

University of Groningen

Holism and reductionism in biology and ecology

Looijen, Richard

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version

Publisher's PDF, also known as Version of record

Publication date:

1998

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Looijen, R. (1998). *Holism and reductionism in biology and ecology: The mutual dependence of higher and lower level research programmes*. s.n.

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

REFERENCES

- Aarssen, L.W., 1983, Ecological combining ability and competitive combining ability in plants: toward a general evolutionary theory of coexistence in systems of competition. *Am. Nat.* 122: 707-731.
- Aarssen, L.W., 1984, On the distinction between niche and competitive ability: implications for coexistence theory. *Acta Biotheor.* 33: 67-83.
- Aarssen, L.W., 1985, Interpretation of evolutionary consequences of competition in plants: an experimental approach. *Oikos* 45: 99-109.
- Abbott, I., 1978, Factors determining the number of land bird species on island around southwestern Australia. *Oecologia* 33: 221-223.
- Abrams, P.A., 1977, Density independent mortality and interspecific competition: A test of Pianka's niche overlap hypothesis. *Am. Nat.* 111: 539-552.
- Abrams, P.A., 1980, Consumer functional response and competition in consumer-resource systems. *Theor. Pop. Biol.* 17: 80-102.
- Abrams, P.A., 1986, Character displacement and niche shift analyzed using consumer-resource models of competition. *Theor. Popul. Biol.* 29: 107-160.
- Abrams, P.A., 1987a, The nonlinearity of competitive effects in models of competition for essential resources. *Theor. Pop. Biol.* 32: 50-65.
- Abrams, P.A., 1987b, The functional responses of adaptive consumers of two resources. *Theor. Pop. Biol.* 32: 262-288.
- Abrams, P.A., 1988a, Resource productivity-consumer species diversity: simple models of competition in spatially heterogeneous environments. *Ecology* 69 (5): 1418-33.
- Abrams, P.A., 1988b, How should resources be counted? *Theor. Popul. Biol.* 33: 226-242.
- Achinstein, P., 1964, On the meaning of scientific terms. *J. Phil.* 61: 497-510.
- Achterberg, W. and W. Zweers, 1984, Environmental crisis and philosophy: Western consciousness and estranged nature. Ecological Publishers, Amsterdam (in Dutch).
- Achterberg, W. (ed.), 1989, Nature: exploitation or respect? Nature values in discussion. Kok/Agora, Kampen (in Dutch).
- Adams, C.C., 1913, Guide to the study of animal ecology. MacMillan, New York.
- Agazzi, E., 1991, The problem of reductionism in science. *Episteme* 18, Kluwer, Dordrecht.
- Alatalo, R.V., 1982, Bird species distributions in the Galapagos and other archipelagoes: competition or chance? *Ecology* 63: 881-887.
- Allee, W.C., A.E. Emerson, O. Park, T. Park and K.P. Schmidt, 1949, Principles of animal ecology. Saunders, Philadelphia.
- Alley, T.R., 1982, Competition theory, evolution, and the concept of an ecological niche. *Acta Biotheor.* 31: 165-179.
- American Naturalist, The, 1983 (122), Special on interspecific competition.
- Andel, J. van, J.P. Bakker and A.P. Grootjans, 1993, Mechanisms of succession: a review of concepts and perspectives. *Act. Bot. Neerl.* 42 (4): 413-433.
- Andrewartha, H.C., and L.C. Birch, 1954, The distribution and abundance of animals. University of Chicago Press, Chicago.
- Andrewartha, H.C., and L.C. Birch, 1984, The ecological web: more on the distribution and abundance of animals. University of Chicago Press, Chicago.
- Armstrong, R.A. and R. McGehee, 1976, Coexistence of species competing for shared resources. *Theor. Popul. Biol.* 9: 317-328.

References

- Armstrong, R.A. and R. McGehee, 1980, Competitive exclusion. *Am. Nat.* 115: 151-170.
- Arrhenius, O., 1921, Species and area. *J. Ecol.* 9: 95-99.
- Austin, M.P., R.B. Cunningham and P.M. Flemming, 1984, New approaches to direct gradient analysis using environmental scalars and statistical curve-fitting procedures. *Vegetatio* 55: 11-27
- Ayala, F., 1968, Biology as an autonomous science. *Am. Sci.* 56: 207-221.
- Ayala, F., 1974, Introduction. In: F. Ayala and T. Dobzhansky (eds.), 1974, *Studies in the philosophy of biology*. MacMillan, London: vii-xvi.
- Ayala, F. (ed.), 1976, *Molecular evolution*. Sinauer, Sunderland, Mass..
- Ayala, F. T. Dobzhansky (eds.), 1974, *Studies in the philosophy of biology*. MacMillan, London.
- Bakker, J.P., 1989, *Nature management by grazing and cutting*. Kluwer, Dordrecht. Thesis, Univ. of Groningen.
- Balzer, W. and C. Dawe, 1986, Structure and comparison of genetic theories. *Brit. J. Phil. Sci.* 37 (1): 55-69, and 37 (2): 177-191.
- Barbour, M.G., J.H. Burk and W.D. Pitts, 1980, *Terrestrial plant ecology*. The Benjamin/Cummings Publishing Company, California.
- Bazzaz, F.A., 1979, The physiological ecology of plant succession. *Ann. Rev. Ecol. Syst.* 10: 351-371.
- Bazzaz, F.A., 1982, Photosynthetic acclimation to variability in the light environment of early successional plants. *Oecologia (Berlin)* 54: 313-316.
- Bazzaz, F.A., 1986, Experimental studies on the evolution of niche in successional plant populations. In: A.J. Gray, M.J. Crawley, and P.J. Edwards (eds.), *Colonization, succession and stability*. Blackwell, Oxford: 245-273.
- Bechtel, W., 1986, The nature of scientific integration. In: W. Bechtel (ed.), *Integrating scientific disciplines*. Martinus Nijhoff, Dordrecht.
- Bechtel, W., 1988, *Philosophy of science: an overview for cognitive science*. Lawrence Erlbaum Ass. Inc., Hillsdale, New Jersey..
- Bechtel, W., 1993, Integrating sciences by creating new disciplines: the case of cell biology. *Biol. & Phil.* 8: 277-299.
- Beckner, M., 1968, *The biological way of thought*. Univ. Calif. Press, Berkeley and Los Angeles.
- Beckner, M., 1974, Reduction, hierarchies and organicism. In: F. Ayala and T. Dobzhansky (eds.), 1974, *Studies in the philosophy of biology*. MacMillan, London: 163-176.
- Begon, M., J.L. Harper, and C.R. Townsend, 1986 (third ed. 1996), *Ecology: individuals, populations and communities*. Blackwell Sci. Publ., Oxford.
- Begon, M. and M. Mortimer, 1981, *Population ecology: a unified study of animals and plants*. Blackwell Sci. Publ., Oxford.
- Bergson, H., 1911, *Creative evolution*. MacMillan, London.
- Bertalanffy, L. von, 1968, *General systems theory: foundations, developments, applications*. Brazilliar, New York.
- Beven, G., 1976, Changes in breeding bird populations of an oak-wood on Bookham Common, Surrey, over twenty-seven years. *London Naturalist* 55: 23-42.
- Blitz, D., 1992, *Emergent evolution: Qualitative novelty and the levels of reality*. Episteme 19, Kluwer, Dordrecht.

- Bock, W. and G. von Wahlert, 1965, Adaptation and the form-function complex. *Evol.* 19: 274.
- Bodenheimer, F.S., 1928, Welche Faktoren regulieren die Individuenzahl einer Insektenart in die Natur? *Biol. Zentralbl.* 48: 714-739.
- Bodenheimer, F.S., 1957, The concept of biotic organization in synecology. I. Ecological and philosophical approach. In: F.S. Bodenheimer (ed.), *Studies in biology and its history.* Biological Studies Publishers, Jerusalem: 75-90.
- Bodenheimer, F.S., 1958, *Animal ecology today.* Junk, The Hague.
- Boer, P. den and J. Reddingius, 1996, *Regulation and stabilization paradigms in population ecology.* Chapman and Hall, London.
- Bohm, D., 1980, *Wholeness and the implicate order.* Routledge and Kegan Paul, London.
- Boyd, D., 1974, *Rolling Thunder.* Dell Publ. Co., New York.
- Bowers, M.A. and J.H. Brown, 1982, Body size and coexistence in desert rodents: Chance or community structure? *Ecology* 63: 391-400.
- Braakhekke, W.G., 1980, On coexistence: a causal approach to diversity and stability in grassland vegetation. *Agric. Res. Rep.* 902. Pudoc, Wageningen.
- Braithwaite, R.B., *Scientific explanation.* Cambridge U.P., Cambridge.
- Brandon, R.N., 1981, Biological teleology: questions and answers. *St. Hist. Phil. Sci.* 12: 91-105.
- Brandon, R.N., 1990, *Adaptation and environment.* Princeton U.P., Princeton.
- Broad, C.D., 1925, *The mind and its place in nature.* Kegan Paul, Trench and trubner, London.
- Braun-Blanquet, J., 1928, *Pflanzensoziologie.* Springer, Berlin.
- Brown, J.H. and A. Kodrick-Brown, 1977, Turnover rates in insular biogeography: effect of immigration on extinction. *Ecol.* 58: 445-449.
- Brown, W.L. and E.O. Wilson, 1956, Character displacement. *Syst. Zool.* 5: 49-64.
- Brussaard, L., 1984, Recent developments in island biogeography. *Vakblad voor Biologen* 64 (7): 121-125 (in Dutch).
- Bunge, M., 1977, Levels and reduction. *Am. J. Physiol.* 233 (3): 75-82.
- Bunge, M., 1982, Is chemistry a branch of physics? *Zeitschr. Allg. Wiss.* 13: 209-223.
- Bunge, M., 1983, *Treatises on basic philosophy, vol. 5; Epistemology and methodology I: Exploring the world.* Reidel, Dordrecht.
- Campbell, D.T., 1974, 'Downward causation' in hierarchically organised biological systems. In: F. Ayala and T. Dobzhansky (eds.), 1974, *Studies in the philosophy of biology.* MacMillan, London: 179-186.
- Capra, F., 1975, *The Tao of physics.* Bantam Books, New york.
- Case, T. and R. Sidell, 1983, Pattern and chance in the structure of model and natural communities. *Evolution* 37: 832-849.
- Castri, F. di, A.J. Hansen and M.M. Holland (eds.), 1988, A new look at ecotones. *Emerging international projects on landscape boundaries.* *Biol. Int. Spec. Iss.* 17.
- Causey, R.L., 1972, Attribute-identities in microreductions. *Phil. Sci.* 69: 407-422.
- Causey, R.L., 1977, *Unity of science,* Reidel, Dordrecht.
- Cherrett, J.M. (ed.), 1989, *Ecological concepts.* Blackwell, Oxford.
- Chesson, P., A need for niches? *Trends Ecol. Evol.* 6: 26-28.
- Chitty, D., 1960, Population processes in the vole and their relevance to general theory. *Can.*

References

- J. Zool. 38: 99-113.
- Clements, F.E., 1916, Plant succession. Carnegie Inst., Washington, Publ. 242: 3-4.
- Clements, F.E., 1936, Nature and structure of the climax. J. Ecol. 24: 252-284.
- Clements, F.E., J.F. Weaver and H.C. Hanson, 1929, Plant competition. Carnegie Inst. Washington Publ. 398.
- Cody, M.L., 1989, Discussion: structure and assembly of communities. In: J. Roughgarden, R.M. May and S.A. Levin (eds.), Perspectives in ecological theory, Princeton U.P., Princeton, New Jersey: 227-241.
- Cohen, J.E., 1978, Food webs and niche space. Princeton U.P., Princeton.
- Cohen, J.E., 1989, Food webs and community structure. In: J. Roughgarden, R.M. May and S.A. Levin (eds.), Perspectives in ecological theory, Princeton U.P., Princeton, New Jersey: 181-202.
- Cole, L.C., 1957, Sketches of general and comparative demography. Cold Spring Harbour Symp. Quant. Biol. 22: 1-15.
- Colwell, R.K. and D.W. Winkler, 1984, A null model for null models in biogeography. In: D.R. Strong, D. Simberloff, L.G. Abele and A.B. Thistle (eds.), Ecological Communities: Conceptual Issues and the Evidence. Princeton U.P., Princeton, New Jersey: 344-359.
- Collier, B.D., G.W. Cox, A.W. Johnson and P.C. Miller, 1973, Dynamic ecology. Prentice-Hall, Englewood Cliffs, New Jersey.
- Connell, J.H., 1980, Diversity and the coevolution of competitors, or the ghost of competition past. Oikos 35: 131-138.
- Connell, J.H., 1983, On the prevalence and relative importance of interspecific competition: evidence from field experiments. Am. Nat. 122: 661-696.
- Connell, J.H. and R.O. Slatyer, 1977, Mechanisms of succession in natural communities and their role in community stability and organization. Am. Nat. 111: 1119-1144.
- Connor, E.F. and E.D. McCoy, 1979, The statistics and biology of the species-area relationship. Am. Nat. 113: 791-833.
- Connor, E.F. and D.S. Simberloff, 1978, Species number and compositional similarity of the Galapagos flora and fauna. Ecol. Mon. 48: 219-248.
- Connor, E.F. and D.S. Simberloff, 1979, The assembly of species communities: chance or competition? Ecology 60 (6): 1132-1140.
- Connor, E.F. and D.S. Simberloff, 1983, Interspecific competition and species co-occurrence patterns on islands: null models and the evaluation of evidence. Oikos 41: 455-465.
- Connor, E.F. and D.S. Simberloff, 1984a, Neutral models of species' co-occurrence patterns. In: D.R. Strong, D. Simberloff, L.G. Abele and A.B. Thistle (eds.), Ecological Communities: Conceptual Issues and the Evidence. Princeton U.P., Princeton, New Jersey: 316-331.
- Connor, E.F. and D.S. Simberloff, 1984b, Rejoinder. In: D.R. Strong, D. Simberloff, L.G. Abele and A.B. Thistle (eds.), Ecological Communities: Conceptual Issues and the Evidence, Princeton U.P., Princeton, New Jersey: 341-343.
- Crawley, M.J., 1986, The structure of plant communities. In: M.J. Crawley (ed.), Plant ecology. Blackwell Sci. Publ., Oxford: 1-50.
- Crick, F., 1966, Of molecules and men. Washington U.P., Seattle.
- Cummins, R., 1975, Functional analysis. J. Phil. 72: 741-765.

- Darden, L. and N. Maull, 1977, Interfield theories. *Phil. Sci.* 44: 43-63.
- Daubenmire, R., 1968, *Plant communities*. Harper and Row, New York.
- Davidson, D., 1984, On the very idea of a conceptual scheme. In: *Inquiries into truth and interpretation*. Clarendon Press, Oxford.
- Davidson, D.W., 1978, Size variability in the worker caste of a coastal insect (*Veromessor pergandei* Mayr) as a function of the competitive environment. *Am. Nat.* 112: 523-532.
- Davies, P., 1983, *God and the new physics*. Dent and Sons Ltd., London.
- Davies, P., 1992, *The mind of God*. Simon and Schuster, London.
- Davies, P. and J. Griblon, 1991, *The matter myth: towards 21st century science*. Viking, London.
- DeBach, P., 1966, The competitive displacement and coexistence principles. *Ann. Rev. Ent.* 11: 183-212.
- Dekker, J., 1990, On the sense and nonsense of 'complete' ecosystems. *Landschap* (in Dutch).
- Diamond, J.M., 1969, Avifaunal equilibria and species turnover rates on the Channel Island of California. *Proc. Natl. Ac. Sci. USA* 64: 57-63.
- Diamond, J.M., 1975a, Assembly of species communities. In: M.L. Cody and J.M. Diamond (eds.), *Ecology and Evolution of Communities*, Harvard U.P., Cambridge, Mass.: 332-445.
- Diamond, J.M., 1975b, The island dilemma: lessons of modern biogeographic studies for the design of natural reserves. *Biol. Cons.* 7: 129-146.
- Diamond, J.M., 1976, Island biogeography and conservation: strategy and limitations. *Science* 193: 1027-1029.
- Diamond, J.M., 1978, Niche shifts and the rediscovery of interspecific competition. *Am. Sci.* 66: 322-331.
- Diamond, J.M., 1982, Shifts in species incidences and occurrence frequencies due to competition: musical chairs on islands. *Proc. Nat. Acad. Sci. USA* 79: 2420-2424.
- Diamond, J.M. and M.E. Gilpin, 1982, Examination of the "Null" model of Connor and Simberloff for species co-occurrences on islands. *Oecologia* 52: 64-74.
- Diamond, J.M. and E. Mayr, 1976, The species-area relation for the birds of the Solomon archipelago. *Proc. Natl. Ac. Sci. USA* 73: 262-266.
- Dobzhansky, T., 1955, *Evolution, genetics and man*. New York and London.
- Dobzhansky, T., 1973, Nothing in biology makes sense except in the light of evolution. *Am. Biol. Teacher* 35: 125-129.
- Dobzhansky, T., 1974, Chance and creativity in evolution. In: F. Ayala and T. Dobzhansky (eds.), 1974, *Studies in the philosophy of biology*. MacMillan, London: 307-337.
- Driesch, H., 1909, *Science and philosophy of the organism*. A & C Black, London
- Driesch, H., 1914, *The history and theory of vitalism*. MacMillan, London.
- Driesch, H., 1927, *Mind and body*. Methuen, London.
- Drury, W.H. and J.C.T. Nisbet, 1973, Succession. *J. Arnold Arbor.* 54: 331-368.
- Egerton, F.N., 1973, Changing concepts in the balance of nature. *Quat. Rev. Biol.* 48: 322-350.
- Egerton, F.N., 1983, History of ecology: achievements and opportunities I. *J. Hist. Biol.* 16: 259-310.
- Egerton, F.N., 1985, The history of ecology: achievements and opportunities II. *J. Hist. Biol.*

References

- 18: 103-143.
- Ellenberg, H., 1956, Aufgaben und Methoden der Vegetationskunde. Einführung in die Phytologie IV. Ulmer, Stuttgart.
- Elton, C., 1927, Animal ecology. Sidgwick and Jackson, London.
- Engelberg, J. and L.L. Boyarsky, 1979, The noncybernetic nature of ecosystems. *Am. Nat.* 114: 317-324.
- Fenchel, T., 1975, Character displacement and coexistence in mud snails (Hydrobiidae). *Oecologia* 20: 19-32.
- Ferguson, M., 1980, The aquarian conspiracy. Tarcher Inc., Los Angeles.
- Feyerabend, P.K., 1962, Explanation, reduction and empiricism. In: H. Feigl and G. Maxwell (eds.), *Minn. St. Phil. Sci.* vol 3, Univ. Minn. Press, Minneapolis: 28-97.
- Feyerabend, P.K., 1965, On the "meaning" of scientific terms. *J. Phil.* 62 (10): 266-274.
- Fisher, R.A., A.S. Corbet and C.B. Williams, 1943, The relation between the number of species and the number of individuals in a random sample of an animal population. *J. An. Ecol.* 12: 42-58.
- Fleck, L., 1979, Genesis and development of a scientific fact. Chicago U.P., Chicago.
- Forbes, S.A., 1883, The food relations of the *Carabidae* and *Coccinellidae*. *Bull. Illin. Mus. Nat. Hist.* 1 (6): 33.
- Forbes, S.A., 1887, The lake as a microcosm. *Bull. Sci. Ass. Peoria, Illinois*: 77-87.
- Freedman, B., 1989, Environmental ecology: the impacts of pollution and other stresses on ecosystem structure and function. Acad. Press Inc., San Diego.
- Fretwell, S., 1981, Bringing ecology to scientific maturity. *Am. Nat.* (118): 306.
- Futuyama, D.J., 1986, Evolutionary biology. Sinauer, Sunderland.
- Gause, G.F., 1934, The struggle for existence. Williams and Wilkins, Baltimore (republished in 1964 by Hafner, New York).
- Gause, G.F., 1935, Experimental demonstration of Volterra's periodic oscillation in the numbers of animals. *J. Exp. Biol.* 12: 44-48.
- Gilbert, F.S., 1980, The equilibrium theory of island biogeography: fact or fiction? *J. Biogeog.* 7: 209-235.
- Giller, P.J., 1984, Community structure and the niche. Chapman and Hall, London.
- Gilpin, M.E. and J.M. Diamond, 1981, Immigration and extinction probabilities for individual species: relation to incidence functions and species colonization curves. *Proc. Natl. Acad. Sci. USA* 78: 393-396.
- Gilpin, M.E. and J.M. Diamond, 1982, Factors contributing to non-randomness in species co-occurrences on islands. *Oecologia* 52: 75-84.
- Gilpin, M.E. and J.M. Diamond, 1984a, Are species co-occurrences on islands non-random, and are null hypotheses useful in community ecology? In: D.R. Strong, D. Simberloff, L.G. Abele and A.B. Thistle (eds.), *Ecological Communities: Conceptual Issues and the Evidence*, Princeton U.P., Princeton, New Jersey: 297-315.
- Gilpin, M.E. and J.M. Diamond, 1984b, Rejoinder. In: D.R. Strong, D. Simberloff, L.G. Abele and A.B. Thistle (eds.), *Ecological Communities: Conceptual Issues and the Evidence*, Princeton U.P., Princeton, New Jersey: 332-341.
- Gilpin, M.E., M.P. Carpenter and M.J. Pomerantz, 1986, The assembly of a laboratory community: multispecies competition in *Drosophila*. In: J.M. Diamond and T.J. Case

- (eds.), Community Ecology, Harper and Row, New York: 23-40.
- Girill, T., 1974, Identity, Causality, and the regressiveness of micro-explanations. *Dialectica* 28: 223-238.
- Girill, T., 1976, Evaluating micro-explanations. *Erkenntnis* 10: 387-405.
- Glasser, J.W., 1982, A theory of trophic strategies: the evolution of facultative strategists. *Am. Nat.* 119:250-262.
- Glasser, J.W., 1984, Evolution of efficiencies and strategies of resource exploitation. *Ecology* 65: 1570-1578.
- Glasser, J.W., and H.J. Price, 1982, Niche theory: new insights from an old paradigm. *J. Theor. Biol.* 99: 437-460.
- Glasser, J.W., and H.J. Price, 1988, Evaluating expectations deduced from explicit hypotheses about mechanisms of competition. *Oikos* 51: 57-70.
- Gleason, H.A., 1922, On the relation between species and area. *Ecol.* 3: 158-162.
- Gleason, H.A., 1939, The individualistic concept of the plant association. *Am. Midl. Nat.* 21: 92-110.
- Gleason, H.A., 1962, The individualistic concept of the plant community. *Bull. Torrey Bot. Club* 53: 1-20.
- Grant, P.R., 1966, Ecological compatibility of bird species on islands. *Am. Nat.* 100: 451-462.
- Grant, P.R., 1968, Bill size, body size, and the ecological adaptations of bird species to competitive situations on islands. *Syst. Zool.* 17: 319-333.
- Grant, P.R., 1975, The classical case of character displacement. *Evol. Biol.* 8: 237-337.
- Grant, P.R. and I. Abbott, 1980, Interspecific competition, island biogeography and null hypotheses. *Evolution* 34: 332-341.
- Grant, P.R. and D. Schluter, 1984, Interspecific competition inferred from patterns of guild structure. In: D.R. Strong, D. Simberloff, L.G. Abele and A.B. Thistle (eds.), *Ecological Communities: Conceptual Issues and the Evidence*, Princeton U.P., Princeton, New Jersey: 201-233.
- Gray, A.J., M.J. Crawley, and P.J. Edwards (eds.), 1987, *Colonization, succession and stability*. Blackwell, Oxford.
- Greene, M., 1980, A note on Simberloff's 'Succession of paradigms in ecology'. In: E. Saarinen (ed.), *Conceptual Issues in Ecology*, Reidel, Dordrecht: 101-106.
- Grinnell, J., 1917, The niche-relations of the California thrasher. *Auk* 34: 427-433.
- Grinnell, J., 1924, Geography and evolution. *Ecology* 5: 225-229.
- Grinnell, J., 1928, Presence and absence of animals. *Univ. Calif. Chron.* 30: 429-450.
- Grootjans, A.P., L.F.M. Fresco, C.C. de Leeuw and P.C. Schipper, 1996, Degeneration of species-rich *Calthion palustris* hay meadows; some considerations on the community concept. *J. Veg. Sci.* 7: 185-194.
- Grubb, P., 1977, The maintenance of species richness in plant communities: the importance of the regeneration niche. *Biol. Rev.* 52: 107-145.
- Grubb, P., 1985. Plant populations and vegetation in relation to habitat, disturbance and competition: problems of generalization. In: J. White (ed.), *The population structure of vegetation*. Junk Publ.: 595-621.
- Guichard, A.P. and R.C. Looijen, 1991, Some philosophical arguments against sociological eliminativism: reconciling sociology and philosophy of science. *Acta Philosophica Groningana* (int. publ.), Univ. Groningen.

References

- Hagen, J.B., 1989, Research perspectives and the anomolous status of modern ecology. *Biol. & Phiol.* 4 (4): 433-455.
- Haila, Y. and O. Järvinen, 1980, The role of theoretical concepts in understanding the ecological theathre: a case study on island biogeography. In: E. Saarinen (ed.), *Conceptual Issues in Ecology*, Reidel, Dordrecht: 261-278.
- Hairston, N.G., 1951, Interspecies competition and its probable influence upon the vertical distribution of Appalachian salamanders of the genus *Plethodon*. *Ecology* 32: 266-74.
- Hairston, N.G., 1980, The experimental test of an analysis of field distributions: competition in terrestrial salamanders. *Ecology* 61: 817-826.
- Hanson, H., 1962, *Dictionary of ecology*. Peter Owen, London.
- Hardin, G., 1960, The competitive exclusion principle. *Science* 131: 1292-1297.
- Harper, J.L., J.N. Chatworthy, I.H. McNaughton and G.R. Sagar, 1961, The evolution and ecology of closely related species living in the same area. *Evolution* 15: 209-227.
- Harvey, P.H., R.K. Collwell, J.W. Silvertown and R.M. May, 1983, Null models in ecology, *Ann. Rev. Ecol. Syst.* 14: 189-211.
- Hempel, C.G., 1965, *Aspects of scientific explanation*. Free Press, New York.
- Hempel, C.G., 1966, *Philosophy of natural science*. Prentice Hall, Englewood Cliffs, New Jersey.
- Hempel, C.G., 1967, Reduction: ontological and linguistic facets. In: S. Morgenbesser et al. (eds.), *Philosophy, science and method*, St. Martin's, New York: 179-199.
- Hettema, H. and T.A.F. Kuipers, 1988, The periodic table: its formalization, status, and relation to atomic theory. *Erkenntnis* 28: 387-408.
- Holling, C.S., 1973, Resilience and stability of ecological systems. *Ann. Rev. Ecol. Syst.* 4: 1-23.
- Holt, R.D., 1984, Spatial heterogeneity, indirect interactions, and the coexistence of prey species. *Am. Nat.* 124: 377-406.
- Holt, R.D., 1987, On the relation between niche overlap and competition: the effect of incommensurable niche dimensions. *Oikos* 48: 110-114.
- Huisman, J. and F.J. Weissing, 1994, Light-limited growth and competition in well-mixed aquatic environments: an elementary model. *Ecology* 75: 507-520.
- Hull, D., 1974, *Philosophy of biological science*. Prentice Hall, Englewood Cliffs, New Jersey.
- Hutchinson, G.E., 1957, Concluding Remarks. *Cold Spring Harbor Symposium on Quantitative Biology* 22: 415-427.
- Hutchinson, G.E., 1959, Homage to Santa Rosalia; or, Why are there so many kinds of animals? *Am. Nat.* 93: 145-159.
- Hutchinson, G.E., 1978, *An introduction to population ecology*. Yale Univ. Press, New Haven.
- Janssen, M., 1987, Utilistic reduction of the macroeconomic consumption function. *LMPS-VIII Abstracts, Moscow*, vol. 5.2: 386-390.
- Järvinen, O., 1982, Species-to-genus ratios in biogeography: a historical note. *J. Biogeogr.* 9: 363-370.
- Järvinen, O. and Y. Haila, 1984, Assembly of land bird communities on northern islands: a quantitative analysis of insular impoverishment. In: D.R. Strong, D. Simberloff, L.G. Abele and A.B. Thistle, 1984, *Ecological Communities: Conceptual Issues and the Evidence*. Princeton U.P., Princeton, New Jersey: 138-147.

- Kemeny, J. and P. Oppenheim, 1956, On reduction. *Phil. Stud.* 7: 6-19.
- Kendeigh, S.C., 1974, *Ecology, with special reference to animals and man*. Prentice-Hall, Englewood Cliffs, New Jersey.
- Kim, J., 1996, *Philosophy of mind*. Westview Press, Boulder.
- Kitcher, P., 1981, Explanatory unification. *Phil. Sci.* 48: 507-531.
- Kitcher, P., 1982, Genes. *Brit. J. Phil. Sci.* 33: 337-359.
- Koppen, K. van, D. van der Hoek, A.M. Leemijer, C.W. Stortenbeker and H. Bongers (eds.), 1984, *Nature and man: visions of nature management from life view, science and politics*. Pudoc, Wageningen (in Dutch).
- Koestler, A., 1967, *The ghost in the machine*. Picador, Pan Books Ltd., London.
- Koestler, A., 1980, *Bricks to Babel*. Picador, Pan Books Ltd., London.
- Koestler, A. and R. Smythies, 1969, *Beyond reductionism: new perspectives in the life sciences*. Hutchinson, London.
- Krajewski, W., 1977, Correspondence principle and growth of knowledge. Reidel, Dordrecht.
- Krebs, C.J., 1988, *The message of ecology*. Harper and Row, New York.
- Krebs, C.J., 1994, *Ecology: the experimental analysis of distribution and abundance*. Harper and Row, New York.
- Kroes, H.W., 1977, The niche structure of ecosystems. *J. Theor. Biol.* 65: 317-326.
- Kuhn, T.S., 1962, *The structure of scientific revolutions*. Univ. of Chicago Press, Chicago.
- Kuipers, T.A.F., 1982, The reduction of phenomenological to kinetic thermostatics. *Phil. Sci.* 49 (1): 107-119.
- Kuipers, T.A.F., 1984, Utilistic reduction in sociology: the case of collective goods. In: W. Balzer et al. (eds.), *Reduction in science*, Reidel, Dordrecht: 239-267.
- Kuipers, T.A.F., 1985, The paradigm of concretization: the law of van der Waals. In: J. Brzezinsky (ed.), *Consciousness: methodological and psychological approaches*, Poznan St. *Phil. Sci. Hum.*, Rodopi, Amsterdam, 8: 185-199.
- Kuipers, T.A.F., 1986, The logic of functional explanation in biology. In: *The tasks of contemporary philosophy*, Proc. 10th Int. Witg. Symp., Kirchberg/Wechsel, Austria: 110-114.
- Kuipers, T.A.F., 1990, Reduction of laws and concepts. In: J. Brzezinski, F. Coniglione, T.A.F. Kuipers and L. Nowak (eds.), *Idealization I: general problems*, Rodopi, Amsterdam: 241-276.
- Kuipers, T.A.F., 1997, *Structures in science: heuristic patterns based on cognitive structures*. Dept. Phil. Sci., Logic and Epist., Fac. Phil., Univ. Groningen.
- Kuipers, T.A.F. (ed.), 1986, *Holism and reductionism in the empirical sciences: Philosophical analyses*. Studium Generale/Univ. Groningen.
- Kuipers, T.A.F., F. Poletiek and G. van Gemert (eds.), 1986, *Holism and reductionism in the empirical sciences: Documentation volume*. Studium Generale/Univ. Groningen.
- Kuipers, T.A.F., F. Poletiek and G. van Gemert (eds.), 1986, *Holism and reductionism in the empirical sciences: Philosophical orientation*. Studium Generale/Univ. Groningen.
- Kuipers, T.A.F. and H. Zandvoort, 1985, Empirical laws and theories. *Kennis en Methode* (9): 49-63 (in Dutch).
- Kwa, C., 1984, The relation to nature in cybernetic and evolutionary ecology. *Kennis and Methode* 8 (1): 25-40 (in Dutch).
- Kwa, C., 1989, *Mimicking nature; the development of systems ecology in the United States, 1950-1975*. Thesis, Univ. of Amsterdam.

References

- Lack, D., 1947, Darwin's finches. Cambridge U.P., Cambridge.
- Lack, D., 1954, The natural regulation of animal numbers. Oxford U.P., New York.
- Lakatos, I., 1978, The methodology of scientific research programmes (eds. J. Worrall and G. Curry). Cambridge U.P., Cambridge.
- Latour, B. and S. Woolgar, 1979, Laboratory life. Sage, Beverly Hills.
- Lawton, J.H., 1984, Non-competitive populations, non-convergent communities, and vacant niches: the herbivores of bracken. In: D.R. Strong, D. Simberloff, L.G. Abele and A.B. Thistle, 1984, Ecological Communities: Conceptual Issues and the Evidence. Princeton U.P., Princeton, New Jersey: 67-100.
- Leeuwen, C.G. van, 1966, A relation theoretical approach to pattern and process in vegetation. *Wentia* 15: 25-46.
- Leon, J.A., and D. Tumpson, 1975, Competition between two species for two complementary or substitutable resources. *J. Theor. Biol.* 50: 185-201.
- Lewes, G.H., 1874-1875, Problems of life and mind. Longmans, Green, London.
- Levin, S., 1970, Community equilibria and stability, and an extension of the competitive exclusion principle. *Am. Nat.* 104: 413-423.
- Levins, R., 1968, Evolution in changing environments. Princeton U.P., Princeton, New Jersey.
- Levins, R., 1975, Evolution in Communities near Equilibrium. In: M.L. Cody and J.M. Diamond (eds.), Ecology and Evolution of Communities, Harvard U.P., Cambridge, Mass.: 16-50.
- Levins, R. and R. Lewontin, 1980, Dialectics and reductionism in ecology. In: E. Saarinen (ed.), Conceptual Issues in Ecology, Reidel, Dordrecht: 107-138.
- Lewin, R., 1984, Santa Rosalia was a goat. *Science* 221: 636-639.
- Lewontin, R., 1981, The organism as the subject and object of evolution. *Scientia* 118: 65-82.
- Lewontin, R., 1983, Darwin's revolution. *New York Rev. Books* 30: 21-27.
- Lewontin, R. and R. Levins, 1976, The problem of Lysenkoism. In: H. Rose and S. Rose (eds.), The radicalisation of science, MacMillan, London: 32-64.
- Lindeman, R.L., 1942, The trophic-dynamic aspect of ecology. *Ecol.* 23: 399-418.
- Loehle, C., 1987, Hypothesis testing in ecology: psychological aspects and the importance of theory maturation. *Quart. Rev. Biol.* 62: 397-409.
- Londo, G., 1971, Pattern and process in dune-valley vegetations in a sunk lake in the Kennemerduinen. Thesis, Univ. Nijmegen (in Dutch).
- Looijen, R.C., 1983, Grazing pressure and vegetation dynamics at the Oosterkwelder salt-marsh on Schiermonnikoog. *Acta Bot. Neerl.* 33: 360-361.
- Looijen, R.C., 1984, Reducti(h)olism in ecology. Dept. Phil., Groningen State University (in Dutch).
- Looijen, R.C., 1987a, Reductionism and holism in biology. In: M. Korthals (ed.), Philosophy of science, Open university, Heerlen: 58-81 (in Dutch).
- Looijen, R.C., 1987b, Reduction and emergence in biology. In: G.M. Huussen and H.E.S. Woldring (eds.), Working with philosophy: a culture-problem. Philosophical Series nr. 19, Eburon, Delft: 180-187 (in Dutch).
- Looijen, R.C., 1987c, Emergence and reduction in biology. LMPS-VIII Abstracts, Moscow, vol. 2: 265-268.
- Looijen, R.C., 1995. On the distinction between habitat and niche, and some implications for species' differentiation. *Poz. St. Phil. Sci. Human.* 45: 87-108.
- Looijen, J., R.C. Looijen and H. Zomer, 1984, Ten years of grazing on the Oosterkwelder

- salt-marsh of Schiermonnikoog. Internal Rep. Dept. of Plant Ecology, Univ. Groningen (in Dutch).
- Looijen, R.C. and J.P. Bakker, 1987, Utilization of different salt marsh plant communities by cattle and geese. In: A.H.L. Huiskes, C.W.P.M. Blom and J. Rozema (eds.), *Vegetation between land and sea*, Junk, Dordrecht: 52-64.
- Looijen, R.C., E. Oosterveld, T. Wams, W. Wiersinga and H. van der Windt, 1989, Focussing on species: the nature conservation strategy for the nineties? In: Meander Foundation (ed.), *New strategies for nature conservation*. Jan van Arkel, Utrecht: 77-93 (in Dutch).
- Looijen, R.C., E. Oosterveld, T. Wams, W. Wiersinga and H. van der Windt, 1989, Practical nature conservation: species protection. *Intermediair* 25 (33): 57-61 (in Dutch).
- Looijen, R., E. Oosterveld and H. van der Windt, 1993, Superorganisms and 'nulls': a controversy in island biogeography and its resolution (unpublished manuscript).
- Lotka, A.J., 1925, *Elements of physical biology*. Williams and Wilkins, Baltimore.
- Lovejoy, A.O., 1927, The meanings of 'emergence' and its modes. In: E.S. Brightman (ed.), *Proceedings of the sixth international conference of philosophy*, New York: 26-27.
- Lovejoy, A.O., 1936, *The great chain of being*. Harvard U.P., Cambridge, Mass.
- Maarel, E. van der, 1976, On the establishment of plant community boundaries. *Ber. Deutsch. Bot. Ges.* 89: 415-443.
- Maarel, E. van der, 1990, Ecotones and ecoclines are different. *J. Veg. Sci.* 1: 135-138.
- MacArthur, R.H., 1968, The theory of the niche. In: R.C. Lewontin (ed.), *Population biology and evolution*, Syracuse U.P., New York: 159-176.
- MacArthur, R.H., 1972, *Geographical Ecology*. Harper and Row, New York.
- MacArthur, R.H. and R. Levins, 1964, Competition, habitat selection and character displacement in a patchy environment. *Proc. Natl. Acad. Sci. U.S.* 51: 1207-1210.
- MacArthur, R. and E.O. Wilson, 1967, *The theory of island biogeography*. Princeton U.P., Princeton, N.J..
- Mackie, J.L., 1965, Causes and conditions. *Am. Phil. Quart.* 2: 245-264.
- Mackie, J.L., 1974, *The cement of the universe*. Clarendon, Oxford.
- Mahner, M. & M. Bunge, 1997, *Foundations of biophilosophy*. Springer, Berlin.
- Margalef, R., 1958, Information theory in ecology. *Gen. Syst.* 3: 36-71.
- Margalef, R., 1968, *Perspectives in ecological theory*. Univ. Chic. Press, Chicago.
- Mauil, N., 1977, Unifying science without reduction. *St. Hist. Phil. Sci.* 8: 143-162.
- May, R.M., 1975a, Stability in ecosystems: some comments. In: W.H. van Dobben and R.H. Lowe-McConnell (eds.), *Unifying concepts in ecology*. Junk, The Hague.
- May, R.M., 1975b, Patterns of species abundance and diversity. In: M.L. Cody and J.M. Diamond (eds.), *Ecology and evolution of communities*. Belknap, Harvard U.P., Cambridge: 81-120.
- May, R.M., 1976, Patterns in multispecies communities. In: R.M. May (ed.), *Theoretical Ecology*, Oxford: 142-162.
- May, R.M., 1979, The structure and dynamics of ecological communities. In: R.M. Anderson et al. (eds.), *Population dynamics*. Blackwell, Oxford: 385-407.
- May, R.M., 1981, *Theoretical ecology: principles and applications*. Sinauer, Sunderland, Mass. 2d ed.
- May, R.M., 1984, An Overview: Real and Apparent Patterns in Community Structure. In: D.R. Strong, D. Simberloff, L.G. Abele and A.B. Thistle (eds.), *Ecological*

References

- Communities: Conceptual Issues and the Evidence, Princeton U.P., Princeton, New Jersey: 3-18.
- Maynard-Smith, J., 1990, Explanation in biology. In: D. Knowles (ed.), *Explanation and its limits*. Cambridge U.P., Cambridge: 65-72.
- Mayr, D., 1981, Investigations of the concept of reduction II. *Erkenntnis* 16: 109-129.
- Mayr, E., 1960, The emergence of evolutionary novelties. In: S. Tax (ed.), *Evolution after Darwin. I. The evolution of life: its origin, history and future*. Univ. Chic. Press, Chicago: 349-380.
- Mayr, E., 1961, Cause and effect in biology. *Science* 134: 1501-1506.
- Mayr, E., 1963, *Animal species and evolution*. Harvard U.P., Cambridge.
- Mayr, E., 1974, Teleological and teleonomic: a new analysis. *Bost. St. Phil. Sci.* 14: 91-117.
- Mayr, E., 1982, *The growth of biological thought: diversity, evolution and inheritance*. Harvard U.P., Cambridge.
- Mayr, E., 1988, *Towards a new philosophy of biology: observations of an evolutionist*. Belknap, Harvard U.P., Cambridge.
- McCoy, D., S.S. Bell and K. Walters, 1986, Identifying biotic boundaries along environmental gradients. *Ecology* 67 (3): 749-759.
- McIntosh, R.P., 1974, Plant ecology. *Ann. Missouri Bot. Gard.* 61: 132-165
- McIntosh, R.P., 1980, The background and some current problems in theoretical ecology. In: E. Saarinen (ed.), *Conceptual Issues in Ecology*, Reidel, Dordrecht: 1-62.
- McIntosh, R.P., 1985, *The Background of Ecology: Concept and Theory*. Cambridge U.P., Cambridge, Mass.
- McIntosh, R.P., 1995, H.A. Gleason's "individualistic concept" and theory of animal communities: a continuing controversy. *Biol. Rev.* 70: 317-357.
- McNaughton, S.J. and L.L. Wolf, 1973, *General ecology*. Holt, Reinhart and Winston, New York.
- Millikan, R.G., 1984, *Language, thought and other biological categories*. MIT Press, Cambridge.
- Millikan, R.G., 1989, In defense of proper functions. *Phil. Sci.* 56: 288-302.
- Milne, A., 1961, Definition of competition among animals. In: F.L. Milnthorpe (ed.), *Mechanisms in Biological competition*. Cambridge U.P., Cambridge: 40-61.
- Monod, J., 1971, *Chance and necessity*. Knopf, New York.
- Monod, J., 1974, On chance and necessity. In: F. Ayala and T. Dobzhansky (eds.), 1974, *Studies in the philosophy of biology*. MacMillan, London: 357-361.
- Monod, J., F. Jacob and J.P. Changeux, 1963, Allosteric proteins and cellular control systems. *J. Mol. Biol.* 6: 306-329.
- Morgan, C.L., 1923, *Emergent evolution*. Williams and Norgate, London.
- Morgan, C.L., 1933, *The emergence of novelty*. Williams and Norgate, London.
- Moritz, R.F.A. and E.F. Southwick, 1992, *Bees as superorganisms: an evolutionary reality*. Springer, Berlin.
- Moulines, C., 1984, Ontological reduction in the natural sciences. In: W. Balzer et al. (eds.), *Reduction in science*. Reidel, Dordrecht: 51-70.
- Müller-Dombois, D. and D. Ellenberg, 1974, *Aims and methods of vegetation ecology*. Wiley, New York.
- Murray, B.J., Jr., 1986, The structure of theory, and the role of competition in community dynamics. *Oikos* 46: 145-158.

- Nagel, E., 1961, *The structure of science*. Harcourt, Brace and World, New York (reprinted 1982).
- Nagel, E., 1977, Teleology revisited. *J. Phil.* 74 (5): 261-301.
- Naiman, R.J., H. Décamps, D. Pastor and C.A. Johnston, 1988, The potential importance of boundaries to fluvial ecosystems. *J. N. Am. Benthol. Soc.* 7 (4): 289-306.
- Neander, K., 1991, Functions as selected effects: the conceptual analyst's defense. *Phil. Sci.* 58: 168-184.
- Nicholson, A.J., 1933, The balance of animal populations. *J. An. Ecol.* 2: 132-178.
- Nicholson, A.J., 1954, An outline of the dynamics of animal populations. *Austr. J. Zool.* 2: 9-65.
- Nicholson, A.J. and V.A. Bailey, 1935, The balance of animal populations. *Proc. Zool. Soc. London*, part 3: 551-598.
- Nickles, T., 1973, Two concepts of intertheoretic reduction. *J. Phil.* 70 (7): 181-201.
- Nowak, L., 1980, *The structure of idealization*. Reidel, Dordrecht.
- Odum, E.P., 1953, *Fundamentals of ecology*. Saunders, Philadelphia (2nd ed. 1959, 3rd ed. 1971).
- Odum, E.P., 1969, The strategy of ecosystem development, *Science* 164: 262-270.
- Odum, E.P., 1977, The emergence of ecology as a new ingrative discipline. *Science* 195: 1289-1293.
- Odum, E.P. and B. Patten, 1981, The cybernetic nature of ecosystems. *Am. Nat.* 118: 886-895.
- Odum, H.T. and R.C. Pinkerton, 1955, Times speed regulator, the optimum efficiency for maximum output in physical and biological systems. *Am. Sci.* 43: 331-343.
- Oloff, H., 1992, On the mechanisms of vegetation succession. Ph.D. Thesis, Univ. Groningen.
- Oosterveld, E., 1985, *The ideal community: a controversy in island biogeography*. Int. Rep. Science and Society, Univ. Groningen (in Dutch).
- Oppenheim, P. and H. Putnam, 1958, Unity of science as a working hypothesis. *Minn. St. Phil. Sci.* vol. II, Univ. Minn. Press, Minneapolis: 3-36.
- Pacala, S.W. and J. Roughgarden, 1982, Spatial heterogeneity and interspecific competition. *Theor. Pop. Biol.* 21: 92-113.
- Palmer, M.W. and P.S. White, 1994, On the existence of ecological communities. *J. Veg. Sci.* 5: 279-282.
- Patten, B., 1959, An introduction to the cybernetics of the ecosystem: the trophic dynamic aspect. *Ecol.* 40: 221-231.
- Patten, B., 1975, Ecosystem as a coevolutionary unit: a theme for teaching systems ecology. In: G.S. Innis (ed.), *New directions in the analysis of ecological systems*. Society for Computer Simulation, La Jolla, Calif.: 1-8.
- Peters, R.H., 1976, Tautology in evolution and ecology. *Am. Nat.* 110: 1-12.
- Petraitis, P.S., 1979, Likelihood measures of niche breadth and overlap. *Ecology* 60: 703-710.
- Pianka, E.R., 1970, On r- and k-selection. *Am. Nat.* 104: 592-597.
- Pianka, E.R., 1974, *Evolutionary ecology*. Harper and Row, New York.
- Pianka, E.R., 1981, Competition and niche theory. In: R.M. May (ed.), *Theoretical Ecology: principles and applications*. Sinauer, Sunderland, Mass.: 167-196.
- Pickett, S.T.A., 1976, Succession: an evolutionary interpretation. *Am. Nat.* 110: 107-119.

References

- Pickett, S.T.A., 1982, Population patterns through twenty years of old field succession. *Vegetatio* 49: 45-59.
- Pimentel, D., 1961, Species diversity and insect population outbreaks. *Ann. Entomol. Soc. Am.* 54: 76-86.
- Pimentel, D., 1968, Population control and negative feedback. *Science* 159: 1432-1437.
- Pimm, S., 1984, The complexity and stability of ecosystems. *Nature* 307: 321-326.
- Pimm, S., 1987, Determining the effects of introduced species. *Trends Ecol. Evol.* 2: 106-108.
- Pimm, S., 1991, *The balance of nature: ecological issues in the conservation of species and communities.* Chicago U.P., Chicago.
- Platt, J.R., 1964, Strong inference. *Science* 146: 347-353.
- Pluhar, E., 1978, Emergence and reduction. *St. Hist. Phil. Sci.* 9 (4): 279-289.
- Polanyi, M., 1968, Life's irreducible structure. *Science*: 1308-1312.
- Popper, K.R., 1963, *Conjectures and refutations: the growth of scientific knowledge.* Harper and Row, New York.
- Popper, K.R., 1968, *The logic of scientific discovery.* Hutchinson, London.
- Popper, K.R., 1974, Scientific reduction and the essential incompleteness of all science. In: F. Ayala and T. Dobzhansky (eds.), *Studies in the philosophy of biology*, MacMillan, London: 258-285. Postscript pp. 282-283.
- Preston, F.W., 1948, The commonness, and rarity, of species. *Ecol.* 29: 254-283.
- Preston, F.W., 1962, The canonical distribution of commonness and rarity. *Ecol.* 43: 185-215, 410-432.
- Prigogine, I. and I. Stengers, 1984, *Order of out chaos.* Bantam Books, New York.
- Quinn, J.F. and A.E. Dunham, 1983, On hypothesis testing in ecology and evolution. *Am. Nat.* 122: 602-617.
- Raunkiaer, C., 1934, *The life forms of plants and statistical plant geography.* Clarendon Press, London.
- Rejmanek, M. and J. Jenik, 1975, Niche, habitat and related ecological concepts. *Acta biotheor.* 24: 100-107.
- Rescigno, A. and I.W. Richardson, 1965, On the competitive exclusion principle. *Bull. Math. Biophysics* 27: 85-89.
- Ricklefs, R.E., 1979, *Ecology.* Chiron, New York (2nd ed.).
- Ricklefs, R.E., D. Cochran and E.R. Pianka, 1981, A morphological analysis of the structure of communities of lizards in desert habitats. *Ecology* 62: 1474-1483.
- Root, R., 1967, The niche exploitation pattern of the blue-grey gnat-catcher. *Ecol. Mon.* 37: 317-350.
- Rosenberg, A., 1982, Causation and teleology in contemporary philosophy of science. In: *Contemporary philosophy*, Nijhoff, The Hague: 51-86.
- Rosenberg, A., 1985, *The structure of biological science.* Cambridge U.P., Cambridge.
- Roughgarden, J., 1983, Competition and theory in community ecology. *Am. Nat.* 122: 583-601.
- Roughgarden, J., 1989, The structure and assembly of communities. In: J. Roughgarden, R.M. May and S.A. Levin (eds.), *Perspectives in ecological theory*, Princeton U.P., Princeton, New Jersey: 203-226.
- Ruse, M., 1973, *The philosophy of biology.* Hutchinson, London.

- Saarinen, E. (ed.), 1980, *Conceptual Issues in Ecology*, Reidel, Dordrecht.
- Salmon, W.C., 1984, *Explanation and the causal structure of the world*. Princeton U.P., Princeton.
- Schaffner, K.F., 1967, Approaches to reduction. *Phil. Sci.* 34: 137-147.
- Schaffner, K.F., 1969a, Correspondence rules. *Phil. Sci.* 36: 280-290.
- Schaffner, K.F., 1969b, The Watson-Crick model and reductionism. *Brit. J. Phil. Sci.* 20: 325-348.
- Schaffner, K.F., 1969c, Chemical systems and chemical evolution: the philosophy of molecular biology. *Am. Sci.* 57: 410-420.
- Schaffner, K.F., 1974a, The unity of science and theory construction in molecular biology. In: R. Seeger and R.S. Cohen (eds.), *Philosophical foundations of science*, Bost. St. Phil. Sci.: 497-533.
- Schaffner, K.F., 1974b, The peripherality of reductionism in the development of molecular biology. *J. Hist. Biol.* 7: 111-139.
- Schaffner, K.F., 1976, Reduction in biology: prospects and problems. In: R. Cohen et al. (eds.), *PSA-1974*, Reidel, Dordrecht: 613-632.
- Schaffner, K.F., 1977, Reduction, reductionism, Values, and progress in the biomedical sciences. In: R.G. Colodny (ed.), *Logic, law and life*, Univ. Pittsburg Series Phil. Sci., vol. 6: 143-171.
- Schaffner, K.F., 1993a, Theory structure, reduction, and disciplinary integration in biology. *Biol. & Phil.* 8: 319-347.
- Schaffner, K.F., 1993b, *Discovery and explanation in biology and medicine*. Univ. Chic. Press, Chicago.
- Schmitt, M., 1987, 'Ecological niche' sensu Günther and 'ecological license' sensu Osche - two valuable but poorly appreciated explanatory concepts. *Zool. Beitr. N.F.* 31: 49-60.
- Schoener, T.W., 1982, The controversy over interspecific competition. *Am. Sci.* 70: 586-595.
- Schoener, T.W., 1983, Field experiments on interspecific competition. *Am. Nat.* 122: 240-285.
- Schoener, R.E., 1989, The ecological niche. In: J.M. Cherrett (ed.), *Ecological concepts*. Blackwell, Oxford: 79-113.
- Schwerdtfeger, F., 1941, *Über die Ursachen des Massenwechsels der Insekten*. *Z. Angew. Entomol.* 28: 254-303.
- Seeley, T.D., 1989, The honey bee colony as superorganism. *Am. Sci.* 77: 546-553.
- Shapere, D., 1966, Meaning and scientific change. In: R.G. Colodny (ed.), *Mind and cosmos*. Univ. Pittsburg Press, Pittsburg: 41-85.
- Shapere, D., 1974a, Scientific theories and their domain. In: F. Suppe (ed.), *The structure of scientific theories*. Univ. Ill. Press, Urbana, Ill.
- Shapere, D., 1974b, On the relations between compositional and evolutionary theories. In: F. Ayala and T. Dobzhansky (eds.), 1974, *Studies in the philosophy of biology*. MacMillan, London: 187-201.
- Sheldrake, R., 1981, *A new science of life*. Paladin, Granada, London.
- Sheldrake, R., 1988, *The presence of the past: morphic resonance and the habits of nature*. Collins, London.
- Sheldrake, R., 1990, *The rebirth of nature: the greening of science and God*. Century, London.
- Shorrocks, B., 1991, A need for niches? *Trends Ecol. Evol.* 6: 262.
- Shrader-Frechette, K.S. and E.D. McCoy, 1993, *Method in ecology*. Cambridge U.P.,

References

- Cambridge.
- Simberloff, D.S., 1970, Taxonomic diversity of island biotas. *Evolution* 24: 23-47.
- Simberloff, D.S., 1974, Equilibrium theory of island biogeography and ecology. *Ann. Rev. Ecol. Syst.* 5: 161-179.
- Simberloff, D.S., 1976a, Experimental zoogeography of islands: effects of island size. *Ecology* 57: 629-641.
- Simberloff, D.S., 1976b, Species turnover and equilibrium island biogeography. *Science* 194: 572-578.
- Simberloff, D.S., 1978, Using island biogeographic data to determine if colonization is stochastic. *Am. Nat.* 112: 713-726.
- Simberloff, D.S., 1980, A Succession of Paradigms in Ecology. In: E. Saarinen (ed.), *Conceptual Issues in Ecology*, Reidel, Dordrecht: 63-100.
- Simberloff, D.S., 1983, Competition theory, hypothesis testing, and other community ecological buzzwords. *Am. Nat.* 122: 626-635.
- Simberloff, D.S., 1984, Properties of coexisting bird species in two archipelagoes. In: D.R. Strong, D. Simberloff, L.G. Abele and A.B. Thistle (eds.), *Ecological Communities: Conceptual Issues and the Evidence*, Princeton U.P., Princeton, New Jersey: 234-253.
- Simberloff, D.S. and L.G. Abele, 1976a, Island biogeography theory and conservation practice. *Science* 191: 285-286.
- Simberloff, D.S. and L.G. Abele, 1976b, Reply to critics. *Science* 193: 1032.
- Simberloff, D.S. and W. Boecklen, 1981, Santa Rosalia reconsidered: size ratios and competition. *Evolution* 35: 1206-1228.
- Simberloff, D.S. and E.F. Connor, 1981, Missing species combinations. *Am. Nat.* 118: 215-239.
- Simberloff, D.S. and E.O. Wilson, 1969, Experimental zoogeography of islands: the colonization of empty islands. *Ecology* 50: 278-296.
- Simberloff, D.S. and E.O. Wilson, 1970, Experimental zoogeography of islands: a two-year record of colonization. *Ecology* 51: 934-937.
- Simon, H., 1962, The architecture of complexity. *Proc. Am. Phil. Soc.* 106: 467-482.
- Simpson, G.G., 1964, *This view of life*. Harcourt, Brace and World, New York.
- Sklar, L., 1967, Types of inter-theoretic reduction. *Brit. J. Phil. Sci.* 18: 109-124.
- Sloep, P.B., 1986, Null hypotheses in ecology: towards the dissolution of a controversy. *Phil. Sci. Ass.* 1: 307-313.
- Sloep, P.B., 1993, Methodology revitalized? *Brit. J. Phil. Sci.* 44: 231-249.
- Smart, J.J.C., 1963, *Philosophy and scientific realism*. Routledge and Kegan Paul, London.
- Smith, R.L., 1980, *Ecology and field biology* (3rd ed.). Harper and Row, New York.
- Smuts, J.C., 1927, *Holism and evolution*. MacMillan, London.
- Sober, E., 1984, *The nature of selection*. MIT Press, Cambridge.
- Sommerhoff, G., 1950, *Analytical biology*. Oxford U.P., New York.
- Sommerhoff, G., 1974, *The logic of the living brain*. Wiley, New York.
- Sneed, J., 1971, *The logical structure of mathematical physics*. Reidel, Dordrecht.
- Stavenga, G. (ed), 1986, *Holism and reductionism in physics and chemistry*. Studium Generale, Univ. Groningen.
- Steen, W.J. van der & H. Kamminga, 1991, Laws and natural history in biology. *Brit. J. Phil. Sci.* 42: 445-467.
- Stenger, V., 1995, *The unconscious quantum: Metaphysics in modern physics and cosmology*.

- Prometheus Books, Amherst.
- Strong, D.R., 1980, Null hypotheses in ecology. In: E. Saarinen (ed.), *Conceptual Issues in Ecology*, Reidel, Dordrecht: 245-259.
- Strong, D.R., 1984, Exorcising the ghost of competition past: phytophagous insects. In: D.R. Strong, D. Simberloff, L.G. Abele and A.B. Thistle (eds.), *Ecological Communities: Conceptual Issues and the Evidence*, Princeton U.P., Princeton, New Jersey: 28-41.
- Strong, D.R. and D.S. Simberloff, 1981, Straining at gnats and swallowing ratios: character displacement. *Evolution* 35: 810-812.
- Strong, D.R., D. Simberloff, L.G. Abele and A.B. Thistle, 1984, *Ecological Communities: Conceptual Issues and the Evidence*. Princeton U.P., Princeton, New Jersey.
- Strong, D.R., L.A. Szyska and D.S. Simberloff, 1979, Tests of community-wide character displacement against null hypotheses. *Evolution* 33: 897-913.
- Sugihara, G., 1981, $S = CA^z$, $z \approx 1/4$: a reply to Connor and McCoy. *Am. Nat.* 117: 790-793.
- Suppe, F., 1977, *The structure of scientific theories*. Univ. of Illinois Press, Chicago.
- Tansley, A.G., 1917, On competition between *Galium saxatile* L. (*G. hercynicum* Weig.) and *Galium sylvestre* Poll. (*G. asperum* Schreb.) on different types of soil. *J. Ecol.* 5: 173-179.
- Tansley, A.G., 1935, The use and abuse of vegetational concepts and terms. *Ecol.* 16: 284-307.
- Taylor, C., 1964, *The explanation of behavior*. Routledge and Kegan Paul, London.
- Terborgh, J., 1975, Faunal equilibria and the design of wildlife preserves. In: F. Golley and E. Medina (eds.), *Tropical ecological systems*. Springer, Berlin.
- Terborgh, J., 1976, Island biogeography and conservation: strategy and limitations. *Science* 193: 1029-1030.
- Terborgh, J., 1981, Discussion of a paper by Simberloff *et al.* In: G. Nelson and D.E. Rosen (eds.), *Vicariance Biogeography*, Columbia U.P., New York: 64-68.
- Thieneman, A., 1918, Lebensgemeinschaft und Lebensraum. *Naturwissenschaft Wochenschrift*, N.F., 17: 282-290, 297-303.
- Thompson, W.R., 1929, On natural control. *Parasitology* 21: 269-281.
- Thorpe, J., 1974, Reductionism in biology. In: F. Ayala and T. Dobzhansky (eds.), 1974, *Studies in the philosophy of biology*. MacMillan, London: 109-136.
- Tilman, D., 1980, Resources: a graphical-mechanistic approach to competition and predation. *Am. Nat.* 116: 362-393.
- Tilman, D., 1982, *Resource competition and community structure*. Princeton U.P., Princeton, New Jersey.
- Tilman, D., 1987, On the meaning of competition and the mechanisms of competitive superiority. *Functional ecology* 1: 304-315.
- Tilman, D., 1988, *Plant strategies and the dynamics and structure of plant communities*. Princeton U.P., Princeton, New Jersey.
- Tinbergen, N., 1963, On aims and methods of ethology. *Zeitschrift für Tierpsychologie* 20: 410-433.
- Tinbergen, N., 1976, *Animal behaviour*. Time Life Int.
- Toft, C.A. and P.J. Shea, 1983, Detecting community-wide patterns: estimating power strengthens statistical inference. *Am. Nat.* 122: 618-625.
- Tuomivaara, T., 1994, On idealization in ecology. *Poz. St. Phil. Sci. Human.* 42: 217-241.

References

- Uvarov, B.P., 1931, Insects and climate. *Trans. Entomol. Soc. London* 79: 1-247.
- Uvarov, B.P., 1961, Quantity and quality in insect populations. *Proc. Roy. Entomol. Soc. London, C*, 25: 52-59.
- Vandermeer, J.H., 1972, Niche theory. *Ann. Rev. Ecol. Syst.* 3: 107-132.
- Verhulst, P.F., 1838, Notice sur la loi que la population suit dans son accroissement. *Corresp. Math. Phys.* 10: 113-121.
- Volterra, V., 1926, Fluctuations in the abundance of a species considered mathematically. *Nature* 118: 558-560.
- Waldrop, M.M., 1993, *Complexity: the emerging science at the edge of order and chaos*. Viking, London.
- Wams, T., W. Wiersinga, H. van der Windt, R. Looijen and E. Oosterveld, 1992, Sustainable development and nature conservation policy: usefulness and uselessness of a new term. *Landschap* 9/3: 217-223 (in Dutch).
- Wangersky, P.J., 1978, Lotka-Volterra population models. *Ann. Rev. Ecol. Syst.* 9: 189-218.
- Weissing, F.J. and J. Huisman, 1994, Growth and competition in a light gradient. *J. Theor. Biol.* 168: 323-336.
- Wemelsfelder, F., 1993, *Animal boredom: towards an empirical approach of animal subjectivity*. Elinkwijk, Utrecht.
- Westhoff, V., 1951, An analysis of some concepts and terms in vegetation study or phytosociology. *Synthese* 8: 194-206.
- Westhoff, V. and A.J. den Held, 1969/75, *Plant communities in the Netherlands*. Thieme, Zutphen (in Dutch).
- Westhoff, V. and E. van der Maarel, 1973, The Braun-Blanquet approach. In: R.H. Whittaker (ed.), *Classification and ordination. Handbook of vegetation science* 5, Junk, The Hague: 617-726.
- Whittaker, R.H., 1948, *A vegetation analysis of the Great Smokey Mountains*. Ph.D. Thesis, Univ. Illinois.
- Whittaker, R.H., 1953, A consideration of climax theory: the climax as a population and pattern. *Ecol. Mon.* 43: 41-78.
- Whittaker, R.H., 1967, Gradient analysis of vegetation. *Biol. Rev.* 42: 207-264.
- Whittaker, R.H., 1972, An hypothesis rejected: the natural distribution of vegetation. In: W.A. Jensen and F.B. Salisbury (eds.), *Botany: an ecological approach*. Wadsworth, Belmont, CA: 689-691.
- Whittaker, R.H., 1973, *Handbook of vegetation science, vol. V: classification and ordination*. Junk, The Hague.
- Whittaker, R.H., 1975, *Communities and ecosystems*. MacMillan, New York.
- Whittaker, R.H., S.A. Levin and R.B. Root, 1973, Niche, habitat, and ecotope. *Am. Nat.* 107: 321-338.
- Williams, C.B. 1964, *Patterns in the balance of nature*. Academic Press, New York.
- Williams, G.C., 1966, *Adaptation and natural selection*. Princeton U.P., Princeton.
- Williamson, M., 1981, *Island populations*. Oxford U.P., Oxford.
- Wilson, D.S. and E. Sober, 1989, Reviving the superorganism. *J. Theor. Biol.* 136: 337-356.
- Wimsatt, W., 1980, Reductionist research strategies and their biases in the units of selection controversy. In: E. Saarinen (ed.), *Conceptual Issues in Ecology*, Reidel, Dordrecht:

- 155-201.
- Windt, H. van der, W. Wiersinga, T. Wams, E. Oosterveld and R. Looijen, 1987, Nature's future is for everyone: on the relation between conceptions of nature, ecology and nature conservation. *Natura* 4: 83-87 (in Dutch).
- Woodfield, A., *Teleology*. Cambridge U.P., Cambridge.
- Woodward, J., 1989, The causal mechanical model of explanation. In: P. Kitcher and W.C. Salmon, *Scientific explanation*. Univ. Minnes. Press, Minneapolis: 357-383.
- Worster, D., 1977, *Nature's economy: the roots of ecology*. Sierra Club Books, San Francisco.
- Wouters, A., 1995, Viability explanation. *Biol. & Phil.* 10 (4): 435-457.
- Wright, L., 1976, *Teleological explanations*. Univ. Calif. Press, Berkely.
- Wright, S.J. and C.C. Biehl, 1982, Island biogeographic distributions: testing for random, regular and aggregated patterns of species occurrence. *Am. Nat.* 119: 345-357.
- Wynne-Edwards, V.C., 1962, *Animal dispersion in relation to social behaviour*. Oliver and Boyd, Edinburgh.
- Zandvoort, H., 1986a, *Models of scientific development and the case of NMR*. Reidel, Dordrecht.
- Zandvoort, H., 1986b, The relation between modern physics and chemistry. In: A. Rip (ed.), *Philosophy and foundations of chemistry*. KNCV Publ., Amsterdam (in Dutch).
- Zukav, G., 1979, *The dancing Wu Li masters*. Rider and Co./Hutchinson and Co., Suffolk, UK.