# Dictionary of Ecological Economics

## Terms for the New Millennium

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ecological economics, industrial ecology, and other areas of sustainability.
b. A maxim that refers to a more prudent use of natural resources.

Andrea S. Thorpe

## Further reading

DeSimone & Popoff 2000.

*See also:* Eco-design, Rebound effect, Jevons paradox, Circular economy.

## Reference

DeSimone, L.D. & Popoff, F. 2000. Eco-Efficiency: The Business Link to Sustainable Development. Boston, MA: MIT Press.

# Ecofeminism

The term, short for "ecological feminism," was coined in the 1970s by Francoise D'Eaubonne (D'Eaubonne 1974). It has two main interconnected sets of meanings or applications.

Political activism: the linking of environmental and other political emancipatory causes to "radical" action, as famously seen in the 1980s Greenham Common anti-nuclear protests, where women were seen as having an innate connection to life and nature and, by extension, the survival of the planet. (Male) patriarchy was blamed for environmental as well as socio-economic injustices.

Academic (social, political, and environmental) sustainability discourses: the extension of this activist perspective to a general anti-exploitation stance that is seen as "anti-masculinist" insofar as "masculinism" refers to capitalist, exploitative, competitive, hegemonic: against the natural world as well as marginalized social groups. Sustainability is seen as a central moral political issue, in which ecology, feminism, socialism, and indigenous politics and globalism are brought together (Salleh 1997, p. 103). The guiding principle of responsibility for our physical environment via the use of fewer resources is matched by that of social responsibility, for equal sharing of those resources (Findlow 2019). "Internationalism" is conceived as a commitment to the common good, for people in other societies as well as to future populations (Lister 1997).

Sally Findlow

*See also:* Feminist ecological economics, Feminist political ecology, Social equity, Ecology, Environmentalism.

## References

D'Eaubonne, F. 1974. Le Féminisme ou la Mort. Paris: P. Horay.
Findlow, S. 2019. Challenging bias in ecological education discourses: emancipatory "development education" in developing countries. Ecological Economics 157: 373–81.
Lister, R. 1997. Citizenship: Feminist Perspectives. London: Macmillan.
Salleh, A. 1997. Ecofeminism as Politics: Nature, Marx and the Postmodern. London: Zed Books.

# Ecohealth

A concept that combines ecosystem health and public health as intertwined objectives, with an emphasis on ecological restoration and allied activities (for example, agroforestry, urban greening, and so on). The science, practice, and policy of ecological restoration undertaken with an ecohealth approach considers its implications for human health. Likewise, public health interventions designed with an ecohealth perspective consider the role of ecosystem health in impacting human health.

This framework differs from planetary health and "one health" in that it is grounded in place-based ecological restoration. The "ecohealth hypothesis" states that the restoration and rehabilitation of a degraded ecosystem will have significant health benefits for people who interact with that ecosystem, in present and future generations.

Laura Orlando, James C. Aronson, Adam T. Cross & Neva R. Goodwin

## Further reading

Breed et al. 2020; Cross et al. 2019.

*See also:* Ecosystem health, Environmental health, Human health, Public health, One health, Planetary health, Ecological restoration, Well-being economy.

## References

Breed, M.F., Cross, A.T., Wallace, K. et al. 2020. Ecosystem restoration: a public health intervention. EcoHealth 18: 269–71.

Cross, A.T., Nevill, P.G., Dixon, K.W. & Aronson, J. 2019. Time for a paradigm shift towards a restorative culture. Restoration Ecology 27(5): 924–8.


# Eco-innovation

An improvement in environmental performance of products and processes, reducing the environmental impact caused by consumption and production activities, whether the main motivation for its development or deployment is environmental or not (Carrillo-Hermosilla et al. 2009, 2010). One of the first appearances of the concept of eco-innovation in the literature is in the book by Fussler and James (1996). Rennings (2000) first introduced the term "eco-innovation," addressing explicitly three kinds of changes towards sustainable development: technological, social, and institutional innovation.

As stressed by the OECD (2009), eco-innovation may be environmentally motivated, but may also occur as a side-effect of other goals, such as reducing production costs. From the social point of view, it does not matter very much if the initial motivation for the uptake of eco-innovation is purely an environmental one. It is more difficult to verify an environmental motivation than an environmental result, although the latter may also prove challenging. While it is mainly environmental impacts that define eco-innovation, economic and social impacts play a crucial role in its development and application, and hence determine its diffusion path and contribution to competitiveness and overall sustainability.

Javier Carrillo-Hermosilla

*See also:* Green innovations, Grassroots innovations, Business innovation, Sustainable business, Circumfauna.


## References

Carrillo-Hermosilla, J., del Rio, P. & Könnölä, T. 2009. Eco-Innovation: When Sustainability and Competitiveness Shake Hands. Basingstoke: Palgrave Macmillan.

Carrillo-Hermosilla, J., del Río, P. & Könnölä, T. 2010. Diversity of eco-innovations: reflections from selected case studies. Journal of Cleaner Production 18(10–11): 1073–83.

Fussler, C. & James, P. 1996. Eco-Innovation: A Breakthrough Discipline for Innovation and Sustainability. London: Pitman Publishing.

Organisation for Economic Co-operation and Development (OECD). 2009. Sustainable Manufacturing and Eco-Innovation. Framework, Practices and Measurement. Synthesis Report. Paris: OECD.

Rennings, K. 2000. Redefining innovation: eco-innovation research and the contribution from ecological economics. Ecological Economics 32(2): 319–32.


# Eco-labeling

Eco-labels (n. eco-label; v. eco-labeling) are a form of environmental performance disclosure that can help consumers, including institutional purchasers, to easily identify products or services that are deemed environmentally preferable based on independently developed criteria and certified by accredited bodies. Eco-labels are typically developed and operated by non-governmental environmental organizations or multi-stakeholder consortia (for example, Forest Stewardship Council), and remain voluntary, relying on consumer awareness for market transformation. However, they can also be government-run and made mandatory (for example, the United States Energy Guide), which can help to increase their effectiveness. Due to the proliferation of "greenwashing" claims and labels, only "third-party" eco-labels should be considered credible.

The International Organization for Standardization (ISO) classifies eco-labels into Type I: multi-attribute "Seal of Approval" based on life-cycle assessment (for example, German Blue Angel); Type II: single-attribute claim certification (for example, "CFC-free," "Dolphin-safe"); and Type III: detailed "Report Card" type disclosures (for example, Environmental Product Declaration) (see ISO 2019).

Abhijit Banerjee

climate change and biodiversity loss); (2) large inequalities within and between nations; and (3) macroeconomic instability, related to finance. The research explores the possibilities for coping with all three crises at the same time, and provides suggestions for policies. The development of such research implies increased cooperation between ecological economics and post-Keynesian economics.

Inge Røpke

## Further reading

Harris 2009; Rezai & Stagl 2016.

*See also:* Macroeconomics, Economic growth, Degrowth, Decoupling economic growth, Steady state, Social metabolism, Biophysical constraints on human economic activity, Ecological footprint, Human appropriation of net primary production (HANPP), Material flow analysis, Post-Keynesian economics.

## References

Harris, J.M. 2009. Ecological macroeconomics: consumption, investment, and climate change. Real-World Economics Review 50: 34–48.

Rezai, A. & Stagl, S. 2016. Ecological macroeconomics: introduction and review. Ecological Economics 121: 181–5.

# Ecological perturbation

Displacement of ecological variables away from their prior or typical state (Rykiel 1985), as the direct consequence of processes that are not part of the ecosystem's description: events that originate externally (for example, human action), at larger scales (for example, geophysical events), or at smaller scales (for example, physiological changes).

The ecosystem's subsequent response to the perturbation encompasses all impacts mediated by processes that are part of the ecosystem's description, such as population dynamics, species interactions, and resource flows (Yodzis 1988). For example, an organism-level perturbation can induce a response in the organism's mortality; in turn, this change in mortality can be seen as a perturbation at the population level, inducing a response in species abundance.

Typical ecological perturbations include changes in species abundance or resource availability (for example, due to human inputs or extraction, fires, invasions), and changes in ecological parameters such as growth and mortality, species interactions, rates of uptake or decomposition (for example, due to climate change, disease).

Matthieu Barbier

*See also:* Perturbation, Disturbance, Stressors, Stability, Spatial dynamics.

## References

Rykiel, E.J. 1985. Towards a definition of ecological disturbance. Australian Journal of Ecology 10(3): 361–5.

Yodzis, P. 1988. The indeterminacy of ecological interactions as perceived through perturbation experiments. Ecology 69(2): 508–15.

# Ecological resilience

*See:* Resilience.

*See also:* Ecosystem resilience.

# Ecological restoration

The process in which people assist the recovery of an impaired ecological system that has been degraded, damaged, or destroyed (Society for Ecological Restoration 2004). It includes a range of activities that have the goal of achieving or supporting substantial ecosystem recovery compared to the baseline condition of degradation and with reference to a collectively agreed-upon model of a healthier ecological system (Clewell & Aronson 2013; Gann et al. 2019). Ecological restoration may be undertaken in any type of ecosystem—terrestrial, aquatic, or oceanic—and in any type of land-use regime, including agricultural and urban.

Examples of ecological investment and restoration activities include: removing invasive plant and animal species; identifying, growing, or collecting specimens (for

example, seeds or wildlings) and using them for the reintroduction or enrichment of populations of native species; improving soil health; removing dams and repairing river channels by re-establishing native riparian vegetation; rehabilitating post-mining sites.

James C. Aronson, Adam T. Cross, Neva R. Goodwin & Laura Orlando

*See also:* Ecology, Restoration ecology, Environmental restoration, Investment.

## References

Clewell, A.F. & Aronson, J.C. 2013. Ecological Restoration: Principles, Values, and Structure of an Emerging Profession, 2nd edn. Washington, DC: Island Press.

Gann, G.D., McDonald, T., Walder, B., Aronson, J. et al. 2019. International principles and standards for the practice of ecological restoration, 2nd edn. Restoration Ecology 27(S1): S1–S46.

Society for Ecological Restoration, International Science & Policy Working Group, 2004. The SER International Primer on Ecological Restoration. https://www.ser-rrc.org/resource/the-ser-international-primer-on/.

# Ecological science

*See:* Ecology.

*See also:* Ecological succession, Ecological perturbation, Ecological footprint, Ecological limits, Ecological indicators, Ecological restoration.

# Ecological succession

The process of change in the structure of plants and animals in an ecological community following a natural or anthropogenic disturbance or perturbation, which can take place over widely varying timescales. It was one of the first theories advanced in ecology. While ideas of ecological succession were proposed in the 18th and 19th centuries, the first formal conception was by Henry Chandler Cowles in his studies of vegetation development on the Indiana Dunes on the shore of Lake Michigan in the United States (Cowles 1899; Egerton 2015).

The course of an ecological succession can be determined by site conditions, perturbations, species interactions, and stochastic factors (for example, weather, availability of seeds, colonists, and so on). Ecological succession is often divided into "primary" (newly exposed lifeless, rocky, or sandy areas, lava flows, or glacial tills are colonized for the first time) and "secondary" (previously occupied communities are disturbed or removed and recolonized, without destroying the soil).

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## Further reading

Luken 1990; Pielou 1966; Chang & Turner 2019.

*See also:* Disturbance, Perturbation, Ecological perturbation, Ecosystem structure and function, Anthropogenic.

## References

Chang, C.C. & Turner, B.L. 2019. Ecological succession in a changing world. Journal of Ecology 107(2): 503–9.

Cowles, H.C. 1899. The ecological relations of the vegetation on the sand dunes of Lake Michigan. Part I—geographical relations of the dune floras. Botanical Gazette 27(2): 95–117.

Egerton, F.N. 2015. History of ecological sciences, part 54: succession, community, and continuum. Bulletin of the Ecological Society of America 96: 426–74.

Luken, J.O. 1990. Directing Ecological Succession. London & New York: Chapman & Hall.

Pielou, E.C. 1966. Species-diversity and pattern-diversity in the study of ecological succession. Journal of Theoretical Biology 10(2): 370–83.

# Ecologically unequal exchange

Posits that "Northern" consumption and capital accumulation, to a large extent, is based on "Southern" environmental degradation and extraction. The environmental space for the poor deteriorates, and at the same time the rich can buy release from global ecosystems' destruction. Ecologically unequal

## References

Sen, A. 1993. "Capability and well-being," pp. 30–66 in The Quality of Life. M.C. Nussbaum & A. Sen, eds. Oxford: Oxford University Press.

Sen, A. 1999. "The ends and the means of development," pp. 35–53 in Development as Freedom. New York: Oxford University Press.

ul Haq, M. 1995. Reflections on Human Development. New York: Oxford University Press.

UNDP (United Nations Development Programme). 1990. Human Development Report 1990: Concept and Measurement of Human Development. New York: Oxford University Press. http://hdr.undp.org/sites/default/files/reports/219/hdr_1990_en_complete_nostats.pdf.


# Human ecology

The study of the interrelationships between human societies and their environment. Some approaches consider only the natural environment, while others include the social and urban environments. Human ecology is an interdisciplinary field that may draw upon natural ecological and Earth system processes, environmental management, resource use and policy, cultural ecology, anthropology, archeology, geography, sociology, psychology, economic history, and the history and philosophy of environmental change (Dyball & Newell 2014).

Mark O. Diesendorf

*See also:* Human–nature relationships, Environmental management, Global change, Social ecology, Urban ecology, Sustainability.


## Reference

Dyball, R. & Newell, B. 2014. Understanding Human Ecology: A Systems Approach to Sustainability. London: Routledge.


# Human–ecosystem interaction

*See:* Human–nature relationships.

*See also*: Ecosystem, Coupled system dynamics.

# Human health

Building on the 1948 definition from the Constitution of the World Health Organization, which refers to a "state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity," this term is increasingly refined to recognize that wellness is a dynamic process, with ecosystem health and social determinants of health as major components to it (Ryff & Singer 1998).

Laura Orlando, James C. Aronson, Adam T. Cross & Neva R. Goodwin

*See also:* Public health, Ecosystem health, Ecohealth, One health, Objective well-being, Matrix of human needs.


## Reference

Ryff, C.D. & Singer, B. 1998. The contours of positive human health. Psychological Inquiry 9(1): 1–28.


# Human-made capital

*See:* Manufactured capital.

*See also:* Capital, Natural capital.

# Human nature

The fundamental psychological characteristics and traits of humans, including ways of thinking, feeling, beliefs, and behavior towards other people, institutions, and nature that humans have naturally, as opposed to being the result of learning or socialization. This concept is controversial, since the existence and nature of such an essence is contested (Hannon & Lewens 2018).

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*See also:* Nature, Natural, Environment.

ecological economists also use qualitative methods. This reinforces Norgaard's call for methodological pluralism, since methodology is the contextual framework, rationale, and justification for using particular research methods.

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## Further reading

Faber et al. 1996.

*See also:* Scientific method, Quantitative analysis, Models and modeling, Multivariate statistical techniques, Econometrics, Revealed preference methods, Stated preference methods, Qualitative research.

## References

Faber, M., Manstetten, R. & Proops, J. 1996. Ecological Economics: Concepts and Methods. Cheltenham, UK and Brookfield, VT, USA: Edward Elgar Publishing.

Norgaard, R.B. 1989. The case for methodological pluralism. Ecological Economics 1(1): 37–57.

# Microbiome

The total assemblage of microbes in a given environment for example, soils, the atmosphere, the human or other animals' guts and skins. A healthy and diverse gut microbiome—to take one example—is linked to improved immune and metabolic function, whereas a compromised gut microbiome impairs homeostasis and can facilitate the development of disease. Exposure to a healthy ecosystem appears to result in the development of human microbiomes with notable similarities to ecosystem microbiomes; much research is under way to test this idea as well as the recent "microbiome rewilding hypothesis" (Mills et al. 2017), which suggests that increasing the biodiversity of an ecosystem through restoration activities will contribute to improved human health.

Adam T. Cross, Neva R. Goodwin, Laura Orlando & James C. Aronson

*See also:* Ecological restoration, Ecohealth, Ecosystem health, Public health.

## Reference

Mills, J.G., Weinstein, P., Gellie, N.J. et al. 2017. Urban habitat restoration provides a human health benefit through microbiome rewilding: the microbiome rewilding hypothesis. Restoration Ecology 25(6): 866–72.

# Microeconomics

A major branch of economics that focuses on individual choices and how they interact with market contexts. The most basic model of human decision-making is one of rational maximizing self-interest. The most basic model of market activity involves frictionless, costless, instantaneous exchange of goods in the absence of any market failures. The famous price/quantity graph of supply and demand curves is found here and demonstrates the potential for microeconomics to predict market exchange outcomes and the impact of regulation. Microeconomics is sometimes called price theory, since it also seeks to explain how market prices are determined and why and when they are high or low.

Microeconomics extends well beyond this starting point. Individuals can be persons, companies, government agencies, or any other decision-making units. More realistic variants of individual behavior lead to more interesting models. They explore the market effects of weaker cognitive powers, comparatively less or more knowledge of markets and goods, and alternative motivations to self-interested profit-seeking (for example, duty, charity). Variants to perfect markets and goods include market failures, heavily regulated markets, and non-market exchange. Insightful extensions of microeconomics include game theory and institutional economics.

Brent M. Haddad

## Further reading

Mankiw 2017.

*See also:* Neoclassical economics, Behavioral economics, Behavioral ecological economics, Individual choice, Game theory, Institutional economics, New institutional economics, Macroeconomics.

## References

Sanders, D. 1999. Indigenous peoples: issues of definitions. International Journal of Cultural Property 8: 4–13.
Webb, D.A. 1985. What are the criteria for presuming native status? Watsonia 15: 231–6.

# Natural

a. (Adjective) denoting the absence of any trace of human influence in the environment.
b. Given that there are few, if any, places on Earth that have not been influenced by humans, the term "natural" can denote a degree of naturalness.

Sara Latorre Tomás

## Further reading

Moriarty 2013.

*See also:* Nature, Naturalness.

## Reference

Moriarty, P.V. 2013. "Nature and the natural," pp. 3549–58 in The International Encyclopedia of Ethics. H. LaFollette, ed. Hoboken, NJ: Wiley-Blackwell.

# Natural assets

The stocks of natural resources or ecosystems that contribute to the provision of one or more services required for the health, well-being, and long-term sustainability of a community and its residents.

Michelle L. Molnar

## Further reading

Municipal Natural Assets Initiative 2017.

*See also:* Natural capital, Ecosystem services, Ecohealth, One health.

## Reference

Municipal Natural Assets Initiative. 2017. Defining and scoping municipal natural assets. https://mnai.ca/key-documents/.

# Natural capital

An economic metaphor for the finite stocks of physical and biological elements naturally found on Earth, some of which are of direct use to society (these are then referred to, anthropocentrically, as resources), and some of which are not.

According to Rees (1995) and the Millennium Ecosystem Assessment (2005), there are four partially overlapping types of natural capital: renewable (living species and ecosystems), non-renewable (subsoil assets such as petroleum, coal, and diamonds), replenishable (for example, the atmosphere, potable water, and fertile soils), and cultivated (for example, heritage seeds, and local races of livestock; traditional horticultural and ecological knowledge associated with agriculture, animal husbandry, and silviculture). Note that the concept of renewable natural capital as an asset includes all elements of ecosystems, not just the obviously marketable parts.

Following on with the metaphor, if natural capital is a stock or an asset, then the "dividend" is the flow in ecosystem goods and services derived from assets such as forests (which, among other things, provide services of cleaning water and air), or land used to produce food.

James C. Aronson, Adam T. Cross, Neva R. Goodwin & Laura Orlando

*See also:* Capital, Manufactured capital, Restoring natural capital (RNC), Ecosystem services.

## References

Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-being: Synthesis. Washington, DC: Island Press.

Rees, W.E. 1995. Cumulative environmental assessment and global change. Environmental Impact Assessment Review 15: 295–309.


# Natural disaster

Any disruptive, rapid, or instantaneous event in nature that is caused by biological, climatological, extraterrestrial, geophysical, hydrological, or meteorological hazards, with a significant adverse effect on socio-economic systems to the extent of direct impacts (for example, manifold loss of life, damaged assets) or indirect impacts (for example, unemployment, reduced economic activity). Examples include hurricanes, floods, earthquakes, and volcanic eruptions.

Mark A. Andor, Benjamin Koch & Leonie Matejko

## Further reading

Alexander 2018; Andor et al. 2020; Botzen et al. 2019; Hallegatte & Przyluski 2010; IRDR 2014; IFRC n.d.

*See also:* Disaster risk management (DRM), Risk, Risk aversion.


## References

Alexander, D. 2018. Natural Disasters. London: Routledge.

Andor, M.A., Osberghaus, D. & Simora, M. 2020. Natural disasters and governmental aid: is there a charity hazard? Ecological Economics 169: 106534.

Botzen, W.J.W., Deschenes, O. & Sanders, M. 2019. The economic impacts of natural disasters: a review of models and empirical studies. Review of Environmental Economics and Policy 13(2): 167–88.

Hallegatte, S. & Przyluski, V. 2010. The economics of natural disasters: concepts and methods. World Bank Policy Research Working Paper 5507, Washington, DC.

IFRC (International Federation of Red Cross). n.d. What is a disaster? Geneva: IFRC. https://www.ifrc.org/what-disaster.

IRDR (Integrated Research on Disaster Risk). 2014. Peril classification and hazard glossary. IRDR DATA Publication No. 1. Beijing: Integrated Research on Disaster Risk.


# Natural environment

*See:* Natural, Naturalness, Nature.

*See also*: Environment.

# Natural insurance

Insurance provided by natural entities or processes that reduce the costs of risk-bearing to humans. More precisely, any risk faced by a risk-averse actor is associated with a cost of carrying that risk—that is, the risk premium—defined as the perceived benefit the agent would be willing to sacrifice to fully eliminate that risk. Based on this, a natural insurance value is defined as the reduction of that risk premium due to natural processes or entities.

Martin F. Quaas

## Further reading

Baumgärtner 2007; Quaas et al. 2019; Yachi & Loreau 1999.

*See also:* Insurance value, Risk, Risk premium, Nature, Natural.


## References

Baumgärtner, S. 2007. The insurance value of biodiversity in the provision of ecosystem services. Natural Resource Modeling 20(1): 87–127.

Quaas, M.F., Baumgärtner, S. & De Lara, M. 2019. Insurance value of natural capital. Ecological Economics 165: 106388.

Yachi, S. & Loreau, M. 1999. Biodiversity and ecosystem productivity in a fluctuating environment: the insurance hypothesis. Proceedings of the National Academy of Sciences of the United States of America 96(4): 1463–8.

environment through hunting or harvesting by humans (Ingram et al. 2015).
b. The channel or drainage point of a river.

Economics:

a. The purchase or "taking off" of goods during a given time period.
b. An offtake agreement is a contract between the buyer and producer or seller of a good, which involves an offtake buyer purchasing all or a large portion of the output from a specific facility, and thereby providing support for project financing through the revenue stream. Offtake agreements are common for energy and infrastructure projects.
c. A pipe or passage for conducting smoke or air pollution, such as in a steel mill.

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## Further reading

Hoffman 2007.

*See also:* Wildlife conservation, Sustainable yield, Industrial economics, Effluent, Industrial ecology, Environmental finance.

## References

Hoffman, S. 2007. The Law and Business of Project Finance, 3rd edn. Cambridge: Cambridge University Press.
Ingram, D.J., Coad, L., Collen, B. et al. 2015. Indicators for wild animal offtake: methods and case study for mammals and birds. Ecology and Society 20(3): 40.

# *Oikos*

Literally "house," but also the family, and the family's property, from ancient Greek (Davies 1992). Ecology and economics share the same root. Thus, "ecology" literally means the "study of the house" while economics means the "management of the house" where "house" means the world. This leads to the meaning of ecological economics as the study and management of the world in an integrated manner (Costanza 2020).

Barry D. Solomon

*See also:* Ecology, Economics, Ecological economics.

## References

Costanza, R. 2020. Ecological economics in 2049: getting beyond the argument culture to the world we all want. Ecological Economics 168: 106484.
Davies, J.K. 1992. "Society and economy," p. 290 in The Cambridge Ancient History, Volume V: The Fifth Century B.C. D.M. Lewis, J. Boardman, J.K. Davies & M. Ostwald, eds. Cambridge: Cambridge University Press.

# One health

A concept that is concerned with the link between humans, animals, and the environment in the evolution and emergence of disease. It encourages fluid boundaries between medical and veterinary practice for the detection of diseases in humans and animals, with the aim of impacting the control of infectious diseases.

Laura Orlando, James C. Aronson, Adam T. Cross & Neva R. Goodwin

## Further reading

Hinchliffe 2015.

*See also:* Human health, Public health, Ecohealth, Ecosystem health, Environmental health.

## Reference

Hinchliffe, S. 2015. More than one world, more than one health: re-configuring inter-species health. Social Science and Medicine 129: 28–35.

# Open access

A resource that is used according to the "first come, first served" principle (for example, unregulated fish stocks, timber, or pastures; free public transport). Open access resources are typically common pool resources (CPR), whose characteristics make it difficult (costly) to exclude potential users. If their regulation is not properly conceived and implemented,

as a constant press, cyclic oscillation, or stochastic noise; Arnoldi et al. 2016).

Matthieu Barbier

*See also:* Disturbance, Stressors, Ecological perturbation.

## References

Arnoldi, J.F., Loreau, M. & Haegeman, B. 2016. Resilience, reactivity and variability: a mathematical comparison of ecological stability measures. Journal of Theoretical Biology 389: 47–59.

Rykiel, E.J. 1985. Towards a definition of ecological disturbance. Australian Journal of Ecology 10(3): 361–65.

# Physiocrats

A school of 18th-century French political economy, and the first to refer to themselves as "economists." They helped to formalize political economy as an objective science, and contributed to the theorization of capital and profit, the "national economy," and the idea of general equilibrium. The physiocrats are sometimes considered proto-environmentalists, in that they regarded land as the source of all wealth, but their view of nature was instrumental: nature is synonymous with natural resources, conceived of as "free gifts" for exploitation by owners of productive property and land.

The overarching goal of physiocracy was to convert France's political economy to the English model, with agrarian capitalists as the vanguard force and principal beneficiaries. To this end, they pressed government to remove obstructions to the flow of capital into agriculture and to put its weight behind wealthy "improving" farmers and other agricultural "entrepreneurs."

Gareth Dale

## Further reading

Dale 2021; Gudeman 1980; Meek 1962.

*See also:* Laissez-faire economics, Classical economics.

## References

Dale, G. 2021. Rule of nature or rule of capital? Physiocracy, ecological economics, and ideology. Globalizations 18(7): 1230–47.

Gudeman, S. 1980. Physiocracy: a natural economics. American Ethnologist 7(2): 240–58.

Meek, R. 1962. The Economics of Physiocracy: Essays and Translations. London: Routledge.

# Planetary health

The intersection of human health, human civilization, and natural systems, as outlined by the Rockefeller Foundation–Lancet Commission on planetary health (Whitmee et al., 2015). Planetary health focuses on human-caused environmental degradation and its impacts on human health and aims to address the multitude of environmental threats to the planet.

Laura Orlando, James C. Aronson, Adam T. Cross & Neva R. Goodwin

*See also:* Human health, Public health, Environmental health, Ecohealth, Ecosystem health.

## Reference

Whitmee, S., Haines, A., Beyrer, C. et al. 2015. Safeguarding human health in the Anthropocene epoch: report of the Rockefeller Foundation–Lancet Commission on planetary health. The Lancet 386(10007): 1973–2028.

# Plausible

A descriptor of a statement, belief, argument, assumption, scenario, hypothesis, or theory that is seemingly reasonable, convincing, probable, credible, or believable by others. For example, a plausible scenario is one that is highly likely to be true or valid, and which fits prior knowledge well with many different sources of corroboration, without complexity of explanation, and with minimal conjecture (Connell & Keane, 2010).

Barry D. Solomon

*See also:* Scenario, Models and modeling, Critical theory.

# Restoration

*See:* Ecological restoration, Environmental restoration.

*See also:* Restoration ecology, Ecosystem, Ecosystem management.

# Restoration ecology

The branch of ecological science that provides concepts, models, methodologies, and tools for the practice of ecological restoration. It also benefits from direct observation of and participation in restoration practice (Gann et al. 2019).

James C. Aronson, Adam T. Cross, Neva R. Goodwin & Laura Orlando

*See also:* Ecological restoration, Restoring natural capital (RNC).

## Reference

Gann, G.D., McDonald, T., Walder, B. et al. 2019. International principles and standards for the practice of ecological restoration. Restoration Ecology 27(S1): S1–S46.

# Restoring natural capital (RNC)

The replenishment of natural capital stocks to improve long-term human well-being and ecosystem health (Aronson et al. 2007). Without natural capital there is no flow of ecosystem services; thus, human well-being is directly diminished when stocks of natural capital are degraded. Reversing such losses may be achieved through ecological investment and restoration and other ecological improvements in agriculture, urbanization, industrial activities, and other areas where people interact with the natural world.

James C. Aronson, Adam T. Cross, Neva R. Goodwin & Laura Orlando

*See also:* Natural capital, Investment, Ecological restoration, Restoration ecology, Environmental restoration.

## Reference

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# Return on investment (ROI)

A popular though simple financial metric used in business to determine the attractiveness of an investment over time. ROI is an easy way to relate profits to capital investment, and to compare several alternative investment options in a portfolio in terms of economic efficiency. An ROI should be evaluated over the lifetime of an investment, as well as for a single time period. There are two common ways to calculate ROI:

$$\text{ROI} = \frac{R - I}{C} \times 100\%$$

$$\text{ROI} = \frac{N}{C} \times 100\%$$

Where R = final value of investment, I = initial value of investment, N = net return on investment, and C = cost of investment.

The ROI is easier to calculate than net present value (NPV), with the latter more likely to be used in a benefit–cost analysis (BCA) conducted by a government agency A limitation of the ROI metric is that it does not fully capture the short-term or long-term importance, value, or risks associated with natural and social capital (Sroufe 2018, p. 268).

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*See also*: Investment, Net present value (NPV), Benefit–cost analysis (BCA).

# Soil conservation

The protection of soil from wind and water erosion, and other types of degradation or deterioration on agricultural lands, for example, reduced fertility and productivity from overusage, salinization, acidification, and chemical contamination. As a result, soil conservation also requires careful management of the watershed and water usage. Soil conservation methods include crop rotation, cover cropping, strip cropping, cross-slope farming, reduced-tillage or no-till farming, composting, mulching, better nutrient management, and adding windbreaks and buffer strips, among others.

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## Further reading

Blanco & Lai 2008.

*See also:* Soil fertility, Soil health, Nutrient retention, Sustainable agriculture.

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# Soil fertility

The ability or capacity of soils to sustain agricultural plant growth by providing essential nutrients and favorable chemical, physical, and biological characteristics as habitat (FAO 2021). Fertile soils contribute to soil health, soil conservation, and food security. Sources of soil nutrients are primarily various kinds of fertilizers. The essential nutrients are often divided into macro and micro. Macronutrients include nitrogen, potassium, phosphorous, calcium, sulfur, and magnesium. Micronutrients include iron, boron, chlorine, copper, manganese, molybdenum, and zinc.

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## Further reading

Havlin et al. 2013; Troeh & Thompson 2005.

*See also:* Soil health, Soil conservation, Nutrient retention, Food security, Food insecurity.

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Troeh, F.R. & Thompson, L.M. 2005. Soils and Soil Fertility, 6th edn. Ames, IA: Blackwell.

# Soil health

The capacity of soil to function as a living ecosystem that supports and sustains terrestrial life (Lehmann et al. 2020). Components of soil health include the physical, chemical, hydrological, and biological characteristics of soil, and the interactions among them. Healthy soil is maintained by a complex web of microbial organisms, plants, and animals, both below and above ground. The health of the soil influences critical processes such as nutrient cycling, water filtration and retention, and carbon sequestration.

Adam T. Cross, Neva R. Goodwin, Laura Orlando & James C. Aronson

*See also:* Soil conservation, Soil fertility, Abiotic resources, Biotic resources, Ecosystem health.

## Reference

Lehmann, J., Bossio, T.A., Kögel-Knabner, I. & Rillig, M.C. 2020. The concept and future prospects of soil health. Nature Reviews Earth and Environment 1: 544–53.

# Solow sustainability

The possibility of maintaining or increasing the intertemporal level of consumption thanks to the substitution of manufactured capital for natural resources (Solow 1974), which is named after the neoclassical economist Robert Solow. This kind of substitution is formalized in a neoclassical growth model

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