CONSERVATION

The minimum land area requiring conservation attention to safeguard biodiversity

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Ambitious conservation efforts are needed to stop the global biodiversity crisis. In this study, we estimate the minimum land area to secure important biodiversity areas, ecologically intact areas, and optimal locations for representation of species ranges and ecoregions. We discover that at least 64 million square kilometers (44% of terrestrial area) would require conservation attention (ranging from protected areas to land-use policies) to meet this goal. More than 1.8 billion people live on these lands, so responses that promote autonomy, self-determination, equity, and sustainable management for safeguarding biodiversity are essential. Spatially explicit land-use scenarios suggest that 1.3 million square kilometers of this land is at risk of being converted for intensive human land uses by 2030, which requires immediate attention. However, a sevenfold difference exists between the amount of habitat converted in optimistic and pessimistic land-use scenarios, highlighting an opportunity to avert this crisis. Appropriate targets in the Post-2020 Global Biodiversity Framework to encourage conservation of the identified land would contribute substantially to safeguarding biodiversity.

Securing places with high conservation value is crucial for safeguarding biodiversity (*1*) and is central to the Convention on Biological Diversity (CBD)'s 2050 vision of sustaining a healthy planet and delivering benefits for all people (*2*). CBD Aichi Target 11 aimed to conserve at least 17% of land area by 2020 (*3*), but this is widely seen as inadequate for halting biodiversity declines and averting the crisis (*4*). Post-2020 target discussions are now well underway (*5*), and there is a broad consensus that the amount of land and sea managed for biodiversity conservation must increase (*6*). Recent calls are for targets to conserve anywhere from 26 to 60% of land and ocean area by 2030 through site-scale responses such as protected areas (PAs) and "other effective area-based conservation measures" (*7*–*12*). There is also increasing recognition that site-scale responses must be supplemented by broader, landscape-scale actions aimed at addressing habitat loss and degradation (*13*) and by action to tackle the underlying drivers of biodiversity loss, such as increasing overconsumption, which is linked to increasing affluence and population size (*14*). Although global conservation targets are ultimately set through intergovernmental negotiation, scientific input is necessary to identify the location and amount of land that requires conservation attention to achieve those targets, and to inform potential strategies.

Several scientific approaches exist that help provide evidence to inform global conservation efforts, but when used in isolation, they can provide conflicting advice. In particular, there are efficiency-based planning approaches that focus on maximizing the number of species or ecosystems captured within a complementary set of conservation areas, by weighting species and ecosystems by their endemicity, extinction risk, or other criteria (*15*–*17*). There are also threshold-based approaches such as the Key Biodiversity Area (KBA) initiative (*18*), which identifies sites of importance for the global persistence of biodiversity by using criteria relating to the occurrence of threatened or geographically restricted species or ecosystems, intact ecological communities, or important biological processes (e.g., breeding aggregations) (*18*). Other approaches instead aim to proactively conserve the most ecologically intact places before they are degraded (*19*). These intact areas are increasingly recognized as essential for sustaining long-term ecological and evolutionary processes (*20*) and long-term species persistence (*21*), especially during climate change (*22*). Examples include boreal forests, which support many wide-ranging species (*23*, *24*), and the Amazon rainforest, which needs to be maintained in its entirety, not just for its most species-rich areas but also to sustain continent-scale hydrological patterns that underpin its ecosystems (*25*).

Although these approaches are complementary and provide essential evidence to set and meet biodiversity conservation targets, the adoption of any one of them as a guide for decision-making is likely to omit potentially critical elements of the CBD vision (*26*). For example, a species-based focus on identifying areas in a way that most efficiently captures the most species would fail to recognize the critical need to maintain large, intact ecosystems for biodiversity persistence (*21*). Equally, a focus on proactively conserving ecologically intact ecosystems would fail to achieve adequate conservation of some threatened species or ecosystems (*27*). Put simply, all approaches will lead to partly overlapping but often distinct science-based suggestions for area-based conservation (*28*). Therefore, combining these approaches into a unified global framework that seeks to comprehensively conserve species, ecosystems, and the remaining intact ecosystems offers a better scientific basis for achieving the CBD vision (*29*, *30*).

In this study, we identify the minimum land area that requires conservation attention globally to safeguard biodiversity. Our aim is to inform the degree to which current conservation efforts require scaling up. We start from the basis of existing PAs (*31*), KBAs (*32*), and ecologically intact areas (*33*) and then efficiently represent the distribution of 35,561 species of mammals, birds, amphibians, reptiles, freshwater crabs, shrimp, and crayfish scaled to the sizes of their ranges (*15*, *16*, *34*) while also capturing samples (17% of area, following CBD Aichi Target 11) of all terrestrial ecoregions (*35*). We used these taxonomic groups because they are those most comprehensively assessed and mapped by the International Union for the Conservation of Nature, noting that the inclusion of plants and other groups would likely increase the area we identify. Conserving the variety of ecosystem types within ecoregions to capture heterogeneity and beta diversity, which would likely require a target larger than 17% of area and increase the overall area identified by our analyses, is also important.

We do not aim to pinpoint specific locations for conservation or suggest that the land we map should be designated as PAs that preclude

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other land management strategies. Rather, we argue that it should be managed through a wide range of strategies for species and ecosystem conservation. We define the term "conservation attention" to capture this broad range of strategies, all of which lead to positive biodiversity outcomes. For example, extensive areas that are remote and unlikely to be converted for intensive human uses in the near term could be safeguarded through effective sustainable land-use policies, whereas other areas customarily governed by Indigenous peoples and local communities can continue to be conserved through their self-determined strategies and practice. We believe the appropriate governance and management regimes for any area depend in part on the likelihood of the habitat being converted or degraded by intensive human uses (*36*–*38*), as well as the land tenure regimes and other sociopolitical factors present in a country, and as such the response for conserving the areas we identify will be context specific.

To highlight places in need of the most immediate attention, we further calculate the parts of the land needing conservation that are most likely to suffer habitat conversion in the near future. We do this by using harmonized projections of future land-use change by 2030 and 2050 (*39*). To determine best- to worst-case scenarios, we evaluated projections under three different shared socioeconomic pathways (SSPs) (*40*) linked to representative concentration pathways (RCPs) (*41*): (i) SSP1, an optimistic scenario in which the world gradually moves toward a more sustainable future (RCP2.6; IMAGE model); (ii) SSP2, a middle-of-the-road scenario without any extreme changes toward or away from sustainability (MESSAGE-GLOBIOM model); and (iii) SSP3, a pessimistic scenario in which regional rivalries dominate international relations and land-use change is poorly regulated (RCP7.0; AIM model). Given the uncertainty in which pathway humanity is following, we also created an "ensemble" land-use projection for which we calculated the average loss across all three SSPs.

We also estimate and map the number of people living on the land area we identify as requiring conservation attention by using the LandScan 2018 global distribution (*42*). We performed this calculation in view of the potential impact of conservation on people living in such areas, given the history of human rights abuses (*43*), displacement (*44*), militarized forms of violence (*45*), and conflict with local worldviews (*46*) that is associated with some past actions done in the name of conservation (*47*). These rights abuses are linked to a pervasive lack of tenure-rights recognition and culturally appropriate rights frameworks for conservation (*48*–*50*). Local residents already effectively conserve large tracts of land, and supporting their actions will thus be a key strategy to continue safeguarding biodiversity (*51*).

The minimum land area that requires conservation attention

We estimate that, in total, the minimum land area that requires conservation attention to safeguard biodiversity is 64.7 million km^2 (44% of Earth's terrestrial area) (Fig. 1). This consists of 35.1 million km^2 of ecologically intact areas, 20.5 million km^2 of existing PAs, 11.6 million km^2 of KBAs, and 12.4 million km^2 (8.4% of terrestrial area) of additional land that is needed to promote species persistence on the basis of conserving minimum proportions of their ranges (Fig. 2). Moreover, PAs, KBAs, and ecologically intact areas have a three-way overlap on only 1.8 million km^2, and consensus area (overlap) captures only 5% of ecologically intact areas, 9% of PA extent, and 16% of KBA extent, emphasizing the importance of considering the various approaches in a unified framework. Some of the highest bilateral overlaps are between KBA and PA extents (31% of PA and 55% of KBA), but even this highlights the need to consider both datasets.

Considerable geographic variation exists in the amount of land that requires conservation. We find that at least 64% of land in North America would need to be conserved, primarily because of the ecologically intact areas of Canada and the United States and extensive additional land areas in Central America. By contrast, at least 33.1% of Europe's land area requires conservation. The proportion of land that requires conservation also varies considerably

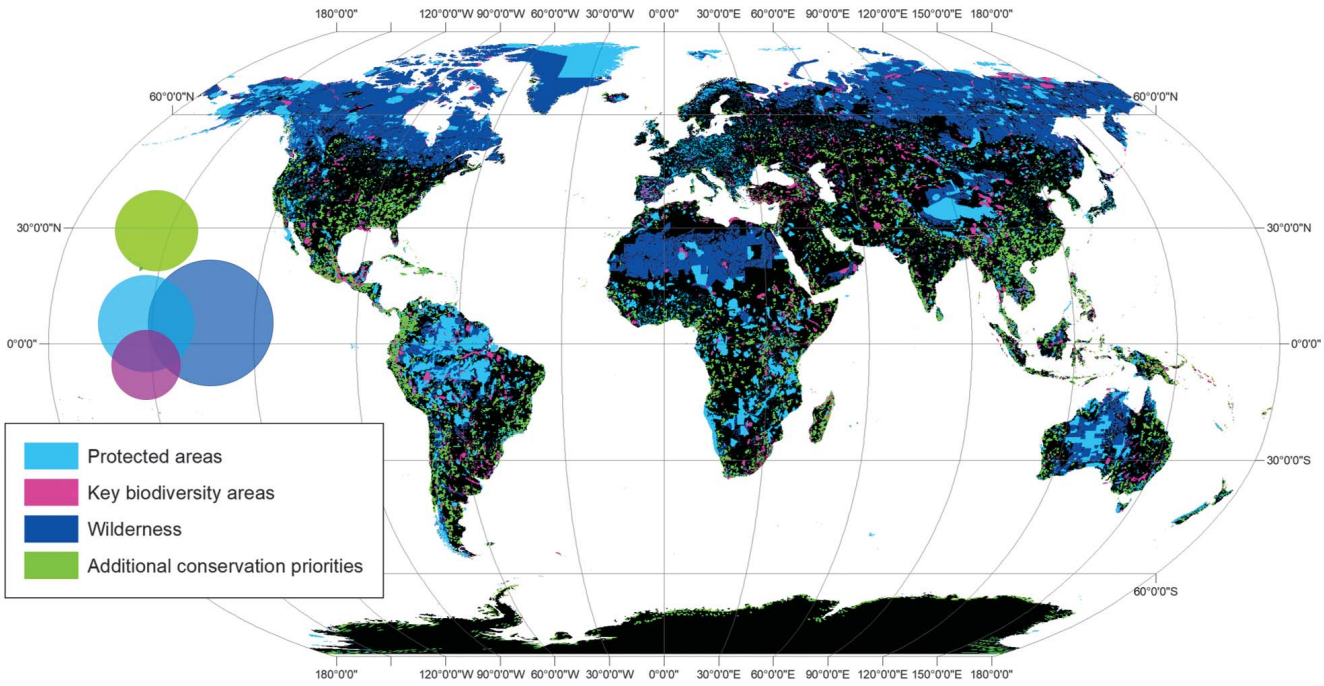

Fig. 1. Minimum land area for conserving terrestrial biodiversity. Components include PAs (light blue), KBAs (purple), and ecologically intact areas (dark blue). Where they overlap, PAs are shown above KBAs, which are shown above ecologically intact areas. New conservation priorities are in green. The Venn diagram shows the proportional overlap between features. Zoom-ins of the map can be found in fig. S6.

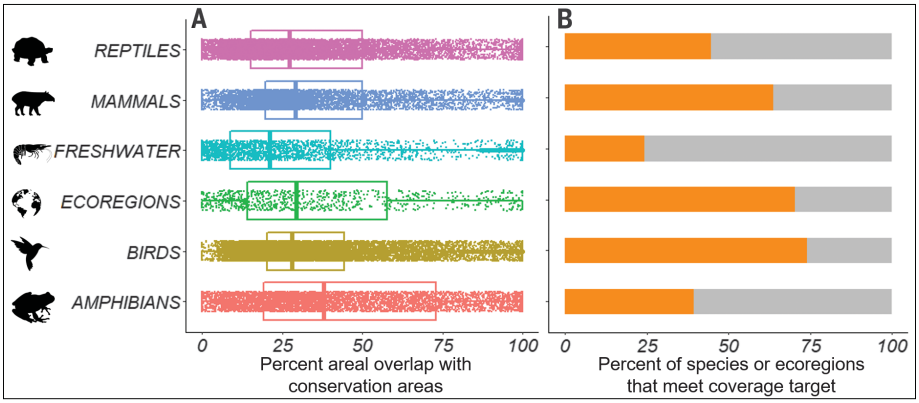

Fig. 2. Gap analyses of species and ecoregion coverage within PAs, KBAs, and ecologically intact areas. (**A**) Percentage of the distribution of each species (in different taxonomic groups; freshwater includes crabs, shrimp, and crayfish) and ecoregion area that overlaps with PAs, KBAs, and ecologically intact areas. Boxplots show the median and 25th and 75th percentiles for each taxonomic group. (**B**) Percentage of species and ecoregions with an adequate proportion of their distribution overlapping existing conservation areas to meet specific coverage targets for species (10 to 100%, depending on range size) or ecoregions (17%) (orange).

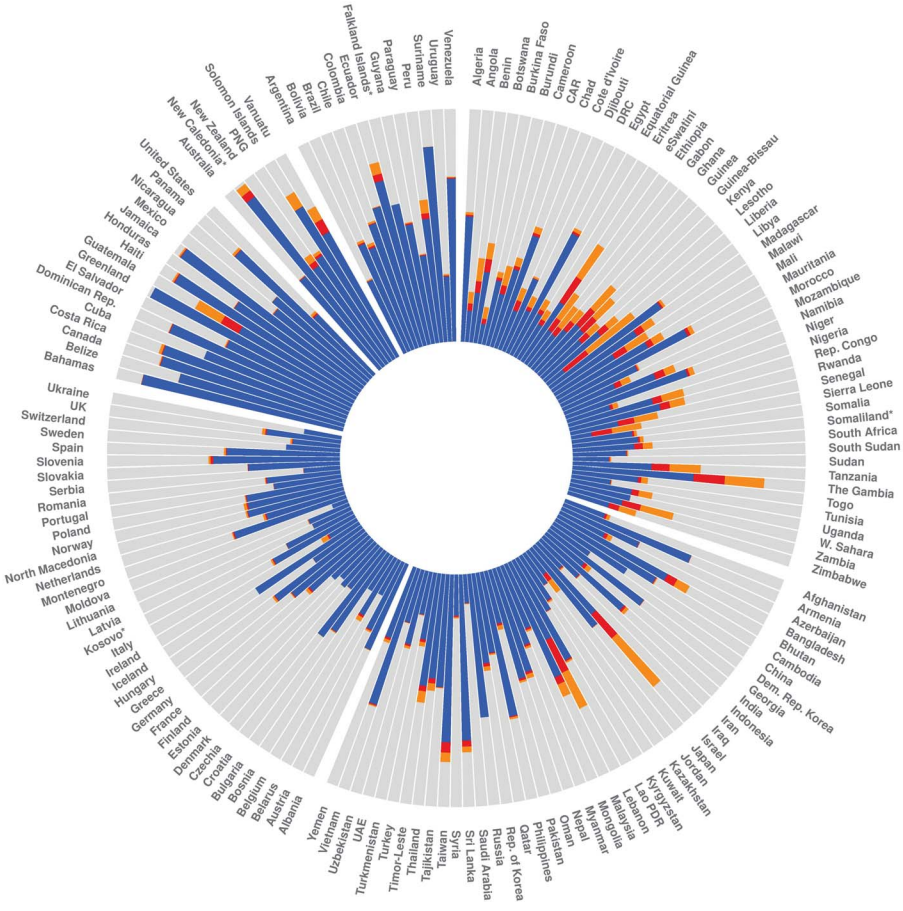

Fig. 3. National-level land area for conservation and projected habitat loss. Estimated proportion of each country requiring effective conservation attention to safeguard biodiversity that is projected to suffer habitat conversion by 2030 (orange) and 2050 (red) or that is projected not to be converted (blue), according to SSP3 (a worst-case scenario). Gray areas are outside the land identified for conservation. We excluded 85 countries with a land area <10,000 km^2 from the figure.

among nations (Fig. 3), with notably high values in Canada (84%), largely because of its extensive ecologically intact areas, and in Costa Rica (86%), Suriname (84%), and Ecuador (81%), owing to their high numbers of endemic species and, in Ecuador's case, the inclusion of a large overlap with the remaining Amazon forest (table S1). We also find that a larger percentage of land in developed economies (55% in total) would require effective conservation compared with the percentage in emerging economies (48%) or developing economies (30%) (tables S2 and S8). Even if we exclude the large ecologically intact areas of Canada and Australia, 42% of land in developed economies would require effective conservation, which is still substantially higher than in developing economies.

Future risk of land conversion in areas that require conservation attention

We found that 44.9 million km^2 (70.1%) of the land area that would require conservation attention is currently intact. Although this is somewhat encouraging, it implies a substantial restoration requirement in the remaining 29.9%. Our results further suggest that in the pessimistic scenario, SSP3, 1.3 million km^2 (2.8%) of the total intact land area that requires conservation will undergo habitat conversion to intensive human land uses by 2030, increasing to 2.2 million km^2 (4.9%) by 2050. Projected habitat conversion varies across continents and countries (Fig. 4). Africa is projected to have the highest proportion of intact land that would require conservation converted by 2030 (>800,506 km^2, 9% of Africa's intact habitat), increasing to 1.4 million km^2 (15.9%) by 2050 (tables S3 and S4). The lowest risk of conversion is in Oceania and North America. Substantially larger proportions of intact land that would require conservation in developing economies are projected to have their habitat converted by 2030 (7.1%), compared with emerging economies (1.7%) or developed economies (1.1%). By 2050, developing economies are projected to have 12.7% of their intact habitat that requires conservation converted under SSP3 (table S5). Notably, much of this loss is driven by demand in developed economies (*52*). Compared with PAs and ecologically intact areas, KBAs are projected to have the largest proportion of habitat converted (table S6).

On the basis of the most optimistic scenario, SSP1, which represents a world acting sustainably, we estimate that 136,380 km^2 (0.3%) of the intact land that would require effective conservation may suffer natural habitat conversion by 2030, and that this area would increase to 320,558 km^2 (0.7%) by 2050. On the basis of SSP2, representing a middle-of-the-road scenario, the values become 841,438 km^2 (1.9%) by 2030 and 1.5 million km^2 (3.3%) by 2050. This highlights how our results are sensitive to future societal development pathways, but

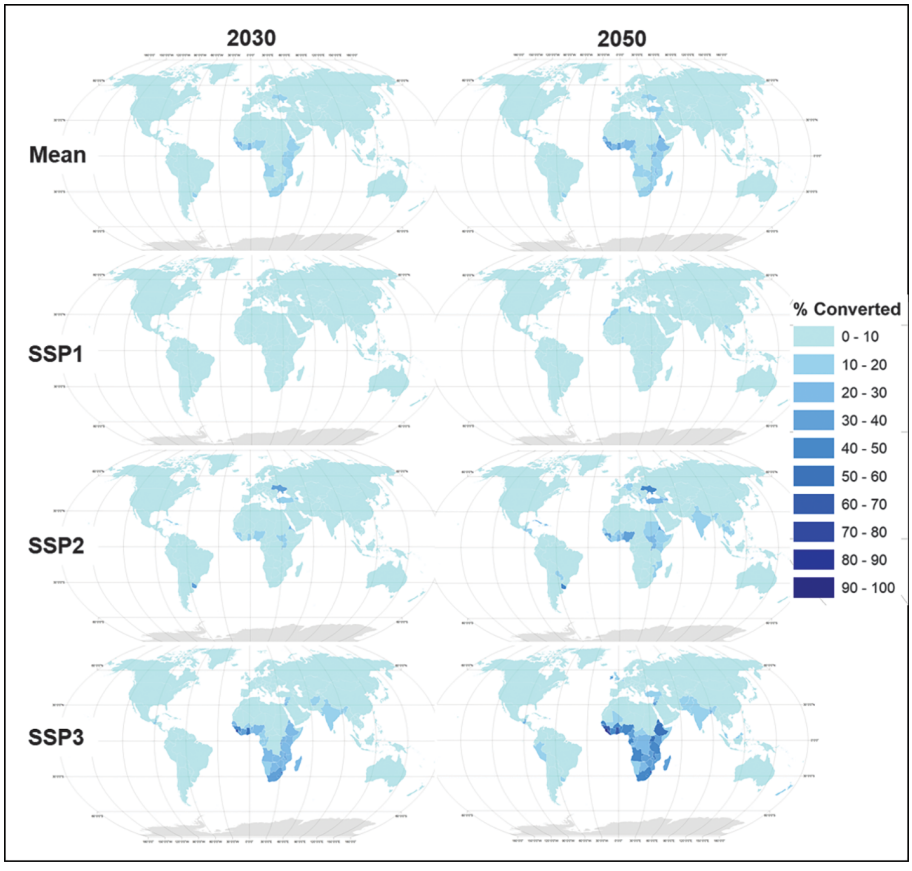

Fig. 4. Future habitat conversion on land that requires conservation attention. Proportion of natural habitat on land that requires conservation to safeguard biodiversity but is projected to be converted to human uses by 2030 and 2050, on the basis of SSP1 (an optimistic scenario), SSP2 (a middle-of-the-road scenario), SSP3 (a pessimistic scenario), and the mean loss across the three scenarios (Mean). The data on future land use do not extend to Antarctica.

even in the most optimistic scenario, large extents of land with high conservation value are at risk of having natural habitat converted to more-intensive human land uses. However, the sevenfold difference between the amount of habitat converted under SSP1 versus that under SSP3 shows a large window of opportunity for humanity to reduce the biodiversity crisis.

There is inherent uncertainty in future land-use projections and on which SSP society is tracking most closely. To minimize the effect of this uncertainty, we also calculated the average loss of intact habitat across the three SSP scenarios. In this ensemble scenario, we expect 740,599 km^2 (1.7%) of intact habitat in land that requires conservation to be converted by 2030, increasing to 1.3 million km^2 by 2050 (2.9%).

Human population in areas that require conservation

We found that 1.87 billion people live in the land area that requires conservation attention to safeguard biodiversity. This is approximately one-quarter of Earth's human population (24%) (fig. S1) and is notably greater than previous estimates (*53*). Africa, Asia, and Central America have particularly large proportions of their human populations living on land with high conservation value (fig. S2). Most people living in the area that requires conservation attention are in emerging and developing economies, which also have much higher proportions of their populations (often >20%) living in areas that require conservation compared with those of developed economies (Fig. 5) (*54*–*56*). This raises critical questions regarding how conservation strategies can be scaled up without compromising social justice goals.

Implications for global policy

Our analyses represent a comprehensive scientific estimate of the minimum land area that requires conservation attention to safeguard biodiversity. Given our inclusion of ecologically intact areas, updated maps of KBAs, and additional locations to conserve species, our estimate that 44% of land requires conservation attention is, unsurprisingly, larger than those from previous analyses that have focused primarily on species and/or ecosystems, used earlier KBA datasets, and/or did not include ecologically intact areas [e.g., 27.9% according to Butchart *et al.* (*16*), 20.2% according to Venter *et al.* (*15*), and 30% according to Larsen *et al.* (*4*)]. Our estimate is in line with some previous ecoregion-based studies (*57*); however, it is smaller than a recent estimate by Jung *et al.*, who identified ~70% of land as necessary for conserving biodiversity (*17*). This is unsurprising because they set higher coverage targets for species' ranges and also included plant distribution data (*17*). Conservation attention to the areas we identify will be important for achieving a suite of targets in the Post-2020 Global Biodiversity Framework under the CBD. These include increasing the area, connectivity, and integrity of natural ecosystems and supporting healthy and resilient populations of all species while reducing the number of species that are threatened and maintaining genetic diversity (the focus of draft Goal A); retaining ecologically intact areas (draft Target 1); conserving areas of particular importance for biodiversity (draft Target 2); and enabling recovery and conservation of wild species of fauna and flora (draft Target 3) (*58*).

The estimate of 44% of Earth's land that requires conservation attention to safeguard biodiversity is large; however, 70% of this area is still relatively intact (as defined here), which implies that these places may not need the larger investments required to restore landscapes (*59*). This pattern holds across different economic brackets, with developed and developing economies having 66 and 69% of important conservation land intact, respectively. By contrast, 1.3 million km^2 of the land that needs conservation, mostly in developing and emerging economies, is at risk of habitat conversion to intensive human land uses and consequent biodiversity loss. Ensuring that this land remains intact is an immediate conservation priority. Appropriately worded targets in the Post-2020 Global Biodiversity Framework to safeguard these at-risk places would make a substantial contribution toward addressing the biodiversity crisis, as long as it is accompanied by parallel efforts to ensure that habitat conversion is not displaced into other important conservation areas and that appropriate safeguards are in place to guarantee that such areas remain intact (*60*).

Our finding that 1.8 billion people live in areas that require conservation attention raises important questions about implementation. Historically, some conservation actions have adversely affected and continue to negatively affect Indigenous peoples, Afro-descendants, and local communities (*43*–*46*, *50*). The high number of people living in areas that require conservation attention implies that practices

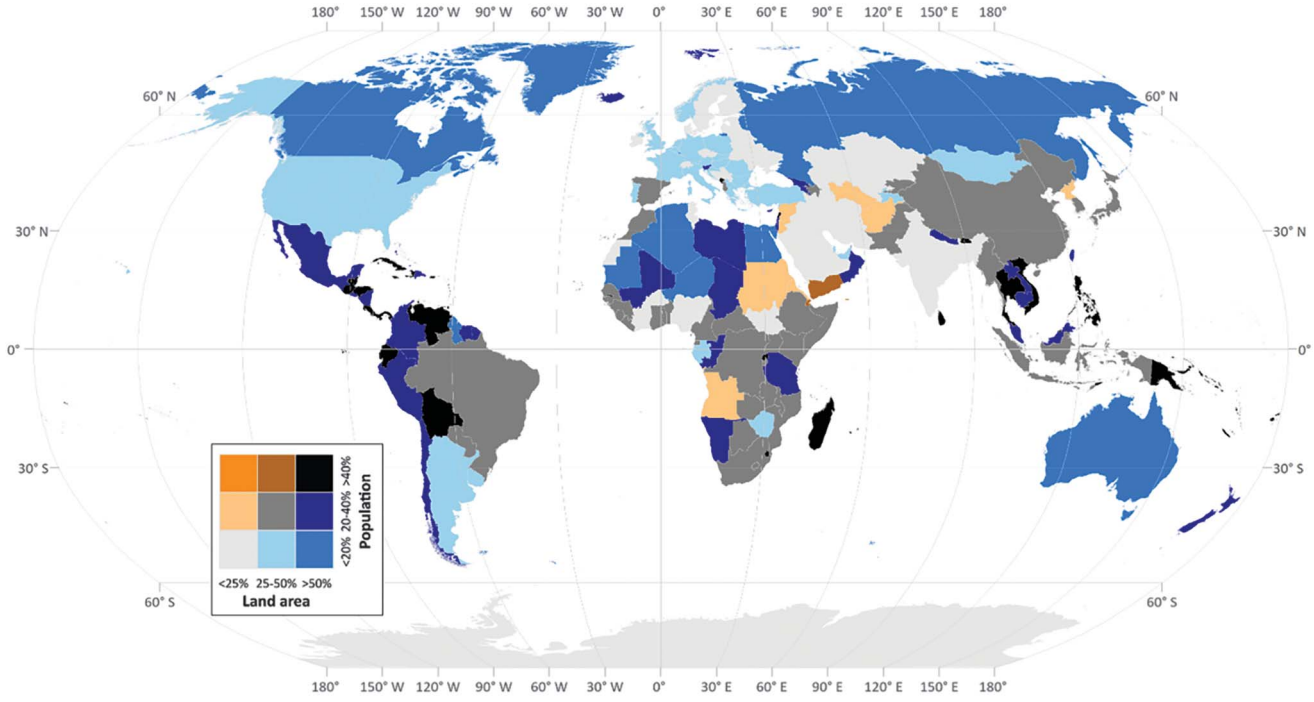

Fig. 5. Bivariate map showing the proportion of each country's human population living in areas that require conservation attention and the proportion of each country's land area that requires conservation attention.

such as displacing or relocating people will be not only unjust but also not possible. Evidence shows that in many cases, Indigenous peoples and local communities have been effective stewards of biodiversity worldwide (*61*). An ethical strategy that may effectively safeguard large extents of land is a human rights–based approach to conservation (*50*, *62*). The central pillars of this are (i) recognizing that through their customary practices, Indigenous peoples, Afro-descendants, and local communities have already demonstrated both leadership and autonomy in biodiversity conservation across the world (*63*); (ii) recognizing their rights to land, benefit sharing, and institutions and supporting efforts to strengthen these rights so that they can continue to effectively conserve their own lands; and (iii) making Indigenous peoples, Afro-descendants, and local communities partners in setting the global conservation agendas through the CBD and promoted as leaders in achieving its targets. Large areas that require conservation attention are claimed by Indigenous peoples, Afro-descendants, and local communities as their territories or lands (*64*), so reinforcing and building the capacity of existing local governing institutions provides a primary pathway for safeguarding biodiversity (*65*).

To mitigate the potential for conflict, governments and conservation organizations can support equitable governance at the site level (*66*). Equity, as defined by the CBD (*67*), promotes the recognition of rights (particularly to land; free, prior, and informed consent; and self-determination), inclusiveness of rule- and decision-making, and the sharing of costs and benefits, which necessitates a focus on governance as opposed to merely management in the pursuit of socioenvironmental gains (*65*, *66*). When conservation and local interests do not align, trade-offs will need to be made. We must recognize that in an equity-based approach, such trade-offs will often entail compromise on the conservation side. If this occurs, it will be possible to rerun the spatial analysis while avoiding those areas to determine whether species range and ecoregion conservation targets can be met elsewhere.

Several additional actions are required to achieve the scale of conservation necessary to deliver positive biodiversity outcomes. On all land that requires conservation attention, the expansion of roads and developments such as agriculture, forestry, and mining needs to follow development frameworks such as the mitigation hierarchy to ensure "no net loss" of biodiversity and natural ecosystems (*68*). As such, mechanisms that direct developments away from important conservation areas are also crucial, including strengthening investment and performance standards for financial organizations such as the World Bank and other development investors (*69*) and tightening existing industry certification standards (*70*). Removing subsidies for activities that destroy or promote the destruction of biodiversity, such as hydrocarbon extraction, roads, dams, and unsustainable forestry and agricultural practices, is also crucial (*71*). The magnitude of human pressures will typically increase if human populations and their rates of consumption increase further, and this could have a multiplier effect on local threats to biodiversity, both locally and via telecoupling. Thus, a dual strategy of mitigating local threats while addressing the underlying anthropogenic drivers of biodiversity loss locally and globally is needed (*70*). Our threat analysis examined only future land conversion; however, a range of other threats such as overhunting, climate change, and fragmentation must also be considered and mitigated in areas that require conservation attention.

A critical implementation challenge is that the proportion of land that different countries would need to conserve is highly inequitable. This variation is largely a reflection of the distribution of biodiversity, where tropical countries with high species richness and many restricted-range endemic species require large areas of land to be conserved because there are few other places to conserve those species. The variation is also due to the distribution of ecologically intact areas, whereby five countries, Canada, Russia, the United States, Brazil, and Australia, contain 75% of Earth's ecologically intact areas (*19*), and so each would need to conserve large areas. However, the issue of inequity is most important in particular places, such as where conservation land is also agriculturally suitable, and so conserving it can

incur a high opportunity cost. In responding to this inequity, the conservation community can apply the concept of common but differentiated responsibilities that is foundational to all global environmental agendas, including the CBD (*72*) and United Nations Framework Convention on Climate Change (*73*). Because the burden of conservation is unevenly distributed, cost-sharing and fiscal transfer mechanisms are likely necessary to ensure that all national participation is equitable and fair and that the opportunity costs of foregone agricultural revenues and developments are considered (*74*, *75*). This is important because most of the land that requires conservation attention but is at risk of immediate habitat conversion is found in developing economies. We are not suggesting that subsidies go to countries that can afford to conserve large portions of their land, such as Canada, Australia, and the United States, but rather that they go to developing economies that incur a large opportunity cost by conserving potentially profitable agricultural lands. Notably, many environmental impacts in emerging and developing economies are driven by overconsumption in developed economies (*52*). Those countries have a moral obligation to reduce these demands [for example, by moving away from an unsustainable model based on promoting environmentally destructive industries in pursuit of infinite economic growth (*14*)] and fund the necessary local conservation efforts.

Our estimate of the land area that requires effective biodiversity conservation to safeguard biodiversity must be considered the bare minimum needed and will almost certainly expand as more data on the distributions of underrepresented species such as plants, invertebrates, and freshwater species become available for future analyses (*76*). Expanding this work as new data become available is a priority for future research. New KBAs are continuing to be identified for underrepresented taxonomic groups, threatened or geographically restricted ecosystems, and highly intact and irreplaceable ecosystems. Species and ecosystems are also shifting during climate change and, as a result, are leading to changes in the location of land that requires effective conservation (*77*), for which we could not account. Future analyses could use our framework to identify the efficacy of the areas we identified in conserving shifting species ranges during climate change. Also, post-2020 biodiversity targets may imply higher levels of ecoregional representation than the 17% used in this study (materials and methods). Higher-resolution assessments at finer spatial scales (particularly, national, or ecoregional for countries that fully encompass multiple ecoregions) using detailed vegetation and ecosystem maps are the logical next step to make this analysis more informative for conservation action. This is important because of large, fine-scale variability in conservation importance, historical conversion rates, and future conversion risk. Many of the species' representation targets (n = 5182, 14.6%) could not be met within areas that have not been converted to human use, emphasizing the importance of restoration in the coming decades. Given the prioritization approach used, any loss of land identified as requiring conservation increases the total area that requires conservation attention, because to meet species and ecoregion coverage targets, the algorithm will be forced to find a less optimal configuration of land areas.

For the aforementioned reasons, our results do not imply that the land our analysis did not identify (the other 56% of Earth's land surface) is unimportant and can be degraded. Much of this area will be important for sustaining the provision of ecosystem services to people, from climate regulation to provisioning of food, materials, drinking water, and crop pollination, in addition to supporting other elements of biodiversity not captured in our priority areas (*6*, *17*). Furthermore, many human activities can affect the entire Earth system regardless of where they occur (e.g., fossil fuel use, pesticide use, synthetic fertilizers, and pollution), so management efforts that focus on limiting the ultimate drivers of biodiversity loss are essential (*78*). Lastly, we have not considered how limiting environmentally damaging development within land area that needs conservation may affect solutions for meeting human needs, such as increasing energy and food demands. Integrated assessments of how we can achieve multiple social objectives while effectively conserving biodiversity at a global scale are important avenues for future research (*79*–*81*).

The world's nations are discussing post-2020 biodiversity conservation targets within the CBD and wider Sustainable Development Goals international agenda. These targets will define the global conservation agenda for the next decade, so they must be adequate to achieve biodiversity outcomes (*10*). Our analyses show that to safeguard biodiversity, a minimum of 44% of land would require conservation attention, through both site- and landscape-scale approaches, which should serve as an ecological foundation for negotiations. Governments failed to meet the CBD's previous Aichi Targets, which suggests a need to reimagine how conservation is done (*82*). If CBD signatory nations are serious about safeguarding the biodiversity and ecosystem services that underpin all life on Earth (*1*, *79*), then they need to recognize that conservation action must be immediately and substantially scaled up in extent, intensity, sophistication, and effectiveness. At the same time, our finding that >1.8 billion people live on lands that require conservation attention further supports the need for substantial shifts in conservation strategies. The implementation of conservation actions must put the rights of Indigenous peoples and local communities, socioenvironmental justice, and culturally appropriate human rights frameworks at their center. We encourage conservation actors, government agencies, and donors to recognize and support this agenda.

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SUPPLEMENTARY MATERIALS

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Materials and Methods
Figs. S1 to S6
Tables S1 to S8
References (*84*–*98*)

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The minimum land area requiring conservation attention to safeguard biodiversity

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Ending biodiversity loss

Land conversion is one of the biggest threats to biodiversity in the modern world. In two related papers, the amount of unconverted land and the degree of connectivity among landscapes were measured, painting a clear picture of both what needs to be protected and the urgency of this task (see the Perspective by McGuire and Shipley). Allan *et al*. found that 44% of terrestrial land must be ecologically sound to prevent major biodiversity losses. Brennan *et al*. found that the most important connectivity routes among protected areas remain threatened by conversion. In both cases, the authors emphasize that much of the needed area is occupied by human populations, emphasizing the importance of improving sustainable cohabitation and ecosystem protection in these regions. —SNV

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