.
 50. "Solar Loans Light Up Rural India," *BBC News*, 29 April 2007.
 51. IEA, *Light's Labour's Lost: Policies for Energy-efficient Lighting* (Paris: 2006), pp. 201–02; Kuwait oil production from DOE, EIA, *International Petroleum Monthly*, at www.eia.doe.gov/emeu, updated 12 October 2007.
 52. Christoph Podewils, "As Cheap as Brown Coal: By 2010, a kWh of PV Electricity in Spain Will Cost Around 9¢ to Produce," *PHOTON International*, April 2007.
 53. Solar cell production (sales) from Worldwatch Institute, op. cit. note

- 4; Maycock, op. cit. note 4; people who lack electricity from IEA, op. cit. note 49.
54. Sybille de La Hamaide, "Bangladesh Seeks World Bank Loan for Solar Power," *Reuters*, 26 April 2007.
 55. Dana Childs, "South Korea Building Largest Solar Installation in World," *Inside Greentech*, 10 May 2007; "Santander and BP Solar Partner in Major Euro Photovoltaic Project," *Green Car Congress*, 24 April 2006; Google, Solar Panel Projects at www.google.com/corporate, updated 20 October 2007; "Google Sets Precedent for Clean Business Practices," *Renewable Energy Access*, 23 October 2006.
 56. Sawin, op. cit. note 39; Sara Parker, "Maryland Expands RPS: 1,500 MW Solar by 2022," *Renewable Energy Access*, 12 April 2007.
 57. "Largest Solar Thermal Plant in 16 Years Now Online," *Energy Efficiency and Renewable Energy News*, 13 June 2007; Asjlynn Loder et al., "FPL Unveils Plans for a Solar Plant," *St. Petersburg Times*, 27 September 2007.
 58. Georg Brakmann et al., *Concentrated Solar Thermal Power—Now!* (Brussels: European Solar Thermal Power Industry Association, 2005).
 59. "Algeria Aims to Export Power—Solar Power," *Associated Press*, 11 August 2007; "Algeria Plans to Develop Solar Power for Export," *Reuters*, 19 June 2007.
 60. "Algeria Aims to Export Power—Solar Power," op. cit. note 59.
 61. Charles F. Kutscher, *Tackling Climate Change in the U.S.—Potential Carbon Emissions Reductions from Energy Efficiency and Renewable Energy by 2030* (Boulder, CO: American Solar Energy Society, 2007).
 62. Brakmann et al., op. cit. note 58.
 63. Karl Gawell et al., *International Geothermal Development Directory and Resource Guide* (Washington, DC: GEA, 2003); REN21, op. cit. note 2, p. 17.
 64. Geothermal growth rate calculated using Eric Martinot, Tsinghua-BP Clean Energy Research and Education Center, e-mail to Joseph Florence, Earth Policy Institute, 12 April 2007, and REN21, op. cit. note 44; Philippines geothermal electricity from "World Geothermal Power Up 50%, New US Boom Possible," press release (Washington, DC: GEA, 11 April 2002); total number of countries with geothermal power from Karl Gawell et al., *2007 Interim Report: Update on World Geothermal Development* (Washington, DC: GEA, 1 May 2007), p. 1; El Salvador geothermal electricity from Ruggero Bertani, "World Geothermal Generation 2001–2005: State of the Art," *Proceeding of the World Geothermal Congress* (Antalya, Turkey: 24–29 April 2005), p. 3.
 65. Jefferson Tester et al., *The Future of Geothermal Energy: Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21st Century* (Cambridge, MA: Massachusetts Institute of Technology,

- 2006); John W. Lund and Derek H. Freeston, "World-Wide Direct Uses of Geothermal Energy 2000," *Geothermics*, vol. 30 (2001), pp. 34, 46, 51, 53.
66. Tester et al., op. cit. note 65.
67. U.S. projects from Gawell et al., op. cit. note 64, p. 11; Japan from Hal Kane, "Geothermal Power Gains," in Lester R. Brown et al., *Vital Signs 1993* (New York: W. W. Norton & Company, 1993), p. 54; DOE, EIA, "Japan," *EIA Country Analysis Brief* (Washington, DC: updated August 2004).
68. Peter Janssen, "The Too Slow Flow: Why Indonesia Could Get All Its Power From Volcanoes—But Doesn't," *Newsweek*, 20 September 2004.
69. World Bank, "Geothermal Energy," prepared under the PB Power and World Bank partnership program, www.worldbank.org, viewed 23 January 2003.
70. Iceland National Energy Authority and Ministries of Industry and Commerce, *Geothermal Development and Research in Iceland* (Reykjavik, Iceland: April 2006), p. 16; World Bank, op. cit. note 69.
71. Lund and Freeston, op. cit. note 65, pp. 34, 51, 53.
72. World Bank, op. cit. note 69.
73. Ibid.
74. Lund and Freeston, op. cit. note 65, pp. 46, 53.
75. U.N. Population Division, op. cit. note 23.
76. Kutscher, op. cit. note 61, p. 118; EIA, "Net Generation by Other Renewables," at www.eia.gov/cneaf, updated 10 October 2007.
77. Swedish Energy Agency, *Energy in Sweden 2005* (Eskilstuna, Sweden: November 2005), p. 37.
78. Population data from U.S. Bureau of the Census, *State & County Quickfacts*, electronic database, at quickfacts.census.gov, updated 31 August 2007; Anders Rydaker, "Biomass for Electricity & Heat Production," presentation at Bioenergy North America 2007, Chicago, IL, 16 April 2007.
79. World Alliance for Decentralized Energy, *Bagasse Cogeneration—Global Review and Potential* (Washington, DC: June 2004), p. 32; sugar production from U.S. Department of Agriculture (USDA), *Commodities and Products*, electronic database, at www.fas.usda.gov/commodities, updated May 2007.
80. Waste to Energy Conference, "Power and Heat for Millions of Europeans," press release, (Bremen, Germany: 20 April 2007).
81. Robin Pence, "AES AgriVerde: An AES-AgCert Joint Venture," fact sheet (Arlington, VA: AES Corporation, May 2006).
82. Ray C. Anderson, presentation at Chicago Climate Exchange, Chica-

- go, IL, 14 June 2006.
83. F.O. Licht, "World Fuel Ethanol Production," *World Ethanol and Biofuels Report*, vol. 5, no. 17 (8 May 2007), p. 354; F.O. Licht, "World-Biodiesel Production (tonnes)," *World Ethanol and Biofuels Report*, vol. 5, no. 14 (23 March 2007), p. 291.
84. F.O. Licht, "World Fuel Ethanol Production," op. cit. note 83; RFA, *Ethanol Biorefinery Locations*, at www.ethanolrfa.org, updated 28 September 2007.
85. Fiona Harvey et al., "Biofuels Growth Hit by Soaring Price of Grain," *Financial Times*, 22 February 2007; Nigel Hunt, "Biofuel Bandwagon Slows as Feedstock Prices Surge," *Reuters*, 5 October 2007; Bill Guerin, "European Blowback for Asian Biofuels," *Asia Times*, 8 February 2007.
86. USDA, *Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply* (Washington, DC: April 2005).
87. Kutscher, op. cit. note 61, p. 127.
88. IEA, op. cit. note 49, pp. 219, 479; IEA, *Member Countries and Countries Beyond the OECD*, electronic database, at www.iea.org/Textbase, viewed 20 October 2007; International Rivers Network, "Frequently Asked Questions about Dams," fact sheet (Berkeley, CA: 2004).
89. "Rural Areas Get Increased Hydro Power Capacity," *Xinhua*, 7 May 2007.
90. Choe Sang-Hun, "South Korea Seeks Cleaner Energy Sources," *International Herald Tribune*, 9 May 2007; Choe Sang-Hun, "As Tides Ebb and Rise, South Korea Prepares to Snare Them," *International Herald Tribune*, 31 May 2007.
91. "China Endorses 300 MW Ocean Energy Project," *Renewable Energy Access*, 2 November 2004; "Company Plans 200-Megawatt Tidal Power Plant in New Zealand," *Energy Efficiency and Renewable Energy News*, 29 November 2006; Sang-Hun, "As Tides Ebb and Rise," op. cit. note 90.
92. Sang-Hun, "As Tides Ebb and Rise," op. cit. note 90; Igor Veletminsky, "Anatoly Chubais Wants Russia to Lead the World in Tidal Power," *FreeEnergy.ca*, 26 February 2007, at www.freeenergy.ca/news.
93. "Company Plans 200-Megawatt Tidal Power Plant in New Zealand," op. cit. note 91; Oceana Energy Company, "Oceana Subsidiary Signs Collaborative Agreement with PG&E, City of San Francisco," press release (Washington, DC: 19 June 2007); Dan Power, Oceana Energy Company, discussion with Jonathan Dorn, Earth Policy Institute, 22 October 2007.
94. Robert Silgado et al., *Finavera Renewables Inc.: Where There is Wind There is a Wave* (Toronto, ON: Dundee Securities Corporation, 18 June 2007); Federal Energy Regulatory Commission, *Hydrokinet-*

- ics—*Issued and Pending Permits*, electronic database, at www.ferc.gov/industries, updated 6 August 2007.
95. “Wave Hub Names Fourth Developer for Wave Energy Farm,” *Renewable Energy Access*, 15 May 2007; European Commission, *Report on the Workshop on Hydropower and Ocean Energy—Part I: Ocean Energy*, 13 June 2007, pp. 1, 3; IEA, op. cit. note 88.
 96. Lila Buckley, “Hydropower in China: Participation and Energy Diversity Are Key,” *China Watch* (Washington, DC: Worldwatch Institute and Global Environmental Institute, 24 April 2007); “Rural Areas Get Increased Hydro Power Capacity,” op. cit. note 89; Pallavi Aiyar, “China: Another Dammed Gorge,” *Asia Times*, 3 June 2006; Gary Duffy, “Brazil Gives Amazon Dams Go-Ahead,” *BBC News*, 10 July 2007; Patrick McCully, *Before the Deluge: Coping with Floods in a Changing Climate* (Berkeley, CA: International Rivers Network, 2007), pp. 22–23.
 97. Table 12–1 by Earth Policy Institute, with 2020 projections cited throughout chapter and with 2006 figures calculated using the following sources: rooftop solar electric systems in Worldwatch Institute, op. cit. note 4, and Maycock, op. cit. note 4; wind from GWEC, op. cit. note 8; geothermal from Gawell et al., op. cit. note 64, and from REN21, op. cit. note 2; biomass from REN21, op. cit. note 2; hydropower, including tidal and wave, from IEA, *Renewables in Global Energy Supply: An IEA Fact Sheet*, pp.13, 25, at www.iea.org/textbase; rooftop solar water and space heaters from IEA, *Solar Heating and Cooling Program, Solar Heat Worldwide: Markets and Contribution to the Energy Supply 2005* (Paris: April 2007); REN21, op. cit. note 2; REN21, op. cit. note 44; geothermal from Tester et al., op. cit. note 65, p. 9.
 98. GM, op. cit. note 36.
 99. Bureau of Transportation Statistics, *Freight in America: A New National Picture* (Washington, DC: January 2006), pp. 7, 28.
 100. Ashlea Ebeling, “What Would You Pay to Stay Cool?” *Forbes*, 15 August 2007.

Chapter 13. The Great Mobilization

1. “New Zealand Commits to 90% Renewable Electricity by 2025,” *Renewable Energy Access*, 26 September 2007; carbon sequestration calculated using Vattenfall, *Global Mapping of Greenhouse Gas Abatement Opportunities up to 2030: Forestry Sector Deep-Dive* (Stockholm: June 2007), p. 16.
2. Greenland sea level rise from U.N. Environment Programme, *Global Outlook for Ice and Snow* (Nairobi: 2007), p. 103.
3. Dahle, discussion with author, State of the World Conference, Aspen, CO, 22 July 2001.
4. Redefining Progress, *The Economists’ Statement on Climate Change*

- (Oakland, CA: 1997).
5. Nicholas Stern, *The Stern Review on the Economics of Climate Change* (London: HM Treasury, 2006), p. 27.
 6. Centers for Disease Control and Prevention, *Sustaining State Programs for Tobacco Control: Data Highlights 2006* (Atlanta, GA: 2006).
 7. Cigarette death toll from World Health Organization, “Chronic Obstructive Pulmonary Disease (COPD),” fact sheet (Geneva: November 2006); Campaign for Tobacco Free Kids, “Top Combined State-Local Cigarette Tax Rates,” fact sheet (Washington, DC: Campaign for Tobacco Free Kids, 1 July 2007); Campaign for Tobacco-Free Kids, “Raising Cigarette Taxes Reduces Smoking, Especially Among Kids (And the Cigarette Companies Know It),” fact sheet (Washington, DC: Campaign for Tobacco Free Kids, 11 June 2007).
 8. Carbon content of fuels from Oak Ridge National Laboratory (ORNL), Bioenergy Conversion Factors, at bioenergy.ornl.gov/papers/misc/energy_conv.html, viewed 15 October 2007.
 9. Gasoline indirect cost calculated based on International Center for Technology Assessment (ICTA), *The Real Price of Gasoline*, Report No. 3 (Washington, DC: 1998), p. 34, and updated using ICTA, *Gasoline Cost Externalities Associated with Global Climate Change: An Update to CTA’s Real Price of Gasoline Report* (Washington, DC: September 2004), ICTA, *Gasoline Cost Externalities: Security and Protection Services: An Update to CTA’s Real Price of Gasoline Report* (Washington, DC: January 2005), Terry Tamminen, *Lives Per Gallon: The True Cost of Our Oil Addiction* (Washington, DC: Island Press, 2006), p. 60, and Bureau for Economic Analysis, “Table 3—Price Indices for Gross Domestic Product and Gross Domestic Purchases,” *GDP and Other Major Series, 1929–2007* (Washington, DC: August 2007); U.S. Department of Energy (DOE), Energy Information Administration (EIA), *This Week in Petroleum* (Washington, DC: various issues).
 10. American Petroleum Institute, *State Gasoline Tax Report* (Washington DC: August 2007); DOE, EIA, “Weekly (Monday) Retail Premium Gasoline Prices, Selected Countries,” at www.eia.doe.gov/emeu, updated 9 July 2007; Gerhard Metschies, “Pain at the Pump,” *Foreign Policy*, July/August 2007.
 11. U.S. Department of Agriculture, Economic Research Service, “Cigarette Price Increase Follows Tobacco Pact,” *Agricultural Outlook*, January–February 1999.
 12. DOE, op. cit. note 10; carbon tax equivalent calculated using DOE, EIA, *Emissions of Greenhouse Gases in the United States 2001* (Washington, DC: 2002), p. B–1; DOE EIA, *Annual Energy Review 2006* (Washington, DC: 2007), p. 359.
 13. Markus Knigge and Benjamin Gorch, *Effects of Germany’s Ecological Tax Reforms on the Environment, Employment and Technologi-*

- cal Innovation: Summary of the Final Report of the Project* (Berlin: Ecologic Institute for International and European Environmental Policy, August 2005); German Wind Energy Association, *A Clean Issue—Wind Energy in Germany* (Berlin: May 2006), p. 4; Donald W. Aitken, “Germany Launches its Transition: How One of the Most Advanced Industrial Nations is Moving to 100 Percent Energy from Renewable Sources,” *Solar Today*, March/April 2005, pp. 26–29.
14. Estimate of Swedish tax shifting based on Paul Ekins and Stefan Speck, “Environmental Tax Reform in Europe: Energy Tax Rates and Competitiveness,” in press, 2007; Ministry of Finance, Sweden, “Taxation and the Environment,” press release (Stockholm: 25 May 2005); household size from Target Group Index, “Household Size,” Global TGI Barometer (Miami: 2005); population from U.N. Population Division, *World Population Prospects: The 2006 Revision Population Database*, at esa.un.org/unpp, updated 2007; Andrew Hoerner and Benoît Bosquet, *Environmental Tax Reform: The European Experience* (Washington, DC: Center for a Sustainable Economy, 2001); European Environment Agency, *Environmental Taxes: Recent Developments in Tools for Integration*, Environmental Issues Series No. 18 (Copenhagen: 2000); environmental tax support from David Malin Roodman, *The Natural Wealth of Nations* (New York: W. W. Norton & Company, 1998), p. 243.
 15. “New Hampshire Town Boosts Recycling with Pay-As-You-Throw,” *Environment News Service*, 21 March 2007; Tom Miles, “London Drivers to Pay UK’s First Congestion Tax,” *Reuters*, 28 February 2002; Energy Council, *Energy Efficiency Policies and Indicators* (London: 2001), Annex 1; Howard W. French, “A City’s Traffic Plans Are Snarled by China’s Car Culture,” *New York Times*, 12 July 2005.
 16. N. Gregory Mankiw, “Gas Tax Now!” *Fortune*, 24 May 1999, pp. 60–64.
 17. Australia in John Tierney, “A Tale of Two Fisheries,” *New York Times Magazine*, 27 August 2000; South Australian Southern Zone Rock Lobster Fishery Management Committee, *Southern Zone Rock Lobster Annual Report 2005–2006* (Adelaide, South Australia: October 2006), p. 2.
 18. Edwin Clark, letter to author, 25 July 2001.
 19. André de Moor and Peter Calamai, *Subsidizing Unsustainable Development* (San José, Costa Rica: Earth Council, 1997); Barbara Crossette, “Subsidies Hurt Environment, Critics Say Before Talks,” *New York Time*, 23 June 1997.
 20. World Bank, *World Development Report 2003* (New York: Oxford University Press, 2003), pp. 30, 142; International Energy Agency (IEA), *World Energy Outlook 2006* (Paris: 2006), p. 279.
 21. Belgium, France, and Japan from Seth Dunn, “King Coal’s Weakening Grip on Power,” *World Watch*, September/October 1999, pp. 10–19; coal subsidy reduction in Germany from Robin Pomeroy, “EU Minis-

- ters Clear German Coal Subsidies,” *Reuters*, 10 June 2002; DOE, EIA, *International Energy Annual 2005* (Washington, DC: June–October 2007), Table E.4; Craig Whitlock, “German Hard-Coal Production to Cease by 2018,” *Washington Post*, 30 July 2007; China, Indonesia, and Nigeria subsidy cuts from GTZ Transport Policy Advisory Service, *International Fuel Prices 2007* (Eschborn, Germany: April 2007), p. 3.
22. John Whitelegg and Spencer Fitz-Gibbon, *Aviation’s Economic Downside*, 3rd ed. (London: Green Party of England & Wales, 2003); dollar conversion based on August 2007 exchange rate in International Monetary Fund, “Representative Exchange Rates for Selected Currencies in August 2007,” *Exchange Rate Archives by Month*, at www.imf.org/external, viewed 16 August 2007; U.N. Population Division, op. cit. note 14.
 23. Doug Koplow, *Subsidies in the U.S. Energy Sector: Magnitude, Causes, and Options for Reform* (Cambridge, MA: Earth Track, November 2006).
 24. Fishery subsidy value includes “bad” subsidies and fuel subsidies as estimated in Fisheries Center, University of British Columbia, *Catching More Bait: A Bottom-Up Re-Estimation of Global Fisheries Subsidies* (2nd Version) (Vancouver, BC: The Fisheries Center, 2006), p. 21.
 25. Table 13–1 calculated with fossil fuel and transport carbon reductions using IEA, op. cit. note 20, p. 493, industry reductions using IEA, *Tracking Industrial Energy Efficiency and CO₂ Emissions* (Paris: IEA, 2007), avoided deforestation and afforestation reductions from Vattenfall, op. cit. note 1, and soil carbon sequestration based on conservative estimates in Rattan Lal, “Soil Carbon Sequestration Impacts on Global Climate Change and Food Security,” *Science*, vol. 304 (11 June 2004), pp. 1623–27; deaths from World Health Organization, “Air Pollution,” fact sheet 187 (Geneva: revised September 2000).
 26. IEA, op. cit. note 20, p. 493.
 27. Vattenfall, op. cit. note 1.
 28. Ibid.
 29. Lal, op. cit. note 25.
 30. Figure of 400 parts per million calculated using fossil fuel emissions from G. Marland et al., “Global, Regional, and National CO₂ Emissions,” in *Trends: A Compendium of Data on Global Change* (Oak Ridge, TN: Carbon Dioxide Information and Analysis Center (CDIAC), ORNL, 2007), and land use change emissions from R. A. Houghton and J. L. Hackler, “Carbon Flux to the Atmosphere from Land-Use Changes,” in *Trends: A Compendium of Data on Global Change* (Oak Ridge, TN: CDIAC, ORNL, 2002), with decay curve cited in J. Hansen et al., “Dangerous Human-Made Interference with Climate: A GISS ModelE Study,” *Atmospheric Chemistry and Physics*, vol. 7 (2007), pp. 2287–312.
 31. “Ditch the Tie Japan Tells Workers as ‘Cool Biz’ Drive Begins,”

- Agence France-Presse*, 1 June 2006; U.N. Population Division, op. cit. note 14.
32. Richard Register, e-mail to author, 16 October 2007.
 33. Gidon Eshel and Pamela A. Martin, "Diet, Energy, and Global Warming," *Earth Interactions*, vol. 10, no. 9 (2006); USDA, *Production Supply and Distribution*, electronic database, at www.fas.usda.gov/psdonline, updated 12 October 2007; U.N. Population Division, op. cit. note 14.
 34. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, *Renewable Energy-Employment Effects: Impact of the Expansion of Renewable Energy on the German Labor Market* (Berlin: June 2006); "German Plan to Close Coal Mines," *BBC News*, 29 January 2007; Michael Levitin, "Germany Says Auf Wiedersehen to Nuclear Power, Guten Tag to Renewables," *Grist.com*, 12 August 2005.
 35. Commission on Weak States and U.S. National Security, *On the Brink: Weak States and U.S. National Security* (Washington, DC: Center for Global Development, 2004), p. 27.
 36. The U.S. Commission on National Security in the 21st Century, *Road Map for National Security: Imperative for Change* (Washington, DC: February 2001), p. 53.
 37. Commission on Weak States and U.S. National Security, op. cit. note 35, pp. 30–32.
 38. "Roosevelt's Tree Army: A History of the Civilian Conservation Corps," at www.cccalumni.org/history1.html, viewed 18 October 2007.
 39. For information on mobilization, see Francis Walton, *Miracle of World War II: How American Industry Made Victory Possible* (New York: Macmillan, 1956).
 40. Franklin Roosevelt, "State of the Union Address," 6 January 1942, at www.ibiblio.org/pha/7-2-188/188-35.html.
 41. Harold G. Vatter, *The US Economy in World War II* (New York: Columbia University Press, 1985), p. 13; Alan L. Gropman, *Mobilizing U.S. Industry in World War II* (Washington, DC: National Defense University Press, August 1996).
 42. Doris Kearns Goodwin, *No Ordinary Time—Franklin and Eleanor Roosevelt: The Home Front in World War II* (New York: Simon & Schuster, 1994), p. 316; "Point Rationing Comes of Age," *Business Week*, 19 February 1944.
 43. "War Production—The Job 'That Couldn't Be Done,'" *Business Week*, 5 May 1945; Donald M. Nelsen, *Arsenal of Democracy: The Story of American War Production* (New York: Harcourt, Brace and Co., 1946), p. 243.
 44. Goodwin, op. cit. note 42.
 45. Sir Edward Grey quoted in Walton, op. cit. note 39.

46. Jeffrey Sachs, "One Tenth of 1 Percent to Make the World Safer," *Washington Post*, 21 November 2001.
47. Table 13–2 compiled from Tables 7–1 and 8–1; see associated discussion in Chapter 7 for more information on social goals and funding.
48. See Table 7–1 and associated discussion in Chapter 7 for more information.
49. See Table 8–1 and associated discussion in Chapter 8 for more information.
50. Table 13–3 compiled from Stockholm International Peace Research Institute (SIPRI), *Military Expenditure Database*, electronic database at www.sipri.org, updated June 2007, with U.S. military expenditure from Center for Arms Control and Non-Proliferation, "Analysis of the Pentagon's Fiscal Year 2006 Supplemental Funding Request," at www.armscontrolcenter.org, viewed 14 September 2007.
51. SIPRI, op. cit. note 50.
52. Amy Belasco, *The Cost of Iraq, Afghanistan, and Other War on Terror Operations Since 9/11* (Washington, DC: Congressional Research Service, 16 July 2007); Linda Bilmes and Joseph Stiglitz, *The Economic Costs of the Iraq War: An Appraisal Three Years After the Beginning of the Conflict* (Cambridge, MA: National Bureau of Economic Research, February 2006).
53. For more information on plug-in hybrids and wind energy, see Chapter 12.
54. SIPRI, op. cit. note 50.
55. Jared Diamond, *Collapse: How Societies Choose to Fail or Succeed* (New York: Penguin Group, 2005); Ronald Wright, *A Short History of Progress* (New York: Carroll and Graf Publishers, 2005).