Available online at www.sciencedirect.com

ScienceDirect

Current Opinion in Environmental Sustainability

Review

Public finance allocation does not reflect biodiversity priorities

Odirilwe Selomane[1,2,3], Michelle Fourie[3], Sally Archibald[2,4], Laura Pereira[2,5], Nadia Sitas[6] and Kim Zoeller[2,5]

Closing the biodiversity finance gap requires increasing funding for nature-positive activities and making nature-negative activities less viable. This would reduce the need for expenditure on conservation and protection from the outset, especially for restoration efforts after the fact. Current financial flows to nature-positive activities are undermined by the considerably larger amount of funds flowing to nature-eroding activities. We used publicly available datasets to assess the allocation of public funds between nature-positive and nature-negative sectors, looking at both within-country and beyond-border spending. On average, high-income countries have the lowest gap between nature-negative and nature-positive expenditure, with lower middle- and low-income countries having the widest gap. However, high-income countries performed just as poorly when sending funds overseas as aid. The implication here is that prioritising sustainability only up to the national level will likely have a net negative outcome for global sustainability.

Addresses
[1] Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, South Africa
[2] Future Ecosystems for Africa Programme, South Africa
[3] uBoomi, South Africa
[4] School of Animal, Plant and Environmental Sciences, Wits University, South Africa
[5] Global Change Institute, Wits University, South Africa
[6] SouthSouthNorth, South Africa

Corresponding author: Selomane, Odirilwe (odirilwe.selomane@up.ac.za)

Current Opinion in Environmental Sustainability 2025, **74**:101524

This review comes from a themed issue on **Biodiversity finance**

Edited by **Lena Gipperth, Nils Droste** and **Joakim Sandberg**

For complete overview of the section, please refer to the article collection, "Biodiversity finance"

Available online 31 March 2025

Received: 3 October 2024; Revised: 27 January 2025; Accepted: 24 February 2025

https://doi.org/10.1016/j.cosust.2025.101524

1877–3435/© 2025 The Author(s). Published by Elsevier B.V. This is an open access article under the CC BY-NC license (http://creativecommons.org/licenses/by-nc/4.0/).

Introduction

The world is facing unprecedented biodiversity loss due to overexploitation, habitat loss, invasive species, climate change, and pollution. Both the Millennium Ecosystem Assessment and recent IPBES assessments conclude that nature's contributions to the quality of life through material, nonmaterial, and regulating services have been declining over the past 50 years [1]. Efforts by governments and other stakeholders through platforms such as the Convention on Biological Diversity have not achieved the intended outcomes for biodiversity [1–3]. The hope is now set on the latest iteration of biodiversity goals, in the form of the Kunming-Montreal Global Biodiversity Framework (GBF). The framework has an overarching goal to guide society toward living in harmony with nature by 2050 — setting out four goals and 23 targets. Regionally, there are other initiatives that could support the achievement of GBF goals such as the African Union Biodiversity Strategy and Action Plan [4] or the European Biodiversity Strategy 2030 [5].

Target 3 of the GBF framework is of particular importance in achieving harmonious human-nature interactions. Target 3 aims to ensure that 30% of terrestrial, inland water, and marine and coastal areas are effectively protected by 2030 by nearly doubling the current protected area coverage from 16% to 30%. Achieving this will require addressing key challenges that prevented the achievement of the previous iterations of the biodiversity goals such as the Aichi targets. Among these challenges are poorly defined indicators [3,6], lack of effective national targets [7,8], lack of integration between local and global scales [9,10], and lack of financing [11], among others. Here we focus on the financing challenges, and in particular, the financial allocations between nature-positive and nature-negative investments [12–14].

Nature-positive investments support and conserve the natural environment and minimise the impact on the environment, whereas nature-negative investments include investment in activities that are typically considered drivers of biodiversity loss [1]. Nature-positive is seen as "an outcome-oriented rallying call for mainstreaming action towards GBF goals" [15] and as indicating "responsible and ethical treatment of nature"

[16]. As such, it includes activities that aim to halt and reverse biodiversity decline globally. Nature-negative activities are those activities that achieve the opposite outcomes for biodiversity. For example, *nature negative* includes industry subsidies that inadvertently contribute to environmental degradation, such as fuel subsidies intended to support the fishing industry, leading to overexploitation of fish stocks [17]. On the other hand, *nature positive* examples include the restoration of degraded areas, reducing harmful subsidies, or reducing pollution.

The recent State of Finance for Nature Report estimates that nature-negative financial flows amount to about US$7 trillion per year, and significantly, nearly a third of these are contributed by the public sector. The imbalance between nature-positive and nature-negative investments presents a significant barrier to achieving the targets set by the GBF. While there is growing recognition of the need to scale up nature-positive financing, the reality is that far more resources are still being directed toward activities that harm the environment. To meet the GBF targets, global biodiversity funding needs to reach an estimated 700–800 billion USD per annum, with the 30 by 30 target requiring 80 billion USD a year [14,18]. While the private sector is the largest contributor to nature-negative financial flows, public sector actors (i.e. governments) still have a critical role to play in reducing harmful subsidies and increasing financial support for biodiversity.

This does not excuse the lack of accountability in the private sector, which contributes 140 times more to nature-negative activities than to those promoting nature-positive outcomes [14]. However, as signatories to the GBF, it is ultimately the responsibility of the public sector to ensure the implementation of nature-positive investments. Understanding financial flows within the public sector is the first crucial step in this process. To explore these financial flows, we analysed publicly available data on current financial allocations for nature and biodiversity. Our aim was to characterise the priority investments of governments both within and beyond their national borders, with priorities defined by these financial allocations.

Method

Defining nature-positive and nature-negative sectors

Financial flows were categorised into *nature-negative* and *nature-positive* based on the government allocation of financial resources into specific sectors (see Table 1). We take these to reflect national priorities within the country (based on government expenditure data) and outside the country (based on Overseas Development Aid [ODA] allocations). If the commitments made in multilateral agreements, such as the GBF, truly represent a country's priorities, then we would expect a consistent alignment in investments both within and outside the country. Specifically, if a country predominantly invests in nature-positive activities domestically, we would expect similar investments internationally. A divergence between internal and external investments would suggest a misalignment between a country's internal and external priorities.

Data

We used two main databases (described below), with data selected from 2010 to 2019 to represent an average over 10 years. Data from 2020 and 2021 were excluded due to the impact of COVID-19, which could skew the priorities as governments were diverting expenditure to deal with the pandemic. Countries were excluded from the analysis if they had less than four years of data between 2010 and 2019. Data for 76 countries were assessed, including 7 low-income, 30 middle-income, and 39 high-income countries (Table S1).

Government national expenditure

Data were obtained from the International Monetary Fund (IMF) under the Classification of Functions of Government (COFOG) database. COFOG provides a detailed classification of expenditure of a government to achieve socioeconomic objectives. Data are collected by the IMF through annual standardised submission forms under the Government Finance Statistics, where each country voluntarily submits financial data that align with the COFOG framework and guidance. Country-level data are collected from multiple sources including national statistical agencies, public accounting systems, and administrative records. Data availability remains a challenge, as not all countries have robust systems.

We take nature-positive expenditure from the Environmental Protection Division, which accounts for the protection of biodiversity, environmental protection research and development, waste management, wastewater management, and pollution abatement (Table S2). This does not mean that other classes do not contribute

Table 1

Classification of sectors into nature-positive and nature-negative categories.

Nature-positive financial allocations	Nature-positive allocations included funding allocations to protection and conservation efforts, wastewater management, pollution reduction, environmental policy development.
Nature-negative financial allocations	Nature-negative expenditure included funding allocations to mining, industries, construction, energy, agriculture, forestry, and fisheries. These sectors are not necessarily always nature negative, but they are persistently considered to be key drivers of biodiversity loss [1,19]

to nature positively — we only use this class as a reasonable proxy given its stated intent to protect the environment. Expenditure on nature-negative activities comes from three Groups under the *Economic Activities Division*, namely, (1) agriculture, forestry, fishing, and hunting; (2) fuel and energy; and (3) mining, manufacturing, and construction (Table S2). Here too, these sectors are not necessarily only nature negative (if managed in a sustainable way, most of these sectors could contribute positively to nature). However, these sectors are currently considered the key drivers of nature loss [1,19]. The data were available as the share of GDP expenditure, which was multiplied by the total GDP for a country, as reported by The World Bank in current US $ values.

Overseas Development Aid

Data were obtained from the Organisation for Economic Cooperation and Development (OECD), which publishes data on allocations made by countries or the private sector to developing countries as an aid to support economic development and welfare. The OECD collects ODA data from statistical reporters based in national aid agencies or relevant ministries through annual voluntary questionnaires aligned with the Development Assistance Committee reporting directives, which are validated before publication. The data are categorised based on the objectives and reported at a sector and subsector level. ODA includes concessional flows and financial transactions (grants, loans, subsidies, and investments) that are targeted at promoting economic development and welfare in eligible countries. Nonconcessional flows or activities unrelated to development objectives, such as military aid and commercial transactions, are excluded.

The selected ODA data focused on bilateral ODA per sector from 37 countries that are predominantly high-income countries. Expenditure on nature-positive activities comes from the subsector *General Environment Protection* under a broader class called Multisector/Cross-Cutting Sector (Table S3). Expenditure on nature-negative activities comes from three subsectors, namely, Agriculture, Fishing, and Forestry; Industry; and Mining and Construction, and the Production Sectors: Energy under the Economic Infrastructure and Services Sector (Table S3). Data were available in current US$ values. ODA data also include information about where the financial resources are sent.

Results

Overview

Domestic government expenditure on nature-positive investment was, on average, only half a percent of the total government expenditure, whereas the nature-negative expenditure was 1.37%. The share of ODA dedicated to nature-positive and nature-negative activities was 1.99% and 9.18%, respectively. However, the value of government expenditure far exceeds ODA flows: government expenditure is almost 156 times larger than ODA (Table 2).

Table 2

Average annual expenditure on nature-positive and nature-negative activities for.

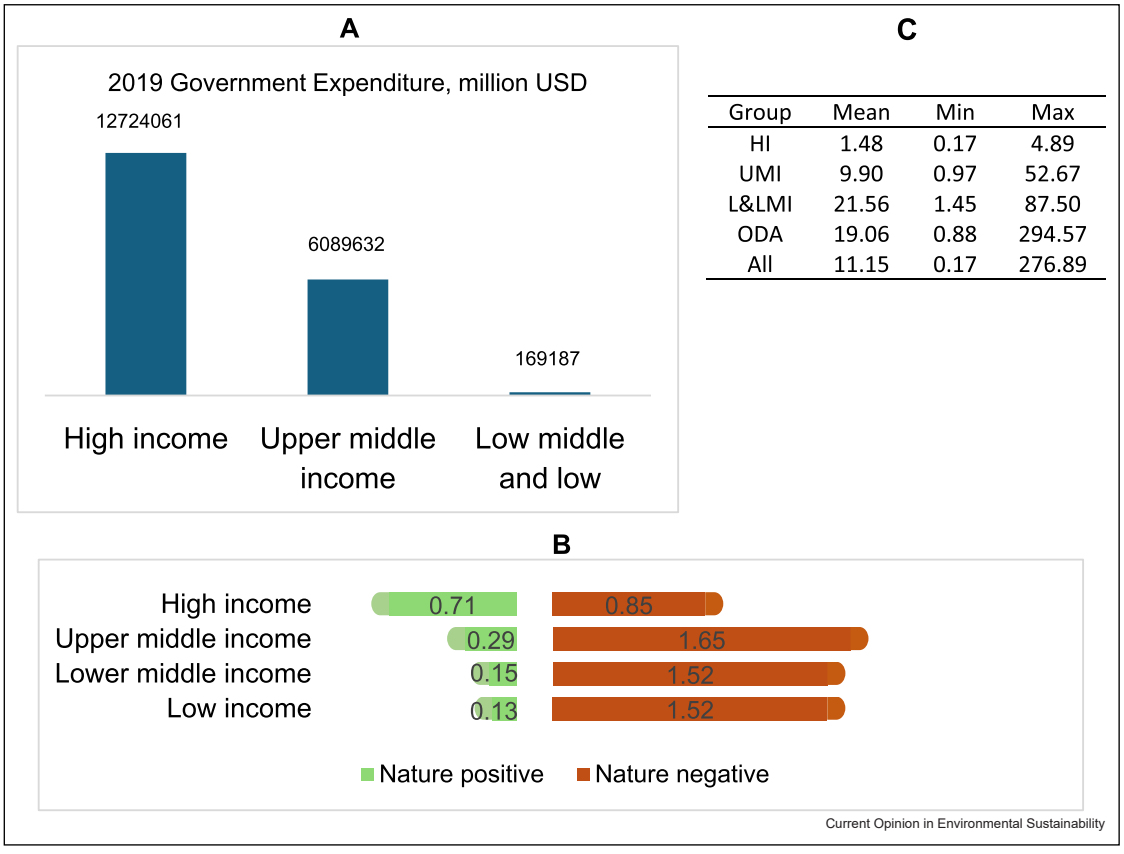
	Government domestic expenditure (USD million)	ODA (USD million)
Nature-positive	137 026.96	4040.54
Nature-negative	245 342.45	15 505.70
Nature-positive as a share of nature-negative spending	55%	26%

Within country spending

Overall, all countries spend more on nature-negative than nature-positive sectors (Figure 1). This is in part because the sectors we consider to be nature-negative here are also usually important sectors driving economic development in most countries. As such from a development point of view, it is no surprise that investments in these sectors exceed investments in environmental protection. Looking across different income groups, the gap between nature-positive and nature-negative expenditure is, on average, smaller in high-income countries compared to middle- to low-income countries (Figure 1b). This could be in part due to the high development needs in these countries, often driven by primary and secondary sectors — which tend to be nature-eroding, compared to services-driven development in high-income countries. The biggest gap is in low- and lower-middle-income countries, spending 21 times more on nature-negative compared to nature-positive sectors (compared to nearly 10 times for upper-middle and 1.5 times more for high-income countries) (Figure 1c). Despite high-income countries spending a lot less of their GDP on nature-negative sectors, they are still spending substantially more in absolute terms — higher-income countries' expenditure is 17 times more than lower-middle-income countries' expenditure (Figure 1a).

Looking at individual countries, we can observe a similar pattern — the higher the income of a country, the less the gap between nature-positive and nature-negative expenditure (Figure 2). There are also a few instances of high-income countries spending more on nature-positive sectors than on negative ones — with only five countries in the sample achieving this: Netherlands, Belgium, France, Greece, and Malta. It should be noted, however, that this is only considering domestic expenditure and does not account for what these countries might be doing externally.

Figure 1



(a) Government expenditure in 2019 for 20 countries in million USD. Part **(b)** shows government expenditure (as percent of GDP) on nature-positive and nature-negative sectors. Part **(c)** shows the ratio of nature-negative to nature-positive spending for high-income (HI), upper-middle-income (UMI), low- and lower-middle-income (L&LMI), providing aid to others (ODA), and for all 72 countries in the analysis. High-income (*n = 40*), upper-middle-income (*n = 20*), lower-middle-income (*n = 7*), and low-income countries (*n = 6*).

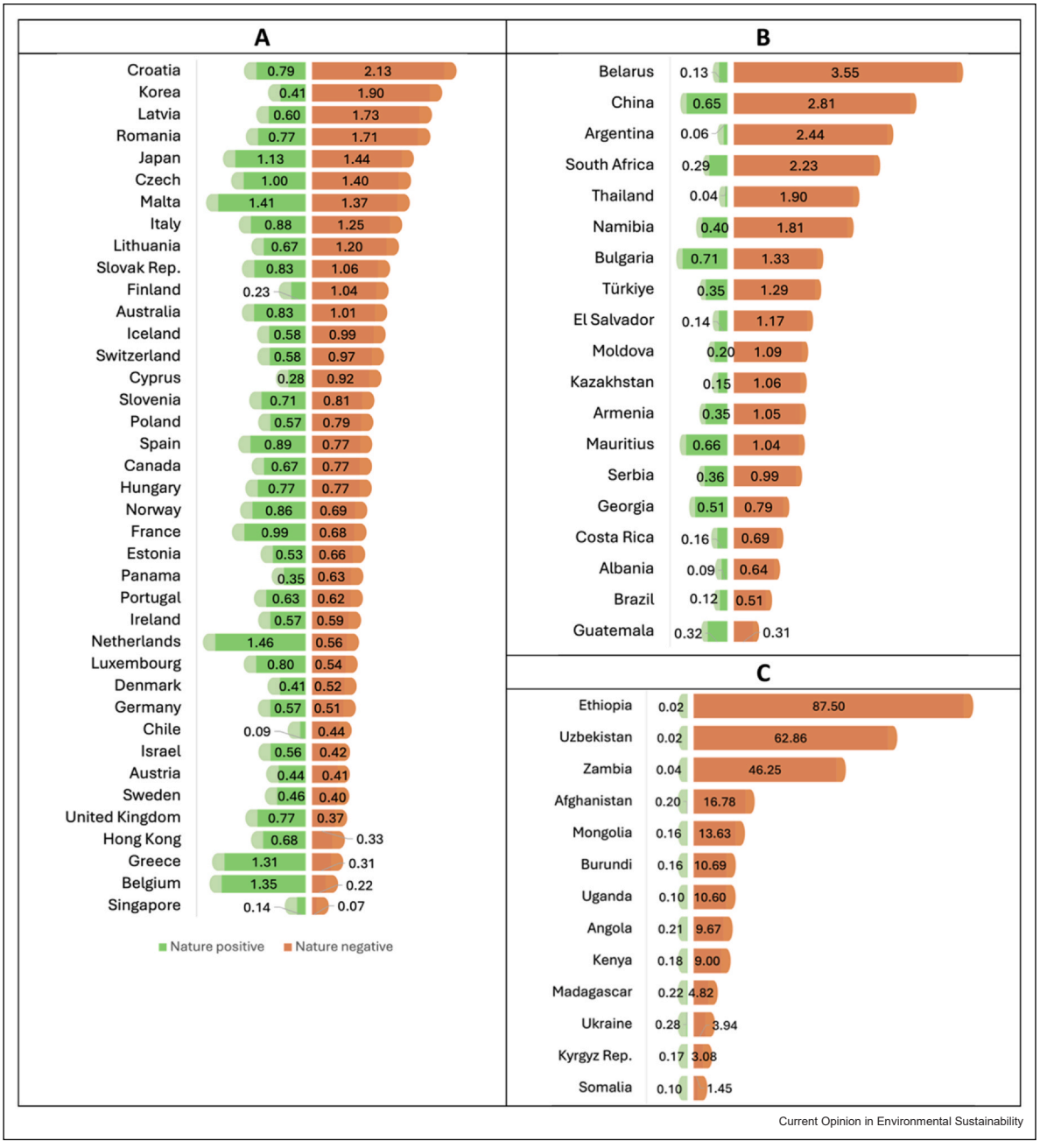
Across country spending

The in-country spending allocation however only reflects internal priorities. These are not always reflected the same way when funds are sent to other countries (Figure 3). Here we see that the spending allocation patterns track that of upper-middle-income countries, with these countries spending over 19 times more on nature-negative sectors overseas. Norway seems to be the only exception here, spending the same percentage of its aid on nature-positive and nature-negative sectors.

Discussion

Finance is often cited as a key challenge impeding the achievement of biodiversity goals and targets. If countries are seriously committed to the goals set up in multilateral agreements such as the GBF, allocations of public funds within and outside their borders will reflect this as a priority. This paper set out to investigate how countries allocate public financial resources between nature-negative and nature-positive sectors. We contend that how public financial resources are allocated is a reasonable indicator of how they prioritise certain activities over others, and therefore more spending on nature-negative sectors suggests that as the priority. We find that richer countries prioritise nature much more within their own borders, as seen in a smaller gap in the distribution of public finance between nature-negative and nature-positive sectors internally. Interestingly, as the income level of a country drops, so do the investments in nature-positive sectors within that country — in other words, the gap widens public allocation in favour of nature-positive sectors. This could be explained in part by that most of these countries still have substantial development needs, which they primarily meet by propping nature-eroding sectors. This would follow the common conviction that countries graduate heavy reliance on primary sectors at the early stages of development, towards service sector reliance at more advanced stages of economic development [20].

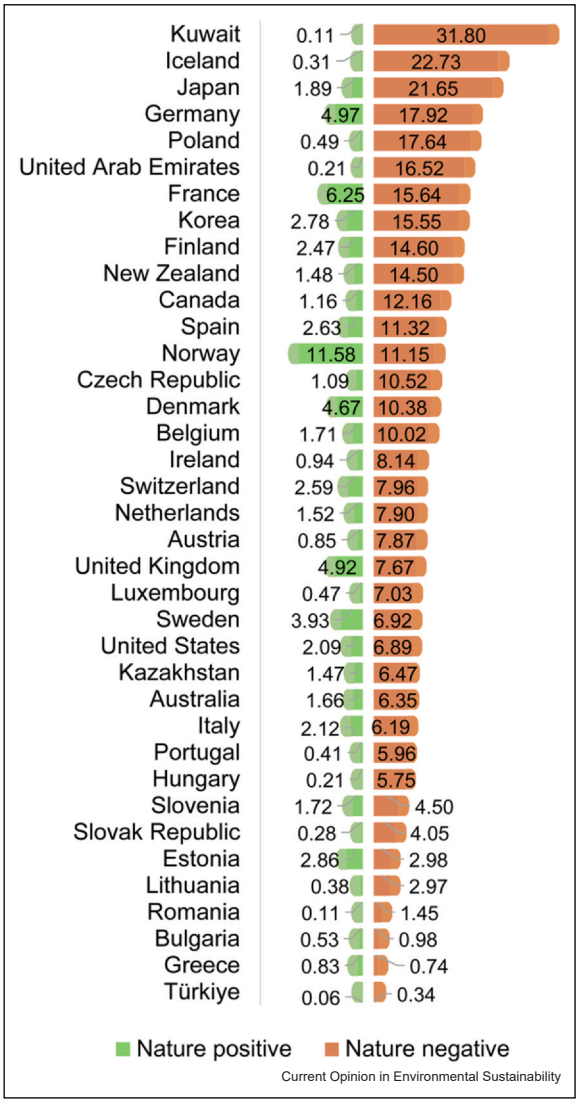
Figure 2



Within-country spending on nature-positive and nature-negative sectors. Part **(a)** shows high-income countries (n = 39), **(b)** upper-middle-income countries (n= 19), and **(c)** lower middle- and low-income countries (n = 9).

Interestingly, the pattern does not hold when we look beyond national borders. Here we see that many of the countries sending aid to others allocate it much the same way as the receiving countries allocate their internal budgets (Figure 1c). This suggests that richer countries prioritise nature-positive spending in their own backyards but not necessarily beyond this. Since there are no funding mechanisms currently designed to coordinate financing at the global level, this is likely to continue in this trajectory. There have been calls for a coordinated global financial mechanism, particularly to support biodiversity conservation through intergovernmental transfers [21]. Without such a mechanism, we will continue to see national-level strategies countering global-level sustainability [22,23].

Figure 3



Percentage of ODA devoted to nature-negative and nature-positive sectors.

The current spending patterns may be misunderstood to support the idea that countries will first degrade the environment until they have developed enough economically to afford fixing the destruction they created, following the Environmental Kuznets Curve hypothesis [24]. However, the fact that richer countries seem to be spending more on nature-negative activities outside of their countries suggests a breakdown in this expectation and logic. Additionally, countries with large public budgets (e.g. China), which are not captured in the aid data used here, still have large gaps in their nature-negative to nature-positive expenditure, which suggests that getting richer does not necessarily reflect more care for biodiversity.

Besides, global development does not have to continue in the current pathway. There is substantial potential to invest in ways to make traditionally nature-eroding activities less damaging. For example, there are several proposed strategies to transform the food system [25,26], the fisheries system [22], and others, towards more sustainable outcomes [27,28]. It is, however, critical to acknowledge that such transformations require redirecting financing from harmful trajectories into sustainable ones. Financing needed, therefore, is not only about addressing underfunding challenges for biodiversity, which is of course critical for halting extinctions and protecting species [29], but also about improving efficiency in funding distribution, reducing harmful subsidies that currently counter these nature-positive funding allocations, and pursuing innovative financial mechanisms such as tax and debt reform [13,30].

Despite the crucial role of governments in implementing nature-positive solutions, private sector involvement is essential as a complementary approach [12]. The role of the private sector in nature-positive financing is now beginning to be seriously discussed, both in terms of addressing nature-related risks to businesses and in taking accountability for creating these risks, which have broader impacts on society. Private finance is essential in bridging the substantial funding gap through innovative funding solutions such as green bonds, impact investments, and public–private partnerships (PPPs), which can mobilise substantial capital and incentivise sustainable business practices that public finance alone cannot cover to halt biodiversity loss [31]. However, the active role of the private sector in terms of actual financial contribution is currently still dwarfed by public allocation [14]. So far according to the State of Nature Finance report, only 17% of nature-positive finance flows originate from the private sector. This remains an untapped leverage, and more instruments need to be developed to bring private capital into the solution mix.

Several public financing mechanisms already exist that governments can utilise to allocate capital for nature-positive initiatives. These include regulatory frameworks (e.g. tax incentives) and voluntary mechanisms (e.g. green certifications), as well as equity and bonds (e.g. sustainability-linked loans) [16,32]. Others include public budgets and grants that provide direct funding for conservation initiatives, tax incentives and subsidies that encourage investment in sustainable practices, and PPPs to leverage private sector investments to co-finance large-scale projects. Additionally, sovereign wealth funds can allocate resources toward responsible investments in natural capital, and payment for ecosystem services

programmes incentivise the resilience of ecosystem services.

Data limitations

A big challenge in the nature financing space is obtaining accurate information about financial flows to nature-positive activities. Publicly available data only provided insights into public expenditure on nature-positive activities. This was easily distinguishable due to dedicated environmental indicators for government expenditure and ODA; however, despite obtaining Foreign Direct Investment information for various countries, there is no clear environmental indicator to report on nature-positive investment flows. Therefore, there needs to be standardisation of financial reporting that includes environmental indicators to obtain an accurate total of expenditure on nature-positive activities, which should also be adopted by the private sector. There should also be a clear differentiation between the nature-negative investment aspect of sectors such as agriculture, forestry, and fisheries and the components of spending dedicated to sustainability options (e.g. distinguishing between fossil fuels and renewable energy). Only once accurate information is available can a true estimate of nature-positive and nature-negative flows be determined.

Conclusion

Finance will remain a key challenge in achieving sustainable development that nations collectively need to address. Specifically, this involves both increasing desirable finance and decreasing undesirable ones. For *desirable finance*, this goes beyond increases but also includes improving efficiencies in distribution and innovating around emerging alternatives. On the undesirable side of finance, this largely requires redirecting finance, stopping tax leaks, addressing the challenge of debts and sometimes phasing out sectors. More importantly, however, these efforts need to be coordinated at a global scale to avoid actions in one or more countries resulting in net negative global sustainability outcomes by reducing sustainable options in other countries.

Author contributions

OS, SA and LP conceptualised and designed the study. OS and MF did the analysis and wrote the first draft. SA, LP, KZ and NS provided substantive reviews and comments to the manuscript.

Data Availability

Data will be made available on request.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships that may be considered as potential competing interests: Odirilwe Selomane reports a relationship with Oppenheimer Generations Research and Conservation that includes: funding grants. Sally Archibald reports a relationship with Oppenheimer Generations Research and Conservation that includes: funding grants. Laura Pereira reports a relationship with Oppenheimer Generations Research and Conservation that includes: funding grants. Kim Zoeller reports a relationship with Oppenheimer Generations Research and Conservation that includes: funding grants. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.cosust.2025.101524.

References and recommended reading

Papers of particular interest, published within the period of review, have been highlighted as:

- • of special interest

1. IPBES: **Summary for Policymakers of the Global Assessment Report on Biodiversity and Ecosystem Services**. Intergovernmomental Science-Policy Plartform on Biodiversity and Ecosystem Services; 2019.

2. Butchart SHM, Walpole M, Collen B, van Strien A, Scharlemann JPW, Almond REA, Baillie JEM, Bomhard B, Brown C, Bruno J, *et al.*: **Global biodiversity: indicators of recent declines**. *Science* 2010, **328**:1164-1168.

3. • Walpole M, Almond REA, Besançon C, Butchart SHM, Campbell-Lendrum D, Carr GM, Collen B, Collette L, Davidson NC, Dulloo E, *et al.*: **Ecology. Tracking progress toward the 2010 biodiversity target and beyond**. *Science* 2009, **325**:1503-1504.
Provides early assessments of the challenges with Aichi Targets, which set the scene for further assessments highlighting more shortcomings of the goals.

4. African Union: African Union Biodiversity Strategy and Action Plan (ABSAP) 2023-203 African Union; 2023.

5. European Commission: **EU biodiversity strategy for 2030**. Bringing Nature Back Into Our Lives. European Commission; 2021.

6. Butchart SHM, Di Marco M, Watson JEM: **Formulating smart commitments on biodiversity: lessons from the Aichi Targets**. *Conserv Lett* 2016, **9**:457-468.

7. Buchanan GM, Butchart SHM, Chandler G, Gregory RD: **Assessment of national-level progress towards elements of the Aichi Biodiversity Targets**. *Ecol Indic* 2020, **116**:106497.

8. Xu H, Cao Y, Yu D, Cao M, He Y, Gill M, Pereira HM: **Ensuring effective implementation of the post-2020 global biodiversity targets**. *Nat Ecol Evol* 2021, **5**:411-418.

9. • Obura DO, Katerere Y, Mayet M, Kaelo D, Msweli S, Mather K, Harris J, Louis M, Kramer R, Teferi T, *et al.*: **Integrate biodiversity targets from local to global levels**. *Science* 2021, **373**:746-748.
Highlights the important issue of aligning and integrating across scales. This is the key challenge facing biodiversity implementation — global goals but no coordination across scales.

10. Perino A, Pereira HM, Felipe-Lucia M, Kim H, Kühl HS, Marselle MR, Meya JN, Meyer C, Navarro LM, van Klink R, *et al.*: **Biodiversity post-2020: closing the gap between global targets and national-level implementation**. *Conserv Lett* 2022, **15**:e12848.

11. Seidl A, Mulungu K, Arlaud M, van den Heuvel O, Riva M: **The effectiveness of national biodiversity investments to protect the wealth of nature**. *Nat Ecol Evol* 2021, **5**:530-539.

12. • Barbier EB, Burgess JC, Dean TJ: **How to pay for saving biodiversity**. *Science* 2018, **360**:486-488.
Asks some pertinent questions about the how of financing, rather than merely suggesting that financing is needed.

13. • Dempsey J, Irvine-Broque A, Bigger P, Christiansen J, Muchhala B, Nelson S, Rojas-Marchini F, Shapiro-Garza E, Schuldt A, DiSilvestro A: **Biodiversity targets will not be met without debt and tax justice**. *Nat Ecol Evol* 2022, **6**:237-239.
The authors get at interesting questions about plugging the finance tap through taxes and debt. Given the scale of tax leaks out of regions that need them the most, this could unlock substantial funds.

14. UNEP: **State of finance for nature**. Time to Act: Doubling Investment by 2025 and Eliminating Nature Negative Finance Flows. United Nations Environment Programme; 2022.

15. Booth H, Milner-Gulland EJ, McCormick N, Starkey M: **Operationalizing transformative change for business in the context of Nature Positive**. *One Earth* 2024, **7**:1235-1249.

16. Luxton SJ, Smith GS, Williams KJ, Ferrier S, Bond AJ, Prober SM: **An introduction to key ecological concepts, financial opportunities, and risks underpinning aspirations for nature positive**. *BioScience* 2024, **74**:450-466.

17. Revollo-Fernández DA, Fulton S, Chávez Sánchez S: **Value and economic impact of fuel subsidies on the Mexican fishing industry**. *Appl Econ* 2024, **0**:1-13.

18. Deutz A, Heal GM, Swanson E, Townsend T, Zhu L, Delmar A, Meghji A, Sethi SA, Tobin de la Puente J: **Financing nature: closing the global biodiversity financing gap**. The Paulson Institute, The Nature Conservancy, and the Cornell Atkinson Center for Sustainability; 2020.

19. Maxwell SL, Fuller RA, Brooks TM, Watson JEM: **Biodiversity: the ravages of guns, nets and bulldozers**. *Nat News* 2016, **536**:143.

20. Cumming GS, Buerkert A, Hoffmann EM, Schlecht E, von Cramon-Taubadel S, Tscharntke T: **Implications of agricultural transitions and urbanization for ecosystem services**. *Nature* 2014, **515**:50-57.

21. • Droste N, Farley J, Ring I, May PH, Ricketts TH: **Designing a global mechanism for intergovernmental biodiversity financing**. *Conserv Lett* 2019, **12**:e12670.
The authors suggest a key mechanism for coordinating biodiversity financing at the intergovernmental scale; without this, we will continue to hit blind spots in implementation.

22. Downing AS, Wong GY, Dyer M, Aguiar AP, Selomane O, Jiménez Aceituno A: **When the whole is less than the sum of all parts – tracking global-level impacts of national sustainability initiatives**. *Glob Environ Change* 2021, **69**:102306.

23. Pascual U, Palomo I, Adams WM, Chan KMA, Daw TM, Garmendia E, Gómez-baggethun E, Groot RSD, Mace GM, Martín-López B, Phelps J: **Off-stage ecosystem service burdens: a blind spot for global sustainability**. *Environ Res Lett* 2017, **12**:075001.

24. Dinda S: **Environmental Kuznets Curve Hypothesis: a survey**. *Ecol Econ* 2004, **49**:431-455.

25. Rosenzweig C, Mbow C, Barioni LG, Benton TG, Herrero M, Krishnapillai M, Liwenga ET, Pradhan P, Rivera-Ferre MG, Sapkota T, *et al.*: **Climate change responses benefit from a global food system approach**. *Nat Food* 2020, **1**:94-97.

26. Zurek M, Hebinck A, Selomane O: **Climate change and the urgency to transform food systems**. *Science* 2022, **376**:1416-1421.

27. Leclère D, Obersteiner M, Barrett M, Butchart SHM, Chaudhary A, De Palma A, DeClerck FAJ, Di Marco M, Doelman JC, Dürauer M, *et al.*: **Bending the curve of terrestrial biodiversity needs an integrated strategy**. *Nature* 2020, **585**:551-556.

28. Mosnier A, Schmidt-Traub G, Obersteiner M, Jones S, Javalera-Rincon V, DeClerck F, Thomson M, Sperling F, Harrison P, Pérez-Guzmán K, *et al.*: **How can diverse national food and land-use priorities be reconciled with global sustainability targets? Lessons from the FABLE initiative**. *Sustain Sci* 2023, **18**:335-345.

29. Lindsey PA, Miller JRB, Petracca LS, Coad L, Dickman AJ, Fitzgerald KH, Flyman MV, Funston PJ, Henschel P, Kasiki S, *et al.*: **More than $1 billion needed annually to secure Africa's protected areas with lions**. *Proc Natl Acad Sci* 2018, **115**:E10788-E10796.

30. • Anyango-van Zwieten N: **Topical themes in biodiversity financing**. *J Integr Environ Sci* 2021, **18**:19-35.
Provides a synthesis of key themes around biodiversity financing that go beyond increasing financial resources — they also suggest innovative financing and being efficient with the distribution of resources.

31. Cosma S, Rimo G, Cosma S: **Conservation finance: what are we not doing? A review and research agenda**. *J Environ Manag* 2023, **336**:117649.

32. Jouffray J-B, Crona B, Wassénius E, Bebbington J, Scholtens B: **Leverage points in the financial sector for seafood sustainability**. *Sci Adv* 2019, **5**:eaax3324.