

הפניות והערות:

1. V. Bush, *Science-The Endless Frontier* (40th Anniversary Edition, NSF, Washington, DC, 1990).
2. Committee on Science, Engineering, and Public Policy, National Academy of Sciences, National Academy of Engineering, Institute of Medicine, *Science, Technology, and the Federal Government: National Goals for a New Era* (National Academy Press, Washington, DC, 1993); W. J. Clinton and A. Gore Jr., *Science in the National Interest* [Executive Office of the President, Office of Science and Technology Policy (OSTP), Washington, DC, 1994]; National Science and Technology Council, OSTP, *Technology for a Sustainable Future: A Framework for Action* [U.S. Government Printing Office (GPO), Washington, DC, 1994]; Committee on Criteria for Federal Support of Research and Development, National Academy of Sciences, National Academy of Engineering, Institute of Medicine, National Research Council, *Allocating Federal Funds for Science and Technology* (National Academy Press, Washington, DC, 1995); National Science and Technology Council (NSTC), Committee on Environment and Natural Resources, *Preparing for the Future Through Science and Technology: An Agenda for Environmental and Natural Resource Research* (NSTC, Washington, DC, 1995); Council on Competitiveness, *Endless Frontier, Limited Resources: U.S. R&D Policy for Competitiveness* (Council on Competitiveness, Washington, DC, 1996); National Science and Technology Council, OSTP, *Accomplishments of the National Science and Technology Council* (GPO, Washington, DC, 1996); Carnegie Commission on Science, Technology, and Government (CCSTG), *Federal Environmental Research and Development: Status Report with Recommendations* (CCSTG, New York, 1997); Energy Research and Development Panel (ERDP), President's Committee of Advisors on Science and Technology, *Federal Energy Research and Development for the Challenges of the Twenty-first Century* (ERDP, Washington, DC, 1997); Executive Office of the President, OSTP, *Science and Technology Shaping the Twenty-first Century* (OSTP, Washington, DC, 1997); J. H. Gibbons, *This Gifted Age: Science and Technology at the Millennium* (Springer-Verlag, New York, 1997); National Academy of Sciences, National Academy of Engineering, Institute of Medicine, National Research Council, "Preparing for the 21st Century," Rep. Ser. Nos. 1-6 (National Academy Press, Washington, DC, 1997); P. M. Smith and M. McGeary, *Issues in Science and Technology*, p. 33 (Spring 1997); A. H. Teich, S. D. Nelson, C. McEnaney, Eds., *AAAS Science and Technology Policy Yearbook 1996-97* (American Association for the Advancement of Science, Washington, DC, 1997).
3. S. Jasanoff, et al., *Science* 278, 2066 (1997)
 כתובת האינטרנט של הדיון האלקטרוני ביוזמת הוועד המנהל של ה-AAAS היא www.sciencemag.org/feature/data/aaasforum.shl.
4. P. M. Vitousek, H. A. Mooney, J. Lubchenco, J. M. Melillo, *ibid.* 277, 494 (1997).
5. L. W. Botsford, J. C. Castilla, C. H. Peterson, *ibid.*, p. 509; J. B. Hughes, G. C. Daily, P. R. Ehrlich, *ibid.* 278, 689 (1997); P. A. Matson, W. J. Parton, A. G. Power, M. J. Swift, *ibid.* 277,504 (1997)
6. F. S. Chapin III et al., *ibid.* 277, 500 (1997).
7. P. M. Vitousek, P. R. Ehrlich, A. H. Ehrlich, P. A. Matson, *Bioscience* 36, 368 (1986); R. W. Kates, B. L. Turner, W. C. Clark, in *The Earth as Transformed by Human Action*,

- B. L. Turner II *et al.*, Eds. (Cambridge Univ. Press, Cambridge, 1990), pp. 1-17; G. C. Daily, *Science* 269, 350 (1995)
8. D. S. Schimel *et al.*, in *Climate Change 1994: Radiative Forcing of Climate Change*, J. T. Houghton *et al.*, Eds. (Cambridge Univ. Press, Cambridge, 1995), pp. 39-71.
 9. P. M. Vitousek *et al.*, *Ecol. Appl.* 7, 737 (1997); J. N. Galloway, W. H. Schlesinger, H. Levy II, A. Michaels, J. L. Schnoor, *Global Biogeochem. Cycles* 9, 235 (1995).
 10. S. L. Postel, G. C. Daily, P. R. Ehrlich, *Science* 271, 785 (1996).
 11. S. L. Olson, in *Conservation for the Twenty-First Century*, D. Western and M. C. Pearl, Eds. (Oxford Univ. Press, Oxford, 1989), p. 50; D. W. Steadman, *Science* 267, 1123 (1995).
 12. Food and Agricultural Organization (FAO), *FAO Fish. Tech. Pap.* 335 (1994).
 13. S. Postel, *Defusing the Toxics Threat: Controlling Pesticides and Industrial Waste* (Worldwatch Institute, Washington, DC, 1987).
 14. United Nations Environment Programme (UNEP), *Saving Our Planet--Challenges and Hopes* (UNEP, Nairobi, Kenya, 1992).
 15. R. S. White, S. Jobling, S. A. Hoare, J. P. Sumpter, M. G. Parker, *Endocrinology* 185, 175 (1994); W. R. Kelce, *et al.*, *Nature* 375, 581 (1995); J. A. McLachlan and S. F. Arnold, *Am. Sci.* 84, 452 (1996); J. Toppari *et al.*, *Environ. Health Perspect.* 104 (suppl. 4), 741 (1996); P. M. Vonier, D. A. Crain, J. A. McLachlan, L. J. Guillette Jr., S. F. Arnold, *ibid.* (no. 12), p. 1318; F. vom Saal *et al.*, *Proc. Natl. Acad. Sci. U.S.A.* 94, 2056 (1997).
 16. Intergovernmental Panel on Climate Change, *Climate Change 1995* (Cambridge Univ. Press, Cambridge, 1996), pp. 9-49.
 17. F. S. Rowland, *Am. Sci.* 77, 36 (1989); S. Solomon, *Nature* 347, 347 (1990).
 18. J. H. Lawton and R. M. May, Eds., *Extinction Rates* (Oxford Univ. Press, Oxford, 1995); S. L. Pimm, G. J. Russell, J. L. Gittleman, T. M. Brooks, *Science* 269, 347 (1995).
 19. UNEP, *Global Biodiversity Assessment*, V. H. Heywood, Ed. (Cambridge Univ. Press, Cambridge, 1995).
 20. E.D. Schulze and H. A. Mooney, Eds., *Biodiversity and Ecosystem Function* (Springer, New York, 1994); H. A. Mooney, J. Lubchenco, R. Dirzo, O. E. Sala, Eds., section 5, in (19), pp. 278-325; section 6, in (19), pp. 328-452; H. A. Mooney, J. H. Cushman, E. Medina, O. E. Sala, E.D. Schulze, Eds., *Functional Roles of Biodiversity: A Global Perspective* (Wiley, New York, 1996).
 21. J. Lubchenco, *et al.*, *Ecology* 72, 371 (1991).
 22. P. Kennedy, *Preparing for the Twenty-First Century* (Random House, New York, 1993); J. A. McNeely, *Conservation and the Future: Trends and Options Toward the Year 2025* (IUCN, The World Conservation Union Biodiversity Policy Coordination Division, Gland, Switzerland, 1997).
 23. K. Arrow, *et al.*, *Science* 268, 520 (1995).
 24. G. Daily, Ed., *Nature's Services: Societal Dependence on Natural Ecosystems* (Island Press, Washington, DC, 1997).
 25. N. Myers, *Proc. Natl. Acad. Sci. U.S.A.* 93, 2764 (1996); Y. Baskin, *The Work of Nature: How the Diversity of Life Sustains Us* (Island Press, Washington, DC, 1997).
 26. R. Costanza, *et al.*, *Nature* 387, 253 (1997).
 27. G. Chichilnisky and G. Heal, *ibid.*, in press.
 28. G. C. Daily *et al.*, *Issues Ecol.* 2 (1997).

29. J. Lederberg, R. E. Shope, S. C. Oaks Jr., Eds., *Emerging Infections: Microbial Threats to Health in the United States* (National Academy Press, Washington, DC, 1992).
30. R. M. Anderson and R. M. May, *Infectious Diseases of Humans: Dynamics and Control* (Oxford Univ. Press, Oxford, 1991); A. P. Dobson and E. R. Carper, *Bioscience* 46, 115 (1996).
31. L. A. Real, *Bioscience* 46, 88 (1996).
32. A. Cruz-Marques, *Parasitol. Today* 3, 166 (1987); C. E. A. Coimbra, *Human Organ.* 47, 254 (1988); D. R. Sawyer, "Malaria and the Environment," *Working Paper No. 13* (Institute Sociedade, Populacas, e Natureza, Brasilia, 1992).
33. A. J. McMichael, A. Haines, R. Slooff, S. Kovats, Eds., *Climate Change and Human Health* (World Health Organization, Geneva, 1996).
34. P. M. Vitousek et al., *Issues Ecol.* 1 (1997).
35. G. M. Hallegraeff, *Phycologia* 32, 79 (1993); "ECO HAB: The Ecology and Oceanography of Harmful Algal Blooms: A National Research Agenda," Report from NSF- and National Oceanic and Atmospheric Administration-sponsored workshop, D. M. Anderson, Chair (Woods Hole Oceanographic Institution, Woods Hole, MA, 1995).
36. J. M. Burkholder, E. J. Noga, C. H. Hobbs, H. B. Glasgow Jr., *Nature* 358, 407 (1992); J. M. Burkholder, H. B. Glasgow Jr., C. H. Hobbs, *Mar. Ecol. Prog. Ser.* 124, 43 (1995); P. R. Epstein, *Am. J. Public Health* 85, 168 (1995); J. A. Patz, P. R. Epstein, T. A. Burke, J. M. Balbus, *J. Am. Med. Assoc.* 275, 217 (1996).
37. President's Council on Sustainable Development, *Sustainable America: A New Consensus for Prosperity, Opportunity, and a Healthy Environment for the Future* (GPO, Washington, DC, 1996).
38. S. Schmidheiny, with the Business Council for Sustainable Development, *Changing Course: A Global Business Perspective on Development and the Environment* (MIT Press, Cambridge, MA, 1992); P. Hawken, *The Ecology of Commerce: A Declaration of Sustainability* (Harper Business, New York, 1993); S. Schmidheiny and F. J. L. Zorraquin, with the World Business Council for Sustainable Development, *Financing Change: The Financial Community, Eco-Efficiency, and Sustainable Development* (MIT Press, Cambridge, MA, 1996).
39. UNEP, "UNEP statement of environmental commitment by the insurance industry" (UNEP, Geneva, 1996); "UNEP insurance initiative position paper on climate change" (UNEP, Geneva, 9 July 1996).
40. G. Daily, personal communication.
41. World Commission on Environment and Development, *Our Common Future* (Oxford Univ. Press, New York, 1987); "Earth Summit Agenda 21: The United Nations Programme of Action from Rio," U.N. Conference on Environment and Development, 3 to 14 June 1992, Rio de Janeiro, Brazil (United Nations, New York, 1992); *Global Change and the Human Prospect: Issues in Population, Science, Technology and Equity* (Sigma Xi, Research Triangle Park, NC, 1992).
42. J. T. Mathews, *Foreign Affairs* 68, 162 (1989); T. F. Homer-Dixon, *Int. Security* 16, 76 (1991); J. T. Mathews, "Nations and Nature: A New Look at Global Security," Twenty-First J. Robert Oppenheimer Memorial Lecture, Los Alamos, NM, 12 August 1991; N. Myers, *Ultimate Security: The Environmental Basis of Political Stability* (Norton, New York, 1993); T. F. Homer-Dixon, *Int. Security* 19, 5 (1994); R. D. Kaplan, *Atlantic Monthly* (Feb. 1994), p. 44; T. F. Homer-Dixon, Environmental Change and Security Project Report 2, 45 (1996); P. J. Simmons, *Environ. Change Security Proj. Rep.* 3, 1 (1997).

43. T. Homer-Dixon and V. Percival, *Environmental Scarcity and Violent Conflict: Briefing Book* (Project on Environmental Population and Security, AAAS, Washington, DC, 1996).
44. W. Christopher, "American Diplomacy and the Global Environmental Challenges of the 21st Century," address at Stanford University, 9 April 1996, reprinted in *Environ. Change Security Proj. Rep.* 2, 81 (1996).
45. U.S. Department of State, "Environmental Diplomacy: The Environment and U.S. Foreign Policy" (Department of State Pub. 10470, Washington, DC, 1997).
46. J. Pastor, personal communication.
47. J. F. Kennedy, address at the Anniversary Convocation of the National Academy of Sciences (22 October 1963).
48. E. Bloch, foreword in (1), pp. v-vi.
49. National Science Board, "Government Funding of Scientific Research," *Working Paper NSB-97-186* (1997).
50. Carnegie Commission on Science, Technology, and Government, *Environmental Research and Development: Strengthening the Federal Infrastructure* (CCSTG, New York, 1992); *International Environmental Research and Assessment: Proposals for Better Organization and Decision Making* (CCSTG, New York, 1992); J. C. I. Dooge et al., Eds., *An Agenda of Science for Environment and Development into the 21st Century* (Cambridge Univ. Press, Cambridge, 1992); National Commission on the Environment, *Choosing a Sustainable Future* (Island Press, Washington, DC, 1993); H. W. Kendall et al., "Meeting the Challenges of Population, Environment and Resources: The Costs of Inaction. A Report of the Senior Scientists' Panels," *Environmentally Sustainable Development Proceedings Ser. 14* (World Bank, Washington, DC, 1995); R. J. Naiman, J. J. Magnuson, D. M. McKnight, J. A. Stanford, Eds., *The Freshwater Imperative: A Research Agenda* (Island Press, Washington, DC, 1995).
51. Committee on Environmental Research, Commission on Life Sciences, National Research Council, *Research to Protect, Restore, and Manage the Environment* (National Academy Press, Washington, DC, 1993).
52. B. Watterson, *Calvin and Hobbes*, 17 May 1992, distributed by Universal Press Syndicate.
53. I thank B. Menge, M. Derr, the AAAS staff (especially R. Nicholson and G. Seiler), and the editors of *Science* for their assistance. I am grateful to S. Arnold, S. Carpenter, T. Chapin, G. Daily, J. Diamond, R. Dirzo, D. Epel, P. Farber, V. Plocq Fichelet, J. Gibbons, B. Goldberg, M. Green, M. Hixon, T. Janetos, S. Jasanoff, B. Johannes, E. Kelley, H. Kendall, C. King, J. Lash, G. Likens, M. Linn, O. Loucks, M. Mangel, J. Maienschein, T. Malone, B. McKay, B. Miller, H. Mooney, W. Murdoch, J. P. Myers, R. Naiman, R. Naylor, R. Noss, G. Omenn, B. Paine, J. Pastor, A. Petsonk, S. Pimm, S. Postel, W. Reid, P. Risser, C. Safina, E. Sanford, D. Simberloff, B. Singer, V. Spruill, K. Shine, C. Stimpson, D. Suzuki, D. Tilman, P. Vitousek, D. Wilcove, and D. Zare for constructive comments on early drafts of this paper and to the Andrew W. Mellon Foundation, the John D. and Catherine T. MacArthur Foundation, the Pew Charitable Trusts, and NSF for funding support.