A new analysis of biodiversity and conservation knowledge products to support environmental assessments

Thomas Starnes[1*], Laure Denos[2], Lewis Kramer[3], Francesca A. Ridley[4,5], Tom Scott[6], Simon Tarr[1], Rosamunde Almond[3], Stuart H. M. Butchart[6,7], Heather C Bingham[3], Neil D. Burgess[3,8], Craig Hilton-Taylor[1], Louise Mair[4,5], Philip J. K. McGowan[4,5], Aidin Niamir[9], Andrew J. Plumptre[6,7,10], Thomas M. Brooks[2,11,12*]

1. International Union for Conservation of Nature, Cambridge, UK
2. International Union for Conservation of Nature, Gland, Switzerland
3. United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), Cambridge, UK
4. School of Natural and Environmental Sciences, Newcastle University, Newcastle upon Tyne, UK
5. IUCN Species Survival Commission Global Biodiversity Framework Task Force, Newcastle University, UK
6. BirdLife International, Cambridge, UK
7. Department of Zoology, University of Cambridge, Cambridge, U.K.
8. Center for Macroecology, Evolution and Climate (CMEC), University of Copenhagen, Denmark
9. Senckenberg – Leibniz Institution for Biodiversity and Earth System Research
10. KBA Secretariat, c/o BirdLife International, Cambridge, UK
11. World Agroforestry Center (ICRAF), University of the Philippines Los Baños, Los Baños, Laguna, Philippines
12. Institute for Marine & Antarctic Studies, University of Tasmania, Hobart, TAS, Australia

* corresponding authors: Thomas Starnes (thomas.starnes@iucn.org) & Thomas M. Brooks thomas.brooks@iucn.org)

Abstract

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) second global assessment of the state of biodiversity is in preparation, to be completed in 2028. To support this and other global and regional environmental assessments, we disaggregate three global knowledge products based on IUCN standards (the IUCN Red List of Threatened Species, Key Biodiversity Areas and Protected Planet), by IPBES regions and subregions, units of analysis and direct drivers. We present twenty-one data tables organised in seven thematic data groups: i) threatened species; ii) endemic and exclusive species; iii) trends in downscaled Red List Indices; iv) threat abatement potential ($STAR_T$); v) restoration potential ($STAR_R$); vi) protected and conserved area coverage (and effectiveness); and vii) key biodiversity area numbers and protected area coverage. We also present three novel crosswalks from IUCN countries, habitats and threats to IPBES regions, units of analysis and direct drivers, respectively. These data can readily be used to inform global, regional and subregional assessments of the status of biodiversity and drivers of its change.

Background & Summary

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is undertaking a second global assessment of biodiversity and ecosystem services (second global assessment, hereafter "GA2"). As outlined in the scoping report set out in Annex I to its decision IPBES 11/1 [1], GA2 will be broadly similar in scope to the first global assessment [2] while building on it to avoid repetition or unnecessary duplication. It will therefore assess relevant knowledge that has become available since the publication of first global assessment, and assess progress towards achieving the goals of sustainability and living in harmony with nature. The GA2 got underway with a first authors meeting in Paris in late 2025 and will be considered for adoption by the 15th IPBES Plenary in 2028. The specific objectives of the second global assessment are: a) to support implementation of multilateral environmental agreements and the Sustainable Development Goals (SDGs); b) to support the assessment of progress towards global targets for 2030 and the global goals for 2050 of the Kunming-Montreal Global Biodiversity Framework (KMGBF) and of relevant Sustainable Development Goals and targets; and c) to assess the scientific and technical basis for additional efforts needed to achieve the 2050 Vision for Biodiversity.

Meanwhile, IPBES is also preparing methodological assessments on monitoring[3] and on spatial planning[4] with expected delivery in 2027. Moreover, the Convention on Biological Diversity is undertaking global reviews of collective progress in the implementation of the KMGBF, further to its decision COP 16/32[5], for presentation at its 17th COP in 2026 and 19th COP in 2030, while other multilateral environmental agreements and institutions are planning further environmental assessments at regional and global levels.

To ensure that the GA2 and other global and regional assessments are supported by the most up-to-date and accurate information, it is important to provide regionally and thematically disaggregated data from authoritative global biodiversity and conservation knowledge products. This analysis updates and expands a previous analysis of global biodiversity and conservation knowledge products based on IUCN standards[6], providing updates to regional and global metrics and indicators with the most recent data versions, corresponding to the temporal coverage of GA2, and adding additional metrics.

The three updated knowledge products are;

i) the IUCN Red List of Threatened Species™ (hereafter "IUCN Red List") and derived Red List Index (RLI),
ii) the World Database of Key Biodiversity Areas (WDKBA) and
iii) Protected Planet, underpinned by the World Database on Protected Areas (WDPA).

In addition to these updates, we

i) incorporate the Species Threat Abatement and Restoration (STAR) metric[7] derived from the IUCN Red List;
ii) expand on the Protected Planet knowledge product to include the newly-launched World Database on Protected and Conserved Areas (WDPCA), which combines and replaces the pre-existing WDPA and World Database on Other Effective Area-based Conservation Measures (WD-OECM), and the Global Database on Protected Area Management Effectiveness (GD-PAME);
iii) include new disaggregations of the IUCN Red List by IPBES units of analysis; and
iv) include new disaggregations of the IUCN Red List by IPBES direct drivers of change.

The inclusion of IPBES units of analysis and direct drivers required 'crosswalks' (i.e. translation tables) from the IUCN habitats classification scheme[8] and IUCN-CMP threats classification scheme[9], respectively, which are themselves also novel in this analysis.

The IUCN Red List is the world's most comprehensive information source on the global extinction risk of animal, fungus and plant species. The Red List Index (RLI), based on the IUCN Red List, shows trends in overall extinction risk for species. The Species Threat Abatement and Restoration (STAR) metric, also based on the IUCN Red List, measures the potential of threat abatement ($STAR_T$) and restoration ($STAR_R$) actions at specific locations to contribute to reducing species extinction risk. Key Biodiversity Areas (KBAs) are sites of significance for the global persistence of biodiversity. Protected Planet is the global source of data on protected and conserved areas, including the World Database on Protected and Conserved Areas (WCPCA) and the Global Database on Protected Area Management Effectiveness (GD-PAME). These knowledge products and their derivatives document, respectively, species-level extinction risk, areas of particular importance for biodiversity, and spatial coverage and management effectiveness of protected and conserved areas.

We present twenty-one Data Tables corresponding to the disaggregation of these knowledge products by IPBES region and subregion, IPBES direct drivers and IPBES units of analysis, including three translation tables. The Data Tables are listed in Table 1.

By updating and extending these global conservation knowledge products based on IUCN standards, these datasets provide a reproducible, transparent and policy-relevant foundation for assessing global biodiversity and conservation. It is envisioned that these data will serve as a useful reference for IPBES GA2 *Chapter 3: Status and trends*, particularly the subchapters on *Nature* and on *Direct and indirect drivers*. Data Tables 1–3 and 7a, in reporting the status of and trends in biodiversity, are anticipated to be particularly valuable in supporting assessment of progress towards the KMGBF and SDG targets and goals (particularly relevant to GA2's second objective, as well as the CBD global review), while Data Tables 4–6 and 7b-c, in reporting on conservation progress and opportunities, are anticipated to be particularly valuable in supporting implementation of multilateral environmental agreements and SDGs (particularly relevant to GA2's first objective). As well as supporting IPBES GA2 and the CBD global review, these datasets are intended to be of relevance to the wider research and policy communities, in support of other regional and global environmental assessments.

Each of these datasets are constantly being updated and the data we provide here is the most recent snapshot from the data hosted online by these datasets in December 2025. Users are encouraged to use the databases where they need the latest data. All Data Tables are available in CSV format on Zenodo under a CC BY-NC license[10], following FAIR principles[11] and the IPBES Data and Knowledge Management Policy[12].

Methods

IPBES regions and sub-regions

The IPBES second global assessment will cover all biogeographic and oceanographic zones from the regional to the global level, including terrestrial, inland water, coastal and marine ecosystems. However, the IPBES regions and sub-regions spatial dataset from the IPBES Zenodo repository[13] only covers the terrestrial realm above the shoreline.

For the STAR disaggregations (Data Tables 4a, 4b, 5a and 5b), a basemap of IPBES regions and subregions that includes marine areas based on Exclusive Economic Zones (EEZs) was used for

the spatial analysis[6,14]. For protected and conserved areas (Data Tables 6a and 6b), another basemap is used which is a combination of terrestrial administrative boundaries aligned with UN cartographic guidelines[15], Exclusive Economic Zones (EEZ)[16] and 30-metre resolution global shoreline[17]. The high spatial resolution of the global shoreline dataset provides a more accurate characterization of the terrestrial-marine boundary than previously available. This results in the terrestrial area of small islands and complex shorelines being represented in more detail and improves the accuracy of calculated coverage statistics.

For the other Data Tables, regional disaggregations were compiled by retrieving national and sub-national data and then aggregating to IPBES regions and subregions based on a modified version of the ISO 3166 lookup table from the IPBES Zenodo repository[13]. The lookup table was modified to include Antarctica and Area Beyond National Jurisdiction (ABNJ), which are not included within the IPBES regions but are nevertheless distinct and important areas for biodiversity and conservation.

The assignment of countries or areas to specific groupings is for statistical convenience and does not imply any opinion concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

The modified countries-regions translation table is made available as Data Table 8.

IPBES units of analysis

The IPBES units of analysis were developed during the IPBES first global assessment[2] where they are described in section 1.3.4 (pp. 33-35) and in Supplementary Material 1.5[18]. The seventeen units of analysis represent coarse-scale global land cover types at the level of natural "biomes" and human-modified "anthromes" and are intended to serve as a framework for comparison within and across assessments in a policy context.

Species-habitat associations are recorded in the IUCN Red List according to the IUCN Habitats Classification Scheme (Version 3.1)[8]. The scheme provides a hierarchical, standardised classification of habitats associated with species assessed in the IUCN Red List.

To enable reporting aligned with the IPBES units of analysis, a one-to-many translation table (hereafter "crosswalk") was developed to map classes from the IUCN habitats classification scheme to the most appropriate IPBES units of analysis. The crosswalk was based on an expert-driven approach that evaluated the conceptual correspondence between habitat definitions in the two classification schemes. The crosswalk includes one hundred IUCN habitat classes at level 2 in the classification scheme, plus four habitats at level 1 which have no level 2 specific habitats.

Six IUCN habitat classes were found to have no equivalent in the IPBES Units of Analysis – three level 1 habitats and three level 2 habitats – and these are represented as N/A in the crosswalk. These N/A habitats are reported here with the number of associated species in parentheses: *7.1. Caves and Subterranean Habitats (non-aquatic) – Caves* (n = 1,374); *7.2. Caves and Subterranean Habitats (non-aquatic) – Other subterranean habitats* (n = 405); *15.5 Artificial aquatic - Excavations (open)* (n = 274); *16 Introduced Vegetation* (n = 368), *17 Other* (n = 785); and *18 Unknown* (n = 4,656). Notably, the IPBES Units of Analysis has no explicit representation of subterranean systems, although IUCN habitat class *5.18. Wetlands (inland) – Karst and other subterranean hydrological systems (inland)* was mapped here to IPBES *Inland surface waters and water bodies/freshwater*. IUCN habitat *15.5 Excavations (open)* includes gravel, brick, clay pits, borrow pits and mining pools, which did not have any clear mapping to IPBES Units of Analysis.

Commercial forests were considered in the IPBES first global assessment to fit conceptually within unit 10 Cultivated areas, but they could not be discriminated on a global scale from natural forests (units 1 and 2), so could not reliably be mapped separately[18]. However, recent advances in natural forest mapping may make this distinction possible in the future [19].

The full translation table is made available as Data Table 9.

IPBES direct drivers of change

We followed the IPBES model of direct drivers of biodiversity and ecosystem change (hereafter "direct drivers"). Direct drivers (natural and anthropogenic) are drivers that unequivocally influence biodiversity and ecosystem processes (also referred to as 'pressures'). The IPBES direct drivers are land-use change, climate change, pollution, natural resource use and exploitation, and invasive species[20].

Threats to species are recorded on the IUCN Red List according to the IUCN-CMP Threats Classification Scheme (Version 3.3)[9]. The scheme provides a hierarchical, standardised classification of threats associated with species assessed in the IUCN Red List. In using this hierarchical classification of the drivers of species decline, Assessors are asked to indicate the threats that triggered the listing of the taxon concerned at the most detailed level possible.

To enable reporting aligned with the IPBES direct drivers, a one-to-many translation table (hereafter "crosswalk") was developed to map classes from the IUCN-CMP threats classification scheme to the most appropriate IPBES direct drivers. The crosswalk was based on an expert-driven approach that evaluated the conceptual correspondence between threat/driver definitions in the two classification schemes. The crosswalk includes forty-five IUCN habitat classes at level 2 in the classification scheme e.g. *1.1 Housing & urban areas*, nested within twelve level 1 threats e.g. *1. Residential & commercial development*. For developing the crosswalk table, we considered the forty-five level 2 threats on a case-by-case basis. Ultimately, the crosswalk is effective at level 1 of the IUCN-CMP scheme, but we present the full breakdown at level 2 for completeness.

Some IUCN threat classes can fit multiple IPBES drivers. For example, a tree species might be impacted by logging & wood harvesting through natural resource use and exploitation, while an amphibian species might be impacted by logging & wood harvesting through land/sea use change (habitat loss and degradation). Considering this caveat, we grouped all of IUCN threats 1-4 under IPBES land/sea use change, acknowledging this as a limitation of the crosswalk, and noting that it is important to consider stresses in any analysis of the threats affecting a species.

Note that a new threats classification scheme has recently been published[21] but it is not yet operational within the IUCN Red List and is therefore not used in this analysis.

The full translation table is made available as Data Table 10.

IUCN Red List of Threatened Species

Established in 1964, the IUCN Red List of Threatened Species is the world's most comprehensive information source on the global extinction risk of animal, fungus and plant species. Species extinction risk is assessed into nine mutually exclusive categories according to the IUCN Red List Categories and Criteria[22]. The Red List categories are Not Evaluated (NE); Data Deficient (DD); Least Concern (LC); Near Threatened (NT); Vulnerable (VU); Endangered (EN); Critically Endangered (CR); Extinct in the Wild (EW); and Extinct (EX). Version 2025-2 of the IUCN Red List includes assessments of 172,620 species[23]. For this analysis we included all

comprehensively assessed groups of species. Groups that have been comprehensively assessed are those containing >80% of species evaluated within the described taxon group. Comprehensively assessed groups are cycads, reef-forming corals, amphibians, selected dicots (cacti and protea family), trees, sharks, rays & chimeras, conifers, selected crustaceans (lobsters; freshwater crabs; freshwater crayfishes; and freshwater shrimps), mammals, freshwater fishes, reptiles, selected insects (dragonflies & damselflies), birds and cephalopods (nautiluses; octopuses; and squids).

Data downloaded from the IUCN Red List database included habitats, threats, countries of occurrence and red list categories.

Countries of occurrence

The IUCN Red List assessments include countries of occurrence (COO), which are marked up according to presence, origin and seasonality codes[24]. The data presented in Data Tables 1a-c and 2a-c include only certain distributions, reintroduced species and regionally extinct species (i.e., the figures exclude all uncertain distributions, introduced species and vagrant records). To this end, COOs with presence coded as extant, extinct or possibly extinct were included, whereas those coded as possibly extant or uncertain were removed. COOs with origin coded as native or reintroduced were included whereas those coded as vagrant, origin or assisted colonisation were removed. All COO seasonality codes were included.

After applying the crosswalk to map IUCN country codes to IPBES subregions, a summary was produced of the total numbers and percentages of assessed species per IUCN Red List category per IPBES subregion, for all species (Data Table 1a) and for species exclusively threatened by each IPBES driver (Data Table 2a).

IUCN habitats

For calculating the total number of species per IPBES Unit of Analysis (Data Tables 1b and 2b), all IUCN level 3 habitat codes were truncated to level 2 of the IUCN habitats classification scheme before mapping to IPBES Units of Analysis using the crosswalk table (Data Table 9). Level 1 habitat codes were excluded from the analysis except for 6 – Rocky Areas, which is mapped to IPBES Tundra and High Mountain habitats. Species-habitat associations are coded as suitable (sometimes “major importance”), marginal and unknown. All habitats were included regardless of their importance. Species habitat associations are also coded for seasonality (resident, breeding, non-breeding, passage and unknown). All habitats were included regardless of their seasonality.

After applying the crosswalk to map IUCN habitats to IPBES units of analysis, a summary was produced of the total numbers and percentages of assessed species per IUCN Red List category per IPBES unit of analysis, for all species (Data Table 1b) and for species “endemic” to the IPBES units of analysis (Data Table 2b).

IUCN threats

IUCN Red List threats are marked up with timing, scope and severity, where scope is the proportion of the species’ population impacted by the threat and severity is the expected rate of population decline. Threats with timing ongoing, future, past and likely to return, unknown and null values were included and those with timing in the past and unlikely to return were removed. Threats with slow, significant declines, rapid declines, very rapid declines, causing fluctuations and unknown and null values were included and those with negligible severity or no decline were removed. All threat scopes were included.

For calculating the total number of species per IUCN Red List category per IPBES Direct Driver (Data Tables 1c and 2c), IUCN threat codes at levels 2 and 3 were truncated to level 1 of the IUCN threat classification scheme before mapping to IPBES drivers using the crosswalk table (Data Table 10).

After applying the crosswalk to map IUCN threats to IPBES drivers, a summary was produced of the total numbers and percentages of assessed species per IUCN Red List category per IPBES unit of analysis, for all species (Data Table 1c) and for species exclusively threatened by each IPBES driver (Data Table 2c).

Red List Index

The Red List Index (RLI), based on the IUCN Red List of Threatened Species, shows trends in overall extinction risk for species. The methods and scientific basis for the Red List Index are described in a series of articles[25–28] and also summarised on the IUCN Red List website[29] and in the SDG metadata for Indicator 15.5.1: Red List Index[30].

The RLI was not calculated for every IPBES driver and unit of analysis because some of the disaggregations contained too few species with genuine changes in Red List category to reliably calculate the index. However where RLIs are already available for thematic disaggregations (e.g. invasive species, pollution), they were included in the relevant Data Tables (Data Tables 3a-c).

Species Threat Abatement and Restoration

The Species Threat Abatement and Restoration (STAR) metric quantifies the potential for threat abatement ($STAR_T$) and habitat restoration ($STAR_R$) in any given place to contribute to the reduction of species extinction risk. STAR considers species that are assessed as Near Threatened or threatened (Vulnerable, Endangered or Critically Endangered) on the IUCN Red List and makes the underlying assumption that the complete alleviation of threats to a species would halt population and/or distribution decline such that the species could be downlisted to Least Concern. The maximum $STAR_T$ score per species is determined by the species IUCN Red List extinction risk category (NT = 100, VU = 200, EN = 300, CR = 400). This maximum score per species can be disaggregated spatially and among threats.

The contribution of any given location to the species total $STAR_T$ score is determined by the proportion of the species' global current area of habitat (AOH) present at that location. The contribution of each threat is determined by the scope and severity of each threat documented in the species' IUCN Red List Assessment. The total $STAR_R$ per species is determined by total global extent of potentially restorable AOH for the species relative to the extent of current AOH for the species, and weighted by the species extinction risk. A multiplier is also applied that down-weights $STAR_R$ scores to reflect the lower and slower conservation return on restored habitat compared to threat abatement in existing habitat. $STAR_R$ can similarly be disaggregated spatially (using extent of restorable AOH present in a location) and by threat (in the same way as for $STAR_T$).

$STAR_T$ has been calculated for 9,100 species of terrestrial amphibians, birds, mammals and reptiles at a 1 km x 1 km resolution globally using IUCN Red List 2025-1[31]. $STAR_T$ has also been calculated for 1,646 marine species at a 5 km x 5 km resolution globally using IUCN Red List 2022-1[32]. $STAR_R$ has been calculated for 5,359 species of terrestrial amphibians, birds and mammals at 5 km x 5 km resolution globally using IUCN Red List 2019-2[7].

Key Biodiversity Areas

Key Biodiversity Areas are defined as sites of significance for the global persistence of biodiversity[33]. A site qualifies as a KBA if it meets one or more of eleven criteria relating to threatened species or ecosystems, geographically restricted species or ecosystems, ecological integrity, biological processes, and irreplaceability. KBAs are delineated as geographical areas on land and/or in water with clearly defined ecological, physical, administrative or management boundaries. Each KBA is actually or potentially manageable as a single unit to ensure the persistence of the biodiversity elements for which it is important. The form of management is not prescribed: some KBAs are formally designated as protected areas, others are recognised OECMs, some are managed by local communities or individual landowners, and some have no management in place. Some 16,602 KBAs have been identified to date in virtually all countries and in terrestrial, freshwater and marine environments.

Data on KBAs are held in the World Database of KBAs (WDKBA) managed by BirdLife International on behalf of the KBA Partnership[34]. These data include the data on the sites, as well as the species and ecosystems that qualify the sites as KBAs. Most of the KBA criteria require estimates of the percentage of the global population of a species at a site or the percentage of the global extent of an ecosystem at a site. These quantitative criteria ensure that sites are comparable between countries or regions, making data on KBAs useful for indicators in multilateral environment agreements.

The World Database of Key Biodiversity Areas contained 16,513 KBAs including 16,226 KBAs with spatial boundaries (polygons) and 287 KBAs with only point locations. An additional 89 sensitive KBAs were not included in the analysis. The WDKBA ISO3 and Country columns were used to crosswalk to IPBES regions and subregions for Data Table 7a. Some minor modifications were needed to complete the crosswalk. “High Seas/---” was assigned to ABNJ, “Russia (Asian)/RUZ”, “Russia (Central Asian)/RUY” and “Russia (European)/RUX” were all assigned to IPBES Eastern Europe (the entire Russian Federation is within the IPBES Eastern Europe subregion). Nineteen Hawaiian KBAs were manually assigned to IPBES Oceania subregion. Seven KBAs with country “Transboundary” were excluded from the analysis.

KBA coverage by protected areas and OECMs and their classification as marine, terrestrial and freshwater was calculated following methods used to calculate Sustainable Development Goal indicators 14.5.1[35], 15.1.2[36] and 15.4.1[37] (Data Table 7b).

Total coverage status of each KBA was classified as either complete (≥98%), partial (2-98%) or none (≤2%). Data presented here use the March 2025 release of WDKBA and July 2025 WDPCA (Data Table 7c).

Protected Planet

With its history dating back to a 1959 UN mandate, Protected Planet is the global source of data on protected and conserved areas. A joint product of the United Nations Environment Programme (UNEP) and the International Union for Conservation of Nature (IUCN), managed by the UN Environment Programme World Conservation Monitoring Centre (UNEP-WCMC), Protected Planet’s primary components are the World Database on Protected and Conserved Areas (WDPCA) and Global Database on Protected Area Management Effectiveness (GD-PAME).

The WDPCA was launched in November 2025 and aggregates the previously separate World Database on Protected Areas (WDPA) and World Database on Other Effective Area-based Conservation Measures (WD-OECM). The WDPCA is made up of spatial data and basic descriptive attributes for protected areas and OECMs. Data are compiled primarily from national governments, with additional data provided by the governance authorities of protected or conserved areas, or by actors providing data on their behalf. These data form the official global dataset used to monitor progress towards relevant multilateral environmental agreements, including Sustainable Development Goals (SDG) 14 and 15, and Target 3 of the KMGBF.

Area and percentage coverage values were calculated using the July 2025 version of the WDPCA.

The GD-PAME supplements the WDPCA with descriptive data on assessments of effectiveness (covering management effectiveness and/or governance quality) carried out in protected and conserved areas. From September 2025, the GD-PAME also stores basic data derived from the results of effectiveness assessments, categorised as data on 'design and planning', 'management effectiveness', 'governance quality', and 'conservation outcomes'. The GD-PAME is used to monitor progress towards Target 3 of the KMGBF.

Data Tables

The dataset comprises twenty-one Data Tables is CSV format; eighteen Data Tables organised into seven thematic data groups (Data Tables 1a-7c) and three crosswalk tables that support harmonisation across IPBES regions, units of analysis, and drivers of change (Data Tables 8-10).

All Data Tables presented here are made available under a CC-BY-NC licence from Zenodo[10]. These static records are not regularly updated. For the latest data, visit the respective data repository.

In Data Tables 1a-c and 2a-c, column headers represent the IUCN Red List categories using abbreviations as follows: EX – Extinct; EW – Extinct in the Wild; CR – Critically Endangered; EN – Endangered; VU – Vulnerable; NT – Near Threatened; LC – Least Concern; DD – Data Deficient. Species in categories EW, CR, EN and VU are considered globally threatened.

Data group 1) IUCN Red List of Threatened Species

Columns represent the numbers and percentages of species per Red List category. Extant species include all categories except for those assessed as Extinct (EX). Threatened species are all species assessed as Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). The lower estimate includes threatened and EW species as if all DD species are not threatened, i.e., (EW + CR + EN + VU) / (total assessed - EX). The best estimate includes threatened and EW extant species as if DD species are equally threatened as data sufficient species, i.e., (EW + CR + EN + VU) / (total assessed - EX - DD). The upper estimate includes threatened and EW extant species as if all DD species are threatened, i.e., (EW + CR + EN + VU + DD) / (total assessed - EX).

Species found in Hawaii are recorded in the IUCN Red List as both HAW-HI (Hawaiian Is.) and US (United States). It is not possible programmatically to distinguish between species which occur only in Hawaii versus species occurring in both Hawaii and the mainland United States.

In the Data Tables, Hawaiian species are therefore counted both in the Oceania and North America totals.

Data Table 1a) Numbers and percentages of species per IUCN Red List Category per IPBES region and subregion

Columns as above. Rows represent IPBES subregions.

Data Table 1b) Numbers and percentages of species per IUCN Red List Category per IPBES unit of analysis

Columns as above. Rows represent IPBES units of analysis.

Data Table 1c) Numbers and percentages of species per IUCN Red List Category per IPBES direct driver of change

Columns as above. Rows represent IPBES direct drivers.

Data group 2) IUCN Red List of Threatened Species, endemic and exclusive species

Columns represent the numbers and percentages of species per Red List category. Extant species include all categories except for those assessed as Extinct (EX). Threatened species are all species assessed as Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). The lower estimate includes threatened and EW species as if all DD species are not threatened, i.e., (EW + CR + EN + VU) / (total assessed - EX). The best estimate includes threatened and EW extant species as if DD species are equally threatened as data sufficient species, i.e., (EW + CR + EN + VU) / (total assessed - EX - DD). The upper estimate includes threatened and EW extant species as if all DD species are threatened, i.e., (EW + CR + EN + VU + DD) / (total assessed - EX).

Data Record 2a) Numbers and percentages of endemic species per IUCN Red List Category, per IPBES region and subregion

Columns as above. Rows represent IPBES subregions. Numbers represent the numbers and percentages of species endemic to each IPBES subregion.

Data Record 2b) Numbers and percentages of species per IUCN Red List Category, exclusive per IPBES unit of analysis

Columns as above. Rows represent IPBES units of analysis. Numbers represent the numbers and percentages of species exclusively associated with each IPBES unit of analysis.

Data Record 2c) Numbers and percentages of species per IUCN Red List Category, exclusive per IPBES direct driver of change

Columns as above. Rows represent IPBES direct drivers of change. Values represent the numbers and percentages of species exclusively threatened by each IPBES driver.

Data group 3) Red List Index trends

Columns contain the aggregated Red List Index (RLI) values and the 5^{th} and 95^{th} centile confidence intervals. Confidence intervals are calculated to account for the number of Data Deficient species in each region and the uncertainty over exactly when changes in status occurred, given that assessments are repeated only at multi-year intervals, and therefore the precise value for any particular year is uncertain. RLI values range from 0 to 1, where an RLI

value of 1 equates to all species being classified as Least Concern (i.e., not expected to become Extinct in the near future), and an RLI value of 0 equates to all species having gone Extinct.

Data Table 3a) Red List Index trends per IPBES region and subregion

Columns as above. Rows represent IPBES regions and subregions for years between 1993 and 2020 inclusive.

Index values for Africa are based on data from mammals (1484), birds (2524), amphibians (1164), corals (464), cycads (68). Index values for Americas are based on data from mammals (2042), birds (4706), amphibians (3523), corals (338), cycads (94). Index values for Asia and the Pacific are based on data from mammals (2273), birds (4633), amphibians (1915), corals (744), cycads (142). Index values for Europe and Central Asia are based on data from mammals (569), birds (959), amphibians (128), corals (384); no cycad species occur in Europe.

Data Table 3b) Red List Index trends per IPBES unit of analysis

Columns as above. Rows represent IPBES units of analysis for years between 1993 and 2020 inclusive.

Data Table 3c) Red List Index trends per IPBES direct driver

Columns as above. Rows represent IPBES direct drivers of change and years between 1993 and 2020 inclusive.

Data group 4) Threat abatement component of the Species Threat Abatement and Restoration metric ($STAR_T$)

Columns represent realms (terrestrial or marine), the number of $STAR_T$ cells (~ 1 km x 1 km for terrestrial, ~ 5 km x 5 km for marine, including zero value cells and excluding null cells), the $STAR_T$ score sum (total), mean, median, standard deviation, minimum and maximum $STAR_T$ values. The percentage column is the percentage of terrestrial and of marine $STAR_T$, respectively, so that all values in the column add to 200.

Data Table 4a) Threat abatement component of the Species Threat Abatement and Restoration metric ($STAR_T$) per IPBES region and subregion

Columns as above. Rows represent IPBES subregions.

Data Table 4b) Threat abatement component of the Species Threat Abatement and Restoration metric ($STAR_T$) per IPBES direct driver

Columns as above. Rows represent IPBES direct drivers of change.

Data group 5) Restoration component of the Species Threat Abatement and Restoration metric ($STAR_R$)

Columns represent the number of $STAR_R$ cells (~ 5 km x 5 km, including zero value cells and excluding null cells), the $STAR_T$ score sum (total), mean, median, standard deviation, minimum and maximum $STAR_T$ values. Note that there is not yet a marine representation of $STAR_R$.

Data Table 5a) Restoration component of the Species Threat Abatement and Restoration metric ($STAR_R$) per IPBES region and subregion

Columns as above. Rows represent IPBES regions and subregions.

Data Table 5b) Restoration component of the Species Threat Abatement and Restoration metric ($STAR_R$) per IPBES direct driver

Columns as above. Rows represent IPBES direct drivers of change.

Data group 6) Protected and conserved areas

Data Table 6a) Area and percentage coverage of land and sea by protected and conserved areas per IPBES region and subregion

Rows represent IPBES regions and subregions. Columns report: (i) total terrestrial and inland water area ("total_land_area_km2") and total marine and coastal area ("total_marine_area_km2"), expressed in square kilometres; (ii) total area covered by protected areas, or by protected areas and OECMs, within each IPBES subregion, disaggregated by land and sea (e.g. "pa_oecm_land_area_km2"); and (iii) the percentage of each IPBES subregion covered by protected areas, or by protected areas and OECMs, disaggregated by land and sea (e.g. "percent_pa_oecm_land_coverage").

Data Table 6b) Area and percentage coverage of land and sea by protected and conserved areas with effectiveness assessments per IPBES region and subregion

Rows represent IPBES regions and subregions. Columns report: (i) total terrestrial and inland water area ("total_land_area_km2") and total marine and coastal area ("total_marine_area_km2"), expressed in square kilometres; (ii) total area of protected areas within each IPBES subregion where an effectiveness assessment has been completed and reported, disaggregated by land and sea (e.g. "pa_land_pame_area_km2"); and (iii) the percentage of each IPBES subregion covered by protected areas where an effectiveness assessment has been completed and reported, disaggregated by land and sea (e.g. "percent_pa_land_pame_coverage"). At the time of the analysis, no OECMs with an effectiveness assessment had been reported.

Data 7) Key Biodiversity Areas

Two formulations are presented for understanding the coverage of KBAs by protected and conserved areas.

Data Table 7a) Numbers and mean sizes of KBAs per IPBES region and subregion

Rows represent IPBES subregions. Columns represent the number of KBAs, the mean KBA size in km^2, and the percentage coverage of the subregion by KBAs.

Data Table 7b) Mean percentage coverage of KBAs by protected and conserved areas per IPBES region and subregion

Rows represent IPBES regions and subregions, and areas beyond national jurisdiction, for years between 1980 and 2025 inclusive. Columns represent the coverage of KBAs by protected areas, OECMs, and both protected areas and OECMs combined, and for marine, terrestrial, freshwater and all realms. For each region, an additional set of rows represent the regional totals. This is the formulation used in the SDG indicators[35–37].

Data Table 7c) Percentage of KBAs that are completely/partially/not covered by protected and conserved areas, per IPBES region and subregion

This is another formulation of KBA coverage by protected and conserved areas. Rows represent IBPES regions and subregions, and areas beyond national jurisdiction. Columns represent the protected and conserved area type (protected areas, OECMS, or both), the type of coverage (complete, partial, none, and the percentage of KBAs within the IPBES subregion. Coverage is defined by three classes; covered (≥ 98%), partial (< 98% and > 2%) and none (≤ 2%). For each region, an additional set of rows represent the regional totals.

Translation tables

These are the three crosswalk tables that were created specifically for this analysis in order to harmonise IUCN countries, habitats and threats to IPBES regions, units of analysis and drivers, respectively.

Data Table 8) Administrative units to IPBES regions and subregions translation table

Columns represent IUCN country of occurrence (COO) names and codes, IPBES country names, GID_0 codes from GADM, and ISO 3166-1 alpha-3, IPBES regions and subregions. A notes column records notes for seven subnational country codes used in the crosswalk. There is one row per IUCN full country code, plus seven subnational codes to map to exceptional cases in the IPBES regions[13].

Data Table 9) IUCN habitats classification scheme to IPBES Units of Analysis translation table

The table contains one row per IUCN level 2 habitat from the IUCN habitat classification scheme, plus four level 1 habitats that have no level 2 nested "child" habitat. Columns represent IUCN habitats at levels 1 and 2, the IPBES Unit of Analysis that was used in the crosswalk, and an Alternative Unit of Analysis where a different Unit of Analysis was considered but not ultimately selected for the crosswalk.

Data Table 10) IUCN threats classification scheme to IPBES Direct Drivers translation table

Columns represent IUCN threats at levels 1 and 2 of the classification scheme, and the corresponding IPBES drivers. There is a notes column that contains some nuances relating to some of the relationships between IUCN threats and IPBES drivers. There is one row per IUCN threat at level 2 of the classification scheme.

Technical Validation

IUCN Red List of Threatened Species

All assessments in the IUCN Red List are produced following the IUCN Red List Categories and Criteria, a globally standardised, versioned framework for assessing species extinction risk [22]. The IUCN Red List is centrally managed by the Red List Unit (RLU), which forms part of the IUCN Secretariat. All assessments must be submitted through the RLU, who carry out checks on criteria use, supporting information, consistency, etc, before publishing the assessments. All assessments undergo an independent review process before they can be accepted for publication on the IUCN Red List. This involves at least one expert on the IUCN assessment process reviewing the assessment and agreeing that the data used have been interpreted correctly and consistently, and that uncertainty has been handled appropriately. Each

assessment has a unique assessment ID, assessment date and DOI, allowing for full transparency and tracking of assessments across Red List versions.

Confidence intervals for the number of threatened species were calculated by considering the number of Data Deficient species, with upper and lower limits respectively including or excluding the number of Data Deficient species, and the "best estimate" calculated by assuming that the same proportion of Data Deficient species are threatened as for data-sufficient species. Some 10276 species (14.6%) within comprehensively assessed groups are assessed as Data Deficient as of Red List version 2025-2[23].

Red List Index

The IUCN Red List Index is based on the standardised categories and criteria of the IUCN Red List. The RLI shows trends in the status of groups of species based only on genuine improvements or deteriorations in status (i.e. excluding changes resulting from improved knowledge or taxonomic revisions[25–27]) of sufficient magnitude to qualify species for listing in more threatened or less threatened Red List Categories[22]. For species newly assessed since the beginning of the RLI assessment period, their Red List categories are "back-cast", assuming that the current Red List categories for these species have applied since the earliest assessment period, unless there is information to the contrary that genuine status changes have occurred[27]. Species that are too poorly known for the Red List Criteria to be applied are assigned to the Data Deficient category. The degree of uncertainty this introduces is estimated through a bootstrapping procedure that randomly assigns each Data Deficient species a category based on the numbers of non-Data Deficient species in each Red List category for the set of species under consideration, and repeats this for 1,000 iterations, plotting the 5th and 95th percentiles as lower and upper confidence intervals[30].

Species Threat Abatement and Restoration

STAR scores are derived from data collected in IUCN Red List assessments, for which the process of review and validation is described above. The underlying AoH maps used in the calculation of terrestrial $STAR_T$ were validated according to a two-stage protocol which includes a model-based evaluation of model prevalence (i.e, the proportion of suitable habitat within a species' range), and a second validation using species point localities (presence-only) [31,38]. Additional challenges are inherent in validating the marine AoH maps used in $STAR_T$ and $STAR_R$, largely due to the paucity of suitable species point localities, particularly for validating historical AoH maps used in $STAR_R$. Future updates to marine $STAR_T$ and $STAR_R$ are expected to further explore appropriate validation methods. The STAR scores presented here are estimated from global datasets. STAR scores can be calibrated at the local scale by confirming the species and threats within the area of interest[39].

Key Biodiversity Areas

All Key Biodiversity Areas are identified following the Global Standard for the Identification of Key Biodiversity Areas [33], which provides a standardised, quantitative and repeatable framework for site identification. Each KBA meets one or more criteria with quantitative thresholds specified in the KBA Standard. Uncertainty is documented within the assessment framework and the best available data are used to assess sites against the criteria. Species triggering KBA identification are based on published Red List assessments or, where a Red List assessment is unavailable, based on accepted taxonomic references approved by the IUCN Red List Unit. All KBA proposals undergo multiple stages of independent review by KBA Regional Focal Points and additional external reviewers, before being nominated for a final validation check by the KBA Secretariat. KBA spatial boundaries are also reviewed to ensure that they align with relevant ecological features and management units. Each KBA is assigned

a unique ID. Any modifications to KBA site boundaries, trigger criteria are versioned and traceable. KBA identification has been validated for several countries and regions where comprehensive biodiversity data allow formal calculation of the site importance (or "irreplaceability") using systematic conservation planning techniques[40,41].

Protected Planet

Protected area data in the World Database on Protected and Conserved Areas are based on an IUCN standard that defines protected areas and provides a framework for grouping them by management category[42] and governance type[43]. OECM data in the World Database on Protected and Conserved Areas are based on the CBD definition of an OECM[44] and associated guidance of the IUCN WCPA[45].

Data submitted to the WDPCA by government authorities are considered state verified. Non-state entities can submit data on protected areas or OECMs under their own governance (or on behalf of other non-state governance authorities), and such data are reviewed to confirm they meet relevant standards (IUCN or CBD definition of a protected area or CBD definition of an OECM) prior to inclusion. The review process is conducted either by the relevant national government or through peer-review by Indigenous Peoples and local communities. The latter occurs only for data submitted by Indigenous Peoples or local communities on protected areas or OECMs under their own governance.

The GD-PAME serves as a repository for data collected using different approaches. This includes Protected Area Management Effectiveness (PAME) assessments, which are based on the IUCN WCPA framework for protected area management effectiveness[46]. Data providers are asked to submit high-level information relating to the governance, design and planning, management and conservation outcomes of a protected area or OECM, aligning with the core components of the IUCN Green List Standard[47]. Data in the GD-PAME are not subject to a review process but must relate to a protected area or OECM included in the WDPCA.

Usage Notes

All Data Tables presented here are made available under a CC-BY-NC licence from Zenodo[10]. These static records are not regularly updated. For the latest data, visit the respective data repository.

The IUCN Red List Terms and Conditions of Use (Version 3.1, June 2024) are available at https://www.iucnredlist.org/terms/terms-of-use.

The World Database of Key Biodiversity Areas™ Terms and Conditions of Use (Version 2.0, November 2023) are available at https://www.keybiodiversityareas.org/terms-service.

The Protected Planet Terms and Conditions are available at https://www.protectedplanet.net/en/legal.

For commercial uses of any of these datasets, please go to the IBAT website: https://www.ibat-alliance.org/.

Code Availability

The codes and instructions for running the Red List Index calculations are available at https://github.com/BirdLifeInternational/rli-codes.

The full code used to both calculate coverage of KBAs by protected areas and OECMs and aggregate this to regional levels following SDG methodology is available at: https://github.com/BirdLifeInternational/kba-overlap.

The full methodology used to calculate protected and conserved area coverage at national and global scales is available from the Protected Planet website at https://www.protectedplanet.net/en/resources/calculating-protected-area-coverage.

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Author contributions

TMB and LD conceived and supervised the project. TSt administered the work and wrote the manuscript. LK, FAR, TS, TSt and ST produced the Data Tables. SHMB, TMB, NDB, AN and TSt contributed to the IUCN-IPBES crosswalk tables. RA, SHMB, TMB, HCB, NDB, LK, CHT, LM, PJKM, AN, AJP, FAR and TS contributed to the main text.

Competing interests

The authors declare no conflicts of interest.

Tables

Table 1) List of Data Tables. An extended version of this file is available as a readme CSV file in the data record.

Data Table	Short name	Description
1a	Red List species per IPBES region	Numbers and percentages of species per IUCN Red List Category per IPBES region and subregion
1b	Red List species per IPBES unit of analysis	Numbers and percentages of species per IUCN Red List Category per IPBES unit of analysis
1c	Red List species per IPBES driver	Numbers and percentages of species per IUCN Red List Category per IPBES direct driver of change
2a	Red List endemic species per IPBES region	Numbers and percentages of endemic species per IUCN Red List Category, per IPBES region and subregion
2b	Red List exclusive species per IPBES unit of analysis	Numbers and percentages of species per IUCN Red List Category, exclusive per IPBES unit of analysis
2c	Red List exclusive species per IPBES driver	Numbers and percentages of species per IUCN Red List Category, exclusive per IPBES direct driver of change
3a	RLI per IPBES region	Red List Index trends per IPBES region and subregion
3b	RLI per IPBES unit of analysis	Red List Index trends per IPBES unit of analysis
3c	RLI per IPBES driver	Red List Index trends per IPBES direct driver
4a	STAR-T per IPBES region	Threat abatement component of the Species Threat Abatement and Restoration metric (START) per IPBES region and subregion

4b	STAR-T per IPBES driver	Threat abatement component of the Species Threat Abatement and Restoration metric (START) per IPBES direct driver
5a	STAR-R per IPBES region	Restoration component of the Species Threat Abatement and Restoration metric (STARR) per IPBES region and subregion
5b	STAR-R per IPBES driver	Restoration component of the Species Threat Abatement and Restoration metric (STARR) per IPBES direct driver
6a	PCA coverage per IPBES region	Area and percentage coverage of land and sea by protected and conserved areas per IPBES region and subregion
6b	PAME coverage per IPBES region	Area and percentage coverage of land and sea by protected and conserved areas with effectiveness assessments per IPBES region and subregion
7a	KBA summary per IPBES region	Numbers and mean sizes of KBAs per IPBES region and subregion
7b	KBA PCA coverage trends per IPBES region	Mean percentage coverage of KBAs by protected and conserved areas per IPBES region and subregion
7c	KBA PCA coverage classes per IPBES region	Percentage of KBAs that are completely/partially/not covered by protected and conserved areas, per IPBES region and subregion
8	Admin units - IPBES regions crosswalk	Administrative units to IPBES regions and subregions translation table
9	IUCN habitats - IPBES units of analysis crosswalk	IUCN habitats classification scheme to IPBES Units of Analysis translation table
10	IUCN threats - IPBES drivers crosswalk	IUCN threats classification scheme to IPBES Direct Drivers translation table

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