

EXPLORING DESIGN PRINCIPLES FOR HIGH INTEGRITY AND SCALABLE VOLUNTARY BIODIVERSITY CREDITS

A technical working paper
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REPORT AT A GLANCE

What businesses need to know

- Voluntary biodiversity credits are standardised and verified units of positive biodiversity outcomes.
- Biodiversity credits have the potential to enable business and finance to make increased voluntary contributions to a nature-positive future by providing confidence that contributions are effective and are aligned with societal goals for nature.
- Biodiversity credits are not an alternative to making reductions in negative biodiversity impacts resulting from business activity.
- Businesses have opportunities to align with emerging societal expectations for corporate action on nature by:
 1. making meaningful reductions in negative biodiversity impacts associated with business activity by following the mitigation hierarchy, using robust frameworks like those in development by the Science-based Targets Network and,
 2. going beyond this to support global nature recovery by contributing to tangible positive outcomes using voluntary biodiversity credits.
- Voluntary biodiversity credits are at an early stage of development, but a number of initiatives are developing crediting standards and publicly accessible registries with the intent of providing frameworks for verified, transparent systems for financing nature conservation and recovery.
- Early engagement by market leaders in business and finance can help structure the market to align with business needs by making early contributions and testing credit schemes.
- Until standards of good practice are recognised by global standards bodies, careful due diligence is required to evaluate the potential biodiversity gains and risks of investment options.

This technical paper contributes to the emerging community of practice around developing biodiversity credits and crediting standards by presenting some potential design principles for high integrity and scalable credit schemes.

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EXECUTIVE SUMMARY

This working paper discusses opportunities for promoting investment in biodiversity conservation and recovery through biodiversity credits, highlighting key risks and the lessons learned from other market-based mechanisms. We outline principles for developing scalable, high integrity biodiversity credits and a global measurement framework.

Biodiversity credits hold significant promise and risk – they have also not yet been tested at scale. It is critical that a wide range of stakeholders, especially those living in or using the ecosystems where credits are focused, are involved in defining appropriate principles and standards.

This working paper is offered as an input to the many ongoing discussions about biodiversity credits and to help guide the development of a high integrity credits market. The authors welcome feedback and discussion.

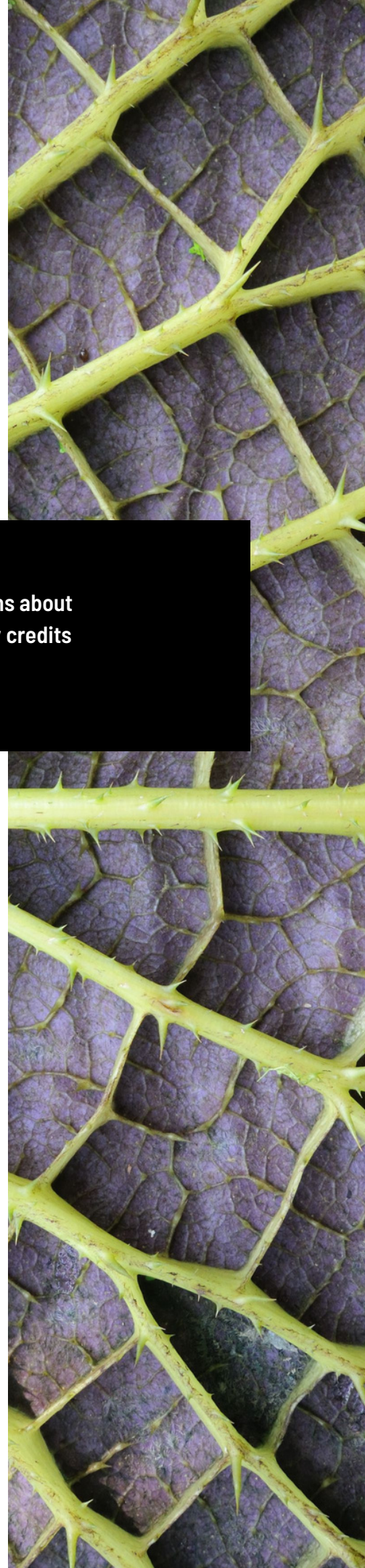
WHAT ARE BIODIVERSITY CREDITS?

Biodiversity credits can be understood as standardised units of positive biodiversity outcomes. These biodiversity units are generated by one or more actors, through conservation, or restoration of biodiversity, monitored over time and verified. They would be the biodiversity equivalent of carbon credits. Just as carbon credits can be acquired by those seeking to contribute to greenhouse gas emissions reductions, biodiversity credits could be acquired by those wanting to drive positive biodiversity outcomes.

As of October 2022, we are aware of over 10 initiatives already underway to develop voluntary biodiversity credit schemes. These all fall under the broad definition above but vary significantly in the types of biodiversity (e.g. species or ecosystems) involved, geographic scope, type of intervention and level of monitoring and verification. We present the case for building a community of good practice for biodiversity credit development, implementation and use, based on principles to ensure that biodiversity credits contribute to a nature-positive¹ future in a way that is socially equitable and scaleable.

There is a huge funding gap for biodiversity conservation and restoration and increasing attention on the potential contribution of the private sector to a nature-positive future.

¹ Recognising that the term is still being defined: see zu Ermgassen et al. (2022)



One challenge for scaling private sector investment in biodiversity is that delivering and verifying tangible biodiversity gains can be complex, with conservation opportunities highly variable in approach, geography and cost. This results in high transaction costs for companies seeking reassurance that investments in biodiversity protection and recovery will be effective.

Reducing transaction costs and improving market confidence are key factors driving interest in the potential of biodiversity credits. Overcoming these barriers could enable significant scaling of private sector funding for biodiversity in the same way that carbon credits have done for the carbon market.

INTEGRITY AND SCALABILITY: ENABLING FACTORS FOR GLOBAL BIODIVERSITY CREDITS

For biodiversity credits to be considered successful, they will need to deliver high integrity outcomes at local and global scales.

- Local-scale integrity ensures that biodiversity credits deliver tangible positive biodiversity outcomes within the perimeter of a conservation intervention, and these gains are maintained, locally relevant and socially equitable.
- Global-scale integrity ensures that biodiversity credits make verifiable contributions to achieving societal goals for nature, delivering nature-positive outcomes that are additional to (and not a substitute for) reducing negative biodiversity impacts.

Global-scale integrity could be compromised if voluntary biodiversity credits are used to circumvent the mitigation hierarchy and justify new losses of biodiversity. This can be avoided if voluntary biodiversity credits are not used as offsets.

Instead, biodiversity credits could be used by companies as a credible pathway for delivering positive contributions to nature. This distinction is analogous to carbon credits being used to go beyond, rather than instead of, direct operational and value chain emission reductions.

Both local- and global-scale integrity are critical to building confidence in the nascent biodiversity credit market. Embedding safeguards, measurement and verification mechanisms, and guidance within biodiversity credit schemes will be essential to ensure positive outcomes for nature and for people.

For credits to play a significant role in addressing the global biodiversity crisis, they will need to be scalable. Biodiversity monitoring can be expensive, which increases the transaction costs of investment in conservation and is a barrier to scalability. A tiered approach to monitoring would support scalability while maintaining high integrity. In a tiered approach, more monitoring effort is appropriate where there is either a greater risk of weak or negative outcomes (e.g. where there is uncertainty about the likely effectiveness of the proposed approach due to a lack of precedents), or where the project focuses on biodiversity features of greater conservation concern, such as Critically Endangered species.

RISKS OF POORLY DESIGNED BIODIVERSITY CREDIT SCHEMES

Experience of payment for ecosystem services (PES), carbon markets, and biodiversity offsets demonstrates very significant risks associated with creating markets for nature. The risks and challenges of carbon credits apply but are likely to be even greater given the complexity of biodiversity.

There is a very real risk that poorly designed biodiversity credits standards frameworks with inadequate or inappropriate ecological, social and financial safeguards could lead to negative outcomes and unintended consequences for biodiversity, people, and business.

Table 1. Summary of identified risks and lessons for the design of biodiversity credits

Risk	Lesson and potential solutions
Enabling biodiversity loss	Prioritise prevention using the mitigation hierarchy
Causing unintended social impacts	Require strong social safeguards
Oversimplifying biodiversity and its uses	Integrate locally relevant indicators into a flexible global monitoring framework
Measurement uncertainty and cost of monitoring	Ensure robust and cost-effective monitoring through a tiered approach to monitoring based on the level of biodiversity risk
Promoting a 'race to the bottom' through inadequate emphasis on quality of outcomes	Measure the level of positive change
Displacement of impacts (leakage)	Encourage landscape / jurisdictional approaches

Towards high integrity and scalable global biodiversity credits

Based on the risks and lessons discussed in the previous section, we identify an initial set of 12 high integrity principles for building an effective voluntary biodiversity credit framework. The principles cover ecological, social and financial dimensions. Biodiversity credits will be most credible if they:

Ecological

1. Promote robust and verifiable positive impacts.
2. Are additional to actions implementing the mitigation hierarchy.
3. Contribute to recognised global conservation priorities and align with regional and local conservation plans where relevant, to promote effective targeting of conservation finance.
4. Use flexible measurement frameworks that allow aggregation of context-specific metrics into globally comparable units.
5. Apply cost-effective and proportionate monitoring and verification, to prioritise delivering investment to on-the-ground actions.

Social

6. Are co-designed with local stakeholders through a rights-based approach to conservation.
7. Produce locally-meaningful benefits that address and respect diverse local uses of nature.
8. Promote equitable distribution of benefits.
9. Include strong safeguards to prevent adverse social impacts.

Financial

10. Enable the sustained funding of credited conservation actions.
11. Ensure transparent reporting of project impacts to manage the risk to credit buyers.
12. Link to clearly defined business needs, to promote scaling of investment finance.

LOOKING FORWARD



The biodiversity credit market is nascent, but has potential to grow rapidly.

The maturation of the voluntary carbon credit market has been accompanied by ongoing refinement and calls for higher standards of integrity to address issues that have emerged over time. Biodiversity credit market actors can learn from this by incorporating existing lessons from the carbon market to promote a high integrity approach to biodiversity credits from the outset. It is also essential to build in processes for learning and refinement. Wide stakeholder engagement and constructive dialogue can help address potential risks of poorly designed credit schemes by bringing together diverse, ecological, social and financial expertise to develop a community of good practice. Bold action is needed, accompanied by transparency and a willingness to communicate, learn and adapt from early efforts to deliver on promises for nature and people. We welcome comments and suggestions on the ideas presented.



01. INTRODUCTION: THE POTENTIAL FOR VOLUNTARY BIODIVERSITY CREDITS TO SUPPORT A NATURE-POSITIVE FUTURE

1.1 What are biodiversity credits?

Biodiversity credits can be understood as standardised units of positive biodiversity outcomes. These biodiversity units are generated by one or more actors, through conservation, or restoration of biodiversity, monitored over time and verified. The credits could be acquired by those wanting to invest in positive biodiversity outcomes (Figure 1).

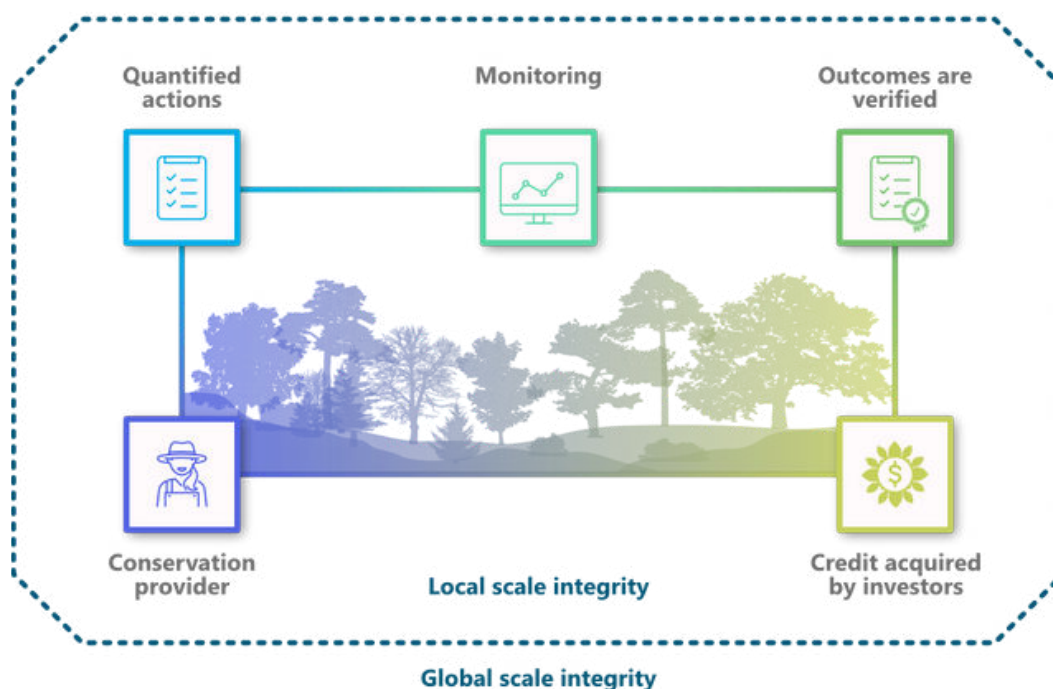


Figure 1: Illustration of a biodiversity credit process from creation by a conservation provider to acquisition by investors, with the need for integrity at local and global scales.

Within this broad definition, biodiversity credits could take many forms. Credits could focus on conserving particular biodiversity features, such as species or habitats, or focus on maintaining ecological processes, such as the functioning or integrity of ecosystems. They could also relate to a particular geography or be global in scope (Figure 2).

This working paper focuses on voluntary biodiversity credits, as distinct from regulatory biodiversity credits (e.g., habitat banking, national offset frameworks).



Figure 2. Illustration of some possible types of biodiversity credit, classified based on whether they focus on maintaining or recovering particular features or on broader ecological processes.

1.2 Why is there interest in biodiversity credits?

There is a huge interest in biodiversity credits. As of October 2022, we have identified more than 10 initiatives that are developing or intending to develop crediting frameworks for voluntary biodiversity credits. This number is growing rapidly.

Interest in biodiversity credits is coming from businesses and their stakeholders, conservation practitioners, and intermediaries (Table 2).

Business interest in biodiversity credits stems in large part from increasing societal expectations for the private sector to play a significant role in achieving societal goals for nature (WBCSD, 2021). Once companies have avoided and reduced impacts in line with societal goals and science-informed targets, they can also make positive contributions to nature recovery (Business for Nature, 2022).

Businesses are also increasingly required or encouraged to measure and disclose their impacts and dependencies on biodiversity, and the steps they are taking to address them. This is driving business to seek quantifiable and verified opportunities for investing in positive outcomes for biodiversity.

Table 2. Summary of different stakeholder interests and opportunities relating to biodiversity credits

Actors	Interest in voluntary biodiversity credits
Businesses seeking to invest in nature (demand)	An effective mechanism for achieving verifiable, positive biodiversity outcomes for targets and disclosures. Providing peace of mind that the conservation project is implemented according to good practice standards.
Conservation practitioners, landowners, stewards (supply)	Potential to scale up funding for conservation actions. Source of funding to enable transition to more biodiversity-aligned production practices.
Stakeholders in businesses (customers of businesses, investors, civil society, individuals)	For confidence that businesses are acting responsibly to address impacts in line with societal goals for biodiversity, and that biodiversity actions meet expectations for integrity and social equity.
Intermediaries (brokers, verification standards, traders)	Business opportunities of connecting supply and demand. Opportunities for trading and investing in biodiversity credits.

On the supply side, many NGOs, communities and civil society groups are already active custodians of nature, and private landowners and stewards are increasingly open to opportunities to enhance biodiversity on their lands. However, there is a huge funding gap. To reverse the decline in biodiversity by 2030, a 5-10 fold increase in global annual spending on conservation is required (IIED, 2021). The potential for business to fill part of this funding gap is driving enthusiasm for biodiversity credits among some conservation practitioners.

Despite the existence of both demand and supply, identifying suitable projects remains challenging. A lack of transparency concerning project impacts, the multitude of ways that projects report progress, a wide diversity of project types and approaches, and highly variable rates of success all create uncertainty about how to direct investment to generate positive biodiversity outcomes.

Verifiable biodiversity credits could provide a way to increase investor confidence and match the supply of conservation projects with emerging demand, and hence an opportunity to scale nature recovery.

1.3 Scope and objectives of this paper

Biodiversity credits present opportunities for scaling investment in nature, but also significant risks. In this rapidly developing space, there is need to make sense of the many emerging initiatives and build a community of good practice based on a common set of guiding principles. These principles should promote a high integrity approach that is locally appropriate and equitable, address the risk of adverse outcomes and channel investment to recognised conservation priorities.

This paper therefore sets out to:

- Describe the concepts of local- and global-scale integrity, which are requirements for biodiversity credits to deliver positive outcomes for nature and people.
- Identify key risks to achieving high integrity outcomes at local and global scales.

- Draw on experience with carbon credits, biodiversity offsets and PES to propose high integrity design principles.
- Identify approaches for developing a global measurement framework for biodiversity credits.
- Encourage constructive dialogue to support the development of a community of good practice.

2. Defining integrity at local and global scales

For biodiversity credits to support positive outcomes for people and nature, integrity is required at both local and global scales.

- Local-scale integrity ensures that biodiversity credits deliver tangible positive biodiversity outcomes within the perimeter of a conservation intervention, with gains that are maintained and socially equitable. The 'local' spatial scale is the area encompassing all people directly and indirectly affected by project activities (often called the project's 'area of influence': Bull et al., 2018).
- Global-scale integrity ensures that biodiversity credits make verifiable contributions to achieving societal goals for nature. This means that credits are used to deliver additional nature-positive outcomes, aligned with global goals that go beyond - and are not a substitute for - avoiding and reducing negative biodiversity impacts.

Securing these two forms of integrity requires robust guardrails and a set of high integrity principles integrating good practice approaches across ecological, social and financial pillars of sustainability (Figure 3, Section 4).

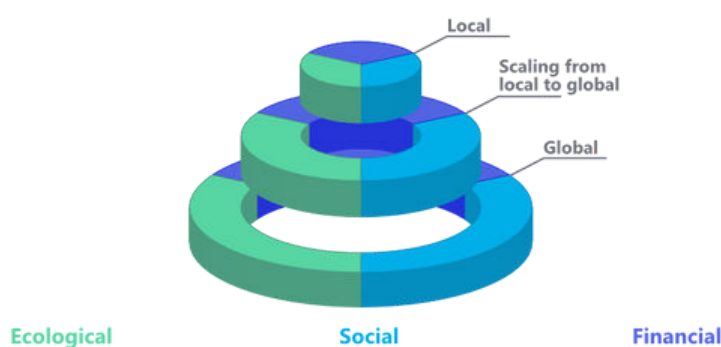


Figure 3. Development of high integrity biodiversity credits requires an integrated approach that considers ecological, social and financial pillars of sustainability, with consideration paid to each pillar at local and global scales and supportive mechanisms to promote scaling from local to global.

3. RISKS OF VOLUNTARY BIODIVERSITY CREDITS

The rapidly expanding market for biodiversity credits offers new opportunities for scaling biodiversity investment, but there is also a risk of poor implementation and negative outcomes if credits are not well designed. Experiences and lessons learned from more established market-based environmental approaches, such as carbon credits, biodiversity offsets, and PES are highly relevant for biodiversity credits. High integrity biodiversity credits will have to tackle the same issues of additionality, leakage and permanence as carbon credits, but with additional complexity due to the multi-dimensional and place-specific nature of biodiversity (Burns et al., 2022).

Here we discuss some key risks and lessons learned from other market-based approaches, which can help to inform the design of high integrity biodiversity credits².

3.1 Risk: enabling biodiversity loss | Lesson: prioritise prevention by using the mitigation hierarchy

Carbon credits have been criticised for diverting attention from the most important climate action, with companies overlooking the need to reduce emissions and instead perceiving the purchase of carbon credits as a right-to-pollute (Miltenberger et al., 2021). To avoid the same issues and to prevent their use as a 'license to trash', the use of biodiversity credits can be combined with broader good practice frameworks for business that prioritise implementation of the mitigation hierarchy, such as those being developed by the Science-Based Targets Network (SBTN)³ for both site-based and broader value-chain impacts.

Clear rules for applying biodiversity credits to support particular claims that draw on these frameworks, such as corporate nature-positive alignment (zu Ermgassen et al., 2022), would help build the credibility of biodiversity credits. This is important to ensure effort is not diverted from actions to avoid and reduce negative biodiversity impacts (Section 4).

² This is not intended to be a comprehensive review of the challenges of market-based approaches. Useful entry points to the literature include (Gómez-Baggethun & Muradian, 2015; Jack et al., 2008; Muradian & Rival, 2012; Pan et al., 2022)

³ <https://sciencebasedtargetsnetwork.org/>

3.2 Risk: measurement uncertainty and cost of monitoring | Lesson: ensure robust and cost-effective monitoring through a tiered approach

Monitoring must provide confidence that investments are delivering tangible gains, but also be cost-effective and proportionate to the overall investment – as most finance should go towards delivering conservation actions on the ground. This requires a balance to be struck.

A key design choice is whether to verify credits according to conservation actions or conservation outcomes (Booth et al., 2021; Gibbons et al., 2011). It is easier and cheaper to verify conservation actions, but this does not provide certainty that the desired outcomes have actually been achieved. Direct assessment of conservation outcomes can be challenging, given the inherent variability in ecosystems and uncertainties in measurements. For example, direct observations of species populations typically result in highly variable results with wide error margins (Sommerville et al., 2011).

A tiered approach to monitoring biodiversity credit outcomes could be employed to balance the cost of monitoring with the level of anticipated biodiversity gains and associated risks. The required level of monitoring effort could take a tiered approach, relating the acceptable level of measurement effort to the type of intervention and intended outcomes. Factors to consider could include:

- How robust is the evidence linking particular actions and pressures to achievement of outcomes?
- What is the biodiversity significance of the target biodiversity features and processes for achieving global goals, or irreplaceability of the target species and habitats?
- How dependent are local communities on positive outcomes, i.e. is there a risk to livelihoods if the intended positive outcomes are not achieved?

For example, credits aimed at restoration of a relatively common and widespread habitat type (low biodiversity significance), with well-understood restoration dynamics (robust evidence available), might be measured at low cost using a small set of simple area, condition and project action metrics. Credits aiming to increase the population of a Critically Endangered species (high irreplaceability) might require more detailed, species-specific monitoring, alongside tracking changes in pressures and project actions.

Making full use of continuing technological advances can also help to reduce the costs and uncertainties of biodiversity monitoring (Stephenson et al., 2022; White et al., 2021).

3.3 Risk: promoting a ‘race to the bottom’ through lack of emphasis on quality of impacts | Lesson: measure the level of positive change

Conservation project outcomes are highly variable. For example, some projects may successfully bring a species back from the brink of extinction to a self-sustaining level. Others may reduce threats but leave the target species still at high risk of extinction. Biodiversity credit assessment frameworks need to be able to distinguish between projects that do an excellent job of protecting or restoring ecosystems and species, from those projects which make only marginal returns.

Without this, biodiversity credits risk incentivizing a ‘race to the bottom’ whereby project developers invest only the minimum required to deliver a threshold of biodiversity return sufficient to gain credit finance. Monitoring the variable level of biodiversity return is therefore essential to incentivize delivery of high-quality biodiversity outcomes.

One possible approach to balance measurement uncertainty (section 3.5) with the need to distinguish between average and excellent outcomes. One such ‘middle way’ approach might be to categorise the level of positive biodiversity change in the chosen indicator into different tiers (e.g. 1-10% gain, 11-20% etc.) to account for measurement uncertainty.

3.4 Risk: displacement of impacts | Lesson: encourage landscape / jurisdictional approaches

Displacement of negative impacts (leakage) is a significant challenge in climate mitigation policies, where reduced deforestation (conservation) in one geographical area can lead to increased forest loss in another. Leakage can be categorised as primary, caused by activity shifting, and secondary, caused by market effects.

The Verified Carbon Standard’s (VCS) Jurisdictional and Nested Reducing Emissions from Deforestation and forest Degraded (REDD+) Framework includes methods for evaluating both primary and secondary leakage (Verified Carbon Standard, 2014). Under these frameworks, carbon leakage must be considered and where possible addressed at different jurisdictional scales: locally through avoided loss projects that address local drivers of deforestation; nationally through well-designed climate mitigation policies; and internationally, for example, through demand-side standards in countries importing forest-risk commodities (Streck, 2021).

It will likely to be more complicated to address biodiversity than carbon leakage, due to biodiversity’s unique and place-based features. Nested programs are needed that align the accounting of smaller-scale activities with jurisdictional systems and national reporting. The World Resources Institute outlines a preference hierarchy for organisations to source jurisdictional-scale credits when available, or seek advance purchase agreements in the meantime (Burns et al., 2022). Coordinating activities across different governance levels and by public and private actors enables an integrated approach to steer business investments in conservation towards achieving global biodiversity policies.

3.5 Risk: causing unintended social impacts | Lesson: require strong social safeguards

Previous market-based interventions, such as PES and REDD+, have been associated with inequitable benefit distribution and unintended negative social outcomes, such as creating social conflicts and weakening community cohesion (Hejnowicz et al., 2014; Maron et al., 2016).

For example, assessments of the equity of REDD+ compensation mechanisms have suggested that the benefits are more accessible to more educated community members with secure land tenure, thereby contributing to pre-existing inequalities within communities (Calvet-Mir et al., 2015; Scheba & Rakotonarivo, 2016).

More broadly, there is a potential conflict between the need to greatly scale up conservation action to achieve global conservation goals and the need to protect local communities' livelihoods and wellbeing (Allan et al., 2022). The literature on social aspects of conservation shows that projects that do not consider local peoples' well-being, or that use and entrench local power imbalances, have a high risk of failure (Dawson et al., 2021). Biodiversity credits that do not address such issues would be poor investments.

There is an opportunity for biodiversity credit schemes to be designed through a fair and inclusive process, when including strong social safeguards applied based on existing principles and guidelines. These could include: ensuring no net loss – or ideally positive outcomes – for people as well as biodiversity (Bull et al., 2018; Jones et al., 2019), a human rights-based approach to conservation (Boyd & Keene, 2021), the International Union for Conservation of Nature (IUCN) Natural Resource Governance Framework (Springer et al., 2021), the International Finance Corporation Performance Standards on Environmental and Social Sustainability (IFC, 2012), and the Global Environment Facility Policy on Environmental and Social Safeguards (GEF, 2019). Some key practices for embedding procedural and distributional justice into biodiversity projects include:

1. Ensure full, free, prior and informed consent (FPIC) of project-affected people.
2. Respect and account for the diverse ways in which indigenous people and local communities (IPLC) use and value nature. This can be achieved through facilitating co-production of knowledge, adopting locally defined indicators of biodiversity value and wellbeing to measure social outcomes, and incorporating local conservation priorities and indicators of ecological success into monitoring and verification schemes.
3. Implement a mitigation hierarchy approach to social impacts, prioritising prevention of negative impacts on project-affected people as far as possible. Where negative impacts do occur (such as opportunity costs of reduced access to natural resources), compensating these through locally acceptable and previously agreed-upon means.
4. Determine a strategy for efficient and equitable distribution of social and ecological benefits (e.g., pro-poor, merit-based), with the majority of the financial value of credits disbursed to delivering conservation and social outcomes. One potential approach is to use a share of credit finance to support social benefits. Payments to project-affected people could be conditional to incentivise conservation actions, or unconditional as a conservation basic income (de Lange et al., 2022).

3.6 Risk: oversimplifying biodiversity and its uses | Lesson: integrate locally relevant indicators into a flexible global monitoring framework

Carbon credit schemes have been criticised for being top-down, with rigid rules on management and monitoring (Hajjar et al., 2021; Newell et al., 2013), and for failing to appropriately consider local context. This can result in poor outcomes for climate change mitigation and people.

To avoid similar pitfalls, a biodiversity crediting assessment framework could allow for the integration of context-specific information on biodiversity into a global measurement framework. For example, this could relate to species or ecosystem services of particular economic or cultural importance for local communities. This would recognise the various ways in which nature is used and valued in different places (Pascual et al., 2021; Pereira et al., 2020).

4. AN INITIAL FRAMEWORK FOR HIGH INTEGRITY BIODIVERSITY CREDITS

4.1 High integrity principles

Based on the risks and lessons discussed in the previous section, we identify an initial set of 12 high integrity principles for building an effective voluntary biodiversity credit framework. The principles cover ecological, social and financial dimensions. Biodiversity credits will be most credible if they:

Ecological

1. Promote robust and verifiable positive impacts.
2. Are additional to actions implementing the mitigation hierarchy.
3. Contribute to recognised global conservation priorities and align with regional and local conservation plans where relevant, to promote effective targeting of conservation finance.
4. Use flexible measurement frameworks that allow aggregation of context-specific metrics into globally comparable units.
5. Apply cost-effective and proportionate monitoring and verification, to prioritise delivering investment to on-the-ground actions.

Social

6. Are co-designed with local stakeholders through a rights-based approach to conservation.
7. Produce locally-meaningful benefits that address and respect diverse local uses of nature.
8. Promote equitable distribution of benefits.
9. Include strong safeguards to prevent adverse social impacts.

Financial

10. Enable the sustained funding of credited conservation actions.
11. Ensure transparent reporting of project impacts to manage the risk to credit buyers.
12. Link to clearly defined business needs, to promote scaling of investment finance.

We emphasise that these are potential components of a high integrity framework, and they need cross sector and interdisciplinary stakeholder input and further development. Refining and elaborating this initial set of high integrity principles, through constructive dialogue and the emergence of a community of good practice, would help foster the development of a robust global biodiversity credit system.

4.2 Biodiversity credits vs biodiversity offsets

Voluntary biodiversity credits are most likely to deliver verifiable positive biodiversity outcomes (principles 1 and 2) if they are not used as biodiversity offsets. While biodiversity offsets and biodiversity credits share some design features, credits are distinct from offsets in terms of their role and function in delivering nature-positive outcomes (Table 3).

Biodiversity offsets are designed to compensate for residual negative biodiversity impacts as the last resort in a mitigation hierarchy of actions to address known site-based impacts, which should first prioritise prevention (BBOP, 2012). Offsets typically need to generate equivalent biodiversity values to those that are lost. Since biodiversity is place-specific and not fungible at the global scale, offsetting schemes are almost always local. In contrast, biodiversity credits are best understood as an economic instrument for financing positive biodiversity outcomes. They are generated independently and often spatially or temporally distant from the negative impacts of companies' value chains⁴. As such, biodiversity credits will not usually be appropriate to offset contemporary, attributable negative business impacts on biodiversity because they are unlikely to generate values that are ecologically equivalent to those damaged by business activity (Table 3 below, see also WEF, 2022).

Rather, biodiversity credits could be used for positive contributions to nature, for example going beyond the mitigation hierarchy to make a proportional contribution towards addressing historical impacts on biodiversity (Figure 4). Addressing companies' contemporary negative impacts separately (e.g. using the mitigation hierarchy in a science-based target framework) serves to guard against credits providing a 'licence to trash'. Excluding the use of credits for offsetting also avoids the many thorny technical and practical challenges with ensuring offsets are used appropriately⁵. This distinction between biodiversity credits and biodiversity offsets is aligned with emerging good practice for carbon credits, which are best used to counterbalance remaining unabated emissions after engaging absolute emissions reductions on a science-based pathway and not instead of absolute emissions reductions⁶.

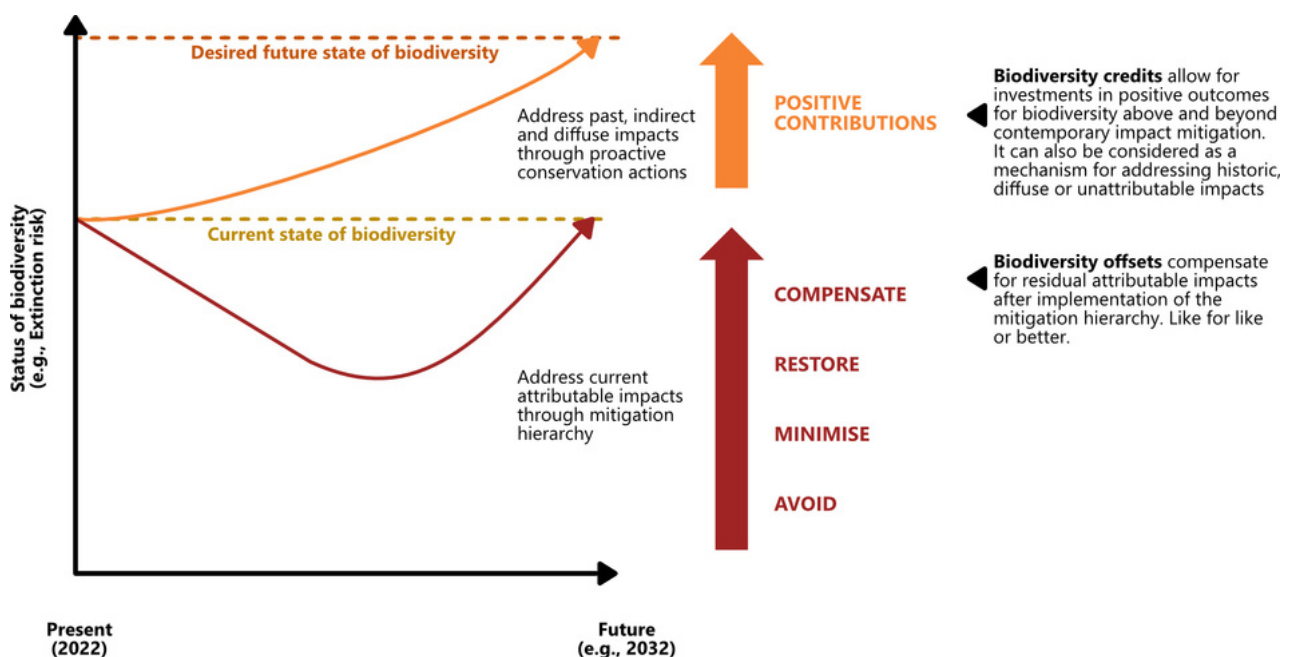


Figure 4. The distinct pathways by which biodiversity offsets and biodiversity credits could contribute to delivering corporate contributions to a nature-positive future. Adapted from the Conservation Hierarchy (Milner-Gulland et al., 2021).

Table 3 Distinction between biodiversity credits and biodiversity offsets.

	Biodiversity credit	Biodiversity offset
Definition	A unit of specified biodiversity value.	Compensation for losses of biodiversity values by generating ecologically equivalent gains.
Purpose	An economic instrument that can be used to scale up financing for measurable positive biodiversity outcomes.	Compensation for residual loss of biodiversity from contemporary attributable business activities, as a last resort step in the mitigation hierarchy.
Description	<p>Created by generating units of biodiversity value, through measurable actions or outcomes.</p> <p>Companies may purchase credits to make positive contributions to nature e.g., as part of a science-based target, or to make a proportional contribution towards addressing historic impacts.</p> <p>Should not be used to circumvent the mitigation hierarchy.</p>	<p>The 'last resort' step of the mitigation hierarchy: impacts must first be avoided, minimised and restored as far as feasibly possible.</p> <p>May be required to meet regulatory, lender or company policy requirements for no net loss/net gain of biodiversity.</p>
Treatment of biodiversity values	Biodiversity values are generated independently of losses, and not designed to directly compensate for attributable environmental harms, so the requirement for ecological equivalence are not met in most use cases.	Good-practice offsets require equivalence via a 'like for like' approach for priority biodiversity features. In some circumstances, offsets may instead involve 'trading up' ('like for like or better').

⁴ In carbon mitigation contexts, this is referred to as "Beyond Value Chain Mitigation": <https://sciencebasedtargets.org/resources/files/Beyond-Value-Chain-Mitigation-FAQ.pdf>

⁵ Applying good practice principles (e.g., BBOP, 2012; Pilgrim & Ekstrom, 2014) can help to improve the outcomes of biodiversity offsets. However, offsets remain challenging to implement both in theory and in practice (e.g., Maron et al., 2015; S. zu Ermgassen et al., 2019). Offsets may not equivalently compensate for impacts (S. zu Ermgassen et al., 2020) and there are high risks that predicted gains are not in fact delivered, through implementation failure and/or poor design (Maseyk et al., 2020). To be effective, offsets thus require a robust and locally-based framework of rules and well-resourced monitoring and due diligence, and issues can arise even if those conditions are met (e.g., S. O. S. E. zu Ermgassen et al., 2021). A global credit scheme is unlikely to have the legitimacy or capacity to be an arbiter of trades between losses and gains in diverse local contexts.

⁶ <https://www.wri.org/insights/guidance-voluntary-use-nature-based-solution-carbon-credits-through-2040>



5. BUILDING BLOCKS OF A GLOBAL MEASUREMENT FRAMEWORK



Biodiversity is complex and many different classes of biodiversity credits targeting different biodiversity features and processes are likely to emerge. For biodiversity credits to be comparable at regional and global scales, projects that focus on different aspects of biodiversity and in different geographies need to be comparable. Deciding how to compare different projects involves value judgements. Yet it is essential to allow for the aggregation of credits resulting from different projects into larger scale crediting systems. Emerging global priorities for nature provide a basis for transparent aggregation and comparison of projects. These frameworks are based on political discourse and sound science, and can help guide biodiversity finance towards the locations where it would make the greatest contribution to meeting societal goals for biodiversity.

The Global Biodiversity Framework sets the societally agreed priorities for conservation. Draft Goal A of the Global Biodiversity Framework focuses on biodiversity outcomes and is therefore the most relevant for informing the design of biodiversity credits. Goal A currently contains four components, relating to ecosystems, species extinction risk, species populations and genetic diversity. Biodiversity credits could potentially contribute to any or all of these components. The most practical immediate focus would be to support two complementary outcomes:

1. Increases in the area, connectivity and integrity of natural ecosystems.
2. Reduce species extinction risk

To maximise the efficacy of biodiversity credit finance in resolving the nature crisis, we suggest that these two global outcomes could inform comparison across individual projects and credit schemes, in relation to their relative contribution to these overarching global targets for nature. For example, projects that contribute to reconnecting and restoring highly fragmented and degraded ecosystems, or reducing the threats to species at high risk of extinction, may be valued higher than projects focusing on common species, or on habitats that are relatively intact and under little immediate threat. The intended conservation outcomes could then inform technical design of credits, including metrics and measurement approaches to demonstrate contributions to these higher order goals.

A flexible measurement framework containing three core components would enable comparison and would support aggregation towards larger spatial scales:

1. Area

The geographic extent of a project provides a simple, communicable unit for biodiversity credits. However, area alone is a poor measure of positive biodiversity outcomes. It does not consider the degree of positive change at a location, nor that biodiversity is patchily distributed across the globe, so actions in some places will make more of a contribution to global conservation goals than in others.

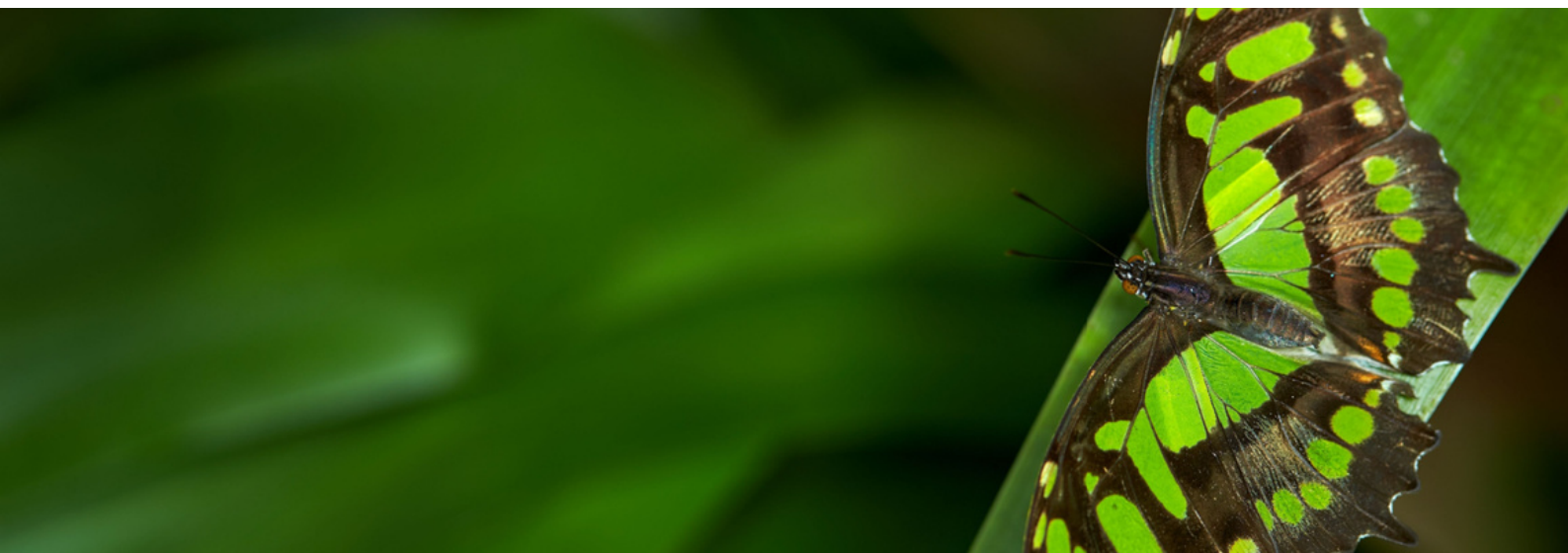
2. Change in condition

A measure of the degree of positive change, relative to a defined baseline state. Including this component differentiates and rewards projects that produce better outcomes. For ecosystems, condition has a number of intercorrelated components but is usually assessed through one or more proxy measures, which could relate to habitat structure and connectivity, the intensity of threatening processes or the populations of indicator species. Condition measures could be designed to incorporate local perspectives and knowledge on biodiversity and thereby integrate local contextual factors into a generalisable measurement framework (section 3.6).

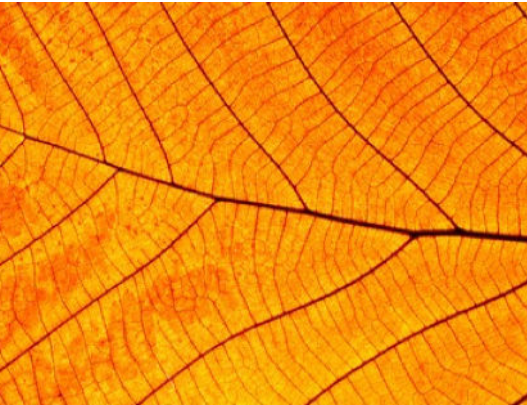
3. Contribution to global goals

This is a measure of a project's significance in terms of its contribution to defined global conservation priorities (such as the Global Biodiversity Framework and Sustainable Development Goals). Including this component promotes the flow of biodiversity credit finance towards the places where it is most effective. Science-based significance weightings can be derived from global frameworks, such as the IUCN Red Lists, for assessing the irreplaceability and vulnerability of species and ecosystems.

This high-level measurement framework is broad enough to encompass the diverse credit schemes and project types identified in Figure 2. It would provide the flexibility to include ecosystem and / or species-specific indicators within a common measurement approach. It also provides the flexibility to accommodate locally relevant indicators into a generalisable measurement framework. If used in conjunction with an agreed set of high integrity principles, this measurement framework could help guide the development of a high integrity global biodiversity credit system.



6. THE WAY FORWARD



The biodiversity credit market is nascent, though likely to grow rapidly, with many types of credits set to be piloted and options being offered to potential purchasers.

Biodiversity credits present significant opportunities for biodiversity and for business. But there are also significant risks. Pursuing a high integrity approach will minimise these risks, maximise positive outcomes for people and nature and build market confidence. Learning from how carbon credits and other payment for ecosystem services initiatives have addressed integrity concerns can help biodiversity credits avoid some of the same pitfalls. To build a community of good practice and a robust biodiversity credit market requires dedicated expertise integrated across the three pillars of sustainability – ecological, social and financial.

Technological advances for measuring biodiversity can be embraced to drive down the cost of monitoring and support the scaling of investment. A flexible monitoring framework that includes standardised components but can be adapted to local contexts to represent how diverse groups interact with nature can help deliver integrity without compromising scalability. Co-designing emerging biodiversity schemes with local actors, piloting and iteration in a spirit of open dialogue will be key to rapidly addressing implementation challenges.

Recognising the multiple forms of expertise that need to be brought together, we present these principles acknowledging that they are a first step, and not complete. We contribute this paper as a basis to stimulate engagement, considered review and further discussion by others with an active interest in biodiversity credits. We welcome comment and further dialogue to build a vibrant debate as a step towards agreeing robust standards that can underpin high integrity biodiversity credits.

7. REFERENCES

Allan, J. R., Possingham, H. P., Atkinson, S. C., Waldron, A., Di Marco, M., Butchart, S. H. M., Adams, V. M., Kissling, W. D., Worsdell, T., Sandbrook, C., Gibbon, G., Kumar, K., Mehta, P., Maron, M., Williams, B. A., Jones, K. R., Wintle, B. A., Reside, A. E., & Watson, J. E. M. (2022). The minimum land area requiring conservation attention to safeguard biodiversity. *Science*, 376(6597), 1094–1101. <https://doi.org/10.1126/science.abl9127>

BBOP. (2012). Principles for Biodiversity Offsets. Business and Biodiversity Offsets Programme.

Booth, H., Arlidge, W. N. S., Squires, D., & Milner-Gulland, E. J. (2021). Bycatch levies could reconcile trade-offs between blue growth and biodiversity conservation. *Nature Ecology & Evolution*, 5(6), Article 6. <https://doi.org/10.1038/s41559-021-01444-w>

Boyd, D., & Keene, S. (2021). Human Rights-Based Approaches to Conserving Biodiversity Equitable, Effective and Imperative. <https://www.ohchr.org/sites/default/files/Documents/Issues/Environment/SREnvironment/policy-briefing-1-summary.pdf>

Bull, J. W., Baker, J., Griffiths, V. F., Jones, J. P., & Milner-Gulland, E. J. (2018). Ensuring No Net Loss for people as well as biodiversity: Good practice principles. <https://doi.org/10.31235/osf.io/4ygh7>

Burns, D., Langer, P., Seymour, F., Taylor, R., Czebniak, R., Hanson, C., & Ranganathan, J. (2022). Guidance on Voluntary Use of Nature-based Solution Carbon Credits Through 2040. <https://www.wri.org/insights/guidance-voluntary-use-nature-based-solution-carbon-credits-through-2040>

Calvet-Mir, L., Corbera, E., Martin, A., & Fisher, J. (2015). Payments for ecosystem services in the tropics: A closer look at effectiveness and equity. *Current Opinion in Environmental Sustainability*, 14(December 2014), 150–162. <https://doi.org/10.1016/j.cosust.2015.06.001>

Dawson, N., Coolsaet, B., Sterling, E., Loveridge, R., Nicole, D., Wongbusarakum, S., Sangha, K., Scherl, L., Phan, H.P., Zafra-Calvo, N. and Lavey, W., 2021. The role of Indigenous peoples and local communities in effective and equitable conservation. *Ecology and Society*, 26(3). <https://doi.org/10.5751/ES-12625-260319>

de Lange, E., Sze, J., Allan, J., Atkinson, S. C., Booth, H., Fletcher, R., Khanyari, M., & Saif, O. (2022). A Global Conservation Basic Income to Safeguard Biodiversity. OSF Preprints. <https://doi.org/10.31219/osf.io/nvppf>

GEF. (2019). Policy on Environmental and Social Safeguards. https://www.thegef.org/sites/default/files/documents/gef_environmental_social_safeguards_policy.pdf

Gibbons, J. M., Nicholson, E., Milner-Gulland, E. J., & Jones, J. P. G. (2011). Should payments for biodiversity conservation be based on action or results? *Journal of Applied Ecology*, 48(5), 1218–1226. <https://doi.org/10.1111/j.1365-2664.2011.02022.x>

Gómez-Baggethun, E., & Muradian, R. (2015). In markets we trust? Setting the boundaries of Market-Based Instruments in ecosystem services governance. *Ecological Economics*, 117, 217–224. <https://doi.org/10.1016/j.ecolecon.2015.03.016>

Hajjar, R., Oldekop, J. A., Cronkleton, P., Newton, P., Russell, A. J. M., & Zhou, W. (2021). A global analysis of the social and environmental outcomes of community forests. *Nature Sustainability*, 4(3), 216–224. <https://doi.org/10.1038/s41893-020-00633-y>

Hejnowicz, A. P., Raffaelli, D. G., Rudd, M. A., & White, P. C. L. (2014). Evaluating the outcomes of payments for ecosystem services programmes using a capital asset framework. *Ecosystem Services*, 9, 83–97. <https://doi.org/10.1016/j.ecoser.2014.05.001>

- IFC. (2012). Performance Standards on Environmental and Social Sustainability. https://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/Sustainability-At-IFC/Policies-Standards/Performance-Standards/
- IIED. (2021). New biodiversity framework can learn from climate change experience. <http://pubs.iied.org/20166IIED>
- Jack, B. K., Kousky, C., & Sims, K. R. E. (2008). Designing payments for ecosystem services: Lessons from previous experience with incentive-based mechanisms. *Proceedings of the National Academy of Sciences of the United States of America*, 105(28), 9465–9470. <https://doi.org/10.1073/pnas.0705503104>
- Jones, J. P. G., Bull, J. W., Roe, D., Baker, J., Griffiths, V. F., Starkey, M., Sonter, L. J., & Milner-Gulland, E. J. (2019). Net Gain: Seeking Better Outcomes for Local People when Mitigating Biodiversity Loss from Development. *One Earth*, 1(2), 195–201. <https://doi.org/10.1016/j.oneear.2019.09.007>
- Maron, M., Bull, J. W., Evans, M. C., & Gordon, A. (2015). Locking in loss: Baselines of decline in Australian biodiversity offset policies. *Biological Conservation*, 192, 504–512. <https://doi.org/10.1016/j.biocon.2015.05.017>
- Maron, M., Gordon, A., Mackey, B. G., Possingham, H. P., & Watson, J. E. M. (2016). Interactions Between Biodiversity Offsets and Protected Area Commitments: Avoiding Perverse Outcomes. *Conservation Letters*, 9(5), 384–389. <https://doi.org/10.1111/conl.12222>
- Maseyk, F. J. F., Maron, M., Gordon, A., Bull, J. W., & Evans, M. C. (2020). Improving averted loss estimates for better biodiversity outcomes from offset exchanges. *Oryx*, 1–11. <https://doi.org/10.1017/S0030605319000528>
- Massarella, K., Sallu, S. M., Ensor, J. E., & Marchant, R. (2018). REDD + , hype , hope and disappointment: The dynamics of expectations in conservation and development pilot projects. *World Development*, 109, 375–385. <https://doi.org/10.1016/j.worlddev.2018.05.006>
- Milner-Gulland, E. J., Addison, P., Arlidge, W. N. S., Baker, J., Booth, H., Brooks, T., Bull, J. W., Burgass, M. J., Ekstrom, J., zu Ermgassen, S. O. S. E., Fleming, L. V., Grub, H. M. J., von Hase, A., Hoffmann, M., Hutton, J., Juffe-Bignoli, D., ten Kate, K., Kiesecker, J., Kümpel, N. F., ... Watson, J. E. M. (2021). Four steps for the Earth: Mainstreaming the post-2020 global biodiversity framework. *One Earth*, 4(1), 75–87. <https://doi.org/10.1016/j.oneear.2020.12.011>
- Miltenberger, O., Jospe, C., & Pittman, J. (2021). The Good Is Never Perfect: Why the Current Flaws of Voluntary Carbon Markets Are Services, Not Barriers to Successful Climate Change Action. *Frontiers in Climate*, 3, 686516. <https://doi.org/10.3389/fclim.2021.686516>
- Muradian, R., & Rival, L. (2012). Between markets and hierarchies: The challenge of governing ecosystem services. *Ecosystem Services*, 1(1), 93–100. <https://doi.org/10.1016/j.ecoser.2012.07.009>
- Newell, R. G., Pizer, W. A., & Raimi, D. (2013). Carbon Markets 15 Years after Kyoto: Lessons Learned, New Challenges. *Journal of Economic Perspectives*, 27(1), 123–146. <https://doi.org/10.1257/jep.27.1.123>
- Pan, C., Shrestha, A., Innes, J. L., Zhou, G., Li, N., Li, J., He, Y., Sheng, C., Niles, J.-O., & Wang, G. (2022). Key challenges and approaches to addressing barriers in forest carbon offset projects. *Journal of Forestry Research*, 33(4), 1109–1122. <https://doi.org/10.1007/s11676-022-01488-z>
- Pascual, U., Adams, W. M., Díaz, S., Lele, S., Mace, G. M., & Turnhout, E. (2021). Biodiversity and the challenge of pluralism. *Nature Sustainability*, 4(7), 567–572. <https://doi.org/10.1038/s41893-021-00694-7>
- Pereira, L. M., Davies, K. K., den Belder, E., Ferrier, S., Karlsson-Vinkhuyzen, S., Kim, H., Kuiper, J. J., Okayasu, S., Palomo, M. G., Pereira, H. M., Peterson, G., Sathyapalan, J., Schoolenberg, M., Alkemade, R., Carvalho Ribeiro, S., Greenaway, A., Hauck, J., King, N., Lazarova, T., ... Lundquist, C. J. (2020). Developing multiscale and integrative nature–people scenarios using the Nature Futures Framework. *People and Nature*, 2(4), 1172–1195. <https://doi.org/10.1002/pan3.10146>

- Pilgrim, J. D., & Ekstrom, J. M. (2014). *Technical conditions for positive outcomes from biodiversity offsets. An input paper for the IUCN Technical Study Group on Biodiversity Offsets*. IUCN.
<https://portals.iucn.org/library/sites/library/files/documents/2014-027.pdf>
- Scheba, A., & Rakotonarivo, O. S. (2016). Territorialising REDD+: Conflicts over market-based forest conservation in Lindi, Tanzania. *Land Use Policy*, 57, 625–637. <https://doi.org/10.1016/j.landusepol.2016.06.028>
- Sommerville, M. M., Milner-Gulland, E. J., & Jones, J. P. G. (2011). The challenge of monitoring biodiversity in payment for environmental service interventions. *Biological Conservation*, 144(12), 2832–2841.
<https://doi.org/10.1016/j.biocon.2011.07.036>
- Springer, J., Campese, J., & Nakangu, B. (2021). *The Natural Resource Governance Framework: Improving governance for equitable and effective conservation*. IUCN, International Union for Conservation of Nature.
<https://doi.org/10.2305/IUCN.CH.2021.16.en>
- Stephenson, P. J., Londoño-Murcia, M. C., Borges, P. A. V., Claassens, L., Frisch-Nwakanma, H., Ling, N., McMullan-Fisher, S., Meeuwig, J. J., Unter, K. M. M., Walls, J. L., Burfield, I. J., do Carmo Vieira Correa, D., Geller, G. N., Montenegro Paredes, I., Mubalama, L. K., Ntiama-Baidu, Y., Roesler, I., Rovero, F., Sharma, Y. P., ... Fumagalli, L. (2022). Measuring the Impact of Conservation: The Growing Importance of Monitoring Fauna, Flora and Funga. *Diversity*, 14(10), 824.
<https://doi.org/10.3390/d14100824>
- Streck, C. (2021). REDD+ and leakage: Debunking myths and promoting integrated solutions. *Climate Policy*, 21(6), 843–852.
<https://doi.org/10.1080/14693062.2021.1920363>
- Verified Carbon Standard. (2014). *Jurisdictional and Nested REDD+ Leakage Tool*. <https://verra.org/project/jurisdictional-and-nested-redd-framework/rules-requirements/>
- WEF. (2022). *Biodiversity Credits: Unlocking Financial Markets for Nature-Positive Outcomes* (p. 13) [Briefing Paper]. World Economic Forum. https://www3.weforum.org/docs/WEF_Biodiversity_Credit_Market_2022.pdf
- White, T. B., Viana, L. R., Campbell, G., Elverum, C., & Bennun, L. A. (2021). Using technology to improve the management of development impacts on biodiversity. *Business Strategy and the Environment*, bse.2816. <https://doi.org/10.1002/bse.2816>
- zu Ermgassen, S. O. S. E., Baker, J., Griffiths, R. A., Strange, N., Struebig, M. J., & Bull, J. W. (2019). The ecological outcomes of biodiversity offsets under “no net loss” policies: A global review. *Conservation Letters*, 12(6).
<https://doi.org/10.1111/conl.12664>
- zu Ermgassen, S. O. S. E., Maron, M., Corlet Walker, C. M., Gordon, A., Simmonds, J. S., Strange, N., Robertson, M., & Bull, J. W. (2020). The hidden biodiversity risks of increasing flexibility in biodiversity offset trades. *Biological Conservation*, 252, 108861. <https://doi.org/10.1016/j.biocon.2020.108861>
- zu Ermgassen, S. O. S. E., Marsh, S., Ryland, K., Church, E., Marsh, R., & Bull, J. W. (2021). Exploring the ecological outcomes of mandatory biodiversity net gain using evidence from early-adopter jurisdictions in England. *Conservation Letters*.
<https://doi.org/10.1111/conl.12820>
- zu Ermgassen, S. O. S. E., Howard, M., Bennun, L., Addison, P.F., Bull, J.W., Loveridge, R., Pollard, E. and Starkey, M., (2022). Are corporate biodiversity commitments consistent with delivering ‘nature-positive’ outcomes? A review of ‘nature-positive’ definitions, company progress and challenges. *Journal of Cleaner Production*, p.134798.
<https://doi.org/10.1016/j.jclepro.2022.134798>