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Article

Redefining Biodiversity Conservation Through an Outcome Separation Framework

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Abstract: The term “conservation,” as it relates to biodiversity in a Western context, has a storied past and as conservation science and societal values have evolved, consensus over its precise meaning has remained elusive. The broad scope of contemporary definitions hampers effective communication during a period of environmental crisis and is troublesome for any derivative concept which aims to empirically quantify the efforts of the conservation sector. This presents an avoidable hindrance to the systematic planning of the conservation field. To help remedy this situation, we provide an outcome separation framework that is based on the expected degree of separation between an action's proximate outcome, from its intended, ultimate outcome for a habitat and/or species. Framing a definition of conservation through this lens of outcome separation allows for conservation-related actions to be clearly categorized into one of three discrete tiers: primary, secondary, and tertiary. A distillation of this tiered framework also provides a new definition of biodiversity conservation that is more rigorous and adaptable to future conceptual evolutions of the field.

Keywords: definition; degrees of separation; objective; primary conservation; secondary conservation; tertiary conservation; native species; ecological replacement species

Introduction

The term “conservation,” as it relates to biodiversity in a Western context, has a storied past and consensus over its precise meaning remains elusive (Usher, 1986; Shuter et al., 1995; Redford & Richter, 1999; Ebbin, 2011; Soulé, 2013; Sandbrook, 2015). Lack of clarity concerning the meaning and bounds of biodiversity conservation has proved troublesome when the need arises for high-level analysis and strategic planning to precisely quantify and analyze biodiversity conservation efforts and funding trends (Brockington & Scholfield, 2010). To date, no objective methodology has been proposed to demarcate what does and does not constitute a conservation organization (Sandbrook, 2015). Despite these deficiencies, biodiversity conservation is a core objective of national governments, state agencies, non-profit and for-profit organizations, and local and indigenous communities (Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1983; Redford & Richter, 1999; IUCN, 2022a). Current imprecision in terminology results in actions, no matter how far removed from the ultimate beneficiary, potentially being included in strategic planning initiatives. One such example can be found with “sweeping of streets” under OECD's Classification of the Functions of Government (COFOG) #7051 (OECD, 2019) contributing toward biodiversity protection in global biodiversity finance analyses which track adherence to international governmental agreements like the Convention on Biological Diversity (OECD, 2020) and Sustainable Development Goals (SDGs). A broad scope such as this hampers effective communication and creates loopholes for corporations and governments to satisfy environmental agreements.

The creation of the first national parks in United States in the early 19th century marked the genesis of the modern conservation ethos. This was a result of a pervasive and evolving appreciation of nature and scenery in the West, yet this ethos existed largely independent of the ethea of other societies which have exhibited varying degrees of conservation practices for millennia (Guha, 1992; Krech, 2005; Brockington et al., 2009). As the popularity of historical concepts have waxed and waned, they have evolved into the current conceptualizations of conservation we have today. These vary in

scope and usage and have resulted in numerous debates and evolutions (Callicott, 1990; Callicott, 1991; Shuter et al., 1995). One demonstrative example can be found in the wide variety of conservation approaches aimed at remedying economic disparities which are now recognized as prominent causal factors for environmental issues. This has led to schisms in the conservation sector with debates over neoliberal or “new” conservation models and the reregulation of nature through forms of commodification (Igoe & Brockington, 2007; Soulé, 2013; Sandbrook, 2015).

Intrinsically, all definitions of conservation will relate to human activities due to the impacts humans have on nature, but they can vary in degree with how anthropocentric they are. Some definitions frame biodiversity conservation in a more anthropocentric manner by focusing on the utility that nature has for human society e.g., through natural resource management (USDA, 2020), with a focus on their intangible cultural and spiritual values (Pungetti et al., 2012), or as a constituent element of sustainability (Vucetich et al., 2018). Others, such as the International Union for Conservation of Nature (IUCN) define conservation more in line with the Evolutionary-Ecological Land Ethic and place more emphasis on the intrinsic value nature has: “The protection, care, management and maintenance of ecosystems, habitats, wildlife species and populations, within or outside of their natural environments, in order to safeguard the natural conditions for their long-term permanence” (IUCN, 2022a). This ethos of nature’s intrinsic right to exist is also embodied in various governments such as the Ecuadorian constitution as the “Rights of Nature” (Tanasescu, 2013) and is in line with the contemporary shift towards a “people and nature” ethos (Coetzee, 2022).

Definitions of biodiversity conservation can also range from broad to specific in scope. Broad definitions may retain utility for longer periods of time as they do not rely on adherence to specific actions or a strict set of objectives. Sandbrook (2015) advances one such definition as “actions that are intended to establish, improve or maintain good relations with nature.” Contrarily, specific definitions rely on a specific set of actions which can render them less resilient to future evolutions of conservation theory and practice. This is clearly demonstrated with the evolving opposition to a characterization of invasive species that is primarily based on geohistories (Warren, 2023). Similarly, a definition may be overly specific by attempting to encompass every action that constitutes conservation, leaving it vulnerable to be superseded once a new approach is adopted. Conservation communications aimed at the public tend to involve overly specific definitions like the National Geographic Society has done by defining wildlife conservation as “the practice of protecting plant and animal species and their habitats...The goal of wildlife conservation is to ensure the survival of these species, and to educate people on living sustainably with other species” (National Geographic Society, 2022). This definition is deficient in several ways: it does not encompass kingdoms of life outside of plants and animals; it is vulnerable to the inclusion of harmful species and unsuitable habitat; it broadly mentions “protection” as the only conservation action, omitting other actions such as maintenance, management, and sustainable use; and its goals ignore ecosystem dynamics and should extend beyond mere survival and education.

These definitions fail to accurately capture the totality of biodiversity conservation endeavors while risking inclusion of actions that do not have intentional and quantifiable impacts on habitats and species. Many rely on vague terms which lead to questions such as “what do they consider a natural resource or nature?” This can lead to the conclusion that a wide range of questionable actions could also be conveyed as relating to conservation, such as removing urban nest deterrents to promote nesting of nonnative pigeons or culling beneficial, native predator populations. Leader-Williams et al. (2010) defines conservation in such a way as “actions that directly enhance the chances of habitats and species persisting in the wild” which ignores urban habitats, could support harmful species, and fails to include indirect, yet impactful actions such as *ex-situ* law enforcement activities, awareness campaigns, or environmental litigation.

Arguably, the most significant uses of the term conservation come from governments and transnational organizations which tend to avoid directly defining the term. Conservation is left undefined in high-profile communications from the United Nation’s Convention on Biological Diversity and within the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES; 1983), though they distinguish “conservation” actions as discrete from actions like

“restoration,” “sustainable use,” “management,” and “protection.” Similarly, the Organization for Economic Co-operation and Development (OECD), a transnational organization which provides data analysis to inform government delegates and high-level workshops on biodiversity finance, defined biodiversity finance as “expenditure that contributes – or intends to contribute – to the conservation, sustainable use and restoration of biodiversity” (OECD, 2020). Again, conservation is made distinct from sustainable use and restoration. Additionally, Dasgupta (2021), in a landmark government report, also only describes conservation relationally with statements such as “conservation of functioning ecosystems and restoration of degraded ecosystems.” This distinction between conservation and restoration represents a misalignment between public and private industry rhetoric and may stem from differing interpretations of the foundational definition of “conservation” provided by dictionaries like Merriam-Webster (2024) as “a careful preservation and protection of something.” Though, protection of something (biodiversity) does not necessarily exclude the act of its restoration considering that its restoration would be protecting historical or potentially actualized values. Oxford (2024) agrees with this and defines conservation in relation to biodiversity as “preservation, protection, or restoration of the natural environment and of wildlife.” This lack of consensus regarding a clear definition of conservation creates a situation prone to miscommunication.

The nebulous nature of what constitutes a conservation action has led to questioning whether it is a practical effort to consider the conservation sector as a single entity (Sandbrook, 2015). While it has been difficult to be precise when referencing “conservation,” the usage of the term has been widely accepted and integrated into public-facing communications and governmental policies (Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1983; OECD, 2020; IUCN, 2022a). The inclusion of imprecise language at these levels can create roadblocks to consensus during attempts to categorize what does and does not constitute a conservation action or conservation organization, hindering conservation discussions and strategic planning. To provide clarity to these discussions and to enable objective analysis of the conservation sector, a more precise and robust definition of biodiversity conservation is provided.

Characterizing Conservation

Base Definitions

The following definitions are either crafted *de novo* or modified from published literature where cited. These base definitions provide a clear foundation for the creation of both a unified and tiered definition of biodiversity conservation:

Beneficial species: A species identified through scientific consensus for its positive impact on an ecosystem and whose presence may align with positive socio-political attitudes.

Biodiversity: The variability among living organisms on Earth, including the variability within and between species and within and between ecosystems (Norse et al., 1986).

Biodiversity conservation: Any action that intends to have a net positive effect for one or more suitable habitats and/or beneficial species.

Direct actor: An individual or entity carrying out primary conservation actions (defined below) or who is likely to have a direct impact on a habitat and/or species in the near future. Direct actors can include, but are not limited to, conservation biologists, conservation organizations, indigenous communities, hunters, fishers, foresters, farmers, park rangers, and communities residing near habitat.

Ecological replacement species: A species that has colonized a new habitat, either through human-assisted means or via natural dispersal, and largely fulfills the ecological role of an extirpated species to provide a net benefit to the ecosystem. These are sometimes referred to as analogue or substitute species. (modified after IUCN, 2013).

Harmful species: A species identified through scientific consensus for its negative impact on an ecosystem and whose presence may align with negative socio-political attitudes.

Suitable habitat: A naturally occurring or modified habitat which supports or improves ecosystem resilience and improves the fitness of a beneficial species due to its requirement for the habitat at some point in its lifecycle (e.g., for breeding or as an important food source) (modified after IUCN, 2022b).

Outcome Separation Framework

A quantitative and holistic solution to the ambiguity of the term biodiversity conservation can be found with the adoption of an outcome separation framework based on the expected degree of separation of a conservation action's proximate outcome in relation to its intended, ultimate outcome for one or more suitable habitats and/or beneficial species. For example, if a conservation action requires zero additional actions to achieve its intended impact, it would exhibit zero degrees of separation and is considered primary conservation. Whereas, if a conservation action requires one additional action to have its intended impact, it would exhibit one degree of separation and is considered secondary conservation. If a conservation action requires two or more additional actions to have its intended impact, it would exhibit two or more degrees of separation and is considered tertiary conservation. Below, we present such a three-tiered framework for biodiversity conservation actions which has the potential to enable more precise analyses of the conservation sector and, in turn, may facilitate general discussions and strategic planning.

Primary biodiversity conservation:

- An action that primarily intends to directly affect a net-positive benefit for a suitable habitat and/or beneficial species;

Secondary biodiversity conservation:

- An action which primarily intends to facilitate a primary biodiversity conservation action either directly or through impacting a direct actor and therefore has proximate outcome(s) which exhibit one degree of separation from the intended ultimate outcome(s) for a suitable habitat and/or beneficial species;

Tertiary biodiversity conservation:

- An action that primarily intends to facilitate a secondary or other tertiary biodiversity conservation action and therefore has proximate outcome(s) which exhibit two or more degrees of separation from the intended ultimate outcome(s) for a suitable habitat and/or beneficial species; and/or
- An action whose intended beneficial outcome(s) to suitable habitat and/or beneficial species are not the primary objective(s).

Not considered biodiversity conservation:

- An action that does not facilitate a primary, secondary, or tertiary biodiversity conservation action; and/or
- An action that does not intentionally benefit suitable habitat and/or beneficial species; and/or
- An action whose intended outcome(s) for suitable habitat and/or beneficial species are net neutral or negative.

Primary conservation actions may include, but are not limited to:

- Effective area-based conservation measures such as purchase or restoration of (potentially) suitable habitat e.g., reforestation, afforestation, habitat restoration, habitat corridor creation, creation of a protected area, fire control, transforming monoculture plantations to multispecies plantations, creation of urban green spaces occupied by native and/or ecological replacement species, and cattle grazing in order to control harmful grasses;

- Establishing/operating an ex-situ breeding program, wildlife sanctuary, or other program such as translocation, de-extinction, and rewilding programs with the ultimate goal of releasing beneficial species for population reinforcement, relocation, or (re)introduction;
- Veterinarian services directly benefiting a beneficial species e.g., emergency care, rehabilitation, and vaccination;
- Harmful species removal following relevant ethical guidelines;
- In-situ law enforcement activities pertaining to suitable habitat and/or beneficial species e.g., anti-poaching and anti-logging activities;
- Removing potentially harmful materials within suitable habitat for the primary purpose of benefiting the health of that habitat or a beneficial species e.g., active wildlife disentangling, preventative wildlife disentangling (removal of ghost netting and snares), and mining pollution remediation schemes.

Secondary conservation actions may include, but are not limited to:

- Scientific research conducted with the primary purpose of influencing direct actors for the net positive benefit of suitable habitat and/or beneficial species;
- Operating an ex-situ breeding program or wildlife sanctuary which has a direct contribution towards primary conservation actions;
- Generating funding or recruiting volunteers for primary conservation actions e.g., grant making, philanthropic donations, and some voluntourism companies;
- Outreach, education, capacity building, and sustainable livelihood facilitation with a primary goal of benefiting suitable habitat and/or beneficial species through targeting direct actors e.g., human-wildlife conflict/coexistence management, targeted awareness programs, and citizen/community science activities;
- Veterinarian services indirectly benefiting a beneficial species e.g., vaccinating domestic animals against a contagion near suitable habitat;
- Litigation e.g., defense of an environmental suitor enacting environmental legislation;
- Ex-situ law enforcement activities impacting direct actors for the benefit of suitable habitat and/or beneficial species e.g., wildlife trafficking monitoring and mitigation;
- Private sector standards and codes such as certified sustainable, extractive activities whose benefit to suitable habitat and/or beneficial species is generally contingent on their exploitative value e.g., management of community conservation areas or forestry plots, and management of regulated hunting and angling as part of a permit-tag program whereby funds are generated for the management of suitable habitat and/or beneficial species.

Tertiary conservation actions may include, but are not limited to:

- Promoting or facilitating the sustainable use or development of natural resources e.g., creating a free-to-use hiking trail system; facilitating gatherings, partnerships, or dialogues of non-direct actors; improving market transparency and accountability; advising or promoting extractive activities such as forestry and hunting; resource conservation and development programs (RC&D);
- Conservation outreach, education, or capacity building directed towards people who do not have significant, direct impacts on suitable habitats and/or beneficial species e.g., influencing

consumer behavior, ecotourism, school education programs, broad scale citizen/community science activities, forestry sustainability programs, and some sportsman clubs and nature education centers;

- Research conducted with the primary purpose of influencing secondary or other tertiary conservation actions e.g., monitoring large-scale fisheries; developing nature-based solutions; enhancing pollution remediation strategies; or enhancing production from sustainable use activities such as aquaculture and fisheries;
- Lobbying or advocating for environmental legislation or policies impacting climate change mitigation strategies with the intent of having positive impacts on suitable habitat and/or beneficial species;
- Pollution control and remediation outside of suitable habitat or primarily for beautification and/or human health with a secondary intent of benefiting suitable habitat and/or beneficial species e.g., some beach cleanups or organic farming;
- Purchase and maintenance of land, with habitat preservation or restoration being a secondary intent, e.g., preserving land mainly for its cultural or aesthetic value; preservation of artificial landscapes such as farms, range land, and man-made lakes; or sustainable resource management as a multiple use resource;

Discussion

While many current definitions can be useful, generally agreeable, and are easily communicated to a layperson, they inherently lack the ability to precisely and wholly encompass the multifaceted complexity of the modern conservation sector. This imprecision can lead to avoidable confusion during high-level discussions and may allow for funding which is spent on non-conservation actions to be erroneously counted towards national conservation benchmarks like Sustainable Development Goals (SDGs) 13, 14, and 15 through categorization errors by the Organization for Economic Cooperation and Development (OECD). For these reasons we provided the following succinct definition of biodiversity conservation that is more rigorous and adaptable to future conceptual evolutions of the field and can remedy many chronic ambiguities: *Any action that intends to have a net positive effect for one or more suitable habitats and/or beneficial species.* This definition of biodiversity conservation does not supersede definitions for second order terms such as the recently introduced Multiple-Benefit Conservation term which was defined as *conservation efforts designed to simultaneously benefit local communities of people, enhance ecological function, and improve habitat quality for fish and wildlife* (Gardali et al., 2021). Rather, our definition provides a clear foundation for such definitions to build from by precisely defining what is meant when referring to “conservation.” Our definition can also remedy definitional oversights such as the redundancy created by Gardali et al. (2021) when they disaggregated “fish” from “wildlife” since both would fall under our “beneficial species” term, while other taxon like fungi would also not be omitted.

In addition to our definition presented above, our outcome separation framing of conservation, through a lens of degrees of separation, allows for actions to be clearly categorized into one of three discrete tiers (primary, secondary, and tertiary) based on the proximate outcome’s degree of separation from its intended, ultimate outcome. With increased degree of separation, additional factors have a higher probability to influence the outcome, intrinsically hampering the ability to quantifiably assess the ultimate impact of an action in relation to its resource cost. It is important to recognize that the efficacy of conservation actions varies greatly (Law et al., 2017; Catalano et al., 2019; Salvidio, 2016), and as such, correlating degree of separation with significance of impact is beyond the scope of this paper. While it is possible that a primary conservation action may be more efficient or effective than a tertiary conservation action, this is not always the case. Reasonably stated

intent to achieve a net positive or negative effect to suitable habitat and/or beneficial species is required, not the magnitude of the impact. Likewise, our definition does not speak to the reasons why these actions should be taken (Knapp, 2003; Tallis & Lubchenco, 2014).

Emphasis has been placed on the stated intent of the conservation outcome considering that unintended co-benefits and costs cannot be practically accounted for *prima facie*. For instance, preservation of modified landscapes such as agricultural land or artificial lakes strictly for historical or leisure purposes did not intentionally lead to positive outcomes for beneficial species, though they may have had unintentional positive impacts. Additionally, the provided definitions of harmful and beneficial species acknowledge the evolving and contentious nature of what constitutes "harmful." They move beyond the traditionally used, and sometimes imprecise label of "invasive species" which is often based on geographic origin and does not fully capture effects of climate change on habitat shifts or anthropogenically influenced population dynamics (Warren, 2023). We believe this beneficial/harmful dichotomy better highlights the importance of certain species in fostering or harming ecological balance and acknowledges their role in reflecting or enhancing socio-political relationships with the natural world.

Utility of our tiered scheme can be demonstrated through the categorization of research which has been broadly considered "conservation biology" (Soule, 1985), that can now be more precisely described as either "secondary conservation biology" or "tertiary conservation biology" based on the number of steps required to take the research output and achieve the actor's intended conservation outcome. For example, ecological studies that focus on interactions in a specific, isolated location that do not represent broader ecological dynamics, or which have no intended goal of being implemented in conservation action plans are not scalable and would be categorized as tertiary conservation biology. Their utility in achieving conservation outcomes is likely limited and inclusion of this research in a quantification of conservation effort would present a confounding inflation of their conservation value.

This method of categorization facilitates efforts to track funding for conservation actions by allowing entities to include only primary and secondary conservation actions for reasons of practicality and utility. In a sector mired with funding deficiencies (Wilson et al., 2007; Underwood et al., 2008; Giving USA, 2021), practicality is paramount. The breadth of tertiary conservation research dwarfs that of secondary conservation research while having less direct effects on conservation—significantly diluting the signal to noise ratio for tracked conservation funding which the effort intends to represent, while also increasing the effort required to attain and analyze the additional data. We believe the accuracy and utility of biodiversity finance tracking would improve by restricting the scope of data to actions that have more proximate, intentional, and quantifiable impacts on a specific suitable habitat or beneficial species. Adoption of our framework would achieve this and thereby remove extraneous contributions towards a country's biodiversity finance goals and enable more manageable and cost-effective analyses to be performed.

By defining biodiversity conservation in this tiered manner, a rigorous framework is developed which objectively defines boundary variables for biodiversity conservation analyses. If adopted, our definitions and framework would provide a remedy to the current widespread ambiguity regarding biodiversity conservation and confer benefits to the conservation community that have been chronically lacking (Sutherland et al., 2004; Bottrill et al., 2011). The clarification imparted by this framework can facilitate the objective and interoperable analysis of the conservation sector, thereby improving the funding impact of intergovernmental entities, corporations, and private funders. Such data-driven analyses would improve systematic conservation planning (Kukkala & Moilanen, 2012) and thus bootstrap the limited funds available for biodiversity conservation. These definitions may also serve the conservation community by improving our ability to effectively communicate our actions and goals, helping to avoid unnecessary confusion. Ultimately, effective conservation relies on effective communication.

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References

- Bottrill, M. C., Hockings, M., & Possingham, H. P. (2011). In pursuit of Knowledge: Addressing Barriers to Effective Conservation Evaluation. *Ecology and Society*, 16(2). <https://doi.org/10.5751/es-04099-160214>
- Brockington, D., Duffy, R., & Igoe, J. (2009). Nature unbound: conservation, capitalism, and the future of protected areas. *Choice Reviews Online*, 46(08). <https://doi.org/10.5860/choice.46-4420>
- Brockington, D., & Scholfield, K. (2010). The work of conservation organisations in sub-Saharan Africa. *Journal of Modern African Studies*, 48(1), 1–33.
- Callicott, J.B. (1990) Whither Conservation Ethics? *Conservation Biology*, 4(1), 15-20.
- Callicott, J.B. (1991). Conservation ethics and fishery management. *Fisheries*, 1, 22-28.
- Catalano, A. S., Lyons-White, J., Mills, M., & Knight, A. T. (2019). Learning from published project failures in conservation. *Biological Conservation*, 238.
- Coetsee, B., Ferriera, S., & Smit, I. (2022). Reimagining the wilderness ethic to include “people and nature”. *Biodiversity and Conservation*, 31. [10.1007/s10531-022-02452-3](https://doi.org/10.1007/s10531-022-02452-3).
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). (1983). (2023, July 29). <https://cites.org/sites/default/files/eng/disc/CITES-Convention-EN.pdf>
- Dasgupta, P. (2021). *The Economics of Biodiversity: the Dasgupta Review: Full Report*. ISBN 978-1-911680-29-1
- Ebbin, S. A. (2011). The Problem with Problem Definition: Mapping the Discursive Terrain of Conservation in Two Pacific Salmon Management Regimes. *Society & Natural Resources*, 24(2), 148–164.
- Gardali, T., Dybala, K. E., & Seavy, N. E. (2021). Multiple-Benefit Conservation defined. *Conservation Science and Practice*, 3(6). <https://doi.org/10.1111/csp2.420>
- Giving USA. (2020). *The Annual Report on Philanthropy for the Year 2020*. (2023, July 29). <http://www.givingusa.org>
- Guha, R. (1992). Prehistory of Indian Environmentalism: Intellectual Traditions. *Economic and Political Weekly*, 27(1-2), 57–64.
- Igoe, J., & Brockington, D. (2007). Neoliberal Conservation: A Brief Introduction. *Conservation and Society*, 5(4), 432–449.
- International Union for Conservation of Nature (IUCN). 2023. Guidelines for Reintroductions and Other Conservation Translocations (Version 1.0). (2024, April 1) <https://portals.iucn.org/library/efiles/documents/2013-009.pdf>
- International Union for Conservation of Nature (IUCN). 2022a. The IUCN Red List of Threatened Species. Version 2022-1. (2022, September 25). <https://www.iucnredlist.org>
- International Union for Conservation of Nature (IUCN). 2022b. The IUCN Red List of Threatened Species. Habitats Classification Scheme (Version 3.1). (2022, September 25). <https://www.iucnredlist.org/resources/habitat-classification-scheme>
- Knapp, S. (2003). Conservation: Dynamic diversity. *Nature*, 422(6931), 475.
- Krech, S. (2005). Reflections on Conservation, Sustainability, and Environmentalism in Indigenous North America. *American Anthropologist*, 107(1), 78–86.
- Kukkala, A. S., & Moilanen, A. (2012). Core concepts of spatial prioritisation in systematic conservation planning. *Biological Reviews*, 88(2), 443–464.
- Law, E. A., Ferraro, P. J., Arcese, P., Bryan, B. A., Davis, K., Gordon, A., Holden, M., Iacona, G. D., Marcos-Martinez, R., McAlpine, C., Rhodes, J. R., Sze, J. S., & Wilson, K. A. (2017). Projecting the performance of conservation interventions. *Biological Conservation*, 215, 142–151.
- Leader-Williams, N., Adams, W. M., & Smith, R. J. (2010). Trade-Offs in conservation. In *Wiley eBooks*. <https://doi.org/10.1002/9781444324907>
- Merriam-Webster (2024). <https://www.merriam-webster.com/dictionary/conservation>. April 1, 2024.
- National Geographic Society. (2023 July 29). <https://education.nationalgeographic.org/resource/wildlife-conservation>
- Norse, E. A., K. L. Rosenbaum, D. S. Wilcove, B. A. Wilcox, W. H. Romme, D. W. Johnston, and M. L. Stout. (1986). Conserving biological diversity in our National Forests. Washington, D.C., Wilderness Society.
- Oxford English Dictionary (2024). https://www.oed.com/dictionary/conservation_n. April 1, 2024.
- OECD 2019. (2023, July 29) <https://www.imf.org/external/pubs/ft/gfs/manual/pdf/ch6ann.pdf>
- OECD 2020. (2023, July 29). <https://www.oecd.org/environment/resources/biodiversity/report-a-comprehensive-overview-of-global-biodiversity-finance.pdf>
- Pungetti, G., Oviedo, G., & Hooke, D. (2012). *Sacred species and sites: Advances in Biocultural Conservation*. Cambridge University Press pp. 28-35.
- Redford, K. H., & Richter, B. D. (1999). Conservation of Biodiversity in a World of Use. *Conservation Biology*, 13(6), 1246–1256.
- Salvidio, S. (2016). Sutherland, W.J., Dicks, L.V., Ockendon, N., Smith, R.K. (Eds). *What works in conservation*. Open Book Publishers, Cambridge, UK. *Acta Herpetologica*, 11, 233-234.
- Sandbrook, C. (2015). What is conservation? *Oryx*, 49(4), 565-566.
- Shuter, B. J., Minns, C. K., & Olver, C. H. (1995). Toward a definition of conservation principles for fisheries management. *Canadian Journal of Fisheries and Aquatic Sciences*, 52(7), 1584–1594.

- Soulé, M. E. (2013). The “New Conservation.” *Conservation Biology*, 27(5), 895–897.
- Sutherland, W. J., Pullin, A. S., Dolman, P. M., & Knight, T. A. (2004). The need for evidence-based conservation. *Trends in Ecology and Evolution*, 19(6), 305–308.
- Tallis, H., & Lubchenco, J. (2014). Working together: A call for inclusive conservation. *Nature*, 515(7525), 27–28.
- Tanasescu, M. (2013) The rights of nature in Ecuador: the making of an idea. *International Journal of Environmental Studies*, 70:6, 846-861.
- Underwood, E. C., Shaw, M. R., Wilson, K. A., Kareiva, P., Klausmeyer, K. R., McBride, M., Bode, M. F., Morrison, S., Hoekstra, J. M., & Possingham, H. P. (2008). Protecting Biodiversity when Money Matters: Maximizing Return on Investment. *PLOS ONE*, 3(1), e1515.
- United States Department of Agriculture (USDA). What Does Conservation Mean? (2020). (2023, July 31). https://web.archive.org/web/20211201122758/https://www.nrcs.usda.gov/wps/PA_NRCSCConsumption/download/?cid=nrcseprd1297918&ext=pdf
- Usher, M. (1986). *Wildlife Conservation Evaluation*. Springer.
- Vucetich, J. A., Burnham, D., Macdonald, E. A., Bruskotter, J. T., Marchini, S., Zimmermann, A., & Macdonald, D. W. (2018). Just conservation: What is it and should we pursue it? *Biological Conservation*, 221, 23–33.
- Warren, C. R. (2023). Beyond ‘Native V. Alien’: Critiques of the Native/alien Paradigm in the Anthropocene, and Their Implications. *Ethics, Policy & Environment*, 26(2), 287–317. <https://doi.org/10.1080/21550085.2021.1961200>
- Wilson, K. A., Underwood, E. C., Morrison, S., Klausmeyer, K. R., Murdoch, W. W., Reyers, B., Wardell-Johnson, G., Marquet, P. A., Rundel, P. W., McBride, M., Pressey, R. L., Bode, M. F., Hoekstra, J., Andelman, S., Looker, M., Rondinini, C., Kareiva, P., Shaw, M. R., & Possingham, H. P. (2007). Conserving biodiversity efficiently: what to do, where, and when. *PLOS Biology*, 5(9), e223.

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