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Article

Defining 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 had a contested history 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 quantify the efforts of the conservation community. This presents an avoidable hindrance to the systematic planning of the conservation field. To remedy this situation, we provide an outcome separation framework that is based on the expected degree of separation of the action’s proximate outcome from its intended, ultimate outcome for native habitat and/or native or ecological replacement 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) based on both the proximate outcome’s degree of separation from its intended, ultimate outcome and the conservation status of native habitat and/or native or ecological replacement species. A distillation of this tiered framework also provides a fully inclusive, succinct definition of biodiversity conservation that is resilient to future conceptual evolutions of the field.

Keywords: definition; degrees of separation; objective; primary conservation; secondary conservation; tertiary conservation

Introduction

The term “conservation” as it relates to biodiversity in a Western context has had a contested history and consensus over its precise meaning remains elusive (Usher, 1986; Shuter et al., 1995; Redford & Richter, 1999; Ebbin, 2011; Soulé, 2013; Sandbrook, 2015). Despite this, 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;). When these entities base decisions upon current biodiversity conservation definitions, actions such as home organic gardening, street cleaning, and social media posting can and have been considered conservation actions, which misrepresents the field when it comes to high-profile decisions such as those regarding biodiversity finance (OECD, 2020). This broad scope and lack of consensus for conservation definitions can be partly attributed to the increasing complexity and multidisciplinary nature of the approaches needed to address an increasingly complicated suite of challenges. Generally, our perception of what does and does not constitute conservation adapts to changes in conservation science and societal values, and over time the rate of changes has increased in frequency and biodiversity conservation has become increasingly difficult to define as a single field (Soulé, 2013; Sandbrook, 2015).

The creation of the first national parks in United States in the early 19th century marked the genesis of the modern conservation ethos and was a result of a pervasive and evolving appreciation of nature and scenery in the West. 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). Definitions of conservation have been more varied during the last two centuries of its usage and this has resulted in numerous debates on the subject (Shuter et al.,

1995). Though varied, these definitions have been primarily shaped by the same three ethical precepts: the Resource Conservation Ethic, the Evolutionary-Ecological Land Ethic, and the prescientific Romantic-Transcendental Preservation Ethic (Callicott, 1991). The Resource Conservation Ethic, a utilitarian ethic otherwise known as “conservation through wise-use,” has been a central theme and is characterized by a definition from the famous American forester and politician Gifford Pinchot in the early 20th century as “the use of the natural resources for the greatest good of the greatest number for the longest time” (Collomb, 2019). This wise-use ethic differs dramatically from preservationist ethics such as the Evolutionary-Ecological Land Ethic, described by Leopold (1949), which suggests a view that conservation is “our effort to understand and preserve [the capacity of the land for self-renewal].” Additionally, the Romantic-Transcendental Preservation Ethic differs in that it aligns itself purely with the protection of the connection between nature and the psychological health of mankind (Shuter et al., 1995).

As the popularity of these concepts have waxed and waned, they have evolved into the current conceptualizations of conservation we have today which vary in scope and contention. One contentious 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). Other forms of conservation can embody an admixture of the foundational concepts or narrowly emphasize a singular aspect of them. For example, the Evolutionary-Ecological Land Ethic gave rise to the polarized non-interventionist approach embodied by Margalef (1968) which states, “any human intervention in nature, even presupposing good intentions, can rarely be reconciled with the idea of strict conservation...genuine conservation forbids any interference.” Later adoptions of non-intervention approaches are more practical in nature such as those incorporated into fire management practices which leave “the vegetation untouched and the burnt trees standing” (Marques and Mora 1998). Additionally, natural heritage conservation draws upon the Romantic-Transcendental Preservation Ethic by focusing on the conservation of biocultural aspects such as the significance of nature with respect to cultural and spiritual values (Harmon, 2007). Still others conceptualize conservation as humans interfering to preserve nature as it is, preserving *statis* (Knapp, 2003). These shifts in conservation *ethica* generally correspond to greater societal shifts and have been temporally mapped by Mace (2014) and Evans (2021) into the following frames: nature for itself (1960-1970), nature despite people (1980-1990), nature for people (2000-2005), people and nature (2010-2017), and peoples and natures (2017-current). Most recently, the people and natures ethos has been characterized by “Multiple-Benefit Conservation” which is 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).

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 wildlife 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’s (IUCN) definition of conservation, are 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 ethic 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).

Definitions of biodiversity conservation can be either broad or specific in scope. Broad definitions can 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 are inclusive of only a specific set of actions which can render them less resilient to future evolutions of conservation theory and practice. Specific definitions can generally be characterized as “the planned protection, maintenance, management, sustainable use, and restoration of natural resources and the environment, in order to secure their long-term survival” (Allaby & Park, 2013). Conservation communications aimed at the public tend to involve similarly specific definitions as 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). It is important to note that terms such as “nature” and “natural resources” are not defined in these definitions rendering them vulnerable to the inclusion of undesirable invasive species.

Arguably, the most impactful uses of the term conservation come from governments and transnational organizations which tend to never directly define 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 (1983), though they distinguish “conservation” actions as discrete from actions like “restoration,” “sustainable use,” “management,” and “protection.” 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 similarly does not define conservation but has defined biodiversity finance as “expenditure that contributes – or intends to contribute – to the conservation, sustainable use and restoration of biodiversity” (OECD, 2020). Dasgupta (2021), in a landmark government report, also only describes conservation relationally with statements like “conservation of functioning ecosystems and restoration of degraded ecosystems.” Does conservation include actions such as restoration of degraded ecosystems and the management and protection of natural resources? According to most scientists, non-governmental organizations, and popular media platforms the answer is yes, but according to many governments and transnational organizations, the answer is generally no. This distinct lack of consensus with regard to 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 referring to “conservation,” the usage of the term has been widely accepted and integrated into national and international policies (Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1983; OECD, 2020; IUCN, 2022a) and thus adoption of a fully inclusive definition of conservation could provide much needed clarification. Furthermore, in order for the conservation sector to be analyzed in an objective manner, a more precise definition must also be provided. Currently, the imprecision of language surrounding biodiversity conservation creates roadblocks to consensus when categorizing what does and does not constitute a conservation action or conservation organization, which hinders conservation discussions and high-level strategic planning.

Characterizing Conservation

Base Definitions

The following definitions provide a clear basis for the creation of a unified definition of biodiversity conservation:

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

Direct actor: an individual or entity carrying out primary conservation actions (defined below) or who is likely to have a direct impact, positive or negative, to a native habitat and/or native or ecological replacement 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 native habitat.

Ecological replacement species: An artificial species replacement which fulfills the ecological role of an extirpated species and provides a net benefit to the ecosystem, otherwise known as an “analogue species.”

Invasive species: Any species that has been introduced by direct human activity to an environment where it is not native and poses significant harm to a native species, or a species that is native to an ecosystem but has become functionally invasive.

Native species: A non-human species living within its natural range (past or present) which includes the area that it can reach and occupy using its natural dispersal systems (modified after ICES, 1994) or one whose presence in a given ecosystem is so ancient that it cannot be presupposed whether it is native or introduced (Métailié & Da Lage, 2015).

Suitable habitat: a naturally occurring or modified habitat which benefits the survival of a species because it has a requirement for the habitat at some point in its lifecycle (e.g., for breeding or as an important food source) (modified after IUCN, 2022b).

Threatened: global and national IUCN Red List of Threatened Species designations of either vulnerable, endangered, critically endangered, extinct in the wild; and/or analogous designations by relevant governmental authorities (IUCN, 2022a).

Problem Statement

To date, no objective methodology has been proposed to demarcate what does and does not constitute a conservation activity (Sandbrook, 2015). This lack of clarity is troublesome when the need arises to precisely discuss biodiversity conservation in order to quantify and analyze efforts and funding trends of the conservation sector. This situation also transitively hinders attempts to categorize which entities qualify as a conservation organization for the purposes of high-level analysis and strategic planning. Current imprecision in terminology results in activities, no matter how far removed from the ultimate beneficiary, potentially being included in strategic planning initiatives like global biodiversity finances analysis to track adherence to international government agreements like the Convention on Biological Diversity (OECD, 2020) and Sustainable Development Goals (SDGs). Benign actions such as street cleaning, home organic gardening, and social media posting can qualify as conservation activities as they adhere to the “protection, maintenance, management, sustainable use, and/or restoration of natural resources and the environment” (Park & Michael, 2013) and can also be considered conservation actions that are “intended to establish, improve, or maintain good relations with nature” (Sandbrook, 2015). A broad scope such as this hampers effective communication, creates loopholes for corporations and states to satisfy environmental agreements, and is troublesome for any derivative concept which aims to quantify the efforts of the entire conservation community (Brockington & Scholfield, 2010).

Solution

A quantitative and holistic solution can be found in the adoption of an outcome separation framework which is based on the expected degree of separation of the action’s proximate outcome in relation to its intended, ultimate outcome for one or more habitats and species. Below, we present such a three-tiered framework for biodiversity conservation activities to enable more precise analyses of the conservation sector which, in turn, facilitates strategic planning and general discussions.

For clarification and reference, example actions for each of the three tiers are also provided below. It should be noted that emphasis has been placed on 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 native and nonnative species though, unintentionally may have. And for the purposes of this framework, the level of benefit conferred through a conservation action is immaterial, beyond the establishment that the net effect to native or ecological replacement beneficiaries is positive.

Outcome Separation Framework

Primary biodiversity conservation:

- An action that primarily serves to directly provide a net-positive benefit for a threatened habitat and/or native or ecological replacement species that are threatened;

Secondary biodiversity conservation:

- An action which facilitates a primary biodiversity conservation action either directly or through impacting a direct actor and therefore has proximate outcome(s) which exhibit two degrees of separation from the intended ultimate outcome(s); and/or
- An action which directly and intentionally benefits only non-threatened native habitat and/or non-threatened native or ecological replacement species;

Tertiary biodiversity conservation:

- An action that facilitates a secondary or other tertiary biodiversity conservation action and therefore has proximate outcome(s) which exhibit three or more degrees of separation from the intended ultimate outcome(s); and/or
- An action whose beneficial outcome(s) to native habitat and/or native or ecological replacement 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 native habitat and/or native or ecological replacement species; and/or
- An action whose intended outcome(s) for native habitat and/or a native or ecological replacement species are neutral or negative.

Additionally, distillation of this three-tiered definition provides a fully inclusive, irreducible definition of biodiversity conservation:

- Any action that is designed to have a net positive effect for native habitat and/or native or ecological replacement species.

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

- Effective area-based conservation measures such as purchase or restoration of (potentially) suitable habitat with the explicit intent of benefitting one or more threatened species e.g., reforestation, afforestation, habitat restoration, habitat corridor creation, creation of a protected area, fire control, and transforming monoculture plantations to multispecies plantations;
- 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 native or ecological replacement species for population reinforcement, relocation, or (re)introduction;
- Veterinarian services directly benefiting a threatened species e.g., emergency care, rehabilitation, and vaccinations;
- Invasive species removal within a suitable habitat;
- *In-situ* law enforcement activities pertaining to native or ecological replacement species and/or their suitable habitats e.g., anti-poaching and anti-logging activities;
- Removing potentially harmful materials within suitable habitat that supports one or more threatened species for the primary purpose of benefiting the health of that habitat or species e.g., active wildlife disentanglement, preventative wildlife disentanglement (removal of ghost netting and snares), and mining pollution remediation schemes.

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

- Scientific research conducted with the primary purpose of influencing direct actors for the net positive benefit of threatened native habitat and/or native or ecological replacement species that are threatened;

- 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 threatened biodiversity through targeting direct actors e.g., human-wildlife conflict/coexistence management, targeted awareness programs, and citizen/community science activities;
- Purchase and maintenance of suitable habitat which does not directly support threatened species, with the primary intent of habitat preservation or restoration e.g., creation of urban green spaces occupied by native and/or ecological replacement species, and cattle grazing in order to control invasive grasses;
- Veterinarian services indirectly benefiting a threatened species or directly benefiting a non-threatened species e.g., vaccinating domestic animals against a contagion near habitat which harbors a susceptible threatened species, and emergency care for a Least Concern species;
- Litigation e.g., defense of an environmental suitor enacting environmental legislation;
- *Ex-situ* law enforcement activities impacting direct actors for the benefit of native habitat and/or native or ecological replacement species that are threatened e.g., wildlife trafficking mitigation and monitoring;
- Private sector standards and codes such as certified sustainable, extractive activities whose benefit to native, non-threatened species or habitat 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 native habitat and/or native or ecological replacement species.

Tertiary conservation actions can 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 native habitats and/or native or ecological replacement species that are threatened 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;
- Advocating for policies impacting climate change mitigation strategies or wild species and their products e.g., Conference of the Parties (COP) and Paris Accords;
- Lobbying for environmental legislation with the intent of having positive impacts on native habitat and/or native or ecological replacement species;
- Pollution control and remediation outside of native habitats or primarily for beautification and/or human health with a secondary intent of benefiting native habitat and/or native or ecological replacement species;
- Purchase and maintenance of land, with habitat preservation or restoration being a secondary intent, for example: preserving land mainly for its cultural or aesthetic value;
- Other activities whose beneficial outcomes to native habitat and/or native or ecological replacement species are not the primary objective, are unintentional outcomes, or are less negative than an alternative but not net positive, e.g., sustainable resource management as a

multiple use resource; preservation of artificial landscapes such as farms, range land, and man-made lakes; and organic farming.

Discussion

Many definitions of conservation found within peer-reviewed publications, communications from government and transnational organizations, and from mainstream platforms suffer from imprecision of language and/or lack inclusion of one or more branches of conservation Sanbrook (2015), which can result in categorical confusion for the user. These definitions fail to capture the totality of biodiversity conservation endeavors while also remaining inclusive of only actions that have intentional and quantifiable impacts to native habitat and/or native or ecological replacement species. For instance, many definitions rely on vague terms which lead to questions such as “what do they consider a natural resource or nature?” which leads one to conclude that a wide gamut of questionable actions could also be conveyed as relating to conservation e.g., removing urban nest deterrents for introduced rock pigeons or culling native predator populations to increase introduced game species 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 both ignores urban habitats and fails to include effective, yet indirect actions such as *ex-situ* law enforcement activities, awareness campaigns, or environmental litigation which indirectly affect habitats and species. One could further challenge this by recognizing that feeding invasive goats on Caribbean islands would fall under this definition as a conservation action, though such an action to assist an invasive species is not traditionally considered conservation. Additionally, mainstream, public-facing platforms like the National Geographic Society define 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 species-centric and ignores fungi which is outside of the plant and animal kingdoms, it inadvertently includes invasive species and unsuitable habitats, and also places outsized importance on the education component as it is the only specific conservation action included. 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 potentially allows for funding which is spent on non-conservation actions to be counted towards national conservation benchmarks like Sustainable Development Goals (SDGs) 13, 14, and 15 through categorization errors by the Organization for Economic Co-operation and Development (OECD). For these reasons we propose the following fully inclusive, succinct definition of biodiversity conservation that is resilient to future conceptual evolutions of the field and can remedy chronic ambiguities: *Any action that is designed to have a net positive effect for native habitat and/or native or ecological replacement species.* This definition does not supersede definitions for terms such as the recently defined “Multiple-Benefit Conservation” (Gardali et al., 2021); it provides as more solid foundation for such definitions to work from by more precisely defining what they mean when referring to “conservation.”

In addition to the succinct 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 and the conservation status of the species and/or suitable habitat. For example, through our tiered scheme, research which has been broadly considered “conservation biology” (Soule, 1985), can 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. This 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. For example, the breadth of tertiary conservation research would dwarf that of secondary conservation research while having potentially far less direct effects on conservation—significantly diluting the signal to noise

ratio for tracked conservation funding which the effort intends to represent. The accuracy of biodiversity finance tracking would greatly improve by restricting the tracking to data that is inclusive of only actions that have more proximate, intentional, and quantifiable impacts to a specific species or habitat. Adoption of our framework would achieve this and thereby remove, for example, the option to count actions such as “sweeping of streets” under OECD’s Classification of the Functions of Government (COFOG) #7051 as environmental protection (OECD, 2019) and counting towards a country’s biodiversity finance goals.

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 outside the scope of this paper, only directness of impact has been correlated. With increased degree of separation, additional factors have a higher probability to influence the outcome, thus hampering the ability to quantifiably assess impact of an action and its resource cost in relation to its ultimate effect. Likewise, our definition does not speak to the reasons why these actions should be taken (Knapp, 2003; Tallis & Lubchenco, 2014).

By defining biodiversity conservation in this tiered manner, a rigorous framework is developed which is resilient to future conceptual evolutions of the field. This framework also objectively defines the boundaries of what constitutes a biodiversity conservation action for the first time in peer-reviewed literature, thereby providing a remedy to the current widespread ambiguity and, if adopted, would confer benefits to the conservation community that have been chronically lacking (Sutherland et al., 2004; Bottrill et al., 2011). 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 (Wilson et al., 2007; Underwood et al., 2008; Giving USA, 2021). These definitions can also serve the conservation community by improving our ability to effectively communicate our actions and goals and help avoid unnecessary confusion. Effective conservation relies on effective communication.

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