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**Forum**

# An introduction to key ecological concepts, financial opportunities, and risks underpinning aspirations for nature positive

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## Abstract

Global biodiversity is in decline, and businesses and society are being required to urgently create new operating models to ameliorate the crisis. Among the strategies proposed to do this, implementing the concept of nature positive has captured worldwide attention. Critical to its success will be effective collaboration between ecologists and businesspeople, driven by a shared understanding of key nature positive terminology, concepts, and risks. To this end, we introduce three core aspects: the ecological concepts in the definition of *nature positive* (health, abundance, diversity, and resilience), a typology of financial instruments that may be applied to achieving nature positive, and an overview of risks to biodiversity and society. The pivotal findings include that ecological complexity and uncertainty belie the simplicity of the definition of *nature positive* and that managing risk requires embedding aspirations into existing and emerging biodiversity conservation and restoration science and policy. Although it is challenging, nature positive deserves pursuit.

**Keywords:** ecology, financial instruments, nature positive, risk

Global biodiversity is in decline, driven largely by unsustainable human behaviors and the systematic undervaluing of nature in decision-making (Brondizio et al. 2019, Dasgupta 2021, White et al. 2023). Seven out of eight safe and just global Earth system boundaries have been exceeded (Rockström et al. 2023), and biodiversity intactness is estimated to have declined below safe planetary levels across 65% of the terrestrial Earth's surface (Newbold et al. 2016). It is now recognized that human well-being and resilience and stability of Earth systems are inseparably linked and that systemization is needed to safeguard the planet for current and future generations (Brondizio et al. 2019, Rockström et al. 2023). In turn, global organizations are realizing the critical importance of nature to a healthy economy and society and the fact that supply chains, operations, and social and business security and values are increasingly being affected by the consequences of the depletion and degradation of nature (Smith et al. 2021a, Carvalho et al. 2023).

Addressing market failures associated with environmental public goods is a critical part of the deep social and economic transformation needed to ameliorate the biodiversity crisis (Rockström et al. 2009, Raworth 2017, Dasgupta 2021). Organizations are being asked to act urgently and decisively to create new operating models, with the hope that positive outcomes will follow for nature, business, and society. For example, nature will benefit by being more explicitly accounted for in business and social operating models (zu Ermgassen et al. 2022), whereas organizations can mitigate nature-related risks (e.g., Smith et al. 2021a) and can create market opportunities through a range of new mechanisms (TNFD 2023a).

The challenge is significant. Detractors argue that capitalist and conservation values can't be aligned and that market-based solutions encourage greenwashing and are vulnerable to political and institutional dynamics that undermine environmental protection (Walker et al. 2009, Adams 2017). Justification for business-as-usual approaches include the maintenance of business profitability and status quo neoliberal ideals (Dempsey and Suarez 2016) and a general lack of efficient ways to measure and report on biodiversity risk and gain, including how to make nature fungible. Meanwhile, advocates are working to develop simple biodiversity reporting methods that are standardized and transferable (Mace et al. 2018, BlackRock 2022, ADMCF 2023). Key to the success and credibility of these methods in emerging nature markets and related solutions will be appropriate governance and the use of evidence-based indicators and standards that draw on ecological science (SBTN 2020, 2023, TNFD 2023a, White et al. 2023).

A key international body that has recently emerged in response to the biodiversity crisis is the Nature Positive Initiative (NPI 2023). Concurrently, the term *nature positive* has been rapidly and widely adopted by organizations as a banner indicating responsible and ethical treatment of nature (zu Ermgassen et al. 2022). The Nature Positive Initiative is part of a wider suite of transdisciplinary organizations seeking to bridge between private organizations and biodiversity conservation and restoration. These include the Taskforce on Nature-Related Financial Disclosure, the Science Based Targets Network, the Kunming–Montreal Global Biodiversity Framework, and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services' *Business and Biodiversity Assessment* (CBD/COP/DEC/15/4 2022, IPBES 2023, SBTN 2023, TNFD 2023a). However, nature positive is distinguished by the

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aspirational and simple and relatable message that it delivers: to halt and reverse biodiversity decline globally by 2030 (NPI 2023). Although it is inspiring, enthusiasm for organizations' engagement in the aspirations of nature positive is tempered by the difficulties of implementing meaningful, positive change for nature, and greenwashing concerns (de Freitas Netto et al. 2020, Li et al. 2023, Maron et al. 2023).

The scope of change required to achieve the nature positive goal to "halt and reverse" nature loss (NPI 2023) is far reaching and cuts across multiple, interconnected dimensions of business and society. This includes upscaling conservation and restoration practices, and concurrent funding for these (Deutz et al. 2020). Also required will be the avoidance of impacts and losses across whole value chains; the transformation of production, consumption, and waste management systems; and the integration of nature positive and net zero carbon initiatives (zu Ermgassen et al. 2022). Within this broad spectrum of challenges are three key considerations: Namely, what do the ecological terms in the definition of *nature positive* mean, what financial instruments are available to support nature positive outcomes, and what are the risks? Also critical will be transdisciplinary communication and collaboration between ecological and social scientists, economists, and businesspeople.

In answer to these questions, and as means to lay a foundation for transdisciplinary research and collaboration, we aim in the present article to introduce those unfamiliar with ecology to the scientific meaning of the concepts mentioned in the definition of *nature positive*, to provide a broad introduction to existing and emerging financial instruments that may be applied within the context of nature positive, and to highlight eight areas of potential risk to the implementation of nature positive initiatives. We envisage that this article maybe of interest to those wanting an overview of the key ecological concepts, financial instruments, and risks relevant to nature positive initiatives. This could include business executives, environmental, social and economic researchers, tertiary-level teachers, ecological practitioners, policymakers, and nongovernment environmental organizations.

## The definition of nature positive: What does it mean?

As biodiversity's catchall equivalent for a net-zero carbon or carbon positive future, nature positive has been defined as a global goal for nature, with the Nature Positive Initiative (NPI 2023) stating that "We need to halt and reverse nature loss measured from a baseline of 2020, through increasing the health, abundance, diversity and resilience of species, populations and ecosystems so that by 2030 nature is visibly and measurably on the path of recovery." It has also been described as "A high-level goal and concept describing a future state of nature (e.g., biodiversity, ecosystem services and natural capital) which is greater than the current state" (TNFD 2023b, p 40) or "At its heart, the goal is to halt and reverse the destruction of nature by 2030 with a full recovery of a resilient biosphere by 2050" (WEF 2021).

Importantly, nature positive was originally intended as a banner term to raise the profile of the global biodiversity crisis internationally (Locke et al. 2020, GG4NG 2022) and complement international human-equity and carbon-neutral objectives such as the Sustainable Development Goals and the United Nations Framework Convention on Climate Change Paris Agreement (Mace et al. 2018, Leclère et al. 2020). However, its adoption by organizations as the next frontier in ethical operation (zu Ermgassen et al. 2022) has seen the phrase variously adapted and defined, with the risk that its meaning will be diluted (Milner-Gulland 2022). The recently launched Nature Positive Initiative (an alliance of "27 of the world's largest nature conservation organizations, institutes, business, and finance coalitions"; NPI 2023), aims to preserve the integrity of the term and support the rollout of the common definition. It also seeks to define a set of metrics and standardized tools and practices that will "enable all to appropriately measure and report on their impact and contributions at the actor level."

Although variants of the definition of *nature positive* may be fashioned for bespoke applications, it is important to retain the key intent of the original definition, that is, of a measurable absolute net gain in biodiversity and nature (Milner-Gulland 2022, NPI 2023). On the other hand, without sufficient detail to facilitate implementation, there is a risk that purported nature positive approaches won't lead to nature positive outcomes. This would have clear negative consequences for nature. For instance, where necessary and meaningful action is not taken because of a lack of direction and clarity on what is required to achieve measurable net-gain improvements in nature (Bull et al. 2020, Maron et al. 2020, Milner-Gulland 2022). Furthermore, this lack of clarity may also have negative implications for organizations invested in nature positive approaches, because their investments may lose legitimacy and may potentially damage reputations through associated greenwashing (de Freitas Netto et al. 2020, Li et al. 2023).

In this context, explicit references to health, abundance, diversity, and resilience in the nature positive framing provide a basis of agreed terms that have ecological meaning and on which robust measures, standards, and indicators of nature positive can be built. These terms have been widely and deeply explored by scientists in the ecological literature; however, they remain under considerable debate and may be difficult for practitioners to implement toward nature positive outcomes. As the agreed definitions have not yet been published under the banner of nature positive initiatives, we offer in the present article an introduction to these terms based on the literature, to provide direction on and encourage wider engagement around their meaning and use (box 1). The concepts represented by these terms are also interrelated, so we then expand on them to highlight the ecological processes and interactions they collectively capture. Critical is that, although accessible terminology is needed, caution must be exercised when applying the terms, because overly simple interpretations may lead to negative outcomes, undermining the intent of nature positive.

## A primer on the ecological concepts underpinning nature positive iniatives

The concepts of health, abundance, diversity, and resilience provide an ecological foundation for what nature positive means in environmental terms (box 1). Consequently, a broad understanding of the concepts by those working toward the nature positive goal may improve the quality of communication, collaborations, and outcomes.

In its most basic form, the concept of health is used to describe the quality or condition of a species, population, or ecosystem, whereas abundance and diversity indicate their amount and variation, and resilience captures their capacity to recover from or resist change (box 1). It is important to note that, together, these concepts indirectly address three central characteristics underpinning ecological integrity (Noss 1990, 1999, Keith et al. 2020). That is, the dimensions of structure and composition (i.e., the

**Box 1. Explanation of key ecological terms in the definition of *nature positive*.**

**Health**

Ecosystem health describes the condition or quality of an ecosystem. Analogous to human health, a healthy ecosystem would be expected to be functioning well and within normal limits and have the capacity to respond effectively to challenges. Although health is often used interchangeably with terms such as ecosystem condition and integrity (Woodley and Kay 1993, Roche and Campagne 2017, Karr et al. 2022), there are ambiguities associated with its use, including that its application is not necessarily confined to nature conservation. Indeed, drawing on the definitions of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, "there is no universally accepted benchmark for a healthy ecosystem. Rather, the apparent health status of an ecosystem can vary, depending on which metrics are employed in judging it, and which societal aspirations are driving the assessment." When applied in a nature positive context, ecosystem health would thus need to be defined in relation to the natural characteristics and processes valued for conserving nature.

**Abundance**

Abundance is the amount or extent of an individual, species, population, or ecosystem that can be measured within a specified space or time. The term needs to be interpreted within a wider context and applied with caution. For example, the famous case of Yellowstone National Park shows how removing wolves led to an increase in the abundance of elk and coyotes, which led to overgrazing and the disappearance of beavers and key tree species for songbirds (Ripple and Larsen 2000, Fortin et al. 2005). We recommend its application in the context of promoting "enough" or "plenty" to optimize resilience of populations, species and ecosystem processes while maintaining a balance to avoid overabundances.

**Diversity**

Diversity is measured at three scales, described as alpha diversity (site scale), beta diversity (species turnover between sites or regions) and gamma diversity (the total diversity of a landscape or region; Whittaker 1960, Whittaker 1972, Tuomisto 2010). *Biodiversity* has been defined by the Convention on Biological Diversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (UN 1992, CBD 2006). Biodiversity can also refer to the diversity of three key characteristics of ecosystems: their compositional diversity, structural diversity, and functional diversity (Noss 1990, 1999).

**Resilience**

*Ecological resilience* can be defined as "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks" (Folke et al. 2004, Folke 2006, Keith et al. 2020). This can capture both a system's capacity to absorb or resist change (also known as *resistance*) and to recover from change (a *system* could be an individual, a species, ecosystem, or landscape). Resilience is also scale dependent and the mechanisms that enable resilience vary across scales and between ecosystems. For example, temperate Themeda-dominated grasslands in Australia are resilient to fire but not livestock grazing (Prober et al. 2017).

abundance and diversity of species and ecosystems) and function (which is related to health and resilience).

Although the four key concepts have distinct ecological meanings (box 1), they are also related to and interconnected with one another. In particular, the relationship between health, diversity, and resilience has advantages for organizations looking to implement projects that support the nature positive goal, because improvements in one dimension will likely lead to improvements in another. Furthermore, the pathways to these outcomes are also interwoven; for example, ecological restoration, rewilding (Perino et al. 2019), weed and pest control, reinstating or mimicking natural disturbance regimes (Angelstam 1998), and halting threatening processes (Harfoot et al. 2021) all have cross-cutting, nature positive benefits (Fischer et al. 2006, Jepson 2022, Pe'er et al. 2022). Indeed, there are numerous ways that improvements in health, diversity, and resilience can interact to facilitate the recovery of species, populations, or ecosystems.

Of the key processes underpinning nature positive iniatives, one that is reasonably well understood by ecologists, is the effect of species diversity on ecosystem health. Diversity is often used as an indicator of health in ecological assessments, because it can be easier to measure than other ecosystem attributes; however, the ways in which diversity improves health are varied. For example, increases in species diversity at a site (i.e., alpha diversity; box 1) may improve the site's overall ecosystem productivity (e.g., through an increase in biomass) via greater capture of available resources. In turn, this enhancement in the abundance of some species may also render the site more resistant to exotic species invasions (Tilman and Snell-Rood 2014), a desirable positive outcome for nature. Other examples that are less obvious (but equally important) include the impact of improved diversity on belowground processes. In this case, improvements in aboveground species diversity may subsequently increase belowground plant and microbial biomass and decomposer abundance and may result in enhanced plant-based nutrient storage (Hooper et al. 2005, Balvanera et al. 2006, Lawler et al. 2015, Orwin et al. 2022). Finally, in a similar way to species diversity, higher genetic diversity within individuals can improve population health, because it's more likely that some individuals will have the genes to survive environmental change (Seddon et al. 2020).

Although the relationship between higher diversity and improved health is generally well demonstrated in ecology, there are exceptions that are also worth noting. For example, more diverse systems don't always lead to improvements in ecosystem function and health (Wardle et al. 1997, de Groot et al. 2002, van der Plas 2019), and highly diverse ecosystems can still collapse. Examples of this include the collapse of Lake Victoria's diverse native fish populations when Nile perch were introduced (Witte et al. 1992) and cases from the highly diverse Caribbean coral reef (Bellwood et al. 2004, Downing et al. 2012). Intricacies in the relationship between ecosystem health and species diversity may also mean that diversity is a poor proxy for health in some circumstances, despite its widespread use as an indicator of ecosystem condition (Hughes et al. 2008). Similarly, although greater abundance might often be seen as positive, we need to be wary of overabundances and notions of ecosystems being out of balance. For example, a high availability of water and nutrients combined with a lack of herbivores can promote high dominance by (i.e., abundance of) one or few plant species but can dramatically reduce plant species diversity (e.g., Borer et al. 2014).

Building on the concepts of diversity and health, resilience describes "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks" (box 1; Folke 2006, p. 259). Environmental drivers of disturbance include fire, windstorms, and floods, and the impacts play out across scales (Pulsford et al. 2016). The positive correlations observed between diversity and health can also be extended to resilience, where more abundant, diverse, and healthy ecosystems often also have greater resilience (and vice versa). For example, abundant (or at least sufficient) above- and belowground biomass helps to maintain landscape and hydrological functions (e.g., through erosion control and water retention). Alternatively, activities such as varied disturbance management that improve species turnover (beta diversity) will result in higher diversity, heterogeneity, and resilience at the landscape scale. In a similar way, higher genetic diversity in populations also confers resilience to ecosystems and landscapes (Seddon et al. 2020). In changing environments, this can, in turn, enable resilience and adaptation of species and ecosystems by facilitating species' access to more suitable environments, promoting regional species persistence (gamma diversity; Prober et al. 2019).

In addition to both the opportunities and the challenges associated with defining and understanding health, abundance, diversity, and resilience are difficulties in applying the goal of increasing these characteristics from a baseline of 2020. The intent of the 2020 baseline is to define a point in time from which no further decline (and subsequent improvements) should occur, and measurable increases from this point are a sensible goal. However, as it's currently stated, the baseline year could be conflated with being an ideal ecological reference point from which to measure the directionality of changes in biodiversity, and increases may not always be desirable. For example, increases in the abundance of one species from a baseline of 2020 may negatively affect another (as was recorded in Yellowstone National Park with increases in elk abundance after the removal of wolves; box 1; Fortin et al. 2005). Or a species may already be locally weedy despite occurring within its expected range (e.g., through woody plant encroachment; Archer et al. 2017). Invasive species may also increase the abundance and diversity of a system but not its health or resilience. Finally, the management of ecosystems for increases in resilience is also challenging (Mori 2016), because the identification and measurement of improvements in resilience requires a detailed understanding of the processes that underly changes and how they lead to corresponding shifts in ecosystem states (Standish et al. 2014).

There is a need for a larger context for defining health, abundance, diversity, and resilience (and appropriate, positive change). Without this, any increases in species abundance and diversity could be viewed as positive, whereas they may actually have negative implications. To define *improvements*, explicit reference

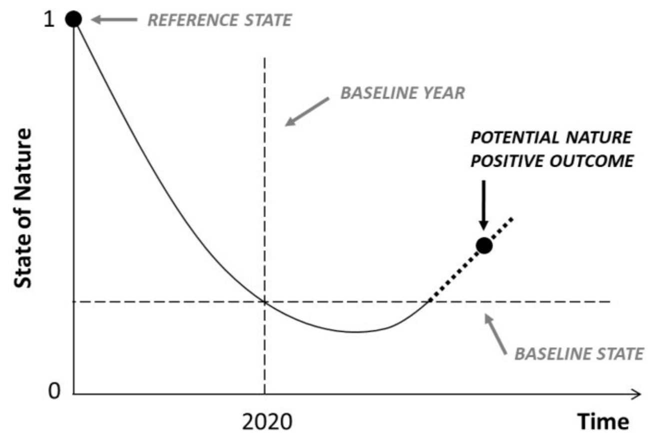


**Figure 1.** The concept of reference state may form an important complement to the nature positive baseline year of 2020, by providing a context that informs the ecological meaningfulness and directionality of change. A reference state describes the state of nature in ideal health, condition, or integrity (typically a predegradation state, but it increasingly requires consideration of climate adaptation processes). The baseline state and year describe the relative, temporal dimension against which change is assessed. Nature positive outcomes may not reach the ideal reference; however, it could be difficult to ascertain whether changes from the 2020 baseline are desirable without referring to a reference state or having a goal to aim for. Source: Adapted from NPI (2023).

to ideal healthy and resilient states in nature may be needed (figure 1; McNellie et al. 2020). The concept of reference states is complex and contentious (Bouleau and Pont 2015), and ideal states may not be achieved (or even targeted; Prober et al. 2017). However, with appropriate characterization (including explicit consideration of the type of reference being used—i.e., historical or contemporary), a reference state provides evidence and the basis for the direction of appropriate change (figure 1). It is likely going to be necessary to incorporate concepts of an ecosystem reference state into how we conceptualize nature positive (figure 1) to overcome some of the challenges in applying these concepts from the definition.

There is also much work to be done to leverage the full range of existing science available to inform biodiversity conservation, restoration, management, and repair, beyond that reflected in the key concepts underpinning the definition (Kukkala and Moilanen 2013, Bestelmeyer et al. 2017, Gann et al. 2019). In addition, transdisciplinary collaboration will be critical to bridging from the global goal to locally meaningful outcomes (White et al. 2023), as was found with implementing the Sustainable Development Goals (Moallemi et al. 2020). Organizations such as the Science Based Targets Network are working to embed science into organizational contexts at high (i.e., board and executive) levels (SBTN 2020, 2023, White et al. 2023). From setting business targets to the implementation of nature positive objectives, there are a number of existing methods to measure and report on ecosystem health (e.g., UN 2014, Harwood et al. 2016, Keith et al. 2020, Czúcz et al. 2021), abundance and diversity (e.g., Magurran 1988, Ferrier et al. 2020, 2022, Mokany et al. 2022), and resilience (e.g., Standish et al. 2014, Baho et al. 2017, Dakos and Kéfi 2022).

Methods to apply these tools to organizational contexts at local scales are also in rapid development. For example, Accounting for Nature is establishing certified methods for measuring environmental condition as a basis for linking to economic incentives through the lens of natural capital accounting (AFN

2023). In addition, the proliferation of technology for environmental monitoring—from remote and near sensors to environmental DNA methods and open source and citizen-science data collection and sharing platforms—provides an array of methods for data collection and reporting (Gibb et al. 2019, Jarić et al. 2020, Li et al. 2020, van der Heyde et al. 2022). Finally, economic incentives and financial instruments to support the implementation of activities supporting nature positive by organizations are emerging. Their credibility will rely on appropriate governance and evaluation of whether they deliver additional gains in reality, supported by the incorporation of ecological science, methods, and tools. These economic incentives and financial instruments bring both opportunities and challenges, as is discussed in the next section.

## A typology of financial instruments with potential for nature positive

The realization by the global community of the critical importance of nature to the economy has led to a recent explosion of financial products, instruments, markets, and other complementary mechanisms that could be applied to achieving the aims of nature positive (Chausson et al. 2023). Before introducing these financial instruments, we outline some background to the current state of play. In economics, it is generally accepted that most modern major environmental problems (such as biodiversity loss) can be characterized as externalities arising from the public good nature of many environmental goods. Public goods are defined as being nonexcludable (no one can be excluded from consuming the public good) and nonrival (consumption of the public good does not decrease the quantity available for others; Samuelson 1954). Therefore, markets, because of private property rights and excludability, will fail in providing them at the socially optimal level (Kangas and Ollikainen 2019). In other words, the benefits from biodiversity conservation are undervalued, and the lack of well-defined property rights means that suitable incentives do not exist to ensure it is in anyone's financial interest to appropriately protect and conserve biodiversity. The consequence is that those who conserve biodiversity are not adequately rewarded, and those who damage biodiversity are not adequately penalized. These market failures are evident by the continuing depletion and degradation of biodiversity. To correct these market failures and remediate this problem, financial instruments aim to include the full benefits from biodiversity conservation and full costs from biodiversity loss by providing appropriate financial incentives and signals.

To facilitate a more broadly shared understanding, we introduce a typology for nature-based financial instruments and summarize existing or emerging examples for each (table 1). Our typology builds on the work of Pirard (2012), who created a lexicon for market-based instruments (regulations that encourage behavior through market signals rather than through explicit directives based on Stavins 2003). In expanding on Pirard (2012), we consider not only those market-based instruments but also a broader set of financial instruments, including equity and debt-based instruments (Smith et al. 2021b, den Heijer and Coppens 2023). Many of these equity and debt-based financial instruments have only gained prominence relatively recently (in the last decade or so), reflecting increased engagement of financial institutions and global financial markets that are likely to be an important part of future business operating models (Galaz et al. 2015). Recent work by den Heijer and Coppens (2023) and Plantinga and colleagues (2024) provides further details on specific nature-based financial instruments and examples of their implementation.

Seven broad categories of financial instruments with potential for achieving the aims of nature positive are covered in table 1. The first two financial instruments refer to economic mechanisms leading to changes in price of products or costs of production to account for externalities during production processes (Pirard 2012)—regulatory and fiscal policy pricing instruments and voluntary pricing instruments.

Regulatory and fiscal policy pricing instruments broadly include taxes, tax incentives, subsidies, agrienvironmental stewardship payments, and grants. They consist of regulatory and fiscal policy measures set by public bodies and governments to drive higher or lower prices in existing markets. For example, environmental taxes and fines impose an additional cost on all covered inputs, products, or services associated with negative environmental externalities, these costs are reflected in higher prices on consumer products. Subsidies (including agrienvironmental payments), tax incentives, and grants can be used to drive reductions in negative environmental externalities or additional provision of positive environmental externalities.

For voluntary pricing instruments, producers voluntarily send a signal to consumers about their positive environmental credentials (e.g., through certification such as Forest Stewardship Council, FSC 2023; Marine Stewardship Council, MSC 2022; or media campaigns such as ecolabelling and advertising). The motivation for producers is to gain a premium market price; however, evidence suggests these premiums are likely to be modest (Cai and Aguilar 2013). Voluntary pricing instruments also include voluntary surcharges where producers offer consumers the chance to add small amounts to the final cost of goods and services to enable philanthropic funding of environmental projects or organizations.

The next two financial instruments—environmental credit or permit markets and voluntary transfers—cover a range of financial instruments such as tradeable credits markets and payment for ecosystem services schemes, in addition to direct transactions such as philanthropic giving (Muñoz-Piña et al. 2008, BHA 2023). Environmental credit or permit markets involve creating specific markets for a given environmental objective. Two examples are especially relevant from a nature positive perspective: offset schemes and mitigation banking. In addition, there are attempts to create broad-ranging markets for nature restoration and preservation, such as the prospective Nature Repair Market in Australia (DCCEEW 2022). Offset schemes allow organizations to balance negative activities or emissions by funding social or environmental improvements. These offsets can be purchased directly or as credits in a secondary market (if credits are tradeable). Mitigation banking covers markets for acquiring and retaining land in advance of ecological mitigations required by subsequent development (Salzman et al. 2018). Where credits or permits are tradable, the market is assumed to lead to more cost-efficient outcomes for a given environmental objective by allowing stakeholders to exchange credits or permits depending on their costs and benefits.

Voluntary transfers cover instruments where transactions occur in response to a common interest between a beneficiary or donor and a provider. Payments for ecosystem services schemes are contracts between purchasers of ecosystem services and providers of those services in return for actions that deliver improved service flows to the purchaser (Salzman et al. 2018). Philanthropic donations cover a variety of private giving methods that fund public goods (e.g., individual donations, bequests, or corporate social responsibility). The finance for philanthropic donations is often provided without requiring a financial return.

**Table 1.** Typology of the seven major financial instruments that could be applied to achieving the aims of nature positive.

| Nature-based financial instruments | Definition | Types of financial instruments and examples |
|---|---|---|
| Regulatory and fiscal policy pricing instruments | A range of financial instruments that lead to a change in the price of a product (or its production costs) to account for environmental externalities during production processes (Pirard 2012). | Environmental subsidies, grants, and tax incentives are financial assistance (usually financed or cofinanced by government) to incentivize certain behaviors. For example, the Environment Restoration Fund in Australia (DCCEEW 2023).<br>Agrienvironmental measures and stewardship are a specific type of subsidy provided to farmers for proenvironmental behaviors. For example, the Common Agricultural Policy in the European Union (Pe'Er et al. 2019).<br>Environmental taxes and fines are compulsory payments levied on issues with environmental relevance. For example, emission or pollution taxes such as the nitric oxide tax in Sweden (Höglund 2000). |
| Voluntary pricing instruments | A range of financial instruments where producers send a signal to consumers about environmental credentials or nature positive outcomes (Pirard 2012). | Green certification signals firms' environmental credentials which can provide access to certain markets for certified products and in some cases can attract price premiums. For example, the Forest Stewardship Council (FSC 2023) or Marine Stewardship Council (MSC 2022).<br>Green Labels are another way to signal environmental credentials to consumers.<br>Voluntary surcharges are small charges added to the final cost of goods and services where the money funds environmental projects or organizations. For example, voluntary carbon offsetting offered by numerous airlines (IATA 2023). |
| Environmental credit or permit markets | Mechanisms for purchasing and trading permits or credits. | Offset schemes cover a variety of schemes that allow organizations to balance their negative activities or emissions through the funding of social or environmental improvements. These offsets can be purchased directly or as offset credits in a secondary market (if credits are tradeable). For example, the Emissions Reduction Fund in Australia supports a carbon market (Australian Government 2023).<br>There are also attempts to create markets for nature restoration and preservation, such as the prospective Nature Repair Market in Australia (DCCEEW 2022), that provide credits for environmental improvements but do not directly involve offsets.<br>Mitigation banking covers markets for acquiring and retaining land in advance of ecological mitigation required by subsequent development. For example, Mitigation Banks in the United States to address adverse impacts on wetlands and other aquatic resources (Zirschky et al. 1995, Salzman et al. 2018). |
| Voluntary transfers | Voluntary monetary transfers with or without expectation for financial returns (Plantinga et al. 2024). | Payments for ecosystem services are direct payments between purchasers of ecosystem services and providers of those ecosystem services in return for actions that deliver improved ecosystem service flows to the purchaser. For example, Costa Rica's Pagos por Servicios Ambientales program (Blackman and Woodward 2010) or Mexico's Pago de Servicios Ambientales Hidrológicos program (Muñoz-Piña et al. 2008).<br>Philanthropic and charity donations cover a wide variety of philanthropic giving methods where the donor provides funding for projects or organizations to fund environmental improvements and may not require repayment. For example, bequests and contributions toward Bush Heritage Australia to purchase land established as private conservation reserves (BHA 2023).<br>Crowdfunding involves raising small amounts of money from a large audience (den Heijer and Coppens 2023). |

**Table 1.** Continued.

| Nature-based financial instruments | Definition | Types of financial instruments and examples |
|---|---|---|
| Green finance: equity investment | Buying shares in a company with sustainable business practices or nature positive impacts, either through the stock market (listed equity) or privately (private equity). Returns are generated through increases in value of the company shares (Plantinga et al. 2024). | Responsible investment incorporates environmental, social, and governance factors into investment decision-making and ownership.<br>Ethical investment avoids investment in companies considered unethical to the investor.<br>Impact investment promotes specific social or environmental objectives alongside financial returns (UNEPFI and UNGC 2018). |
| Green finance: debt, loans | Loans secured by organizations that will be paid back from revenue generated (either from specific green projects or from general funds). The interest rate on the loan may be tied to performance (Plantinga et al. 2024). | Sustainability linked loans incentivize the borrower's achievement of ambitious, predetermined sustainability performance objectives (Loan Market Association 2023b).<br>Green loans are loans made available exclusively to finance new or existing eligible green projects (Loan Market Association 2023a). |
| Green finance: debt, bonds | Bonds secured by nations, municipal governments or by large, well-established organizations when they want to borrow more money than a bank is willing to lend (Plantinga et al. 2024). | Green bonds are bonds where the capital raised is promised to be directed toward financing environmental activities or projects<br>Environmental impact bonds are a subset of green bonds where the yield is tied to the environmental performance of the activities or projects (den Heijer and Coppens 2023). For example, wetland restoration in Louisiana (Herrera et al. 2019).<br>Climate bonds are a subset of green bonds aimed at climate change mitigation and adaptation.<br>Sustainability or SDG bonds are similar to green bonds with funds directed to a mix of social development and green projects.<br>A range of other bond instruments are potentially relevant (e.g., resilience bonds, catastrophe bonds) see den Heijer and Coppens (2023) for further discussion. |

The final three financial instruments—equity investment, debt (loans), and debt (bonds)—cover a range of green finance instruments. *Equity investment* refers to the buying of shares in a company, either directly by individuals or through investment funds. Investor returns are generated through increased value of company shares or dividends. There are several different but linked equity investment financial instruments that are relevant from a nature positive perspective. Responsible investment incorporates environmental, social, and governance factors into investment choices. Ethical investment avoids investment in companies considered unethical to the investor. Socially responsible investment screens investments according to certain social or environmental criteria. Impact investment promotes specific social or environmental objectives alongside financial returns (UNEPFI and UNGC 2018). Although a market-rate return on investment is the standard expectation, some investors are willing to accept below market (concessionary) returns in exchange for positive social or environmental outcomes (GIIN 2018).

Loans involve a contractual agreement between a lender and borrower. Most loans are provided by banks and form the lowest cost source of finance for many small and medium enterprises. From a nature positive perspective there are currently two relevant types of loan instruments: green loans and sustainability linked loans. Green loans are available to exclusively finance or refinance new or existing eligible green projects. Green Loan Principles list potentially eligible green projects, including, for example, environmentally sustainable forestry and the preservation or restoration of natural landscapes (Loan Market Association 2023a). *Sustainability linked loans* have been defined as "the economic characteristics [of loan instruments] which can vary depending on whether the borrower achieves ambitious, material, and quantifiable predetermined sustainability performance objectives" (Loan Market Association 2023b, p.2). These differ from green loans because money borrowed need not be spent on specific green projects but must be used for any purpose providing borrower sustainability performance improves over time on the basis of specific measurable indicators.

Bonds are issued by large, well-established companies or governments when they want to borrow significant amounts of money. Green bonds are generally identical in structure to conventional bonds, differing only in the promise that money raised is directed toward actions consistent with nature positive. Pricing for green bonds is very similar to conventional bonds, with potential for a green bond premium (i.e., that a portion of investors are willing to pay a higher price for green bond and, therefore, accept a lower yield versus a comparable conventional bonds). A green bond premium could have positive implications for growth in green bond markets (MacAskill et al. 2021).

The examples in table 1 illustrate that the number of financial instruments applicable to nature positive are growing rapidly. Some of these financial instruments have a long history of being used to reduce environmental damage or promote environmental restoration (e.g., agrienvironmental and stewardship subsidies; Pe'er et al. 2022). Other financial instruments, however, have only recently emerged or are in an early stage of development (e.g., sustainability-linked loans; Loan Market Association 2023b). There is also considerable heterogeneity between different instruments, and so generalizations should be avoided when considering their potential to deliver nature positive outcomes. Building on the financial instruments described here and the ecological terms outlined earlier, the following section turns to a discussion of the risks inherent in attempts to achieve nature positive.

## Eight ecological, financial, and ethical risks relevant to nature positive aspirations

Historic shortfalls in public spending and support for biodiversity mean that engagement by the corporate sector in nature conservation, restoration and repair is both welcome and needed (Leclère et al. 2020, Dasgupta 2021). However, market-based approaches come with a range of risks, and actions may not lead to the intended outcomes. In the present article, we outline eight key risks relevant to the aims of nature positive under three broad categories (environment-related risks, risks linked to the financing and design of markets, and social, institutional, and business-related risks; table 2). To demonstrate the importance of the interconnected aspects of risks, ecology, and financial instruments to the likelihood of achieving nature positive aspirations (and the need for transdisciplinary coordination), we also outline several ways in which these areas are linked.

### Environment-related risks

Environment-related risks encompass those related to ecosystem dynamics, including restoration failure due to environmental drivers, limits to ecological and technical feasibility, and the sufficiency of scientific knowledge needed to implement plans (table 2). Failure of restoration is commonly due to severe events, exacerbated by climate change (e.g., drought, fires, floods, cyclones, or pest outbreaks; Suding 2011). More subtle factors may limit the general feasibility of nature repair projects (table 2). These include ecological barriers to achieving high-integrity outcomes, and the long time periods needed by many species, populations, and ecosystems to recover (i.e., decades to centuries; Maron et al. 2012). For example, salmon gum (*Eucalyptus salmonophloia*) woodlands in Australia take 250 years to form a mature open woodland (Gosper et al. 2018), a timeframe that far exceeds the typical operational cycles of organizations within which nature positive objectives will be planned. Difficulties in implementing the technical elements of restoration, such as securing adequate land or seed supply or for restoration activities, may also render a project unfeasible (Gibson-Roy 2022). Finally, the scientific expertise needed to provide ecological solutions and ensure trust in market incentives and outcomes may be absent or in development (table 2; White et al. 2023).

Together, restoration failure, ecological and technical feasibility, and insufficient scientific knowledge contribute to varying degrees of uncertainty that affect the design, uptake, and implementation of projects and the characterization of risks. Uncertainty in the context of nature positive initiatives may have multiple sources and implications. For example, uncertainty may derive from nature (e.g., the unpredictable nature of severe disturbance events; Brambila et al. 2023) or human systems (e.g., scientific uncertainty about casual links between land management interventions and intended ecological outcomes; table 2; Broadhurst et al. 2023). However, it is the interface between human and natural systems that will often pose particular challenges (Löfqvist et al. 2023). One instance of this in the application of financial instruments to nature positive aspirations is measurement uncertainty (Carstensen and Lindegarth 2016), which affects the trustworthiness of data related to the extent, quality, and stage of activities (Carstensen et al. 2023). A lack of measurement certainty underpins challenges such as developing, affordable, reliable, and accurate measures of biodiversity that are fit for purpose at multiple scales and enable the measurement of absolute net gain (table 2). A key consequence of measurement uncertainty may be a lack of trust between actors participating in financial approaches to activities for nature positive, potentially undermining efforts toward the goal. This includes businesses and land managers implementing projects, investors and other financially oriented participants, and end users (e.g., the public, regulators, or conservation institutions).

### Risks linked to the financing and design of markets

The next two broad categories of risk are inadequate financing and mechanism design (table 2). Meeting nature positive goals will require a substantial and rapid increase in investment and there is a distinct risk that a lack of or a limited investment will jeopardize success (McCarthy et al. 2012, Plantinga et al. 2024). In addition, even when sufficient finance is available, the inappropriate design of market instruments may fail to allocate investments to the most pressing biodiversity needs.

Several factors may drive inadequate financing for activities related to nature positive. For example, there may be a mismatch between the potential supply and demand of nature positive activities (e.g., large-scale projects and substantial green finance mechanisms that require a certain size, scale, and timing to be viable) or insufficient or unpredictable financial returns on investments (table 2; McCarthy et al. 2012, Plantinga et al. 2024). This can mean that projects do not make financial sense for investors and may lack the certainty needed to commit to activities that support the goals of nature positive.

Similarly, risks exist from high opportunity costs and transaction costs associated with nature positive activities. Opportunity cost risks enter when the opportunity provided by a fixed-price incentive (e.g., reduced interest payments on a loan) doesn't adequately compensate for the costs of remediation and protection work (e.g., fencing, restoration; Layton and Siikamäki 2009). Transaction costs are the cost to define, establish, maintain, and exchange property rights (table 2; McCann et al. 2005). Financial instruments are considered successful if benefits outweigh costs, including transaction and opportunity costs (Coggan et al. 2010). In the case of complex environmental problems such as biodiversity conservation, transaction costs are likely to be relatively high (McCann et al. 2005, Marshall 2013) and, as such, will have an important influence on the overall success of financial instruments. High administrative, monitoring, and compliance costs may be particularly prohibitive—for example, where projects require the collection of detailed ecological data or when payments are conditional on reaching certain positive ecological outcomes (table 2; Gross-Camp et al. 2012). The existing applications of financial instruments to environmental problems provide evidence for the realities of transactions costs. For example, Needham and colleagues (2019) indicated that low levels of supply (a lack of participation) was associated with high transaction costs and a key limitation in the effectiveness of biodiversity and pollution financial instruments. Furthermore, zu Ermgassen and colleagues (2020) showed that there is a trend toward allowing more flexibility in the rules of financial instruments to counter problems associated with high transaction costs and, perversely, that such flexibility can undermine achievement of positive biodiversity outcomes.

**Table 2.** Eight key risks to achieving the aspirations of nature positive.

| Risk | Description | References |
|---|---|---|
| Environment-related risks | | |
| Restoration failure due to environmental drivers | Uncertainty in achieving restoration outcomes due to stochastic environmental drivers, including disturbance events (e.g., drought, fire, flood, cyclones), disease outbreaks and other threatening processes (e.g., weed invasion, pests). Climate change will likely exacerbate all of these factors. | Pannell and Roberts 2010, Suding 2011 |
| Projects are ecologically or technically unfeasible | Projects may be ecologically or technically unfeasible within organizational timeframes and the expectations of investors for short-term returns may not align with benefits delivered by nature over decades or centuries.<br>Ecological constraints include:<br>• time lags: long time periods may be needed to achieve ecological outcomes.<br>• ecosystems are irreplaceable and are therefore impossible to replace or restore to high integrity.<br>• a lack of resilience of species or ecosystems to changing environments, including constraints to germination, establishment, and persistence of healthy populations of desired species.<br>• difficulties in achieving ecological landscape complementarity.<br>• difficulties in achieving absolute net gain objectives.<br>Technical constraints include:<br>• inadequacies in the restoration supply chain, including insufficient propagules or a lack of technical capability to restore at large scales.<br>• a lack of available land to implement nature positive actions. | Ferraro 2001, Fischer et al. 2011, Quétier and Lavorel 2011, Lindenmayer et al. 2012, Maron et al. 2012, Tilman and Snell-Rood 2014, Zahawi et al. 2014, zu Ermgassen et al. 2019, Blakley and Franks 2021, de Mello et al. 2021, Baisero et al. 2022, Kedward et al. 2022, Brambila et al. 2023 |
| Lack of scientific knowledge | The scientific knowledge needed to implement projects is lacking, making them scientifically unfeasible. For example:<br>• insufficient ecological knowledge to effectively restore (e.g., potentially manageable ecological barriers not recognized and so not addressed).<br>• limitations in predicting (qualitatively and quantitatively) how ecosystems will recover through time (e.g., how certain management actions will lead to intended outcomes).<br>• limitations in adequately implementing spatial targeting and landscape-scale planning principles for projects.<br>• a lack of methods for measuring absolute net outcomes accurately and reliably.<br>• challenges in developing common, fungible, units for biodiversity trade.<br>• challenges in developing, cheap, reliable, and accurate measures of biodiversity that are fit-for-purpose at multiple scales. | Moilanen 2005, Maron et al. 2012, Athey 2017, Seddon et al. 2020, Wunder et al. 2020, zu Ermgassen et al. 2020, Blakley and Franks 2021, Broadhurst et al. 2023 |
| Risks linked to the financing and design of markets | | |
| Inadequate financing | Meeting nature positive goals requires a substantial and rapid increase in investment.<br>• a lack of investment will limit success and could be a particular problem for large-scale projects and significant green finance mechanisms.<br>• financial uncertainties, such as cash flow variability, and insufficient or unpredictable financial return on investment will likely limit investment.<br>High transaction and opportunity costs:<br>• transaction costs: there will be administrative, monitoring and compliance costs associated with demonstrating nature positive that may reduce the viability or uptake of market instruments, particularly by smaller businesses. Monitoring costs are particularly relevant for projects with conditional payments on ecological outcomes.<br>• opportunity costs: the opportunity provided by a fixed-price incentive (e.g., reduced interest payments on a loan or stewardship payments) may not adequately compensate producers or cover the costs for remediation and protection work (e.g., fencing, restoration). This is a major limiting factor in the uptake in voluntary fixed-price incentives. | McCann et al. 2005, Layton and Siikamäki 2009, Coggan et al. 2010, McCarthy et al. 2012, Waldron et al. 2013, Tanentzap 2017, den Heijer and Coppens 2023, Plantinga et al. 2024 |

**Table 2.** Continued.

| Risk | Description | References |
|---|---|---|
| Mechanism design | The design of market instruments fails to allocate investments to the most pressing biodiversity recovery needs, including due to:<br>• an inability to cope with natural ecosystem dynamics. This causes difficulties in measuring and translating natural values across ecological assets and markets, potentially resulting in low standards or coarse or poor-quality indicators and a lack of objective criteria for selecting actions or projects. See also a lack of scientific knowledge.<br>• when the concept of additionality is poorly applied, leading to payments for outcomes that would have happened anyway (for example, by offsetting with land that is never likely to be subject to conversion for human-dominated uses).<br>• poor enforcement of conditionality (where payments are contingent on evidence of ecological improvement): interest in enforcing conditionality may be eroded due to nonenvironmental pressures(for example, distributional equity or the political sensitivities of sanctioning).<br>• fine details within rules and regulations may weaken or undermine overall outcomes. For example, when nature certificates are allowed to be traded in an offsets market. | Armsworth et al. 2006, Pannell 2008, Walker et al. 2009, Maron et al. 2012, Mason and Plantinga 2013, zu Ermgassen et al. 2019, Pates and Hendricks 2020, Wunder et al. 2020 |
| Social, institutional, and business-related risks | | |
| Regulatory and legal | Regulatory, legal and institutional frameworks required by nature positive goals are inadequate or political willingness is lacking.<br>• displacement of existing regulations: a reliance on markets and businesses to drive nature positive outcomes could begin to replace core conservation measures (e.g., strong environmental regulation, the expansion of protected areas and allocation of public funds toward on-ground conversation work).<br>• government policy: changes in government policy (i.e., following an election) may lead to a change in environmental regulation and potentially reverse previous nature positive gains.<br>Cooperation and collaboration between many different private and public actors is complex.<br>• the complexities of institutional, legal, economic, and environmental factors mean the scalability and transferability for nature positive goals might not be feasible. | Gustafsson 1998, Freeman et al. 2006, Damiens et al. 2021, Schulze 2021, den Heijer and Coppens 2023 |
| Ethical and values-based considerations | Nonfinancial concerns may affect the likelihood of market incentive uptake. For example<br>• actions consistent with nature positive may have adverse outcomes for participants. For example, biodiversity-focused restrictions on how land can be used may change land zoning designations or reduce the monetary value of land.<br>• local legitimacy (equity and fairness): poorly designed processes (including a lack of transparency) may lead to perceived or real inequity for participants, in turn influencing legitimacy and uptake. For example, land manager costs to provide a service may differ between participants, so equal payments may be perceived as inequitable.<br>• values conflicts: the values and preferences of people developing market instruments (e.g., economists, government, scientists) may not be aligned with those who are affected by or use the tools (e.g., land managers, businesspeople, conservationists).<br>• behavioral economic considerations: participants responses to market signals may modify standard economic recommendations. For example, landholders' responses to payment schemes will be motivated by pluralistic values.<br>Ethical considerations that may negatively affect people and nature:<br>• commodification of nature: the privatization and monetary valuation of nature reduces ethical and moral issues and pluralistic values to a single monetary number, which may disempower cultural appreciation of nature.<br>• crowding out: individual motivation toward conservation activities could be displaced because of the introduction of economic incentives. | Kerr and Jindal 2007, Greiner and Gregg 2011, Gross-Camp et al. 2012, Schröter et al. 2014, Jayachandran et al. 2017, Chapman et al. 2019, Smessaert et al. 2020, Wunder et al. 2020, Yuliani et al. |
| Improper behavior from organizations | There is a risk of improper behavior from organizations wanting to be recognized as contributing to nature positive—for example, through:<br>• greenwashing: inauthentic claims regarding the nature positive of product production and distribution may mislead stakeholders and buyers, with adverse effects on both business reputations and the environment.<br>• leakage: economic activity may be relocated to less-regulated regions, leading to the displacement of impacts on nature and false claims or greenwashing in more regulated jurisdictions.<br>• human-rights violations (for example, land grabbing and the displacement of indigenous landowners) may occur by international organizations looking to meet social and investor demand for improved environmental standards under the banner of nature positive. | Borras et al. 2011, Hertel 2018, de Freitas Netto et al. 2020, Yang and He 2021, Dechezleprêtre et al. 2022, Li et al. 2023 |

The financial uncertainties described in the present article also have links to the environment-related risks and challenges outlined above and in table 2. For example, negative drivers of ecological and technical feasibility (time lags, sourcing local seed) and restoration failure may lead to poor financial returns for conditional payments. These risks are also integrated with and further compounded by ecological complexity (i.e., the complexity that arises from the numerous, interconnected, elements and processes that make up nature; Parrott 2010). In the context of nature positive iniatives, diversity and resilience can be considered aspects of ecological complexity. In the case of transaction costs, the complexity of ecological systems can directly influence costs associated with the implementation of financial instruments for nature positive. For example, the expense to employ experts to perform environmental assessments on project progress and outcomes may limit project viability.

In addition to financial uncertainties, effective mechanism design is vital to success. It also demands an understanding of complex natural ecosystem dynamics (including the environment-related risks outlined previously) and the creation of appropriate incentives to drive required actions and outcomes (Kinzig et al. 2011). The drivers of risks to effective mechanism design include the poor handling of additionality, inadequate implementation of spatial targeting and related landscape-scale planning principles (Kukkala and Moilanen 2013), and insufficient enforcement of conditionality (table 2; Wunder et al. 2020). In the case of poorly applied additionality, calculations of (and payments for) activities contributing to nature positive may include areas that were not degraded or in need of repair, leading to no absolute positive outcomes for nature (Mason and Plantinga 2013, Pates and Hendricks 2020). On the other hand, landscape-scale planning (including the spatial targeting of activities) measures and assesses essential components of ecosystem health at the landscape scale—for example, beta and gamma diversity (box 1) and the connectivity of habitat for fauna (Ferrier et al. 2007, Keeley et al. 2021). If those components are overlooked, this may result in poor outcomes for nature at regional and landscape scales.

The establishment of appropriate and measurable goals and outcomes is another essential element of robust mechanism design, and a failure to do so will create additional risks to achieving nature positive. Maron and colleagues (2021) demonstrated this in relation to setting explicit, measurable, and robust biodiversity goals. They described the difference between measures of relative (common to offset schemes) and absolute net biodiversity outcomes. Relative net outcomes are measured in relation to a counterfactual scenario (i.e., to compare outcomes with what would have happened without the intervention in question). The implication is that, if biodiversity is declining in the counterfactual scenario, then anything that the intervention delivers above that would be classified as a relative net gain. This is in comparison to an absolute net gain, which requires the cessation of biodiversity loss in an absolute sense and is a necessary part of nature positive (Maron et al. 2018, Bull et al. 2020, Maron et al. 2020).

## Social, institutional, and business-related risks

The final three broad categories of risk considered in this article are related to the social, institutional, and business dynamics of nature positive iniatives. They include regulatory and legal risks, a series of ethical and values-based considerations, and improper behavior from organizations (table 2). Organizational conduct includes the controversial topic of greenwashing (Li et al. 2023) and less well known aspects of business behavior such as leakage (Hertel 2018, Dechezleprêtre et al. 2022) and human-rights violations (Yang and He 2021). Greenwashing may occur when inauthentic and misleading claims are made regarding activities related to nature positive, whereas leakage is the relocation of economic activity to less regulated regions (table 2). Furthermore, human rights violations have been reported in Global South countries, driven by international Global North organizations looking to meet social and investor demand for improved environmental standards (Yang and He 2021).

Beyond the improper behavior of businesses themselves, the larger social picture that regulatory and legal risks encapsulate is broad and complex. The drivers of risk include that stable and sympathetic political attitudes and policy environments are needed (but may be lacking; Schulze 2021), whereas the sheer scalability and transferability of change in institutional, legal, and economic systems needed for nature positive may not be feasible (table 2; zu Ermgassen et al. 2022). A key concern by some conservation groups is that a reliance on markets and businesses to drive nature positive outcomes could displace existing regulations and core conservation measures (Hackett 2013). For example, through leading to the weakening of (currently strong) environmental regulations, halting the expansion of protected areas, and reducing the allocation of public funds toward on-the-ground conversation work (table 2). However, financial instruments for environmental goods are meant to complement, not replace, existing government-led laws, regulation, programs, and strategies. These include (but are not limited to) environmental law and impact assessment processes, nature conservation reserve systems, and threatened species programs (Dietz et al. 2003).

To overcome these risks and prevent adverse outcomes, Deutz and colleagues (2020) recommended that governments pursue transformative policy reforms to reverse biodiversity loss. This includes tax reforms that halt flows of biodiversity-degrading finance. In particular, in the forestry sectors in relation to deforestation, in fisheries with regards to the overexploitation of fish stocks, and in agriculture, when agricultural subsidies focus on increasing crop output without consideration of biodiversity impacts (Deutz et al. 2020). Alongside policy reforms, there is also a continuing need to address current funding gaps and to increase public finance for biodiversity (Deutz et al. 2020) while ensuring that the funds are directed in an equitable way (Dempsey et al. 2022). To overcome these challenges, governments need new innovations to increase the quantum of funding available for nature positive change—for example, as was outlined in the financial instruments section earlier and in table 1.

Finally, ethical and values-based considerations may affect the likelihood of market incentive uptake and success (table 2). These risks are also complex and nuanced, and although some risks have direct negative consequences for people, it is more difficult to ascribe where impacts may occur for others. For example, it is hard to predict the role that pluralistic values will play in determining the uptake of market mechanisms (Chapman et al. 2019, Yuliani et al. 2022). Conversely, biodiversity-focused restrictions can lead to reductions in land value (e.g., in high-value agricultural areas) or limitations on how land can be used (e.g., through the banning of tree harvesting). In these cases, there are direct, negative financial and personal consequences for people which may be a significant deterrent to engaging in market instruments. Social research and transdisciplinary collaboration across the financial, ecological, and social sectors may assist with managing these risks and would also benefit the market design process. This type of research and collaboration may also help to reduce the risk that the values and preferences of those developing market instruments (e.g., economists, policymakers, scientists) are not aligned with those who are affected by or use the tools (e.g., land managers, businesspeople, conservationists; Chapman et al. 2019, Yuliani et al. 2022). Although engaging with social aspects of market design and risks can be challenging, it will be critical to the long-term success of nature positive aspirations.

Collectively, the risks to achieving nature positive ambitions outlined in the present article highlight potential critical weak points along the design, planning, implementation, reporting, and renumeration pipeline (zu Ermgassen et al. 2022, Maron et al. 2023). Remediating the risks can be tackled through preventive action, alongside the strategic design of markets and associated planning, regulatory, and monitoring frameworks, standards, and indicators. We also acknowledge that the categories presented in the present article are broad and do not cover all of the risks relevant to the necessary widespread social and economic transitions needed to achieve nature positive futures (for alternative and complementary perspectives, please see Maron et al. 2018, 2023, Bull et al. 2020, zu Ermgassen et al. 2022). However, they do provide an entry point for a deeper exploration of risks and explicit consideration of the challenges will open and improve pathways and solutions toward nature positive. It is our hope that consideration of the risks presented in the present article will support the design of more ecologically meaningful and socially responsible nature positive initiatives and to help prevent unintended adverse outcomes. In particular, positive solutions may arise where shared expertise is applied to these transdisciplinary issues.

## Conclusions

Nature positive is both an inspiring global goal and a potential fad in the mission to protect, conserve, and restore nature (Redford et al. 2013, Maron 2023). As the Global Goal for Nature and alongside the Kunming–Montreal Biodiversity framework, it may be the catalyst that society needs to recover and live as part of nature. Conversely, there is a real risk that it will be constantly plagued by greenwashing concerns and result in few actual outcomes in the recovery of nature. The devil is in the details, and adapting the global goal to locally meaningful objectives (that are adequately resourced and appropriately implemented) will be enormously challenging but isn't something that society should shy away from.

Looking ahead, effective transdisciplinary collaboration across the financial, ecological, and social sectors is needed. As Dasgupta (2021) wrote about developing a grammar for the economics of biodiversity, improving our ecological and financial literacy, alongside our understanding of key ethical issues, may better enable this. To this end, we have provided in the present article an accessible introduction to key concepts and terminology from ecology and finance, as a basis for developing a shared understanding of what's needed to enable collective action toward nature positive solutions between these disciplines. All available avenues will be needed to ensure that there are adequate resources to halt and reverse nature loss across society, and the financial instruments summarized in the present article provide a range of means for doing this.

There are also numerous risks and challenges linked to the nature positive approach and awareness of these risks will be a first step toward developing socially and environmentally sensitive solutions to them. They encompass both the risks that environmental uncertainty and complexity pose to the success of market instruments for conservation (e.g., the ecological and technical feasibility of planned actions) and a myriad of ways that financial mechanisms may lead to poor or unsatisfactory outcomes for nature. A critical consideration in the development of solutions is the role of existing science in guiding the practical implementation of projects. The simplicity of the nature positive message (and its use as a banner term for change) has been important to its success and uptake by organizations thus far. However, if nature positive is to truly become the Global Goal for Nature and a third pillar alongside climate and human equity goals, this simplicity is also a barrier to its success. For example, although health, abundance, diversity, and resilience are useful and meaningful ecological concepts at global scales, they can become messy and divisive at local and regional scales because of complexities in their meaning or application in practice. Frustratingly, there is a risk that nature positive outcomes will not be positive for nature if the definition is the only yardstick by which the outcomes are designed and measured.

Nature positive advocates need to capitalize on the momentum and potential for positive change that the global goal has generated, alongside developing the scientific scaffolding needed to ensure ecologically meaningful and fit-for-purpose outcomes. This includes the need for capacity-building across sectors, to enable engagement with the complexity that biodiversity-related challenges present. Although simplicity is desirable and needed, fit for purpose, ecologically meaningful solutions necessitate the inclusion of ecological complexity when working at local scales. This work is already underway (e.g., Bull et al. 2020, Bull et al. 2022, zu Ermgassen et al. 2022, Maron et al. 2023), but much more is needed, including practical guidance and demonstration projects to maintain this momentum.

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