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PERSPECTIVE

The neglected importance of managing biological invasions for sustainable development

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Abstract

1. Biological invasions have substantial and rising social-ecological impacts threatening human livelihoods and communities and hampering progress towards a just and equitable world.
2. Currently, biological invasions are not adequately recognised and included in the UN Agenda 2030.
3. Using a literature review conducted in Web of Science, we highlight the bias in available literature of biological invasions related to the UN Agenda 2030 and its Sustainable Development Goals. We find abundant scientific literature towards environmental and biodiversity related sustainability targets while other especially provisioning targets are less well represented.
4. Subsequently, we discuss the risks of neglecting biological invasions within sustainable development and how invasive alien species can have changing and adverse effects through time counteracting the intended benefits at the time of introduction.
5. Finally, we provide key recommendations for action at the international scale to ensure that biological invasions are adequately considered in sustainable development. Those recommendations include (1) acknowledgement of biological invasions as a key threat to sustainable development, (2) a call for stronger multilateral exchange under the umbrella of an adequately financed coordinating body and (3) appropriate implementation and resource provisioning for international monitoring, data infrastructure, data exchange and use of adequate indicators of biological invasions to streamline decision making based on a solid evidence base.

KEYWORDS
biological invasions, impacts, policy, sustainable development, temporal lag effects

1 | THE AMBIVALENT PERCEPTION OF BIOLOGICAL INVASIONS IN SUSTAINABLE DEVELOPMENT

Global leaders have recently recommitted to the United Nations (UN) Agenda 2030 on Sustainable Development and its Sustainable Development Goals (SDGs; United Nations, 2023). The High-Level Political Forum on Sustainable Development calls for "urgent action to halt and reverse biodiversity loss by 2030 to put nature on a path to recovery for the benefit of people and the planet by conserving and sustainably using biodiversity [...]" (United Nations, 2023). Biological invasions, the human-facilitated spread of organisms to new regions, are an often-overlooked yet major driver of the biodiversity crisis (IPBES, 2019). More than 37,000 alien species have been documented worldwide, and their numbers are rapidly growing (IPBES, 2023). Current economic costs to compensate for their negative impacts are estimated at $423 billion annually. This figure has quadrupled every decade since 1970 and is now of similar magnitude to the cost of damage imposed by natural disasters such as storms or earthquakes (Turbelin et al., 2023).

Biological invasions may have both positive and negative effects on sustainable development through impacts on nature's contribution to people, and good quality of life. However, as reported in Bacher et al. (2023), an overwhelming 85% of the documented impacts are negative (Figure 1; IPBES, 2023). Perceived positive effects have encouraged the intentional introduction of species for various purposes including climate change adaptation, food security and restoration of ecological functions (Bacher et al., 2023). Negative effects include the erosion of essential ecosystem functions (such as flood prevention and crop productivity), damage to economies, and harm to human health (Bacher et al., 2023). Despite these well-documented risks, species are frequently introduced to combat sustainable development challenges. We strongly caution against the adoption of invasive alien species (i.e. those species with documented negative impacts on nature and in some cases also nature's contributions to people or good quality of life; IPBES, 2023) as a cornerstone to reach the SDGs, because they pose a severe and unequivocal threat towards all facets of sustainable development, beyond the threat they pose to biodiversity as currently recognised in the Agenda 2030 and Kunming-Montreal Global Biodiversity Framework (KM-GBF; CBD, 2022).

Across the SDGs, biological invasions are recognised in Target 15.8 (within SDG 15—Life on Land) "*By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species*" not accounting for the well-documented impacts on other aspects of sustainable development beyond the environment. Moreover, the associated indicator focuses on "national legislations and adequately resourcing the prevention or control of invasive alien species" without considering their effectiveness or actual impacts. This lack of consideration is particularly concerning as biological invasions are a rapidly growing facet of environmental change, with economic costs having increased four times per decade recently (Turbelin et al., 2023).

2 | TAKING STOCK OF THE BIOLOGICAL INVASION LITERATURE FOR SUSTAINABLE DEVELOPMENT

Based on a literature query in Web of Science (WoS) and the subsequent attribution of the identified studies to the SDGs via the "Sustainable Development Goals" filter in WoS, we illustrate how biological invasions are discussed within the context of the UN Agenda 2030 on Sustainable Development (see search details in the Figure 1 caption). This review shows that the available scientific literature mainly focuses on just three environment-related SDGs (SDG 15—Life on Land [76%], SDG 13—Climate Action [31%] and SDG 14—Life Below Water [17%]; Figure 2a), followed by two societal SDGs with substantially less studies (SDG 2—Zero Hunger [9%] and SDG 3—Good Health and Well-Being [7%]; Figure 2a). Most of these studies focus exclusively on one specific target and when they consider another target in addition, these belong to the same three environment-focused targets, except for SDG 2 (Figure 2a). In a second step, we searched for each one of the IUCN 100 of the World's Worst Invaders (Global Invasive Species Database, 2023) in WoS and recorded their association with each of the SDGs. Figure 2b illustrates that the majority of these invasive alien species have effects beyond the environment-focused SDGs, especially SDG 3 (98 species) and SDG 2 (92 species). Overall, every SDG (except SDG 17—Partnerships for the Goals; not covered by WoS) is affected and eight SDGs are affected by at least 50 of the 100 of the World's Worst Invaders. Please note that these literature assessments provide insights into where the scientific literature on biological invasions can be placed within the SDG's context, and do not disentangle realised impacts or directionality.

3 | TIME-LAGS IN BIOLOGICAL INVASIONS ARE MASKING RISKS TO SUSTAINABLE DEVELOPMENT

The full consequences of biological invasions on biodiversity and human livelihoods often unfold with substantial delays after introduction (Rouget et al., 2016). Impacts on SDGs are thus likely underestimated, and delayed recognition of impacts leads to lack of timely management and reduced management options as established invasive alien species can be very difficult or impossible to manage (IPBES, 2023). Many countries around the world (45%) do not invest in management, research and monitoring of biological invasions leading to uneven availability of information particularly in relation to realised impacts (IPBES, 2023).

There is ample evidence showing that the magnitude, and direction, of impacts of invasive alien species on sustainable

FIGURE 1 Examples of species with positive and negative impacts on the Sustainable Development Goals. Bars indicate the percentage of documented negative and positive impacts of biological invasions on good quality of life as reported in (IPBES, 2023), noting the overwhelming dominance of negative impacts. Positive impacts do not offset negative impacts and should be considered separately. Examples and associated negative and positive impacts for selected example species are based on the CABI Invasive Species Compendium (https://www.cabidigitallibrary.org/product/QI).

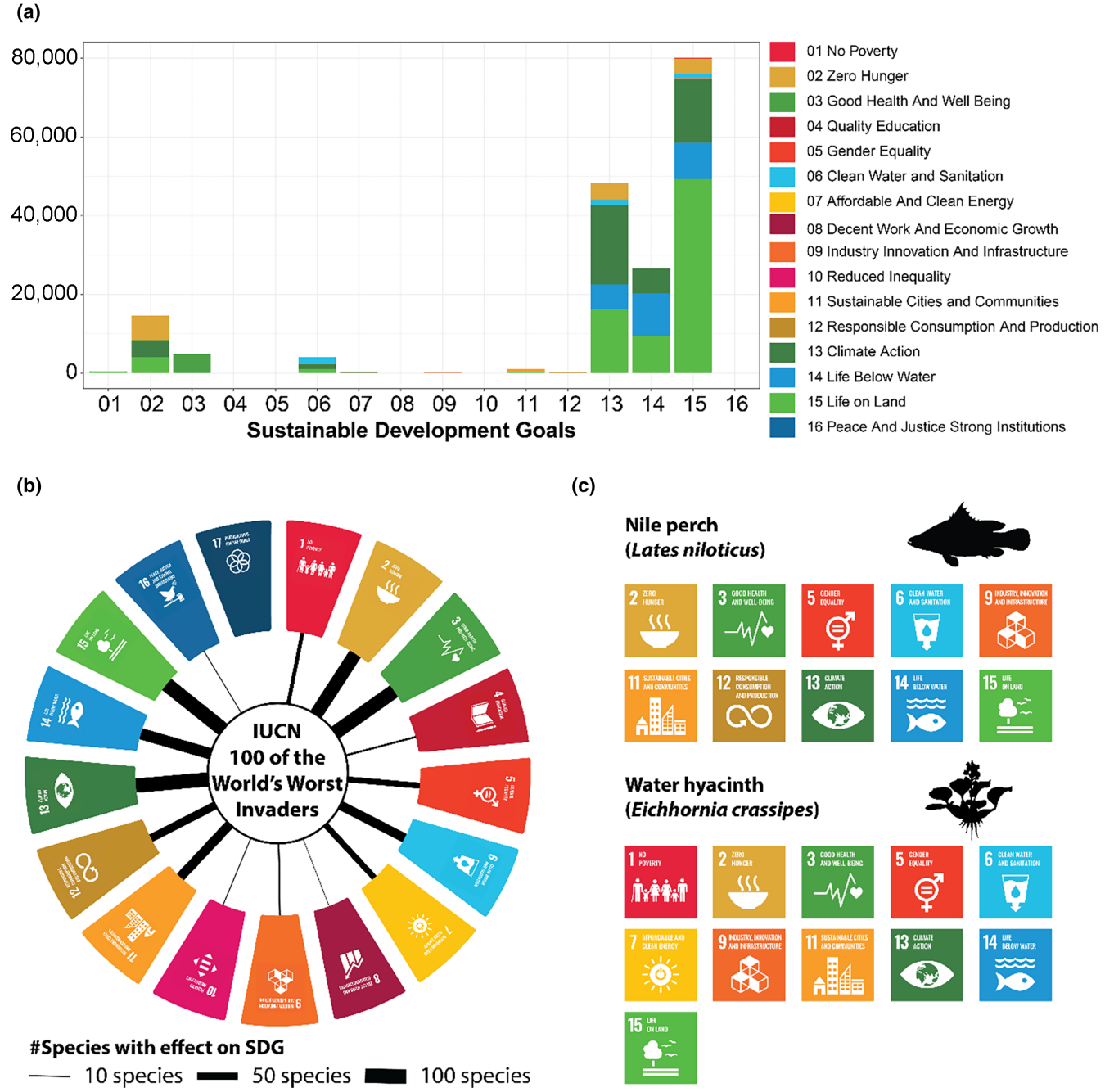

FIGURE 2 Number of biological invasion studies related to (a) one individual Sustainable Development Goal (SDG) and the SDG most frequently addressed alongside the main SDG represented as stacked bars. (b) Effects (positive or negative) of IUCN's 100 of the World's Worst Invaders on each SDG, with link width indicating the number of species affecting the specific SDGs. (c) Two example species from the IUCN including the SDGs they directly affect. For (a), we ran a literature query in Web of Science using the following search string: TS = (((ecolog* OR biolog*) NEAR/0 invasion*) OR (invasion NEAR/0 (ecology OR biology OR science)) OR ((introduced OR invasive OR alien OR non*native OR non*indigenous OR allochthonous OR exotic) NEAR/0 (species OR taxon OR taxa OR plant* OR animal* OR fungus OR fungi))) resulting in 65,151 studies. For (b) and (c), we searched Web of Science for all taxa included in the IUCN list using their scientific names. Classification of the literature relevance to specific SDGs was done using the "Sustainable Development Goals" filter in Web of Science. Searches were done on 03 December 2023.

development may change over time (Ricciardi et al., 2022). For instance, alien fish species that are stocked as food resource (e.g. Nile Perch [*Lates niloticus*] in Lake Victoria; Aloo et al., 2017) or alien tree species introduced for their wood or pollination services (e.g. honey mesquite [*Prosopis glandulosa*] across Southern Africa; Global Invasive Species Database, 2023) in early phases of invasion improve local livelihoods. But over time, when native species have been largely outcompeted, detrimental impacts on the entire ecosystem through food-web alterations or habitat destruction can emerge with cascading negative impacts on local food provisioning,

water quality, human health, and economy (Aloo et al., 2017; Global Invasive Species Database, 2023). As an example, after its introduction to Lake Victoria, the Nile Perch initially boosted catch rates and improved food security and increased wealth in local communities. Abundant catch produced new jobs and sources of income thus reducing local and gender inequalities (Aloo et al., 2017). Nevertheless, over time the growing industry attracted foreign investors resulting in financial outflows towards multinational corporations away from the local communities (Aloo et al., 2017). In addition, with fishers following the seasonal migration patterns of the Nile Perch, an increase in border conflicts associated with fishing ground delineations and increased HIV/AIDS spread rates associated with the higher mobility of local fishermen in the region emerged (Aloo et al., 2017). Such unforeseen temporal changes in impacts also emerge as a consequence of worsening of other drivers of biodiversity loss including ongoing climate or land and sea-use changes (Ricciardi et al., 2022). Consequently, short-term benefits towards the achievement of one or few SDGs can have severe downstream impacts on multiple other targets over time (Figure 2c). This introduces another facet related to intergenerational justice, whereby consideration should be given to the potential impact exerted on future generations by introductions of invasive alien species. Hence, risk assessments that include predictions on long-term impacts are critical to inform decisions about intentional introductions of alien species. Successful mitigation of impacts relies on joint, coordinated efforts across administrative and spatial scales, through a context-specific integrated governance approach that enhances multilateral cooperation. This must include financial commitments, the involvement of relevant sectors and stakeholders, indigenous peoples and local communities, the development of information systems, and efficient technology and knowledge transfers (IPBES, 2023; Obura, 2023).

4 | WHERE TO GO FROM HERE

Ensuring a sustainable and just future for all within planetary boundaries is at the heart of the UN Agenda 2030. The prevention and control of biological invasions is achievable (Roy et al., 2024) and will play an integral role in achieving or failing this vision, but the rising impacts of invasive alien species are currently inadequately monitored and mitigated (supported by integrated governance needs in IPBES, 2023). The renewed commitment towards the UN Agenda 2030 amplifies this call to place biological invasions on the global political agenda. Below, we outline key actions to adequately address biological invasions for sustainable development.

4.1 | Acknowledge biological invasions as a multi-faceted phenomenon affecting sustainable development

In light of the recent IPBES Invasive Alien Species Assessment that provides a global synthesis of multifaceted impacts (IPBES, 2023), the international community needs to explicitly acknowledge the role played by biological invasions on all facets of sustainable development, especially provisioning SDGs of basic human needs (e.g. SDGs 2 and 3; also supported by key message D4 in IPBES, 2023). Since the vast majority (85%) of all known impacts of biological invasions on nature's contributions to people and good quality of life are negative (IPBES, 2023), the successful implementation of the Agenda 2030 also strongly depends on our ambition and capacity to prevent and manage them. Key actors and intergovernmental political and economic fora have started to put biological invasions more prominently on the agenda, for example as illustrated by the Group of Seven (G7) meeting in Japan in 2023 calling for "Enhancing international cooperation on measures against invasive alien species" including "global, regional and bilateral collaboration" and a "whole society approach for outreach and mainstreaming" (https://www.env.go.jp/en/nature/gairai_inter-conf_2023.html). Such commitments also need to be prioritised across policy streams, and explicitly included in the commitments from the emerging discussions on the successor of the UN Agenda 2030 by the end of this decade.

Unfortunately, the lack of awareness of the major threat posed by biological invasions has become evident in multiple instances, especially where economic interests clash with environmental and societal ones and arguments become driven by interest rather than science. For example, the pacific oyster (*Crassostrea gigas*) has many observable negative impacts; however, its commercial exploitation remains in accordance with the EU invasive alien species regulation (EU, No 1143/2014), which hampers its effective management despite the well documented negative impacts. Invasive alien tree species (e.g. *Pinus contorta* or *Prosopis juliflora*) are frequently introduced for carbon credits or to restore degraded ecosystems (Nuñez et al., 2021). Similarly, sustainability labels (e.g., for sustainable fishing products like the Marine Stewardship Council) currently do not acknowledge impacts of invasive alien species, where species like the snow crab (*Chionocetes opilio*) or Russian red king crab (*Paralithodes camtschaticus*) in the Barents Sea have been erroneously labelled as sustainable despite their known deleterious impacts (Kourantidou et al., 2022). To reduce such conflicts, better monitoring and evidence-driven invasive alien species policy developments are paramount (see the following).

4.2 | Strengthen multilateralism and synergies across existing structures

International cooperation is imperative to halt the adverse effects of biological invasions and follows the commitment of the UN High-Level Political Forum (United Nations, 2023). Resource allocation towards biological invasions is most cost-efficient when invested into impact prevention through early detection and rapid response (IPBES, 2023). We call for stronger connection among international agreements and conventions, including standardised, open data sharing, increased information exchange and

coordination to improve targeted resource allocation and avoid redundant efforts. The UN is at the forefront of integrating these needs across multilateral conventions. We encourage continued coordination between the UNFCCC and CBD with their associated intergovernmental science-policy platforms, IPCC and IPBES, and efforts towards the Agenda 2030. Within the CBD, the Inter-Agency Liaison Group on Invasive Alien Species (hereafter liaison group) facilitated cooperation across relevant organisations towards achieving the Strategic Plan for Biodiversity 2011–2020. We recommend the continuation and strengthening of this already existing structure including adequate resource provisioning and recognition across relevant global political agendas so that the liaison group can assess common challenges and provide targeted recommendations. Targeted expert groups on biological invasions and sustainable development within the liaison group, for example at the intersection of the CBD, IPBES, SDGs and IPCC could then identify priority questions, synergies and actions towards joint and interlinked targets across bodies and agendas. Further, the liaison group could then also ensure the uptake of actions to prevent and manage biological invasions in other important multisectoral frameworks like One Health (and in its proposed extension towards One Biosecurity; Hulme, 2021), where the quadripartite organisations currently discuss challenges at the human-animal–plant intersection (FAO et al., 2022).

Finally, we also support previous calls for a bold reorganisation of existing power structures within international policy bodies to ensure a transformative systemic change involving updates to financial commitments and transdisciplinary collaborations and capacity building (Obura, 2023). In that light, we also acknowledge strong context dependencies related to the response capacities of nations and regions towards biological invasions, which need to be addressed. A coordinating body such as the Inter-Agency Liaison Group on Invasive Alien Species would bring far-reaching benefits. The liaison group could for example oversee all relevant multilateral agreements and associated reporting. This would include agreements and reports for National Biodiversity Strategy and Action Plans (NBSAP), that are mandatory for the parties to the Convention on Biological Diversity, and progress towards global and national targets. Such coordination would increase the efficiency of the reporting process and also prevent multiple or conflicting reporting across platforms. Furthermore, the coordinating body could monitor and report progress, and highlight shortcomings including proposed actions (e.g. in the NBSAPs) that do not match national cross-sector policy, towards such relevant agreements (Sankaran et al., 2023).

4.3 | Improve biological invasion monitoring and associated indicators

Current indicators of biological invasions used in global initiatives (outlined above) fall short in their capacity to capture the full biological invasion process and associated impacts. The global community needs to make progress moving from purely descriptive indicators, such as the existence of policy documents (SDG15 target 15.8), and include quantitative measures of the extent of biological invasions, their trends, impacts and the effectiveness of current policies. In the absence of such information it is difficult to monitor the effectiveness of actions and progress to address the threat of invasive alien species and target allocation of scarce resources (e.g. for the prevention of introduction of high priority species). The absence of adequate monitoring and indicators is a well-known impediment for effective tracking of biodiversity change in general and particularly for biological invasions (supported by key message D5 in IPBES, 2023). We call for a more holistic adoption of a suite of appropriate indicators that capture all facets of the biological invasion process including the rate of introduction, distribution, and spread of alien species, associated impact risks and the efficacy and fairness of policy and management. The identified indicators need to be operational within the next 1 to 3 years to inform the progress assessment of the intermediate goal of the KM-GBF by 2030.

Frameworks to assess impacts, like the Environmental Impact Classification for Alien Taxa (EICAT; Hawkins et al., 2015) have been endorsed by the IUCN and extended to socio-economic impacts (Bacher et al., 2018). In addition, global resources for populating these indicators including the Global Register for Introduced and Invasive Species (Pagad et al., 2022) are available. These efforts should facilitate the integration of indicator reporting for the KM-GBF under article 7 of the CBD, the UN SDG Global Database but also mobilise data from other relevant UN conventions (e.g. the International Convention for the Control and Management of Ships' Ballast Water and Sediments, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the International Plant Protection Convention) into a common data platform. Joint acknowledgement and endorsement by the different relevant UN conventions would also support the implementation of the Cape Town Global Action Plan for Sustainable Development Data through the operationalisation and standardisation of data from established structures, significantly improving the uptake of standardised information, reporting and cost-efficient resource allocation. Such standardised and systematically collected data are imperative for screening of invasive alien species with potential impacts on sustainable development (also by utilising emerging technologies like large language models and other artificial intelligence software) to ensure that lists of priority invasive alien species are informed by the best available scientific knowledge.

The implementation of these three key actions will ensure that biological invasions will be adequately represented in decisions towards achieving the CBD vision of "living in harmony with nature" and Agenda 2030 vision of "securing a future of prosperity and peace for people and planet, leaving no one behind". Taking biological invasions seriously will be an important task in the future negotiations of the next round of SDGs. We especially urge for the recognition of biological invasions in hampering progress in provisioning and societal SDGs where impact alleviation from biological invasions holds the chance for multiple future co-benefits.

AUTHOR CONTRIBUTIONS

Bernd Lenzner conceived the idea, led the analysis and writing of the manuscript. Adrián García-Rodríguez and Franz Essl significantly contributed to the conceptualisation, writing and revision of the study. Gilles Colling, Stefan Dullinger, Julia Fugger, Michael Glaser, Jennifer H. Hennenfeind, Ekin Kaplan, Daijun Liu, Ali Omer, Tobias Schernhammer, Anna Schertler, Lisa Tedeschi, Tom Vorstenbosch and Johannes Wessely contributed to writing and revision of the study. Michael Glaser supported the development of the figures. Aníbal Pauchard, Helen E. Roy and Peter Stoett contributed significantly to the writing and revision of the manuscript.

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CONFLICT OF INTEREST STATEMENT

H. E. Roy, A. Pauchard and P. Stoett are the co-chairs of the recently approved IPBES thematic assessment report on invasive alien species and their control. B. Lenzner and F. Essl were experts of the same assessment. Their opinions are made in their own personal capacity and do not represent IPBES or their institutions. H. E. Roy is an Associate Editor for People and Nature but is not involved in the peer review and decision-making process for this publication.

DATA AVAILABILITY STATEMENT

Data based on the literature search and to create Figure 2a are provided online on Zenodo (https://doi.org/10.5281/zenodo.12806035). The repository also holds the R code to produce the figure.

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REFERENCES

Aloo, P. A., Njiru, J., Balirwa, J. S., & Nyamweya, C. S. (2017). Impacts of Nile Perch, *Lates niloticus*, introduction on the ecology, economy and conservation of Lake Victoria, East Africa. *Lakes & Reservoirs: Research and Management*, *22*(4), 320–333. https://doi.org/10.1111/lre.12192

Bacher, S., Blackburn, T. M., Essl, F., Genovesi, P., Heikkilä, J., Jeschke, J. M., Jones, G., Keller, R., Kenis, M., Kueffer, C., Martinou, A. F., Nentwig, W., Pergl, J., Pyšek, P., Rabitsch, W., Richardson, D. M., Roy, H. E., Saul, W. C., Scalera, R., … Kumschick, S. (2018). Socio-economic impact classification of alien taxa (SEICAT). *Methods in Ecology and Evolution*, *9*(1), 159–168. https://doi.org/10.1111/2041-210X.12844

Bacher, S., Galil, B. S., Nuñez, M. A., Ansong, M., Cassey, P., Dehnen-Schmutz, K., Fayvush, G., Hiremath, A. J., Ikegami, M., Martinou, A. F., McDermott, S. M., Preda, C., Vilà, M., Weyl, O. L. F., Fernandez, R. D., & Ryan-Colton, E. (2023). Chapter 4: Impacts of invasive alien species on nature, nature's contributions to people, and good quality of life. In H. E. Roy, A. Pauchard, P. Stoett, & T. Renard Truong (Eds.), *Thematic assessment report on invasive alien species and their control of the intergovernmental science-policy platform on biodiversity and ecosystem services*. IPBES secretariat. https://doi.org/10.5281/zenodo.7430731

CBD. (2022). *Decision adopted by the conference of the parties to the convention on biological diversity: Kunming-Montreal Global Biodiversity Framework*.

FAO, UNEP, WHO, & WOAH. (2022). *One health joint plan of action, 2022–2026*. FAO; UNEP; WHO; World Organisation for Animal Health (WOAH) (founded as OIE). https://doi.org/10.4060/cc2289en

Global Invasive Species Database. (2023). *100 of the worst invaders*. http://www.iucngisd.org/gisd/species.php?sc=70

Hawkins, C. L., Bacher, S., Essl, F., Hulme, P. E., Jeschke, J. M., Kühn, I., Kumschick, S., Nentwig, W., Pergl, J., Pyšek, P., Rabitsch, W., Richardson, D. M., Vilà, M., Wilson, J. R. U., Genovesi, P., & Blackburn, T. M. (2015). Framework and guidelines for implementing the proposed IUCN Environmental Impact Classification for Alien Taxa (EICAT). *Diversity and Distributions*, *21*(11), 1360–1363. https://doi.org/10.1111/ddi.12379

Hulme, P. E. (2021). Advancing one biosecurity to address the pandemic risks of biological invasions. *Bioscience*, *71*(7), 708–721. https://doi.org/10.1093/biosci/biab019

IPBES. (2019). *Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (S. Díaz, J. Settele, E. S. Brondízio E.S., H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, … C. N. Zayas, Eds.). IPBES Secretariat.

IPBES. (2023). *Summary for policymakers of the thematic assessment report on invasive alien species and their control of the intergovernmental science-policy platform on biodiversity and ecosystem services* (H. E. Roy, A. Pauchard, P. Stoett, T. Renard Truong, S. Bacher, B. S. Galil, P. E. Hulme, T. Ikeda, K. V. Sankaran, M. A. McGeoch, L. A. Meyerson, M. A. Nuñez, A. Ordonez, S. J. Rahlao, E. Schwindt, H. Seebens, A. W. Sheppard, & V. Vandvik, Eds.). IPBES Secretariat. https://doi.org/10.5281/zenodo.7430692

Kourantidou, M., Haubrock, P. J., Cuthbert, R. N., Bodey, T. W., Lenzner, B., Gozlan, R. E., Nuñez, M. A., Salles, J. M., Diagne, C., & Courchamp, F. (2022). Invasive alien species as simultaneous benefits and burdens: Trends, stakeholder perceptions and management. *Biological Invasions*, *24*(7), 1905–1926. https://doi.org/10.1007/s10530-021-02727-w

Nuñez, M. A., Davis, K. T., Dimarco, R. D., Peltzer, D. A., Paritsis, J., Maxwell, B. D., & Pauchard, A. (2021). Should tree invasions be used in treeless ecosystems to mitigate climate change? *Frontiers in Ecology and the Environment*, *19*(6), 334–341. https://doi.org/10.1002/fee.2346

Obura, D. (2023). The Kunming-Montreal Global Biodiversity Framework: Business as usual or a turning point? *One Earth*, *6*(2), 77–80. https://doi.org/10.1016/j.oneear.2023.01.013

Pagad, S., Bisset, S., Genovesi, P., Groom, Q., Hirsch, T., Jetz, W., Ranipeta, A., Schigel, D., Sica, Y. V., & McGeoch, M. A. (2022). Country compendium of the global register of introduced and invasive species. *Scientific Data*, *9*(1), 391. https://doi.org/10.1038/s41597-022-01514-z

Ricciardi, A., Iacarella, J. C., Aldridge, D. C., Blackburn, T. M., Carlton, J. T., Catford, J. A., Dick, J. T. A., Hulme, P. E., Jeschke, J. M., Liebhold, A. M., Lockwood, J. L., Macisaac, H. J., Meyerson, L. A., Pyšek, P., Richardson, D. M., Ruiz, G. M., Simberloff, D., Vilà, M., & Wardle, D. A. (2022). Correction: Four priority areas to advance invasion science in the face of rapid environmental change. *Environmental Reviews*, *30*(1), 174. https://doi.org/10.1139/er-2021-0075.

(ref: *Environ. Rev.* 29(2): 119–141 (2021), https://doi.org/10.1139/er-2020-0088).

Rouget, M., Robertson, M. P., Wilson, J. R. U., Hui, C., Essl, F., Renteria, J. L., & Richardson, D. M. (2016). Invasion debt—Quantifying future biological invasions. *Diversity and Distributions*, *22*(4), 445–456. https://doi.org/10.1111/ddi.12408

Roy, H. E., Pauchard, A., Stoett, P. J., Renard Truong, T., Meyerson, L. A., Bacher, S., Galil, B. S., Hulme, P. E., Ikeda, T., Kavileveettil, S., McGeoch, M. A., Nuñez, M. A., Ordonez, A., Rahlao, S. J., Schwindt, E., Seebens, H., Sheppard, A. W., Vandvik, V., Aleksanyan, A., … Ziller, S. R. (2024). Curbing the major and growing threats from invasive alien species is urgent and achievable. *Nature Ecology & Evolution*, *8*(7), 1216–1223. https://doi.org/10.1038/s41559-024-02412-w

Sankaran, K. V., Schwindt, E., Sheppard, A. W., Foxcroft, L. C., Vanderhoeven, S., Egawa, C., Peacock, L., Castillo, M. L., Zenni, R. D., Müllerová, J., González- Martínez, A. I., Bukombe, J. K., Wanzala, W., & Mangwa, D. C. (2023). Chapter 5: Management; challenges, opportunities and lessons learned. In H. E. Roy, A. Pauchard, P. Stoett, & T. Renard Truong (Eds.), *Thematic assessment report on invasive alien species and their control of the intergovernmental science-policy platform on biodiversity and ecosystem services*. IPBES Secretariat. https://doi.org/10.5281/zenodo.7430733

Turbelin, A. J., Cuthbert, R. N., Essl, F., Haubrock, P. J., Ricciardi, A., & Courchamp, F. (2023). Biological invasions are as costly as natural hazards. *Perspectives in Ecology and Conservation*, *21*(2), 143–150. https://doi.org/10.1016/j.pecon.2023.03.002

United Nations. (2023). *Political declaration of the high-level political forum on sustainable development convened under the auspices of the General Assembly* (A/HLPF/2023/L.1). https://doi.org/10.18814/epiiugs/2006/v29i4/009

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