



[Ecology Revisited](#) pp 183-194

The Rise of Systems Theory in Ecology

Abstract

The emergence of systems theory in ecology, particularly during the 1950s and 1960s, was accompanied by the hope that ecology might turn into an exact science with prognostic potential and a set of uniform theoretical foundations. The impact of systems theory on ecology was manifested mainly in the formulation and development of ecosystem theory. The widely-held view is that ecosystem theory is concerned primarily with units comprising communities of organisms of various species and the abiotic environment of these

communities. The components of systems are seen to interact with one another.

Keywords

System Concept Ecosystem Approach Abiotic Environment Ecosystem Research General System Theory

These keywords were added by machine and not by the authors. This process is experimental and the keywords may be updated as the learning algorithm improves.

This is a preview of subscription content,

[log in](#)

to check access.

References

1. Allen TFH, Starr TB (1982) Hierarchy: perspectives in ecological complexity. University of Chicago Press, Chicago [Google Scholar](#)
2. Bertalanffy L (1926) Zur Theorie der organischen 'Gestalt'. Roux' Archiv: 413–416 [Google Scholar](#)
3. Bertalanffy L (1929) Vorschlag zweier sehr allgemeiner biologischer Gesetze. Biol. Zentralbl. 49: 83–111 [Google Scholar](#)
4. Bertalanffy L (1932) Theoretische Biologie, Bd. I: Allgemeine Theorie, Physikochemie, Aufbau und Entwicklung des Organismus. Borntraeger, Berlin [Google Scholar](#)
5. Bertalanffy L (1949) Das biologische Weltbild. Die Stellung des Lebens in Natur und Wissenschaft. Francke, Bern [Google Scholar](#)
6. Bertalanffy L (1950) An Outline of General System Theory. Brit. J. Philos. Sci. 1:134–165 [CrossRef](#) [Google Scholar](#)
7. Bertalanffy L (1951) General System Theory: A New Approach to Unity of Science. Problems of General System Theory. Human Biology 23/4:302–312 [Google Scholar](#)
8. Bertalanffy L (1955) General System Theory. Main Currents in Modern Thought 11:75–83 [Google Scholar](#)
9. Bertalanffy L (1968) General system theory: foundations, development applications. George Braziller, New York [Google Scholar](#)
10. Botkin DB (1990) Discordant harmonies: a new ecology for the twenty-first century. Oxford Univ. Pr., New York [Google Scholar](#)
11. Bormann FH & Likens GE (1967) Nutrient cycling. Science 155(3461): 424–429 [PubMed](#) [CrossRef](#)

[Google Scholar](#)

12. Boulding KE (1941) Economic analysis. Harper & Brothers, New York [Google Scholar](#)
13. Boulding KE (1953) Toward a general theory of growth. Canadian J. o. Economics and Political Science 19/3:326–340 [Google Scholar](#)
14. Boulding KE (1956) Generals systems theory. The skeleton of science. Management Science 2:197–208 [CrossRef](#) [Google Scholar](#)
15. Churchman CW, Ackoff RL, Arnoff EL (1957) Introduction to operations research. Wiley, New York [Google Scholar](#)
16. Clements FE (1916) Plant succession: an analysis of the development of vegetation. Carnegie Institution of Washington, Washington, DC [Google Scholar](#)
17. Clements FE (1936) Nature and structure of the climax. J. of Ecology 24:252–284 [Google Scholar](#)
18. Clements FE, Shelford VE (1939) Bio-ecology. Wiley, New York [Google Scholar](#)
19. Davidson M (1983) Uncommon sense: the life and thought of Ludwig von Bertalanffy, father of general system theory. JP Tarcher, Los Angeles [Google Scholar](#)
20. Ellenberg H (ed) (1971) Integrated experimental ecology: methods and results of ecosystem research in the German Solling Project. Springer, Berlin [Google Scholar](#)
21. Ellenberg H (ed) (1986) Ökosystemforschung. Ergebnisse des Sollingprojektes, 1966–1986. Ulmer, Stuttgart [Google Scholar](#)
22. Engelberg J, Boyarsky LL (1979) The noncybernetic nature of ecosystems. Am Nat 114(3):317–324 [CrossRef](#) [Google Scholar](#)
23. Friederichs K (1927) Grundsätzliches über die Lebenseinheiten höherer Ordnung und den ökologischen Einheitsfaktor. Naturwissenschaften 8:153–157, 182–186 [CrossRef](#) [Google Scholar](#)
24. Friederichs K (1934) Vom Wesen der Ökologie. – Sudhoffs Arch. Gesch. d. Medizin u. Naturwissens 27 (3): 277–285 [Google Scholar](#)
25. Friederichs K (1937) Ökologie als Wissenschaft von der Natur oder biologische Raumforschung. Barth, Leipzig [Google Scholar](#)
26. Frontier S, Leprêtre A (1998) Développements récents en théorie des écosystèmes. Ann. Inst. océanogr. Paris 74(1): 43–87 [Google Scholar](#)
27. Gams H (1918) Prinzipienfragen der Vegetationsforschung. Ein Beitrag zur Begriffsklärung und Methodik der Biocoenologie. Naturf. Gesellschaft Zürich. Vierteljahresschr, 63:293–493 [Google Scholar](#)
28. Gerard RW (1940) Unresting Cells. Harper & Brothers, New York [Google Scholar](#)
29. Gerard RW (1953) The Organismic view of society. Chicago Behavioral Science Publications 1: 12–18 [Google Scholar](#)
30. Gleason HA (1917) The structure and development of the plant association. Bull Torrey Bot Club 44:463–481 [CrossRef](#) [Google Scholar](#)

The Rise of Systems Theory in Ecology

Written by Gaia

Thursday, 20 June 2019 21:53 - Last Updated Thursday, 20 June 2019 22:13

31. Gleason HA (1926) The individualistic concept of the plant association. Bull Torrey Bot Club 53:7–26 [CrossRef](#) [Google Scholar](#)
32. Golley FB (1993) A history of the ecosystem concept in ecology: more than the sum of the parts. Yale University Press, New Haven/London [Google Scholar](#)
33. Hagen JB (1992) An entangled bank: the origins of ecosystems. Chapman & Hall, New York [Google Scholar](#)
34. Hall CAS, Day J (eds) (1977) Ecosystem modeling in theory and practice. Wiley, New York [Google Scholar](#)
35. Hall AD, Fagen RE (1956) Definition of System. General System, 118–28 [Google Scholar](#)
36. Hammond D (2003) The science of synthesis: exploring the social implications of General Systems Theory. Univ. Pr. of Col., Colorado [Google Scholar](#)
37. Hauhs M, Lange H (2003) Informationstheorie und Ökosysteme. Handbuch der Umweltwissenschaften. Ecomed, München: 1–22 [Google Scholar](#)
38. Heims SJ (1993) Constructing a social science for postwar America: the cybernetics group, 1946 – 1953. MIT Press, Cambridge [Google Scholar](#)
39. Higashi M, Burns TP (eds) (1991) Theoretical studies of ecosystems. Cambridge University Press, Cambridge [Google Scholar](#)
40. Hutchinson GE (1948) Circular causal systems in ecology. Annals of the New York Academy of Sciences 50:221–246 [PubMed](#) [CrossRef](#) [Google Scholar](#)
41. Jax K (1998) Holocoen and ecosystem: on the origin and historical consequences of two concepts. J. Hist. Biology, 31:113–142 [CrossRef](#) [Google Scholar](#)
42. Jax K (2002) Die Einheiten der Ökologie. Analyse, Methodenentwicklung und Anwendung in Ökologie und Naturschutz. Lang, Frankfurt/M [Google Scholar](#)
43. Jones CG, Lawton JH (1995) Linking species and ecosystems. Chapman & Hall, New York [Google Scholar](#)
44. Jørgensen SE (2000) A general outline of thermodynamic approaches to ecosystem theory. In: Jørgensen S, Müller F (eds) Handbook of ecosystem theories and management. Lewis, London/New York/Washington, DC [Google Scholar](#)
45. Jørgensen SE, Müller F (2000) Handbook of ecosystem theories and management. Lewis, London/New York/Washington, DC [Google Scholar](#)
46. Kay JJ (2000) Ecosystems as self-organising holarchic open systems: narratives and the second law of thermodynamics. In: Jørgensen S, Müller F (eds) Handbook of ecosystem theories and management. Lewis, London/New York/Washington, DC [Google Scholar](#)

47. Köhler W (1920) Die physischen Gestalten in Ruhe und im stationären Zustand: eine naturphilosophische Untersuchung. Vieweg, Braunschweig [Google Scholar](#)
48. Kwa C (1987) Representations of nature mediating between ecology and science policy: the case of the International Biological Programme. Social Studies of Science 17, 3, 413–442 [CrossRef](#) [Google Scholar](#)
49. Lamotte M, Bourliere F (1978) Problemes d'écologie, structure et fonctionnement des écosystèmes terrestres. Masson, Paris [Google Scholar](#)
50. Lotka, AJ (1925) The elements of physical biology. Williams & Wilkins, Baltimore [Google Scholar](#)

The Rise of Systems Theory in Ecology

Written by Gaia

Thursday, 20 June 2019 21:53 - Last Updated Thursday, 20 June 2019 22:13

51. Lindeman RL (1942) The trophic-dynamic aspect of ecology. *Ecology* 23:339–418 [Google Scholar](#)

52. Likens GE, Bormann FH, Pierce RS, Eaton JS, Johnson NM (1977) Biogeochemistry of a forested ecosystem. Springer, New York [Google Scholar](#)
53. Lilienfeld R (1978) The rise of systems theory. Wiley, New York [Google Scholar](#)
54. Margalef R (1958) Information theory in ecology. *YearB Soc Gen Syst Res* 3:36–71 [Google Scholar](#)

55. Margalef R (1968) Perspectives in ecological theory. University of Chicago Press, Chicago, pp 1–25 [Google Scholar](#)
56. Maturana HR & Varela FJ (1987) Der Baum der Erkenntnis: die biologischen Wurzeln des menschlichen Erkennens. Scherz Verlag, Bern [Google Scholar](#)
57. McIntosh RP (1995) The background of ecology: concept and theory. Cambridge University Press, Cambridge [Google Scholar](#)
58. McIntosh RP (1995) H. A. Gleason's 'Individualistic concept' and theory of animal communities: a continuing controversy. - *Biol. Rev.*, 70:317–357 [Google Scholar](#)
59. Müller K (1996) Allgemeine Systemtheorie. *Studien zur Sozialwissenschaft* 164. Opladen [Google Scholar](#)
60. Neumann J, Morgenstern O (1944) Theory of games and economic behavior. Princeton Univ. Press, Princeton, NJ [Google Scholar](#)
61. Nielsen SN (2000) Ecosystems as information systems. In: Jørgensen S, Müller F (eds) Handbook of ecosystem theories and management. Lewis, London/New York/Washington, DC [Google Scholar](#)
62. Odum E (1953, 1959, 1971) Fundamentals of ecology. Saunders, Philadelphia [Google Scholar](#)

63. Odum HT (1956) Primary production in flowing waters. *Limnology and Oceanography* 1:102–117 [CrossRef](#) [Google Scholar](#)
64. Odum EP (1969) The strategy of ecosystem development: an understanding of ecological succession provides a basis for resolving man's conflict with nature. *Science* 164:262–270 [PubMed](#) [CrossRef](#) [Google Scholar](#)
65. Odum HT (1971) Environment, power and society. Wiley, London [Google Scholar](#)
66. O'Neill RV, DeAngelis DL, Waide JB, Allen TFH (1986): A hierarchical concept of ecosystems. Princeton Univ. Pr., Princeton, NJ [Google Scholar](#)
67. Parsons T (1937) The structure of social action. McGraw-Hill, New York [Google Scholar](#)
68. Pace ML, Groffman PM (eds) (1998) Successes, limitations, and frontiers in ecosystem science. Springer, New York [Google Scholar](#)
69. Patten BC (1959) An introduction to the cybernetics of the ecosystem: the trophic dynamic aspect. *Ecology* 40:221–231 [CrossRef](#) [Google Scholar](#)
70. Patten BC, Odum EP (1981) The cybernetic nature of ecosystems. *Am Nat*

The Rise of Systems Theory in Ecology

Written by Gaia

Thursday, 20 June 2019 21:53 - Last Updated Thursday, 20 June 2019 22:13

118:886–895

[CrossRef](#) [Google Scholar](#)

71. Peus F (1954) Auflösung der Begriffe “Biotop” und “Biozönose”. Deutsche Entomologische Zeitschrift N F 1:271–308 [CrossRef](#) [Google Scholar](#)

72. Phillips J (1934,1935) Succession, development, the climax, and the complex organism: an analysis of concepts. Part 1–3. J Ecol 22:554–571, 23: 210–246, 3: 488–508

[CrossRef](#)

[Google Scholar](#)

73. Pias C & Foerster H (eds) (2003) Cybernetics: the Macy-Conferences 1946–1953. Diaphanes, Zürich [Google Scholar](#)

74. Pomeroy LR, Alberts JJ (eds) (1988) Concepts of ecosystem ecology. Springer New York [Google Scholar](#)

75. Prigogine I (1955) Introduction to thermodynamics of irreversible processes. Thomas, Springfield [Google Scholar](#)

76. Ramensky LG (1926) Die Gesetzmäßigkeiten im Aufbau der Pflanzendecke. Botanisches Centralblatt N F 7:453–455 [Google Scholar](#)

77. Rapoport A (1947) Mathematical theory of motivation of interactions of two individuals. Bulletin of Mathematical Biophysics 9,1:17–27 [CrossRef](#) [Google Scholar](#)

78. Rapoport A (1950) Science and the goals of man: a study in semantic orientation. Harper, New York [Google Scholar](#)

79. Recknagel F (ed) (2003) Ecological informatics: understanding ecology by biologically-inspired computation. Springer, Berlin [Google Scholar](#)

80. Shannon CE, Weaver W (1949) The mathematical theory of communication. University of Illinois Press, Urbana, Illinois [Google Scholar](#)

81. Schwarz AE (1996) Aus Gestalten werden Systeme: Frühe Systemtheorie in der Biologie. In: Mathes K, Breckling B, Eckschmitt K (eds) Systemtheorie in der Ökologie. Landsberg, pp 35–45 [Google Scholar](#)

82. Tansley AG (1935) The Use and abuse of vegetational concepts and terms. Ecology 16(3):284–307 [CrossRef](#) [Google Scholar](#)

83. Taylor P (1988) Technocratic optimism, H.T. Odum, and the partial transformation of ecological metaphor after World War II. – J. Hist. Biol., 21(2):213–244 [Google Scholar](#)

84. Thienemann A, Kieffer JJ (1916) Schwedische chironomiden. Arch. hydrobiol. 2(Suppl):489 [Google Scholar](#)

85. Tobey RC (1981) Saving the prairies. University of California, Berkeley [Google Scholar](#)

86. Trepl L (1987) Geschichte der Ökologie. Vom 17. Jahrhundert bis zur Gegenwart. Athenäum, Frankfurt a. M. [Google Scholar](#)

87. Ulanowicz RE (1997) Ecology, the ascendent perspective. Columbia University Press, New York [Google Scholar](#)

88. Vogt KA, Gordon JC, Wargo JP, Vogt DJ, Asbjorsen H, Palmiotto PA, Clark HJ, O'Hara JL, William S-K, Toral P-W, Larson B, Tortoriello D, Perez J, Marsh A, Corbett M,

The Rise of Systems Theory in Ecology

Written by Gaia

Thursday, 20 June 2019 21:53 - Last Updated Thursday, 20 June 2019 22:13

Kaneda K, Meyerson F, Smith D (1997) Ecosystems: balancing science with management. Springer, New York [Google Scholar](#)

89. Voigt A (2001) Ludwig von Bertalanffy: Die Verwissenschaftlichung des Holismus in der Systemtheorie. Verhandlungen zur Geschichte und Theorie der Biologie 7:33–47
[Google Scholar](#)

90. Volterra V (1926) Variazioni e fluttuazioni del numero d'individui in specie animali conviventi. Mem. Accad. Lincei series 6, 2(36):31–113 [Google Scholar](#)

91. Weil A (1999) Über den Begriff des Gleichgewichts in der Ökologie - ein Typisierungsvorschlag. Unversitätsverlag, TU Berlin, Berlin [Google Scholar](#)

92. Wiener N (1948) Cybernetics or control and communication in the animal and the machine. Wiley, New York [Google Scholar](#)

93. Worster D (1994) Nature's economy: a history of ecological ideas. Camb. Univ. Pr., Cambridge [Google Scholar](#)

Copyright information

© Springer Science+Business Media B.V. 2011

About this chapter

Cite this chapter as: Voigt A. (2011) The Rise of Systems Theory in Ecology. In: Schwarz A., Jax K. (eds) Ecology Revisited. Springer, Dordrecht

- First Online 12 March 2011
- DOI https://doi.org/10.1007/978-90-481-9744-6_15
- Publisher Name Springer, Dordrecht
- Print ISBN 978-90-481-9743-9
- Online ISBN 978-90-481-9744-6
- eBook Packages [Biomedical and Life Sciences](#)