

Report on the use of indicators in IPBES assessments and other global frameworks

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Version: 2 (May 2024)

DOI: <https://doi.org/10.5281/zenodo.7738965>

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Highlights

- The indicators that describe the socio-ecological system were assessed within global and thematic assessments and compared to indicators proposed by Multilateral Environmental Agreements.
- Extracted indicators were categorised based on the different elements of a socio-ecological system that they describe: 1) Biodiversity, 2) Ecosystems, 3) Ecosystem Services, 4) Direct drivers of change, 5) Human well-being, 6) Governance, 7) Anthropogenic Assets, 8) Knowledge systems, and harmonised for better comparability.
- After harmonising, the dataset consisted of more than 2000 indicators, variables and indices that describe all aspects of the socio-ecological system.
- 30% of the indicators proposed in MEAs are mentioned in assessment reports. IPBES assessments, particularly the Global assessment, take the most advantage of the available indicators and uniquely incorporate indicators that describe Indigenous and local knowledge.
- Previous work delineating core and highlighted indicators, carried out by the IPBES task force on knowledge and data, has been used in IPBES assessments.
- A catalogue of indicators which measure multiple elements of the socio-ecological system is provided including information on the elements they describe and the framework in which they were included.

Rationale

This document presents a comprehensive analysis of the use of indicators in IPBES assessments (the first Global, Values, Sustainable Use and Invasive Alien Species assessments) and compares it with other global environmental assessments and multilateral agreements. The report, along with the accompanying dataset, aims to serve as a valuable resource for IPBES experts engaged in ongoing thematic assessments such as Nexus, Transformative Change and Business and Biodiversity, as well as future endeavours.

Background

Assessing the intricate interactions within socio-ecological systems lies at the heart of IPBES' mission (Díaz et al., 2015; IPBES, 2014). Indicators, which describe the state or changes of biodiversity and ecosystem services, and the broader functioning of socio-ecological systems, play a crucial role in understanding these complex systems and monitoring their changes. Tracking progress toward environmental goals set in Multilateral Environmental Agreements also requires robust descriptors of nature and the environment that can take the form of indicators (e.g., Pereira et al., 2013; Tittensor et al., 2014; Geijzenendorffer et al., 2015).

Indicators are standardised synthetic forms of data, information, and knowledge (i.e., metrics) that facilitate understanding the status, trends or outcomes of specific objects or processes (IPBES, 2019). These metrics can be quantitative measurements (numerical values that represent a certain condition) or qualitative descriptions. These can range from directly measurable parameters (e.g., European human population or Gross Domestic Product) to aggregated indices (e.g., projected biodiversity retention in a landscape under climate change scenarios (IPBES, 2019)). The effectiveness of indicators in measuring natural phenomena depends on the complexity of the object under analysis and how the available data are aggregated and reported (IPBES, 2019).

Quantitative indicators play a key role in establishing a common language and facilitating comparisons across measurements, thereby enabling the envisioned mandate of the platform (IPBES, 2018). Given the proliferation of ecological indicators, driven either by environmental policies (e.g. the endorsement of the Sustainable Development Goals (United Nations, 2017) and the widespread adoption of the Global Biodiversity Framework (CBD, 2022)) and research, standardisation and harmonisation have become imperative. The Biodiversity Indicator Partnership (<https://www.bipindicators.net/>) is an example of such global efforts to promote and coordinate the development and delivery of biodiversity indicators. Another example is the list of core and highlighted indicators for use in IPBES Assessments developed by the IPBES task force on knowledge and data and approved by the Multidisciplinary Expert Panel in 2016, which

was presented during IPBES 5 (IPBES, 2017; IPBES technical support unit on knowledge and data, 2017). In 2020, the technical support unit for knowledge and data harmonised the core indicators and assessed their availability at country or regional-to-global scales (IPBES Technical Support Unit on Knowledge and Data, 2021). The concept of socio-ecological bundles of indicators was also developed recently to organise and structure available indicators incorporating diverse knowledge systems and worldviews. These bundles encompass groups of indicators that address various elements of complex socio-ecological systems and intersect with non-measurable knowledge and disciplines (Krug et al., 2021).

The distinction between indicators, indices, and variables is not always clear. In this report, we use the term indicator very broadly to refer to any measure, variable, or metric that is used to assess or represent some aspect of the socio-ecological system (qualitative or quantitative). Hence, the distinction between indicators and variables has not been made. An index generally summarises various aspects of Nature by combining multiple indicators into a single value or score (Rees et al., 2008). Indices are easier to identify in text extraction because they have the word 'Index' as part of their name but we did not make such a distinction in this report. Indicators, in a science-policy context, can be a proxy for something different from what they measure including metrics that may not have been developed for the specific purpose that is being used in environmental assessments or agreements, for instance, 'Marine Stewardship Council Certified Fisheries' may have been developed to assess the progress of this specific certification but is used as a proxy for sustainable fisheries, which was categorised here as *Specific mention of sustainable use of species/ecosystems within Ecosystem Services*.

Driven by the need of assessment authors to have easily accessible information about the type of indicators available, this report on the use of indicators in IPBES assessments was developed.

Methods

To have a better understanding of the different indicators used in the science-policy arena, indicators (and other metrics) were extracted from assessment reports carried out by major international organisations (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), Intergovernmental Panel on Climate Change (IPCC) and United Nations Environment Programme (UNEP)), as well as from international policies and Multilateral Agreements (MEA) documents.

Sources

The latest global and thematic IPBES assessments were reviewed for this work: i) the Global assessment report on biodiversity and ecosystem services (hereafter Global Assessment or GA) (IPBES, 2019), ii) the Methodological assessment of the diverse values and valuation of nature (hereafter Values Assessment or VA) (IPBES, 2022b), iii) the Thematic assessment of the sustainable use of wild species (hereafter Sustainable Use Assessment or SUA) (IPBES, 2022a) and iv) the Thematic Assessment Report on Invasive Alien Species and their Control (hereafter Invasive Alien Species Assessment or IAS) (IPBES, 2023).

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change. The IPCC prepares comprehensive Assessment Reports about the state of scientific, technical, and socio-economic knowledge on climate change, its impacts and future risks, and options for reducing the rate at which climate change is taking place. The latest report is the Sixth Assessment Report which consists of three Working Group contributions and a Synthesis Report. The Working Group I Contribution to the Sixth Assessment Report (IPCC, 2022) was reviewed here (here on IPCC), as it addresses the most up-to-date physical understanding of the climate system and climate change.

The Global Environmental Outlook (UN Environment, 2019) is a series of reports that review the state and direction of the global environment. It is a global process conducted by the United Nations Environment Programme (UNEP) at regional, national, and local levels around the world. The seventh edition of the Global Environment Outlook (here on GEO) was included in this revision.

Many current MEAs (e.g., GBF, SDGs, UNCCD) explicitly propose indicators to quantify progress towards their targets (Hughes et al., 2022). However, not every target has a supporting indicator, and some targets can be addressed by multiple metrics reflecting different aspects of the target. In December 2022, the Secretariat of the United Nations Convention on Biological Diversity (CBD) released the Kunming-Montreal Global Biodiversity Framework (GBF) which has been adopted by multiple nations in the United Nations Biodiversity Conference (CBD, 2022). This landmark agreement includes four overarching long-term goals to be accomplished by 2050 and 23 action-oriented targets for urgent action over the decade to 2030. The monitoring framework designed to ensure the implementation of the goal and targets included a total of 367 indicators classified in headline (36), component (66) and complementary (265). Headline indicators are high-level indicators that capture the overall scope of the goals and/or targets and have been proposed to be mandatory for national reporting. Component indicators are recommended to be used for monitoring different aspects of the goals and/or targets, whereas

complementary indicators can be used for thematic or in-depth analysis of each goal and/or target.

In July 2017, the General Assembly of the United Nations adopted the Work of the Statistical Commission pertaining to the 2030 Agenda for Sustainable Development (United Nations, 2017) which described a global indicator framework for the Sustainable Development Goals and targets for 2030 (SDGs). This agreement described 17 global goals accompanied by 169 targets. The global indicator framework for SDGs included 249 indicators (234 unique ones).

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was established in 1975 (signed in 1973) and has been joined by 184 Parties and regulates the trade of threatened species. The Conservation of Migratory Species (CMS) was signed in 1979 and became effective in 1983, and currently has 15 Member States that are working towards the Conservation of Migratory Species. The International Consortium on Combating Wildlife Crime (ICWC) was formally established in 2010 and is the collaborative effort of 5 inter-governmental organisations: CITES, UNODC (the United Nations Office on Drugs and Crime), the World Bank and the World Customs Organization (WCO), the Convention on the Conservation of Migratory Species of Wild Animals). 172 Parties joined Ramsar which was established in 1975 to regulate the conservation and sustainable use of wetlands. Lastly, the United Nations Convention to Combat Desertification (UNCCD) joins parties combating desertification.

To have a better understanding of the indicators used in the global policy landscape, the monitoring frameworks of widely adopted MEAs were revised:

- Convention on Biological Diversity, Kunming-Montreal Global Biodiversity Framework (GBF) (<https://www.post-2020indicators.org/>)
- Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development (SDGs) (<https://unstats.un.org/sdgs/indicators/indicators-list/>)
- United Nations Convention to Combat Desertification (UNCCD) (<https://www.unccd.int/>)
- Ramsar Convention (Ramsar) (<https://www.ramsar.org/>)
- International Consortium on Combating Wildlife Crime (ICWC) (<http://www.cites.org/eng/prog/ICWC.php>)
- Convention on Migratory Species (CMS) (<https://www.cms.int/>)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (<https://cites.org/eng/disc/what.php>)

Some of the indicators proposed in these MEAs are composed of multiple measurements (e.g. indicators proposed for SDG 5.5.1 Proportion of seats held by women in (a) national parliaments and (b) local governments). In these cases, we split the indicator according to the measurements suggested (e.g., Proportion of seats held by women in national parliaments and Proportion of seats held by women in local governments). Hence, the total number of indicators identified here might be slightly higher than the ones reported in the agreement documentation.

Taking advantage of previous work of the task force on knowledge and data, IPBES core and highlighted indicators were accessed from IPBES website (<https://ipbes.net/indicators> accessed on January 30th, 2023). 30 core and 42 highlighted IPBES indicators were extracted and included in this report (one of the core indicators was further divided into 3 indicators or individual measurements, percentage of areas covered by protected areas - marine, coastal, terrestrial, inland water).

Data extraction

To assess which indicators have been used in environmental assessments and international policies and agreements, two approaches were considered: i) systematic search of indicators and other metrics in the assessment reports, and ii) extraction of tables and lists of indicators proposed in current MEAs.

The systematic search was carried out using the keywords ‘indicator’, ‘index’, ‘indices’ and ‘indic’. The reports were loaded as PDFs in R using the `pdftools` package v3.3.3 (Ooms, 2023). All paragraphs with a match to these keywords were extracted along with the chapter and page numbers. Each paragraph was carefully read to assess the appropriateness of the indicator found. In many cases, the term indicator is used for an overarching concept, for which one or multiple examples of measurable variables are mentioned. In those cases, the measurable variables were extracted as indicators, rather than the concept that was specified as being an indicator. When appropriate all indicators were extracted from the paragraphs keeping track of which paragraph, chapter, and page they were extracted from.

Supplementary material and annexes to the different assessment reports were also revised. Tables were scraped from the supplementary material of chapters 2 and 3 of the global assessment (Purvis et al., 2019; Brauman et al., 2020; Balvanera et al., 2019), chapter 2 of the sustainable use assessment (Rice et al., 2022; Rice & Ticktin, 2022) and chapter 11 from IPCC.

Regarding MEAs, it was not necessary to systematically extract indicators because they were listed in resolutions and annexes that accompany the main regulatory documents. The following documents were revised:

- The global monitoring framework of Kunming – Montreal Global Biodiversity Framework package in CBD/COP/DEC/15/5 and the associated website (<https://www.post-2020indicators.org/>)
- The Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development in A.RES.71.313 Annex
- Good Practice Guidance on SDG Indicator 15.3.1 “Proportion of Land That Is Degraded Over Total Land Area” in support of UNCCD (Sims et al. 2021)
- The Integrated Framework for wetland inventory, assessment, and monitoring (Ramsar Convention Secretariat 2010)
- The ICCWC Indicator Framework for Combating Wildlife and Forest Crime
- The Strategic Plan for Migratory Species 2015-2023 (2014) and the indicators on CMS-listed and migratory species in UNEP/CMS/ScC-SC4/Doc.8/Rev.1/Annex 3 (BirdLife International 2019)
- The Revised set of indicators to measure progress with the CITES Strategic Vision 2008-2020

Data curation and classification

All extracted indicators were harmonised before combining them to avoid duplicated concepts. The first cleaning step was conducted by removing non-English characters, trailing commas, and spaces and setting indicator names to lowercase. A second cleaning step was then applied harmonising indicators names that refer to the same measurements but are phrased differently among sources (e.g., ‘Red List Index (species used for food and medicine)’ and ‘Red List Index (species used in food & medicine)’). The harmonisation process was automated and documented in open scripts that can be found in the IPBES-Data Organization GitHub repository (https://github.com/IPBES-Data/IPBES_Data_Indicators).

All harmonised indicators were then assigned to a category based on the element of the social-ecological system that they are describing. Following IPBES Conceptual framework (Díaz et al., 2015), 6 types of elements constitute a social-ecological system: Nature, Nature’s contribution to people, Institutions and governance systems and other indirect drivers, Direct Drivers of change, Good quality of life, and Anthropogenic assets. These elements were used as a basis to classify indicators according to the element that was measured or described. To capture different aspects of Nature (Biodiversity and Ecosystems) and Anthropogenic assets (economic and infrastructure assets and knowledge), nine categories of indicators were defined:

1) *Biodiversity*, 2) *Ecosystems*, 3) *Ecosystem Services*, 4) *Direct Drivers of change*, 5) *Human well-being*, 6) *Governance*, 7) *Anthropogenic Assets*, 8) *Knowledge systems* (Table 1). These main categories were further divided into subcategories based on more informative measurements (e.g., *Direct Drivers of change* can be subdivided into drivers related to *climate change*, *pollution*, *land conversion*, *specific mention of overexploitation or unsustainable use*, *invasive alien species*, *(infectious) diseases and natural drivers*, Table A.1). Each harmonised indicator was also assigned to a subcategory.

Boundaries between classes are not always clear-cut and some indicators fall into multiple categories and/or subcategories, therefore classifying indicators is a highly subjective step as others might make different choices. For instance, ‘Severe global bleaching events’ could be considered to be a change in ecosystems within *Ecosystems*, but also as an indicator of climate change in the category of *Direct drivers*, and ‘Proportion of bodies of water with good ambient water quality’ was considered to be an indicator of the state of ecosystems within *Ecosystems*, but it can also be interpreted as a measure of healthy living conditions within *Human well-being*. In addition, the same indicators can be used to describe different processes, introducing another level of subjectivity. In Chapter 2 of the Sustainable Use assessment, indicators representing more than one category were assessed; a small number of indicators (less than 10% per indicator set) represented both an ecological category and a social category (e.g., the ‘Marine Stewardship Council Certified catch’ was classified under *Governance* as well as *Ecological*) (IPBES 2022a). In previous work on core and highlighted indicators done by IPBES, 28 indicators were assigned to multiple categories (e.g., ‘Proportion of agricultural area under productive and sustainable agriculture’ was classified as *Institutions and governance systems and other indirect drivers* and *Direct Drivers*). In cases like these where indicators could fall within multiple categories, a secondary category was allowed. However, as first category we chose the one that mostly describes the metric used. For the above example, ‘Severe global bleaching events’ was classified as ‘Ecosystems’ as the first category and ‘Direct drivers’ as the second category.

Table 1: Main categories of indicators describing the status and/or trends of the different elements of the socio-ecological system.

Categories	Description
Human well-being	Metrics assessing human life quality (including descriptions of ways to live in harmony with nature, measurements of gender equality, freedom, access to food, water, education)
Biodiversity	Metrics related to wild species (including metrics on the status and change of biodiversity)
Ecosystems	Metrics on natural ecosystem’s structure and functioning (including configuration and change of marine, terrestrial and freshwater ecosystems)

Ecosystem Services	Measurement or descriptions of nature's contributions to people (ecosystem goods and services, including valuation of the contributions)
Governance	Descriptors of institutions and governance systems (including measurements of the application of nature-based policies, funding, and international agreements)
Direct Drivers	Factors that cause a direct change on the environment (including metrics on climate change, land conversion, nature over-exploitation, pollution, and species introductions)
Anthropogenic Assets	Financial and infrastructure assets (including measures of income, build-up area)
Knowledge Systems	Information on biodiversity, information on society and socio-economics, specific information on ILK and IPLCs, specific information on human-nature relationships and ILK

The classification of indicators according to the different elements they measure or describe, allowed us to compare the use of indicators within assessments (IPBES, IPCC and GEO assessments), within MEAs (GBF, SDGs, RAMSAR, CMS, CITES, ICCW) and among them. The diversity of indicators within a category and subcategory was explored as well as among categories. Finally, the usage of core and highlighted indicators in IPBES assessments was assessed.

Results

General findings

The extraction process yielded a total of 2101 unique indicators, variables and indices used in environmental assessments and agreements. The systematic search resulted in a total of 1646 indicators, variables and indices used in environmental assessments (Figure 1) whereas the scraping of indicators from MEAs documentation yielded a total of 647 indicators and indices (Figure 2). GA is the assessment that made the most use of indicators (764) followed by IPCC (374) and GEO (223). GBF (307) and SDG (257) are the MEAs with the most proposed indicators.

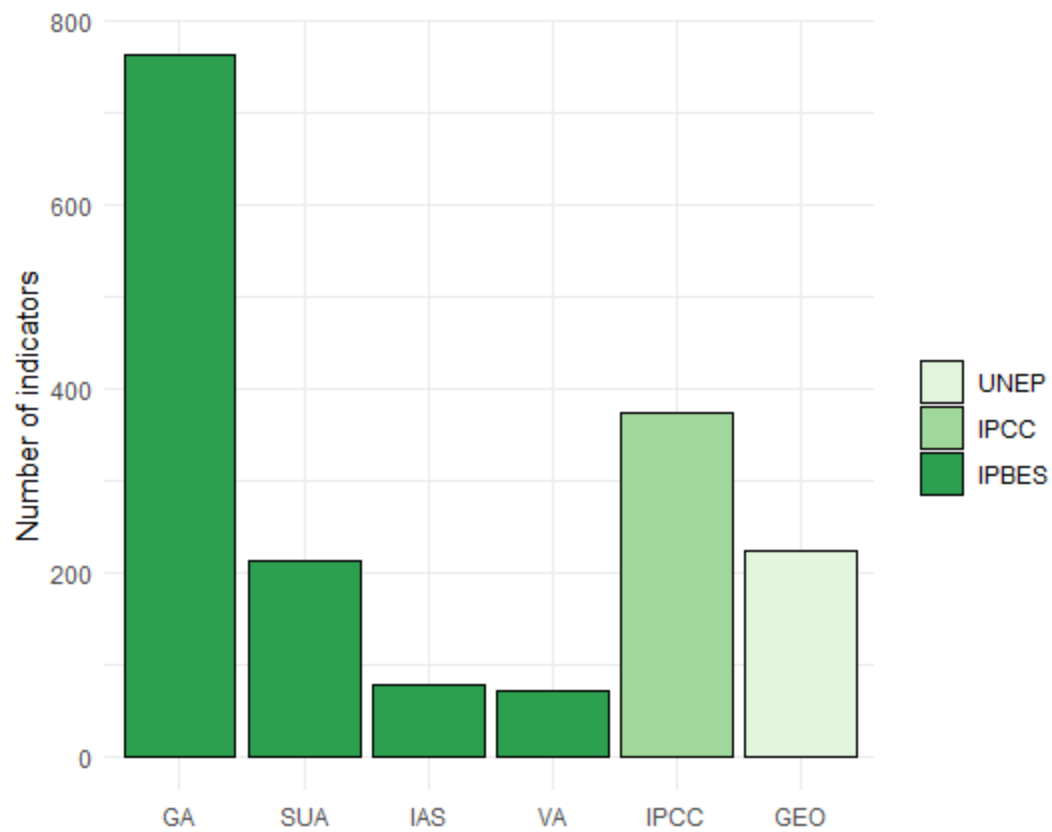


Figure 1: Number of indicators, indices and variables extracted from IPBES, IPCC and UNEP assessments.

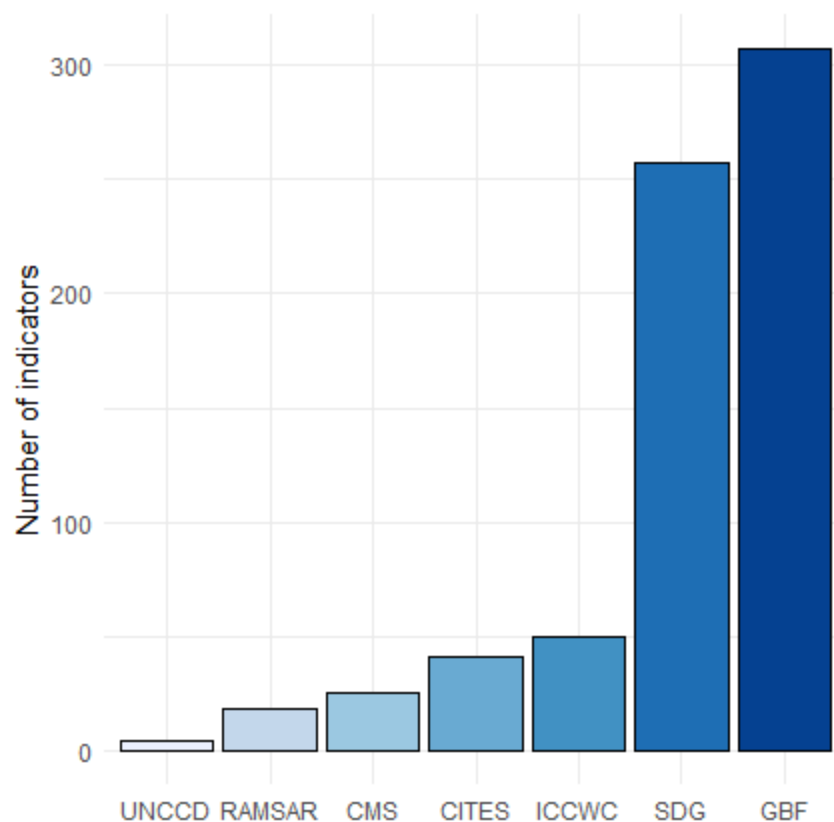


Figure 2: Number of indicators proposed in ongoing MEAs.

Usage of indicators

12% of all indicators, indices and variables found were included in more than one assessment report or MEAs (235 out of 2001). Only 1 indicator, the 'Red List Index', was included in 6 of the 13 sources consulted: all IPBES assessments (except VA), GEO, GBF and SDG. 4 indicators were used in 5 sources: 'Proportion of fish stocks within biologically sustainable levels', 'Proportion of agricultural area under productive and sustainable agriculture and Forest area as a percentage of total land area' are used in GA, SUA, GEO, GBF and SGD, and 'Proportion of land that is degraded over total land area' was used in GA, SUA, GBF, SGD and UNCCD. SUA and SDGs share the most indicators (145) followed by GBF and SDGs (53), SUA and GBF (47) and GA and GBF (42).

The socio-ecological system being described

All aspects of the socio-ecological system are described by the indicators extracted. 27% of the indicators describe different aspects of Ecosystems, followed by 12% of indicators describing *Biodiversity*, *Governance* and *Direct Drivers*. Human Assets, Ecosystem Services, Human Well-Being and Knowledge Systems are described by 10, 9, 8 and 7%, respectively. In total, 356 indicators fell within 2 categories, without a clear pattern of categories that are used together.

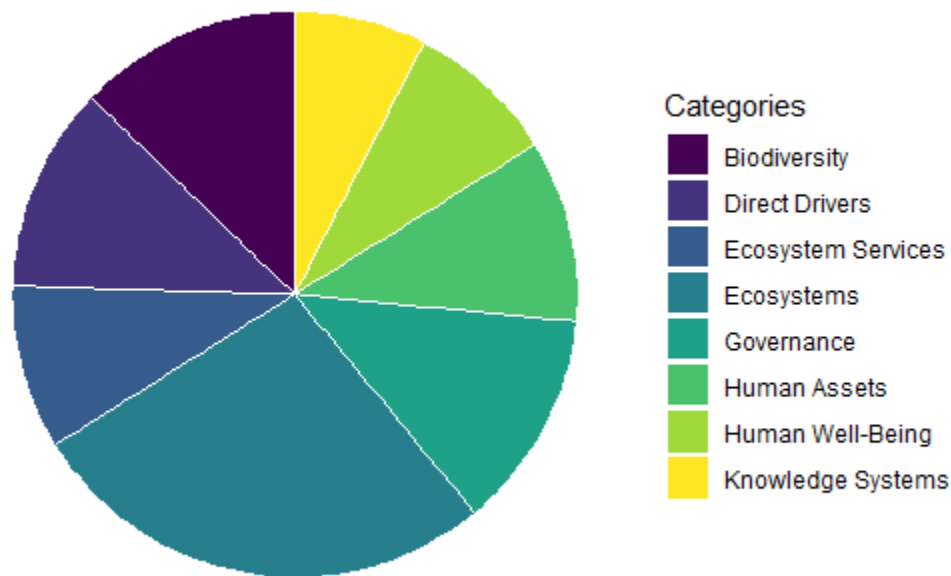


Figure 3: Proportions of indicators describing the different aspects of the socio-ecological system. These results do not include the secondary category.

46 subcategories were identified, 14% of the indicators described *Abiotic Conditions* (within *Ecosystems*), 9% described the *State of Biodiversity* (*Biodiversity*), 7% *Nature-Based Legislation* (*Governance*) and 7% *Nature Contribution to people* (*Ecosystem Services*).

378 Indicators were collected from the Sixth Assessment Report, which were mostly unique: only 3 of them were also found in IPBES assessments, and 4 of them were also included GEO ('World Trade Organisation Greenbox agricultural subsidies' was cited by both the IAS assessment and GEO, resulting in 372 unique identifiers).

MEAs indicators

30% of the indicators proposed in MEAs are mentioned in assessment reports (194 out of 1648). Interestingly, there is not much overlap in the proposed indicators within MEAs, only one indicator (i.e., 'Proportion of land that is degraded over total land area') is proposed in 3 monitoring frameworks (GBF, SDG, and UNCCD), 52 indicators are proposed both in GBF and SDG and 1 indicator is proposed in GBF and UNCCD (soil organic carbon (soc) stocks; Table 2).

Table 2: Counts of unique indicators proposed in different MEAs. *Values in parenthesis indicate the number of total indicators proposed in each MEA.

Multilateral Environmental Agreement	Number of unique indicators proposed*
GBF	253 (307)
SDGs	204 (257)
ICCWC	50 (50)
CITES	41 (39)
CMS	25 (5)
RAMSAR	18 (18)
UNCCD	2(4)
GBF and SDG	52
GBF and UNCCD	1
GBF, SDG and UNCCD	1

The other MEAs have mostly unique indicators as they have very specific, and distinct, topics. For example, the agreements on the ban and regulations of threatened species trade (CITES), on the conservation of Migratory Species (CMS), on combating wildlife crime (ICCWC) and on the conservation and sustainable use of wetlands (RRAMSAR) include indicators with specific information on the parties joining the agreement. Such is the case for CITES ('The number of parties that have been involved in CITES awareness' and 'The number of parties that have criminal (penal) law and procedures and forensic capacity in place, and that use specialised investigation techniques, for investigating, prosecuting, and penalising CITES offences') and CMS ('Trends in awareness and attitudes to migratory species' and 'Trends in the distribution of migratory species'). The ICCWC has similar examples ('The extent of international cooperation to combat wildlife crime', 'The percentage of wildlife crime causes that were prosecuted in court'), As well as Ramsar ('The overall conservation status of wetlands', 'The overall population trends of wetland taxa'). 2 out of the 4 UNCCD indicators are unique ('Trends in land cover', 'Trends in land productivity').

Indicators used in the monitoring or indicator frameworks of the main MEAs include commonly used and already developed metrics or indices (e.g., Red List Index or Species Habitat Index which were particularly developed to assess the status of the different elements in the socio ecological system), as well as variables or other metrics for which the methods are not always straightforward or developed (e.g. indicator on biodiversity information for monitoring the global biodiversity framework).

Governance, Human Assets and Ecosystems are the categories that include the highest number of policy indicators (28%, 18% and 14%, respectively; Figure 4). Within *Governance*, the subcategory *Nature-based legislation* includes 18% of the indicators. Only 1 indicator within the subcategory on *Indigenous and Local Knowledge* is proposed on GBF ('The extent of indigenous peoples and local communities lands that have some form of recognition'). Two other indicators on the subcategory *Specific Information on ILK And LPLC* are included in GBF and CMS ('Number of countries implementing national legislation, policies or other measures regarding FPIC related to conservation (indigenous peoples), if spatial planning was substituted for conservation' and 'Trends in the degree to which traditional knowledge and practices are respected through full integration, participation and safeguards in national implementation of the strategic plan for migratory specie').

The monitoring framework of GBF mostly uses indicators on the *State of Ecosystems, Governance and Biodiversity* whereas SDGs' proposed indicators mostly focus on *Human assets, Governance and Human Well-Being* (Figure 4). ICCWC and CITES also focus on *Governance* (Figure 4).

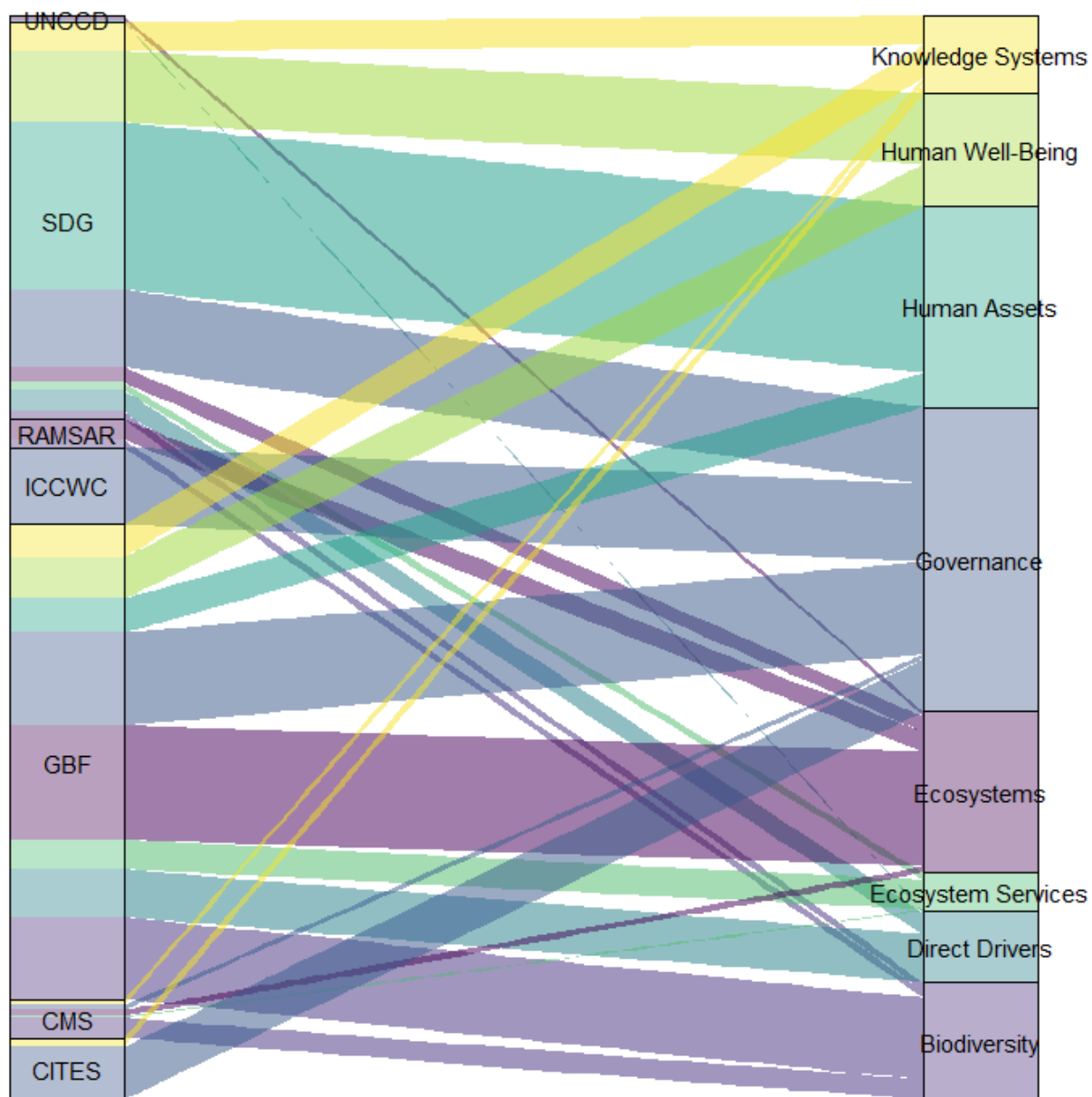


Figure 4: Categories among MEAs. The width of the lines is adjusted to the number of indicators in the category.

Indicators in assessments

Indicators are repeatedly used among assessments, the 'Red List Index' is used in GA, SUA, IAS and GEO. 'Gross Domestic Product (GDP)', 'Human Development Index (HDI)' and 'Gross

National Happiness Index’ are used in all IPBES assessments. 10 indicators are mentioned in 3 assessments: ‘The proportion of fish stocks within biologically sustainable levels’, ‘The proportion of agricultural area under productive and sustainable agriculture’, ‘The Living Planet Index’ and ‘The forest area as a percentage of total land area’ are used in GA, SUA, GEO; ‘Ecological footprint’ and ‘Biodiversity Intactness Index’ are used in GA, VA, GEO; ‘Inclusive wealth’ is used in GA, SUA, VA; ‘The proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species’ is used in SUA, IAS, GEO, the ‘Genuine Progress Indicator’ is mentioned in GA, VA, IAS. The ‘World Trade Organisation Greenbox agricultural subsidies’ is the only indicator that is used in IPCC as well as in GA and GEO. 44 indicators are used in 2 assessments and 1590 are only used once.

Table 3: Counts of unique indicators, indices and variables used in each assessment. *Values in parenthesis indicate the number of total indicators used in each assessment report.

Assessment report	Number of unique indicators used*
GA	721 (764)
IPCC	368 (374)
GEO	192 (223)
SUA	185 (213)
IAS	67 (78)
VA	57 (72)

IPBES assessments

The four IPBES assessments analysed here include 1085 indicators, indices, and variables. 70% of those come from GA followed by SUA (19%), IAS (7%) and VA (6.5%). As mentioned before, there are 3 indicators used in all IPBES assessments (‘Gross Domestic Product (GDP)’, ‘Human Development Index (HDI)’ and ‘Gross National Happiness Index’), and other 3 indicators were used in 3 assessments (‘The Red List Index’ in GA, SUA and IAS, ‘Inclusive Wealth’ in GA, SUA and VA and the ‘Genuine Progress indicator’ in GA, VA, IAS), 27 indicators were used in 2 assessments, and 1052 were only used once. Regarding the previous work of the IPBES Data and Knowledge Task Force, all core and highlighted indicators were used in the analysed IPBES assessments.

Biodiversity, *Ecosystems Services* and *Ecosystems* are the categories that include the most amount of policy indicators (19%, 15% and 14% respectively; Figure 5). Within *Biodiversity*, the subcategory of *State of Biodiversity* includes 13% of the indicators, whereas *Nature*

Contributions to People (within *Ecosystem Services*) represent 11% of the indicators in IPBES assessments.

Compared to other environmental assessments, IPBES specifically incorporates indicators that measure or describe Indigenous and Local Knowledge (ILK), for example, the use of different indigenous calendars for foraging or hunting or the recognition of forest management knowledge and skills of local people. 9 out of the 13 indicators on ILK are included in GA.

GA mostly uses indicators on *Biodiversity*, *Ecosystems Services* and *Ecosystems* whereas SUA uses mostly indicators on *Governance* and *Human Assets* (Figure 5). ICCWC and CITES also focus on *Governance* (Figure 4).

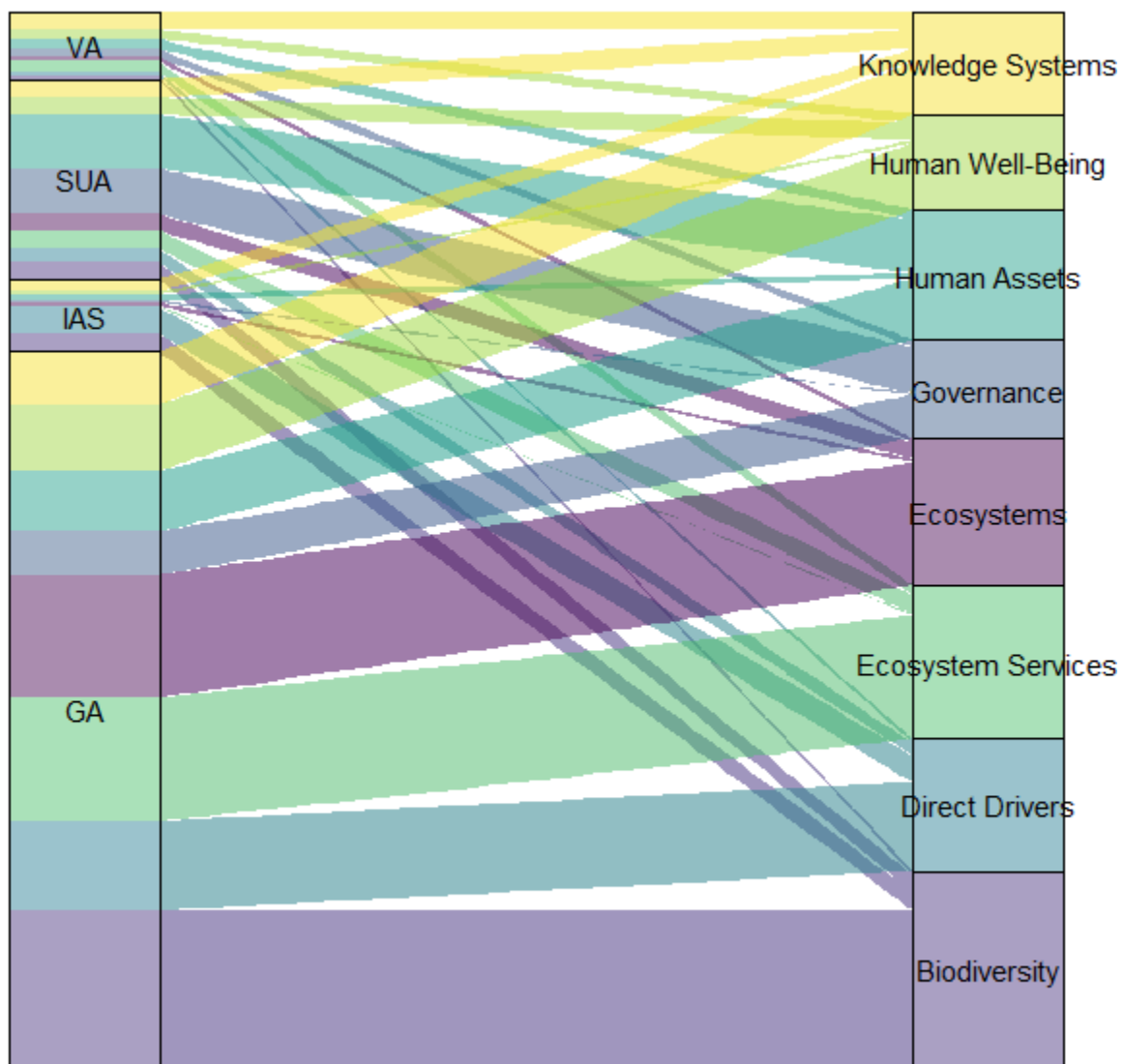


Figure 5: Categories among IPBES assessments. The width of the lines is adjusted to the number of indicators in the category.

Conclusions

No comprehensive list of global indicators that describe or measure the elements of the socio-ecological system currently exists. Even though this report does not intend to cover all available indicators, it aims to create a catalogue of indicators that have been previously used within IPBES and other global frameworks. The dataset that goes with this report (IPBES-TSU-KND-2023-Indicators-Dataset-v2) includes all indicators, variables and indices extracted from IPBES, IPCC and GEO assessments and proposed in seven Multilateral Environmental Agreements (Sustainable Development Goals, Global Biodiversity Framework, RAMSAR, Conservation of Migratory Species, International Consortium on Combating Wildlife Crime, Convention on International Trade in Endangered Species of Wild Fauna and Flora, United Nations Convention to Combat Desertification), and is a valuable resource for IPBES assessment experts who are interested in identifying and selecting qualitative and quantitative metrics and descriptors of the socio-ecological system. An example of such usage is the current work of experts from the Thematic assessment of the interlinkages among biodiversity, water, food and health (Nexus assessment) who, using this resource, have addressed accessibility and spatiotemporal resolution of a subset of indicators to be used in the assessment.

The list of indicators also provides a rough quantitative summary of the focus of the respective report and MEA as users can easily identify the content of the report from the types of indicators used. For instance, many of the MEAs propose indicators that are only included in that agreement or policy as they have very specific, and distinct, topics and include indicators specifically designed to measure parties' participation on the underlying topic. We acknowledge that many more environmental agreements are not included in this analysis, some, like the Cartagena Protocol on Biosafety (2003) and the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of the Benefits arising from their Utilization (2010), could be considered next. Others, such as the Commission for the Conservation of Antarctic Marine Living Resources, the Convention on the Protection and Use of Transboundary Watercourses and International Lakes or the African-Eurasian Migratory Waterbirds are focused on specific regions rather than globally.

The methods used for this analysis could be improved, including automatizing the strings extraction process to reduce subjectivity in the following interpretation and validation of the paragraphs extracted, and further harmonising the extracted indicators to reduce duplication in the concepts measured. A sensitivity assessment can also be carried out to assess the quality of

the manual validation process. We acknowledge that many more environmental agreements could be included in this analysis, some, like the Cartagena Protocol on Biosafety (2003) and the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of the Benefits arising from their Utilization (2010), could be considered for future work. Others, such as the Commission for the Conservation of Antarctic Marine Living Resources, the Convention on the Protection and Use of Transboundary Watercourses and International Lakes or the African-Eurasian Migratory Waterbirds are focused on specific regions rather than globally.

The classification schema used to characterise indicators can be adapted to diverse needs and the categories identified are not formal and rigid classes. To reduce the subjectivity introduced during the classification and harmonisation of indicators, all input data is openly available including all sources with original indicators, harmonised indicators and categorised indicators linked via a unique id. This allows each step of the process to be traced back to the source.

Assessment experts and authors will benefit from this report and the dataset produced. The workflow used for this work (an R script) as well as the source data and the list of indicators extracted can be accessed via GitHub¹.

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¹ https://github.com/IPBES-Data/IPBES_Data_Indicators

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Annex

Table A.1: Categories and subcategories of indicators according to the elements of the socio-ecological system they represent.

Categories	Subcategories	Description
Biodiversity	State of biodiversity	Status of populations, communities and/or species.
	Change in biodiversity	Change or trends in populations, communities and/or species
	Genetic resources	Information, access and/or safehouse of species genetic resources
Ecosystems	State of ecosystems (coverage)	Extent of natural ecosystems (this sub-category is only applied to terrestrial ecosystems)
	State of ecosystems (configuration)	Configuration (fragmentation, connectivity) of natural ecosystems (this sub-category is only applied to terrestrial ecosystems)
	State of ecosystems (integrity)	Integrity (quality) of natural ecosystems (this sub-category is only applied to terrestrial ecosystems)
	State of ecosystems (marine)	Extent, configuration, and quality of marine ecosystems
	State of ecosystems (freshwater/coastal)	Extent, configuration, and quality of freshwater and coastal ecosystems
	State of ecosystems	Extent, configuration, and quality of ecosystems where no realm or other differentiation was done
	Change in ecosystems	Change or trends in natural ecosystems
	Area conservation	Measures of protected areas, OECMs and indigenous lands
	Restoration efforts	Status of restoration or regeneration activities
	Species conservation	Species conservation status and/or action
Ecosystem Services	Sustainable use of species/ecosystems	Sustainable use of Nature
	Unsustainable use of species/ecosystems	Unsustainable use of Nature (explicitly unsustainable or illegal)
	Monetary nature contribution	Economic valuation of ecosystem services
	Nature contribution	Nature's Contribution to people (i.e., ecosystems services) with no differentiation between sustainable/unsustainable use or monetary/intrinsic values
Anthropogenic Assets	State of economy	Financial assets such as investments, loans, GDP
	Build-up area	Metrics on human infrastructure
Scientific information	Information on biodiversity	Information status on biodiversity (data on species, number of assessments, and knowledge gaps)
	Information on society	Information status on social aspects (population trends, growth, etc.)
	Information on ILK and IPLC	Information status on indigenous and local communities (IPLC areas, indigenous peoples' populations)

Categories	Subcategories	Description
	Information on human-nature relationship	Actions describing people living in harmony with nature (recycling programs, environmental education)
	Socio-economical information	Information status on socio-economical aspects
ILK	ILK	Indigenous local knowledge (local calendar, artisanal management, linguistics)
Direct Drivers	Land conversion	Metrics on habitat loss, land use change
	Pollution	Measurements of air and/or water pollution
	Exploitation	Over-exploitation of nature, human footprint, hydroelectric developments
	Climate change	Metrics of climate change and their effects
	Invasive alien species	Introductions, establishments, spread and impacts of invasive alien species
	Natural drivers	Natural disasters or extreme weather events
Human well-being	Wellness	Descriptions of happiness, general human wellness
	Healthy living conditions	Metrics of environmental conditions required for a healthy livelihood
	Access to jobs/income	Metrics on job/income, poverty
	Access to food	Food availability
	Access to health	Healthcare availability
	Access to education	Education availability
	Cultural diversity	Descriptions of race and ethnicity diversity, identity
	Equity	Gender, age and disability equality and justice
	Freedom of choice	Descriptions liberty, the possibility to make one's own choices
	Human consumption	Measurement of food and other resource consumption and food waste
Governance	Nature-based funding	Programs involving funding for conservation/restoration/climate change
	Legislation/governance	Descriptions of institutions and governance systems
	Nature-based legislation	Legislation that supports nature-based and climate mitigation solutions
	Anti-nature legislation	Legislation that supports extractive and non-sustainable activities
	National/international cooperation	International legislation, cooperations, agreements, migration treaties
	Legislation regarding ILK and IPLC	Legislation on ILC
	Broken governance	Measurements of corruption, broken laws, violence, assault, injustice