

Contents

<i>Acknowledgements</i>	ix
<i>Series Preface</i> Kenneth Button and Peter Nijkamp	xiii
<i>Introduction</i> Robert U. Ayres, Kenneth Button and Peter Nijkamp	xvii

PART I ECOLOGICAL/BIOLOGICAL PERSPECTIVE: HUMAN IMPACTS ON BIOSPHERE, GAIA, ETC.

1. W.I. Vernadsky (1945), 'The Biosphere and the Noösphere', <i>American Scientist</i> , 33 (1), January, 1–12	3
2. G.E. Hutchinson (1948), 'On Living in the Biosphere', <i>Scientific Monthly</i> , LXVII (6), December, 393–7	15
3. Walter Isard (1968), 'Some Notes on the Linkage of the Ecologic and Economic Systems', <i>Papers of the Regional Science Association</i> , XXII , 85–96	20
4. Lester Machta (1972), 'The Role of the Oceans and Biosphere in the Carbon Dioxide Cycle', in David Dyrssen and Daniel Jagner (eds), <i>The Changing Chemistry of the Oceans: Proceedings of the Twentieth Nobel Symposium held 16–20 August, 1971 at Aspenäsgråden, Lerum and Chalmers University of Technology, Göteborg, Sweden</i> , New York: John Wiley, 121–45	32
5. James E. Lovelock and Lynn Margulis (1974), 'Atmospheric Homeostasis by and for the Biosphere: The Gaia Hypothesis', <i>Tellus</i> , XXVI (1–2), 2–9	57
6. M.J. Chadwick (1975), 'The Cycling of Materials in Disturbed Environments', in M.J. Chadwick and G.T. Goodman (eds), <i>The Ecology of Resource Degradation and Renewal</i> , Oxford: Blackwell Scientific Publications, 3–16	65
7. J.M. Wood and E.D. Goldberg (1977), 'Impact of Metals on the Biosphere', in Werner Stumm (ed.), <i>Global Chemical Cycles and their Alterations by Man</i> , Berlin: Dahlem Konferenzen, 137–53	79
8. Rudolf B. Husar and Janet M. Holloway (1983), 'Sulfur and Nitrogen over North America', in <i>Ecological Effects of Acid Deposition</i> , National Swedish Environment Protection Board, Report PM 1636, 95–115	96
9. William C. Clark (1989), 'The Human Ecology of Global Change', <i>International Social Science Journal</i> , 121 , August, 315, 317–21, 323–45	117
10. Paul P. Christensen (1989), 'Historical Roots for Ecological Economics – Biophysical versus Allocative Approaches', <i>Ecological Economics</i> , 1 , 17–36	146

11. Ann P. Kinzig and Robert H. Socolow (1994), 'Human Impacts on the Nitrogen Cycle', *Physics Today*, November, 24–31 166
12. Robert Costanza, Ralph d'Arge, Rudolf de Groot, Stephen Farber, Monica Grasso, Bruce Hannon, Karin Limburg, Shahid Naeem, Robert V. O'Neill, Jose Paruelo, Robert G. Raskin, Paul Sutton and Marjan van den Belt (1997), 'The Value of the World's Ecosystem Services and Natural Capital', *Nature*, **387**, 15 May, 253–60 174

PART II PHYSICAL ECONOMICS PERSPECTIVE: MATERIALS ENERGY, ENTROPY, MASS BALANCE

13. William D. Nordhaus (1973), 'The Allocation of Energy Resources', *Brookings Papers on Economic Activity*, **3**, 529–76 185
14. Clark W. Bullard, III and Robert A. Herendeen (1975), 'Energy Impact of Consumption Decisions', *Proceedings of the IEEE*, **63** (3), March, 276–85 233
15. Bruce Hannon (1975), 'Energy Conservation and the Consumer', *Science*, **189**, 11 July, 95–102 243
16. R.U. Ayres and M. Narkus-Kramer (1976), 'An Assessment of Methodologies for Estimating National Energy Efficiency', *ASME Winter Meeting*, 1–20 251
17. Nicholas Georgescu-Roegen (1976), 'Process Analysis and the Neoclassical Theory of Production' (Chapter 2) and 'The Economics of Production' (Chapter 4), in *Energy and Economics Myths. Institutional and Analytic Economic Essays*, New York: Pergamon Press, 37–52, 61–69 271
18. R. Stephen Berry, Peter Salamon and Geoffrey Heal (1978), 'On a Relation Between Economic and Thermodynamic Optima', *Resources and Energy*, **1** (2), October, 125–37 296
19. Nicholas Georgescu-Roegen (1979), 'Energy Analysis and Economic Valuation', *Southern Economic Journal*, **45** (3), January, 1023–58 309
20. Cutler J. Cleveland, Robert Costanza, Charles A.S. Hall and Robert Kaufmann (1984), 'Energy and the U.S. Economy: A Biophysical Perspective', *Science*, **225**, 31 August, 890–97 345
21. Robert U. Ayres (1989), 'Industrial Metabolism', in Jesse Ausubel and Hedy E. Sladovich (eds), *Technology and Environment*, Washington DC: National Academy Press, 23–49 353
22. R.U. Ayres and A.V. Kneese (1989), 'Externalities: Economics & Thermodynamics', in F. Archibugi and P. Nijkamp (eds), *Economy and Ecology: Towards Sustainable Development*, Chapter 6, Dordrecht: Kluwer, 89–118 380
23. Evan Mills, Deborah Wilson and Thomas B. Johansson (1991), 'Getting Started: No-Regrets Strategies for Reducing Greenhouse Gas Emissions', *Energy Policy*, **19**, July/August, 526–42 408

24. Herman E. Daly (1992), 'Is the Entropy Law Relevant to the Economics of Natural Resource Scarcity? – Yes, of course it is!', *Journal of Environmental Economics and Management*, **23** (1), July, 91–5 425
25. C. Bianciardi, A. Donati and S. Ulgiati (1993), 'On the Relationship between the Economic Process, the Carnot Cycle and the Entropy Law', *Ecological Economics*, **8**, 7–10 430
26. A. Azapagic and R. Clift (1995), 'Life Cycle Assessment and Linear Programming – Environmental Optimisation of Product System', *Computers and Chemical Engineering*, **19**, Supplement, S229–34 434
27. Sander de Bruyn, Jeroen van den Bergh and Hans Opschoor (1997), 'Structural Change, Growth, and Dematerialization: An Empirical Analysis', in Jeroen van den Bergh and Jan van der Straaten (eds), *Economy and Ecosystems in Change: Analytical and Historical Approaches*, Chapter 10, Cheltenham: Edward Elgar, 201–28 440
- Name Index* 469