Business and Biodiversity

This chapter focuses on strategies for biodiversity conservation and restoration, as they have been developed by corporations and other businesses. Biodiversity is defined as “the variability among living organisms from all sources, including…the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems” (Secretariat of the Convention on Biological Diversity, 1992, p. 4). Corporations and other businesses depend on and impact biodiversity, and the relationship between business and nature has attracted increasing attention (Ed Ballard, 2022; Holger, 2023; Kirby, 2023). Global sustainability goals seek to preserve existing and restore lost biodiversity, and companies are exploring how to sue ecosystems and species “in a way and at a rate that does not lead to the long-term decline of biodiversity” (Secretariat of the Convention on Biological Diversity, 1992, p. 5).

This chapter defines biodiversity, provides an overview of the history of biodiversity in the context of business, and describes methods for assessing biodiversity and biodiversity change. It then covers the ways in which businesses impact biodiversity, including causing biodiversity loss but also contributing to both biodiversity conservation and restoration. The chapter concludes with a discussion of research needs to achieve adequate biodiversity conservation and the implications of biodiversity conservation for business practice and the roles of business in society.

In 2022, more than 200 nations established the Kunming-Montreal Global Biodiversity Framework laying out a plan for the world to live in harmony with nature. Target 15 directly notes the roles and responsibilities of businesses in achieving societies compatible with biodiversity conservation and restoration. “Take legal, administrative or policy measures to encourage and enable business, and in particular to ensure that large and transnational companies and financial institutions: (a) Regularly monitor, assess, and transparently disclose their risks, dependencies and impacts on biodiversity, including with requirements for all large as well as transnational companies and financial institutions along their operations, supply and value chains, and portfolios; (b) Provide information needed to consumers to promote sustainable consumption patterns; (c) Report on compliance with access and benefit-sharing regulations and measures, as applicable; in order to progressively reduce negative impacts on biodiversity, increase positive impacts, reduce biodiversity-related risks to business and financial institutions, and promote actions to ensure sustainable patterns of production” (CBD, 2022, p. 11).

Biodiversity is important for both utilitarian and cultural reasons (IPBES, 2022). The sustainable use of biodiversity allows us to meet present human needs while preserving options for future people to meet their own needs, in line with the concept of sustainable development (UNWCED, 1987). The most basic need met by biodiversity is the need for natural resources produced by ecosystems. An ecosystem is "a dynamic complex of plant, animal, and micro-organism communities and their nonliving environment interacting as a functional unit" (United Nations, 1992, p. 3). Common ecosystem units include forests, wetlands, and estuaries. Materials produced by ecosystems and useful for people are natural resources. Natural resources include both living and nonliving materials. Biodiversity is relevant to living materials, such as timber, edible plants and animals, and fibers. Meeting present shelter, food, and clothing needs requires sustainable sources of such natural resources. Ecosystem produce natural resources, and meeting present and future needs requires sustaining ecosystem function to produce and reproduce resources. The same argument applies to immaterial benefits derived from ecosystems, which have been named ecosystem services to distinguish them from material natural resources. Some ecosystem services derived from biodiversity include waste disposal, water purification, climate regulation, recreation, cultural value, religious meaning, inspiration, flood mitigation, and protection from natural disasters (Hanson et al., 2012). Companies depend on ecosystem services that maintain stable business environments (Hanson et al., 2012). Biodiversity decline can create business risks at the level of individual businesses and at the higher level of systemic risks across economies (Evison & Knight, 2010; Kedward et al., 2020, 2022; TEEB, 2010). Maintaining and restoring biodiversity is necessary to ensure the sustainability of natural resources and ecosystem services used by businesses and needed by people, in both the present and future.

Biodiversity is conceptualized in three types that can be nested: ecosystem diversity, species diversity, and genetic diversity (Berrisford, 2021). Ecosystem diversity is the variety of ecological systems or “ecosystems.” The second type of biodiversity is species diversity, the variety of organisms within an ecosystem. Genetic diversityis the third type of biodiversity and is the variety of genes within a species.

What is the current state of biodiversity, and is it justifiable to say that we are experiencing a biodiversity “crisis”? Answering this question requires defining a threshold where, if a measure of biodiversity is below that threshold, it is a crisis and if a measure exceeds it, there is not a crisis. Attempts to define such a threshold have had mixed results. At the global level, there are two such thresholds for biodiversity within the planetary boundaries framework (Steffen et al., 2015). The first is genetic diversity, measured with planetary-level extinction rate. The second threshold is functional diversity, measured with the regional- or biome-level Biodiversity Intactness Index that measures how much of a region’s natural biodiversity still exists (The Trustees of The Natural History Museum, London, 2024).

Both thresholds provide some evidence that we are in a biodiversity crisis. The current extinction rate suggests the planet is losing species much faster than the historical rate. The Biodiversity Intactness Index has only been evaluated for a single region, a large area of South Africa. Results suggested that the region still had 84% of its natural biodiversity, below the threshold of 90% set as the threshold indicating a problem (Scholes & Biggs, 2005).

However, there is disagreement over whether we are experiencing a biodiversity crisis or if we even have the theoretical and empirical tools needed to determine if we are or are not in a crisis. Proponents of the planetary boundaries framework acknowledged that the thresholds and measures are provisional suggestions and might need to be updated with findings from future biodiversity and earth system functioning. “Our assessment is that science is, as yet, unable to provide a boundary measure that captures, at an aggregate level, the regulating role of biodiversity. Instead we suggest, as an interim indicator, using extinction rate as a substitute. In doing so, we conclude that humanity has already entered deep into a danger zone where undesired system change cannot be excluded, if the current greatly elevated extinction rate (compared with the natural background extinction) is sustained over long periods of time” (Rockström et al., 2009, p. 15). Uncertainty continues about the acceptable level of biodiversity loss and how to measure biodiversity at the planet, region, biome, and other scales (Alberts, 2022; Mace et al., 2014; Pennisi, 2021).

# The history of biodiversity and business

How did we arrive at a point where there is a growing perception that the world is losing too much biodiversity and that business operations are a significant cause of and solution to reversing biodiversity loss? “Biodiversity crisis” appeared in the academic literature as early as 1992. Western (1992) suggested ways that biologists and members of the Royal Swedish Academy of Sciences could help end the biodiversity crisis by actively participating in biodiversity conservation and rehabilitation. The same year saw publication of an article indexed with both biodiversity and business as subject terms. Swaney and Olson, writing about “the economics of biodiversity,” argued that biologists do not know how many species exist, complicating our ability to understand if biodiversity is in crisis or not. They call for an insurance approach to address that uncertainty, which would focus on protecting habitats while allocating resources to reducing biodiversity uncertainty through identifying species (1992). This was an early attempt to translate biodiversity into the language of economics by placing a monetary value on biodiversity. Monetary value then informs resource allocation decisions made by comparing the value of biodiversity to the values of other economic activities. This approach aligns with the emergence of the natural capital framework born from the work of Herman Daly (1973, 1991), where “natural capital refers to the living and nonliving components of ecosystems that contribute to the provision of goods and services of value to people” (Polasky & Daily, 2021, p. 88).

Biodiversity entered the business literature as early as the 1990s. Jones (1996) suggested how the field of accounting could assess a company’s biodiversity impacts so they could be disclosed in annual reports. Westley (1997, p. 342) examined how biologists, zoologists, and wildlife managers working in an international effort to save endangered species, finding that organizational form, network relationships, inspirational leadership, and psychological mechanisms were important for being able to continue working on a “seemingly hopeless situation.”

[[[The remainder of this section reviews the academic literature on business and biodiversity.]]]

# Measuring biodiversity and biodiversity change

Biodiversity measurement takes two forms: baseline measurement and change measurement. Baseline measurement is a point-in-time assessment of species biodiversity in an ecosystem or genetic biodiversity in a species. Change measurement is a measure of the difference in biodiversity between two points in time.

[[[This paragraph describes how to measure species biodiversity in an ecosystem.]]] eDNA measurement <https://www.naturemetrics.com/species-detection>.

[[[This paragraph describes how to measure genetic biodiversity in a species.]]]

[[[This paragraph describes how to measure biodiversity change.]]] Measuring biodiversity change requires choosing a reference condition to compare against a point-in-time biodiversity measurement. The choice of reference condition often determines if change has been loss or gain, making the choice of reference condition a critical decision point in the measurement of biodiversity change. Imagine a company engaged in soybean farming wants to measure biodiversity change over 200 acres of soil ecosystem it owns and has used for 35 years to grow soybeans. The choice of reference condition will determine the biodiversity change measurement. If the reference condition is the ecosystem 3 years ago when the soil was under the same cultivation conditions as the present point-in-time biodiversity measurement, then the biodiversity change measure will likely show no change in biodiversity. However, if the reference condition is the soil ecosystem 80 years ago, when it was a prairie ecosystem rather than a soybean field, then the same point-in-time measure that showed no change in biodiversity compared to a reference condition from 3 years prior could show a biodiversity loss compared to a reference condition from 80 years prior.

Scientists have developed several methods to define a reference condition for measuring biodiversity change (Gann et al., 2019). Broadly, the choice of reference condition involves normative judgments about the desired ecosystem and/or biodiversity state. Scholars have called conservation biology—the field of study most associated with biodiversity conservation and restoration—an “explicitly normative science” (Galusky, 2000).

# The interdependence of biodiversity and business

[[[This section explains the need for businesses to integrate biodiversity conservation into their operations to mitigate risks, enhance resilience, and contribute positively to global sustainability goals.]]]

# How business affects biodiversity

[[[This section describes the ways in which business activity affects biodiversity, both negatively through biodiversity loss and ecosystem degradation and positively through biodiversity conservation and restoration.]]]

Panwar et al. (2023) organized the biodiversity strategies of corporations into four types: conservation, restoration, compensation, and reparation. The typology is constructed on two dimensions of time and space. Time refers to whether the biodiversity strategy is executed before or after biodiversity loss occurs. Space refers to whether the biodiversity strategy is implemented where the biodiversity loss occurred or in some other location. These strategies can be generalized from corporations to other types of organizations.

## Negative impact: Biodiversity loss

[[[This section describes the ways business causes biodiversity loss.]]]

## Positive impact: Biodiversity conservation and restoration

[[[This section describes the ways business causes biodiversity conservation and restoration.]]]

# Biodiversity strategies for business

[[[This section describes the strategies individual businesses use to manage biodiversity impacts and risks.]]]

## The mitigation hierarchy

[[[The mitigation hierarchy: avoid, minimize, remediate, offset.]]] Achieving the sustainable use of biodiversity resources requires business managers to change or abandon some business practices and/or adopt new practices. “The conservation and development literature has identified a sequence of approaches, known as the mitigation hierarchy (BBOP, 2012), which serves as a set of guidelines for companies to develop their biodiversity protection strategies. The mitigation hierarchy suggests that companies should first try to avoid biodiversity loss, if not possible then minimize what cannot be avoided, and subsequently remediate and offset the damage they cause” (Panwar et al. 2023, p. 5).

## Corporate biodiversity strategies

Panwar et al. (2023) organized business biodiversity strategies into four types: conservation, restoration, compensation, and reparation. A biodiversity conservation strategy …. A biodiversity restoration strategy …. A biodiversity compensation strategy …. A biodiversity reparation strategy ….

Panwar et al.’s (2023) framework organizes biodiversity strategies according to whether the company implements the strategy before biodiversity loss occurs (conservation and compensation) or after (restoration and reparation). One risk of organizing strategies this way is that doing so can provide a justification for causing biodiversity loss. Managers might consider it acceptable to cause the extinction of genes, species, or ecosystems if a post-loss strategy is seen as an acceptable way for businesses to manage their impacts on biodiversity.

Justification risk also arises from the other dimension used to organize these four strategies: whether biodiversity loss occurs on-site where the company operates (conservation and restoration) or off-site of company operations (compensation and reparation). The off-site strategies of reparation and compensation explicitly justify biodiversity destruction. Compensation “accepts that substantial biodiversity loss will occur on-site but assumes that such loss can be counterbalanced by enhancing or protecting biodiversity in another location if the company’s managers pay an equivalent of the value of the biodiversity destroyed” (Panwar et al., 2023, p. 2548). A reparation strategy is the same, except payment occurs after biodiversity destruction rather.

Promoting biodiversity destruction as acceptable aligns with the weak sustainability approach in which nature can be destroyed if doing so creates more non-nature capital (Roome, 2011). In contrast, a strong sustainability approach rejects that nature can be destroyed to create non-nature capital. The difference between weak and strong sustainability can be related to differences in worldviews, ethics, and values about the acceptable ways to use and treat nature. Research on the diverse ways that people value nature suggests that destroying nature to produce non-nature capital is not universally accepted but is instead reflective of a particular set of norms and values about business practice (IPBES, 2022). Research on the underlying values toward nature within corporate practice suggest that most corporate managers hold a weak sustainability view that accepts the destruction of biodiversity in pursuit of non-nature capital (Demastus & Landrum, 2023; Landrum & Ohsowski, 2018).

## Sustainability strategies in practice

[[[This paragraph describes a company-level biodiversity strategy in the fashion industry.]]] Kering biodiversity strategy <https://www.kering.com/en/sustainability/safeguarding-the-planet/biodiversity-strategy/>

[[[This paragraph describes an economy-level success story of businesses engaging on biodiversity restoration and conservation]]]. 15 years of conservation finance in the Great Bear Rainforest and Haida Gwaii 2007-2022 (Coast Funds, 2023).

[[[This paragraph describes collective action among businesses and others to conserve biodiversity in agriculture.]]] “One Planet Business for Biodiversity (OP2B) is an international cross-sectorial, action-oriented business coalition on biodiversity with a specific focus on agriculture” (WBCSD, 2024).

## Biodiversity finance

[[[This section describes emerging biodiversity finance approaches (Benetto et al., 2023; Flammer et al., 2023).]]] Biodiversity bonds <https://am.pictet/en/belgium/global-articles/2024/monthly-markets-views/fixed-income/biodiversity-bonds>.

# Future research and practice on business and biodiversity

[[[This section explores future research needs on business and biodiversity (White et al., 2024), with a focus on biodiversity measurement and on linking companies to biodiversity outcomes. This section also discusses the difference between choice of outcome unit of analysis between ecosystems (WCMC, 2023), species, companies, and economies, which deals with the question of the most appropriate way to assess biodiversity in the context of business. Finally, this section will cover pressing sustainability questions in the world of practice, including emerging regulations, changes in the social license to operate regarding business impact on nature, and changing consumption preferences related to conceptions of nature and business impacts on nature.]]]

# References

Alberts, E. C. (2022, April 11). *Global biodiversity is in crisis, but how bad is it? It’s complicated*. Mongabay Environmental News. https://news.mongabay.com/2022/04/global-biodiversity-is-in-crisis-but-how-bad-is-it-its-complicated/

Benetto, E., Busch, T., Hickey, V., & Verones, F. (2023). Biodiversity Finance: Measuring and Managing Biodiversity in Corporations and Financial Markets. *Journal of Industrial Ecology*. https://jie.yale.edu/biodiversity-finance-measuring-and-managing-biodiversity-corporations-and-financial-markets

Berrisford, K. (2021, December 21). *A Simple and Visual Definition of Biodiversity*. Network for Business Sustainability. https://www.nbs.net/articles/a-simple-and-visual-definition-of-biodiversity

CBD. (2022, December 19). *15/4. Kunming-Montreal Global Biodiversity Framework*. https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf

Coast Funds. (2023). *Sustaining People and Place: 15 Years of Conservation Finance in the Great Bear Rainforest and Haida Gwaii 2007-2022*.

Daly, H. (1973). *Toward a steady-state economy*. Freeman.

Daly, H. (1991). *Steady-State Economics* (Second). Island Press.

Demastus, J., & Landrum, N. E. (2023). Organizational sustainability schemes align with weak sustainability. *Business Strategy and the Environment*. https://doi.org/10.1002/bse.3511

Ed Ballard. (2022, March 15). Quantifying Companies’ Impact on Forests, Oceans Is a Challenge—WSJ. *Wall Street Journal*. https://www.wsj.com/articles/quantifying-companies-impact-on-forests-oceans-is-a-challenge-11647349201

Evison, W., & Knight, C. (2010). *Biodiversity and business risk*. PricewaterhouseCoopers and the World Economic Forum.

Flammer, C., Giroux, T., & Heal, G. M. (2023). *Biodiversity Finance* (SSRN Scholarly Paper 4379451). https://doi.org/10.2139/ssrn.4379451

Galusky, W. J. (2000). The Promise of Conservation Biology: The Professional and Political Challenges of an Explicitly Normative Science. *Organization & Environment*, *13*(2), 226–232. https://doi.org/10.1177/1086026600132008

Gann, G. D., McDonald, T., Walder, B., Aronson, J., Nelson, C. R., Jonson, J., Hallett, J. G., Eisenberg, C., Guariguata, M. R., Liu, J., Hua, F., Echeverría, C., Gonzales, E., Shaw, N., Decleer, K., & Dixon, K. W. (2019). International principles and standards for the practice of ecological restoration. Second edition. *Restoration Ecology*, *27*(S1). https://doi.org/10.1111/rec.13035

Hanson, C., Ranganathan, J., Iceland, C., & Finisdore, J. (2012). *The corporate ecosystem services review: Guidelines for identifying business risks and opportunities arising from ecosystem change. Version 2.0* (p. 48). World Resources Institute. https://www.wri.org/research/corporate-ecosystem-services-review

Holger, D. (2023, January 18). Coming Soon to Carbon-Credit Markets: New Principles Aiming to Enhance Quality. *Wall Street Journal*. https://www.wsj.com/articles/carbon-credit-standards-sustainable-11674078579

IPBES. (2022). *Methodological assessment of the diverse values and valuation of nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. [object Object]. https://doi.org/10.5281/ZENODO.6522522

Jones, M. J. (1996). Accounting for Biodiversity: A Pilot Study. *The British Accounting Review*, *28*(4), 281–303. https://doi.org/10.1006/bare.1996.0019

Kedward, K., Ryan-Collins, J., & Chenet, H. (2020). *Managing nature-related financial risks: A precautionary policy approach for central banks and financial supervisors* [Working Paper]. https://www.ucl.ac.uk/bartlett/public-purpose/publications/2020/aug/managing-nature-related-financial-risks

Kedward, K., Ryan-Collins, J., & Chenet, H. (2022). Biodiversity loss and climate change interactions: Financial stability implications for central banks and financial supervisors. *Climate Policy*, 1–19. https://doi.org/10.1080/14693062.2022.2107475

Kirby, J. (2023, June 21). Half a Year After the COP Agreement on Nature, Companies Are Increasingly Looking at Their Biodiversity Impact. *Wall Street Journal*. https://www.wsj.com/articles/half-a-year-after-the-cop-agreement-on-nature-companies-are-increasingly-looking-at-their-biodiversity-impact-d0b53fb3

Landrum, N. E., & Ohsowski, B. (2018). Identifying Worldviews on Corporate Sustainability: A Content Analysis of Corporate Sustainability Reports. *Business Strategy and the Environment*, *27*(1), 128–151. https://doi.org/10.1002/bse.1989

Mace, G. M., Reyers, B., Alkemade, R., Biggs, R., Chapin III, F. S., Cornell, S. E., Díaz, S., Jennings, S., Leadley, P., Mumby, P. J., Purvis, A., Scholes, R. J., Seddon, A. W. R., Solan, M., Steffen, W., & Woodward, G. (2014). Approaches to defining a planetary boundary for biodiversity. *Global Environmental Change*, *28*(1), 289–297. https://doi.org/10.1016/j.gloenvcha.2014.07.009

Panwar, R., Ober, H., & Pinkse, J. (2023). The uncomfortable relationship between business and biodiversity: Advancing research on business strategies for biodiversity protection. *Business Strategy and the Environment*, *32*(5), 2541–2647. https://doi.org/10.1002/bse.3139

Pennisi, E. (2021). Getting the big picture of biodiversity. *Science*, *374*(6570), 926–931. https://doi.org/10.1126/science.acx9637

Polasky, S., & Daily, G. (2021). An Introduction to the Economics of Natural Capital. *Review of Environmental Economics and Policy*, *15*(1), 87–94. https://doi.org/10.1086/713010

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., De Wit, C. a, Hughes, T., Van Der Leeuw, S., Rodhe, H., Sorlin, S., Snyder, P. K., Costanza, R., Svedin, U., … Foley, J. (2009). Planetary Boundaries: Exploring the Safe Operating Space for Humanity. *Ecology and Society*, *14*(2). https://doi.org/10.1038/461472a

Roome, N. (2011). Looking Back, Thinking Forward: Distinguishing Between Weak and Strong Sustainability. In *The Oxford Handbook of Business and the Natural Environment*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199584451.003.0034

Scholes, R. J., & Biggs, R. (2005). A biodiversity intactness index. *Nature*, *434*(7029), 45–49. https://doi.org/10.1038/nature03289

Secretariat of the Convention on Biological Diversity. (1992, May 22). *Convention on Biological Diversity: Text and Annexes*.

Steffen, W., Richardson, K., Rockström, J., Cornell, S., Fetzer, I., Bennett, E., Biggs, R., & Carpenter, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science (New York, N.Y.)*, *348*(6240), 1217. https://doi.org/10.1126/science.aaa9629

Swaney, J. A., & Olson, P. I. (1992). The Economics of Biodiversity: Lives and Lifestyles. *Journal of Economic Issues*, *XXVI*(1), 1–25.

TEEB. (2010). *The Economics of Ecosystems and Biodiversity in Business and Enterprise.* https://teebweb.org/publications/teeb-for/business-and-enterprise/

The Trustees of The Natural History Museum, London. (2024). *Biodiversity Intactness Index*. https://www.nhm.ac.uk/our-science/services/data/biodiversity-intactness-index.html

United Nations. (1992). *Convention on Biological Diversity*. https://www.cbd.int/convention/text/

UNWCED. (1987). *Our Common Future*. Oxford University Press.

WBCSD. (2024). *One Planet Business for Biodiversity (OP2B) – WBCSD*. https://www.wbcsd.org/actions/one-planet-business-for-biodiversity-op2b/

WCMC. (2023, November). *Towards ecosystem-level thinking by the private sector*. UNEP-WCMC. http://production-wordpress.unep-wcmc.org/towards-ecosystem-level-thinking-by-the-private-sector/

Western, D. (1992). The Biodiversity Crisis: A Challenge for Biology. *Oikos*, *63*(1), 29–38. https://doi.org/10.2307/3545513

Westley, F. (1997). “Not on Our Watch”: The Biodiversity Crisis and Global Collaboration Response. *Organization & Environment*, *10*(4), 342–360. https://doi.org/10.1177/192181069701000402

White, T. B., Bromwich, T., Bang, A., Bennun, L., Bull, J., Clark, M., Milner-Gulland, E. J., Prescott, G. W., & Starkey, M. (2024). The “Nature-Positive” Journey for Business: A Conceptual Research Agenda to Guide Contributions to Societal Biodiversity Goals. *One Earth*, *7*(8), 1373–1386. https://doi.org/10.1016/j.oneear.2024.07.003