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Conservation accord: Let countries govern

In their Perspective “How to pay for saving biodiversity” (4 May, p. 486), E. B. Barbier *et al.* propose a global agreement for biodiversity conservation in which both countries and corporations would participate. We argue that corporate involvement is unrealistic. Only countries should serve as formal parties to the conservation agreement.

Each country joining the proposed conservation agreement would use national conservation data to create targets, policies, and regulations that rigorously standardize the activities of corporations as well as the government (1–4). This way, corporations would take part in the biodiversity conservation, regardless of whether they sign the agreement. If corporations independently join the agreement, they could pursue their own targets, policies, and timelines, which may differ from the national standard. Two conflicting standards would confuse the participants, complicate enforcement, and undermine the goal of saving biodiversity.

Corporate involvement may also be unrealistic in terms of logistics. There are vastly more corporations and organizations than there are countries (5). The manpower, financial support, and material resources required to add a large number of diverse corporations and organizations to the conservation agreement would not be economical. Therefore, countries should take the lead in governing biodiversity conservation.

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REFERENCES

1. E. D. Minin *et al.*, *Biol. Conserv.* **206**, 56 (2017).
2. H. M. Pereira *et al.*, *Science* **339**, 277 (2013).
3. F. T. Wetzel *et al.*, *Biodiversity* **16**, 137 (2015).
4. S. H. M. Butchart *et al.*, *Conserv. Lett.* **8**, 329 (2015).
5. The World Bank, “Listed domestic companies, total” (2017); <https://data.worldbank.org/indicator/CM.MKT.LDOM.NO>.

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Conservation accord: Cash is not enough

In their Perspective “How to pay for saving biodiversity” (4 May, p. 486), E. B. Barbier *et al.* call for a global biodiversity agreement and substantially increased corporate financing to conserve 50% of the global land area. However, additional financing will achieve little without first resolving the divergent perspectives of the various societal actors in conservation.

Barbier *et al.* refer to the Paris Climate Change Agreement, but the success of that accord reflects the near-universal recognition of the urgent need to respond to climate change. This is not yet the case for conservation. Cajoling society toward common conservation values and goals requires societal engagement rather than arbitrary global targets. Funds without such societal commitment and governance will simply be lost to corruption or rendered ineffective.

Barbier *et al.* also call for the agriculture industry to contribute financially to conservation in recognition of the estimated billions received from environmental services such as pollination. However, only a third of global agriculture area depends on pollinators (1). Moreover, the agriculture industry includes large transnational companies as well as millions of small farmers. The latter group depends most on ecosystem services (2, 3), yet has the least capacity to contribute financially to global conservation. Locally

orientated conservation action, driven by locally recognized conservation values, is a more credible approach that needs less funding and more engagement and capacity development.

Finally, massive allocation of funding to conserve extensive swathes of land in largely tropical countries will be subject to neocolonial interpretation and national sovereignty concerns, for which there are many unhappy precedents.

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REFERENCES

1. M. A. Aizen *et al.*, *Curr. Biol.* **18**, 1572 (2008).
2. Millennium Ecosystem Assessment, “Ecosystems and human well-being: Synthesis” (Island Press, Washington, DC, 2005).
3. R. Vignola *et al.*, *Agric. Ecosyst. Environ.* **211**, 126 (2015).

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Conservation accord: Corporate incentives

In their Perspective “How to pay for saving biodiversity” (4 May, p. 486), E. B. Barbier and colleagues suggest that corporations should support global biodiversity conservation. They propose an international policy, similar to the Paris Climate Change Agreement, alongside an objective of conserving 50% of all habitats [“Half Earth”

(1)]. They suggest that corporations that benefit directly from increased biodiversity could buy into this agreement and help finance conservation efforts. We agree that corporations can play a larger role in conserving biodiversity. However, direct benefit is not the best incentive for corporations, and the Half Earth concept is not the best goal.

Simply suggesting that corporations finance conservation, in part because certain sectors stand to gain directly, is dangerous. Even if a sector benefitted overall, buy-in would be substantially eroded wherever this did not visibly translate into benefits for individual corporations, or more critically operational units within corporations. This argument could also marginalize action on biodiversity as a corporate social responsibility initiative, thereby diverting corporations' attention from addressing their environmental impacts and comprehensively managing their biodiversity risks (2, 3).

Corporations will be motivated to take effective, large-scale action only when biodiversity loss is perceived as a material risk to operations (including financial losses and damage to reputation) (4), not just as the opportunity for direct financial gain as Barbier and colleagues suggest. This will require stronger external market forces, such as environmental regulation, financial incentives, and public pressure, and the translation of science-based approaches to support businesses in measuring and evaluating business operations' impacts on biodiversity (3–5).

Barbier *et al.* also fail to acknowledge scientific criticism of the Half Earth concept (1, 6), which could make it a hard sell to corporations attempting to manage risk. More appealing might be a “no net loss or better” objective (7), integrating both existing international biodiversity targets (8) and those already adopted by leading corporations (9).

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REFERENCES

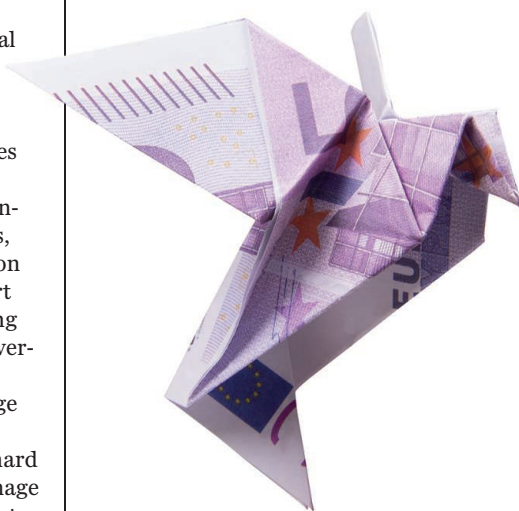
1. J. E. M. Watson, O. Venter, *Nature* **550**, 48 (2017).
2. K. H. Redford *et al.*, *Front. Ecol. Evol.* **3**, 1 (2015).
3. Cambridge Conservation Initiative, “Biodiversity at the heart of accounting for natural capital: The key to credibility” (Cambridge Conservation Initiative, Cambridge, UK, 2016); <https://naturalcapitalcoalition.org/biodiversity-at-the-heart-of-accounting-for-natural-capital/>.
4. J. Dempsey, *Geoforum* **45**, 41 (2013).
5. C. J. Vorösmarty *et al.*, *Science* **359**, 523 (2018).
6. B. Büscher *et al.*, *Oryx* **51**, 407 (2017).
7. W. N. S. Arlidge *et al.*, *Bioscience* **68**, 336 (2018).

8. Convention on Biological Diversity, “Strategic plan for biodiversity 2011–2020, including Aichi Biodiversity Targets” (CBD, 2011); www.cbd.int/sp/default.shtml.
9. H. J. Rainey *et al.*, *Oryx* **49**, 232 (2015).

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Response

Chen *et al.* argue against allowing corporations to participate formally in a Global Agreement of Biodiversity (GAB). Instead, they suggest an agreement in which only countries sign and enforce. Unfortunately, there is little evidence to indicate that current global agreements and financing are adequate to prevent continued decline in global biodiversity and critical habitats (1–3). It is unlikely that governments on their own will close the chronic funding gap in time to avert a global biodiversity crisis. Companies, especially those in key sectors, such as seafood, forestry, agriculture, and insurance, also have a financial stake in averting the global biodiversity crisis. These sectors could support the



GAB conservation targets as well as provide financial and technological assistance for conservation in developing countries.

Such a GAB would engage government and industry, and hopefully other nonstate actors. The evolution of the Paris Climate Agreement suggests that the strategy could succeed. Already some corporations, local governments, and other nonstate entities have announced voluntary pledges and low-carbon strategies to comply with the Paris Agreement (4), even though the private sector is not a formal participant and corporations do not contribute to the accord's climate financing. A recent proposal (4) advocates adding a mechanism to the Paris Agreement by which corporations, cities, and other nonstate actors could formally join the accord.

Ghazoul argues that the Paris Agreement is not a good model, because the global consensus and prioritization of climate change is more ingrained than conservation. He argues that local conservation efforts will be more effective. We agree that local and decentralized approaches to biodiversity conservation should be recognized and supported by any GAB and are fundamentally important for its success. However, we disagree that local conservation efforts will provide sufficient scale of conservation or resolve the chronic funding gap for global biodiversity conservation. As with any public good, biodiversity conservation suffers from a free-riding problem, in which governments have an incentive to provide less than the optimal level of funding in the hope that others will cover the costs. In particular, global funding to support conservation efforts in developing countries, which host most biodiversity, is woefully inadequate to prevent habitat loss and overexploitation. We maintain that the private sector can play a central role in addressing these problems. As we discuss in our Perspective, some corporations in natural resource-based sectors are already taking concrete actions.

Ghazoul also questions whether agricultural companies will have the incentive to contribute to a GAB, based on the benefits they receive from pollination services. We believe that this incentive does exist for agriculture and that the industry should be willing to contribute substantially to protect pollination services. Agriculture also receives other benefits from biodiversity protection, such as maintaining landraces that contain the genetic diversity used for generating new and improved crop varieties and assisting crop breeding programs (5).

Addison and Bull support private sector involvement in a GAB but propose that the conservation targets apply a “no net loss or better” objective rather than E.O. Wilson's Half-Earth concept. We agree that establishing targets for terrestrial and marine biodiversity conservation should be supported by sound scientific evidence. The Convention on Biodiversity (CBD) is already considering how to extend the existing Aichi Targets toward the 50% conservation goal as part of its post-2020 agenda (6).

Addison and Bell also raise concerns about corporate motivations for financing a GAB. We agree that there may be a need to enhance the incentives for corporations to finance conservation by adopting complementary policies, improving environmental regulations, and increasing public pressure.

A good example is the emerging science-business initiative for ocean stewardship (7). As we stated in our Perspective, the inclusion of corporations alongside governments in supporting and implementing a GAB could also help coordinate and align their incentives for greater conservation. A carefully crafted government-corporation GAB could create substantial opportunities for enterprise and innovation, align incentives by eliminating corporate free-rider problems, and revitalize the global system of biodiversity protection.

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REFERENCES

1. G. Ceballos, P. R. Ehrlich, R. Dirzo, *Proc. Natl. Acad. Sci. U.S.A.* **114**, E6089 (2017).
2. B. Worm *et al.*, *Science* **314**, 787 (2006).
3. E. Dinerstein *et al.*, *BioScience* **67**, 534 (2017).
4. D. C. Esty, P. Boyd, "To move Paris Accord forward, bring cities and companies on board" *Yale Environment* 360

(2018); <https://e360.yale.edu/features/to-move-paris-accord-forward-bring-cities-and-companies-on-board>.

5. M. R. Bellon, in *Agrobiodiversity Conservation and Economic Development*, A. Kontoleon, U. Pascual, M. Smale, Eds. (Routledge, 2008), ch. 4; www.taylorfrancis.com/books/e/9781134039104/chapters/10.4324%2F9780203890127-13.
6. J. Watts, "Make half of the world more nature friendly by 2050, urges UN biodiversity chief," *The Guardian* (2018); www.theguardian.com/environment/2018/apr/13/make-half-the-world-more-nature-friendly-by-2050-says-un-chief.
7. H. Österblom *et al.*, *Proc. Natl. Acad. Sci. U.S.A.* **114**, 9038 (2017).

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TECHNICAL COMMENT ABSTRACTS

Comment on "Satellites reveal contrasting responses of regional climate to the widespread greening of Earth"

Yue Li, Zhenzhong Zeng, Ling Huang, Xu Lian, Shilong Piao

Forzieri *et al.* (Reports, 16 June 2017, p. 1180) used satellite data to show that boreal greening caused regional warming. We show that this positive sensitivity of temperature to the greening can be derived from the positive response of vegetation to boreal warming, which indicates that results from a statistical

regression with satellite data should be carefully interpreted.

Full text: [dx.doi.org/10.1126/science.aap7950](https://doi.org/10.1126/science.aap7950)

Response to Comment on "Satellites reveal contrasting responses of regional climate to the widespread greening of Earth"

Giovanni Forzieri, Ramdane Alkama, Diego G. Miralles, Alessandro Cescatti

Li *et al.* contest the idea that vegetation greening has contributed to boreal warming and argue that the sensitivity of temperature to leaf area index (LAI) is instead likely driven by the climate impact on vegetation. We provide additional evidence that the LAI-climate interplay is indeed largely driven by the vegetation impact on temperature and not vice versa, thus corroborating our original conclusions.

Full text: [dx.doi.org/10.1126/science.aap9664](https://doi.org/10.1126/science.aap9664)

ERRATA

Erratum for the Report "Seasonal and daily climate variation have opposite effects on species elevational range size" by W.-P. Chan *et al.*, *Science* 360, eaat9919 (2018). Published online 4 May 2018; 10.1126/science.aat9919

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