

# 『地球白書 2013-14』 原注

\* STATE of the WORLD 2013 から抽出  
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## State of the World: A Year in Review

**December 2011.** Justin Gillis, “Carbon Emissions Show Biggest Jump Ever Recorded,” *New York Times*, 4 December 2011; “Brazil Says Amazon Deforestation Down to Lowest Level,” *Agence France-Presse*, 5 December 2011; Louise Gray, “Durban Climate Change Conference: Big Three of US, China and India Agree to Cut Carbon Emissions,” (London) *Daily Telegraph*, 11 December 2011; “Mass Burials as Toll Hits 1000,” *Agence France-Presse*, 21 December 2011; Christopher Joyce, “Turbulence as EU Court Okes Fee on Plane Emissions,” *National Public Radio*, 21 December 2011.

**January 2012.** David Zeiler, “Oil Companies Big Winners as U.S. Becomes Net Exporter of Fuel,” *Money Morning*, 4 January 2012; Juliet Eilperin, “Toxic Releases Rose 16 Percent in 2010, EPA Says,” *Washington Post*, 5 January 2012; Julia Whitty, “Doomsday Clock Ticks Closer to Midnight,” *Mother Jones*, 10 January 2012; “Nitrogen Pollution an Increasing Problem Globally,” *Public Radio International*, 27 January 2012; Karla Zabłudovsky, “Food Crisis as Drought and Cold Hit Mexico,” *New York Times*, 30 January 2012.

**February 2012.** “Snow Blocks in Tens of Thousands as Cold Death Toll Rises,” *Terra Daily*, 11 February 2012; Paul Vallely, “Special Report: The Hungry Generation,” (London) *Independent*, 15 February 2012; Alan Buis, “NASA Satellite Finds Earth’s Clouds are Getting Lower,” *Space Daily*, 23 February 2012; David Fogarty, “World Bank Issues SOS for Oceans, Backs Alliance,” *Planet Ark*, 27 February 2012.

**March 2012.** Rik Myslewski, “Oceans Gaining Acid Faster than Last 300 Million Years,” (London) *The Register*, 2 March 2012; UNICEF, “Millennium Development Goal Drinking Water Target Met,” press release (New York: 6 March 2012); “World Breakthrough on Salt-Tolerant Wheat,” *Seed Daily*, 13 March 2012; Fiona Harvey, “England Faces Wildlife Tragedy as Worst Drought in 30 Years Hits Habitats,” (London) *Guardian*, 18 March 2012; “International Chiefs of Environmental Compliance and Enforcement: Summit Report,” INTERPOL, 27–29 March 2012.

**April 2012.** U.S. Environmental Protection Agency, “EPA Issues Updated, Achievable Air Pollution Standards for Oil and Natural Gas,” press release (Washington, DC: 18 April 2012); Justin Gillis, “Study Indicates a Greater Threat of Extreme Weather,” *New York Times*, 26 April 2012; Eleanor Bader, “A New Autism Theory,” *Salon*, 26 April 2012; Isma’il Kshkush and Josh Kron, “Sudan Declares State of Emergency as Clashed Continue,” *New York Times*, 29 April 2012; W. Barksdale Maynard, “An Underground Forest Offers Clues on Climate Change,” *New York Times*, 30 April 2012; fossilized ferns photo credit: ©2012 University of Illinois Board of Trustees. All rights reserved. For permission information, contact the Illinois State Geological Survey. Photo courtesy of Scott Elrick.

**May 2012.** Eyder Peralta, “Study: Plastic Garbage in Pacific Ocean Has Increased 100-fold in 40 Years,” *National Public Radio*, 9 May 2012; Doyle Rice, “Study: Many Mammals Won’t be Able to Outrun Climate Change,” *USA Today*, 14 May 2012; Suzanne Goldenberg, “US’s Dolphin-safe Tuna Labels Banned by Court Calling Them ‘Unfair’ to Mexico,” (London) *Guardian*, 16 May 2012; Tom Miles, “World Living Beyond its Resources, Summit Off-track: WWF,” *Planet Ark*, 16 May 2012; Geoffrey Lean, “G8: Leaders Open Up Vital New Front in the Battle to Control Global Warming,” (London) *Daily Telegraph*, 21 May 2012.

**June 2012.** Pete Spotts, “Report: Humans Near Tipping Point That Could Dramatically Change Earth,” *Christian Science Monitor*, 6 June 2012; Fiona Harvey, “Fishing Discards Practice Thrown Overboard by EU,” (London) *Guardian*, 13 June 2012; Richard Black, “Rio Summit: Little Progress, 20 Years On,” *BBC*, 22 June 2012; David

Tuller, “BPA Linked to Brain Tumors for the First Time,” *Mother Jones*, 27 June 2012; Sandy Shore, “Wheat, Corn Prices Climb as Heat Takes Toll on Crops,” *Chicago Sun-Times*, 27 June 2012.

**July 2012.** Erik Olsen, “Growing Ship Traffic Threatens Blue Whales,” *New York Times*, 2 July 2012; Kate Kelland, “Diseases from Animals Hit Over Two Billion People a Year,” *Baltimore Sun*, 5 July 2012; Joseph O’Leary, “More than 2,000 Heat Records Matched or Broken,” *Planet Ark*, 5 July 2012; Todd Wilkinson, “New Breed of Ranchers Shapes a Sustainable West,” *Christian Science Monitor*, 29 July 2012; Brian Handwerk, “Caffeinated Seas Found off U.S. Pacific Northwest,” *National Geographic*, 30 July 2012.

**August 2012.** Tim Newcomb, “Mutant Butterflies Found Near Fukushima,” *Time*, 14 August 2012; Kelly Slivka, “Introducing the Ocean Health Index,” *New York Times*, 15 August 2012; Kim Murphy, “Keystone XL Pipeline Construction Begins Amid Protests,” *Los Angeles Times*, 16 August 2012; Monica Eng, “Who Determines Safety of New Food Ingredients?” *Chicago Tribune*, 25 August 2012; “Vast Reservoir of Methane Locked Beneath Antarctic Ice Sheet,” (London) *Guardian*, 29 August 2012.

**September 2012.** Jeffrey Gettleman, “Elephants Dying in Epic Frenzy as Ivory Fuels Wars and Profits,” *New York Times*, 3 September 2012; Alister Doyle, “Rising Chemicals Output a Hazard, Clean-up Needed by 2020: UN,” *Planet Ark*, 6 September 2012; Jay Lindsay, “National Fishery Disaster Declared in New England by Commerce Department,” *Huffington Post*, 13 September 2012; Nina Chestney, “100 Million Will Die by 2030 if World Fails to Act on Climate: Report,” *Planet Ark*, 26 September 2012; Barbara Lewis, “EU Wind Capacity Hits 100 Gigawatt Mark: Industry,” *Planet Ark*, 28 September 2012.

**October 2012.** Kenneth Weiss, “Oceans’ Rising Acidity a Threat to Shellfish—and Humans,” *Los Angeles Times*, 6 October 2012; Michael Lemonick, “New Study Ties Hurricane Strength to Global Warming,” *Climate Central*, 15 October 2012; Alister Doyle, “Twenty-five Primates on Brink of Extinction, Study Says,” *Planet Ark*, 16 October 2012; Jonathan Allen, “Pollution as Harmful as Malaria, TB in Developing World—Study,” *AlertNet*, 23 October 2012; Alister Doyle, “U.N. Urges Foreign Fishing Fleets to Halt ‘Ocean-Grabbing,’” *Planet Ark*, 31 October 2012.

**November 2012.** John Hocevar, “Looking for Hope in the Ruins as CCAMLR Talks Fizzle,” *Huffington Post*, 1 November 2012; Tom Miles, “Greenhouse Gas Volumes Reached New High in 2011: Survey,” *Planet Ark*, 21 November 2012; Stanglin Dough and Michael Winter, “Scattered Walmart Protests Don’t Dent the Bottom Line,” *USA Today*, 24 November 2012; Hilary Russ, “New York, New Jersey Put \$71 Billion Price Tag on Sandy,” *Chicago Tribune*, 26 November 2012; Ben Cubby, “The Top of the World Is Melting,” *Brisbane Times*, 28 November 2012.

## Chapter 1. Beyond Sustainababble

1. Definition (paraphrased) and etymology of sustainable from *Webster’s Third New International Dictionary of the English Language Unabridged* (Springfield, MA: Merriam-Webster, 1981); World Commission on Environment and Development (WCED), *Our Common Future* (Oxford: Oxford University Press, 1987), p. 43.
2. “Sustainable Cars,” *Inhabit.com*, at [inhabitat.com/tag/sustainable-cars](http://inhabitat.com/tag/sustainable-cars); “LOOK: PACT Sustainable Underwear,” *Good Is*, at [www.good.is/post/look-pact-sustainable-underwear](http://www.good.is/post/look-pact-sustainable-underwear); airline and gas-utility material collected in 2012 by the author.
3. Maria Cardona, “What Olympics Teach about Going Green,” *CNN Opinion*, 28 July 2012; Figure 1–1 by Randall Munroe, at [xkcd.com/1007](http://xkcd.com/1007).
4. Lester R. Brown, *Building a Sustainable Society* (New York: W. W. Norton & Company, 1981); George Perkins Marsh, *The Earth as Modified by Human Action* (London: Sampson Low, Marston, Low, and Searle, 1874).
5. Edmund Morris, *Theodore Rex* (New York: Random House, 2001), p. 76; National Environmental Policy Act, at [ceq.hss.doe.gov/nepa/regs/nepa/nepaeqia.htm](http://ceq.hss.doe.gov/nepa/regs/nepa/nepaeqia.htm); Figure 1–2 from Jay N. “Ding” Darling Wildlife Society, originally published 15 September 1936.
6. Gro Harlem Brundtland, “Chairman’s Foreword,” in WCED, op. cit. note 1, p. xi.
7. Box 1–1 from the following: Justin Kitzes et al., *Guidebook to the National Footprint Accounts: 2008 Edition* (Oakland, CA: Global Footprint Network, 2008), pp. 9, 88; U.N. Environment Programme (UNEP), *The Emissions Gap Report 2012* (Nairobi: 2012), p. 1; U.N. Population Division, *World Population Prospects: The 2010 Revision, Volume I: Comprehensive Tables* (New York: 2011); Robert Engelman, *Profiles in Carbon: An Update on Population, Consumption and Carbon Dioxide Emissions* (Washington, DC: Population Action International, 1998); WWF et

- al., *Living Planet Report 2012* (Gland, Switzerland: WWF, 2012); Robert Engelman, “Nine Strategies for Stopping Short of 9 Billion,” in Worldwatch Institute, *State of the World 2012* (Washington, DC: Island Press, 2012).
8. Brundtland, op. cit. note 6.
  9. UNICEF and World Health Organization, *Progress on Drinking Water and Sanitation: 2012 Update* (New York: United Nations, 2012); Homi Kharas and Andrew Rogerson, *Horizon 2025: Creative Destruction in the Aid Industry* (London: Overseas Development Institute, 2012).
  10. UNEP, Ozone Secretariat, “The Montreal Protocol on Substances that Deplete the Ozone Layer,” at [ozone.unep.org](http://ozone.unep.org).
  11. Marc Lacey, “Across Globe, Hunger Brings Rising Anger,” *New York Times*, 18 April 2008; Jim Yardley and Gardiner Harris, “India Staggered by Power Blackout; 670 Million People in Grip,” *New York Times*, 1 August 2012.
  12. Seth Borenstein, “World’s Carbon Emissions Surpass Target,” *Washington Post*, 3 December 2012; Potsdam Institute for Climate Impact Research and Climate Analytics, *Turn Down the Heat: Why a 4°C Warmer World Must Be Avoided* (Washington, DC: World Bank, 2012). Figure 1–3 based on data from BP, *BP Statistical Review of World Energy* (London: 2012).
  13. Haibing Ma, “Energy Intensity Rising Slightly,” *Vital Signs Online*, 20 September 2011.
  14. Johan Rockström et al., “A Safe Operating Space for Humanity,” *Nature*, 23 September 2009, pp. 472–75.
  15. Anthony D. Barnofsky et al., “Approaching a State Shift in Earth’s Biosphere,” *Nature*, 7 June 2012, pp. 52–58.
  16. UNEP, “World Remains on Unsustainable Track Despite Hundreds of Internationally Agreed Goals and Objectives,” GEO5 press release (Rio de Janeiro, 6 June 2012).
  17. Paul Epstein and Dan Ferber, *Changing Planet, Changing Health* (Berkeley: University of California Press, 2011).
  18. Bill McKibben, “Global Warming’s Terrifying New Math,” *Rolling Stone*, 2 August 2012.
  19. W. H. Auden, “September 1, 1939,” in *Another Time* (New York: Random House, 1940).
  20. U.N. Population Division, op. cit. note 7.
  21. Potsdam Institute, op. cit. note 12, p. xviii.
  22. Bill McKibben, *The End of Nature* (New York: Random House, 2006); Paul Wapner, *Living through the End of Nature* (Cambridge, MA: The MIT Press, 2010); Michiel Schaeffer et al., “Long-term Sea Level Rise Implied by 1.5°C and 2°C Warming Levels” (letter), *Nature Climate Change*, December 2012, pp. 867–70.
  23. “A Wild Love for the World,” Joanna Macy interview by Krista Tippett, *On Being*, American Public Media, 1 November 2012.

## Chapter 2. Respecting Planetary Boundaries and Reconnecting to the Biosphere

1. Carl Folke et al., “Reconnecting to the Biosphere,” *Ambio*, vol. 40, no. 7 (2011), pp. 719–38.
2. Hans Rosling, *Gapminder*, 2012, at [www.gapminder.org/world/](http://www.gapminder.org/world/); Paul J. Crutzen, “Geology of Mankind,” *Nature*, 3 January 2002, p. 23; Will Steffen, P. J. Crutzen, and J. R. McNeill, “The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature?” *Ambio*, vol. 36, no. 8 (2007), pp. 614–21.
3. Will Steffen et al., “The Anthropocene: From Global Change to Planetary Stewardship,” *Ambio*, vol. 40 (2011), pp. 739–61.
4. Lisa Deutsch et al., “Feeding Aquaculture Growth through Globalization; Exploitation of Marine Ecosystems for Fishmeal,” *Global Environmental Change*, May 2007, pp. 238–49; Evan D. G. Fraser and A. Rimas, “The Psychology of Food Riots,” *Foreign Affairs*, 30 January 2011.
5. Folke et al., op. cit. note 1; Victor Galaz et al., “Institutional and Political Leadership Dimensions of Cascading Ecological Crises,” *Public Administration*, June 2011, pp. 360–80; Brian Walker et al., “Looming Global-Scale Failures and Missing Institutions,” *Science*, 11 September 2009, pp. 1,345–46.

6. F. Stuart Chapin, III et al., “Ecosystem Stewardship: Sustainability Strategies for a Rapidly Changing Planet,” *Trends in Ecology and Evolution*, 24 November 2009, pp. 241–49.
7. Steffen et al., op. cit. note 3.
8. Figure 2–1 from Oran Young and W. Steffen. “The Earth System: Sustaining Planetary Life Support Systems,” in F. S. Chapin III, G. P. Kofinas, and C. Folke, eds., *Principles of Ecosystem Stewardship: Resilience-Based Natural Resource Management in a Changing World* (New York: Springer-Verlag, 2009), pp. 295–315; Chapin et al., op. cit. note 6; Robert Costanza et al., “Sustainability or Collapse: What Can We Learn from Integrating History of Humans and the Rest of Nature,” *Ambio*, vol. 36, no. 7 (2007), pp. 522–27.
9. Johan Rockström et al., “A Safe Operating Space for Humanity,” *Nature*, 23 September 2009, pp. 472–75.
10. Table 2–1 and data in this section from Johan Rockström et al., “Planetary Boundaries: Exploring the Safe Operating Space for Humanity,” *Ecology and Society*, vol. 14, no. 2 (2009).
11. Rockström et al., op. cit. note 9; Rockström et al., op. cit. note 10.
12. Stephen R. Carpenter and E. M. Bennett, “Reconsideration of the Planetary Boundary for Phosphorus,” *Environmental Research Letters*, vol. 6, no. 1 (2011).
13. John M. Anderies et al., “The Topology of Non-Linear Global Carbon Dynamics: From Tipping Points to Planetary Boundaries,” *Geophysical Research Letters*, forthcoming; Folke et al., op. cit. note 1; Chapin et al., op. cit. note 6; Young and Steffen, op. cit. note 8.
14. Carl Folke et al., “Resilience Thinking: Integrating Resilience, Adaptability and Transformability,” *Ecology and Society*, vol. 15, no. 4 (2010).
15. Frances Westley et al., “Tipping Towards Sustainability: Emerging Pathways of Transformation,” *Ambio*, vol. 40, no. 7 (2011), pp. 762–80; Melissa Leach et al., “Transforming Innovation for Sustainability,” *Ecology and Society*, vol. 17, no. 2 (2012).

### Chapter 3. Defining a Safe and Just Space for Humanity

1. Joseph Stiglitz, Amartya Sen, and Jean-Paul Fitoussi, *Report of the Commission on the Measurement of Economic Performance and Social Progress*, at [www.stiglitz-sen-fitoussi.fr/documents/rapport\\_anglais.pdf](http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf).
2. Johan Rockström et al., “A Safe Operating Space for Humanity,” *Nature*, 23 September 2009, pp. 472–75; Johan Rockström et al., “Planetary Boundaries: Exploring the Safe Operating Space for Humanity,” *Ecology and Society*, vol. 14, no. 2 (2009), p. 32.
3. Rockström et al., “Planetary Boundaries,” op. cit. note 2.
4. For the need for further conceptual clarification of planetary boundaries, see Simon L. Lewis, “We Must Set Planetary Boundaries Wisely,” *Nature*, 23 May 2012, p. 417, and Ted Nordhaus, Michael Shellenberger, and Linus Blomqvist, *The Planetary Boundaries Hypothesis: A Review of the Evidence* (Oakland, CA: Breakthrough, 2012).
5. Kate Raworth, *A Safe and Just Space for Humanity: Can We Live within the Doughnut?* Oxfam Discussion Paper (Oxford: Oxfam International, 2012).
6. Figure 3–1 from Raworth, op. cit. note 5, based on Rockstrom et al., “Safe Operating Space,” op. cit. note 2, and from Rockström et al., “Planetary Boundaries,” op. cit. note 2.
7. See, for example, U.N. Committee on Economic, Social and Cultural Rights, General Comment No. 12: The Right to Adequate Food, 1999, and the Office of the United Nations High Commissioner for Human Rights, The Right to Water, Fact Sheet 35; on ecological economics, see Herman Daly, *Beyond Growth: The Economics of Sustainable Development* (Boston: Beacon Press, 1996), and Paul Ekins, *Economic Growth and Environmental Sustainability: The Prospects for Green Growth* (London: Routledge, 2000).
8. Table 3–1 based on the following: prevalence of undernourishment from U.N. Food and Agriculture Organization (FAO), food deficit database 2012; population living on less than \$1.25 (PPP) per day from S. Chen and M. Ravallion, *The Developing World is Poorer Than We Thought But No Less Successful in the Fight against Poverty*, Policy Research Working Paper (Washington, DC: World Bank, 2008); total net primary enrollment rate from World



Bank Databank; United Nations, *The Millennium Development Goals Report 2011* (New York: 2011) for population using an improved water source, population using an improved sanitation facility, literacy rate of 15–24 year olds, gap between women's and men's share in non-agricultural wage employment, and gap between women and men holding seats in national parliaments; population without regular access to essential medicines from World Health Organization, *Equitable Access to Essential Medicines: A Framework for Collective Action* (Geneva: 2004); population lacking access to electricity and clean cooking facilities from International Energy Agency (IEA), *Energy for All: World Energy Outlook 2011* (Paris: 2011); social inequity based on national Gini coefficients exceeding 0.35, from Frederick Solt, "Standardizing the World Income Inequality Database," *Social Science Quarterly*, June 2009, pp. 231–42; SWIID Version 3.0, July 2010.

9. Figure 3–2 from Rockström et al., "Safe Operating Space," op. cit. note 2, and from Raworth, op. cit. note 5.

10. The statistic on food supply requirements is calculated for each country by multiplying the average food deficit of the undernourished population by the total undernourished population, then dividing the global total by the global food supply (per capita global food supply x global population). Data source for food-deficit and undernourished population is FAO, "Food Security Indicators," at [www.fao.org/economic/ess/ess-fs/fs-data/ess-fadata/en](http://www.fao.org/economic/ess/ess-fs/fs-data/ess-fadata/en), and the source for per capita global food supply and global population is FAO, *FAOSTAT Statistical Database*, at [faostat.fao.org](http://faostat.fao.org). Other data from FAO, *Global Food Losses and Food Waste: Extent, Causes and Prevention* (Rome: 2011), from IEA, *Energy for All: Financing Access for the Poor* (Paris: 2011), and from L. Chandy and G. Gertz, *Poverty in Numbers: The Changing State of Global Poverty from 2005 to 2015* (Washington, DC: The Brookings Institution, 2011).

11. B. Milanovic, *Global Inequality Recalculated: The Effect of New 2005 PPP Estimates on Global Inequality*, Policy Research Working Paper (Washington, DC: World Bank, 2009); S. Chakravarty et al., "Sharing Global CO<sub>2</sub> Emission Reductions among One Billion High Emitters," *Proceedings of the National Academy of Sciences*, 6 July 2009; S. Chakravarty, discussions with author; nitrogen use from Mark A. Sutton et al., "Too Much of a Good Thing," *Nature*, 10 April 2011, pp. 159–61.

12. H. Kharas, *The Emerging Middle Class in Developing Countries*, Working Paper (Paris: OECD Development Centre, 2010); Foresight, *The Future of Food and Farming: Challenges and Choices for Global Sustainability* (London: Government Office for Science, 2011).

13. Stiglitz, Sen, and Fitoussi, op. cit. note 1. Box 3–1 from the following: Lew Daly and Stephen Posner, *Beyond GDP: New Measures for a New Economy* (New York: Demos, 2012); Stiglitz, Sen, and Fitoussi, op. cit. note 1; "Resolution 65/309. Happiness: Towards a Holistic Approach to Development," U.N. General Assembly, 25 August 2011; WAVES Partnership, World Bank, at [www.wavespartnership.org/waves](http://www.wavespartnership.org/waves); World Bank, *Moving Beyond GDP* (Washington, DC: WAVES Partnership, 2012); Office for National Statistics, *Measuring What Matters: National Statistician's Reflections on the National Debate on Measuring National Well-being* (London: 2011); Australian Bureau of Statistics, "Measures of Australia's Progress," at [www.abs.gov.au/ausstats](http://www.abs.gov.au/ausstats); J. Steven Landefeld et al., "GDP and Beyond: Measuring Economic Progress and Sustainability," *Survey of Current Business*, April 2010; "Maryland's Genuine Progress Indicator," at [www.green.maryland.gov/mdgpi](http://www.green.maryland.gov/mdgpi); "Vermont Establishes a Genuine Progress Indicator, Blazes a Path for Measuring What Matters," Demos, 9 May 2012.

14. Basel data from Shahra Razavi, *The Political and Social Economy of Care in a Development Context*, Gender and Development Programme Paper (Geneva: U.N. Research Institute for Social Development, 2007); U.S. household production data from Benjamin Bridgman et al., "Accounting for Household Production in the National Accounts, 1965–2010," *Survey of Current Business*, May 2012.

15. U.N. Environment Programme (UNEP)–World Conservation Monitoring Centre, *The UK National Ecosystem Assessment: Synthesis of the Key Findings* (Cambridge, U.K.: 2011).

16. United Nations University–International Human Dimensions Programme and UNEP, *Inclusive Wealth Report 2012: Measuring Progress toward Sustainability* (Cambridge, U.K.: Cambridge University Press, 2012).

17. Organisation for Economic Co-operation and Development, *Divided We Stand: Why Income Inequality Keeps Rising* (Paris: 2011).

18. Ian Gough et al., *The Distribution of Total Greenhouse Gas Emissions by Households in the UK, and Some Implications for Social Policy* (London: Centre for Analysis of Social Exclusion and the New Economics Foundation,

2011, amended 2012); Statistics Sweden, System of Environmental and Economic Accounts, *CO<sub>2</sub> Emission per Income Deciles 2000* (Stockholm: 2000); China from Jie Li and Yan Wang, “Income, Lifestyle and Household Carbon Footprints (Carbon-Income Relationship), a Micro-level Analysis on China’s Urban and Rural Household Surveys,” *Environmental Economics*, vol. 1, no. 2 (2010).

#### Chapter 4. Getting to One-Planet Living

1. Jared Diamond, *Collapse: How Societies Choose to Fail or Succeed* (New York: Viking Press, 2005).
2. U.N. Department of Economic and Social Affairs, *World Economic and Social Survey 2011* (New York: United Nations, 2011), p. ix.
3. Donella Meadows et al., *The Limits to Growth* (New York: Universe Books, 1972); Lance Gunderson and C. S. Holling, eds., *Panarchy: Understanding Transformations in Human and Natural Systems* (Washington, DC: Island Press, 2002); Millennium Ecosystem Assessment, *Ecosystems and Human Well-being: Synthesis* (Washington, DC: Island Press, 2005).
4. WWF et al., *Living Planet Report 2010* (Gland, Switzerland: WWF, 2010); WWF, *Living Planet Report 2012* (Gland, Switzerland: WWF, 2012); Mathis Wackernagel and William E. Rees, *Our Ecological Footprint* (Gabriola Island, Canada: New Society Publishers, 1996). Box 4–1 from Global Footprint Network, *National Footprint Accounts, 2011 Edition* (Oakland, CA: 2012), and from [www.footprintnetwork.org](http://www.footprintnetwork.org).
5. Wackernagel and Rees, op. cit. note 4; William E. Rees, “Ecological Footprint: Concept of,” in S. A. Levin, ed. in chief, *Encyclopedia of Biodiversity*, 2nd ed. (Amsterdam: Elsevier/Academic Press, forthcoming); WWF et al., *Living Planet Report 2010*, op. cit. note 4; WWF, *Living Planet Report 2012*, op. cit. note 4.
6. Anup Shah, “Poverty Facts and Stats,” citing *World Development Indicators*, World Bank, 2008, at [www.globalissues.org/article/26/poverty-facts-and-stats](http://www.globalissues.org/article/26/poverty-facts-and-stats); William E. Rees, “Ecological Footprints and Biocapacity: Essential Elements in Sustainability Assessment,” in J. Dewulf and H. Van Langenhove, eds., *Renewables-based Technology: Sustainability Assessment* (Chichester, U.K.: John Wiley and Sons, 2006); WWF et al., *Living Planet Report 2010*, op. cit. note 4.
7. Table 4–1 from the following: Global Footprint Network, at [www.footprintnetwork.org/en/index.php/GFN/page/world\\_footprint](http://www.footprintnetwork.org/en/index.php/GFN/page/world_footprint); U.N. Food and Agriculture Organization, “Nutrition Country Profiles,” at [www.fao.org/ag/agn/nutrition/profiles\\_by\\_country\\_en.stm](http://www.fao.org/ag/agn/nutrition/profiles_by_country_en.stm); Peter Menzel, *Material World* (San Francisco: Sierra Club Books, 1994); World Bank, “Indicators,” at [data.worldbank.org/indicator](http://data.worldbank.org/indicator); International Civil Aviation Organization, “Special Report: Annual Review of Civil Aviation,” *ICAO Journal*, vol. 61, no. 5 (2005); Worldmapper, at [www.worldmapper.org](http://www.worldmapper.org); World Resources Institute, “EarthTrends: Environmental Information,” at [earthtrends.wri.org](http://earthtrends.wri.org); WWF, “Footprint Interactive Graph,” at [wwf.panda.org/about\\_our\\_earth/all\\_publications/living\\_planet\\_report](http://wwf.panda.org/about_our_earth/all_publications/living_planet_report). Global average statistics for living space and motor vehicle travel are estimated assuming two thirds of the global population consumes at the one-planet level and one third consumes at the three-planet level.
8. Life expectancy from World Bank, op. cit. note 7.
9. Land area data from “Understanding Vancouver,” at [vancouver.ca/commsvcs/planning/census/index.htm](http://vancouver.ca/commsvcs/planning/census/index.htm); 2006 population from Statistics Canada, “Census Data: Community Profiles: Vancouver, British Columbia (Census Metropolitan Area)” (Ottawa).
10. Figure 4–1 from Jennie Moore, *Getting Serious About Sustainability: Exploring the Potential for One-planet Living in Vancouver*, submitted in partial fulfillment of requirements for PhD degree (Vancouver: School of Community and Regional Planning, University of British Columbia, forthcoming).
11. City of Vancouver, *Greenest City 2020 Action Plan* (Vancouver: 2011), pp. 48–53.
12. Figure 4–2 from Moore op. cit. note 10.
13. Moore, op. cit. note 10; British Columbia (The Province of), *Carbon Neutral BC, A First for North America*, press release (Victoria: 30 June 2011).
14. Moore, op. cit. note 10.
15. Ibid.

16. City of Vancouver, op. cit. note 11.
17. City of Vancouver, *Greenest City 2020 Action Plan (GCAP): Council Report* (Vancouver: 2011), pp. 110–11.
18. Ibid.
19. City of Vancouver op. cit. note 11.
20. Anthony Giddens, *The Politics of Climate Change* (Cambridge, U.K.: Polity Press, 2011); Norman Myers and Jennifer Kent, *Perverse Subsidies: How Tax Dollars Can Undercut the Environment and the Economy* (Washington, DC: Island Press, 2001); Ernst von Weizsäcker, Amory Lovins, and Hunter Lovins, *Factor Four* (London: Earthscan, 1997).
21. William E. Rees, “Globalization and Sustainability: Conflict or Convergence,” *Bulletin of Science, Technology and Society*, August 2002, pp. 249–68; Ernst von Weizsäcker et al., *Factor 5* (London: Earthscan, 2009); U.N. Department of Economic and Social Affairs, op. cit. note 2.
22. William E. Rees, “The Way Forward: Survival 2100,” *Solutions*, June 2012; William E. Rees, “What’s Blocking Sustainability? Human Nature, Cognition and Denial,” *Sustainability: Science, Practice, & Policy*, fall 2010; Giddens, op. cit. note 20; von Weizsäcker, Lovins, and Lovins, op. cit. note 20; World Commission on Environment and Development, *Our Common Future* (Oxford: Oxford University Press, 1987).
23. Von Weizsäcker et al., op. cit. note 21; U.N. Department of Economic and Social Affairs, op. cit. note 2.
24. World Commission on Environment and Development, op. cit. note 22, pp. 52, 89.
25. Emmanuel Saez, *Striking it Richer: The Evolution of Top Incomes in the United States* (updated with 2009 and 2010 estimates) (Berkeley: University of California, 2012); U.N. Development Programme, *Human Development Report 2010* (New York: 2010); U.N. Department of Economic and Social Affairs, op. cit. note 2; U.N. Department of Economic and Social Affairs, *World Economic and Social Survey 2006* (New York: United Nations, 2006).
26. Rees, “What’s Blocking Sustainability?” op. cit. note 22; Rees, “The Way Forward,” op. cit. note 22.
27. Diamond, op. cit. note 1.

## Chapter 5. Sustaining Freshwater and Its Dependents

1. Figure of 250 million is approximate, per Joel E. Cohen, *How Many People Can the Earth Support?* (New York: W. W. Norton & Company, 1995), p. 77; 7 billion from U. S. Census Bureau, “U.S. & World Population Clocks,” at [www.census.gov/main/www/popclock.html](http://www.census.gov/main/www/popclock.html); gross world product estimate for 2011 from U.S. Central Intelligence Agency, *The World Factbook*, at [www.cia.gov/library/publications/the-world-factbook/index.html](http://www.cia.gov/library/publications/the-world-factbook/index.html).
2. For analysis and sources, see later text.
3. Figure of 800 million from UNICEF and World Health Organization (WHO), *Progress on Drinking Water and Sanitation: 2012 Update* (New York: United Nations, 2012).
4. Igor A. Shiklomanov, *World Water Resources: A New Appraisal and Assessment for the 21st Century* (Paris: UNESCO, 1998). Box 5–1 based on National Academy of Sciences, Water Science and Technology Board, *Desalination: A National Perspective* (Washington, DC: National Academy Press, 2008); 15,000 figure from Quirin Schiermeier, “Purification with a Pinch of Salt,” *Nature*, 20 March 2008, pp. 260–61.
5. Sandra L. Postel, Gretchen D. Daily, and Paul R. Ehrlich, “Human Appropriation of Renewable Fresh Water,” *Science*, 9 February 1996, pp. 785–88.
6. Figures of 19 percent, 42 percent, and 15,600 cubic kilometers from *ibid.*, adjusted for rise in water captured by dams to 10,800 cubic kilometers, from B. F. Chao, Y. H. Wu, and Y. S. Li, “Impact of Artificial Reservoir Water Impoundment on Global Sea Level,” *Science*, 11 April 2008, pp. 212–14, and assumption that 64 percent of this storage capacity is actively used in the regulation of runoff, per Postel, Daily, and Ehrlich, op. cit. note 5; amount used by each sector from United Nations, *Water in a Changing World: United Nations World Water Development Report*, 3rd ed. (Paris: UNESCO, 2009).
7. Figure of 82 percent from U.N. Food and Agriculture Organization (FAO), *Aquastat Database*, at [www.fao.org/NR/WATER/AQUASTAT/main/index.stm](http://www.fao.org/NR/WATER/AQUASTAT/main/index.stm).

8. Arjen Y. Hoekstra and Mesfin M. Mekonnen, “The Water Footprint of Humanity,” *Proceedings of the National Academy of Sciences*, 28 February 2012, pp. 3,232–37.
9. Data for Figure 5–1 from FAO, op. cit. note 7, viewed 11 September 2012, except 2010 world irrigated area of 299 million hectares from International Commission on Irrigation and Drainage (ICID), *Database*, at [www.icid.org/database.html](http://www.icid.org/database.html), viewed 11 September 2012, and 2010 world population of 6.9 billion from Population Reference Bureau, *2010 Population Clock*, at [www.prb.org/Articles/2010/worldpopulationclock2010.aspx](http://www.prb.org/Articles/2010/worldpopulationclock2010.aspx); most figures are for 2010, except reported irrigated areas by country are for various years.
10. Economic Commission for Africa, *Economic Report on Africa 2007: Accelerating Africa's Development through Diversification* (Addis Ababa, Ethiopia: 2007).
11. Intergovernmental Panel on Climate Change, *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report* (Cambridge, U.K.: Cambridge University Press, 2007); P. C. D. Milly et al., “Stationarity is Dead: Whither Water Management?” *Science*, 1 February 2008, pp. 573–74.
12. Basic sustainability definition from World Commission on Environment and Development, *Our Common Future* (Oxford: Oxford University Press, 1987), p. 43.
13. UNICEF and WHO, op. cit. note 3; reasonable access to water is defined as the availability of 20 liters per person per day from a source within 1 kilometer of the user's dwelling; acceptable sources include household connections, public standpipes, boreholes, protected dug wells, protected spring water, and rainwater collection, from United Nations, *Water for People, Water for Life: United Nations World Water Development Report*, 1st ed. (Paris: UNESCO Publishing and Berghahn Books, 2003), p. 113; the 0.1 percent figure is author's calculation.
14. UNICEF and WHO, op. cit. note 3. Figures reported are for 2010.
15. Number of dams at least 15 meters high from World Commission on Dams, *Dams and Development* (London: Earthscan, 2000); 26 percent is author's calculation using estimated water impounded by dams by Chao, Wu, and Li, op. cit. note 6.
16. Jamie Pittock et al., *Interbasin Water Transfers and Water Scarcity in a Changing World—A Solution or a Pipe-dream?* (Frankfurt: World Wildlife Fund Germany, 2009); Ruixiang Zhu, “China's South-North Water Transfer Project and Its Impacts on Economic and Social Development,” Ministry of Water Resources, People's Republic of China, n.d.
17. “Your Water,” City of Phoenix, at [phoenix.gov/waterservices/wrc/yourwater/index.html](http://phoenix.gov/waterservices/wrc/yourwater/index.html), viewed 25 July 2012.
18. Figure of 16 percent from “Hydropower Generation,” Strategic Energy Technologies Information System, European Commission, at [setis.ec.europa.eu/newsroom-items-folder/hydropower-generation](http://setis.ec.europa.eu/newsroom-items-folder/hydropower-generation), viewed 25 July 2012; Energy Information Administration, U.S. Department of Energy, “International Energy Outlook 2011,” at [www.eia.gov/forecasts/ieo/electricity.cfm](http://www.eia.gov/forecasts/ieo/electricity.cfm), viewed 25 July 2012.
19. Brian D. Richter et al., “Lost in Development's Shadow: The Downstream Human Consequences of Dams,” *Water Alternatives*, vol. 3, no. 2 (2010), pp. 14–42; Box 5–2 from Sandra Postel, *Liquid Assets: The Critical Need to Safeguard Freshwater Ecosystems* (Washington, DC: Worldwatch Institute, 2005).
20. Sandra Postel and Brian Richter, *Rivers for Life: Managing Water for People and Nature* (Washington, DC: Island Press, 2003); Anthony Ricciardi and Joseph B. Rasmussen, “Extinction Rates of North American Freshwater Fauna,” *Conservation Biology*, vol. 13 (1999), pp. 1,220–22; 39 percent vulnerable and 61 presumed extinct from Howard L. Jelks et al., “Conservation Status of Imperiled American Freshwater and Diadromous Fishes,” *Fisheries*, August 2008, pp. 372–407.
21. Postel, op. cit. note 19; 90 percent from Francisco Zamora-Arroyo et al., *Conservation Priorities in the Colorado River Delta: Mexico and the United States* (Sonoran Institute et al., 2005); a third of Egypt's crop from “Egypt's Fertile Nile Delta Falls Prey to Climate Change,” *Agence France-Presse*, 28 January 2010.
22. Millennium Ecosystem Assessment, *Ecosystems and Human Well-being* (Washington, DC: Island Press, 2005); wetlands drained from Rudy Rabbinge and Prem S. Bindraban, “Poverty, Agriculture, and Biodiversity,” in John A. Riggs, ed., *Conserving Biodiversity* (Washington, DC: The Aspen Institute, 2005), pp. 65–77.



23. “Plan to Breach Levee in Missouri Advances,” *New York Times*, 1 May 2011; wetland loss from Linda R. Wires et al., *Upper Mississippi Valley/Great Lakes Waterbird Conservation Plan*, Final Report submitted to the U.S. Fish and Wildlife Service, Fort Snelling, MN, March 2010; Donald L. Hey and Nancy S. Philippi, “Flood Reduction through Wetland Restoration: The Upper Mississippi River Basin as a Case History,” *Restoration Ecology*, March 1995, pp. 4–17.
24. Matthew Rodell, Isabella Velicogna, and James S. Famiglietti, “Satellite-Based Estimates of Groundwater Depletion in India,” *Nature*, 20 August 2009, pp. 999–1,002; J. S. Famiglietti et al., “Satellites Measure Recent Rates of Groundwater Depletion in California’s Central Valley,” *Geophysical Research Letters*, 5 February 2011.
25. Sandra Postel, *Pillar of Sand* (New York: W. W. Norton & Company, 1999); 60 percent from World Bank, *Deep Wells and Prudence: Towards Pragmatic Action for Addressing Groundwater Overexploitation in India* (Washington, DC: 2010); 15 percent from John Briscoe and R. P. S. Malik, *India’s Water Economy: Bracing for a Turbulent Future* (New Delhi: Oxford University Press, 2006), p. xviii.
26. Ogallala depletion from Jennifer S. Stanton et al., *Selected Approaches to Estimate Water-Budget Components of the High Plains, 1940 through 1949 and 2000 through 2009* (Reston, VA: U. S. Geological Survey, 2011); U.S. wheat production from U.S. Department of Agriculture, Economic Research Service, “Wheat Data,” at [www.ers.usda.gov/data-products/wheat-data.aspx](http://www.ers.usda.gov/data-products/wheat-data.aspx), viewed 6 September 2012.
27. Yoshihide Wada et al., “Global Depletion of Groundwater Resources,” *Geophysical Research Letters*, vol. 37, L20402 (2010); other calculations are the author’s, with 2000 global grain harvest from FAO, *FAOSTAT Statistical Database*, at [faostat.fao.org](http://faostat.fao.org), viewed 6 September 2012.
28. Mark Giordano, “Global Groundwater? Issues and Solutions,” *Annual Review of Environmental Resources*, vol. 34 (2009), pp. 7.1–7.26, based on data from FAO, op. cit. note 7; Saudi example from FAO, *Aquastat Database*, at [www.fao.org/nr/water/aquastat/countries\\_regions/saudi\\_arabia/index.stm](http://www.fao.org/nr/water/aquastat/countries_regions/saudi_arabia/index.stm).
29. FAO, op. cit. note 28; “Squeezing Africa Dry: Behind Every Land Grab is a Water Grab,” GRAIN (Barcelona, Spain), 11 June 2012.
30. High Plains Water District, “Average Groundwater Level Decline of –2.56 Feet Recorded in 2011 Is Third Largest in High Plains Water District’s 61-Year History,” press release (Lubbock, TX: 2 July 2012).
31. World Bank, op. cit. note 25; other states may follow from John Grimond, “For Want of a Drink: A Special Report on Water,” *The Economist*, 22 May 2010.
32. Sandra Postel, “Texas Water District Acts to Slow Depletion of the Ogallala Aquifer,” *Water Currents*, National Geographic, 7 February 2012.
33. Kate Galbraith, “Texas Farmers Battle Ogallala Pumping Limits,” *The Texas Tribune*, 18 March 2012; Sandra Postel, “That Sinking Feeling about Groundwater in Texas,” *Water Currents*, National Geographic, 19 July 2012.
34. ICID, op. cit. note 9; Anil Jain, managing director, Jain Irrigation, discussion with author, San Antonio, TX, December 2010.
35. ICID, op. cit. note 9; Sandra Postel et al., “Drip Irrigation for Small Farmers: A New Initiative to Alleviate Hunger and Poverty,” *Water International*, March 2001, pp. 3–13; 600,000 sales from “Design for the Other 90%,” at [other90.cooperhewitt.org/Design/drip-irrigation-system](http://other90.cooperhewitt.org/Design/drip-irrigation-system), viewed 14 July 2010.
36. Murray Darling Basin Authority (MDBA), at [www.mdba.gov.au](http://www.mdba.gov.au).
37. MDBA, “Plain English Summary of the Proposed Basin Plan, with Explanatory Notes,” Canberra, November 2011; “The Proposed Murray-Darling Basin Plan: Scientific Statement” (32 signatories), April 2012.
38. Sandra Postel, “Lessons from the Field—Boston Conservation,” National Geographic online, at [environment.nationalgeographic.com/environment/freshwater/lessons-boston-conservation](http://environment.nationalgeographic.com/environment/freshwater/lessons-boston-conservation), March 2010.
39. Aaron Koch, Policy Advisor, Mayor’s Office of Long-Term Planning and Sustainability, New York, e-mail to author, 8 June 2011.
40. Carolyn Whelan, “Liquid Asset,” *Nature Conservancy*, autumn 2010, pp. 43–49.
41. Benjamin Moline, manager, Water Resources and Real Estate, Molson-Coors, Golden, Co, discussion with

author, 11 May 2012 (MillerCoors is a partnership between SABMiller and Molson Coors); Unilever, “Water Use in Agriculture,” at [www.unilever.com/sustainable-living/water/agriculture](http://www.unilever.com/sustainable-living/water/agriculture); tomatoes from Unilever, Sustainable Agriculture Team, *Unilever & Sustainable Agriculture—Water* (2009).

42. Water Footprint Network, “Product Gallery,” at [www.waterfootprint.org/?page=files/productgallery](http://www.waterfootprint.org/?page=files/productgallery), viewed 13 September 2012; Carey W. King and Michael E. Webber, “Water Intensity of Transportation,” *Environmental Science & Technology*, vol. 42, no. 21 (2008), pp. 7,866–72.

## Chapter 6. Sustainable Fisheries and Seas: Preventing Ecological Collapse

1. Rachel Carson, *The Sea Around Us* (New York: Oxford University Press, 1961), p. xii.
2. Homer, *The Odyssey*, trans. Robert Fagles (New York: Viking, 1996); Tina Bishop et al., “Then and Now: The HMS Challenger Expedition and the ‘Mountains in the Sea’ Expedition,” *NOAA Ocean Explorer Podcast RSS*, National Oceanic and Atmospheric Administration (NOAA), 16 July 2012.
3. “Ocean,” NOAA, at [www.noaa.gov/ocean.html](http://www.noaa.gov/ocean.html).
4. National Ocean Economics Program, *State of the U.S. Ocean and Coastal Economies*, Center for the Blue Economy, 2009; NOAA, “The Oceans Are the Trading Routes for the Planet,” *How Important Is the Ocean to Our Economy?* at [oceanservice.noaa.gov/facts/oceaneconomy.html](http://oceanservice.noaa.gov/facts/oceaneconomy.html).
5. U.N. Environment Programme (UNEP)–World Conservation Monitoring Centre, *In the Front Line: Shoreline Protection and Other Ecosystem Services from Mangroves and Coral Reefs* (Cambridge, U.K.: 2006); H. Cesar et al., *Economic Valuation of Hawaiian Reefs* (Arnhem, Netherlands: Cesar Environment Economics Consulting, 2002).
6. Marah Hardt and Carl Safina, “Covering Ocean Acidification: Chemistry and Considerations,” *Yale Forum on Climate Change & the Media*, 24 June 2008.
7. Kenneth W. Bruland et al., “Iron, Macronutrients and Diatom Blooms in the Peru Upwelling Regime: Brown and Blue Waters of Peru,” *Marine Chemistry*, vol. 93, no. 2 (2005), pp. 81–103; Milagros Salazar, “Peru’s Vanishing Fish,” Center for Public Integrity, 26 January 2012.
8. International Energy Agency, “Prospect of Limiting the Global Increase in Temperature to 2°C Is Getting Bleaker,” press release (Paris: 30 May 2011); UNEP, *Keeping Track of Our Changing Environment* (Nairobi: 2011); U.S. Environmental Protection Agency, “Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2010 (April 2012),” *U.S. Greenhouse Gas Inventory Report* (Washington, DC: 2012).
9. Richard A. Feely, Christopher L. Sabine, and Victoria J. Fabry, “Carbon Dioxide and Our Ocean Legacy,” *Clear the Air and Conserve Our Ocean Legacy*, April 2006; Royal Society, *Ocean Acidification Due to Increasing Atmospheric Carbon Dioxide* (London, 2005).
10. UNEP, op. cit. note 8; Bärbel Hönlisch et al., “The Geological Record of Ocean Acidification,” *Science*, 2 March 2012, pp. 1,058–63; NOAA, “Corals: Zooxanthallae...What’s That?” *NOAA National Ocean Service Education*, 25 March 2008.
11. UNEP, op. cit. note 8; Lauretta Burke et al., *Reefs at Risk Revisited* (Washington, DC: World Resources Institute, 2011).
12. “The Biological Effects of Ocean Acidification,” Princeton University, at [www.princeton.edu/grandchallenges](http://www.princeton.edu/grandchallenges).
13. UNEP, op. cit. note 8.
14. Lothar Stramma et al., “Expansion of Oxygen Minimum Zones May Reduce Available Habitat for Tropical Pelagic Fishes” (letter), *Nature Climate Change*, January 2012, pp. 33–37.
15. Elliott L. Hazen et al., “Predicted Habitat Shifts of Pacific Top Predators in a Changing Climate” (letter), *Nature Climate Change*, online 23 September 2012.
16. Yearly cycle and lowest in 8,000 years from Institute of Environmental Physics, University of Bremen, “Arctic Sea Ice Extent Small as Never Before,” 2011, at [www.iup.uni-bremen.de:8084/amsr/minimum2011-en.pdf](http://www.iup.uni-bremen.de:8084/amsr/minimum2011-en.pdf); National Snow and Ice Data Center (NSIDC), “Arctic Sea Ice Reaches Lowest Extent for the Year and the Satellite Record,” press release (Boulder, CO: 19 September 2012).

17. NSIDC, “Arctic Sea Ice Extent: Area of the Ocean with at Least 15 Percent Sea Ice” (graph), at [nsidc.org/data/seaice\\_index/images/daily\\_images/N\\_stddev\\_timeseries.png](http://nsidc.org/data/seaice_index/images/daily_images/N_stddev_timeseries.png); Polar Science Center, “Arctic Sea Ice Volume Anomaly and Trend from PIOMAS,” University of Washington, 30 July 2012; NSIDC, “Frequently Asked Questions on Arctic Sea Ice,” June 2009.
18. Andrew McMinn, “Production in Sea Ice Could Fall,” *Australian Antarctic Magazine*, spring 2005, p. 11.
19. U.N. Food and Agriculture Organization (FAO), *The State of World Fisheries and Aquaculture 2010* (Rome: 2010).
20. Ibid.; UNEP, op. cit. note 8.
21. B. B. Collette et al., “High Value and Long Life—Double Jeopardy for Tunas and Billfishes,” *Science*, 15 July 2011, pp. 291–92; UNEP, op. cit. note 8.
22. National Academies, *Coastal Hazards* (Washington, DC: Ocean Studies Board, 2007); R. J. Nicholls et al., “Coastal Systems and Low-lying Areas,” in Intergovernmental Panel on Climate Change, *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report* (Cambridge, U.K.: Cambridge University Press, 2007), pp. 315–56.
23. C. M. Boerger et al., “Plastic Ingestion by Planktivorous Fishes in the North Pacific Central Gyre,” *Marine Pollution Bulletin*, December 2010, pp. 2,275–78; Peter Kershaw et al., “Plastic Debris in the Ocean,” in UNEP, *UNEP Yearbook 2011* (Nairobi: 2011).
24. Council on Environmental Quality, *Interim Framework for Effective Coastal and Marine Spatial Planning* (Washington, DC: White House, 2009).
25. Ibid.
26. Christopher Costello, Stephen D. Gaines, and John Lynham, “Can Catch Shares Prevent Fisheries Collapse?” *Science*, 19 September 2008, p. 1,678–81.
27. Daniel Pauly, “Major Trends in Small-Scale Marine Fisheries, with Emphasis on Developing Countries, and Some Implications for the Social Sciences,” *Maritime Studies*, vol. 4, no. 2 (2006), pp. 7–22.
28. FAO, op. cit. note 19; UNEP, op. cit. note 8.
29. George Karleskint, Richard Turner, and James Small, *Introduction to Marine Biology*, 2nd ed. (Philadelphia: Saunders College Publishing, 1998).
30. UNEP, op. cit. note 8; C. Giri et al., “Mangrove Forest Distributions and Dynamics (1975–2005) of the Tsunami-Affected Region of Asia,” *Journal of Biogeography*, vol. 35 (2008), pp. 519–28.
31. UNEP, op. cit. note 8; P. M. Strain and B. T. Hargrave, “Salmon Aquaculture, Nutrient Fluxes, and Ecosystem Processes in Southwestern New Brunswick,” in Barry T. Hargrave, ed., *The Handbook of Environmental Chemistry: Environmental Effects of Marine Finfish Aquaculture. Volume 5: Water Pollution* (New York: Springer, 2005); NOAA and Gulf of Mexico Fishery Management Council, *Fishery Management Plan for Regulating Offshore Marine Aquaculture in the Gulf of Mexico* (St. Petersburg and Tampa, FL: 2009).
32. Sarah Simpson, ed., “10 Solutions to Save the Oceans,” *Conservation Magazine*, July–September 2007.

## Chapter 7. Energy as Master Resource

1. Ostwald’s account is quoted in R. J. Deltete, “Wilhelm Ostwald’s Energetics 1: Origins and Motivations,” *Foundations of Chemistry*, January 2007, pp. 33–35.
2. Ibid., p. 33
3. Ibid., p. 34.
4. C. Hakfoort, “Science Deified: Wilhelm Ostwald’s Energeticist World-view and the History of Scientism,” *Annals of Science*, vol. 49, no. 6 (1992), pp. 525–44.
5. Martin J. Klein, “Thermodynamics in Einstein’s Thought,” *Science*, 4 August 1967, pp. 509–16; Donald Worster, *Nature’s Economy*, 2nd ed. (Cambridge, U.K.: Cambridge University Press, 1994), pp. 301–06.

6. Henry Adams, “The Tendency of History,” “A Letter to American Teachers of History,” and “The Rule of Phase Applied to History,” in Brooks Adams, ed., *The Degradation of the Democratic Dogma* (New York: Macmillan, 1919); William Frederick Cottrell, *Energy and Society* (New York: McGraw-Hill, 1955); Lewis Mumford, *The Myth of the Machine II: The Pentagon of Power* (New York: Harcourt Brace Jovanovich, 1970).
7. Daniel C. Foltz, “Does Nature Have Historical Agency? World History, Environmental History, and How Historians Can Help Save the Planet,” *The History Teacher*, November 2003, pp. 9–28; Alfred Crosby, *Children of the Sun: A History of Humanity’s Unappeasable Appetite for Energy* (New York: W. W. Norton & Company, 2006).
8. Lester Thurow and Rober Heilbroner, *The Economic Problem* (New York: Prentice Hall, 1981), pp. 127, 135.
9. Nicholas Georgescu-Roegen, “Energy Analysis and Economic Valuation,” *Southern Economic Journal*, April 1979, p. 1,041.
10. Frederick Soddy, *Wealth, Virtual Wealth, and Debt* (London: George Allen & Unwin, 1926); Frederick Soddy, *Money Versus Man* (New York: E. P. Dutton, 1933); Frederick Soddy, *The Role of Money* (London: Routledge, 1934, 2003); see also Herman Daly, “The Economic Thought of Frederick Soddy,” *History of Political Economy*, winter 1980, pp. 469–88.
11. Eric Zencey, “The Financial Crisis is the Environmental Crisis,” *The Daly News* (Center for the Advancement of the Steady State Economy), 6 January 2011.
12. Frank Knight, “Money,” *Saturday Review of Literature*, 16 April 1927, p. 732; Irving Fisher, *100% Money* (New York: Adelphi Company, 1935).
13. Nicholas Georgescu-Roegen, *The Entropy Law and the Economic Process* (Cambridge, MA: Harvard University Press, 1971); Herman Daly, *Steady State Economics* (New York: W. H. Freeman, 1977).
14. Georgescu-Roegen, op. cit. note 13, p. 18; Joseph Stiglitz, Amartya Sen, and Jean-Paul Fitoussi, Report of the Commission on the Measurement of Economic Performance and Social Progress, at [www.stiglitz-sen-fitoussi.fr/documents/rapport\\_anglais.pdf](http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf).
15. James H. Keeling, *Quaero [Some Questions in Matter, Energy, Intelligence, and Evolution]* (London: Taylor and Francis, 1898), see especially pp. 7–9.
16. John Stuart Mill, “Of the Stationary State,” Chapter VI of Book IV, *Principles of Political Economy* (New York: D. Appleton and Company, 1896); Herman Daly and Joshua Farley, *Ecological Economics: Principles and Applications* (Washington, DC: Island Press, 2011), pp. 6–7.
17. For the first uses of the concept and term, see C. J. Cleveland et al., “Energy and the U.S. Economy: A Biophysical Perspective,” *Science*, 31 August 1984, pp. 890–97, and R. Herendeen and R. L. Plant, “Energy Analysis of Four Geothermal Technologies,” *Energy*, January 1981, pp. 73–82; Georgescu-Roegen, op. cit. note 13, p. 18.
18. C. A. S. Hall and C. J. Cleveland, “Petroleum Drilling and Production in the United States: Yield per Effort and Net Energy Analysis,” *Science*, 6 February 1981, pp. 576–79; Warren Davis, “A Study of the Future Productive Capacity and Probable Reserves of the U.S.,” *Oil and Gas Journal*, 24 February 1958, pp. 105–19; David J. Murphy and Charles A. S. Hall, “Year in Review: EROI or Energy Return on (Energy) Invested,” *Annals: Ecological Economics Review*, February 2010, pp. 102–18.
19. Murphy and Hall, op. cit. note 18.
20. Jessica Lambert et al., *EROI of Global Energy Resources: Preliminary Status and Trends* (London: U.K. Department for International Development, forthcoming), pp. 3–6.
21. Table 7–1 from Richard Heinberg, *Searching for a Miracle: ‘Net Energy’ Limits and the Fate of Industrial Society* (San Francisco and Santa Rosa, CA: International Forum on Globalization and the Post-Carbon Institute, 2009), p. 55.
22. Charles A. S. Hall, Stephen Balogh, and David J. R. Murphy, “What is the Minimum EROI That a Sustainable Society Must Have?” *Energies*, vol. 2, no. 1 (2009), pp. 29, 30.
23. EROI estimates from Ida Kubiszewski and Cutler Cleveland, “Energy Return on Investment (EROI) for Wind Energy,” *Encyclopedia of Earth*, June 2007, revised 10 September 2011, at [www.eoearth.org](http://www.eoearth.org).



24. Tom Murphy, “The Energy Trap,” *Do the Math*, at [physics.ucsd.edu/do-the-math/2011/10/the-energy-trap](http://physics.ucsd.edu/do-the-math/2011/10/the-energy-trap).
25. Ibid.
26. Ibid.
27. Ibid.
28. Figure 7–1 from World Bank Data, at [search.worldbank.org/data?qterm=world%20GDP%20per%20unit%20of%20energy&language=EN](http://search.worldbank.org/data?qterm=world%20GDP%20per%20unit%20of%20energy&language=EN), viewed 10 December 2012.
29. Eric Zencey, “The New Austerity and the EROI Squeeze,” *The Daly News* (Center for the Advancement of the Steady State Economy), 18 July 2011.
30. A. S. Eddington, *The Nature of the Physical World* (New York: MacMillan Company, 1928), pp. 73–75.

## Chapter 8. Renewable Energy’s Natural Resource Impacts

1. U.N. Framework Convention on Climate Change, Cancun Agreements, 10 December 2010, Article 1; U.S. Department of Energy (DOE), Energy Information Administration, *International Energy Statistics*, at [www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm](http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm), viewed 17 July 2012; Intergovernmental Panel on Climate Change (IPCC), *Summary for Policymakers, Fourth Assessment Report* (Geneva: 2007), pp. 8, 16; A. P. Sokolov et al., *Probabilistic Forecast for 21st Century Climate Based on Uncertainties in Emissions (without Policy) and Climate Parameters* (Cambridge, MA: Massachusetts Institute of Technology, Joint Program on the Science and Policy of Global Change, 2009), p. 1; International Energy Agency (IEA), *World Energy Outlook 2011* (Paris: 2011).
2. National Research Council, *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use* (Washington, DC: National Academies Press, 2010), pp. 4–5; U.N. Environment Programme, “Mercury Control from Coal Combustion,” at [www.unep.org/hazardoussubstances](http://www.unep.org/hazardoussubstances); U.S. Environmental Protection Agency (EPA), “Mercury: Health Effects,” [www.epa.gov/hg/effects.htm](http://www.epa.gov/hg/effects.htm); Union of Concerned Scientists, “The Hidden Costs of Fossil Fuels,” 29 October 2002, [www.ucsusa.org/clean\\_energy/our-energy-choices](http://www.ucsusa.org/clean_energy/our-energy-choices).
3. Paul R. Epstein et al., “Full Cost Accounting for the Life Cycle of Coal,” in Robert Costanza, Karin Limburg, and Ida Kubiszewski, eds., “Ecological Economics Reviews,” *Annals of the New York Academy of Sciences*, no. 1219 (2011), pp. 73–98; Worldwatch Institute, *Roadmap to a Sustainable Electricity System: Harnessing Haiti’s Sustainable Energy Resources* (draft) (Washington, DC: forthcoming); Economic Commission for Latin America and the Caribbean, *Centroamerica: Estadísticas de Hidrocarburos* (Santiago, Chile: 2010).
4. DOE, Office of Energy Efficiency and Renewable Energy, “Wind Powering America: Installed Wind Capacity,” November 2012, at [www.windpoweringamerica.gov](http://www.windpoweringamerica.gov); REN21, *Renewables 2012 Global Status Report* (Paris: 2012), p. 101; BP, *BP Statistical Review of World Energy* (London: 2012), p. 108. Box 8–1 based on David L. Chandler, “What Can Make a Dent?” press release (Cambridge, MA: Massachusetts Institute of Technology, 23 October 2011), and on Janet Sawin and William Moomaw, *Renewable Revolution: Low-Carbon Energy by 2030* (Washington, DC: Worldwatch Institute, 2009), p. 18.
5. Table 8–1 from the following: global solar PV, CSP, wind, and small hydro potential and solar PV and wind land needs estimates from M. Jacobson and M. Delucchi, “Providing All Global Energy with Wind, Water, and Solar Power, Part 1: Technologies, Energy Resources, Quantities and Areas of Infrastructure, and Materials,” *Energy Policy*, vol. 39 (2011), pp. 1,159–60; solar PV crystalline material requirements from A. Feltrin and A. Freundlich, “Material Considerations for Terawatt Level Development of Photovoltaics,” *Renewable Energy*, February 2008, p. 182; solar thin-film PV material requirements and solar PV environmental impacts from V. M. Fthenakis, “Sustainability of Photovoltaics: The Case for Thin-Film Solar Cells,” *Renewable and Sustainable Energy Reviews*, December 2009, pp. 2,749–50; CSP land and water requirements from DOE, Office of Energy Efficiency and Renewable Energy, *2010 Solar Technologies Market Report* (Washington, DC: 2011), pp. 54, 77; material requirements for wind from D. R. Wilburn, *Wind Energy in the United States and Materials Required for the Land-Based Wind Turbine Industry from 2010 Through 2030*, Scientific Investigations Report (Washington, DC: U.S. Geological Survey (USGS), 2011), p. 15; small-hydro environmental impacts from T. Abbasi and S. A. Abbasi, “Small Hydro and the Environmental Implications of Its Extensive Utilization,” *Renewable and Sustainable Energy Reviews*, May 2011, pp. 2,139–40; geothermal potential estimate calculated based on data from International Geothermal Association, *Contribution of Geothermal Energy to the Sustainable Development*, Report to the U.N. Commission on Sustainable Development

(Bochum, Germany: 2001); geothermal land needs from DOE, Office of Energy Efficiency and Renewable Energy, “Geothermal Power Plants—Minimizing Land Use and Impact,” at [www1.eere.energy.gov/geothermal](http://www1.eere.energy.gov/geothermal), January 2006; geothermal water needs from C. E. Clark et al., *Water Use in the Development and Operation of Geothermal Power Plants* (Lemont, IL: Argonne National Laboratory, DOE, 2010), p. 1; geothermal environmental impacts from D. Giardini, “Geothermal Quake Risks Must Be Faced,” *Nature*, 17 December 2009, pp. 848–49; wave and tidal information from O. Langhamer et al., “Wave Power—Sustainable Energy or Environmentally Costly?” *Renewable and Sustainable Energy Reviews*, May 2010, pp. 1,330–33; biomass potential estimate calculated based on data from S. Ladanai and J. Vinterbäck, *Global Potential of Sustainable Biomass for Energy* (Uppsala: Swedish University of Agricultural Sciences, Department of Energy and Technology, 2009).

6. International Renewable Energy Agency, *Solar Photovoltaics, Renewable Energy Technologies: Cost Analysis Series, Vol. 1: Power Sector*, Issue 4/5, June 2012, pp. 15, 28; Fthenakis, op. cit. note 5, p. 2,747; O. Edenhofer et al., *Special Report on Renewable Energy Sources and Climate Change* (Geneva: IPCC, 2011), p. 71.

7. Jacobson and Delucchi, op. cit. note 5, p. 1,159.

8. DOE, *2010 Solar Technologies Market Report*, op. cit. note 5, p. 54.

9. Ibid., pp. 54, 77; Jacobson and Delucchi, op. cit. note 5, p. 1,160; IPCC, *Climate Change 2007: Mitigation, Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, U.K.: Cambridge University Press, 2007), Chapter 8; U.N. Food and Agriculture Organization, *The State of the World's Land and Water Resources for Food and Agriculture* (Rome: 2011); David Beillo, “Gigalopolises: Urban Land Area May Triple by 2030,” *Scientific American*, 18 September 2012; Karen C. Seto, Burak Güneralp, and Lucy R. Hutyra, “Global Forecasts of Urban Expansion to 2030 and Direct Impacts on Biodiversity and Carbon Pools,” *Proceedings of the National Academy of Sciences*, 2 October 2012.

10. DOE, *2010 Solar Technologies Market Report*, op. cit. note 5, p. 77; Jacobson and Delucchi, op. cit. note 5, p. 1,160.

11. Alexander Ochs et al., *Implications of a Low-Carbon Energy Transition for U.S. National Security* (Washington, DC: Worldwatch Institute, 2010), p. 6; Feltrin and Freundlich, op. cit. note 5, pp. 182, 184.

12. Fthenakis, op. cit. note 6; Jacobson and Delucchi, op. cit. note 5, p. 1,162.

13. Fthenakis, op. cit. note 6.

14. Ochs et al., op. cit. note 11, p. 7.

15. REN21, op. cit. note 4, p. 22; BP, op. cit. note 4, p. 57.

16. “Onshore Wind Energy to Reach Parity with Fossil-fuel Electricity by 2016,” *Bloomberg New Energy Finance*, 10 November 2011.

17. Jacobson and Delucchi, op. cit. note 5, pp. 1,159–61; Ochs et al., op. cit. note 11, p. 11.

18. Ochs et al., op. cit. note 11, p. 4; Jacobson and Delucchi, op. cit. note 5, p. 1,161; Wilburn, op. cit. note 5, pp. 14–15.

19. Wilburn, op. cit. note 5, p. 15; Gareth P. Hatch, “Going Green: The Growing Role of Permanent Magnets in Renewable Energy Production and Environmental Protection,” presentation to the Magnetics 2008 Conference, May 2008, quoted in Ochs et al., op. cit. note 11, p. 7; Jacobson and Delucchi, op. cit. note 5, p. 1,161.

20. Jacobson and Delucchi, op. cit. note 5, p. 1,162.

21. REN21, op. cit. note 4, p. 22; BP, op. cit. note 4, p. 23; Abbasi and Abbasi, op. cit. note 5, p. 2,136; EPA, “Clean Energy: Hydroelectricity,” 28 December 2007, at [www.epa.gov/cleanenergy/energy-and-you/affect/hydro.html](http://www.epa.gov/cleanenergy/energy-and-you/affect/hydro.html); Jacobson and Delucchi, op. cit. note 5, p. 1,159.

22. Abbasi and Abbasi, op. cit. note 5, pp. 2,139–40.

23. IEA, *Technology Roadmap: Geothermal Heat and Power* (Paris: 2011), p. 6.

24. Edenhofer et al., op. cit. note 6, p. 405; DOE, Office of Energy Efficiency and Renewable Energy, “Geothermal Technologies Program: Electricity Generation,” at [www1.eere.energy.gov/geothermal/powerplants.html](http://www1.eere.energy.gov/geothermal/powerplants.html).

25. REN21, op. cit. note 4, p. 22; BP, op. cit. note 4, p. 40; Nicaraguan Energy Institute, *Generación Bruta por Tipo de Planta, Sistema Eléctrico Nacional, Año 2012*, August 2012.
26. DOE, Office of Energy Efficiency and Renewable Energy, “What is an Enhanced Geothermal System?” September 2012, at [www1.eere.energy.gov/geothermal/pdfs/egs\\_basics.pdf](http://www1.eere.energy.gov/geothermal/pdfs/egs_basics.pdf); “A Googol of Heat Beneath Our Feet,” Google.org, 2011; Giardini, op. cit. note 5.
27. Clark et al., op. cit. note 5, pp. 1–2.
28. Bruce D. Green and R. Gerald Nix, *Geothermal—The Energy Under Our Feet* (Golden, CO: National Renewable Energy Laboratory, 2006).
29. Jacobson and Delucchi, op. cit. note 5, p. 1,157; Carbon Trust, “Accelerating Marine Energy,” July 2011, at [www.carbontrust.com/media](http://www.carbontrust.com/media), pp. 13–14.
30. Jacobson and Delucchi, op. cit. note 5, p. 1,159; Langhamer et al., op. cit. note 5, p. 1,330.
31. Langhamer et al., op. cit. note 5, pp. 1,331–33.
32. M. F. Demirbas et al., “Potential Contribution of Biomass to the Sustainable Energy Development,” *Energy Conservation and Management*, July 2009, pp. 1,746–60; A. Evans et al., “Sustainability Considerations for Electricity Generation from Biomass,” *Renewable and Sustainable Energy Reviews*, June 2010, p. 1,422.
33. V. Dornburg et al., “Bioenergy Revisited: Key Factors in Global Potentials of Bioenergy,” *Energy and Environmental Science*, issue 3 (2010), pp. 258–67.
34. Table 8–2 based on the following: technology status for all technologies from IEA and International Renewable Energy Agency, “Electricity Storage Technology Brief,” Paris, April 2012; lead acid battery material needs and environmental impacts from EPA, “Common Wastes & Materials: Batteries,” at [www.epa.gov/osw/conserve/materials](http://www.epa.gov/osw/conserve/materials); nickel-cadmium battery material needs and environmental impacts from European Parliament and Council Directive on Batteries and Accumulators and Waste Batteries and Accumulators, Brussels, 6 September 2006; lithium ion battery material needs from P. Gruber et al., “Global Lithium Availability,” *Journal of Industrial Ecology*, October 2011; molten salt thermal storage and high voltage direct current transmission line material needs from A. Garcia-Olivares et al., “A Global Renewable Energy Mix with Proven Technologies and Common Materials,” *Energy Policy*, February 2012, p. 566; hydrogen environmental impacts from DOE, *Energy Demands on Water Resources* (Washington DC: 2006), p. 61; high-voltage direct current transmission line and high-temperature superconducting cable environmental impacts from P. Bujis et al., “Transmission Investment Problems in Europe: Going beyond Standard Solutions,” *Energy Policy*, March 2011, p. 5; high-temperature superconducting cable material needs from USGS, *Mineral Commodity Summaries 2012* (Washington, DC: 2012), p. 185.
35. IEA and International Renewable Energy Agency, op. cit. note 34, p. 4.
36. EPA, op. cit. note 34; European Parliament, op. cit. note 34.
37. IEA and International Renewable Energy Agency, op. cit. note 34, p. 15; Garcia-Olivares et al., op. cit. note 34, p. 567; USGS, *Mineral Commodity Summaries 2009* (Washington, DC: 2009), p. 95; USGS, op. cit. note 34, p. 95; Gruber et al., op. cit. note 34.
38. IEA and International Renewable Energy Agency, op. cit. note 34, p. 15.
39. Ibid.
40. David Biello, “How to Use Solar Energy at Night,” *Scientific American*, 18 February 2009.
41. Garcia-Olivares et al., op. cit. note 34, p. 565.
42. DOE, Office of Energy Efficiency and Renewable Energy, “Hydrogen Storage,” January 2011, at [www1.eere.energy.gov/hydrogenandfuelcells/pdfs/fct\\_h2\\_storage.pdf](http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/fct_h2_storage.pdf).
43. DOE, op. cit. note 34, p. 61.
44. Bujis et al., op. cit. note 34, p. 5.
45. Garcia-Olivares et al., op. cit. note 34, p. 566.

46. Ochs et al., op. cit. note 11, p. 12; USGS, op. cit. note 34, p. 185.
47. Box 8–2 based on the following: U.S. Department of the Interior, Bureau of Land Management, “Programmatic EIS for Geothermal Resources: Frequently Asked Questions,” at [www.blm.gov/wo/st/en/prog/energy/geothermal/geothermal\\_nationwide.html](http://www.blm.gov/wo/st/en/prog/energy/geothermal/geothermal_nationwide.html); Doug Boucher et al., *The Root of the Problem: What’s Driving Tropical Deforestation Today?* (Cambridge, MA: Union of Concerned Scientists, 2011), p. 51; World Commission on Dams, *Dams and Development: A New Framework for Decision-Making* (London: Earthscan, 2000), p. 102.
48. United Nations, International Decade for Action 2005–2015, “Water for Life,” at [www.un.org/waterforlifedecade/scarcity.shtml](http://www.un.org/waterforlifedecade/scarcity.shtml).
49. “Situation and Policies of China’s Rare Earth Industry,” *Xinhua News*, 20 June 2012.

## Chapter 9. Conserving Nonrenewable Resources

1. Elisa Alonso et al., “Evaluating Rare Earth Element Availability: A Case with Revolutionary Demand from Clean Technologies,” *Environmental Science and Technology*, vol. 46, no. 6 (2012), pp. 3,406–14; “China Cuts Rare-Earths Mine Permits 41% to Boost Control,” *Bloomberg News*, 14 September 2012.
2. I am indebted to Christopher Clugston for this framing and for the analytical framework in his book *Scarcity*, which informed the structure of this chapter; D. Giurco et al., *Peak Minerals in Australia: A Review of Changing Impacts and Benefits* (Broadway, Australia: Institute for Sustainable Futures, 2010).
3. Elisabeth Rosenthal, “Race is On as Ice Melt Reveals Arctic Treasures,” *New York Times*, 18 September 2012.
4. Share in United States from Lorie A. Wagner, Daniel E. Sullivan, and John L. Sznopce, *Economic Drivers of Mineral Supply*, Open-File Report 02-335 (Reston, VA: U.S. Geological Survey (USGS), 2002); share in China from Heming Wang et al., “Resource Use in Growing China: Past Trends, Influence Factors, and Future Demand,” *Journal of Industrial Ecology*, August 2012, pp. 481–92.
5. Figure 9–1 from Thomas D. Kelly and Grecia R. Matos, *Historical Statistics for Mineral and Material Commodities in the United States*, Data Series 140 (Reston, VA: USGS, 2011). The Figure covers data for 85 metals and other nonrenewable materials.
6. Yuval Atsom et al., “Winning the \$30 Trillion Decathlon: Going for Gold in Emerging Markets,” *McKinsey Quarterly*, August 2012, p. 4.
7. U.N. Environment Programme (UNEP), *Recycling Rates of Metals: A Status Report* (Paris: 2011).
8. Worldwatch calculation based on data in Kelly and Matos, op. cit. note 5; Richard Dobbs, Jeremy Oppenheim, and Fraser Thompson, “Mobilizing for a Resource Revolution,” *McKinsey Quarterly*, January 2012.
9. Jeremy Grantham, “Time to Wake Up: Days of Abundant Resources and Falling Prices Are Over Forever,” *GMO Quarterly Letter*, April 2011.
10. Ibid.; Richard Dobbs, Jeremy Oppenheim, and Fraser Thompson, “A New Era for Commodities,” *McKinsey Quarterly*, November 2011; Suwin Sandu and Arif Syed, *Trends in Energy Intensity in Australian Industry* (Canberra: Australian Bureau of Agricultural and Resource Economics, 2008).
11. Figure 9–2 from Gavin M. Mudd, e-mail to author, 11 September 2012; Canada and Russia from Gavin M. Mudd, “Global Trends and Environmental Issues in Nickel Mining: Sulfides versus Laterites,” *Ore Geology Reviews*, October 2010, pp. 9–26; Gavin M. Mudd, “The Environmental Sustainability of Mining in Australia: Key Megatrends and Looming Constraints,” *Resources Policy*, June 2010, pp. 106–07; Gavin M. Mudd, e-mail to author, 7 October 2012; quote is from Mudd, “Environmental Sustainability of Mining,” op. cit. this note, p. 107.
12. Table 9–1 from Gavin Mudd, “Sustainability Reporting and Water Resources: A Preliminary Assessment of Embodied Water and Sustainable Mining,” *Australian Journal of Mining*, August 2009.
13. Mudd, “Environmental Sustainability of Mining,” op. cit. note 11, pp. 113–14.
14. Gavin M. Mudd, “Uranium,” in Trevor M. Letcher and Janet L. Scott, *Materials for a Sustainable Future* (London: Royal Society of Chemistry, 2012), pp. 201–03; Mudd, “Environmental Sustainability of Mining,” op. cit. note 11, p. 110.



15. Andre Dierderren, *Global Resource Depletion: Managed Austerity and the Elements of Hope* (Delft: Eburon Academic Publishers, 2010), p. 53.
16. Sandu and Syed, op. cit. note 10.
17. Gavin M. Mudd, Zhehan Weng, and Simon M. Jowitt, “A Detailed Assessment of Global Cu Resource Trends and Endowments,” *Economic Geology*, forthcoming.
18. Cutler J. Cleveland, “Net Energy from Extraction of Oil and Gas in the United States,” *Energy*, April 2005.
19. Carey W. King and Charles A. S. Hall, “Relating Financial and Energy Return on Investment,” *Sustainability*, vol. 3, no. 10 (2011), pp. 1,810–32.
20. Dobbs, Oppenheim, and Thompson, op. cit. note 8.
21. Ernst von Weizsäcker, *Factor Five: Transforming the Global Economy Through 80% Improvements in Resource Productivity* (London: Earthscan, 2009).
22. Figure of \$600 million is a 2009 estimate from Global Subsidies Initiative, at [www.iisd.org/gsi/fossil-fuel-subsidies/fossil-fuels-what-cost](http://www.iisd.org/gsi/fossil-fuel-subsidies/fossil-fuels-what-cost); \$775 billion to \$1 trillion from Alexander Ochs, Eric Anderson, and Reese Rogers, “Fossil Fuel and Renewable Energy Subsidies on the Rise,” *Vital Signs Online*, 21 August 2012; European Commission, *Roadmap to a Resource Efficient Europe* (Brussels: 2011); Kerryn Lang, *The First Year of the G-20 Commitment on Fossil-Fuel Subsidies: A Commentary on Lessons Learned and the Path Forward* (Geneva: Global Studies Initiative, International Institute for Sustainable Development, 2011).
23. Box 9–2 from the following: USGS, “Metal Stocks in Use in the United States,” Fact Sheet 2050-3090 (Reston, VA: July 2005); Ben Schiller, “Trash to Cash: Mining Landfills for Energy and Profit,” *Fast Company*, 7 September 2011; Group Machiels, “Enhanced Landfill Mining,” at [www.machiels.com](http://www.machiels.com), viewed 23 September 2012.
24. European Commission, op. cit. note 22; UNEP, *Green Jobs: Towards Decent Work in a Sustainable, Low-carbon World* (Nairobi: 2008).
25. Office of the Mayor, “Mayor Lee Celebrates San Francisco’s Composting Achievements,” press release (San Francisco: 28 March 2012); United States from U.S. Environmental Protection Agency (EPA), *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010* (Washington, DC: 2011); Barbara K. Reck and T. E. Graedel, “Challenges in Metal Recycling,” *Science*, 10 August 2012.
26. Table 9–2 from the following: Elliot Martin, Susan A. Shaheen, and Jeffrey Lidi, “Impact of Carsharing on Household Vehicle Holdings: Results from North American Shared-Use Vehicle Survey,” *Transportation Research Record*, March 2010; John A. Mathews and Hao Tan, “Progress Toward a Circular Economy in China: The Drivers (and Inhibitors) of Eco-industrial Initiative,” *Journal of Industrial Ecology*, June 2011, pp. 435–57; U.S. Department of Energy and EPA, *Combined Heat and Power: A Clean Energy Solution* (Washington, DC: August 2012); Eric S. Belsky, “Planning for Inclusive and Sustainable Urban Development,” in Worldwatch Institute, *State of the World 2012* (Washington, DC: Island Press, 2012), p. 45; “Neighborhood Tool Libraries in Portland Oregon,” at [www.neighborhoodnotes.com](http://www.neighborhoodnotes.com), viewed 23 September 2012; Osamu Kimura, *Japanese Top Runner Approach for Energy Efficiency Standards* (Tokyo: Socio-economic Research Center, Central Research Institute of Electric Power Industry, 2010).
27. Jeremy Grantham, “Welcome to Dystopia! Entering a Long-term and Politically Dangerous Food Crisis,” *GMO Quarterly Letter*, July 2012.

## Chapter 10. Reengineering Cultures to Create a Sustainable Civilization

1. Erik Assadourian, “The Rise and Fall of Consumer Cultures,” in Worldwatch Institute, *State of the World 2010* (New York: W. W. Norton & Company, 2010), pp. 3–20.
2. Population Division, *World Population Prospects: The 2010 Revision* (New York: United Nations, 2011).
3. Monika Dittrich et al., *Green Economies Around the World?* (Vienna: Sustainable Europe Research Institute, 2012); WWF et al., *Living Planet Report 2012* (Gland, Switzerland: WWF, 2012).
4. Dittrich et al., op. cit. note 3.

5. Overweight Americans from Trust for America's Health, *Fas in Fat: How Obesity Policies Are Failing in America* (Washington, DC: Robert Wood Johnson Foundation, 2008); medical and productivity costs from Society of Actuaries, "New Society of Actuaries Study Estimates \$300 Billion Economic Cost Due to Overweight and Obesity," press release (Schaumburg, IL: 10 January 2011); Institute for Health Metrics and Evaluation, "Life Expectancy in Most US Counties Falls Behind World's Healthiest Nations," press release (Seattle, WA: 15 June 2011); David Brown, "Life Expectancy in the U.S. Varies Widely by Region, in Some Places Is Decreasing," *Washington Post*, 15 June 2011; S. Jay Olshansky et al., "A Potential Decline in Life Expectancy in the United States in the 21st Century," *New England Journal of Medicine*, 17 March 2005, pp. 1,138–45.
6. Global obesity from Richard Weil, "Levels of Overweight on the Rise," *Vital Signs Online*, 14 June 2011; Sarah Catherine Walpole et al., "The Weight of Nations: An Estimation of Adult Human Biomass," *BMC Public Health*, vol. 12 (2012), pp. 439–45; other ills from Erik Assadourian, "The Path to Degrowth in Overdeveloped Countries," in Worldwatch Institute, *State of the World 2012* (Washington, DC: Island Press, 2012), pp. 22–37.
7. Millennium Ecosystem Assessment, *Ecosystems and Human Well-being: Synthesis* (Washington, DC: Island Press, 2005); WWF et al., op. cit. note 3.
8. Assadourian, op. cit. note 1, pp. 11–16.
9. Ibid., p. 9.
10. Advertising from Jonathan Barnard, "ZenithOptimedia Releases September 2012 Advertising Expenditure Forecasts," press release (London: ZenithOptimedia, 1 October 2012); other expenditures from Assadourian, op. cit. note 1, pp. 13–14; new consumers from McKinsey Global Institute, *Urban World: Cities and the Rise of the Consuming Class* (McKinsey & Company, June 2012).
11. Kevin Anderson and Alice Bows, "Beyond 'Dangerous' Climate Change: Emission Scenarios for a New World," *Philosophical Transactions of the Royal Society A*, January 2011, pp. 20–44; Potsdam Institute for Climate Impact Research and Climate Analytics, *Turn Down the Heat: Why a 4°C Warmer World Must Be Avoided* (Washington, DC: World Bank, 2012); Mark G. New et al., "Four Degrees and Beyond: The Potential for a Global Temperature Increase of Four Degrees and Its Implications," *Philosophical Transactions of the Royal Society A*, January 2011, pp. 6–19; Joe Romm, "Royal Society Special Issue Details 'Hellish Vision' of 7°F (4°C) World—Which We May Face in the 2060s!" *Climate Progress*, 29 November 2010.
12. DARA International, *Climate Vulnerability Monitor: A Guide to the Cold Calculus of a Hot Planet*, 2nd ed. (Washington, DC: 2012). Box 10–1 from the following: Roland Stulz and Tanja Lütolf, "What Would Be the Realities of Implementing the 2,000 Watt Society in Our Communities?" presentation, Novatlantis, 23–24 November 2006; Saul Griffith, "Climate Change Recalculated," presentation at The Long Now Foundation, San Francisco, 16 January 2009; Danielle Nierenberg and Laura Reynolds, "Disease and Drought Curb Meat Production and Consumption," *Vital Signs Online*, 23 October 2012; Assadourian, op. cit. note 1; Juliet Schor, *Plenitude: The New Economics of True Wealth* (New York: Penguin Press, 2010).
13. Peter N. Stearns, *Consumerism in World History: The Global Transformation of Desire* (New York: Routledge, 2001), pp. 34–35; "Not Such a Bright Idea: Making Lighting More Efficient Could Increase Energy Use, Not Decrease It," *The Economist*, 26 August 2010; Lizabeth Cohen, *A Consumer's Republic: The Politics of Mass Consumption in Postwar America* (New York: Alfred A. Knopf, 2003).
14. Peter D. Norton, *Fighting Traffic: The Dawn of the Motor Age in the American City* (Cambridge, MA: The MIT Press, 2008); Peter Dauvergne, *The Shadows of Consumption: Consequences for the Global Environment* (Cambridge, MA: The MIT Press, 2008); automobile advertising from Stephen Williams, "Report Predicts Auto-Ad Spending Will Grow 14% This Year," *Advertising Age*, 30 April 2012; Michael Renner, "Auto Production Roars to New Records," *Vital Signs Online*, 11 September 2012.
15. McDonald's, "Company Profile," at [www.aboutmcdonalds.com/mcd/investors/company\\_profile.html](http://www.aboutmcdonalds.com/mcd/investors/company_profile.html); Eric Schlosser, *Fast Food Nation* (New York: Harper Perennial Company, 2005), pp. 197–98.
16. Schlosser, op. cit. note 15; advertising from Keith O'Brien, "How McDonald's Came Back Bigger Than Ever," *New York Times*, 6 May 2012.
17. Lydia Polgreen, "Matchmaking in India: Canine Division," *New York Times*, 17 August 2009; David Lummis,

Packaged Facts Pet Analyst, *U.S. Pet Market Outlook 2009–2010: Surviving and Thriving in Challenging Times*, PowerPoint presentation; Packaged Facts, *Pet Supplies in the U.S.*, 7th ed. (Rockville, MD: August 2007), pp. 141–43.

18. Pet food from Transparency Market Research, “Global Pet Food Market is Forecasted to Reach USD 74.8 Billion by 2017,” press release (Albany, NY: 10 August 2012); supplies and vet care from American Pet Products Association, “Industry Statistics & Trends,” at [www.americanpetproducts.org/press\\_industrytrends.asp](http://www.americanpetproducts.org/press_industrytrends.asp), viewed 18 November 2012, and from William Grimes, “New Treatments to Save a Pet, but Questions About the Costs,” *New York Times*, 5 April 2012; Packaged Facts, “Cat Litter a Nearly \$2 Billion Market in the U.S.,” *Pets International*, Issue 4/2010; total populations and impacts from Robert Vale and Brenda Vale, *Time to Eat the Dog: The Real Guide to Sustainable Living* (London: Thames & Hudson, 2009), pp. 235–38.

19. David W. Chen, “Shanghai Journal; A New Policy of Containment, for Baby Bottoms,” *New York Times*, 5 August 2003; William Foreman, “Pork-flavored Doughnuts? A Chinese Market Beckons,” *Associated Press*, 13 February 2010; calculation based on Barnard, op. cit. note 10; Assadourian, op. cit. note 1.

20. Assadourian, op. cit. note 1.

21. Adam Aston, “Patagonia Takes Fashion Week as a Time to Say: ‘Buy Less, Buy Used,’” *GreenBiz*, 8 September 2011; Tim Nudd, “Ad of the Day: Patagonia,” *Ad Week*, 28 November 2011.

22. Johanna Mair and Kate Ganly, “Social Entrepreneurs: Innovating Toward Sustainability,” in Worldwatch Institute, op. cit. note 1, pp. 103–09.

23. Number of B Corporations from B Corps website, at [www.bcorporation.net](http://www.bcorporation.net), viewed 10 November 2012; Colleen Cordes, “The Earth-Friendly Corporation: Campaigning Opportunities and Caveats for the Environmental Community,” White Paper, September 2012, unpublished; \$4.2 billion from Heather Carpenter, “A Scoop of Social Responsibility: Ben and Jerry’s the B Corp,” *Nonprofit Quarterly*, 29 October 2012.

24. George Lerner, “New York Health Board Approves Ban on Large Sodas,” *CNN*, 14 September 2012; Neal Riley, “Expanded Plastic Bag Ban Takes Effect Monday,” *SFGate*, 29 September 2012; Michael Maniates, “Editing Out Unsustainable Behavior,” in Worldwatch Institute, op. cit. note 1, pp. 119–26; Erik Assadourian, “The Mallport and the Bibliometro” (blog), *Transforming Cultures*, 30 March 2010. Box 10–2 based on the following: Michael Grynbaum, “In Soda Fight, Industry Focuses on the Long Run,” *New York Times*, 12 September 2012; Larry Gordon, “All You Can Carry: College Cafeterias Go Trayless,” *Los Angeles Times*, 14 September 2009; Nate Berg, “The Math Behind Sacking Disposable Bags,” *Atlantic Cities Place Matters*, 26 September 2011; “Albert Lea, MN—Blue Zones Pilot Project,” Blue Zones website, at [www.bluezones.com](http://www.bluezones.com); Nancy Perry Graham, “Creating America’s Healthiest Hometown,” *AARP The Magazine*, September/October 2012.

25. Cormac Cullinan, “Earth Jurisprudence: From Colonization to Participation,” in Worldwatch Institute, op. cit. note 1, pp. 143–48; Geoff Olson, “Bolivia’s Law of Mother Earth,” *Common Ground*, July 2011.

26. Ecovillages from Erik Assadourian, “Engaging Communities for a Sustainable World,” in Worldwatch Institute, *State of the World 2008* (New York: W. W. Norton & Company, 2008), p. 154; transition towns from Assadourian, op. cit. note 6, p. 34.

27. Trine S. Jensen et al., *From Consumer Kids to Sustainable Childhood* (Copenhagen: Worldwatch Institute Europe, 2012), p. 53; Rome from Kevin Morgan and Roberta Sonnino, “Rethinking School Food: The Power of the Public Plate,” in Worldwatch Institute, op. cit. note 1, pp. 69–74.

28. Gary Gardner, “Engaging Religions to Shape Worldviews,” in Worldwatch Institute, op. cit. note 1, pp. 23–29; Gary Gardner, “Ritual and Taboo as Ecological Guardians,” in Worldwatch Institute, op. cit. note 1, pp. 30–35; *shemitah* from Nina Beth Cardin, Baltimore Jewish Environmental Network, discussion with author, 16 October 2012.

29. Embalming fluid and concrete from Dave Reay, *Climate Change Begins at Home* (London: Macmillan, 2005), p. 147; steel, wood, and cost from Mark Harris, *Grave Matters: A Journey through the Modern Funeral Industry to a Natural Way of Burial* (New York: Scribner, 2007), pp. 10, 34; green burial from Joe Sehee, The Green Burial Council, presentation, 2010.

30. “Avatar,” and “Memorable Quotes for Avatar,” *IMDb.com*; “Crude,” *IMDb.com*.

31. Bhopal from “Yes Men Hoax on BBC Reminds World of Dow Chemical’s Refusal to Take Responsibility for Bhopal Disaster,” *Democracy Now*, 6 December 2004; Andy Bichlbaum, “Chevron Ad Campaign Derailed” (blog), *The Yes Men*, 19 October 2010; “Chevron’s \$80 Million Ad Campaign Gets Flushed” (blog), *The Yes Men*, 19 October 2010.

32. Box 10–3 from Wolfgang Sachs, ed., *The Development Dictionary* (London: Zed Books, 2010).

33. Tompkins and Chouinard quotes from *180° South*, Magnolia Pictures, 2010.

## Chapter 11. Building a Sustainable and Desirable Economy-in-Society-in-Nature

1. This chapter is adapted from a report commissioned by the United Nations for the 2012 Rio+20 Conference as part of the Sustainable Development in the 21st century project; see R. Costanza et al., *Building a Sustainable and Desirable Economy-in-Society-in-Nature* (New York: United Nations Division for Sustainable Development, 2012). Table 11–1 from R. Costanza et al., “The Value of the World’s Ecosystem Services and Natural Capital,” *Nature*, 15 May 1997, pp. 253–60

2. New research from T. Kasser, *The High Price of Materialism* (Cambridge, MA: The MIT Press, 2002).

3. R. A. Easterlin, “Explaining Happiness,” *Proceedings of the National Academy of Sciences*, 16 September 2003, pp. 11,176–83; R. Layard, *Happiness: Lessons from a New Science* (New York: Penguin Press, 2005).

4. Costanza et al., “Value of the World’s Ecosystem Services and Natural Capital,” op. cit. note 1; R. Costanza, *Ecological Economics: The Science and Management of Sustainability* (New York: Columbia University Press, 1991); H. E. Daly and J. Farley, *Ecological Economics: Principles and Applications* (Washington, DC: Island Press, 2004).

5. Easterlin, op. cit. note 3; Layard, op. cit. note 3.

6. Figure 11–1 from R. Hernández-Murillo and C. J. Martinek, “The Dismal Science Tackles Happiness Data,” *The Regional Economist*, January 2010, pp. 14–15.

7. R. Costanza et al., *Beyond GDP: The Need for New Measures of Progress* (Boston, MA: The Pardee Papers, 2009); P. A. Lawn, “A Theoretical Foundation to Support the Index of Sustainable Economic Welfare (ISEW), Genuine Progress Indicator (GPI), and Other Related Indexes,” *Ecological Economics*, February 2003, pp. 105–18.

8. Figure 11–2 from J. Talberth, C. Cobb, and N. Slattery, *The Genuine Progress Indicator 2006: A Tool for Sustainable Development* (Oakland, CA: Redefining Progress, 2007).

9. K. Raworth, *A Safe and Just Space for Humanity: Can We Live within the Doughnut?* (Oxford: Oxfam International, 2012).

10. Costanza et al., *Building a Sustainable and Desirable Economy-in-Society-in-Nature*, op. cit. note 1; Great Transition initiative, at [www.gtinitiative.org](http://www.gtinitiative.org); The Future We Want, at [www.futurewewant.org](http://www.futurewewant.org).

11. R. Costanza et al., “Principles for Sustainable Governance of the Oceans,” *Science*, 10 July 1998, pp. 198–99.

12. R. Beddoe et al., “Overcoming Systemic Roadblocks to Sustainability: The Evolutionary Redesign of Worldviews, Institutions, and Technologies,” *Proceedings of the National Academy of Sciences*, 24 February 2009, pp. 2,483–89.

13. R. Costanza, W. J. Mitsch, and J. W. Day, Jr., “A New Vision for New Orleans and the Mississippi Delta: Applying Ecological Economics and Ecological Engineering,” *Frontiers in Ecology and the Environment*, November 2006, pp. 465–72; Intergovernmental Panel on Climate Change, *Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, U.K.: Cambridge University Press, 2007).

14. J. B. Schor, “Sustainable Consumption and Worktime Reduction,” *Journal of Industrial Ecology*, January 2005, pp. 37–50; A. Durning, *How Much Is Enough?* (New York: W. W. Norton & Company, 1992); T. Jackson, *Prosperity without Growth: Economics for a Finite Planet* (London: Earthscan/James & James, 2009).

15. D. Acemoglu and J. Robinson, “Foundations of Societal Inequality,” *Science*, 30 October 2009, pp. 678–79; Jackson, op. cit. note 14.

16. H. E. Daly, “From a Failed-Growth Economy to a Steady-State Economy,” *Solutions*, February 2010, pp. 37–43.



17. Ibid.; studies on giving up personal gain from I. Almås et al., “Fairness and the Development of Inequality Acceptance,” *Science*, 28 May 2010, pp. 1,176–78, and from E. Fehr and A. Falk, “Psychological Foundations of Incentives,” *European Economic Review*, vol. 46 (2002), pp. 687–724; Jackson, op. cit. note 14.
18. G. Hardin, “The Tragedy of the Commons,” *Science*, 13 December 1968, pp. 1,243–48; E. Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge, U.K.: Cambridge University Press, 1990); D. Pell, in F. Berkes, ed., *Common Property Resources: Ecology and Community-Based Sustainable Development* (London: Belhaven Press, 1989); D. Feeny et al., “The Tragedy of the Commons: Twenty-two Years Later,” *Human Ecology*, vol. 18, no. 1 (1990), pp. 1–19.
19. J. Farley and R. Costanza, “Envisioning Shared Goals for Humanity: A Detailed, Shared Vision of a Sustainable and Desirable USA in 2100,” *Ecological Economics*, vol. 43, no. 2–3 (2002), pp. 245–59; T. Prugh, R. Costanza, and H. E. Daly, *The Local Politics of Global Sustainability* (Washington, DC: Island Press, 2000).
20. Box 11–1 is adapted from James Gustave Speth, *America the Possible: Manifesto for a New Economy* (New Haven, CT: Yale University Press, 2012) and is based on the following: banks’ control of deposits and assets from David Korten, *How to Liberate America from Wall Street Rule* (Washington, DC: New Economy Working Group, July 2011); Thomas H. Greco, Jr., *The End of Money and the Future of Civilization* (White River Junction, VT: Chelsea Green, 2009), p. 35; Mary Mellor, “Could the Money System Be the Basis of a Sufficiency Economy?” *Real World Economics Review*, no. 54 (2010), p. 79; Otto Scharmer, “Seven Acupuncture Points for Shifting Capitalism to Create a Regenerative Ecosystem Economy,” Roundtable on Transforming Capitalism to Create a Regenerative Economy, MIT, Cambridge, MA, 8–9 June and 21 September 2009, p. 19; Herman E. Daly, “Moving from a Failed Growth Economy to a Steady State Economy,” unpublished manuscript, forthcoming in volume from Palgrave Publishers; Daly, op. cit. note 16, p. 37.
21. Total debt from “Z.1 Statistical Release,” Board of Governors of the Federal Reserve System, at [www.federalreserve.gov/datadownload/Download.aspx?rel=Z1&series=654245a7abac051cc4a9060c911e1fa4&filetype=csv&lab el=include&layout=seriescolumn&from=01/01/1945&to=12/31/2010](http://www.federalreserve.gov/datadownload/Download.aspx?rel=Z1&series=654245a7abac051cc4a9060c911e1fa4&filetype=csv&lab el=include&layout=seriescolumn&from=01/01/1945&to=12/31/2010).
22. Daly, op. cit. note 16; H. E. Daly, *Ecological Economics and Sustainable Development, Selected Essays of Herman Daly* (Northampton, MA: Edward Elgar Publishing, 2008).
23. M. Gaffney, “The Hidden Taxable Capacity of Land: Enough and to Spare,” *International Journal of Social Economics*, vol. 36, no. 4 (2009), pp. 328–411.
24. Figure 11–3 from R. G. Wilkinson and K. Pickett, *The Spirit Level: Why Greater Equality Makes Societies Stronger* (New York: Bloomsbury Press, 2009); data for Figure 11–4 from Organisation for Economic Co-operation and Development and from Wilkinson and Pickett, op. cit. this note; Paulson from M. Goldstein, “Paulson, at \$4.9 Billion, Tops Hedge Fund Earner List,” *Reuters*, 1 April 2011.
25. Jackson, op. cit. note 14.
26. R. Costanza et al., “Sustainability or Collapse: What Can We Learn from Integrating the History of Humans and the Rest of Nature?” *Ambio*, November 2007, pp. 522–27; J. Diamond, *Guns, Germs, and Steel: The Fates of Human Societies* (New York: W. W. Norton & Company, 2005); H. Weiss and R. S. Bradley, “What Drives Societal Collapse?” *Science*, 26 January 2001, pp. 609–10.
27. See, for example, C. Rolfsdottir-Jansson, “Malmo, Sweden,” *Solutions*, January 2010, pp. 65–68, and S. M. Kristinsdottir, “Energy Solutions in Iceland,” *Solutions*, May 2010, pp. 52–55.
28. D. H. Meadows et al., *The Limits to Growth* (New York: Universe Books, 1972); R. Boumans et al., “Modeling the Dynamics of the Integrated Earth System and the Value of Global Ecosystem Services Using the GUMBO Model,” *Ecological Economics*, June 2002, pp. 529–60.
29. P. A. Victor and G. Rosenbluth, “Managing without Growth,” *Ecological Economics*, March 2007, pp. 492–504; P. A. Victor, *Managing without Growth: Slower by Design, Not Disaster* (Northampton, MA: Edward Elgar Publishing, 2008).
30. Figure 11–5 from Victor, op. cit. note 29.

## Chapter 12. Transforming the Corporation into a Driver of Sustainability

1. Johan Rockström et al., “Planetary Boundaries: Exploring the Safe Operating Space for Humanity,” *Ecology and Society*, vol. 14, no. 2 (2009).
2. Private sector as percent of global gross domestic product based on 2010 global data, per IHS, “Country & Industry Forecasting: IHS Global Insight,” at [www.ihs.com/products/global-insight/index.aspx](http://www.ihs.com/products/global-insight/index.aspx); Messaoud Ham-mouya, *Statistics on Public Sector Employment: Methodology, Structures, and Trends* (Geneva: Bureau of Statistics, International Labour Office, 1999).
3. For corporate externalities, see Principles for Responsible Investment (PRI) and U.N. Environment Programme (UNEP) Finance Initiative, *Universal Ownership: Why Environmental Externalities Matter to Institutional Investors* (London and Geneva: 2010).
4. Subsidies for fossil-fuel use include \$550 billion in price subsidies and \$100 billion in production subsidies, as reported in UNEP, *Towards a Green Economy* (Nairobi: 2011); see also International Energy Agency (IEA), “Analysis of the Scope of Energy Subsidies and Suggestions for the G-20 Initiative,” Paris, 16 June 2010. The World Bank estimated subsidies for agriculture at around \$273 billion; World Bank, *World Development Report 2008: Agriculture for Development* (Washington, DC: 2007). Subsidies for open-access pelagic fisheries are also significant.
5. World Bank, *World Development Indicators* and *Global Development Finance*, database, at [data.worldbank.org](http://data.worldbank.org); IEA, *2011 Key World Energy Statistics* (Paris: 2011).
6. “Mankind Using Earth’s Resources Faster than Replenished,” (London) *The Independent*, 25 November 2009.
7. Pavan Sukhdev, *Corporation 2020: Transforming Business for Tomorrow’s World* (Washington, DC: Island Press, 2012), Chapter 7.
8. Romesh Sobti, chief executive office, IndusInd Bank Limited, interviewed by Pavan Sukhdev and Rafael Torres, 2011.
9. Donald DePamphilis, *Mergers, Acquisitions, and Other Restructuring Activities: An Integrated Approach to Process, Tools, Cases, and Solutions*, 5th ed. (Waltham, MA: Academic Press, 2009), Chapter 13.
10. Estimates of global advertising turnover differ among company reports. This estimate is from the Center for Media Research, *2012 Ad Spending Outlook* (New York: 2011).
11. See The Bubble Project, at [www.thebubbleproject.com](http://www.thebubbleproject.com).
12. David Evan Harris, “São Paulo: A City without Ads,” *Adbusters*, 3 August 2007; Guanaes quote from Vincent Bevins, “São Paulo Advertising Goes Underground,” *Financial Times*, 6 September 2010.
13. Bob Garfield, *The Chaos Scenario* (Nashville, TN: Stielstra Publishing, 2009).
14. PRI and UNEP Finance Initiative, op. cit. note 3.
15. Matt Barney and Infosys Technologies Ltd., *Leadership @ Infosys* (New Delhi: Portfolio, 2010); see also Infosys, “Smt. Sonia Gandhi Inaugurates Infosys’ Global Education Center–II in Mysore,” press release (Mysore, India: 15 September 2009); human capital externality calculation done by Infosys and GIST Advisory, cited in “Human Resource Valuation,” in Infosys, *Infosys Annual Report 2011–12* (2012).
16. TEEB for Business Coalition, “Natural Capital at Risk: A Study of the Top 100 Business Impacts,” care of Institute of Chartered Accountants in England and Wales, June 2012.

## Chapter 13. Corporate Reporting and Externalities

1. Sarah Anderson and John Cavanagh, *Top 200: The Rise of Corporate Global Power* (Washington, DC: Institute for Policy Studies, 2000), p. 1; Luca Errico and Alexander Massara, *Assessing Systemic Trade Interconnectedness—An Empirical Approach* (Washington, DC: International Monetary Fund, 2001), p. 8; The Prince’s Accounting for Sustainability Project, at [www.accountingforsustainability.org](http://www.accountingforsustainability.org).
2. Kevin Wilhelm, *Return on Sustainability* (Indianapolis, IN: Dog Ear Publishing, 2009); Bob Willard, *The Sustainability Advantage: Seven Business Case Benefits of a Triple Bottom Line* (Gabriola Island, Canada: New Society Publishers, 2002); Robert G. Eccles and Michael P. Krzus, *One Report: Integrated Reporting for a Sustainable Strategy* (New York: Wiley, 2010).

3. Laurence Chandy and Geoffrey Gertz, “With Little Notice, Globalization Reduced Poverty” (blog), *Yale Global Online*, 5 July 2011; Paul Harrison and Fred Pearce, *AAAS Atlas of Population and the Environment* (Berkeley: University of California Press, for American Association for the Advancement of Science, 2011), pp. 43–46; WWF et al., *Living Planet Report 2012* (Gland, Switzerland: WWF, 2012), pp. 8–9; Millennium Ecosystem Assessment, *Living Beyond Our Means: Natural Assets and Human Well-being*, Statement from the Board (Washington, DC: Island Press, 2005), p. 3.
4. J. Hall, V. Brajer, and F. Lurmann, *The Benefits of Meeting Federal Clean Air Standards in the South Coast and San Joaquin Valley Air Basins* (Fullerton: California State University–Fullerton, Institute for Economic and Environmental Studies, 2008).
5. California Department of Toxic Substances Control, “Emerging Chemicals of Concern,” at [www.dtsc.ca.gov/assessingrisk/emergingcontaminants.cfm](http://www.dtsc.ca.gov/assessingrisk/emergingcontaminants.cfm).
6. B. E. Erickson, “Bisphenol A under Scrutiny,” *Chemical and Engineering News*, 2 June 2008, pp. 36–39; Public Works and Government Services Canada, *Statutory Instruments 2010, Canada Gazette Part II*, 13 October 2010, 144(21):1806–18.
7. Principles for Responsible Investment and U.N. Environment Programme Finance Initiative, *Universal Ownership: Why Environmental Externalities Matter to Institutional Investors* (London and Geneva: 2010), pp. 2–7; Theo Ferguson, “A Fossil Fuel Diet—Taking Action to Get from Here to There,” *Green Money Journal*, fall 2011.
8. Securities and Exchange Commission (SEC), “Commission Statement about Management’s Discussion and Analysis of Financial Condition and Results of Operations,” Washington, DC, 22 January 2002.
9. E. Lynn Grayson and Patricia L. Boye-Williams, “SEC Disclosure Obligations: Increasing Scrutiny on Environmental Liabilities and Climate Change Impacts,” in Lawrence P. Schnapf, ed., *Environmental Issues in Business Transactions* (Chicago: American Bar Association, 2011), pp. 447–69.
10. Global Reporting Initiative, *A New Phase: The Growth of Sustainability Reporting: GRI’s Year in Review 2010/11* (2011), p. 6.
11. BP, *BP Sustainability Review 2009* (London: 2009), p. 5; BP, *BP Sustainability Review 2010* (London: 2010).
12. International Integrated Reporting Council (IIRC), at [www.theiirc.org](http://www.theiirc.org).
13. IIRC, “Draft Framework Outline,” 11 July 2012, pp. 5, 7.
14. IIRC, *Capturing the Experiences of Global Businesses and Investors: The Pilot Programme 2012 Yearbook* (2012), p. 7.
15. Sustainability Accounting Standards Board, at [www.sasb.org](http://www.sasb.org).
16. Association of Certified Chartered Accountants, Flora and Fauna International, and KPMG, *Is Natural Capital a Material Issue?* (London: 2012), p. 8.
17. “Benefits of Signing the NCD” and “The Declaration,” at [www.naturalcapitaldeclaration.org](http://www.naturalcapitaldeclaration.org)
18. IIRC, “Pilot Programme,” at [www.theiirc.org/companies-and-investors](http://www.theiirc.org/companies-and-investors), viewed 12 December 2012.

## Chapter 14. Keep Them in the Ground: Ending the Fossil Fuel Era

1. For an illustration of an idealistic energy transition, see “Shift: To A Smarter Energy Future” (documentary), Arcos Films, 2012; for a realistic, historically and empirically grounded view of energy transition, see Vaclav Smil, *Energy Transitions: History, Requirements, Prospects* (Santa Barbara, CA: Praeger, 2010), Chapter 2.
2. Percentage of world energy from Vaclav Smil, “Global Energy: The Latest Infatuations,” *American Scientist*, vol. 99 (2011), pp. 212–19; national oil company portion from “Introduction and Overview,” in David G. Victor, David R. Hultz, and Mark C. Thurber, eds., *Oil and Governance: State-Owned Enterprises and the World Energy Supply* (Cambridge, U.K.: Cambridge University Press, 2012), pp. 3–31; industry capitalization from Michael L. Ross, *The Oil Curse: How Petroleum Wealth Shapes the Development of Nations* (Princeton, NJ: Princeton University Press, 2012), p. 3; ExxonMobil profits from Steve Coll, *Private Empire: ExxonMobil and American Power* (New York: Penguin Press, 2012) p. 8; 2010 statistics from *Global Trends* at <http://www.globaltrends.com/knowledge-center/features/shapers-and-influencers/66-corporate-clout-the-influence-of-the-worlds-largest-100-economic>

entities. Box 14–1 from the following: Smil, op. cit. this note; Smil, op. cit. note 1, p. 117; James Clark, *BP Energy Outlook 2030*, at [www.bp.com](http://www.bp.com); International Energy Agency, “How Will Global Energy Markets Evolve to 2035?” *World Energy Outlook 2011 Factsheet*, at [www.worldenergyoutlook.org](http://www.worldenergyoutlook.org); Roni A. Neff et al., “Peak Oil, Food Systems, and Public Health,” *American Journal of Public Health*, September 2011, p. 1,589; Carbon Tracker Initiative, *Unburnable Carbon: Are the World’s Financial Markets Carrying a Carbon Bubble?* March 2012, at [www.carbon-tracker.org](http://www.carbon-tracker.org); Paul R. Epstein and Jesse Selber, eds., *Oil: A Life Cycle Analysis of Its Health and Environmental Impacts* (Boston: Center for Health and the Global Environment, Harvard Medical School, 2002), p. 4.

3. Richard Dobbs et al., *Resource Revolution: Meeting the World’s Energy, Materials, Food, and Water Needs* (McKinsey Global Institute and McKinsey Sustainability & Resource Productivity Practice, 2011), p. 15; German Advisory Council on Global Change, *World in Transition: A Social Contract for Sustainability: Summary for Policy-Makers* (Berlin: 2011), p. 4; petroleum royalties from *U.S. Department of the Interior News*, 20 November 2008, cited in Coll, op. cit. note 2, p. 606; Saudi percentages from Ross, op. cit. note 2, p. 45.

4. Resource curse statements from Ross, op. cit. note 2, pp. 189, 236, 253.

5. Woosley statement from Annie Maccoby Berglof, “At Home: Jim Woosley. The Former Head of the CIA Wants to Wean the US Off Oil,” *Financial Times*, 6 July 2012; John Hofmeister, *Why We Hate the Oil Companies: Straight Talk From an Energy Insider* (New York: Palgrave Macmillan, 2010), p. 48; German Advisory Council on Global Change, op. cit. note 3, p. 25.

6. Hofmeister, op. cit. note 5.

7. On moral entrepreneurs, see Ethan A. Nadelmann, “Global Prohibition Regimes: The Evolution of Norms in International Society,” *International Organization*, autumn 1990, pp. 479–526.

8. Paul Hawken, *Blessed Unrest: How the Largest Movement in the World Came into Being, and Why No One Saw It Coming* (New York: Viking, 2007); Rob Nixon, *Slow Violence and the Environmentalism of the Poor* (Cambridge, MA: Harvard University Press, 2011); Robert Goodland, “Responsible Mining: The Key to Profitable Resource Development,” *Sustainability*, vol. 4, no. 9 (2012), pp. 2,099–126.

9. Pamela L. Martin, *Oil in the Soil: The Politics of Paying to Preserve the Amazon* (Boulder, CO: Rowman and Littlefield Publishers, 2011).

10. Ibid.

11. “Ecological Debt and Oil Moratorium in Costa Rica,” *Oilwatch International*, August 2005; “Costa Rica,” in U.N. Development Programme, *Human Development Indicators*, at [hdrstats.undp.org/en/countries/profiles/CRI.html](http://hdrstats.undp.org/en/countries/profiles/CRI.html); Adam Williams, “While Natural Gas Remains an Option, Chinchilla Says No to Oil Drilling in Costa Rica,” *Tico Times*, 17 June 2011.

12. Alex Trembath et al., *Where the Shale Gas Revolution Came From* (Oakland, CA: Breakthrough Institute, 2012).

13. Peter Applebome, “On Drilling, Patterson Pleases Both Sides,” *New York Times*, 13 December 2010.

14. Trembath et al., op. cit. note 12; New York State Department of Environmental Conservation, “Draft Supplemental Generic Environmental Impact Statement (DSGEIS) Relating to Drilling for Natural Gas in New York State Using Horizontal and Hydraulic Fracturing,” at [www.dec.ny.gov/energy/75370.html](http://www.dec.ny.gov/energy/75370.html).

15. Dusty Horwitt, *Drilling Around the Law* (Washington, DC: Environmental Working Group, 2010); Onondaga Nation, “Traditional Native Leaders: Hydrofracking Must Be Banned,” press release (Albany, NY: Onondaga Nation, 5 November 2009); Haudenosaunee Environmental Task Force, “Haudenosaunee Statement on Hydrofracking,” Roseveltown, NY, 2009; Onondaga Nation, “Onondaga Nation’s Statement to NYSDEC on ‘Hydro-fracking,’” press release (Syracuse, NY: 12 January 2012).

16. Appalachian coal from Laura Bozzi, Yale School of Forestry and Environmental Studies, dissertation in progress; uranium from James Goodman, “Leave It in the Ground! Eco-social Alliances for Sustainability,” in Josée Johnston, Michael Gismond, and James Goodman, eds., *Nature’s Revenge: Reclaiming Sustainability in an Age of Corporate Globalization* (Peterborough, Canada: Broadview Press, 2006), pp. 155–82; gold in El Salvador from Robin Broad and John Cavanagh, “Like Water for Gold in El Salvador,” *The Nation*, 1–8 August 2011; gold and diamonds from “Guyana Bans Gold, Diamond Mining In Rivers,” *Jamaica-Gleaner*, 8 July 2012; oil from Berit



Kristoffersen and Stephen Young, “Geographies of Security and Statehood in Norway’s ‘Battle of the North,’” *Geoforum*, July 2010, pp. 577–84.

17. Donella Meadows, “Envisioning a Sustainable World,” paper presented at the Third Biennial Meeting of the International Society for Ecological Economics, San Jose, Costa Rica, 24–28 October 1994, pp. 1–6.

18. Barbara Freese, *Coal: A Human History* (New York: Penguin, 2003), pp. 190–97.

19. Evidence of change in fossil fuel industries in part from informal interviews with high-level officials in the automobile and oil industries; see also George Mobus, “Industry Leaders Seem to be Showing More Openness to Energy Descent Issue” (blog), *The Oil Drum*, 4 May 2010; Hofmeister, op. cit. note 5, p. 168; evidence for end of cheap energy from Robert L. Hirsch, “The Inevitable Peaking of World Oil Production,” *Atlantic Council Bulletin*, vol. XVI, no. 3, from Richard D. Kerr, “World Oil Crunch Looming?” *Science*, 21 November 2008, and from Robert Rapier, “German Military Study Warns of Potential Energy Crisis” (blog), *The Oil Drum*, 2 September 2010; Coll, op. cit. note 2; Adam Hochschild, *Bury the Chains: Prophets and Rebels in the Fight to Free an Empire’s Slaves* (Boston: Houghton Mifflin, 2005); Allan M. Brandt, *The Cigarette Century: The Rise, Fall, and Deadly Persistence of the Product that Defined America* (New York: Basic Books, 2007).

## Chapter 15. Beyond Fossil Fuels: Assessing Energy Alternatives

1. Early application of coal from E. A. Wrigley, *Energy and the English Industrial Revolution* (New York: Cambridge University Press, 2010), p. 45.

2. Author’s estimate.

3. Annual growth at 3 percent from U.S. Energy Information Administration, *Annual Energy Review* (Washington, DC: 2011), Appendix E; current global power demand from International Energy Agency (IEA), *Key World Energy Statistics* (Paris: 2010), p. 6.

4. T. W. Murphy, Jr., “Can Economic Growth Last?” *Do the Math*, at [physics.ucsd.edu/do-the-math/2011/07/can-economic-growth-last](http://physics.ucsd.edu/do-the-math/2011/07/can-economic-growth-last).

5. Hydroelectric power potential from Eurelectric, *Study on the Importance of Harnessing the Hydropower Resources of the World* (Brussels: April 1997).

6. Figure of 81 percent from IEA, op. cit. note 3, p. 6; automobile efficiency from R. A. Ristinen and J. J. Kraushaar, *Energy and the Environment*, 2nd ed. (New York: John Wiley and Sons, 2006), p. 71.

7. T. W. Murphy, Jr., “The Alternative Energy Matrix,” *Do the Math*, at [physics.ucsd.edu/do-the-math/2012/02/the-alternative-energy-matrix](http://physics.ucsd.edu/do-the-math/2012/02/the-alternative-energy-matrix).

8. Photovoltaic panel production from G. Hering, “Year of the Tiger,” *Photon International*, March 2011, p. 186; W. F. Pickard, “A Nation-Sized Battery,” *Energy Policy*, June 2012, pp. 263–67; small number of locales from T. W. Murphy, Jr., “Pump Up the Storage,” *Do the Math*, at [physics.ucsd.edu/do-the-math/2011/11/pump-up-the-storage](http://physics.ucsd.edu/do-the-math/2011/11/pump-up-the-storage).

9. Considerable fraction of present needs from C. de Castro et al., “Global Wind Power Potential: Physical and Technological Limits,” *Energy Policy*, October 2011, pp. 6,677–82.

10. Compelling possibility from E. S. Andreiadis, “Artificial Photosynthesis: From Molecular Catalysts for Light-driven Water Splitting to Photoelectrochemical Cells,” *Photochemistry and Photobiology*, 8 August 2011, pp. 946–64; U.S. Department of Energy project from “Fuels from Sunlight Hub,” at [energy.gov/articles/fuels-sunlight-hub](http://energy.gov/articles/fuels-sunlight-hub), 1 August 2010.

11. Judy Dempsey and Jack Ewing, “Germany, in Reversal, Will Close Nuclear Plants by 2022,” *New York Times*, 30 May 2011; Risa Maeda and Aaron Sheldrick, “Japan Aims to Abandon Nuclear Power by 2030s,” *Reuters*, 14 September 2012; Ayesha Rascoe, “U.S. Approves First New Nuclear Plant in a Generation,” *Reuters*, 9 February 2012.

12. Fully 99.7 percent of natural uranium is U-238 while 0.7 percent is U-235; see Ristinen and Kraushaar, op. cit. note 6, p. 184.

13. Ristinen and Kraushaar, op. cit. note 6, pp. 145–50.

14. For an expanded discussion of these other sources, see Murphy, op. cit. note 7.
15. T. W. Murphy, Jr., “The Energy Trap,” *Do the Math*, at [physics.ucsd.edu/do-the-math/2011/10/the-energy-trap](http://physics.ucsd.edu/do-the-math/2011/10/the-energy-trap).

## Chapter 16. Energy Efficiency in the Built Environment

1. Percent of energy-related emissions from U.S. Department of Energy (DOE), Energy Information Administration (EIA), *What Are Greenhouse Gas Emissions? How Much Does the US Emit?* (Washington, DC: 2012); leveled costs from DOE, EIA, *Annual Energy Outlook 2012* (Washington, DC: 2012).
2. DOE, *2009 Buildings Energy Data Book* (Washington, DC: 2009); Confederation of Indian Industry, CII-Sohrab ji Godrej Green Business Centre, “Energy Efficiency in Building Design and Construction,” New Delhi, June 2005, p. 1.
3. Karim Elgendy, “The State of Energy Efficiency Policies in Middle East Buildings,” at [www.carboun.com](http://www.carboun.com); Confederation of Indian Industry, op. cit. note 2, p. 1.
4. McKinsey & Company, *Unlocking Energy Efficiency in the US Economy* (2009), p. iii; McKinsey & Company, *Impact of the Financial Crisis on Carbon Economics* (2010), p. 8.
5. Matt Krantz, “Investors Question Wisdom of 10% Rule of Thumb Rule,” *USA Today*, 17 October 2011; American Council for an Energy-Efficient Economy from Institute for Building Efficiency, “Why Focus on Existing Buildings?” 2008, at [www.institutebe.com/Existing-Building-Retrofits.aspx?lang=en-US](http://www.institutebe.com/Existing-Building-Retrofits.aspx?lang=en-US); U.S. Environmental Protection Agency (EPA), *Introduction to Energy Performance Contracting* (Washington, DC: 2007), p. 11.
6. EPA, Office of Air and Radiation, *Energy Star Building Upgrade Manual* (Washington, DC: 2008), p. 2; U.S. Green Building Council, “FAQ: LEED Green Building Rating System,” Washington, DC, 2012, p. 1.
7. Jonathan Miller, *Emerging Trends in Real Estate 2008* (Washington, DC: Urban Land Institute, 2007), p. 13; Charles DiRocco and Jonathan Miller, *Emerging Trends in Real Estate 2013* (Washington, DC: Urban Land Institute, 2012), p. 56.
8. Harvey M. Bernstein and Michele A Russo, *Business Case for Energy Efficient Building Retrofit and Renovation* (New York: McGraw-Hill Construction, 2011), p. 29; Piet Eichholtz, Nils Kok, and John M. Quigley, “Doing Well by Doing Good? Green Office Buildings,” *American Economic Review*, December 2010; “Green Building Market to Hit \$173.5 Billion by 2015,” *Environmental Leader*, 1 July 2010; Melissa Hinch-Ownby, “LEED-Certified Space Tops 2 Billion Square Feet” (blog), *Mother Nature Network*, 30 July 2012.
9. DOE, *Memorandum of Understanding Between the Appraisal Foundation and U.S. Department of Energy Office of Energy Efficiency and Renewable Energy* (Washington, DC: 2011).
10. “Commercial Building Asset Rating: A New Buzz Word or a True Driver of Transformation in Building Energy Consumption?” (blog), *Retroficiency*, 8 November 2011.
11. ICLEI Local Governments for Sustainability USA, *U.S. Local Sustainability Plans and Climate Action Plans* (Oakland, CA: 2009); DOE, “Obama Administration Announces Major Steps to Advance Energy Efficiency Efforts, Improve Access to Low-Cost Financing for States and Local Communities,” press release (Washington, DC: 26 June 2012).
12. Institute for Market Transformation, “Existing Policies,” at [www.buildingrating.org/content/existing-policies](http://www.buildingrating.org/content/existing-policies); “China Policy Brief: Commercial and Residential Buildings,” at [www.buildingrating.org](http://www.buildingrating.org); New York City Building Code, “Construction Codes Update Pages,” New York, 11 May 2009, p. 1.
13. Lane Burt et al., *A New Retrofit Industry* (Washington, DC: U.S. Green Building Council et al., 2011), p. 5; ICLEI USA, op. cit. note 11; “Mayors Leading the Way on Climate Protection,” Climate Protection Center, at [www.usmayors.org](http://www.usmayors.org).
14. Elgendy, op. cit. note 3.
15. Charles Lockwood, “Building the Green Way,” *Harvard Business Journal*, June 2006, p. 1; Ludwig Wittgenstein, *Culture and Value*, ed. G. H. von Wright, trans. P. Winch (Oxford: Blackwell, 1980), p. 74.

## Chapter 17. Agriculture: Growing Food—and Solutions

1. Self Employed Women's Association (SEWA), "About Us," at [www.sewa.org/About\\_Us.asp](http://www.sewa.org/About_Us.asp), viewed 4 October 2012; author's visit to SEWA Farm, Ahmedabad, India, February 2011.
2. Surajben Shankasbhai Rathwa, interview with Janeen Madan, "Women Farmers Key to End Food Insecurity" (blog), *Worldwatch: Nourishing the Planet*, 6 August 2011; SEWA Manager Ni School, at [www.sewamanagerni.school.org](http://www.sewamanagerni.school.org), viewed 4 October 2012; author's visit, op. cit. note 1.
3. SEWA members, Ahmedabad, India, interview with author, February 2011.
4. Figure 17–1 based on U.N. Food and Agriculture Organization (FAO), *The State of Food Insecurity in the World* (Rome: 2010) p. 8; FAO, *Obesity and Overweight*, Fact Sheet No. 311 (Rome: March 2011); World Bank, *Reduced Emissions and Enhanced Adaptation in Agricultural Landscapes*, Agricultural and Rural Development Notes (Washington, DC: World Bank, 2009), p. 1.
5. Jeffrey Delaurentis, "In Somalia Seeds of Hope and Progress Have Begun to Sprout, but They Need to be Carefully and Generously Nurtured," Security Council Meeting, United Nations, New York, 14 September 2011; FAO, "925 Million in Chronic Hunger Worldwide," press release (Rome: 14 September 2010); FAO, *The State of Food and Agriculture 2010–2011* (Rome: 2011), p. 67.
6. Figure 17–2 from FAO, Food Price Index, at [www.fao.org/worldfoodsituation/wfs-home/foodpricesindex/en](http://www.fao.org/worldfoodsituation/wfs-home/foodpricesindex/en), updated 6 October 2011; World Bank, *Food Price Watch*, February 2011; World Bank, "Poverty Headcount Ratio at Rural Poverty Line," online database, at [data.worldbank.org/indicator/SI.POV.RUHC](http://data.worldbank.org/indicator/SI.POV.RUHC), viewed 4 October 2012.
7. Olivier De Schutter, Eleventh Annual Edward and Nancy Dodge Lecture, Center for a Livable Future, Johns Hopkins Bloomberg School of Public Health, 27 September 2011.
8. Tristram Stuart, "Post-Harvest Losses: A Neglected Field," in Worldwatch Institute, *State of the World 2011* (New York: W. W. Norton & Company, 2011), pp. 99–108.
9. Julian Parfitt et al., *Food Waste within Food Supply Chains: Quantification and Potential for Change to 2050* (London: The Royal Society, 2010).
10. International Institute of Tropical Agriculture (IITA), "IITA, Partners Launch Initiative to Tackle Killer Aflatoxin in African Crops," press release (Ibadan, Nigeria: 4 April 2011); IITA, "Investing in Aflasafe™," 13 April 2011, at [r4dreview.org/2011/04/investing-in-aflasafe%E2%84%A2](http://r4dreview.org/2011/04/investing-in-aflasafe%E2%84%A2).
11. Love Food, Hate Waste, an initiative of Waste and Resources Action Programme, at [www.wrap.org.uk/wrap\\_corporate/about\\_wrap/resource\\_efficiency](http://www.wrap.org.uk/wrap_corporate/about_wrap/resource_efficiency).
12. International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD), *Agriculture at a Crossroads* (Washington, DC: Island Press, 2008); U.K. Government Office for Science / Foresight, *The Future of Food and Farming: Challenges and Choices for Global Sustainability* (London: 2011); Climate Change, Agriculture and Food Security, *Achieving Food Security in the Face of Climate Change* (Washington, DC: Commission on Sustainable Agriculture and Climate Change, CGIAR, 2011); Daniele Giovannucci et al., *Food and Agriculture: The Future of Sustainability* (New York: U.N. Department of Economic and Social Affairs, 2012).
13. IAASTD, *Agriculture at a Crossroads, Synthesis Report* (Washington, DC: Island Press, 2009), p. 5.
14. IAASTD, op. cit. note 12.
15. Olivier De Schutter, Office of the UN Special Rapporteur on the Right to Food, "Agroecology and the Right to Food," presented at the 16th Session of the United Nations Human Rights Council, March 2011; "Integrated Rice-duck: A New Farming System for Bangladesh," in Paul Van Mele, Ahmad Salahuddin, and Noel P. Magor, eds., *Innovations in Rural Extension: Case Studies from Bangladesh* (Cambridge, MA: CABI Publishing, 2005).
16. Eric Holt-Giménez, "Measuring Farmers' Agroecological Resistance after Hurricane Mitch in Nicaragua: A Case Study in Participatory, Sustainable Land Management Impact Monitoring," *Agriculture, Ecosystems and Environment*, December 2002, pp. 87–105.
17. Meera Shekar, "Scaling Up Nutrition: A Framework for Action," 5th Friedman School Symposium on Nutrition Security, Tufts University, Boston, 5 November 2010; Meera Shekar, *State of the World 2011* Symposium Panel

- Discussion, Carnegie Endowment, Washington, DC, 12 January 2011; K. Weinberger and T. A. Lumpkin, *Horticulture for Poverty Alleviation—The Unfunded Revolution*, Working Paper No. 15 (Shanhua, Taiwan: AVRDC—The World Vegetable Center, 1995); Abdou Tenkouano, “The Nutritional and Economic Potential of Vegetables,” in Worldwatch Institute, op. cit. note 8, pp. 27–35.
18. Danielle Nierenberg, “Breeding Vegetables with Farmers in Mind” (blog), *Worldwatch: Nourishing the Planet*, 3 December 2010; Monika Blössner and Mercedes de Onis, *Malnutrition: Quantifying the Health Impact at National and Local Levels*, Environmental Burden of Disease Series, No. 12 (Geneva: World Health Organization (WHO), 2005).
19. WHO, *Global Status Report on Noncommunicable Diseases 2010* (Geneva: 2011), p. 9; Rachel Nugent, *Bringing Agriculture to the Table* (Chicago: Chicago Council on Global Affairs, 2011).
20. FoodCorps, *2010–2011 Annual Report*, at [www.foodcorps.org/about/files/FoodCorps-AnnualReport.pdf](http://www.foodcorps.org/about/files/FoodCorps-AnnualReport.pdf).
21. Hannah B. Sahud et al., “Marketing Fast Food: Impact of Fast Food Restaurants in Children’s Hospitals,” *Pediatrics*, 1 December 2006, pp. 2,290–97; Molly Theobald, “Innovation of the Week: Healing Hunger” (blog), *Worldwatch: Nourishing the Planet*, 13 January 2011; “Chris Hani Baragwanath Hospital, South Africa,” at [www.chrishanibaragwanathhospital.co.za](http://www.chrishanibaragwanathhospital.co.za), viewed 8 November 2011.
22. Edward Mukiibi, Project Coordinator, Developing Innovations in School Cultivation (DISC), Uganda, interview with author, November 2009; Danielle Nierenberg, “How to Keep Kids ‘Down on the Farm’” (blog), *Worldwatch: Nourishing the Planet*, 9 December 2010.
23. Betty Nabukalu, student, DISC, Uganda, interview with author, November 2009; Nierenberg, op. cit. note 22; Slow Food International, “A Thousand Gardens in Africa,” at [www.slowfood.com/terramadreday/page/eng/pagina2.lasso?-id\\_pg=113](http://www.slowfood.com/terramadreday/page/eng/pagina2.lasso?-id_pg=113), viewed 8 November 2011.
24. PRNewswire via COMTEX, “World Cocoa Foundation, USAID and IDH Launch the African Cocoa Initiative,” press release (Washington, DC: 18 October 2011); World Cocoa Foundation, “Family Support Scholarships—Parents’ Entrepreneurship for Children’s Education” at [www.worldcocoafoundation.org/family-support-scholarships-parents-entrepreneurship-for-childrens-education](http://www.worldcocoafoundation.org/family-support-scholarships-parents-entrepreneurship-for-childrens-education), viewed 1 November 2011; *Nurturing the Next Generation of Cocoa Farmers*, event at the Field Museum, Chicago, 4 October 2011.
25. Kristin E. Davis, “Extension in Sub-Saharan Africa: Overview and Assessment of Past and Current Models, and Future Prospects,” *Journal of International Agricultural and Extension Education*, fall 2008, pp. 17–20.
26. Danielle Nierenberg, “Learning to Listen to Farmers” (blog), *Worldwatch: Nourishing the Planet*, 28 June 2011; Ernest Laryea Okorley, University of Cape Coast, School of Agriculture, Ghana, interview with author, June 2010.
27. Howard G. Buffett Foundation, *The Hungry Continent: African Agriculture and Food Insecurity* (draft) (Decatur, IL: October 2011).
28. FAO, “Increased Agricultural Investment Is Critical to Fighting Hunger,” at [cm.naturelabs.org/?p=242](http://cm.naturelabs.org/?p=242).
29. Feed the Future, at [www.feedthefuture.gov](http://www.feedthefuture.gov), viewed 4 November 2011; Global Agriculture & Food Security Program, at [www.gafspfund.org/gafsp](http://www.gafspfund.org/gafsp), viewed 4 November 2011.
30. Cheryl Doss et al., *The Role of Women in Agriculture* (Rome: FAO, 2011), p. 5.
31. Rainforest Alliance, “Our Work in Sustainable Agriculture,” at [www.rainforestalliance.org/work/agriculture](http://www.rainforestalliance.org/work/agriculture), viewed 12 October 2012.
32. Figure of \$2 per day from World Bank, *World Development Indicators 2010* (Washington, DC: 2010), pp. 91–92; World Bank, “Poverty Headcount Ratio,” op. cit. note 6; World Bank, *Food Price Watch*, op. cit. note 6.
33. Box 17–1 based on the following: 500 million accounts from Robert Peck Christen, Richard Rosenberg, and Veena Jayadeva, *Financial Institutions with a Double-Bottom Line: Implications for the Future of Microfinance*, Occasional Paper No. 8 (Washington, DC: Consultative Group to Assist the Poor, July 2004), p. 13; Amy Waldman, “Debts and Drought Drive India’s Farmers to Despair,” *New York Times*, 6 June 2004; William J. Grant and Hugh C. Allen, “CARE’s Mata Masu Dubara (Women on the Move) Program in Niger: Successful Financial Intermediation in the Rural Sahel,” *Journal of Microfinance*, fall 2002, pp. 189–216; Kim Wilson, Malcolm Harper, and



Matthew Griffith, eds., *Financial Promise for the Poor: How Groups Build Microsavings* (Sterling, VA: Kumerian Press, 2010); Ben Fowler and Candace Nelson, *Beyond Financial Services: Combining Savings Groups with Agricultural Marketing in Tanzania* (Aga Khan Foundation, 2011); Bob Morikawa, “Plant With Purpose Tanzania Impact Evaluation, September, 2011,” unpublished, at [www.plantwithpurpose.org/resources](http://www.plantwithpurpose.org/resources). Food prices nearly 20 percent higher in 2011 from Hazel Healy, “The Food Rush,” *New Internationalist*, October 2011; Olivier De Schutter, “Food Commodities Speculation and Food Price Crisis: Regulation to Reduce the Risks of Price Volatility,” *Briefing Note* (September 2010).

34. United Nations, “United Nations Launches Year-Long Celebration of Vital Role of Cooperatives in Sustainable Development,” press release (New York: 31 October 2011).

35. FrontlineSMS, “About the Project,” at [www.frontlinesms.com/about-us/history-and-support](http://www.frontlinesms.com/about-us/history-and-support), viewed 5 October 2012.

36. The World Food Prize, “The 2011 World Food Prize Laureates,” at [www.worldfoodprize.org/index.cfm?nodeID=33367&audienceID=1](http://www.worldfoodprize.org/index.cfm?nodeID=33367&audienceID=1), viewed 12 October 2012.

## Chapter 18. Protecting the Sanctity of Native Foods

1. Dennis Martinez, “The Missing Delegate at Cancún: Indigenous Peoples,” *National Geographic News Watch*, 8 December 2010.

2. Dan Wildcat, *Red Alert! Saving the Planet with Indigenous Knowledge* (Golden, CO: Fulcrum Publishing, 2009).

3. Claire Cummings, “Risking Corn, Risking Culture,” *World Watch Magazine*, November/December 2002; John Mohawk, “The Art of Thriving in Place,” in Melissa Nelson, ed., *Original Instructions: Indigenous Teachings for a Sustainable Future* (Rochester, VT: Bear & Company, 2008), pp. 126–37; Colin Carter and Henry Miller, “Food for Food, Not Fuel,” *New York Times*, 30 July 2012.

4. Hawai‘i SEED, “Taro,” at [www.hawaiiiseed.org](http://www.hawaiiiseed.org).

5. Ibid.

6. White Earth Land Recovery Project & Native Harvest, at [www.nativeharvest.com](http://www.nativeharvest.com).

7. “Letter from Winona LaDuke about the Manoomin Rice Fall Harvest,” Slow Food USA site, at [www.slowfoodusa.org/index.php/programs/presidia\\_product\\_detail/wild\\_rice\\_anishinaabeg\\_manoomin](http://www.slowfoodusa.org/index.php/programs/presidia_product_detail/wild_rice_anishinaabeg_manoomin).

8. Claire Cummings, *Uncertain Peril: Genetic Engineering and the Future of Seeds* (Boston: Beacon Press, 2008).

9. Tirso A. Gonzales and Melissa K. Nelson, “Contemporary Native American Responses to Environmental Threats in Indian Country,” in John Grim, ed., *Indigenous Traditions and Ecology—The Interbeing of Comology and Community* (Cambridge, MA: Harvard University Press, 2001), p. 504.

10. M. Kat Anderson, *Tending the Wild: Native American Knowledge and the Management of California’s Natural Resources* (Berkeley: University of California Press, 2005); Dennis Martinez, “Indigenous Ecosystem-based Adaptation and Community-based Ecocultural Restoration during Rapid Climate Disruption: Lessons for Western Restorationists,” presented at the 4th World Conference on Ecological Restoration, the 20th Annual Meeting of the Society for Ecological Restoration International, and the 2nd Meeting of the Ibero-American and Caribbean Ecological Restoration Network, 23 August 2011, Mérida, Yucatan, Mexico.

11. Beth Rose Middleton, *Trust in the Land: New Directions in Tribal Conservation* (Tucson: University of Arizona Press, 2011); Carlo Petrini, speech to the U.N. Permanent Forum on Indigenous Issues, New York, May 2012.

12. Cook quoted in Winona LaDuke, *All Our Relations: Native Struggles for Land and Life* (Cambridge, MA: South End Press, 1999), pp. 18–23.

13. Blue Voice, “Toxic Contamination in the Arctic,” at [www.bluevoice.org/news\\_toxicarctic.php](http://www.bluevoice.org/news_toxicarctic.php); Lisa Charleyboy, “In the Arctic, a Hunger for Ancestral Foods,” *Spirituality and Health*, November–December 2012.

14. Slow Food USA, “US Ark of Taste,” at [www.slowfoodusa.org/index.php/programs/details/ark\\_of\\_taste](http://www.slowfoodusa.org/index.php/programs/details/ark_of_taste).

15. Slow Food USA, “US Presidia,” at [www.slowfoodusa.org/index.php/programs/details/us\\_presidia](http://www.slowfoodusa.org/index.php/programs/details/us_presidia).

16. Slow Food USA, op. cit. note 14.
17. Lois Ellen Frank, “The Discourse and Practice of Native American Cuisine: Native American Chefs and Native American Cooks in Contemporary Southwest Kitchens” (PhD Diss., University of New Mexico, 2011), pp. 448–51.
18. Physicians’ Committee for Responsible Medicine, “PCRM’s Native American Diabetes Prevention Classes Focus on Ancestral Foods,” August 2011, at [www.pcrm.org](http://www.pcrm.org); Physicians’ Committee for Responsible Medicine, “Diabetes Success Stories,” at [www.pcrm.org/health/diabetes-resources](http://www.pcrm.org/health/diabetes-resources).
19. Tohono O’odham Community Action, at [www.tocaonline.org](http://www.tocaonline.org); Robert Bazell and Linda Carroll, “Indian Tribe Turns to Tradition to Fight Diabetes,” *NBC News*, 12 December 2011; Gary Paul Nabhan, *Coming Home to Eat: The Pleasures and Politics of Local Foods* (New York: W. W. Norton & Company, 2002), pp. 289–302.
20. Author’s observations.
21. Melissa Nelson, “Re-Indigenizing Our Bodies and Minds Through Native Foods,” in Nelson, op. cit. note 3, pp. 180–94.

## Chapter 19. Valuing Indigenous Peoples

1. First Peoples Worldwide (FPW), “Ancient Past: A Bridge over Troubled Economic Transition in Tanzania,” Fredericksburg, VA, May 2010.
2. FPW, “Maasai Women Signify New Indigenous Rights in Kenya,” Fredericksburg, VA, August 2010; Shadrack Kavilu, “Adoption of New Constitution in Kenya Heralds a New Dawn for Indigenous Communities,” *Gáldu*, Guovdageaidnu-Kautokeino, Norway, 8 September 2010; Jerry Reynolds, “Simat Praises Indigenous Presence in New Kenya Constitution” (blog), *First Peoples Worldwide*, 30 August 2010.
3. Claudia Sobrevila, *The Role of Indigenous Peoples in Biodiversity Conservation* (Washington, DC: World Bank, 2008), pp. xii and 7; Evelyn Arce, International Funders for Indigenous People (IFIP), “The Story of IFIP” (blog); Evelyn Arce, “In Focus: A New Paradigm of Collaboration with Indigenous Peoples,” *IFIP Human Rights Funding News*, 5 May 2011.
4. FPW, “Conservation’s ‘New Breed of Refugee’ is All Too Familiar to Indian County,” Fredericksburg, VA, August 2009.
5. FPW, “Conservation Evictions: First Peoples Worldwide Background Paper,” Fredericksburg, VA, March 2007; Marcus Colchester, “Conservation Policy and Indigenous People,” *Cultural Survival Quarterly*, spring 2004.
6. Colchester, op. cit. note 5; FPW, op. cit. note 5.
7. Table 19–1 from the following: Davinder Kumar, “Philippines’ Tribes Try to Save their Forest,” *Al Jazeera News*, 9 August 2011; Robyn Dixon, “Kenyan Tribe Slowly Driven Off Its Ancestral Lands,” *Los Angeles Times*, 4 January 2010; Slow Food Foundation for Biodiversity, “Imraguen Women’s Mullet Botargo,” undated; S. Heckbert et al., “Indigenous Australians Fight Climate Change with Fire,” *Solutions*, November 2011, pp. 50–56.
8. World Bank, “Food Price Hike Drives 44 Million People into Poverty,” press release (Washington, DC: 15 February 2011).
9. Maurice Colchester and Maurizio Farhan Ferrari, *Making FPIC—Free, Prior and Informed Consent—Work: Challenges and Prospects for Indigenous Peoples* (Moreton-in-Marsh, U.K.: Forest Peoples Programme, June 2007).
10. United Nations, *United Nations Declaration on the Rights of Indigenous Peoples* (New York: 2008); FPW, “Corporate Engagement,” at [www.firstpeoples.org](http://www.firstpeoples.org).
11. Shell, *Shell Sustainability Report 2011* (April 2012), pp. 9, 14.
12. Ibid.; Mark Betancourt, FPW, discussion with author Rebecca Adamson, 8 October 2012.
13. Accra Caucus on Forests and Climate Change, *Realizing Rights, Protecting Forests: An Alternative Vision for Reducing Deforestation* (June 2010).
14. FPW, “Grants: Keepers of the Earth Fund,” at [www.firstpeoples.org](http://www.firstpeoples.org).
15. FPW, “Grants Awarded,” at [www.firstpeoples.org](http://www.firstpeoples.org).

16. Ibid.
17. Ibid.
18. “CONGO: New Law to Protect Rights of Indigenous Peoples,” *IRIN* (U.N. Office for the Coordination of Humanitarian Affairs), 7 January 2011.
19. United Nations, op. cit. note 10.

## Chapter 20. Crafting a New Narrative to Support Sustainability

1. Robert Pool, *Earthrise: How Man First Saw the Earth* (New Haven, CT: Yale University Press, 2010).
2. Gary Gardner, *Inspiring Progress* (New York: W. W. Norton & Company, 2006), p. 70; “Religious Teachings on the Environment,” at [www.greenfaith.org](http://www.greenfaith.org); Mary Evelyn Tucker and John Grimm, “Overview of World Religions and Ecology,” Forum on Religion and Ecology at Yale, at [fore.research.yale.edu](http://fore.research.yale.edu); “Renewal” (video), FineCut Productions, LLC, 2007.
3. E. O. Wilson, *On Human Nature*, 25th anniv. ed. (Cambridge, MA: Harvard University Press, 1979), p. 201; Brian Swimme and Thomas Berry, *The Universe Story* (New York: HarperCollins, 1992); “billions and billions” from Carl Sagan, *Cosmos*, television series, Public Broadcasting System, 1980.
4. Barry Rodrigue and Daniel Stasko, “A Big History Directory, 2009: An Introduction,” *World History Connected*, October 2009; Michael Duffy, “Cosmic Education and Big History,” presentation at American Montessori Society Conference, 2011.
5. Peter J. Richerson and Robert Boyd, *Not by Genes Alone* (Chicago: University of Chicago Press, 2006); Robert Boyd and Peter J. Richerson, *The Origin and Evolution of Cultures* (New York: Oxford University Press, 2005).
6. Andrew J. Revkin, “The ‘Anthropocene’ as Environmental Meme and/or Geological Epoch” (blog), *New York Times*, 17 September 2012; F. John Odling-Smee, Kevin N. Laland, and Marcus W. Feldman, *Niche Construction* (Princeton, NJ: Princeton University Press, 2003).
7. Jeffrey Bennett and Seth Shostak, *Life in the Universe*, 3rd ed. (Boston: Addison-Wesley, 2012).
8. David Christian, “Humanoid Histories,” at [www.metanexus.net/essay/humanoid-histories](http://www.metanexus.net/essay/humanoid-histories); see also video of the comparative humanoid histories talk, Global Futures 2045 conference, Moscow, March 2012, at [www.youtube.com/watch?v=7FYfpaJ3ek0&feature=youtu.be](http://www.youtube.com/watch?v=7FYfpaJ3ek0&feature=youtu.be); Peter Richerson, “Rethinking Paleoanthropology: A World Queerer Than We Supposed,” in Gary Hatfield, ed, *Evolution of Mind* (Philadelphia: Penn Museum Conference Series, in press).
9. Laurie Garrett, *The Coming Plague* (New York: Farrar, Straus, and Giroux, 1994); Peter Turchin, *War and Peace and War*, reprint ed. (New York: Plume, 2007).
10. The Big History Project is a collaboration between pilot schools, teachers, and educators—supporters include Bill Gates, David Christian, and the University of Michigan, see [www.bighistoryproject.com](http://www.bighistoryproject.com); “First Year Experience—Big History at Dominican University of California,” at [www.dominican.edu/academics/big-history](http://www.dominican.edu/academics/big-history); Ryan Wyatt et al., “Life, A Cosmic Story,” California Academy of Sciences Planetarium show, 2010; Gregory C. Farrington, “Transformation of the California Academy of Sciences,” in Worldwatch Institute, *State of the World 2010* (New York: W. W. Norton & Company, 2010), p. 68.
11. Dwight Collins, “The Evolutionary Account of the Universe: A Support for Behavioral Change Toward Sustainability,” in Cheryl Genet et al., eds., *Science, Wisdom, and the Future* (Santa Margarita, CA: Collins Foundation Press, 2012).
12. Student quoted in David Christian, “Big History for the Era of Climate Change,” *Solutions*, March 2012.
13. Matt Lappé, Director of Education, Alliance for Climate Education, discussions with authors.
14. Dwight Collins, Ron Nahser, and Art Whatley, “Sustainability as the Core Theme in Graduate Management Education: A Synopsis of Two Programs,” *Management International Conference 2008: Intercultural Dialogue and Management*, Barcelona, Spain, November 2008; Ron Nahser, *Journeys to Oxford* (Global Scholarly Publications, 2008), pp.174–79, 207–11; Donella H. Meadows et al., *Limits to Growth* (New York: Universe Books, 1972); Donella

H. Meadows, *Thinking in Systems* (White River Junction, VT: Chelsea Green Publishing, 2008), pp. 25–27, 145–65.  
 15. Sagan, op. cit. note 3.

## Chapter 21. Moving Toward a Global Moral Consensus on Environmental Action

1. Justin Gillis, “Study Finds More of Earth Is Hotter and Says Global Warming Is at Work,” *New York Times*, 6 August 2012; Suzanne Goldenburg, “Greenland Ice Sheet Melted at Unprecedented Rate during July,” (London) *Guardian*, 24 July 2012; “More Record Highs across Kansas Wednesday—Including Dodge City’s All-Time High,” *Finger on the Weather* (blog), 27 June 2012; Weather Forecast Office, “Drought Briefing Page,” National Weather Service, at [www.crh.noaa.gov/lxx/?n=drought](http://www.crh.noaa.gov/lxx/?n=drought); “As Wildfires Rage, the Russian Government Heads East to Battle the Crisis,” *Siberian Times*, 6 August 2012; Justin Gillis, “Ending Its Summer Melt, Arctic Sea Ice Sets a New Low That Leads to Warnings,” *New York Times*, 19 September 2012.
2. Severin Carrell, “NASA Scientist: Climate Change is a Moral Issue on a Par with Slavery,” (London) *Guardian*, 6 April 2012; Desmond Tutu, “Foreword,” in K. D. Moore and M. P. Nelson, eds., *Moral Ground: Ethical Action for a Planet in Peril* (San Antonio, TX: Trinity University Press, 2010), p. xiii; Sheila Watt-Cloutier, “The Inuit Right to Culture Based on Ice and Snow,” in *ibid.*, p. 28 (adapted from *Transcripts from Indigenous Peoples’ Resistance to Economic Globalization: A Celebration of Victories, Rights and Cultures*, New York, 23 November 2006); The Dalai Lama, “A Question of Our Own Survival,” in *ibid.*, p. 19.
3. For a denial of the harms of carbon emissions, see ads by The Competitive Enterprise Institute, at [www.youtube.com/watch?v=7sGKvDNdJNA](http://www.youtube.com/watch?v=7sGKvDNdJNA).
4. United Nations, “The Universal Declaration of Human Rights,” at [www.un.org/en/documents/udhr/index.shtml](http://www.un.org/en/documents/udhr/index.shtml); International Panel on Climate Change, *Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, U.K.: Cambridge University Press, 2007); Sandra Steingraber, “Three Bets On Ecology, Economy, and Human Health,” *Orion*, May/June 2009.
5. “Real Leadership for a Clean Energy Future,” Remarks of Senator Barack Obama, Portsmouth, NH, 8 October 2007.
6. Aldo Leopold, *A Sand County Almanac* (New York: Oxford University Press, 1949), pp. 224–25.
7. James Gustave Speth, “The Limits of Growth,” in Moore and Nelson, op. cit. note 2, p. xiii.
8. A. Leiserowitz et al., *Global Warming’s Six Americas: March 2012 & Nov. 2011* (New Haven, CT: Yale Project on Climate Change Communication, 2012).
9. Quotes in Box 21–1 from Victor E. Frankl, *Man’s Search for Meaning* (Boston: Beacon Press, 2006), pp. 86, 135.
10. Ezra M. Markowitz and Azim F. Shariff, “Climate Change and Moral Judgment,” *Nature Climate Change*, vol. 2 (2012), pp. 243–47.
11. “The Earth Charter,” Earth Charter Initiative, at [www.earthcharterinaction.org/content/pages/Read-the-Charter.html](http://www.earthcharterinaction.org/content/pages/Read-the-Charter.html); “Ecuador Rights of Nature,” at [www.rightsofmotherearth.com/ecuador-rights-nature](http://www.rightsofmotherearth.com/ecuador-rights-nature); John Vidal, “Bolivia Enshrines Natural World’s Rights with Equal Status for Mother Earth,” (London) *Guardian*, 10 April 2011.
12. Juliette Jowit, “British Campaigner Urges UN to Accept ‘Ecocide’ as International Crime,” (London) *Guardian*, 9 April 2010.
13. Jeremy Hance, “12,000 Surround White House to Protest Tar Sands Pipeline,” *Mongabay.com*, 7 November 2011; Bill McKibben, “Global Warming’s Terrifying New Math,” *Rolling Stone*, 2 August 2012; Isabel Hayes, “Thousands Protest on Climate Change,” *Sydney Morning Herald*, 15 August 2010.
14. Catherine Woodiwiss, “Stop the Frack Attack: Religious Leaders Kick Off First Ever Nation-wide Anti-Fracking Rally in DC” (blog), *Climate Progress*, 31 July 2012.
15. “Partner in Prayer,” Evangelical Environmental Network, at [prayerforcreationcare.creationcare.org](http://prayerforcreationcare.creationcare.org); Interfaith Moral Action on Climate, “Interfaith Call to Action on Climate Change,” at [www.interfaithactiononclimatechange.org](http://www.interfaithactiononclimatechange.org).
16. “The Blue River Declaration: An Ethic of the Earth,” November 2011, at [springcreek.oregonstate.edu/documents/BlueRiverDeclaration.2012.pdf](http://springcreek.oregonstate.edu/documents/BlueRiverDeclaration.2012.pdf), p. 2.



17. “Certified B Corporation,” at [www.bcorporation.net](http://www.bcorporation.net).
18. “Joanna Macy and Her Work: The Great Turning,” at [www.joannamacy.net/thegreatturning.html](http://www.joannamacy.net/thegreatturning.html).

## Chapter 22. Pathways to Sustainability: Building Political Strategies

1. United Nations Conference on Sustainable Development, at [www.uncsd2012.org](http://www.uncsd2012.org); “Rio+20: At Downtown Gathering, Citizens Voice Concerns at People’s Summit,” UN News Centre, 20 June 2012.
2. Helpful overviews of the reformist and radical approaches include W. M. Adams, *Green Development: Environment and Sustainability in a Developing World*, 3rd ed. (London: Routledge, 2008), and A. N. H. Dobson, *Green Political Thought*, 4th ed. (London: Routledge, 2007).
3. M. Leach et al., “Transforming Innovation for Sustainability,” *Ecology and Society*, vol. 17, no. 2 (2012), art. 11; for more detail of a “pathways” approach to sustainability challenges, see M. Leach, I. Scoones, and A. Stirling, *Dynamic Sustainabilities: Technology, Environment, Social Justice* (London: Earthscan, 2010).
4. World Commission on Environment and Development, *Our Common Future* (Oxford: Oxford University Press, 1987), p. 43.
5. M. Hajer and H. Wagenaar, eds., *Deliberative Policy Analysis* (Cambridge, U.K.: Cambridge University Press, 2003); F. Fischer and J. Forester, eds., *The Argumentative Turn in Policy Analysis and Planning* (Durham, NC: Duke University Press, 1993).
6. Guyana from S. Mangal and J. Forte, *Community Tradeoffs Assessment: For Culture-sensitive Planning and Evaluation*, Power Tools Series (London: International Institute for Environment and Development (IIED), 2005); India from M. P. Pimbert and T. Wakeford, *Prajateerpu: A Citizens Jury/Scenario Workshop on Food and Farming Futures for Andhra Pradesh, India* (London: IIED and Institute of Development Studies (IDS), Sussex, 2002); Box 22–1 from Sally Brooks et al., *Environmental Change and Maize Innovation in Kenya: Exploring Pathways In and Out of Maize*, STEPS Working Paper 36 (Brighton, U.K.: STEPS Centre, 2009); A. Stirling et al., *Empowering Designs: Towards More Progressive Appraisal of Sustainability*, STEPS Working Paper 3 (Brighton, U.K.: STEPS Centre, 2007).
7. International Assessment of Agricultural Knowledge, Science and Technology for Development, at [www.agassessment.org](http://www.agassessment.org).
8. “Rio+20: After Dialogues, Citizens to Make Recommendations on Rio+20 Issues,” UN News Centre, 20 June 2012; Clarinha Glock, “Rio+20 Doubts over Impact of Sustainable Development Dialogues,” *Inter Press Service*, 19 June 2012; Adrian Ely, “Opening up Sustainable Development Decision-making at the UN?” *The Crossing* (STEPS Centre blog), 21 June 2012.
9. For further discussion of deliberative approaches and their challenges, see F. Fischer, *Reframing Public Policy: Discursive Politics and Deliberative Practices* (Oxford: Oxford University Press, 2003), and R. Munton, “Deliberative Democracy and Environmental Decision-making,” in F. Berkhout, M. Leach, and I. Scoones, eds., *Negotiating Environmental Change* (Cheltenham, U.K.: Edward Elgar, 2003).
10. Save the Narmada Movement, at [www.narmada.org](http://www.narmada.org); see also W. F. Fisher, ed., *Toward Sustainable Development? Struggling over India’s Narmada River* (Armonk, NY: M.E. Sharpe Publishers, 1995).
11. World Commission on Dams, *Dams and Development: A New Framework for Decision-Making* (London: Earthscan, 2000); L. Mehta, *The Politics and Poetics of Water: Naturalising Scarcity in Western India* (Delhi: Orient Longman, 2005); Lyla Mehta, Gert Jan Veldwisch, and Jennifer Franco, “Water Grabbing? Focus on the (Re)appropriation of Finite Water Resources,” *Water Alternatives*, special issue, vol. 5, no. 2 (2012).
12. “Occupy Movement,” (London) *Guardian*, at [www.guardian.co.uk/world/occupy-movement](http://www.guardian.co.uk/world/occupy-movement).
13. For more detail on citizen mobilization and environmental social movements, see A. Jamison, *The Making of Green Knowledge: Environmental Politics and Cultural Transformation* (Cambridge, U.K.: Cambridge University Press, 2001), and M. Leach and I. Scoones, *Mobilizing Citizens: Social Movements and the Politics of Knowledge*, IDS Working Paper 276 (Brighton, U.K.: IDS, 2007).
14. La Via Campesina: International Peasant Movement, at [viacampesina.org/en](http://viacampesina.org/en); World Social Forum, at

en.wikipedia.org/wiki/World\_Social\_Forum; “Rio+20,” op. cit. note 1.

15. For discussion of the rise and operation of networked forms of governance and politics, see R. A. W. Rhodes, *Understanding Governance* (Maidenhead, U.K.: Open University Press, 1997).

16. J. Keeley and I. Scoones, *Understanding Environmental Policy Processes: Cases from Africa* (London: Earthscan, 2003); Peter Newell, “The Governance of Energy Finance: The Public, the Private and the Hybrid,” *Global Policy*, September 2011, pp. 94–105; M. Betsill and H. Bulkeley, “Cities and the Multilevel Governance of Global Climate Change,” *Global Governance*, April–June 2006, pp. 141–59.

17. P. Olsson et al., “Shooting the Rapids: Navigating Transitions to Adaptive Governance of Social-Ecological Systems,” *Ecology and Society*, vol. 11, no. 1 (2006), art. 18.

18. Everglades management from *ibid.*; J. W. Kingdon, *Agendas, Alternatives, and Public Policies*, 2nd ed. (New York: Longman, 1995).

### Chapter 23. Moving from Individual Change to Societal Change

1. “Crying Indian PSA,” Keep America Beautiful and The Ad Council, 1970. The one-minute ad can be seen at [www.youtube.com/watch?v=j7OHG7tHrNM](http://www.youtube.com/watch?v=j7OHG7tHrNM).

2. Container Recycling Institute, “Keep America Beautiful: A History,” Culver City, CA, undated.

3. The Lazy Environmentalist, at [www.lazyenvironmentalist.com](http://www.lazyenvironmentalist.com); Recyclebank, at [www.recyclebank.com](http://www.recyclebank.com).

4. Michael Maniates, Allegheny College, email to author, 3 December 2012; The Story of Stuff Project, *The Story of Change: Why Citizens (Not Shoppers) Hold the Key to a Better Future*, 2012, available at [www.storyofchange.org](http://www.storyofchange.org).

5. Figure 23–1 from Maria Csutora, “One More Awareness Gap? The Behaviour-Impact Gap Problem,” *Journal of Consumption Policy*, March 2012, p. 149.

6. *Ibid.*

7. See, for example, “The No Trash Family,” *People Magazine*, 16 January 2012.

8. Figure 23–2 from Annie Leonard, *The Story of Stuff* (New York: Free Press, 2010), based on Joel Makower, “Calculating the Gross National Trash” (blog), *Greenbiz.com*, 20 March 2009, and on Joel Makower and Cara Pike, *Strategies for a Green Economy* (New York: McGraw-Hill, 2008), p. 112.

9. Andrew Szasz, *Shopping Our Way to Safety: How We Changed from Protecting the Environment to Protecting Ourselves* (Minneapolis: University of Minnesota Press, 2007), pp. 2–3.

10. See, for example, diverse perspectives in “Responsible Shoppers, but Bad Citizens?” Room for Debate (blog), *New York Times*, 30 July 2012

11. Lawrence Glickman, *Buying Power: A History of Consumer Activism in America* (Chicago: University of Chicago Press, 2009), p. 84.

12. *Ibid.*

13. See “Responsible Shoppers, but Bad Citizens?” op. cit. note 10.

14. James Gustave Speth, *America the Possible: Manifesto for a New Economy* (New Haven, CT: Yale University Press, 2012), p. 191.

15. Andy Igrejas, Safer Chemicals, Healthy Families Coalition, discussion with author, 10 November 2012.

16. Events and countries from 350.org; Bill McKibben, discussion with author, 3 December 2012; Brian Merchant, “1,252 Peaceful Protestors Arrested Opposing Tar Sands Pipeline at the White House,” *TreeHugger*, 3 September 2011.

17. Monica Wilson, Global Alliance for Incinerator Alternatives, discussion with author, 4 September 2012.

18. William Martin, *Best Liberal Quotes Ever* (Naperville, IL: Sourcebooks, Inc., 2004), p. 173.

## Chapter 24. Teaching for Turbulence

1. Susan Clark et al., “College and University Environmental Programs as a Policy Problem (Part 1): Integrating Knowledge, Education, and Action,” and “(Part 2): Strategies for Improvement,” *Environmental Management*, both online 26 February 2011.
2. Michael Soulé and Daniel Press, “What Is Environmental Studies?” *BioScience*, May 1998, pp. 397–405; Michael Maniates and John Whissel, “Environmental Studies: The Sky is Not Falling,” *BioScience*, June 2000, pp. 509–17.
3. Marvin Soroos, “Adding Green to the International Studies Curriculum,” *International Studies Notes*, winter 1991, pp. 37–42.
4. Shirley Vincent, *Interdisciplinary Environmental Education on the Nation’s Campuses: Elements of Field Identity and Curriculum Design* (Washington, DC: National Council of Science and Environment, 2010).
5. These patterns are drawn from analysis of 41 prominent U.S. undergraduate ESS programs conducted for this chapter; these programs typically serve as models for other programs in the United States.
6. Sharon Hall, Tom Tietenberg, and Stephanie Pfirman, *Environmental Programs at Liberal Arts Colleges: Findings and Recommendations for the Andrew W. Mellon Foundation* (Washington, DC: Project Kaleidoscope, 2005).
7. Shirley Vincent, email to author, 19 October 2012.
8. Clark et al., op. cit., note 1; Richard Wallace, discussion with author, 19 October 2012; Matthew Auer, “Communication and Competition in Environmental Studies,” *Policy Science*, December 2010, pp. 365–90.
9. Mark Dowie, *Losing Ground: American Environmentalism at the End of the 20th Century* (Cambridge, MA: The MIT Press, 1996).
10. Ibid.; James Gustave Speth, *The Bridge at the End of the World* (New Haven, CT: Yale University Press, 2008).
11. Samuel Rigotti, *Environmental Problem Solving: How Do We Make Change?* (Meadville, PA: Department of Environmental Science, Allegheny College, 2010).
12. Ibid.
13. Ibid.
14. G. Tyler Miller and Scott Spoolman, *Environmental Science* (Belmont, CA: Brooks Cole, 2012); Daniel Chiras, *Environmental Science* (Burlington, MA: Jones and Bartlett, 2012); Walter Rosenbaum, *Environmental Politics and Policy* (Washington, DC: CQ Press, 2010).
15. Norman Vig and Michael Kraft, *Environmental Policy: New Directions for the Twenty-First Century* (Washington, DC: CQ Press, 2012); Garrett Hardin, “The Tragedy of the Commons,” *Science*, 13 December 1968, pp. 1,243–48.
16. Harris Interactive, Inc., “How Green Are We? Putting Our Money (And Our Behavior) Where Our Mouth Is,” press release (New York: 13 October 2009); Harris Interactive, Inc., “One-Quarter of Americans Do Not Recycle in Their Own Homes,” press release (Rochester, NY: 11 July 2007); Harris Interactive, Inc., “Fewer Americans ‘Thinking Green,’” press release (New York: 18 April 2012).
17. Flexi Display Marketing, Inc., “Benefits of Using CFL Lightbulbs,” *AwarenessIDEAS.com*, 8 June 2008.
18. Global Footprint Network, “Footprint Calculator,” at [www.footprintnetwork.org/en/index.php/GFN/page/calculators](http://www.footprintnetwork.org/en/index.php/GFN/page/calculators).
19. Emanuel quoted in Jeff Zelany, “Obama Weighs Quick Undoing of Bush Policy,” *New York Times*, 10 November 2008; Niccolo Machiavelli, *II Principe* (1513).
20. Rebecca Solnit, *A Paradise Built in Hell: The Extraordinary Communities that Arise in Disaster* (New York: Viking Press, 2008), pp. 305–06.
21. Ibid.
22. Michael Shellenberger and Ted Nordhaus, *Break Through: From the Death of Environmentalism to the Politics*

of Possibility (New York: Houghton Mifflin, 2009), John M. Meyer, “A Democratic Politics of Sacrifice,” in Michael Maniates and John M. Meyer, *The Environmental Politics of Sacrifice* (Cambridge, MA: The MIT Press, 2010), pp. 26–27.

23. Robert Reich, *Aftershock: The Next Economy and America's Future* (New York: Vintage, 2011); Ted Nordhaus and Michael Shellenberger, “The Green Bubble: Why Environmentalism Keeps Imploding,” *New Republic*, 20 May 2009; Richard Hofstadter, “The Paranoid Style in American Politics,” *Harper's Magazine*, November 1964; Thomas Edsall, *The Age of Austerity: How Scarcity Will Remake American Politics* (New York: Anchor Books, 2012).

24. Robert Heilbroner, *An Inquiry into the Human Prospect* (New York: W. W. Norton & Company, 1980); J. O. Hertzler, “Crises and Dictatorships,” *American Sociological Review*, April 1940.

25. Box 24–1 from the following: Andrew Revkin, “The Changing (Communication) Climate” (Dot Earth blog), *New York Times*, 31 March 2011; John Meyer, Humboldt State University, email to author; Stephen Cunha, Humboldt State University, email to author; Wheaton College, “Political Science 361: Environmental Conflict Resolution,” at [wheatoncollege.edu/catalog/pols\\_361](http://wheatoncollege.edu/catalog/pols_361).

26. Charles Sayan and Daniel Blumstein, *The Failure of Environmental Education (And How We Can Fix It)* (Berkeley: University of California Press, 2011).

## Chapter 25. Effective Crisis Governance

1. I thank Lyn Carson, Mark Diesendorf, and Steve Wright for valuable comments on earlier drafts of this chapter.

2. Michael Renner and Zoé Chafe, “Turning Disasters into Peacemaking Opportunities,” in Worldwatch Institute, *State of the World 2006* (New York: W. W. Norton & Company, 2006), pp. 123–27; Eric Stover and Patrick Vinck, “Cyclone Nargis and the Politics of Relief and Reconstruction Aid in Burma (Myanmar),” *Journal of the American Medical Association*, 13 August 2008, pp. 729–31.

3. Stockholm International Peace Research Institute, *Warfare in a Fragile World: Military Impact on the Human Environment* (London: Taylor & Francis, 1980).

4. Janet Abbate, *Inventing the Internet* (Cambridge, MA: The MIT Press, 1999).

5. Jasper Becker, *Hungry Ghosts: Mao's Secret Famine* (New York: Free Press, 1996); Frank Dikötter, *Mao's Great Famine: The History of China's Most Devastating Catastrophe, 1958–62* (London: Bloomsbury, 2011); Article 19, *Starving in Silence: A Report on Famine and Censorship* (London: 1990).

6. Kenneth Bain, *Treason at Ten: Fiji at the Crossroads* (London: Hodder and Stoughton, 1989); Robert T. Robertson and Akosita Tamanisau, *Fiji—Shattered Coups* (Sydney: Pluto Press, 1988).

7. Peter Ackerman and Jack DuVall, *A Force More Powerful: A Century of Nonviolent Conflict* (New York: St. Martin's Press, 2000); Michael Randle, *People Power: The Building of a New European Home* (Stroud: Hawthorn, 1991); Kurt Schock, *Unarmed Insurrections: People Power Movements in Nondemocracies* (Minneapolis, MN: University of Minnesota Press, 2005); Stephen Zunes, “Arab Revolutions and the Power of Nonviolent Action,” *National Catholic Reporter*, 25 November 2011, p. 26.

8. Erica Chenoweth and Maria J. Stephan, *Why Civil Resistance Works: The Strategic Logic of Nonviolent Conflict* (New York: Columbia University Press, 2011); Table 25–1 from *ibid.*, p. 73.

9. Adam Roberts, “Civil Resistance to Military Coups,” *Journal of Peace Research*, March 1975, pp. 19–36; D. J. Goodspeed, *The Conspirators: A Case Study in the Coup d'État* (London: Macmillan, 1962); Victoria E. Bonnell, Ann Cooper, and Gregory Freidin, eds., *Russia at the Barricades: Eyewitness Accounts of the August 1991 Coup* (Armonk, NY: M. E. Sharpe, 1994).

10. Michael Flood and Robin Grove-White, *Nuclear Prospects: A Comment on the Individual, the State and Nuclear Power* (London: Friends of the Earth, 1976); Robert Jungk, *The New Tyranny: How Nuclear Power Enslaves Us* (New York: Grosset and Dunlap, 1979).

11. David Collingridge, *The Social Control of Technology* (London: Frances Pinter, 1980).

12. C. George Benello and Dimitrios Roussopoulos, eds., *The Case for Participatory Democracy: Some Prospects for a Radical Society* (New York: Grossman, 1971); Gerry Hunnius, G. David Garson, and John Case, eds., *Workers'*



*Control: A Reader on Labor and Social Change* (New York: Vintage, 1973).

13. John Gastil, *Democracy in Small Groups: Participation, Decision Making, and Communication* (Philadelphia: New Society Publishers, 1993); Jane J. Mansbridge, *Beyond Adversary Democracy* (New York: Basic Books, 1980).

14. Sharon Erickson Nepstad, *Nonviolent Revolutions: Civil Resistance in the Late 20th Century* (New York: Oxford University Press, 2011).

15. Lyn Carson et al., eds., *The Australian Citizens' Parliament and the Future of Deliberative Democracy* (University Park, PA: Pennsylvania State University Press, in press); John Gastil and Peter Levine, eds., *The Deliberative Democracy Handbook: Strategies for Effective Civic Engagement in the Twenty-First Century* (San Francisco: Jossey-Bass, 2005).

16. Daniel Guérin, *Anarchism: From Theory to Practice* (New York: Monthly Review Press, 1970).

17. David E. Hoffman, *The Oligarchs: Wealth and Power in the New Russia* (New York: PublicAffairs, 2011); Vadim Volkov, *Violent Entrepreneurs: The Use of Force in the Making of Russian Capitalism* (Ithaca, NY: Cornell University Press, 2002).

18. Marina Sitrin, ed., *Horizontalism: Voices of Popular Power in Argentina* (Edinburgh: AK Press, 2006).

19. Ken Darrow and Mike Saxenian, eds., *Appropriate Technology Sourcebook: A Guide to Practical Books for Village and Small Community Technology* (Stanford, CA: Volunteers in Asia, 1986); Willem Riedijk, *Technology for Liberation: Appropriate Technology for New Employment* (Delft: Delft University Press, 1986).

20. Rob Hopkins, *The Transition Handbook: From Oil Dependency to Local Resilience* (Totnes, U.K.: Green Books, 2008).

21. Rebecca MacKinnon, *Consent of the Networked: The Worldwide Struggle for Internet Freedom* (New York: Basic Books, 2012).

22. Ziauddin Sardar and Merryl Wyn Davies, *Why Do People Hate America?* (Cambridge, U.K.: Icon, 2002); Craig R. Smith, ed., *Silencing the Opposition: How the U.S. Government Suppressed Freedom of Expression During Major Crises*, 2nd ed. (Albany, NY: State University of New York Press, 2011).

23. Daron Acemoglu and James A. Robinson, *Why Nations Fail: The Origins of Power, Prosperity, and Poverty* (New York: Crown, 2012); Shaazka Beyerle, "Civil Resistance and the Corruption-Violence Nexus," *Journal of Sociology and Social Welfare*, June 2011, pp. 53–77.

24. Bruce Stokes, *Helping Ourselves: Local Solutions to Global Problems* (New York: W. W. Norton & Company, 1981); War Resisters' International, *Handbook for Nonviolent Campaigns* (London: 2009); Karl Fogel, *Producing Open Source Software: How to Run a Successful Free Software Project* (Sebastopol, CA: O'Reilly Media, 2005).

25. Leonardo Avritzer, *Participatory Institutions in Democratic Brazil* (Baltimore, MD: Johns Hopkins University Press, 2009); Brian Wampler, *Participatory Budgeting in Brazil: Contestation, Cooperation, and Accountability* (University Park, PA: Pennsylvania State University Press, 2007).

26. Johan Galtung, *There Are Alternatives! Four Roads to Peace and Security* (Nottingham, U.K.: Spokesman, 1984), pp. 131–38.

27. Roméo Dallaire with Brent Beardsley, *Shake Hands with the Devil: The Failure of Humanity in Rwanda* (New York: Carroll & Graf, 2004).

28. Thomas Beamish, *Silent Spill: The Organization of an Industrial Crisis* (Cambridge, MA: The MIT Press, 2002).

## Chapter 26. Governance in the Long Emergency

1. Svante Arrhenius, "On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground," *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science*, April 1896.

2. The phrase is from James Howard Kunstler, *The Long Emergency* (New York: Atlantic Monthly Press, 2005); Kevin A. Baumert, Timothy Herzog, and Jonathan Pershing, *Navigating the Numbers: Greenhouse Gas Data and International Climate Policy* (Washington, DC: World Resources Institute, 2005), p. 113.

3. Brian Barry, *Why Social Justice Matters* (Cambridge, U.K.: Polity Press, 2005), p. 251.
4. Thomas Homer-Dixon, *The Ingenuity Gap* (New York: Knopf, 2000); Mark Mazower, *Governing the World* (New York: Penguin, 2012), p. 424.
5. Robert Heilbroner, *An Inquiry into the Human Prospect* (New York: W. W. Norton & Company, 1980), p. 175; Robert Heilbroner, “Second Thoughts on *The Human Prospect*,” *Challenge*, May-June, 1975, p. 27.
6. Anthony Giddens, *The Politics of Climate Change* (Cambridge, U.K.: Polity Press, 2009), p. 96; David Rothkopf, *Power, Inc: The Epic Rivalry Between Big Business and Government and the Reckoning that Lies Ahead* (New York: Farrar, Straus and Giroux, 2012), p. 360.
7. David W. Orr and Stuart Hill, “Leviathan, the Open Society, and the Crisis of Ecology,” *Western Political Quarterly*, December 1978, pp. 457–69.
8. Amory B. Lovins et al., *Reinventing Fire* (White River Junction, VT: Chelsea Green Publishing, 2011), p. ix.
9. Value over \$20 trillion from Bill McKibben, “Global Warming’s Terrifying New Math,” *Rolling Stone*, 2 August 2012; Robert B. Reich, *Supercapitalism* (New York: Knopf, 2007), pp. 170–01, 204.
10. Charles E. Lindblom, *Politics and Markets* (New York: Basic Books, 1977), p. 356; Charles E. Lindblom, *The Market System* (New Haven, CT: Yale University Press, 2001).
11. Karl Polanyi, *The Great Transformation* (Boston: Beacon Press, 1967), p. 73; John Dunn, *The Cunning of Unreason* (London: Harper-Collins, 2000), p. 332; David Rothkopf, *Superclass* (New York: Farrar, Straus, Giroux, 2008), p. 322; Michael Sandel, *What Money Can’t Buy: The Moral Limits of Markets* (New York: Farrar, Straus and Giroux, 2012).
12. Nicholas A. Christakis and James Fowler, *Connected* (Boston: Little Brown, 2009), pp. 289–92; Steven Johnson, *Emergence* (New York: Scribners, 2001), pp. 224–26; Anne-Marie Slaughter, *A New World Order* (Princeton, NJ: Princeton University Press, 2004), p. 263.
13. Paul Hawken, *Blessed Unrest* (New York: Penguin, 2007); Steve Waddell, *Global Action Networks* (New York: Palgrave-Macmillan, 2011), p. 23.
14. Mark Mazower, *Governing the World* (New York: Penguin, 2012), pp. 420, 418; Matthew Bishop and Michael Green, *Philanthropocapitalism: How Giving Can Save the World* (New York: Bloomsbury, 2008).
15. Naomi Klein, “Capitalism vs. the Climate,” *The Nation*, 21 November 2011.
16. Harold Myerson, “Foundering Fathers,” *American Prospect*, October 2011, p. 16; to improve at least U.S. democracy, see Steven Hill, *10 Steps to Repair American Democracy* (Sausalito, CA: PoliPoint Press, 2006).
17. Benjamin Barber, *Strong Democracy* (Berkeley: University of California Press, 1984), pp. 117, 151; see also Thad Williamson, David Imbroscio, and Gar Alperovitz, *Making a Place for Community* (New York: Routledge, 2002); Jefferson and Dewey from Carol Pateman, *Participation and Democratic Theory* (Cambridge, U.K.: Cambridge University Press, 1970); final quote from Barber, op. cit. this note, p. 269.
18. Amy Gutmann and Dennis Thompson, *Why Deliberative Democracy* (Princeton, NJ: Princeton University Press, 2004), pp. 7, 59; see also Susan Clark and Woden Teachout, *Slow Democracy* (White River Junction, VT: Chelsea Green, 2012). Box 26–1 from the following: Adam Liptak, “Justices, 5–4, Reject Corporate Spending Limit,” *New York Times*, 22 January 2010; Robert J. Shapiro and Douglas Dowson, *Corporate Political Spending: Why the New Critics Are Wrong*, Legal Policy Report No. 15 (New York: Manhattan Institute for Policy Research, June 2012); Barber, op. cit. note 17, pp. 3, 4; Adolf G. Gundersen, *The Environmental Promise of Democratic Deliberation* (Madison: University of Wisconsin Press, 1995), pp. 9, 10, 19, and 22.
19. Bruce Ackerman and James Fishkin, *Deliberation Day* (New Haven, CT: Yale University Press, 2004), p. 171; see also James S. Fishkin, *The Voice of the People: Public Opinion and Democracy* (New Haven, CT: Yale University Press, 1995).
20. Sanford Levinson, *Framed: America’s 51 Constitutions and the Crisis of Governance* (New York: Oxford University Press, 2012), p. 389; see also Derek Bok, *The Trouble with Government* (Cambridge, MA: Harvard University Press, 2001).

21. Richard J. Lazarus, *The Making of Environmental Law* (Chicago: University of Chicago Press, 2004), pp. 30, 33, 42; Richard J. Lazarus, “Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future,” *Cornell Law Review*, vol. 94 (2009), pp. 1,153–234.
22. Thomas Berry, *Evening Thoughts* (San Francisco: Sierra Club Books, 2006), p. 95.
23. Ecuador from Erik Assadourian, “The Rise and Fall of Consumer Cultures,” in Worldwatch Institute, *State of the World 2010* (New York: W. W. Norton & Company, 2010), p. 19; Christopher Stone, *Should Trees Have Standing: Toward Legal Rights for Natural Objects* (Los Altos, CA: William Kaufmann, 1972); Berry, op. cit. note 22, p. 44.
24. John Keane, *The Life and Death of Democracy* (New York: W. W. Norton & Company, 2009); see also Paul Woodruff, *First Democracy: The Challenge of an Ancient Idea* (New York: Oxford University Press, 2005); John Plamenatz, *Democracy and Illusion* (London: Longman, 1973), p. 9.
25. Wilson Carey McWilliams, *Redeeming Democracy in America* (Lawrence: University of Kansas Press, 2011), p. 15; Peter Burnell, *Climate Change and Democratization* (Berlin: Heinrich Böll Stiftung, 2009), p. 40.
26. See, for example, Thomas E. Mann and Norman J. Ornstein, *It’s Even Worse than It Looks* (New York: Basic Books, 2012), Theda Skocpol and Vanessa Williamson, *The Tea Party and the Remaking of Republican Conservatism* (New York: Oxford University Press, 2012), and Jill Lepore, *The Whites of Their Eyes* (Princeton, NJ: Princeton University Press, 2010); Frank Bryan, *Real Democracy* (Chicago: University of Chicago Press, 2004), p. 294; see also Robert Dahl and Edward Tufte, *Size and Democracy* (Stanford, CA: Stanford University Press, 1973).
27. Richard M. Weaver, *Ideas Have Consequences* (Chicago: University of Chicago Press, 1984), p. 127; Jean M. Twenge and W. Keith Campbell, *The Narcissism Epidemic* (New York: The Free Press, 2009), p. 276.
28. Naomi Klein, *Shock Doctrine: The Rise of Disaster Capitalism* (New York: Metropolitan Books, 2007); see also Corey Robin, *Fear: The History of a Political Idea* (New York: Oxford University Press, 2004).
29. Rothkopf, op. cit. note 11; see also International Forum on Globalization, *Outing the Oligarchy: Billionaires Who Benefit from Today’s Climate Crisis* (San Francisco: 2011).
30. Josh Bivens, “Inequality, Exhibit A: Walmart and the Wealth of American Families” (blog), Economic Policy Institute, 17 July 2012; Richard Wilkinson and Kate Pickett, *The Spirit Level: Why Equality is Better for Everyone* (London: Penguin Books, 2010); Jeffrey Winters, *Oligarchy* (Cambridge, U.K.: Cambridge University Press, 2011), pp. 284–85.
31. Lewis Mumford, *The Myth of the Machine: The Pentagon of Power* (New York: Harcourt, Brace, Jovanovich, 1970), pp. 413, 434.
32. Gar Alperovitz, *America Beyond Capitalism* (Takoma Park, MD: Democracy Collaborative Press, 2011); Gar Alperovitz, “Anchoring Wealth to Sustain Cities and Population Growth,” *Solutions*, July 2012; James Gustave Speth, *America the Possible: Manifesto for a New Economy* (New Haven, CT: Yale University Press, 2012); Michael H. Shuman, *Going Local* (New York: Routledge, 2000); Michael H. Shuman, *Local Dollars, Local Sense* (White River Junction, VT: Chelsea Green, 2012); Greg Pahl, *Power from the People* (White River Junction, VT: Chelsea Green, 2012); Jeff Gates, *Democracy at Risk* (Cambridge, MA: Perseus, 2000).
33. William McDonough and Michael Braungart, *Cradle to Cradle* (New York: North Point Press, 2002); Janine Benyus, *Biomimicry: Innovation Inspired by Nature* (New York: William Morrow, 1996); John Lyle, *Regenerative Design for Sustainable Development* (New York: John Wiley, 1994); John R. Ehrenfeld, *Sustainability by Design* (New Haven, CT: Yale University Press, 2008); Rob Hopkins, *The Transition Handbook* (Totnes, U.K.: Greenbooks, 2008); Rob Hopkins, *The Transition Companion* (White River Junction, VT: Chelsea Green, 2011). Box 26–2 based on National Environmental Policy Act, at [ceq.hss.doe.gov/laws\\_and\\_executive\\_orders/the\\_nepa\\_statute.html](http://ceq.hss.doe.gov/laws_and_executive_orders/the_nepa_statute.html), and on David W. Orr, *The Oberlin Project: A Clinton Climate Initiative Climate Positive Project* (Oberlin, OH: undated).
34. For more on these issues, see Ron Rosenbaum, *How the End Begins: The Road to a Nuclear World War III* (New York: Simon & Schuster, 2011); Peter Barnes, *Capitalism 3.0* (San Francisco: Barrett-Koehler, 2006); Burns Weston and David Bollier, *Green Governance: Ecological Survival, Human Rights, and the Commons* (Cambridge, U.K.: Cambridge University Press, 2013); Tim Jackson, *Prosperity without Growth* (London: Earthscan, 2009); Peter Victor, *Managing without Growth: Slower by Design, Not Disaster* (Northampton, MA: Edward Elgar, 2008); Peter G. Brown, *Restoring the Public Trust* (Boston: Beacon Press, 1994), pp. 71–91; Peter G. Brown, *The Commonwealth*

of Life, 2nd ed. (Montreal: Black Rose Books, 2008); Steven Pinker, *The Better Angels of Our Nation: Why Violence Has Declined* (New York: Viking, 2011); Harald Welzer, *Climate Wars: Why People Will be Killed in the 21st Century* (Cambridge, U.K.: Polity Press, 2012).

35. Jared Diamond, *Collapse: How Societies Choose to Fail or Succeed* (New York: Viking, 2005), p. 438.

## Chapter 27. Building an Enduring Environmental Movement

1. Berg quoted in Bill Devall and George Sessions, *Deep Ecology: Living as if Nature Mattered* (Layton, UT: Gibbs Smith, 1985), p. 3.

2. Michael Shellenberger and Ted Nordhaus, *The Death of Environmentalism* (Oakland, CA: Breakthrough Institute, 2004); Tom Crompton, *Weathercocks and Signposts: The Environment Movement at a Crossroads* (Godalming, U.K.: WWF-UK, 2008).

3. Shellenberger and Nordhaus, op. cit. note 2, pp. 7, 8.

4. Crompton, op. cit. note 2.

5. Michael Narberhaus, “Breaking Out of the System Trap: Civil Society Organizations,” *Solutions Journal*, August 2012.

6. Jennifer Washburn, *University, Inc.* (New York: Basic Books, 2006); National Film Board of Canada, *Pink Ribbons, Inc.*, First Run Features, 2011; Christine MacDonald, *Green, Inc.* (Guilford, CT: The Lyons Press, 2008).

7. MacDonald, op. cit. note 6.

8. Ibid., pp. 25–28, 58–60; David B. Ottaway and Joe Stephens, “Nonprofit Land Bank Amasses Billions: Charity Builds Assets on Corporate Partnerships,” *Washington Post*, 4 May 2003.

9. DARA International, *Climate Vulnerability Monitor: A Guide to the Cold Calculus of a Hot Planet*, 2nd ed. (Washington, DC: 2012); Fiona Harvey, “Climate Change Is Already Damaging Global Economy, Report Finds,” (London) *Guardian*, 26 September 2012.

10. Anthony A. Leiserowitz and Lisa O. Fernandez, *Toward a New Consciousness: Values to Sustain Human and Natural Communities* (New Haven, CT: Yale School of Forestry & Environmental Studies, 2008).

11. Arne Naess, *The Ecology of Wisdom: Writings by Arne Naess* (Berkeley, CA: Counterpoint, 2010); Devall and Sessions, op. cit. note 1.

12. Palmer quoted in Helen Grady, “Using Religious Language to Fight Global Warming,” *BBC Radio 4*, 25 January 2010.

13. Havel quoted in James Gustave Speth, “Foreword,” in Leiserowitz and Fernandez, op. cit. note 10, p. 5.

14. Naess, op. cit. note 11, p. 111.

15. Aldo Leopold, *A Sand County Almanac* (New York: Oxford University Press, 1966), p. 262.

16. Naess, op. cit. note 11, p. 111.

17. Stewart J. Brown, “The Social Gospel in Britain, Germany, and the United States, 1870–1920,” Ecclesiastical History Course 2D at University of Edinburgh, 1998; Roy Hattersley, *Blood and Fire: William and Catherine Booth and Their Salvation Army* (New York: Doubleday, 2000).

18. *The YMCA Blue Book* (Geneva: World Alliance of YMCAs, 2012); YMCA, “Mission,” at [www.ymca.int/who-we-are/mission](http://www.ymca.int/who-we-are/mission); Salvation Army USA, *The Salvation Army 2012 Annual Report* (2012); Hattersley, op. cit. note 17; The Salvation Army International, “About Us,” at [www.salvationarmy.org/ihq/about](http://www.salvationarmy.org/ihq/about).

19. Erik Assadourian, “The Living Earth Ethical Principles: Spreading Community,” *World Watch Magazine*, September/October 2009, pp. 38–39; Knights of Columbus, “Knights of Columbus Tops \$80 Billion of Life Insurance in Force,” press release (New Haven, CT: 21 April 2011).

20. Box 27–1 based on *Ken Burns’ America: The Shakers*, Public Broadcasting System, 1985.

21. Brook P. Hales, “Statistical Report, 2011,” *Ensign*, May 2012; The Church of Jesus Christ of Latter-day Saints,



“One Million Missionaries, Thirteen Million Members,” press release (Provo, UT: 25 June 2007).

22. Isaiah Thompson, “Idealists for Hire,” *Philadelphia City Paper*, 11 August 2010; Dana R. Fisher, *Activism, Inc.* (Stanford, CA: Stanford University Press, 2006); Green Corps canvas operations, winter 2001, author’s observations.

23. Uzma Anzar, “Islamic Education: A Brief History of Madrassas With Comments on Curricula and Current Pedagogical Practices,” March 2003.

24. Population and area from Muchiri Karanja, “Myth Shattered: Kibera Numbers Fail to Add Up,” *Daily Nation*, 3 September 2010, and from Mikel Maron, “Kibera’s Census: Population, Politics, Precision,” *Map Kibera* (blog), 5 September 2010; school calculation based on Map Kibera’s education database at [www.mapkibera.org](http://www.mapkibera.org), viewed 11 December 2012, and on Mikel Maron, Map Kibera Trust, email to author, 11 December 2012.

25. Maron, email to author, op. cit. note 24.

26. Erik Assadourian, “The Living Earth Ethical Principles: Life of Service and Prepare for a Changing World,” *World Watch Magazine*, May/June 2009, pp. 34–35.

27. Erik Assadourian, “The Living Earth Ethical Principles: Right Diet and Renewing Life Rituals,” *World Watch Magazine*, November/December 2008, pp. 32–33; Sarah Catherine Walpole et al., “The Weight of Nations: An Estimation of Adult Human Biomass,” *BMC Public Health*, vol. 12 (2012), pp. 439–45.

28. Eduardo Porter, “Charity’s Role in America, and Its Limits,” *New York Times*, 13 November 2012.

29. Salvation Army USA, op. cit. note 18; Michael H. Shuman and Merrian Fuller, “Profits for Justice,” *The Nation*, 24 January 2005.

30. Friends World Committee for Consultation, *Finding Quakers Around the World* (Philadelphia: 2007); A. Glenn Crothers, *Quakers Living in the Lion’s Mouth* (Gainesville: University Press of Florida, 2012); see, for example, American Friends Service Committee, at [afsc.org/afsc-history](http://afsc.org/afsc-history).

31. Box 27–2 based on the following: Gary Gardner, “Engaging Religions to Shape Worldviews,” in Worldwatch Institute, *State of the World 2010* (New York: W. W. Norton & Company, 2010), pp. 23–29; Sarvodaya from Gary Gardner, *Invoking the Spirit* (Washington, DC: Worldwatch Institute, 2002), pp. 38–42.

32. Potsdam Institute for Climate Impact Research and Climate Analytics, *Turn Down the Heat: Why a 4°C Warmer World Must Be Avoided* (Washington, DC: World Bank, 2012).

33. Walter M. Miller, Jr., *A Canticle for Leibowitz* (Philadelphia: Lippincott, 1959).

34. “A Wild Love for the World,” Joanna Macy interview by Krista Tippett, *On Being*, American Public Media, 1 November 2012.

## Chapter 28. Resistance: Do the Ends Justify the Means?

1. “The Religion and Politics of Earth First!,” *The Ecologist*, November/December 1991, pp. 258–66; “Radical Environmentalism” and “Earth First! and the Earth Liberation Front,” in Bron Taylor, ed., *The Encyclopedia of Religion and Nature* (New York: Continuum, 2005), vol. 2, pp. 1,326–35, and vol. 1, pp. 518–24; Bron Raymond Taylor, ed., *Ecological Resistance Movements: The Global Emergence of Radical and Popular Environmentalism* (Albany: State University of New York Press, 1995).

2. Derrick Jensen and Lierre Keith, *Earth at Risk* (video), at PMPress/Flashpoint, 2012; Deep Green Resistance, at [deepgreenresistance.org](http://deepgreenresistance.org); Aric McBay, Lierre Keith, and Derrick Jensen, *Deep Green Resistance: Strategy to Save the Planet* (New York: Seven Stories Press, 2011).

3. For an example of radical prescriptions, see Alex Budd, “Time is Short: Systems Disruption and Strategic Militancy,” *DGR (Dark Green Resistance) News Service*, 24 October 2012; for an influential anti-pacifism statement in 1994, see Ward Churchill, “Pacifism as Pathology,” in *Pacifism as Pathology: Reflections on the Role of Armed Struggle in North America* (Oakland, CA: AK Press, 2007).

4. Bron Taylor, “Environmental Ethics,” in Taylor, *Encyclopedia*, op. cit. note 1, vol. 1, pp. 597–606.

5. Bron Taylor, *Dark Green Religion: Nature Spirituality and the Planetary Future* (Berkeley: University of California Press, 2010).

6. James C. Scott, *Weapons of the Weak: Everyday Forms of Peasant Resistance* (New Haven, CT: Yale University Press, 1985); Ramachandra Guha, *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya* (Berkeley: University of California Press, 1989, expanded edition 2000).
7. Peter Galvin and Kieran Suckling, cofounders of the Center for Biological Diversity, discussion with author, 1 August 1992.
8. Donella H. Meadows, Jørgen Randers, and Dennis L. Meadows, *The Limits to Growth: The 30-Year Update* (White River Junction, VT: Chelsea Green Publishing Company, 2004); William Catton, *Overshoot: The Ecological Basis of Revolutionary Change* (Chicago: University of Illinois Press, 1980); Jared Diamond, *Collapse: How Societies Choose to Fail or Succeed* (New York: Viking, 2005).
9. For green anarchism, see John Zerzan, *Future Primitive* (Columbia, MO: C.A.L. Press, 1994); *Elements of Refusal* (Seattle, WA: Left Bank Books, 1988); John Zerzan, ed., *Against Civilization: Readings and Reflections*, 2nd ed. (Los Angeles, CA: Feral House, 2005); for a sense of the scale of such activism, see [greenanarchy.org/earthliberation](http://greenanarchy.org/earthliberation).
10. Steven Stoll, "Farm against forest," in M. L. Lewis, ed., *American Wilderness: A New History* (New York: Oxford University Press, 2007); Julie L. Lockwood and Michael L. McKinney, eds., *Biotic Homogenization* (New York: Springer, 2001); Jared Diamond, "The Worst Mistake in the History of the Human Race," *Discover*, May 1987, pp. 64–66; Jared Diamond, *Guns, Germs, and Steel* (New York: W. W. Norton & Company, 1997); Jim Mason, *An Unnatural Order: Uncovering the Roots of Our Domination of Nature and Each Other* (New York: Simon and Schuster, 1993); Paul Shepard, *Coming Home to the Pleistocene* (Washington, DC: Island Press, 1998); Clive Ponting, *A New Green History of the World: The Environment and the Collapse of Great Civilizations*, rev. ed. (New York: Penguin Books, 2007).
11. Kera Abraham, "Flames of Dissent" (five-part series), *Eugene Weekly*, 2006; Vanessa Grigoriadis, "The Rise and Fall of the Eco-Radical Underground," *Rolling Stone*, 10 August 2006, pp. 73–77, 100–07; "Operation Backfire," at [en.wikipedia.org/wiki/Operation\\_Backfire\\_\(FBI\)](http://en.wikipedia.org/wiki/Operation_Backfire_(FBI)).
12. For rules of radical activism, see Saul David Alinsky, *Rules for Radicals* (New York: Random House, 1971), and Bron Taylor, "Experimenting with Truth," in Steven Best and Anthony J. Nocella, eds., *Igniting a Revolution: Voices in Defense of the Earth* (Oakland, CA: AK Press, 2006), pp. 1–7; interviews with affected activists in Oregon and California, September and October 2011.
13. Joel E. Cohen, *How Many People Can the Earth Support?* (New York: W. W. Norton & Company, 1995); Garrett Hardin, *Living within Limits* (New York: Oxford University Press, 1993).
14. Bron Taylor, "Deep Ecology and Its Social Philosophy: A Critique," in E. Katz, A. Light, and D. Rothenberg, eds., *Beneath the Surface: Critical Essays on Deep Ecology* (Cambridge, MA: The MIT Press, 2000), pp. 269–99.
15. Taylor, *Ecological Resistance Movements*, op. cit. note 1; David Helvarg, *The War against the Greens* (San Francisco: Sierra Club Books, 1992); Andrew Rowell, *Green Backlash: Global Subversion of the Environmental Movement* (New York: Routledge, 1996).
16. Jeni Kendell and Eddie Buivids, *Earth First: The Struggle to Save Australia's Rainforest* (Sidney, Australia: ABC Enterprises, 1987); Paul Watson, "In Defense of Tree Spiking," *Earth First!* 10.8 (1989): pp. 8–9.
17. Mike Roselle, discussion with author, 8 March 1992; Mike Roselle, *Tree Spiker: From Earth First! to Lowbagging: My Struggles in Radical Environmental Action* (New York: St. Martin's Press, 2009).
18. "Hundreds Arrested at Protest Against Redwood Logging," *Los Angeles Times*, 16 September 1996.
19. David Harris, *The Last Stand: The War between Wall Street and Main Street over California's Ancient Redwoods* (New York: Times Books/Random House, 1995); Richard Widick, *Trouble in the Forest: California's Redwood Timber Wars* (Minneapolis: University of Minnesota Press, 2009); Bill Dawson, "Redwood Protests Ease amid Reports of Deal," *Houston Chronicle*, 17 September 1996.
20. Bron Taylor, "Earth First! Fights Back," *Terra Nova* 2.2, spring 1997, pp. 29–43; Nina Witoszek, Lars Trägårdh, and Bron Taylor, eds., *Civil Society in the Age of Monitory Democracy* (New York: Berghahn Books, 2013).
21. For the October 2011 ruling in *Wyoming v. United States Department of Agriculture*, see [caselaw.findlaw.com/us-10th-circuit/1583397.html](http://caselaw.findlaw.com/us-10th-circuit/1583397.html); "US Supreme Court Supports Clinton's Roadless Rule," at [pennfuture.blogspot](http://pennfuture.blogspot)

.com/2012/10/us-supreme-court-supports-clintons.html, and at wilderness.org/blog/roadless-rule-becomes-law-land.

22. Helvarg, op. cit. note 15; Will Potter, *Green Is the New Red: An Insiders Account of a Social Movement under Siege* (San Francisco: City Lights Books, 2011); Christian Parenti, *Tropic of Chaos: Climate Change and the New Geography of Violence* (New York: Nation Books, 2011).

23. On the changing political discourse, see Bron Taylor, “The Religion and Politics of Earth First!” *The Ecologist*, November/December 1991, pp. 258–66, and Taylor, *Ecological Resistance Movements*, op. cit. note 1; Lynne Davis, ed., *Alliances: Re/Envisioning Indigenous-Non-Indigenous Relationships* (Toronto, Canada: University of Toronto Press, 2010).

24. Martin Luther King, Jr., “Letter from Birmingham Jail,” in S. Jonathan Bass and Martin Luther King, *Blessed Are the Peacemakers* (Baton Rouge: Louisiana State University Press, 2001).

25. Mark Dragem, “NASA’s Hansen Arrested Outside White House at Pipeline Protest,” *Bloomberg*, 29 August 2011; see also www.350.org.

26. Henry David Thoreau, *The Annotated Walden*, ed. Philip Van Doren Stern (New York: Barnes and Noble, 1970), p. 153.

## Chapter 29. The Promises and Perils of Geoengineering

1. Box 29–1 based on Royal Society, *Geoengineering the Climate: Science, Governance and Uncertainty* (London: 2009), and on D. Keith, “Geoengineering the Climate: History and Prospects,” *Annual Review of Energy and the Environment*, vol. 25 (2000), pp. 245–84.

2. For an accessible discussion of geoengineering options, see J. Goodell, *How to Cool the Planet* (New York: Mariner Books, 2010); for an authoritative statement of the current state of geoengineering research, see The Royal Society, op. cit. note 1.

3. Intergovernmental Panel on Climate Change (IPCC), Expert Meeting on Geoengineering, Lima, Peru, 20–22 June 2011; U.S. government efforts from E. Kintisch, *Hack the Planet* (Hoboken, NJ: John Wiley & Sons, 2010), p. 12.

4. Holdren quoted in A. Jha, “Obama Climate Adviser Open to Geo-engineering to Tackle Global Warming,” (London) *Guardian*, 8 April 2009.

5. J. Fleming, *Fixing the Sky: The Checkered History of Weather and Climate Control* (New York: Columbia University Press, 2010).

6. L. Lane et al., eds., *Workshop Report on Managing Solar Radiation*, Ames Research Center, 18–19 November 2006 (Washington, DC: National Aeronautics and Space Administration, 2007).

7. J. Fleming, “The Climate Engineers: Playing God to Save the Planet,” *Wilson Quarterly*, spring 2007, p. 46.

8. P. Crutzen, “Albedo Enhancement by Stratospheric Sulfur Injections: A Contribution to Resolve a Policy Dilemma?” (essay), *Climatic Change*, August 2006, pp. 212, 217.

9. Periodic assessments from the IPCC available at www.ipcc.ch; a useful popular primer is B. McKibben, “Global Warming’s Terrifying New Math,” *Rolling Stone*, 2 August 2012.

10. IPCC, *Third Assessment Report: Climate Change 2001—Working Group III: Mitigation*, section 4.7.

11. Figure 29–1 designed by Isabelle Rodas.

12. A. Ridgwell et al., “Tackling Regional Climate Change by Leaf Albedo Bio-geoengineering,” *Current Biology*, vol. 19, no. 2 (2009), pp. 146–50; U.S. Department of Energy, “Secretary Chu Announces Steps to Implement Cool Roofs at DOE and Across the Federal Government,” press release (Washington, DC: 19 July 2010).

13. See C. Mims, “Albedo Yachts’ and Marine Clouds: A Cure for Climate Change?” *Scientific American*, 21 October 2009.

14. Gates Foundation from O. Dorell, “Can Whiter Clouds Reduce Global Warming?” *USA Today*, 11 June 2010; for what Ken Caldeira calls the “Pinatubo option,” see Kintisch, op. cit. note 3, p. 56.

15. A. Robock et al., “Benefits, Risks, and Costs of Stratospheric Geoengineering,” *Geophysical Research Letters*, vol. 36, L19,703 (2009); quote from Fleming, op. cit. note 7; helium-filled balloons from Crutzen, op. cit. note 8; J. Pierce et al., “Efficient Formation of Stratospheric Aerosol for Climate Engineering by Emission of Condensable Vapor from Aircraft,” *Geophysical Research Letters*, vol. 37, L18,805 (2010).
16. Crutzen, op. cit. note 8; N. Stern, *The Economics of Climate Change: The Stern Review* (Cambridge, U.K.: Cambridge University Press, 2007).
17. R. Angel, “Feasibility of Cooling the Earth with a Cloud of Small Spacecraft near the Inner Lagrange Point (L1),” *Proceedings of the National Academy of Sciences*, 14 November 2006, pp. 17,184–89.
18. Royal Society, op. cit. note 1; Carbon Engineering, at [www.carbonengineering.com](http://www.carbonengineering.com); Figure 29–2 designed by Isabelle Rodas.
19. Kintisch, op. cit. note 3; K. Roberts et al., “Life Cycle Assessment of Biochar Systems: Estimating the Energetic, Economic, and Climate Change Potential,” *Environmental Science & Technology*, vol. 44, no. 2 (2010), pp. 827–33.
20. C. Bahric, “Hungry Shrimp Eat Climate Change Experiment,” *New Scientist*, 25 March 2009.
21. IPCC, “Carbon Dioxide Capture and Storage: Summary for Policymakers,” Geneva, September 2005; Global CCS Institute, *The Global Status of CCS: 2012* (Canberra: 2012).
22. See Kintisch, op. cit. note 3, p. 117; G. Shaffer, “Long-term Effectiveness and Consequences of Carbon Dioxide Sequestration” (letter), *Nature Geoscience*, July 2010, pp. 464–67.
23. Fleming, op. cit. note 7, p. 48.
24. Quoted in A. Revkin, “Branson on the Power of Biofuels and Elders” (Dot Earth blog), *New York Times*, 15 October 2009; Virgin Earth Challenge, at [www.virgin.com/subsites/virginearth](http://www.virgin.com/subsites/virginearth).
25. Quoted in M. Specter, “The Climate Fixers,” *New Yorker*, 14 May 2012.
26. For earlier discussion of these categories, see S. Nicholson, “Intelligent Design? Unpacking Geoengineering’s Hidden Sacrifices,” in M. Maniates and J. Meyer, eds., *The Environmental Politics of Sacrifice* (Cambridge, MA: The MIT Press, 2010), pp. 271–92.
27. H. Petroski, *To Engineer Is Human: The Role of Failure in Successful Design* (New York: Vintage Books, 1985); see also H. Petroski, *Design Paradigms: Case Histories of Error and Judgment in Engineering* (Cambridge, U.K.: Cambridge University Press, 1994), and H. Petroski, *Success through Failure: The Paradox of Design* (Princeton, NJ: Princeton University Press, 2006).
28. R. Pielke, Jr., *The Climate Fix* (New York: Basic Books, 2010), p. 132.
29. H. Schmidt et al., “Solar Irradiance Reduction to Counteract Radiative Forcing from a Quadrupling of CO<sub>2</sub>: Climate Responses Simulated by Four Earth System Models,” *Earth System Dynamics*, vol. 3 (2012), pp. 63–78.
30. K. J. Anchukaitis et al., “Influence of Volcanic Eruptions on the Climate of the Asian Monsoon Region,” *Geophysical Research Letters*, vol. 37, L22703 (2010).
31. E. Tenner, *Why Things Bite Back: Technology and the Revenge of Unintended Consequences* (New York: Vintage Books, 1997).
32. H. Lamb, “Climate-Engineering Schemes to Meet a Climatic Emergency,” *Earth Science Reviews*, April 1971, p. 95.
33. Fleming, op. cit. 7, p. 60.
34. S. Brand, *Whole Earth Discipline: An Ecopragmatist Manifesto* (New York: Viking, 2009), p. 275; on the notion of sufficiency, see T. Princen, *The Logic of Sufficiency* (Cambridge, MA: The MIT Press, 2005).
35. L. Winner, *The Whale and the Reactor* (Chicago, IL: University of Chicago Press, 1986), p. 10; O. Edenhofer et al., eds., *IPCC Expert Meeting on Geoengineering: Meeting Report* (Potsdam, Germany: Potsdam Institute for Climate Impact Research, 2012), p. 4.
36. Quote from Kintisch, op. cit. note 3, p. 13.



37. M. Specter, “The First Geo-vigilante,” *New Yorker*, 18 October 2012.
38. Box 29–2 from “‘Oxford Principles’ Provide a Code of Conduct for Geoengineering Research,” press release (Oxford: Oxford Martin School, University of Oxford, 14 September 2011).
39. Box 29–3 from R. Olson, “Soft Geoengineering: A Gentler Approach to Addressing Climate Change,” *Environment*, September–October 2012, pp. 29–39.

### Chapter 30. Cuba: Lessons from a Forced Decline

1. Figure for 1990 from United Nations, *Millennium Development Goals Indicators*, at [mdgs.un.org/unsd/mdg/Data.aspx?cr=192](http://mdgs.un.org/unsd/mdg/Data.aspx?cr=192); 2009 data from International Energy Agency, *Key World Energy Statistics* (Paris: 2011).
2. “Cuba’s Special Period,” in Louis A. Pérez, Jr., in *Cuba: Between Reform & Revolution*, at [HistoryofCuba.com](http://HistoryofCuba.com); “Operation Mongoose,” Spartacus Educational, at [www.spartacus.schoolnet.co.uk/JFKmongoose.htm](http://www.spartacus.schoolnet.co.uk/JFKmongoose.htm); Thomas Blanton, “Annals of Blinksmanship,” *Wilson Quarterly*, summer 1997.
3. Minor Sinclair and Martha Thompson, *CUBA, Going Against the Grain: Agricultural Crisis and Transformation* (Boston: Oxfam America, 2001), p. 8; American Association for World Health, *Denial of Food and Medicine: The Impact of the U.S. Embargo on Health and Nutrition in Cuba, An Executive Summary* (Washington, DC: 1997), p. 1; Zoë Amerigian, “Radio and TV Marti Should be Prime Targets for Budget Cutters” (blog), Council on Hemispheric Affairs, 7 April 2011.
4. Amerigian, op. cit. note 3.
5. Sinclair and Thompson, op. cit. note 3, p. 8; Pan American Health Organization, “Health Situation Analysis and Trends Summary—Country Chapter Summary from *Health in the Americas, 1998*,” Washington, DC.
6. M. Franco et al., “Impact of Energy Intake, Physical Activity, and Population-wide Weight Loss on Cardiovascular Disease and Diabetes Mortality in Cuba, 1980–2005,” *American Journal of Epidemiology*, 15 December 2007, pp. 1,374–80; Manuel Franco et al., “Obesity Reduction and Its Possible Consequences: What Can We Learn from Cuba’s Special Period?” *Canadian Medical Association Journal*, 8 April 2008, pp. 1,032–34.
7. American Association for World Health, op. cit. note 3.
8. Pérez, Jr., op. cit. note 2; Dalia Acosta, “Transport-Cuba: Nearly There,” *Inter Press Service*, 17 March 2009.
9. Liliana Núñez Velis, “Taxicab Service in Cuba: A Civil Society Approach,” PowerPoint presentation, May 2011.
10. Sinclair and Thompson, op. cit. note 3, p. 9.
11. *Ibid.*, p. 10.
12. *Ibid.*, p. 4.
13. *Ibid.*, pp. 10, 18–19.
14. *Ibid.*, pp. 10, 13, 31.
15. Laurie Guevara-Stone, “La Revolución Energetica: Cuba’s Energy Revolution,” *Renewable Energy World Magazine*, April 2009, p. 2.
16. *Ibid.*
17. Mario Alberto Arrastía Avila, “Distributed Generation in Cuba: Part of a Transition Towards a New Energy Paradigm,” *Cogeneration and On-Site Power Production*, November–December 2008, pp. 61–65; Mario Alberto Arrastía Avila and Laurie Guevara-Stone, “Teaching Cuba’s Energy Revolution,” *Solar Today*, January/February 2009, p. 31.
18. “Hurricanes Have Added to the Woes of the Downturn,” *The Economist*, 30 December 2008; Miguel A. Altieri and Fernando R. Funes-Monzote, “The Paradox of Cuban Agriculture,” *Monthly Review*, January 2012.
19. Ivet González, “Abrupt Shift from Drought to Flooding in Central Cuba,” *Inter Press Service*, 30 May 2012; “Report on 2008 Hurricane Season in Cuba,” World Meteorological Organization, at [www.wmo.int/pages/prog/www/tcp/Meetings/HC31/documents/Doc.4.2.8\\_Cuba.doc](http://www.wmo.int/pages/prog/www/tcp/Meetings/HC31/documents/Doc.4.2.8_Cuba.doc); James Hansen, Makiko Sato, and Reto Ruedy,

“Perception of Climate Change,” *Proceedings of the National Academy of Sciences*, 6 August 2012.

20. Arrastía Avila, op. cit. note 17, p. 65; Mario Alberto Arrastía Avila, presentation to Global Exchange, Havana, Cuba, April 2012; Guevara-Stone, op. cit. note 15, p. 3.

21. Arrastía Avila, op. cit. note 17, p. 65.

22. Guevara-Stone, op. cit. note 15; Anita Snow, “Cuba to Restructure Electric Grid and Utilize Wind and Solar Power,” *Havana Journal*, 19 January 2006; Arrastía Avila, op. cit. note 17, p. 65.

23. Guevara-Stone, op. cit. note 15, pp. 5–6.

24. Marc Frank, “Cuban 2010 Oil Output Up, Natural Gas Down,” *Reuters*, 13 June 2011; “Cuba–Venezuela Relations,” *Wikipedia*, viewed June 2012.

25. Arrastía Avila, op. cit. note 17, p. 65.

26. Table 30–1 from International Energy Agency, *2011 Key Energy Statistics* (Paris: 2011).

27. Peter G. Bourne, “Public Health in Cuba,” PowerPoint presentation, at [www.pitt.edu/~super7/9011-10001/9881.ppt](http://www.pitt.edu/~super7/9011-10001/9881.ppt).

28. “Physicians Density” and “Hospital Bed Density,” in Central Intelligence Agency (CIA), *CIA World Factbook*, at [www.cia.gov](http://www.cia.gov); “Health Statistics: Physicians > per 1,000 People (1960) by Country,” NationMaster.com; Conner Gorry, Marcio Ulises, Estrada Paneque, “Global Health, Cuban Health Cooperation and Disasters,” *MEDICC Review*, chart 8, at [www.pitt.edu/~super4/lecture/lec32661/index.htm](http://www.pitt.edu/~super4/lecture/lec32661/index.htm).

29. Save the Children, *State of the World’s Mothers 2012* (Westport, CT: 2012).

30. “Education Expenditures” and “School Life Expectancy,” in CIA, op. cit. note 28; World Bank quote from Lavinia Gasperini, *The Cuban Education System: Lessons and Dilemmas* (Washington, DC: World Bank, July 2000). Box 30–1 based on the following: “Cuba’s Special Period,” op. cit. note 2; Ministry of Foreign Affairs of Cuba, “Cuba at a Glance: Social Organizations,” at [www.cubaminrex.cu/english/LookCuba/Articles/Others/2005/040005.html](http://www.cubaminrex.cu/english/LookCuba/Articles/Others/2005/040005.html); Isaac Saney, *Cuba—A Revolution in Motion* (Winnipeg, Canada: Fernwood Publishing, 2004), pp. 65–67; Rachel Bruhnke, email to authors, 23 October 2012; Faith Morgan, “The Power of Community: How Cuba Survived Peak Oil,” documentary, Community Solutions, Yellow Springs, OH, 2006; authors’ interviews with Cubans.

31. Altieri and Funes-Monzote, op. cit. note 18.

32. Ibid.

33. Ibid.; Sinclair and Thompson, op. cit. note 3, p. 33.

34. Agri-Food Trade Service, “Agri-Food: Past, Present and Future Report Cuba,” Agriculture and Agri-Food Canada, March 2012; Altieri and Funes-Monzote, op. cit. note 18.

35. Altieri and Funes-Monzote, op. cit. note 18; Sinclair and Thompson, op. cit. note 3, p. 43.

36. “Total Fertility Rate,” in CIA, op. cit. note 28; CIA, op. cit. note 28, pp. 168, 694; Country Templates for Cuba and United States, *CIA Factbook*, at [www.cia.gov/library/publications/the-world-factbook](http://www.cia.gov/library/publications/the-world-factbook); Melissa Healy, “Obesity in U.S. Projected to Grow, Though Pace Slows: CDC study,” *Los Angeles Times*, 7 May 2012; Eric A. Finkelstein et al., “Obesity and Severe Obesity Forecasts Through 2030,” *American Journal of Preventive Medicine*, June 2012, pp. 563–70.

37. Jorge Pérez et al., *Approaches to the Management of HIV/AIDS in Cuba: Case Study* (Geneva: World Health Organization, 2004); Cuba and United States Comprehensive Indicator Reports, *HIV InSite*, University of California, San Francisco, at [hivinsite.ucsf.edu](http://hivinsite.ucsf.edu).

38. WWF, *Living Planet Report 2006* (Gland, Switzerland: 2006).

39. Castro quote from Mario Alberto Arrastía Ávila, “Cuba: Energy and Development,” PowerPoint presentation, at [www.agdf.org.au/documents/item/15](http://www.agdf.org.au/documents/item/15); Roberto Pérez Rivero, PEACB-FANJ Director, discussion with authors, June 2012; Pat Murphy, *Plan C: Community Survival Strategies for Peak Oil and Climate Change* (Gabriola Island, Canada: New Society Publishers, 2008).

40. Arrastía Avila quote in Guevara-Stone, op. cit. note 15, p. 7.

## Chapter 31. Climate Change and Displacements

1. Robert F. Worth, “Earth Is Parched Where Syrian Farms Thrived,” *New York Times*, 13 October 2010.
2. Ibid.; Wadid Erian, Bassem Katlan, and Ouldbdey Babah, *Drought Vulnerability in the Arab Region: Special Case Study: Syria*, contributed to the Global Assessment Report on Disaster Risk Reduction 2011 (2010); Francesco Femia and Caitlin Werrell, “Syria: Climate Change, Drought and Social Unrest” (blog), Center for Climate and Security, 29 February 2012.
3. Femia and Werrell, op. cit. note 2.
4. Emissions gap from U.N. Environment Programme (UNEP), *The Emissions Gap Report 2012: A UNEP Synthesis Report* (Nairobi: 2012); Potsdam Institute for Climate Impact Research and Climate Analytics, *Turn Down the Heat: Why a 4°C Warmer World Must Be Avoided* (Washington, DC: World Bank, 2012).
5. Intergovernmental Panel on Climate Change, *First Assessment Report* (Cambridge, U.K.: Cambridge University Press, 1990), p. 20.
6. Alex de Sherbinin, Koko Warner, and Charles Ehrhart, “Casualties of Climate Change: Sea-level Rises Could Displace Tens of Millions,” *Scientific American*, January 2011.
7. Short-distance, temporary from Frank Laczko and Christine Aghazarm, eds., *Migration, Environment and Climate Change: Assessing the Evidence* (Geneva: International Organization for Migration (IOM), 2009), p. 23; Hurricane Katrina impact from Susan L. Cutter, “CSI: The Katrina Exodus,” Foresight Project, Migration and Global Environmental Change, U.K. Government, October 2011, p. 6.
8. F. Renaud et al., “Control, Adapt or Flee. How to Face Environmental Migration?” *InterSecTions No. 5* (2007), p. 24.
9. Estimate of 135 million from “The Almeria Statement on Desertification and Migration,” International Symposium on Desertification and Migrations, 9–11 February 1994, Almeria, Spain; water shortage impacts from Vikram Odedra Kolmannskog, *Future Flood of Refugees: A Comment on Climate Change, Conflict and Forced Migration* (Oslo: Norwegian Refugee Council, 2008), p. 15.
10. Drought from Vikas Bajaj, “Crops in India Wilt in a Weak Monsoon Season,” *New York Times*, 3 September 2012; World Meteorological Organization from “With Drought Intensifying Worldwide, UN Calls for Integrated Climate Policies,” *UN News*, 21 August 2012; impacts in a 4-degrees warmer world from Actionaid et al., *Into Unknown Territory: The Limits to Adaptation and Reality of Loss and Damage from Climate Impacts* (Bonn: 2012), p. 7.
11. Impacts on household income from Laczko and Aghazarm, op. cit. note 7, pp. 3–4.
12. Figure 31–2 is based on U.N. Food and Agriculture Organization, “FAO Food Price Index,” at [www.fao.org/world/foodsituation/wfs-home/foodpricesindex/en](http://www.fao.org/world/foodsituation/wfs-home/foodpricesindex/en), viewed 19 October 2012; Marco Lagi, Karla Z. Bertrand, and Yaneer Bar-Yam, *The Food Crises and Political Instability in North Africa and the Middle East* (Cambridge, MA: New England Complex Systems Institute, 2011).
13. Coastal population from Kolmannskog, op. cit. note 9, p. 16; Bangladesh from Actionaid et al., op. cit. note 10, p. 9; India and Vietnam from de Sherbinin, Warner, and Ehrhart, op. cit. note 6.
14. Laczko and Aghazarm, op. cit. note 7, p. 24; need for resources and social networks from François Gemenne, “Climate-Induced Population Displacements in a 4 C+ World,” *Philosophical Transactions of the Royal Society*, January 2011, p. 188.
15. Chris Bright, “Anticipating Environmental ‘Surprise,’” in Lester R. Brown et al., *State of the World 2000* (New York: W. W. Norton & Company, 2000).
16. De Sherbinin, Warner, and Ehrhart, op. cit. note 6.
17. Ibid.
18. Box 31–1 based on the following: International Federation of Red Cross and Red Crescent Societies (IFRC), *World Disasters Report 2012* (Geneva: 2012), p. 15; United Nations Office for the Coordination of Humanitarian Affairs (OCHA) and Internal Displacement Monitoring Centre (IDMC), “42 Million Displaced by Sudden Natural

Disasters in 2010—Report,” press release (Geneva and Oslo: 6 June 2011); OCHA and IDMC, *Monitoring Disaster Displacement in the Context of Climate Change* (Geneva: 2009); Actionaid et al., op. cit. note 10, p. 9; IFRC, op. cit. this note, p. 14.

19. James Morrissey, “Rethinking the ‘Debate on Environmental Refugees’: From ‘Maximilists and Minimalists’ to ‘Proponents and Critics,’” *Journal of Political Ecology*, vol. 19 (2012), p. 36; Essam El-Hinnawi, *Environmental Refugees* (Nairobi: UNEP, 1985).

20. Gemenne, op. cit. note 14, p. 186.

21. Kolmannskog, op. cit. note 9, p. 9.

22. Table 31–1 from the following: refugee definition from U.N. High Commissioner for Refugees (UNHCR), “Convention Relating to the Status of Refugees,” at [www2.ohchr.org/english/law/refugees.htm](http://www2.ohchr.org/english/law/refugees.htm); internally displaced persons definition from U.N. Economic and Social Council, Commission on Human Rights, “Further Promotion and Encouragement of Human Rights and Fundamental Freedoms, Including the Question of the Programme and Methods of Work of the Commission Human Rights, Mass Exoduses and Displaced Persons,” 11 February 1998; definition of international migrants from IOM, “Identifying International Migrants,” at [www.iom.int/jahia/Jahia/about-migration/developing-migration-policy/identify-intl-migrants](http://www.iom.int/jahia/Jahia/about-migration/developing-migration-policy/identify-intl-migrants); proposed definition of environmental refugees from El-Hinnawi, op. cit. note 19; proposed definition of environmental migrants from Laczko and Aghazarm, op. cit. note 7, p. 19.

23. Renaud et al., op. cit. note 8; IFRC, op. cit. note 18, p. 18.

24. Kolmannskog, op. cit. note 9, p. 13; Oli Brown, *Climate Change and Forced Migrations: Observations, Projections and Implications*, Occasional Paper 2007/17 (New York: Human Development Report Office, U.N. Development Programme (UNDP), 2007), p. 15.

25. Brown, op. cit. note 24, p. 13.

26. World Bank and higher estimates from Actionaid et al., op. cit. note 10, p. 11; inadequate funding from UNDP, *Human Development Report 2007/2008* (New York: Palgrave Macmillan, 2007), p. 189.

27. UNHCR, *State of the World’s Refugees 2012* (Geneva: 2012); Alister Doyle, “World Needs Refugee Re-think for Climate Victims: U.N.,” *Reuters*, 6 June 2011.

## Chapter 32. Cultivating Resilience in a Dangerous World

1. “Haiti Raises Quake Death Toll on Anniversary,” *CBC News*, 12 January 2011; “Japan Earthquake and Tsunami of 2011,” *Encyclopedia Britannica*, at [www.britannica.com](http://www.britannica.com); U.N. Food and Agriculture Organization, “New Crisis in the Sahel Region,” at [www.fao.org/crisis/sahel](http://www.fao.org/crisis/sahel); U.S. Department of Agriculture, Economic Research Service, “U.S. Drought 2012: Farm and Food Impacts,” at [www.ers.usda.gov/newsroom/us-drought-2012-farm-and-food-impacts.aspx](http://www.ers.usda.gov/newsroom/us-drought-2012-farm-and-food-impacts.aspx).

2. Center for Research on the Epidemiology of Disasters, *EmDat: The International Disaster Database*, at [www.emdat.be/sites/default/files/Trends/natural/world\\_1900\\_2011/affyr1.jpg](http://www.emdat.be/sites/default/files/Trends/natural/world_1900_2011/affyr1.jpg); Munich Re, “Greater Uncertainty a Challenge to the Insurance Market—Munich Re Well Positioned,” press release (Munich: 24 October 2011).

3. U.N. Population Division, *The World at Six Billion* (New York: 1998); U.N. Population Division, *World Population Prospects: The 2011 Revision* (New York: 2011); Angus Maddison, *Historical Statistics of the World Economy*, online database, at [www.ggdcd.net/maddison/Horizontal.../horizontal-file\\_02-2010.xls](http://www.ggdcd.net/maddison/Horizontal.../horizontal-file_02-2010.xls).

4. Intergovernmental Panel on Climate Change, *Climate Change 2007: Synthesis Report, Summary for Policymakers* (Geneva: 2007); Millennium Ecosystem Assessment, *Ecosystems and Human Well-Being: Synthesis* (Washington, DC: Island Press, 2005); Hansen quoted in “Tradition Circle of Indian Elders and Youth” (blog), Haudenosaunee Task Force, 2 August 2010.

5. World Economic Forum, *Global Risks 2011* (Geneva: 2011), p. 10.

6. For guides to this body of research, see Brian Walker and David Salt, *Resilience Thinking* (Washington, DC: Island Press, 2006), and Brian Walker and David Salt, *Resilience Practice* (Washington, DC: Island Press, 2012); Lance H. Gunderson and C. S. Holling, eds., *Panarchy: Understanding Transformations in Human and Natural*



*Systems* (Washington DC: Island Press, 2002); for national security applications, the Community and Regional Resilience Institute, a joint effort of the Department of Homeland Security and Oak Ridge National Laboratory, is incorporating resilience thinking into disaster preparedness; notable efforts to assess and cultivate social resilience include the Building Resilient Regions project at the University of California and the Project on Resilience and Security at Syracuse University; for research in psychological resilience, see publications of Ann S. Masten, University of Minnesota, at [www.experts.scival.com/umn/expertPubs.asp?n=Ann+S+Masten&u\\_id=1809](http://www.experts.scival.com/umn/expertPubs.asp?n=Ann+S+Masten&u_id=1809).

7. Carl Folke et al., “Regime Shifts, Resilience and Biodiversity in Ecosystem Management,” *Annual Review of Ecology, Evolution and Systematics*, December 2004, pp. 557–81. Box 32–1 from the following: Svalbard Global Seed Vault, at [www.nordgen.org/sgsv/index.php?page=welcom](http://www.nordgen.org/sgsv/index.php?page=welcom); Global Crop Diversity Trust, at [www.croptrust.org](http://www.croptrust.org); Global Crop Diversity Trust, “Amaranth Grain from Ancient Aztecs, Barley Used by Modern Craft Beer Brewers, and Wheat from Pamir Mountains in Tajikistan, Among New Shipments to Arctic Seed Vault,” press release (Longyearbyen, Norway: February 2012); Nordic Genetic Resource Center, at [www.nordgen.org/index.php/en](http://www.nordgen.org/index.php/en).

8. Kevin Bullis, “How Power Outages in India May One Day Be Avoided,” *Technology Review India*, 31 July 2012; Che Biggs, Chris Ryan, and John Wiseman, “Distributed Systems: A Design Model for Sustainable and Resilient Infrastructure,” Victorian Eco-Innovation Lab, University of Melbourne, 2008.

9. John C. Mutter, “Voices: From Haiti to Japan: A Tale of Two Disaster Recoveries,” *Earth Magazine*, 9 March 2012; Richard H. Moss et al., *Vulnerability to Climate Change: A Quantitative Approach* (Washington, DC: Pacific Northwest National Laboratory, 2001).

10. Walker and Salt, *Resilience Practice*, op. cit. note 6; Sarah Pressman et al., “Loneliness, Social Network Size, and Immune Response to Influenza Vaccination in College Freshmen,” *Health Psychology*, May 2005, pp. 297–306; Daniel Aldrich, *Building Resilience: Social Capital in Post-Disaster Recovery* (Chicago: University of Chicago Press, 2012).

11. Katrina Brown and Elizabeth Westaway, “Agency, Capacity, and Resilience to Environmental Change: Lessons from Human Development, Well-Being, and Disasters,” *Annual Review of Environment and Resources*, 2011, pp. 321–42. Box 32–2 from the following: U.N. International Strategy for Disaster Reduction, “Women and Girls—the [in]Visible Force of Resilience,” at [www.unisdr.org/2012/iddr/about.html](http://www.unisdr.org/2012/iddr/about.html); New Course, *Women, Natural Resource Management, and Poverty* (Seattle, WA: undated); Elizabeth Frankenberg et al., “Mortality, the Family and the Indian Ocean Tsunami,” University of California Los Angeles, March 2011; Oxfam International, “The Tsunami’s Impact on Women,” Briefing Note, Oxford, U.K., March 2005; UN Women, “Women, Poverty & Economics,” at [www.unifem.org/gender\\_issues/women\\_poverty\\_economics](http://www.unifem.org/gender_issues/women_poverty_economics); World Bank, “Gender and Climate Change: 3 Things You Should Know,” at [go.worldbank.org/TN0KYRX8Q0](http://go.worldbank.org/TN0KYRX8Q0).

12. Doug Millen, “Deliberative Democracy in Disaster Recovery,” Centre for Citizenship and Public Policy, University of Western Sydney, 2011; Daron Acemoglu and James A. Robinson, *Why Nations Fail: The Origins of Power, Prosperity and Poverty* (New York: Random House, 2012).

13. Elinor Ostrom, *Governing the Commons* (Cambridge, U.K.: Cambridge University Press, 1990). Box 32–3 from the following: W. Neil Adger, “Social and Ecological Resilience: Are They Related?” *Progress in Human Geography*, September 2000, pp. 347–64; Saudamini Das and Jeffrey R. Vincent, “Mangroves Protected Villages and Reduced Death Toll during Indian Super Cyclone,” *Proceedings of the National Academy of Sciences*, 5 May 2009, pp. 7,357–60.

14. System resilience or vulnerability from Gunderson and Holling, op. cit. note 6.

15. Joan Stiles, “Neural Plasticity and Cognitive Development,” *Developmental Neuropsychology*, vol. 18, no. 2 (2002), pp. 237–72; Mike Celizic, “Meet the Girl with Half a Brain,” *NBC News*, 25 March 2010.

16. John Harte, “Numbers Matter: Human Population as a Dynamic Factor in Environmental Degradation,” in Laurie Mazur, ed., *A Pivotal Moment: Population, Justice and the Environmental Challenge* (Washington, DC: Island Press, 2009).

17. Ann Masten, “Ordinary Magic” (blog), *This Emotional Life*, PBS.

18. Fikret Berkes and Carl Folke, “Back to the Future: Ecosystem Dynamics and Local Knowledge,” in Gunderson and Holling, op. cit. note 6.

19. Example taken from Brian Walker, “Learning How to Change in Order Not to Change: Lessons from Ecology

for an Uncertain World,” lecture, University of Canberra, 20 February 2012.

20. Stephen Flynn, *The Edge of Disaster* (New York: Random House, 2007).

21. Betty Hearn Morrow, *Community Resilience: A Social Justice Perspective* (Oak Ridge, TN: Community and Regional Resilience Institute, 2008).

22. U.N. Population Division, *World Population Prospects: The 2010 Revision*, online database at [esa.un.org/unpd/wpp/unpp/panel\\_population.htm](http://esa.un.org/unpd/wpp/unpp/panel_population.htm); Malea Hoepf Young et al., “Adapting to Climate Change: The Role of Reproductive Health,” in Mazur, op. cit. note 16, pp. 108–23.

23. Patricia H. Longstaff et al., *Building Resilient Communities: Tools for Assessment* (Syracuse, NY: Syracuse University, Institute for National Security and Counterterrorism, Project on Resilience and Security, 2010); chapters on the Norse settlement of Greenland in Jared Diamond, *Collapse: How Societies Choose to Fail or Succeed* (New York: Viking Penguin, 2005).

24. Andrew Zolli and Ann Marie Healy, *Resilience: Why Things Bounce Back* (New York: Free Press, 2012), p. 259.

25. See, for example, Sami Grover, “Resilience vs. Sustainability,” *Treehugger*, 28 March 2011, and Jamais Cascio, “The Next Big Thing: Resilience,” *Foreign Policy*, 15 April 2009.

26. Tony Juniper, “Will 2012 be the Year of the ‘R’ Word?” (London) *Guardian*, 14 December 2011.

### Chapter 33. Shaping Community Responses to Catastrophe

1. Vahidin Omanovic, discussions with author, 1997–2002.

2. Vahidin Omanovic, discussion with author, July 2010.

3. Randall Kuhn, “Facts on the Seashore: Conflict, Population Displacement, and Coastal Vulnerability on the Eve of the Sri Lankan Tsunami,” Josef Korbel School of International Studies, University of Denver, 2009.

4. Joseph Sebarenzi, discussions with author, June 2012; Joseph Sebarenzi and Laura Mullane, *God Sleeps in Rwanda* (New York: Atria Books, 2009).

5. Mark Pelling, David Manuel-Navarrete, and Michael Redclift, *Climate Change and the Crisis of Capitalism: A Chance to Reclaim Self, Society and Nature* (London: Routledge, 2011); “Disaster Preparedness and Prevention (DPP): State of Play and Strategic Orientation for EC Policy,” European Commission of Humanitarian Aid Office, Brussels, 2011; John Vidal, “Global Warming Causes 300,000 Deaths a Year, says Kofi Annan Thinktank,” (London) *Guardian*, 29 May 2009.

6. Richard Heinberg, *Peak Everything: Waking Up to the Century of Declines* (Gabriola Island, Canada: New Society Publishers, 2012), p. 23; Robert Jay Lifton and Richard Falk, *Indefensible Weapons* (New York: Basic Books, 1982).

7. T. S. Eliot, *The Four Quartets* (New York: Mariner Books, 1968); Research & Degrowth, at [degrowth.org](http://degrowth.org).

8. Index Mundi, at [www.indexmundi.com](http://www.indexmundi.com); Christian Parenti, *Tropic of Chaos: Climate Change and the New Geography of Violence* (New York: Nation Books, 2011).

9. Kuhn, op. cit. note 3; Climate Change Knowledge Portal, “Sri Lanka Dashboard,” World Bank, at [sdwebx.worldbank.org/climateportalb](http://sdwebx.worldbank.org/climateportalb).

10. Victoria Transport Policy Institute, at [www.vtpi.org](http://www.vtpi.org).

11. Brendon Nafziger, “Weathering Hurricane Issac: Health Care Lessons Learned from Katrina,” *DOTmed News*, 11 September 2012.

12. Juliette Landphair, “The Forgotten People of New Orleans: Community Vulnerability, and the Lower Ninth Ward,” *Journal of American History*, December 2007, pp. 837–45; Karen J. Leong et al., “Resilient History and the Rebuilding of a Community: The Vietnamese American Community in New Orleans East,” *Journal of American History*, December 2007, pp. 770–79.

13. Eva Fogelman, *Conscience and Courage: Rescuers of Jews During the Holocaust* (New York: Anchor Books, 1995); PROOF: Media for Social Justice, at [proofmsj.com](http://proofmsj.com).

14. Kevin Ronan and David Johnston, *Promoting Community Resilience in Disasters: The Role for Schools, Youth, and Families* (New York: Springer Publishing, 2005).
15. Daniel P. Aldrich, *Building Resilience: Social Capital in Post-Disaster Recovery* (Chicago: University of Chicago Press, 2012); bus passengers in India from author's observations; Tamil Nadu from Daniel P. Aldrich, "How to Weather a Hurricane," *New York Times*, 28 August 2012.
16. "Office of Emergency Management," Seattle.gov, at [www.seattle.gov/emergency](http://www.seattle.gov/emergency); Ronan and Johnston, op. cit. note 14; Robert D. Putnam, *Bowling Alone: The Collapse and Revival of American Community* (New York: Simon & Schuster, 2001).
17. Ashutosh Varshney, *Ethnic Conflict and Civic Life: Hindus and Muslims in India* (New Haven, CT: Yale University Press, 2012).
18. Ken Belson, "Japanese Find Radioactivity on Their Own," *New York Times*, 31 July 2011; "Social Capital and Disaster Recovery," *Social Capital Blog*, 15 November 2011; Tina Gerhardt, "After Fukushima, Nuclear Power on Collision Course With Japanese Public," *Huff Post Green*, 26 July 2012.
19. Gerhardt, op. cit. note 18; Brendan Barret, "Japan Considers Green Future After Nuclear Disaster," *Aljazeera*, 11 February 2012.
20. Transition Putney 2.0, at [www.transitionputney.net](http://www.transitionputney.net); Transition Town TOTNES, at [www.transitiontowntotnes.org](http://www.transitiontowntotnes.org); quote from 3rd International Conference on Degrowth, Ecological Sustainability and Social Equity, Venice, 19–23 September 2012, at [www.venezia2012.it](http://www.venezia2012.it).
21. Amanda Ripley, *The Unthinkable: Who Survives When Disaster Strikes—and Why* (New York: Three Rivers Press, 2009); Ronan and Johnston, op. cit. note 14.
22. "Minneapolis Community Emergency Response Teams (CERT)," Minneapolis, at [www.minneapolismn.gov](http://www.minneapolismn.gov); "Community Readiness," Emergency Management Department, City of Los Angeles, at [emergency.lacity.org](http://emergency.lacity.org).
23. Donald E. Geis, "Creating Sustainable and Disaster Resistant Communities," *The Aspen Global Change Institute*, 10 July 1996.
24. Pauline W. Chen, "After the Tempest Passes, Easing the Trauma It Left," *New York Times*, 6 November 2012.
25. Environmental Translation Project, at [environmentaltranslation.org](http://environmentaltranslation.org); DeMond Shondell Miller and Jason David Rivera, *Comparative Emergency Management: Examining Global and Regional Responses to Disasters* (Boca Raton, FL: CRC Press, 2011).
26. Anouk Ride and Diane Bretherton, *Community Resilience in Natural Disasters* (Basingstoke, U.K.: Palgrave Macmillan, 2011).
27. World Bank, "Community Driven Development," at [web.worldbank.org](http://web.worldbank.org).
28. U.N. Environment Programme, "Disasters and Conflicts," fact sheet, Geneva, undated.
29. U.N. High Level Panel on Global Sustainability, *Resilient People, Resilient Planet* (New York: United Nations, 2012).

## Chapter 34. Is It Too Late?

1. Robert Socolow, "Wedges Reaffirmed," *Bulletin of the Atomic Scientists*, 27 September 2011.
2. Robert A. Dahl, *A Preface to Economic Democracy* (Berkeley: University of California Press, 1985).
3. Raymond Williams, *Marxism and Literature* (Oxford: Oxford University Press, 1977), pp. 121–27.
4. For more information on cliodynamics, see Peter Turchin, "Cliodynamics: History as Science," at [cliodynamics.info](http://cliodynamics.info).
5. Robert Costanza et al., "The Value of the World's Ecosystem Services and Natural Capital," *Nature*, 15 May 1997, pp. 253–60.