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UNEP

Design and development of integrated indicators for the Sustainable Development Goals

Report: Senior Expert Meeting

3-5 December 2014, Gland, Switzerland

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Executive Summary

As part of the United Nations support to member countries in the development of the Sustainable Development Goals and following on from UNEA Resolution 1/4, UNEP organized an expert workshop on integrated indicators and the data revolution. The main aim was to develop integrated indicators which could support multiple goals and targets, using semantic networks and ontologies, relevant up-to-date information and where needed big data derived from earth observation and mobile platforms.

The multi-disciplinary nature of large-scale monitoring creates a complex collaborative setting characterised by a broad and varied knowledge-base. Ensuring that entities in this environment are clearly represented on a semantic level can greatly enhance the gathering, retrieval, querying, handling, sharing, analysis, and reuse of data by diverse systems and communities, and ultimately the generation of indicators based on a common understanding and set of protocols. The discipline of ontology has much to contribute towards this aim in information-rich systems.

An ontology attempts to systematically identify, in simple (i.e. as 'low-level' or empirical as possible) and precise terms, what the component entities in domains of interest are and how they relate to one another. This is done by creating a defined and logically-structured vocabulary comprising classes and the relations between them. A series of six ontologies were used as a basis for the development of integrated indicators in six environmental areas, air quality, water quality, biodiversity, oceans, chemicals and waste, and land tenure.

Domain	Ontology	Citation or URI
Chemical entities of biological interest	CHEBI	(Degtyarenko et al., 2008)
Human disease	DOID	http://purl.obolibrary.org/obo/doid.owl
Environments and ecosystems	ENVO	(Buttigieg et al., 2013)
Phenotypic qualities	PATO	http://purl.obolibrary.org/obo/pato.owl
Populations and communities	PCO	(Walls et al., 2014)
Cross-species anatomy	UBERON	(Mungall et al., 2012)

The aims of the workshop were to:

i) determine the key semantics, ontologies and definitions for the six areas in order to develop common frameworks for integrated indicators across domains

ii) Identify potential comparable baseline data and statistics for existing indicators and measurements, protocols for their use and where new and/or disaggregated data and statistics would be needed.

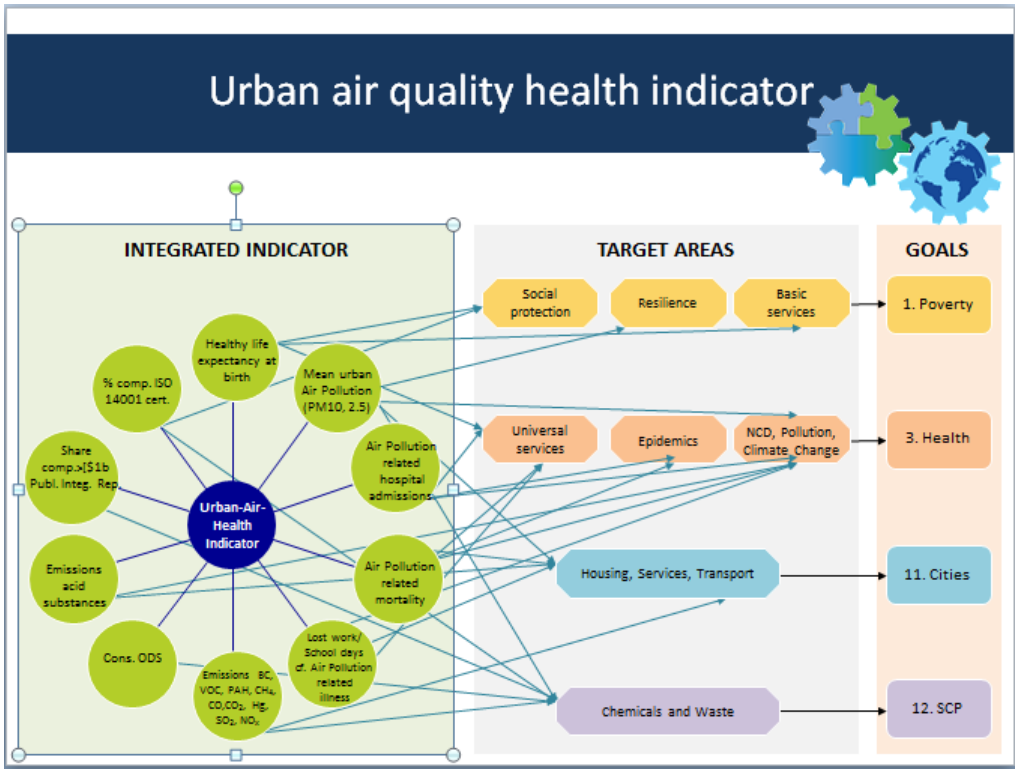
The general conclusions from the meeting were:

- Despite the numerous processes currently ongoing at the global, regional, sub-regional and national levels which aim to promote and support the development and use of indicators, specific work on alignment of domains is needed to be able to develop indicators to measure progress in an integrated and systematic way.
- The six focus areas, air quality, water quality, biodiversity, chemicals and waste, land tenure and oceans, were found to be causally linked to all 17 proposed SDGs, and to underpin their successful delivery.
- The complexity of interactions between thematic areas could be captured through a core set of integrated indicators based on well-aligned domain ontologies.

- To fully support the SDGs, additional ontologies will need to be developed, for example in land and common resources.

Environmental themes

1. **Air quality,** especially in cities, is important to the achievement of all 17 SDGs; the thematic group identified indicative linkages to all SDGs. The overarching SDG objective for air quality can best be achieved through up-to-date assessments of urban emissions, including the estimation of exposures in urban populations and vulnerable groups, and assessments of the short and long-term health impacts. Existing indirect and direct indicators, plus a new design for a global indicator based on an ontology for urban air quality health were identified. The integrated indicator is based on new global data sources derived from satellites and sensor-web enablement to provide air pollution exposure maps for vulnerable groups in cities.



2. For **biodiversity and ecosystem services**, there are numerous processes currently ongoing at the global, regional, sub-regional and national levels that aim to promote and support the development and use of indicators. An analysis of the suite of BIP indicators developed under the CBD framework highlights the relevance of existing BIP indicators to the SDG targets. Of the 60 BIP indicators, 25 are cross-cutting in nature and indicate progress towards multiple SDGs. Key to the development of integrated indicators will be the connection to ecosystem services, resilience and the system of environmental and ecosystem accounting.

3. **Sound management of chemicals and wastes** is essential for sustainable development through its linkages with poverty reduction; gender; water and air pollution, health, agriculture and food safety, industrialization and economic growth.. Sound management of chemicals and wastes provides solutions not only to environmental concerns but also social and economic issues. Proposed indicators are focused under the proposed goals and targets that explicitly mention chemicals, while recognizing that mainstreaming chemicals under the other domains is important in order to capture the complexity of chemicals management and its relationship with sustainable development. The development of

integrated indicators would need to be aligned with the 10 Year Framework Programmes on Sustainable Consumption and Production Patterns (10YFP).

4. Current indicators for **common land and natural resources**, pertaining to rangelands, forests, wetlands, and the natural resources above and below ground, often do not adequately capture the complexity of diverse, flexible and periodic tenure rights and regimes, of the important role that reciprocity and non-marketed goods, services and relationships play, or the voice of users themselves. Data are generally patchy, and definitions and methodologies vary across countries. But the sustainable management of common lands and natural resources can provide substantial benefits to indigenous peoples and local communities (IPLC), to the poor in rural areas, to the health of ecosystems, and downstream benefits such as the water supply of cities. It is therefore urgent to measure progress on this issue in a more systematic manner. There were two types of indicators considered, namely a) those that focus on the existence of IPLC rights, governance, and equitable distribution of benefits, as expressed either in area of land or percentage of people, and disaggregated by gender, ethnicity, age group, land-user group, or other parameters of inequality, both within communities and in comparison with national averages, and b) those that focus on how the rights are exercised and practiced, on the extent of loss or gain of common lands and natural resources, and on how the land and natural resources are used and managed.

5. In addressing **oceans**, a number of issues are highlighted which need to be taken into account more broadly, including the ontology of rights, and benefit sharing. Ocean problems are linked to land-based problems, and experts on both themes need to work together to ensure that these inter-linkages are property reflected in any integrated approach. Connectivity of ecosystem services should also be reflected in the indicators, as well as mainstreaming the value of ocean ecosystem services in national level measures of progress and outcomes. The group developed an approach for developing 4 integrated indicators for the ocean goal: Small-Scale Fisheries; Industrial fisheries (capture fisheries and aquaculture); Coastal and marine Development and Areas beyond national jurisdiction (ABNJ).

These indicators address that address the following issues: Decent work - Food security - Profit and income - Inclusion in decision making - Ecosystem health ("ecological foundation"). Further indicators to be defined include Tourism and Pollution. A revised map of ontologies for Oceans was developed.

6. **Water quality** is relevant to social, environmental and environmental aspects of sustainable development. Water quality is closely linked to all the other environmental themes discussed. These links are partially reflected by the proposed targets, e.g. the sound management of chemicals proposed in target 12.4 that directly relates to eliminating dumping and minimizing release of hazardous chemicals stated in target 6.3. Any indicator development will benefit from using a causal systems framework taking into account functional and contextual relations as defined through well-aligned ontologies such as environments (ENVO), location (GAZ), and populations and communities (PCO). These links need to be considered in future indicator development. A closer collaboration especially with the biodiversity and chemicals & waste communities is necessary. Five proposed core indicators are feasible but their implementation requires additional efforts in terms of monitoring coordination. Ontologies could augment global monitoring systems and indicator application but considerable harmonization work is necessary. Large-scale water quality modelling can help to bridge the data gaps and support indicator application but requires careful analysis and clear communication of model-related uncertainties.

Key Conclusions and Way Forward

1. Integrated indicators, based on universal data and information sources, need to be developed for the SDGs. The indicators will need to be balanced, robust, coherent, comprehensive, accurate and comparable.

2. To ensure the integrity of the SDG indicators it will be crucial that the inter-linkages amongst concepts and classes of processes and entities are clearly defined. This allows data gathered from one

domain to be deployed successfully in another. For example, being able to use sectoral data such as catches from local fisheries in analyses of nutrition and food security.

3. Ontologies are well recognized in this regard. They are widely used in knowledge engineering, artificial intelligence and computer science; in applications related to areas such as knowledge management, natural language processing, e-commerce, intelligent information integration, bio-informatics, education; and in new emerging fields such as the semantic web.

4. The design of indicators based on the use of ontologies and the semantic web avoids the risk of extensive redundancy in data gathering and ensures that different data and statistics standards can be used together.

5. A series of indicator-ontology workshops are currently underway with a view to offering a pilot set of integrated indicators in the areas linked to a minimum level of social and environmental protection, ensuring equity and prosperity within the Earth's life support systems and increasing capital for greater resilience and intergenerational equity. These workshops involve scientists and researchers from all the major disciplines plus ontology engineers, in order to rapidly progress the underpinning framework for the SDGs.

Workshop Details

Facilitators: Jacqueline McGlade, UNEP Chief Scientist, UNEP and Maryam Niamir-Fuller, *Special Advisor to the Executive Director on Post 2015/SDGs, UNEP*

Secretariat: Ludgarde Coppens, DEWA, UNEP

1. Background

As part of the United Nations support to member countries in the development of the Sustainable Development Goals and following on UNEA Resolution 1/4, UNEP has been requested to help establish relevant up-dateable quality assured environmental data flows and indicators. This work is to be undertaken in collaboration with member countries, multilateral environmental agreement secretariats, relevant UN agencies and programmes, centres of excellence, research programmes business and experts, and developed as part of UNEP Live (http://unep.org/uneplive).

UNEP is working with a range of partners to identify ways in which appropriate and integrated measurements can be developed to assess progress on the inter-linkages between environment and other dimensions. Such measurements, whilst challenging to develop and implement, will help to enhance monitoring of the three dimensions of sustainable development, as well as the objectives of the Rio+20 and Post 2015 processes, namely: integration and achieving a transformative and ambitious agenda. Overall, it will require a robust, transparent and multi-stakeholder monitoring and reporting framework to ensure that progress towards meeting goals is effectively tracked and that stakeholders are mutually held accountable for action and delivery.

UNEP's efforts build on existing work with various partners, including inter alia the Climate and Clean Air Coalition (CCAC), the Global Water Assessment, 10 -Year Framework of Programmes on Sustainable Consumption and Production, WAVES and UN SEEA, UN-Oceans, and the Global Call to Action on Community Land Rights. It will draw on and contribute to work being undertaken on indicators for the Post 2015 process, including by the UN Statistical Commission and the Sustainable Development Solutions Network. Eminent scientists and practitioners, UN partners including co-lead Agencies in the UNTST process and the UN Statistical Division, and civil society and private sector partners will be invited to collaborate.

Six areas have been selected because of their inter-linkages across the social, economic and environmental aspects of sustainable development: air quality, water quality, biodiversity, chemicals and waste, land tenure and oceans. The meeting was run as a combination of plenary sessions and parallel working groups.

The aims of the workshop were to support and provide input into the Post-2015 UN-Agency work on monitoring of SDGs by:

iii) determining the key semantics, ontologies and definitions for the six areas in order to develop common frameworks for integrated indicators across domains

iv) Identifying potential comparable baseline data and statistics for existing indicators and measurements and where new and/or disaggregated data and statistics will be needed.

2. The use of ontology in the context of environmental monitoring

Expert: *Pier Luigi Buttigieg, HGF MPG Group for Deep-Sea Ecology and Technology, Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung*

The following introduction is a condensed version of 'A brief encounter with ontology in the context of environmental monitoring', PL Buttigieg, which is available on the UNEP Live CoP (http://uneplive.unep.org/community/groups/profile/5713/integrated-measures-for-monitoring) Please refer to the original paper for references used.

The multi-disciplinary nature of large-scale monitoring creates a complex collaborative environment characterised by a broad and varied knowledge-base. Ensuring that entities in this environment are clearly represented on a semantic level can greatly enhance the gathering, retrieval, querying, handling, sharing, analysis, and reuse of data by diverse systems and communities. The discipline of ontology has much to contribute towards this aim in information-rich systems.

An ontology attempts to systematically identify, in simple (i.e. as 'low-level' or empirical as possible) and precise terms, what the component entities in some domain of interest are and how they relate to one another. This is done by creating a defined and logically-structured vocabulary comprising classes and the relations between them (*for illustration, see Figure 1*).

A fully realised ontology differs from a glossary, vocabulary (controlled, structured, or otherwise), taxonomy, or thesaurus in several). For example, **classes in ontology represent conceptual rather than textual entities**: the textual representation of a given class is merely a label and alternative labels can be added as synonyms. Class definitions and logical relations to other classes take precedence in identifying their meaning. As long as collaborators agree on the class' position in the conceptual map (*see Figure 1*), they can add and use their own labels while availing of homogenous semantics. Further, **every sub-class inherits all the properties of its super-class**. For example, given a class 'rainforest', the subclass 'tropical rainforest' inherits all the properties of its super-class; however, it is differentiated from other types of rainforests by some property, 'tropical'. This formalism is among several which impose logical constraints on ontological classes which contribute to clear communication both between human and machine agents.

It would be overly ambitious and vastly cumbersome to model the diverse knowledge in this environment with a single, monolithic ontology managed by a single authority. The solution is to **distribute the tasks of modelling** each "orthogonal" (i.e. largely unrelated) domain to several domain-specific expert groups. Each of these groups would follow the same development model and interoperate both on the theoretical and technical level. A workable template for this model has been established in the life sciences in the form of the OBO Foundry (Smith et al., 2007).

Well-aligned domain ontologies can easily import portions of one another to create compound concepts that are, instantaneously, linked to all knowledge models involved**.** To illustrate, consider the environment class 'gut environment'. A class such as 'digestive tract' can be imported from an anatomy ontology such as UBERON (Mungall et al., 2012) and combined with an environment ontology's (e.g. ENVO; Buttigieg et al., 2013) concept of an environment determined by a specific material entity to create a new class, 'digestive tract environment'. The knowledge represented in both ontologies would then be linked and exploitable while the concept stands adequately represented. Similarly, concepts such as 'contaminated soil' or 'heavy metal enriched wastewater' can be constructed using ENVO and CHEBI (Degtyarenko et al., 2008). *Table 3.1* lists a few OBO-Foundry-linked ontologies that are likely to

provide good starting points in the development of an application ontology for environmental monitoring. (See the OBO Foundry homepage for more: http://www.obofoundry.org)

Table 2.1: Examples of domain ontologies primarily used in the biomedical sciences

Domain	Ontology	Citation or URI
Chemical entities of biological interest	CHEBI	(Degtyarenko et al., 2008)
Human disease	DOID	http://purl.obolibrary.org/obo/doid.owl
Environments and ecosystems	ENVO	(Buttigieg et al., 2013)
Phenotypic qualities	PATO	http://purl.obolibrary.org/obo/pato.owl
Populations and communities	PCO	(Walls et al., 2014)
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As a welcome 'side-effect' of their logical character, **ontologies – or, at the very least, an ontologically-flavoured development approach – can assist in developing coherent and robust standards which are poised for conversion to machine-readable representations**. Casting knowledge in an ontological form encourages the 'teasing apart' of concepts into their (more or less) empirical parts, which prevents unstructured debate over nebulously-defined, inter-domain inconsistencies when they arise. Further, existing standards can be linked to an appropriate ontology and provide the raw material to extend that ontology. Thus, ontology projects with open membership and development models offer official entities an opportunity to embed their standards into future development.

Table 2.2: Examples of candidate vocabularies

Domain	Instance	Concepts
Biodiversity	Global names architecture GBIF	Institutions, Networks Country nodes, Datasets Search and Metrics
	eCat name parser	Taxonomic names
Ecosystem characterisation	LTER	Organizational units, disciplines, events measurements, methods, processes substances, substrates ecosystems, organisms
Environmental law	ECOLEX/FAOLEX	
Hydrology and inland water sciences	CUHASI	Observations Data Model (ODM) Controlled Vocabulary Registry
	Water ML OGC	OG
Oceanography	Rolling Deck to Repository (R2R)	Controlled vocabulary and ontology
Pollution control	US-EPA Terminology Reference System	
Socio-economics	SEDLAC	

In conclusion, ontologies have great potential to enhance multiple facets of monitoring endeavours by clarifying the semantics of these complex undertakings both for human and machine agents.

3. Environmental Themes

3.1. Air quality

Facilitator: *Jane Akumu, Transport Unit, DTIE, UNEP*

3.1.1. Introduction

Poor air quality is a serious and worsening problem in many rapidly growing cities. According to a March, 2014 report by the World Health Organization (WHO), air pollution is now the world's largest single environmental health risk, and is fast becoming one of the leading causes of illness and death in developing countries. The report estimates that more than 7 million people died prematurely in 2012 due to outdoor and indoor air pollution, one out of eight people worldwide. It is also the poor, young, elderly and sick who are suffering disproportionately from the impacts of deteriorating air quality.

Many factors contribute to increasing air pollution in developing and transition countries: growing vehicle emissions, inefficient industrial technologies, and energy generation are important contributors in urban areas. The use of biomass fuel for cooking and heating in households is another major source of air pollution, particularly in urban poor households and rural areas.

3.1.2. Air quality and SDGs

Improving air quality is vital to the achievement of the proposed SDGs:

Table 3.1: Crosscutting issues in SDGs

Open Working Group proposal SDG		**Indicative Linkages**
Goal 1	End poverty in all its forms everywhere	The poor are more vulnerable to air pollution.
Goal 2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Ozone is damaging crops. Mercury can contaminate fish.
Goal 3	Ensure healthy lives and promote well-being for all at all ages	Health and well-being is influenced by air pollution.
Goal 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Disease caused by air pollution can increase school absences.
Goal 5	Achieve gender equality and empower all women and girls	Women and children suffer more from indoor air pollution than men.
Goal 6	Ensure availability and sustainable management of water and sanitation for all	Air pollution can contaminate water. Volatile liquid effluents in water can evaporate into the air. Sanitation can contribute to air pollution, e.g. germs.
Goal 7	Ensure access to affordable, reliable, sustainable and modern energy for all	Modern energy use can reduce air pollution.
Goal 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Sustainable economic growth can increase air pollution; an economic equilibrium can limit air pollution.
Goal 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	Sustainable industrialization can increase air pollution.
Goal 10	Reduce inequality within and among countries	Reducing inequality within countries can reduce the vulnerability to air pollution of the poor. Reducing inequality among countries can avoid the export of

Open Working Group proposal SDG		Indicative Linkages
		polluting industries and waste.
Goal 11	Make cities and human settlements inclusive, safe, resilient and sustainable	Sustainable urbanization can reduce air pollution.
Goal 12	Ensure sustainable consumption and production patterns	Sustainable consumption (food and water) and production to satisfy basic needs can reduce air pollution. Sound management of chemicals and wastes (e.g. open burning) can reduce air pollution.
Goal 13	Take urgent action to combat climate change and its impacts*	Some air pollutants are greenhouse gases.
Goal 14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	Air pollutants can contaminate water and accumulate in the food chain.
Goal 15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	Air pollutants can contaminate terrestrial ecosystems and accumulate in the food chain. Sustainable management of forest can avoid emissions from forest fires.
Goal 16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	The poor are more vulnerable to air pollution and have less access to justice.
Goal 17	Strengthen the means of implementation and revitalize the global partnership for sustainable development	Implementation of air quality standards is decisive for combating air pollution. The global partnership for sustainable development is important for the abatement of global air pollution.

3.1.3 Design of an integrated Indicator for Urban Air Quality Health

By 2030, 50% of the world's population is forecast to live in cities, giving impetus to the development of an urban air quality health indicator. For each goal and set of targets there are compelling arguments for developing just such an indicator, including the numbers of premature deaths due to indoor and outdoor air pollution, economic damages to infrastructure, and loss of ecosystem functioning.

In reviewing the overarching SDG objective for air quality, it is clear that it will be critical that countries are able to assess urban emissions, estimate exposure to the urban population and its vulnerable groups, and assess the health impacts. Whilst the existing indicators measure many of the underlying elements of such a monitoring process but do not provide an integrated indicator (Annex 1).

The participants therefore worked on an illustrative example of an initial application ontology for urban environmental monitoring (Figure 3.1)

3.1.4 Indicator components and sources of data

The sources of air pollutants are diverse, often diffuse and sometimes unknown, making them difficult to monitor and mitigate. This is a particular issue in the urban setting where transport, industrial and household emissions can combine to create conditions of high exposure for humans and ecosystems.

The constituent parts of an urban air quality health indicator should therefore comprise: ambient

concentrations of pollutants, emissions inventories, dispersion model outputs, human demographics and topography and spatial distribution of the built and natural environment. These should linked through ontologies to remove ambiguities and ensure transparency in their construction.

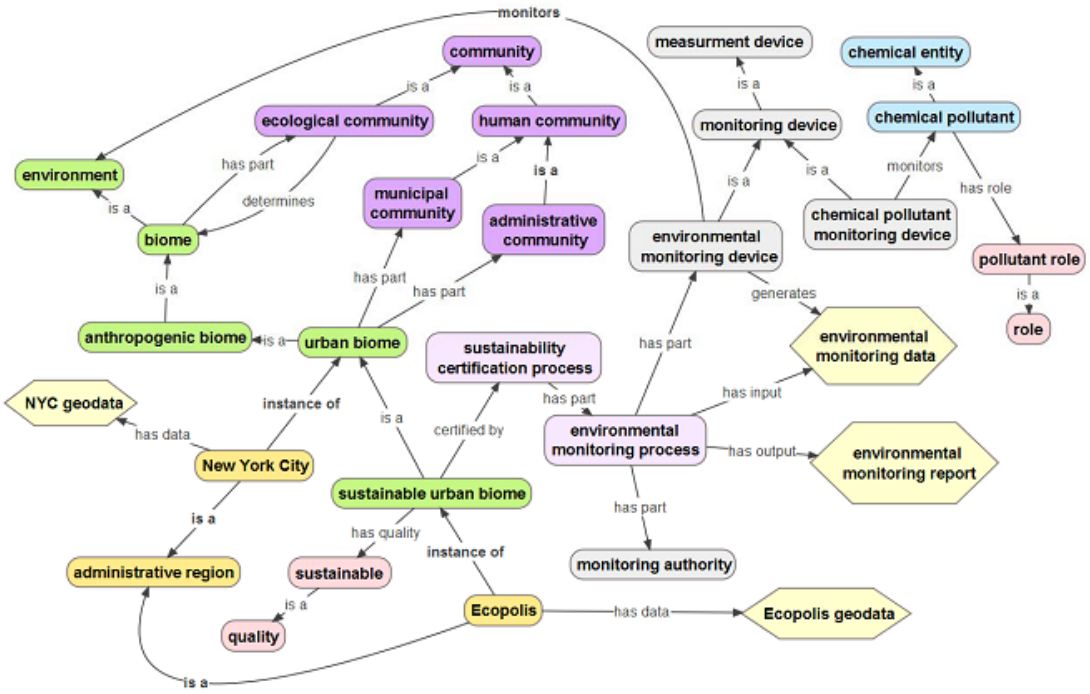


Figure 3.1.1: Classes from environmental (green), chemical (blue), gazetteer (yellow), and community (purple) ontologies have been called upon and other classes created as needed (grey). Both instance-level (e.g. New York City and other objects present in the real world) and class-level (e.g. an urban biome and other categories into which instances can be grouped according to their common properties) entities are shown5. The easily-extensible, structured web of classes and relations provide a basis for coherent informatics. Data, documents, or other informational entities (pale yellow hexagons) can be linked into this web for semantically-aware mobilisation by, e.g., database systems.

Amongst the pollutants to be monitored through in situ stations, mobile sensor webs, airborne and space based platforms are; PM 2.5/10 (and other aerosols), Ozone, Mercury, Lead, Black Carbon (BC), NO2, SO2, CO, Methanol as ozone precursor, VOCs and PAHs. These are all known to have harmful human effects, including as carcinogens and respiratory irritants.

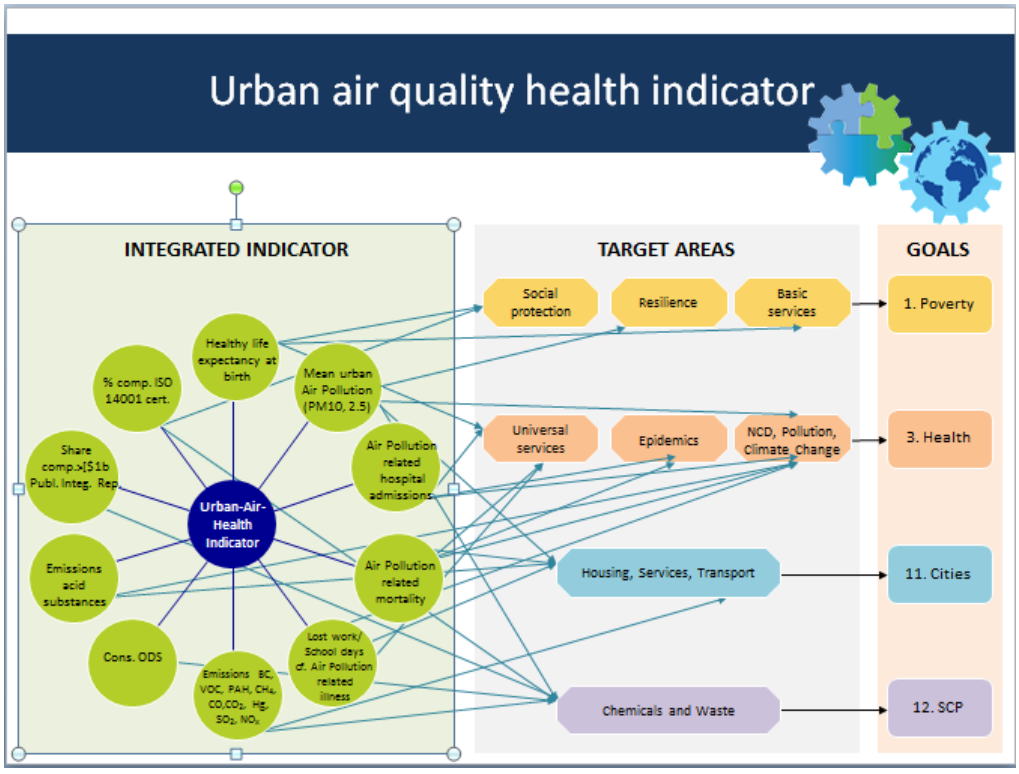
From a practical perspective there exist both sophisticated and rapid emission inventories that are being deployed throughout the developed and developing world respectively. Particularly where there are high levels of air pollution, rapid inventories could provide sufficient information for mitigation policies to be developed. These can be coupled with affordable, sensor-web enabled monitoring networks as inputs to simple and sophisticated dispersion models which can be adapted to the respective situation of a particular city.

Human demography at the city level are compiled through a range of avenues including the national health plans. WHO also has access to air quality related health data for more than 1600 cities.

Finally, the Satellite Radar Topography Mission 2, which is to be released in 2015, provides imaging at 30m resolution; the 3D topography of cities can be accurately mapped by NASA using synthetic

aperture radar altimetry (www.cirgeo.unipd.it/nasaww). The combination of data flows on a regular basis from global and local sources would provide a new opportunity for countries to be able to monitor air quality policies on a near-real-time basis. The mapping of such an urban air quality health indicator shows how such an integrated indicator can support multiple SDGs and Targets (Figure 3.1.2).

Figure 3.1.2 Integrated urban air quality health indicator showing links to the proposed sustainable development goals and targets



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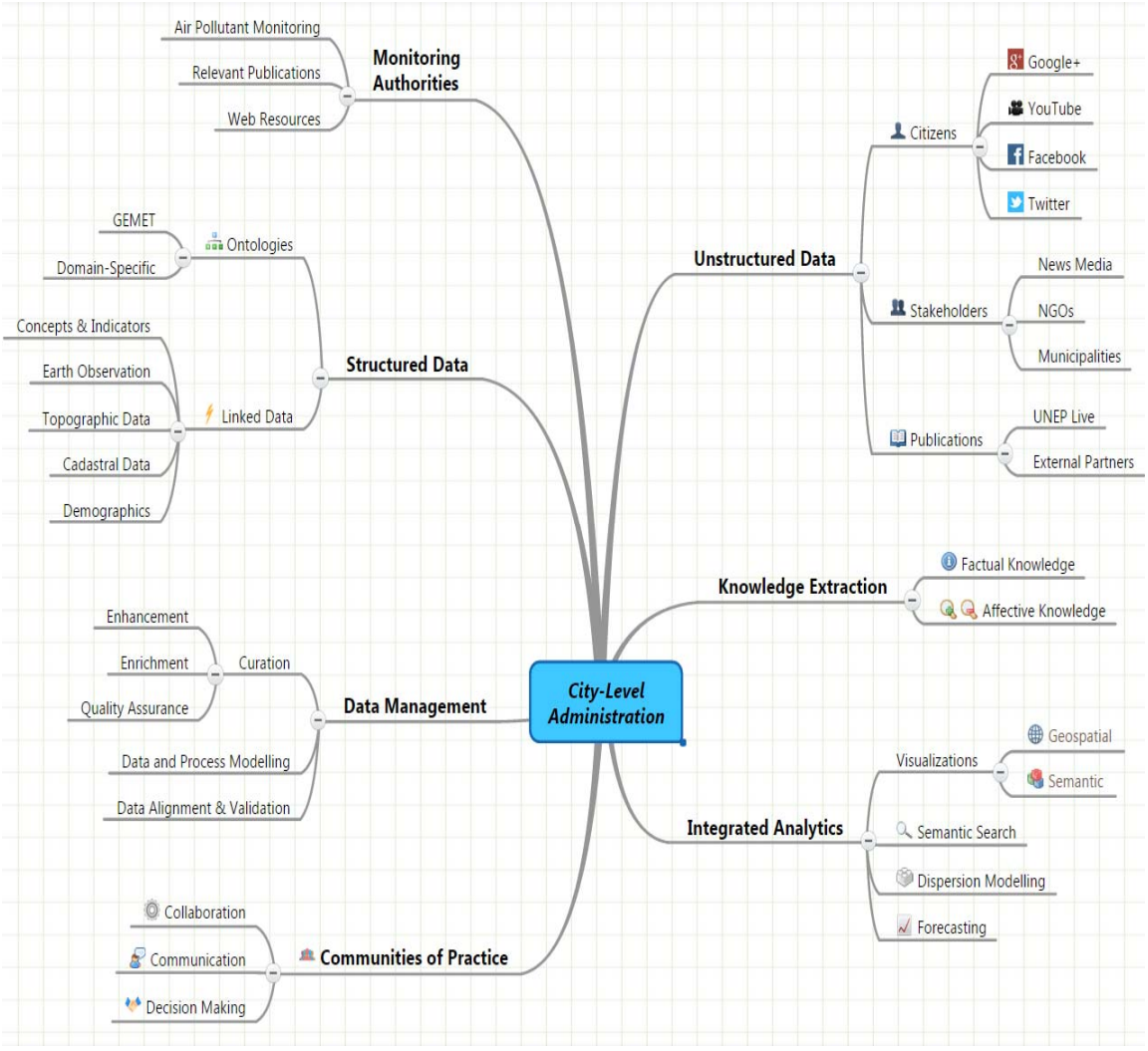
The administration of such an indicator by a city level administration would include many sources of data and information (Figure 3.1.3).

Figure 3.1.3 Knowledge management system based on UNEP Live (www.uneplive/unep.org) reflecting the needs for a City Administration to produce an urban air quality health inducator and public awareness process, showing the types of data and analytical tools that will be needed

3.2 Biodiversity



Facilitator: *Marcos Silva, Chief, Knowledge Management and Outreach Services, CITES Secretariat*

3.2.1 Ongoing processes

There are numerous processes currently ongoing at the global, regional, sub-regional and national levels that aim to promote and support the development and use of indicators for biodiversity and ecosystem services.

The tenth meeting of the Conference of the Parties, held from 18 to 29 October 2010, in Nagoya, Aichi Prefecture, Japan, in decision X/2 adopted a revised and updated Strategic Plan for Biodiversity, including the ***Aichi Biodiversity Targets***, for the 2011-2020 period. The Strategic Plan provides a useful flexible framework that is relevant to all biodiversity-related conventions, for the establishment of national and regional targets and for enhancing coherence in the implementation of the provisions of

the Convention and the decisions of the Conference of the Parties, including the programmes of work and the Global Strategy for Plant Conservation as well as the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of the Benefits Arising from their Utilization. Therefore indicators that are used for tracking progress the goals and targets of the Strategic Plan are highly relevant to the seven biodiversity conventions and other United Nations instruments concerned with the health of the planet.

An important initiative established to assist Parties to achieve the Aichi targets is the ***Biodiversity Indicators Partnership (BIP)*** which brings together a host of international organisations, non-governmental organisations and research and academic institutions working on indicator development to provide the best available information on biodiversity trends to the global community. The Partnership was initially established to help monitor progress towards the CBD 2010 biodiversity target. However, since its establishment in 2006, the BIP has developed a strong identity with Multilateral Environmental Agreements (MEAs), national and regional governments and other sectors.

For the ***fourth Global Biodiversity Outlook, the*** BIP mobilised a suite of global indicators to monitor progress towards implementation of the Strategic Plan for Biodiversity 2011-2020. These indicators utilised a wealth of global, regional and national datasets in their development. Fifty-five indicators were projected to 2020 to provide an assessment of progress towards 2020 (*Figure 3.2.1*). Both the Global Biodiversity Outlook report 4 and the underlying CBD Technical Series 78 used a range of indicators that are also applicable to Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) assessments such as land use trends, the status of pollinating species, and extent of natural habitats.

In addition, there is also the decision adopted at the CBD CoP12 (Pyeongchang, Republic of Korea, 2014) to convene a meeting of the ***Ad Hoc Technical Expert Group on Indicators for the Strategic Plan for Biodiversity 2011-2020*** in the middle of 2015. This meeting will agree a road map for addressing indicator gaps for tracking the Aichi Biodiversity Targets as well as understand how current indicators can better support other initiatives such as IPBES, the Global Strategy on Plant Conservation (GSPC), the Ramsar Convention, and the Sustainable Development Goals (SDGs).

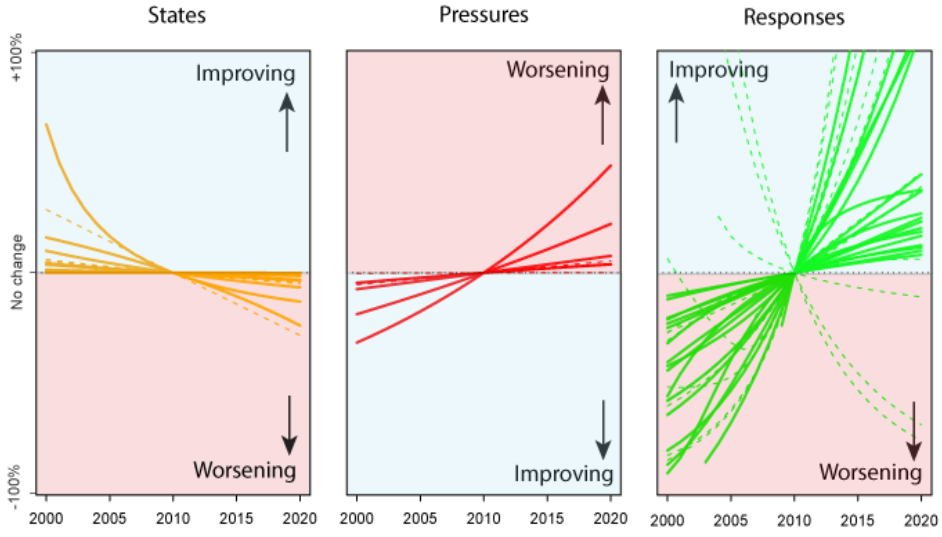


Figure 3.2.1 Overview of the indicator trends across 20 Aichi Targets in the fourth edition of the Global Biodiversity Outlook - For the fourth Global Biodiversity Outlook (the flagship publication of the CBD), the BIP mobilised a suite of global indicators to monitor progress towards implementation of the Strategic Plan for Biodiversity 2011-2020. These indicators utilised a wealth of global, regional and national datasets in their development. Fifty-five indicators were projected to 2020 to provide an assessment of progress towards 2020

Target 12 (reducing risk of extinction), aims to support CBD Parties and others to achieve Aichi Target 12 by providing practical guidance and raising awareness of initiatives and programmes that contribute to the implementation of the activities needed to stem the tide of species' extinctions, may provide further input in the use and development of appropriate indicators.

Given the considerable overlap in the overarching goals of the biodiversity-related Conventions, efforts have been made to ***harmonise indicators across conventions*** and to identify those produced by BIP Partners that can be used directly - or for which the underlying data can be used - to produce meaningful indicators for other Conventions. For example, an exploratory study found that at least 16 of the BIP indicators used for reporting for the CBD could also be utilised for the Ramsar Convention on Wetlands. For many of these, trend analysis and versions for multiple scales were possible. A Red List Index was calculated for wetland species, and abundance trends were calculated for wetland species from the Living Planet Database, which illustrate the high potential for adapting global indicators to the specific needs of the Ramsar Convention, and potentially other conventions.

In addition to this work, partners from the Group on Earth Observation Biodiversity Observation Network (GEO BON) are developing ***Essential Biodiversity Variables (EBVs)***. EBVs are a semantic ontological framework useful for study, reporting, and management of biodiversity change and may support the harmonization of existing monitoring schemes and facilitate the development of new indicators of biodiversity change, especially in gap areas where information on biodiversity change is still very sparse.

3.2.2 Biodiversity Indicators for SDGs

The Open Working Group on SDGs released its Proposal on 19th July 2014. This included 17 goals and 169 targets and potential targets. While this list is likely to be significantly modified as the SDG process progresses, the analysis presented here provides a further preliminary assessment of the biodiversity component of these Goals and Targets. The proposed SDGs include two Goals (14 & 15) focusing on biodiversity while a number of others refer to or allude to biodiversity issues. It is an opportune moment therefore to consider the development of indicators to monitor the SDGs that builds on the work achieved under the Aichi targets.

An analysis of the suite of BIP indicators developed under the CBD framework highlights the relevance of existing BIP indicators to the SDG targets (Annex 2a,b). Ten of the 60 indicators identified and brought together under the BIP have been also identified by the UN Sustainable Development Solutions Network as relevant to the work under the SDGs , as nine SDSN indicators towards eight SDG targets: nitrogen surplus (SDG 2.4; SDSN 13), rural population access to water (SDG 6.1; SDSN 49), water footprint (SDG 6.4; SDSN 52), ocean health (SDG 14.1; SDSN 82), safe fish stocks (SDG 14.4; SDSN 83), natural habitat extent (SDG 15.1; SDSN 84), protected area coverage of IBAs (SDG 15.1; SDSN 87), protected area coverage of AZEs (SDG 15.1; SDSN 87), forest under sustainable management (SDG 15.2; SDSN 85), and Red List index (SDG 15.5; SDSN 86). It should be noted that many of the BIP indicators are cross-cutting in nature and may indicate progress towards multiple SDGs. For example, a Protected areas overlay with species and populations data may provide a more holistic overview of the state of the ecosystem. Moreover, some SDG targets explicitly call for a cross-cutting multi-disciplinary approach between the biodiversity, environment and chemical clusters. This approach is exemplified by Target 12.4 by 2020 achieve environmentally sound management of chemicals and all wastes throughout their life cycle in accordance with agreed international frameworks and significantly reduce their release to air, water and soil to minimize their adverse impacts on human health and the environment.

Of the 60 BIP indicators considered in this paper, 25 of these are cross-cutting in nature and indicate progress towards multiple SDGs. Examples of these include protected area overlay with biodiversity, the Red List Index, and the Living Planet Index. The remaining 35 indicate progress towards single SDGs, for example the invasives indicators which are essential to indicate progress towards SDG no. 15.

3.2.3 Main findings

- Biodiversity underpins sustainable development and must be reflected in SDG indicators accordingly.

- The development and further enhancement of indicators under the SDGs should be based on those 60 indicators identified for the tracking of progress towards the Aichi Targets of the Strategic Plan for Biodiversity 2011-2020. This includes 55 reported in 2014, plus five very nearly ready for inclusion.

- Under the CBD the development of the suite of indicators is being pursued with a view to filling gaps, taking advantage of relevant indicators in use by other conventions and processes, and where possible agreeing on a small number of high-level indicators that could potentially be used by all countries.

- Ten of the current 60 indicators identified and brought together under the BIP have been also identified by the UN Sustainable Development Solutions Network as relevant to the work under the SDGs, as nine SDSN indicators towards eight different SDG targets.

- Twenty-five of the 60 BIP indicators are cross-cutting in nature and indicate progress towards multiple SDGs.

- The value and significance of involving the work under the BIP in the SDG indicators relates to the rigor and scientific processes used in their development and selection. Their selection was based on agreed taxonomies, best practices in monitoring, and has been adopted by the Parties to the Convention on Biological Diversity (CBD). The majority of these indicators are not based on national submissions or official statistics.To enable tracking change over time of something as complex as biodiversity multiple lines of evidence are needed, including basing assessments on all available information.

- The process used by the BIP to identify these 55 relevant indicators may also be useful to the SDG process in identifying indicators for other domains that may also be relevant to biodiversity. Also of importance is the pressing need to address targets under the SDGs where suitable or relevant indicators are currently not available. Such work may require an interdisciplinary approach and further review of existing data and information resources.

3.3 Chemicals and Waste

Facilitator: *Tatiana Terekhova, Technical Assistance Branch, the Secretariat of the Basel, Rotterdam and Stockholm Conventions and Leonor Alvarado, Chemicals Branch, DTIE, UNEP*

3.3.1 Ongoing processes

Sound management of chemicals and wastes is essential for sustainable development through its linkages with poverty reduction; gender; water and air pollution, health, agriculture and food safety, industrialization and economic growth. Sound management of chemicals and wastes provides solutions not only to environmental concerns but also social and economic issues. The Chemicals cluster in UNEP, composed of the Chemicals Branch and the Secretariat of the Basel, Rotterdam and Stockholm Convention, as well as the Environment Management Group of the United Nations (EMG) have undertaken a number of efforts to ensure that the chemicals and waste management issues are included in the Sustainable Development Goals (SDGs). In this regard, the following activities were undertaken:

- Preparation of the background document on the Indicator-based assessment of harmful substances to support an expert workshop sponsored by UNEP DEWA in September 2013;
- Preparation of a fact sheet on why the sound management of chemicals and waste is an integral part to SDGs and provision of support to the side-event on Achieving Sustainable Development through the Sound Management of Chemicals and Waste" that took place on 8 January 2014 at OWG-7 on SDGs in New York;

- Organization of the Panel Discussion on Detoxifying Development: How strengthened sound management of chemicals and wastes contributes to sustainable development which was held on 24 June 2014 during the United Nations Environment Assembly (UNEA) at Nairobi, Kenya;
- Provision of comments and technical input in relation to chemicals and waste management issues into the OWG work through UNEP and the UN System Technical Support Team (TST);
- Participation in the work of the Issue Management Group on Sound Management of Chemicals and Waste under the Environment Management Group to support integration of the sound management of chemicals and wastes into the SDGs; and
- Concept Note for the Expert Group Meeting: Discussion on Chemicals and Waste Management contains the set of proposed SDGs indicators agreed by the EMG;

3.3.2 Challenges

Governments face challenges in reporting to the chemicals and waste related MEAs due to lack of capacity, combined with the lack of effective compliance mechanisms. This was seen as an important consideration when discussing sustainable development indicators (SDGs) and the recognition that any new potential indicator or reporting system may not be welcomed by Governments given the different reporting commitments within a logical framework that ties data currently collected through the various international instruments and their links to sustainable development. The development of an index on sound management of chemicals and wastes was raised as a tool to capture progress in the implementation of the existing legally-binding agreements and voluntary initiatives such as SAICM.

Other challenges relate to the quality of data, including the lack of harmonized definitions of certain issues reported under different MEAs and agencies, as sometimes national definitions (i.e. hazardous waste) may overdrive internationally agreed definitions. This leads to data being heavily skewed due to definitional issues. Also, the lack of compliance mechanism as well as lack of data verification may give the impression that compliance is actually greater than what it may be in reality (not very robust data).

Regarding non-hazardous waste in terms of volume and how it is dealt with within cities may have more relevance than the chemicals hazard itself. It was suggested that SDGs should also consider municipal waste to ensure a broader spectrum of waste is considered, as this is not covered under the Basel Convention – this consideration will most likely be considered under proposed Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable.

The data reported under the Basel Convention cover both imports and exports of hazardous waste, but do not differentiate between definitions of hazardous waste used by different governments and also does not cover exposure, just trans-boundary movements.

The nature of the information communicated to decision makers and stakeholders is relevant when defining what is meant by exposure to chemicals as it is important to differentiate from exposure to chemicals at large and exposure to hazardous chemicals. The tone of the message is also important to avoid lack of action due to overwhelming negative messages. There is a delicate balance between communicating the urgency of action on sound management of chemicals and waste and maintaining a positive message that empowers decision makers and stakeholders to take action. This is particularly relevant as global chemicals production is expected to increase in the next 25 years – doubles every quarter.

In most developing countries, a large share of resource recovery from waste is performed in the informal sector, which makes it very difficult to control – the issue has become how to improve and formalize these sectors, in particular as jurisdiction falls among many sectors, and it also is a good source of employment for poor and unskilled labour.

Labour and occupational health remains as a significant challenge. Nearly all workers are potentially exposed to some sort of chemical hazard because of the ubiquitous use of chemicals in every type of industry, ranging from mining, welding, mechanical and manufacturing work, to office work and other occupations. While significant advances have been made in occupational safety and health globally,

workers around the world still face unhealthy and unsafe working conditions. Accidents resulting in exposure as well as chronic health effects from long-term exposure to lower levels remain a global concern. Safety of people engaged in economic activities where chemical exposures are significant (e.g., e-waste recycling, agriculture, small-scale and artisanal mining, lead acid battery recycling, etc.) need to be ensured without compromising employment opportunities.

Although a number of chemicals are covered under the existing legal instruments, there is a large amount of chemicals and wastes released in the environment that are not being tracked and to which the population at large is exposed through products and/releases to the environment – POPs-like, CMR and endocrine disrupting chemicals, etc. often present in consumer goods. There was broad agreement that the indicators should be designed to be used by policymakers to better understand the impact of not managing chemicals safely.

Proposed indicators are focused under the goals and targets that explicitly mention chemicals, while recognizing that mainstreaming chemicals under the other domains is important to capture the complexity of chemicals management and its relationship with sustainable development.

3.3.3 Proposed Indicators

The group reviewed and proposed indicators for those Goals with specific/explicit references to chemicals and/or wastes in targets.

While chemicals and wastes are specifically referred to in specific targets under the goals on Agriculture, Health, Sustainable Consummation and Production, Water and Cities, there are a number of other targets where the sound management of chemicals is also essential for their achievement:

Goal 1 End poverty in all its forms everywhere - Target 1.5
Rationale: With increased weather unpredictability, chemical safety has become an issue of concern as floods, severe storms and other related natural catastrophes of this nature can cause chemicals that have been stored to enter the environment and pollute water ways, soil and air. Therefore, preparedness for extreme weather conditions must necessarily include a component of chemical safety – also a requirement under the legally binding International Health Regulations sponsored by WHO. Under this category, compliance with WHO chemical safety component can be used as an indicator of progress towards improved chemicals safety worldwide.

Goal 2 End hunger; achieve food security and improved nutrition, and promote sustainable agriculture - Targets 2.1; 2.2; 2.3; and **2.4**
Rationale: Measures to increase food security must necessarily be accompanied by policies promoting safe use of pesticides and other agrochemicals, including promotion of integrated pest management practices and promotion of safer alternatives. Indicators 7 and 8 under the international Aichi biodiversity target could be used as a proxy to monitor the direct effects of pesticides, nitrogen and other chemicals in biodiversity from industrial, agricultural, aquaculture systems.

Goal 3 Ensure healthy lives and promote well-being for all at all ages - Target 3.4
Rationale: According to WHO, each year around three million children under the age of five die due to environment-related diseases. In developing countries, exposures to environmental hazards such as: unsafe water and inadequate sanitation; unsafe nutrition (itself related to poor water and sanitation); or maternal exposure to pesticides or other chemicals, constitute important risks to infant health, increasing the mortality rate for low-birth-weight and preterm infants. Acute respiratory infections annually kill an estimated 1.6 million children under the age of five. As much as 60 percent of acute respiratory infections worldwide are related to environmental conditions, some associated with the

release of particular matter and other toxic substances derived from industrial processes, transportation and other non-regulated economic activities (i.e. burning of hazardous wastes). There is strong evidence of neurodevelopmental impairment related to the exposure of expectant mothers to hazardous substances including heavy metals.

Goal 4 Ensure inclusive and equitable quality education and promote life-long learning opportunities for all - Target 4.7

Rationale: education and awareness raising about the risk of chemicals and the need to manage chemicals and wastes soundly is an important step towards achieving sustainable development by enjoying the well-being that chemicals bring to human development while avoiding/diminishing the harmful effects that chemicals and wastes can have in human health and the environment. While it may not be practical or suitable to develop a specific indicator that measures the level of understanding of sound management of chemicals and wastes in the general population, it would be appropriate to monitor how environmental awareness education programmes include it in their curriculum.

Goal 6 Ensure availability and sustainable management of water and sanitation for all - Targets 6.1 and 6.3

Rationale: safe drinking water involves the absence of toxic substances running off from industrial process including agriculture but also from chemicals in products and related use and disposal with associated release into water supplies. Chemical safety policies and regulations are therefore essential to protect drinking water reservoirs, with special considerations to the effects of severe weather conditions that can cause chemical spills and run-off into water reservoirs. A consideration of water filtration mechanisms that can capture chemicals of concern and substitution of chemicals of concern should also be made. **The working group on chemicals and waste discussed these inter-relations with the drinking water working group**, and agreed that the proposed indicators would cover the chemicals and waste component.

Goal 8 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all - Target 8.4; **8.8**

Rationale: the promotion of sustainable economic growth is associated with safe management of chemicals and wastes throughout their life cycle, as well as the protection of workers through he implementation of occupational health standards on the safe handling of chemicals. In addition, monitoring the implementation of ILO's Conventions No. 170 on Safety in the Use of Chemicals at Work and No. 174 on the Prevention of Major Industrial Accidents would contribute to monitoring the achievement of this target.

Goal 9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation – Targets 9.2; 9.4; and **9.5**

Rationale: an important component of the sound management of chemicals and wastes throughout their lifecycle is the promotion of safer alternatives to chemicals through green/sustainable chemistry approaches and improvements into the existing industrial infrastructure to reduce releases of toxic substances in the environment and reduce their use in products.

Goal 11 Make cities and human settlements inclusive, safe, resilient and sustainable - Targets 11.1 and 11.6

Rationale: The indoor environment in the home is an important source of exposure to hazardous substances. Therefore, ensuring safe housing must consider safety of the materials utilized in construction. UNEP is currently leading a project for the disclosure of information on the chemicals in products which includes the construction industry. An indicator for this target should also capture the trends in substitution of hazardous substances included in the construction of safe housing.

Goal 13 Take urgent action to combat climate change and its impacts - Target 13.2

Rationale: mainstreaming sound management of chemicals and wastes into national development plans is one of the objectives under SAICM and will contribute to support actions to combat climate change.

Goal 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development - Target 14.1

Rationale: chemical pollution from unsafe management of chemicals and wastes is one of the components affecting marine pollution and improvements in sound management of chemicals and wastes can contribute positively to the achievement of this target. The working group on chemicals identified this as a cross-cutting issue with the domain of oceans.

Goal 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss - Target 15.5

Rationale: Insecticides and fungicides can affect a wide variety of non-target organisms, including beneficial soil microorganisms, decreasing ecosystem resilience and reducing soil fertility. If used on a broad scale, pesticides can disrupt the ecological balance of ecosystems by killing natural biological controls, leading to outbreaks of pests that were previously of minor importance and consequently to lower crop yields. Once used, pesticides can accumulate in the air or water or on land, where they can harm non-target species and diminish biodiversity. By contaminating groundwater, lakes, rivers and other bodies of water, pesticides can pollute drinking supplies, fish and other resources that are vital for human wellbeing. Areas of un-reclaimed land with past industrial use (brownfields) also contribute to land degradation and biodiversity loss.

3.3.4 Ontologies

There is an ontology already developed for the chemicals domain. Following ontological concepts should be further developed:

A. Chemical:
- Hazardous chemical
- Hazardous wastes

There are legal definitions under the Basel, Stockholm and Rotterdam Conventions are to be considered. Other definition of wastes should be considered, including municipal definitions of hazardous wastes.

B. Waste:
- Formal definition
- Guidance
- Legal definition
- Technical definition

C. Releases

D. Illegal traffic –definition under the Basel Convention
E. Globally Harmonized System of classification and labelling of chemicals.

3.3.5 Way forward

Group discussions were not possible during the last day given that only three members of the working group had remained. Consequently, it was agreed that follow up actions would be encouraged to obtain input from all workshop participants as well as other relevant stakeholders. These include:

A. A1. Map goals and targets in the context of chemicals and waste
   A2. Map indicators for relevant targets
B. B1. Identify concepts and terms for ontology
   B2. Establish their relationships

3.4 Common land and natural resources

Facilitator: *Maryam Niamir-Fuller, Special Advisor to the Executive Director on Post 2015/SDGs, UNEP*

3.4.1 Background

Forests, rangelands, dry lands and bodies of water worldwide are frequently governed by local communities, through community-based tenure rights and institutions. Empowering local communities with the means and incentives to sustainably manage their ecosystem has been increasingly seen as a critical factor to protect the environment, eradicate extreme poverty, and thereby achieve sustainable development.

In 2012, the Voluntary Guidelines on the Governance of Tenure highlighted the need to secure tenure rights for Indigenous peoples and local communities with customary tenure systems to enhance food security and food sovereignty. Few months later, the Rio+20 Outcome Document emphasized the role secure tenure plays in meeting the needs of rural communities, and called for strengthened forest governance frameworks, and the inclusion of Indigenous Peoples and Local Communities (IPLC) in forest, mountain and biodiversity management,[1] echoing guidance by the Convention on Biological Diversity. Tenure rights are also expected to be included throughout the upcoming Sustainable Development Goals (SDGs) of the Post-2015 Agenda[2].

However, a large gap still exists between policy and practice. It is estimated that two billion people directly rely on common pool resources for their livelihoods and well-being. Ecosystem services and other non-marketed goods make up 50-90% of the total source of livelihoods of poor rural households world-wide –the "GDP of the poor"[3]. Common property resources contribute some US$5 billion to income of the rural poor in India, about 12% of their income[4]. Notwithstanding, community tenure rights are rarely recognized and documented as such, and poor measures are taken to enhance their protection. Tenure is not restricted to formal property rights, it also includes customary tenure regimes, flexible rights, and long term use rights (usufruct). Current indicators often do not adequately capture the complexity of diverse, flexible and periodic tenure regimes, of the important role that reciprocity and non-marketed goods play, or the voice of users themselves. Data can be patchy, and definitions and methodologies may vary a lot across countries. Best practices exist for legal reform but they are not well known. It is therefore urgent to measure progress on this issue in a more systematic manner, by taking stock of the wealth of experience gained over the last decades and looking at

[1] Sec. 109; 193; 197; 211.
[2] See reference to land tenure in the Outcome Document of the UN Open Working Group on Sustainable Development Goals (http://sustainabledevelopment.un.org/focussdgs.html).
[3] TEEB. 2010. The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB
[4] Beck, T and C Nesmith (2001) Building on poor people's capacity: the case of common property resources in India and West Africa. World Development Vol. 29(1):119-133

current promising initiatives, such as ICCAs, (Indigenous Community Conserved Areas) and their land tenure and protection rules, Governance of Tenure in Priority Nature Conservation Landscapes/ Protected Areas, group ranches and conservancies in pastoral areas, and community lands set aside for restoration and rehabilitation.

To this end, and as part of a growing effort to monitor progress on land and forest governance, UNEP is convening an expert group meeting on community land and resource rights indicators, with the intention to contribute to integrated monitoring frameworks, such as UNEP-Live[5] and ILC's Land Portal[6], and be of potential benefit to the upcoming Sustainable Development Goals (SDGs), and the implementation of wider international strategies on this subject. The workshop will build on and feed into other ongoing conversations, in particular those on community-based monitoring systems for the Strategic Plan for Biodiversity, and the Global Land Indicators Initiative (GLII), facilitated by the Global Land Tenure Network.

The meeting gathered senior experts in law, human rights, environment and economics, from a wide variety of institutions, including GLII, CIFOR, IUCN CEESP, Green Economy Coalition, WRI, UNREDD, WISP, IASS, Oxfam, University College London, and UN entities (FAO, UNHABITAT and UNEP). Representatives of Indigenous Peoples and the Spanish Government also participated. Many more entities were part of a virtual Community of Practice that peer reviewed and helped finalize the work.

3.4.2 Overview

The focus of this exercise has been on common land and natural resources (pertaining to rangelands, forests, wetlands, and the natural resources therein – both above and below ground). Through the protection, legal recognition, sustainable use and management of common lands and natural resources, three overall objectives should be attained:

- Human rights and wellbeing,
- Equitable prosperity and sustainable livelihoods, and
- Healthy and sustainably managed environments.

The objectives were further broken down into a set of priority "must have" issues and variables that further define the problem, or are drivers of change, as collected in *Table 3.4.2.*

Table 3.4 Objectives

Human rights and well being	Sustainable livelihoods	Healthy and Sustainable environments
• Legal identity • Protect dignity • Cultural heritage • Diversity of rights within the community • Perceptions and awareness • Self-determination • Violation of rights	• Sustainable incomes • Equitable access • Reduced conflicts • Multiple benefit streams	• Sustainable land use • Ecosystem services and benefits • Sustainable production and consumption • Community regulations and protection • Mobility and other traditional systems • Strong local institutions • Harmonization of sectoral laws

[5] www.uneplive.unep.org
[6] http://landportal.info/

It was recognized by the Thematic Group, that while this focus is important so as to advance the science, management and monitoring of common property, many of the indicators proposed are just as relevant to other types of land and natural resources used by indigenous peoples and local communities (IPLC), and even in some instances to urban open spaces.

It was recognized that secure tenure alone will not guarantee equitable rights nor sustainable management of land and natural resources. For that reason, the Thematic Group focused on two types of indicators:

a) Those that focus on the existence of IPLC rights, governance, and equitable distribution of benefits, as expressed either in area of land or percentage of people, and disaggregated by gender, ethnicity, age group, land-user group, or other parameters of inequality, both within communities and in comparison with national averages,

b) Those that focus on how the rights are exercised and practiced, on the extent of loss or gain of common lands and natural resources, and on how the land and natural resources are used and managed.

The purpose of the exercise is to raise awareness, political support and practical outcomes from stronger recognition of secure common land and resource tenure rights in many different fora and processes, including the Post 2015 Agenda, UN specialized agency processes, and civil movements including that of Indigenous Peoples. As such therefore, it is considered as a universal issue applicable to all countries.

The Thematic Group recognized that there are examples of both traditional and innovative mechanisms for securing rights to common lands and natural resources; for example, the “certificates of ancestral domain” in Mindanao, and West Africa’s “transhumance passports”. In some cases, such as for the First Nation States, creation of ‘tribal trusts’ has helped protect such lands. It also recognized that titling in general is important not only for equitable rights of people and healthy ecosystems, but also as tactical measures to prevent land grabbing or the negative effects of misplaced policies.

The Thematic Group also recognized that Free Prior Informed Consent (FPIC) is an important principle to apply to common lands and natural resources. Policies and institutional mechanisms must hold businesses, local governments, and civil society accountable to recognize, protect and fulfill the requirement for free, prior and informed consent from indigenous peoples and local communities for the governance, restriction, conservation, and management of common land and resources, including the allocation of concessions or rights for resource exploitation on common land.

When the results of the thematic Group’s work are set in a DPSIR-type of a framework, it shows that indicators were developed for all 5 issues:

- Drivers and Responses = secure tenure, governance, and practices/management
- State = loss/gain of common land
- Impact = Distribution of benefits to people, and ecosystem sustainability

The Thematic Group recommends a menu or dashboard of 25 indicators, that are directly relevant to 45 different SDG targets, and which can be adopted by countries according to their current baseline and circumstances of the management and protection of common lands and natural resources. The Group also decided that the following indicator would be of paramount importance for inclusion in “headline” or global indicators, in complementarity with more headline indicators from GLII on tenure in general, and to be monitored by the High Level Political Forum on Sustainable Development:

Proportion (area) of common land under the tenure of indigenous peoples and local communities that is legally recognized, secured, documented, and protected, and that guarantees equitable access and use to women and men [7].

The Thematic Group recognized that there are some outstanding issues to further refine:

1. Adaptation to climate change: is there a specific risk or issue pertaining to secured common lands that is different from non-common or non-secured lands, and how would that be translated into an indicator?

2. Some of the indicators integrate different variables. They could be developed into indices, or they could remain as separate indicators but with a view towards statistical comparability and therefore integrated analysis. Therefore more work needs to be done to refine and finalize the indicators.

3. Selection and clarification of the data sources needed for each of the indicators proposed. On the whole the Thematic Group agreed that the capacity or potential capacity for data collection and analysis to support these indicators exists at national, regional and international levels. For example, reported cases of involuntary resettlement can be obtained from UN, government, NGO including Amnesty International and others. Data source on local and customary regulations would have to rely on qualitative literature or surveys. However, it is also recognized that the term "common land and natural resources" is not a legally recognized construct and therefore will require additional awareness raising and capacity building in all countries and among all stakeholders so that it can be measured properly.

3.4.3 Definitions used in the exercise

The Thematic Group recognized that certain terms are defined differently depending on the sector, discipline or stakeholder, and that therefore finalization of the indicators will require a detailed effort at creating the semantic ontologies that would then facilitate measurement and comparability. Some terms have been defined through inter-governmental or other international processes of standard setting.

These definitions are explained below.

"*Common lands and natural resources*" = these are geographic entities with corresponding natural resources, that are commonly or collectively owned, or used, or managed by communities that share a societal, ethnic, geographic, or administrative identity[8]. These can be statutory (legal and formally defined) or customary. They can be held by local communities, or indigenous peoples. The term also includes land that is privately held but that is collectively managed (through certain customary and traditional systems, or through agreements between a community of owners). For the purpose of this exercise, this definition does NOT include the term "*commons*" which in some States is associated with publicly-owned (government owned) lands[9]. In reference to "common lands" held by indigenous

[7] This index is a combination of the following indicators identified by the Thematic Group: a) Percentage of indigenous peoples and local communities with tenure [ownership, control, access, manage and use] over common land and natural resources that is legally recognized, secured, documented, and protected; b) Area of common land held by indigenous peoples and local communities that is given enforceable legal recognition guaranteeing access and use; and c) gender equality.

[8] This definition of "community" may not necessarily capture all types of communities, but is included here so as to address capture of membership and benefits by outside elite.

[9] FAO. 2012. "Voluntary Guidelines on the Responsible Governance of Tenure of Lands, Fisheries and Forests in the Context of National Food Security". Paragraph 8.3

peoples, this refers to their collective right to lands, territories and resources as defined and recognized by the UN Declaration on the Rights of Indigenous Peoples (UNDRIP). The term "common" land and natural resources has been adopted by the Thematic Group rather than "communal" as it has a more neutral connotation in political settings. It is consistent with definitions used by CAPRI (common property), ILC (community land rights), and others[10].

Many States have a legal obligation to recognize to respect and recognise customary land tenure, or customary rights to lands, territories and resources. However, the term "*customary*" tenure can refer to both common lands/common natural resources, and individual ownership. GLII is working to encourage all States to legally recognize customary tenure. In complement to these efforts, the Thematic Group recognized that specific attention needs to be paid also to the legal recognition of "*commonly-held and managed land and natural resources*" as these require different and new legal definitions and challenges to capture complex arrangements such as flexible use rights.

The Group recognized that there are cases where common land is held by national governments, but lacks recognition of the rights of Indigenous Peoples and local communities to that land/NR. Thus the Thematic Group focused on the category of common land and natural resources that are held by indigenous peoples, local communities, and collectively managed by them.

Gender and common land = It is recognized that common land is being used differently by women and men. Changes to land rights held in common can result in dispossession of women, and could alter or damage the production system and ecosystem. Thus indicators should be disaggregated by gender as much as possible.

"*Land*" is distinguished from "*natural resources*" because there may be multiple tenure and use regimes within the same geographic area. National laws differ over whether land rights imply rights to everything that occurs on, above or below the ground.

"*Rights*" = contain 5 bundles of measurable rights: access, withdraw, manage, exclude, alienate[11]. This is consistent with WRI's classification of tenure rights[12]. Rights must be exercised along with responsibilities.

"*Tenure*" = any or all of : ownership, control, access, manage, use. In terms of common land, there are at least three ways in which "ownership" has been legally defined:

- common lands can and are mostly found on reserved/gazetted lands that are ordinarily governed as public trusts in many countries as enshrined in their constitutions. The tenure regimes that can only be secured in this regard would be access, use and control. NOT ownership.
- The common lands found within communities that are clearly common property with clear management vested in that community. This form of freehold ownership is possible where the boundaries of the community are clearly documented.
- The most complex type of common land is that shared by many communities and even accessed or used seasonally, periodically or occasionally (fluid boundaries, fluid use rights and regimes), such as for pastoral lands or floodplain fisheries. Applying simple titling regimes could alter or destroy the production system and ecosystems.

[10] Wilusz, D. 2010. "Quantitative Indicators for Common Property Tenure Security". Washington, CAPRI and International Land Coalition.
[11] Terms consistent with internationally agreed standards, in particular the Voluntary Guidelines on the Governance of Tenure (see chapter 8 and 9).
[12] WRI. 2005. The wealth of the poor – managing ecosystems to fight poverty. In collaboration with WB and UNDP.

"*Indigenous peoples*" = Considering the diversity of indigenous peoples, an official definition of "indigenous" has not been adopted by any UN-system body. Instead the system has developed a modern understanding of this term based on the following:

- Self- identification as indigenous peoples at the individual level and accepted by the community as their member
- Historical continuity with pre-colonial and/or pre-settler societies
- Strong link to territories and surrounding natural resources
- Distinct social, economic or political systems
- Distinct language, culture and beliefs
- Form non-dominant groups of society
- Resolve to maintain and reproduce their ancestral environments and systems as distinctive peoples and communities.

"*Indigenous Peoples and local communities (IPLC)*" = as agreed and endorsed by Member States at the Conference of Parties of the Convention on Biological Diversity in October 2014.

"*Land loss*" = is meant to cover a wide variety of tenure regimes, access rights, and user rights.

"*Resource exploitation*" = includes the extraction of minerals, timber and hydrocarbons, or installation of water, wind, solar and geothermal infrastructure, or extraction of non-timber products, medicinal plants and other natural resources

"*Involuntary displacement and eviction*" = this covers common-land-dependent people who have been denied their rights, and includes involuntary displacement, forceful eviction, and any other involuntary restriction of use[13]. This is a human rights indicator, and a key safeguard to ensure that changes to tenure are undertaken only in line with international law and standards on human rights. It is also important to note that women and men can experience involuntary displacement and eviction differently. Within a community, it could even occur specifically among women. Causes could be privatization, nationalization, eminent domain and natural disasters. The operating variable is the involuntary, forceful and non-compensatory nature of the restriction of rights.

"*Extent to which*" = measures both the quantity and quality of policies and institutional mechanisms

"*GDP+*" = in this meeting this open-ended term used to refer to measures of economic growth that incorporate societal benefits (e.g. tenure) with environmental benefits (i.e. ecosystem values and assets). An index such as the Inclusive Wealth Index could be used but would need to be expanded to also cover social rights/benefits.

"*Distribution of benefits*" = "benefits" include both the value of assets, and income from the assets. Income could be in-cash or in-kind, formal or informal. Also, it could be monetized or non-monetized. Definition of "distribution" is intended to cover all stakeholders (men, women, youth, seniors, etc.), different ethnic backgrounds and land-user groups, and therefore requires disaggregation of the data.

"*Basic infrastructure and social services*" = includes: roads, water, electricity, formal markets, health, education, information and communications, judicial system

"*Sustainable practices and management*" = No singular definition exists, but this follows international best practices considering economic, environmental and social aspects , sustainable traditional

[13] Michael M. Cernea. Re-examining "Displacement": A Redefinition of Concepts in Development and Conservation Policies Social Change March 2006 36: 8-35, doi:10.1177/004908570603600102; and Cernea, Michael M.; McDowell, Christopher. 2000. Risks and reconstruction : experiences of resettlers and refugees. Washington, D.C. : The World Bank. http://documents.worldbank.org/curated/en/2000/03/437761/risks-reconstruction-experiences-resettlers-refugees

knowledge, and emerging certification schemes, and is meant to result in enhanced biological diversity, water quality and quantity, soil health including biological, chemical and physical aspects , plant productivity and diversity, and other measures of ecosystem health. Indicators would need to be disaggregated enough to cover the diversity of viable traditional, customary and local practices including mobility, flexibility, reciprocity in pastoral systems, and other practices that ensure shared, equitable and multiple usage consistent with ecosystem health.

"*Hazardous waste*" = the definition follows that of the Basel, Rotterdam and Stockholm Conventions, and is aimed at monitoring the dumping of such waste, either legally or otherwise, on common lands. One indicator is a biophysical marker of hazardous waste on common lands, including: dumping of industrial and telecomm waste, un-managed domestic/commercial waste, spread of plastic refuse, etc. The other is a measure of the effectiveness of environmental/social impact assessments conducted by the business sector and its level of public consultation.

"*Natural resource sustainability*" = No singular definition exists, but consistency is maintained with international best practices and standards, the Aichi Targets, especially Target 7, the UN Convention to Combat Desertification, and other relevant international agreements.

"*Net primary productivity (NPP)*" = NPP is a proxy for loss/gain of natural resources, and can be measured through remote sensing complemented by country level data.

3.4.4 Criteria for selection of indicators

In addition to adopting SMART indicators, the Group appreciated the criteria developed by the GLTN, UNEP Post 2015, and others. Indicators should be: meaningful, scientifically credible, statistically sound, consistent over time, and sensitive to root causes, drivers and underlying phenomena. They should be intelligible and easily interpreted, compelling, aspirational and transformative. They should enhance the integration of the three dimensions of sustainable development. They should allow international comparison and be universally applicable.

3.5 Oceans

Facilitator: *Jacqueline Alder, Head Freshwater and Marine Ecosystems Branch, DEPI, UNEP*

3.5.1 Indicators, framework, models

The indicators should focus on livelihoods and food security or anything that is directly related to human needs. (Anthropocentric approach), but also consider the "ecological foundations". There should be a link between the protection of oceans and the safeguard of livelihoods. Therefore, we need to combine the social and environmental aspects, as anthropocentric indicators, rather than biodiversity-centric, would be more popular.

The oceans theme poses some specific issues that need to be taken into account, including rights issues, e.g. case where a State dictates the fishing rights within his jurisdiction. "Benefit sharing" is often seen as a critical point because it may lead to unsustainable practices. Ocean problems are sometimes linked to land-based problems, and experts on both themes need to work together to ensure the inter-linkage. Connectivity of ecosystem services should be considered in the indicators, mainstreaming the value of ocean ecosystem services at the national level. The Aichi targets could also be used as the basis for developing indicators. Short, medium and long-term time scales should all be considered, and indicators should cover international seas (EEZ and ABNJ).

Building on components of the Ocean Health Index (OHI) (Halpern et al., 2012) could be an approach. However, one problem is that OHI gives low scores when a resource is exploited at levels below MSY, and there is an issue of substitutability (Rickels et al., 2014). The scoring algorithms would need

revisiting. It requires more data on the percentage of the ocean that is managed, and availability of global datasets on present and predicted future state of the ocean as well as pressures.

Indicators work better when progress is measured against targets. For this, we need to set a baseline scenario/reference point for comparison. One option is to define core indicators and supplementary (indirect) indicators.

The DPSIR framework, a linear system of expressing the state of the environment (Driver → Pressure → State → Impact → Response), vs. different indicators could be a useful concept to consider DPSIR. The risk assessment framework of the IOC, risk – exposure – vulnerability, would equally be useful in the SDG discussion, with identification of the cluster of countries at risk.

Data problems should not be neglected, and institutional capacities have to be considered. It is important to create indicators that will allow SIDS and LDCs to collect the data themselves. Data collection should not be costly. Indicators need to take into account the particularities of different regions. There is a difference between governmental data and experimental data, which requires a mechanism to verify the accuracy of experimental data. This also raises the issue of 'democratization of data gathering' and the right of civil society to request the governments for accurate environmental data ("citizen science").

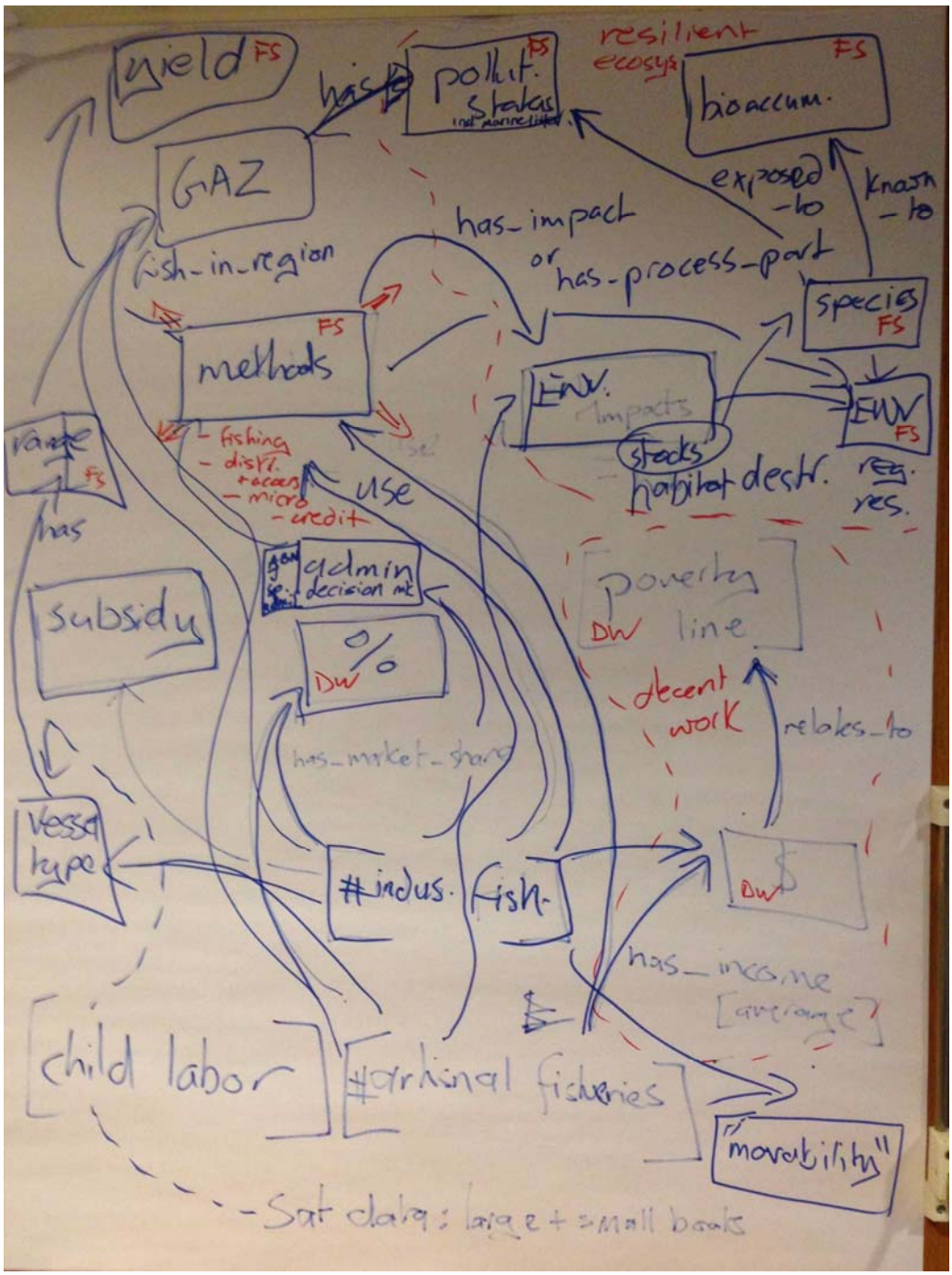
3.5.2 Ontologies

One can distinguish between PCO (population community ontology), which encompasses populations, communities etc., and ENVO (environmental ontology) with entities like biomes, habitats, environments.

These entities (objects) are held together by certain properties (e.g. cultural values in the case of PCOs) and can have various structural relationships with each other, which can all change over time. The entities can be part of or contribute to processes or process chains. Gazetteers can be used to link for examples ENVOs and PCOs.

The idea is to define the entities and understand their links to be able to use big data and for underpinning the indicators for the SDGs.

After further discussion with the ontology expert a revised map of ontologies for SDG14 was developed:



3.5.3 Towards integrated indicators for GOAL 14 - approach

The following describes the thought process and approach followed by the Oceans thematic group.

A. Communities by ENVOs (e.g. biomes) and geographical or legal entities were mapped and connections identified for defining integrated indicators that relate to the health of the ecosystem and to livelihoods:

   1. Map the PCO communities, e.g. fisheries
   2. Describe with regard to the SDG goal and the targets:
      a. Roles
      b. Processes (e.g. administrations)

c. Attributes

3. Map the defined communities onto ENVOs
4. Select and define an integrated indicator that could also address other targets and that relates to ecosystem health (i.e. the ecological foundation) and to livelihoods; critically check the formulations for “safe” and “unsafe” words

B. Identification of content and aims of the targets that relate to fisheries:

- Ecosystem (health)
  - Pollution (prevent and reduce)
  - Coastal ecosystems (protection, management, restoration, strengthen resilience, …)
- Fisheries and fish stocks
  - Regulate harvesting and end overfishing, end IUU fishing, …
  - Restore fish stocks
  - …
- Enable
  - Scientific knowledge
  - Technology transfer
  - …

C. More in-depth discussion of small scale fisheries

For developing an integrated indicator for small-scale fisheries, a mind map can be developed that describes all relevant components and processes to explain the link between food security and ecosystem health in small-scale fisheries. The next step is to pull out variables to build an integrated indicator and formulate the indicator like a narrative in which the single parameters are named (explicitly or implicitly).

- Livelihoods
  - Food security and nutrition
    - Measurements: fish consumption?
  - Profit and income
    - Creating opportunities (access to markets, building resilience, …)
    - Income
    - Return on investment **-> core indicator?**
    - Catch per unit effort, yield, hours of fishing
    - …
  - Decent* (safe) jobs
    - Free from corruption
    - Security
    - Personal safety
    - Human rights
    - …
  - Coastal communities
    - Education and child labour, e.g. number of children in school after age of 12
    - Inclusion in decision making
    - …
- Healthy and resilient ecosystems
    - …

➔ Define **benchmarks** from existing communities

D. **Develop 5 integrated indicators** that address the following issues:

- Decent work
- Food security
- Profit and income
- Inclusion in decision making
- Ecosystem health ("ecological foundation")

Further indicators to be defined include industrial fishing; aquaculture (separate, or incorporated in one of the other fisheries indicators); ABNJ; Tourism; and Pollution.

3.5.4 Towards integrated indicators for GOAL 14 - proposal

Indicator 1: Small-Scale Fisheries
% or # of small-scale fisheries (as per FAO), including the actors along the value chain, with decent work (as defined by ILO) in fisheries sector that provides food and nutritional security, supported by management plans based on ecosystem approach to fisheries (as FAO) that account for small-scale fisheries and that conserves and builds resilient (marine/coastal) social-ecological systems.

Indicator 2: Industrial fisheries (capture fisheries and aquaculture)
% of industrial fisheries (as per FAO), both capture and aquaculture, providing sustainable and decent work (as per ILO) [cross-reference to goal on decent work], including the actors along the value chain, under a precautionary and ecosystem approach to fisheries[14] (as per FAO) management plan that ensures equitable benefit sharing, with harmful subsidies eliminated (diminished) and the harvest being used efficiently fairly[15] [cross-reference to goal 12] and conserves and builds resilient social-ecological systems.

Indicator 3: Coastal and marine Development
% of coastal and marine development (A) with formulated or implemented ICZMs and MSPs (that are harmonized where applicable), based on an ecosystem approach (B), that builds resilient human communities and ecosystems and provides for equitable benefit sharing and decent work.

(A) unpacks into many relevant indicators – city coastal plans, energy, transport, ports, tourism, pollution control, sewage treatment, solid waste management, climate change adaptation
(B) need to define (UNEP or CBD?)

Indicator 4: Areas beyond national jurisdiction (ABNJ)
Increase the extent to which states implement the existing international legal frameworks and expand international legal instruments to encompass areas beyond the limits of national jurisdictn [ABNJ] and implement through regional and national legal planning processes to include:

- Monitoring and social and environmental impact assessments (SEIA) and MSP to ensure restoration, preservation and enhancement of natural capital, based on a robust and strengthened [best] scientific evidence base and natural capital accounting,
- ensuring access and benefit sharing - both inter- and intra-generational - in an inclusive and equitable way.

Note: The narratives of the developed integrative (aggregate) indicators include a range of keywords which expand into single indicators/parameters (see index for measuring human well-being for Winnipeg at www.mypeg.ca).

[14] Includes by-catch, management/gear restrictions etc.
[15] Refers to sustainable consumption; cross-reference to goal 12

3.6 Water quality

Facilitator*: Phillip Saile, Federal Institute of Hydrology IHP/HWRP-Secretariat, Germany*

3.6.1 Introduction

The health and well-being of humans and ecosystems as well as social and economic development are heavily dependent on sufficient water supply of appropriate quality. Human settlements and industrial and cultural activities are the major sources of water pollution. Polluted water directly affects water availability for use in a number of areas reducing water security.

It is estimated that 80% of sewage in developing countries is discharged untreated into water bodies. Each year approximately 3.5 million deaths related to inadequate water supply, sanitation and hygiene (WaSH) occur, mainly in developing countries. [16]

With respect to water, the current global development agenda has been primarily focused on socio-economic aspects, i.e. improving access to WaSH services to reduce waterborne and water-washed diseases disregarding environmental challenges caused by global change. There is an emerging consensus on the need for a dedicated water goal, which covers wastewater management and water quality (WWQM), water resources management (WRM) as well as safe drinking water and basic sanitation.

3.6.2 Background and on-going processes

In support of a dedicated and comprehensive sustainable development goal for water, UN Water has conducted an expert consultation process proposing a set of five potential targets and related indicators[17]. These targets have been picked up and extended by the OWG to propose a Global Goal for Water: 6. Ensure availability and sustainable management of water and sanitation for all. The fourth UN-Water target ("Target D: Reduce wastewater pollution and improve water quality by reducing untreated domestic and industrial wastewater by (x%); increasing wastewater reused safely by (y%); and reducing nutrient pollution by (z%) to maximize water resource availability and improve water quality") directly addresses water quality related development issues and translates to target 6.3 of the OWG proposal: "By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse by X% globally".

Monitoring developments and tracking progress for a water-specific SDG will require a coherent and efficient monitoring system that is able to provide global comparisons on progress and guide national and donor investment towards priority interventions. Taking on the targets and indicators proposed by UN-Water and the OWG, the Global Expanded Monitoring Initiative, a Swiss-funded tripartite collaboration between WHO, UN Habitat and UNEP is currently exploring possibilities to complement the existing WHO/UNICEF Joint Monitoring Programme (JMP) for water supply and sanitation with monitoring mechanisms for WWQM and WRM. In a first phase, the monitoring framework is being developed by seven task teams. There are six thematic areas and a seventh, cross-cutting, data-driven area:

1. Domestic wastewater and reuse (6.2, 6.3);
2. Industrial wastewater and reuse (6.3);
3. Water quality and reuse (6.3);
4. Water withdrawals and productivity (6.4);
5. Water withdrawals and ecosystems; and (6.6)
6. Integrated water resources management (6.5)
7. Earth observations, novel data collection and data integration.

[16] http://www.unwater.org/topics/water-quality/en/
[17] http://www.unwater.org/topics/water-in-the-post-2015-development-agenda/en/

The developed framework will be tested in selected countries in a proof-of-concept phase afterwards and later applied globally.
The preliminary results of the task teams show that there is a clear preference to build on existing monitoring mechanism, indicators and datasets. The SDG process offers the opportunity to enhance these existing mechanisms in terms of sustainability and to improve the spatial and temporal coverage of the supporting data sources.

Because most participants of the water quality working group are also involved in the GEMI, the discussions and resulting proposed indicators closely relate to the previous work conducted by the task teams.

3.6.3 Towards integrated measures - Links between water quality and the other environmental themes

Water quality is more or less closely linked to the other environmental themes discussed here. The following figure depicts these links in the context of the DPSIR framework perspective. Driving forces such as land use change, intensification of agriculture and change of consumption and production patterns can be influenced by community rights to land and natural resources and affect the domain of chemicals and wastes. Chemicals such as acids, POPs and heavy metals trigger pollution that poses pressures to both water and air quality. Wet and dry deposition from the atmosphere adds to water pollution both in inland waters and oceans. State changes (e.g. increased nutrient loads) of terrestrial water bodies have impacts (e.g. eutrophication) that can propagate to the oceans and adversely influence freshwater and maritime biodiversity.

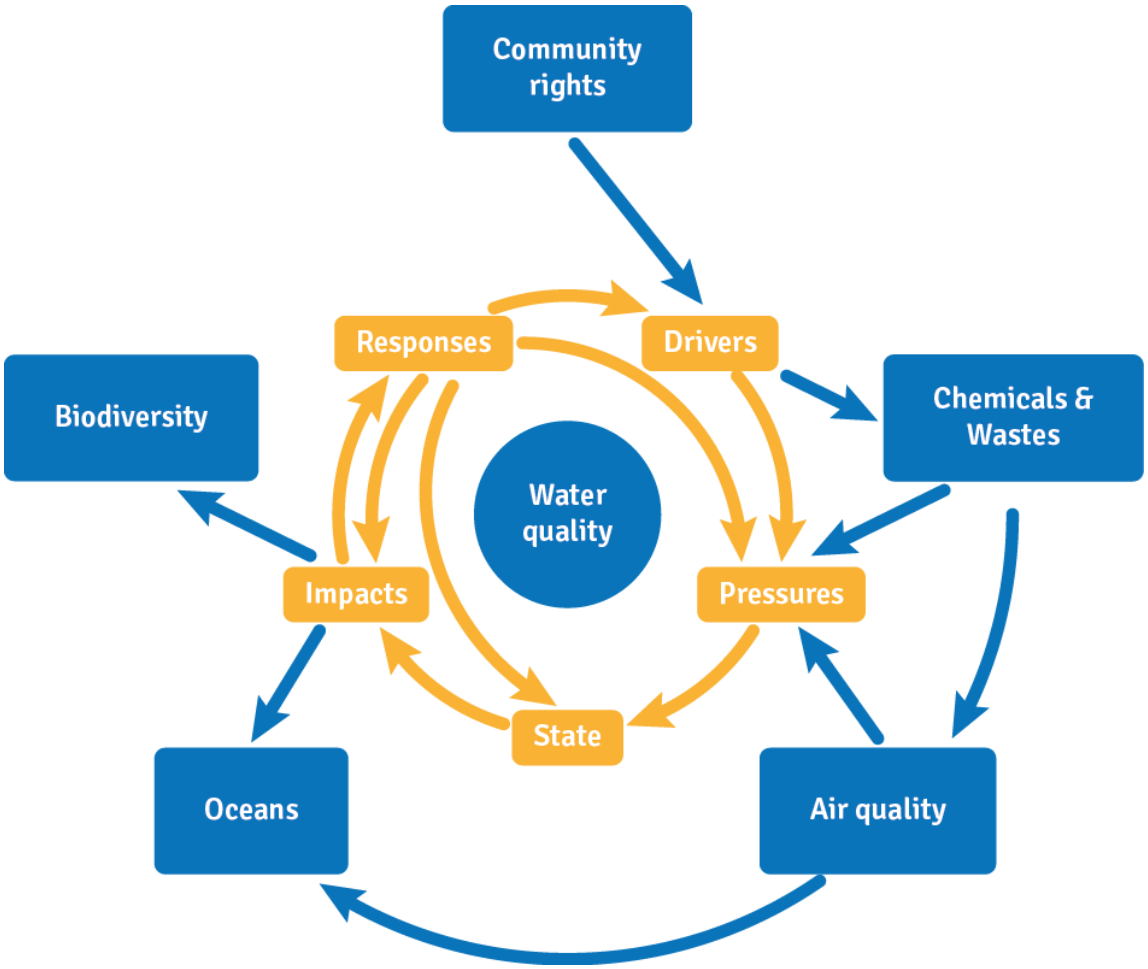


Figure 3.6.1 Water quality and the other environmental themes in the context of DPSIR

These links are partially reflected by the proposed targets, e.g. the sound management of chemicals requested in target 12.4 that directly relates to eliminating dumping and minimizing release of hazardous chemicals stated in target 6.3. The further reduction of SDG targets that is likely to happen and any indicator development can benefit from using a causal systems framework taking functional relations into account.

3.6.4 Proposed SDG indicators related to water quality

In a first step, the working group prioritized water quality issues deeming faecal contamination the most pressing problem over nutrient and hazardous chemical pollution.

Eleven criteria suggested by the GEMI task team for water withdrawals and productivity are used in order to evaluate the proposed indicators. The criteria are summarized in Table 3.6.1 below and are divided into three broad categories of policy relevance, analytical soundness, and measurability.

Table 3.6.1: Summary of criteria and characteristics considered in indicator evaluation, drawn from the GEMI task team draft report on Water-use efficiency, sustainable withdrawals and water scarcity

Policy Relevance	
Actionable	Indicators should be "actionable," that is, go beyond advocacy to policy, providing support for the debate, implementation and assessment of policy.
Clear linkage to target	Indicators must be clearly linked to the target, be easy to understand and unambiguous for interpreting positive and negative change relative to the benchmark and target by policymakers, Governments, civil society and the public. Indicators need to be simple to compile and interpret.
Analytical Soundness	
Data quality	Consideration of data sources is important. Preferably accounting is based on best estimates of actual local water management, verified on the ground. Ambient water quality monitoring programs should be quality-assured based on comparable analytical methods. While directly measured data are preferred estimated or modelled data are also acceptable.
Credibility/Consensus based	Core indicators, in particular, should be underpinned by a broad international consensus on their measurement and be based on international standards, recommendations, and best practices to facilitate international comparison.
Broadly consistent with systems-based information	To ensure coherence indicators should be broadly consistent with systems of national accounts, systems of environmental-economic accounting, and other systems-based information. In some cases, such systems are in development and improvements might be needed.
Universal relevance	The set of SDG indicators as a whole needs to track a universal agenda. Core indicators should be universally applicable to countries of different sizes, natural hydrologic regimes, and levels of development.
Measurability	
Institutional Responsibility	Each core indicator should be managed by one or more designated lead organization(s) that will be responsible for annual, high-quality national reporting of the indicator with due consideration to cost effectiveness, lean reporting processes, and national monitoring methods.

Data availability (baseline)	Data should be available or collection feasible to set a baseline at the national scale for the year 2015, especially for core indicators.
Feasibility of data acquisition and reporting	Feasibility of existing institutional arrangements to provide data collection is an important consideration. If new arrangements need to be made, feasibility of obtaining data with broad coverage is critical especially for core indicators.
Capacity implications at country level	Capacity or potential capacity for data collection and analysis to support the indicator must exist at national and international levels. This could be an opportunity to improve datasets and develop capacities in some countries.
Disaggregation	Indicators should allow, where relevant, for disaggregation by 1). Economic activity (e.g. agriculture, industry, energy, domestic), 2) Spatial disaggregation to small catchments, and 3) Temporal disaggregation to annual or monthly averaging period.

The focus was set on target 6.3 and the discussions based on the core indicators proposed by UN-Water targeting faecal and nutrient contamination (Table 3.6.2). Criteria for which the indicator performs well are highlighted in green, whereas those that do not perform well are highlighted in red (yellow as an intermediary)

Table 3.6.2 Summary of proposed indicators and evaluation criteria

		Policy Relevance			**Analytical Soundness**			**Measurability**				
	Proposed Indicator	**Actionable**	**Clear Linkage to Target**	**Universal relevance**	**Data quality**	**Credibility/Consensus based**	**Systems-based**	**Institutional Responsibility**	**Data availability (baseline)**	**Feasibility of data acquisition**	**Capacity implications at country-level**	**Disaggregation**
Wastewater	Proportion of the population for whom all domestic wastewater is treated to national standards in either collective or individual facilities											
	Proportion of industrial (and point source agricultural) wastewater flows not collected in public systems that is treated to national standards											
	Proportion of the flows of treated municipal wastewater that are directly and safely reused.											
	Proportion of the flows discharged by industrial wastewater treatment plants that are safely re-used. (This indicator does not include water directly re-used without leaving the factory).											
Ambient water quality	Proportion of receiving water bodies meeting water quality standards (nitrogen & phosphorous as a minimum).											

Data quality and availability are likely to be the main issues as data collection for global indicators is complex, time consuming and expensive. The indicators related to wastewater could draw required data from an expanded sanitation service chain approach building on data on improved sanitation, unimproved sanitation, open defecation and wastewater available from the JMP, additional environmental monitoring data, classification and analysis of waste management technologies and extending/adapting existing databases and surveys such as FAO Aquastat and the IBNET database. Data on safe management and reuse is quite sparse and data may need to be upscaled or derived from models.

Data on ambient water quality is collected globally by the UNEP GEMS/Water Programme. GEMS/Water has developed a composite global water quality index (Figure 3.6.2) on a country-level that covers different water quality parameters depending on the scope (drinking water, source water, acceptability).

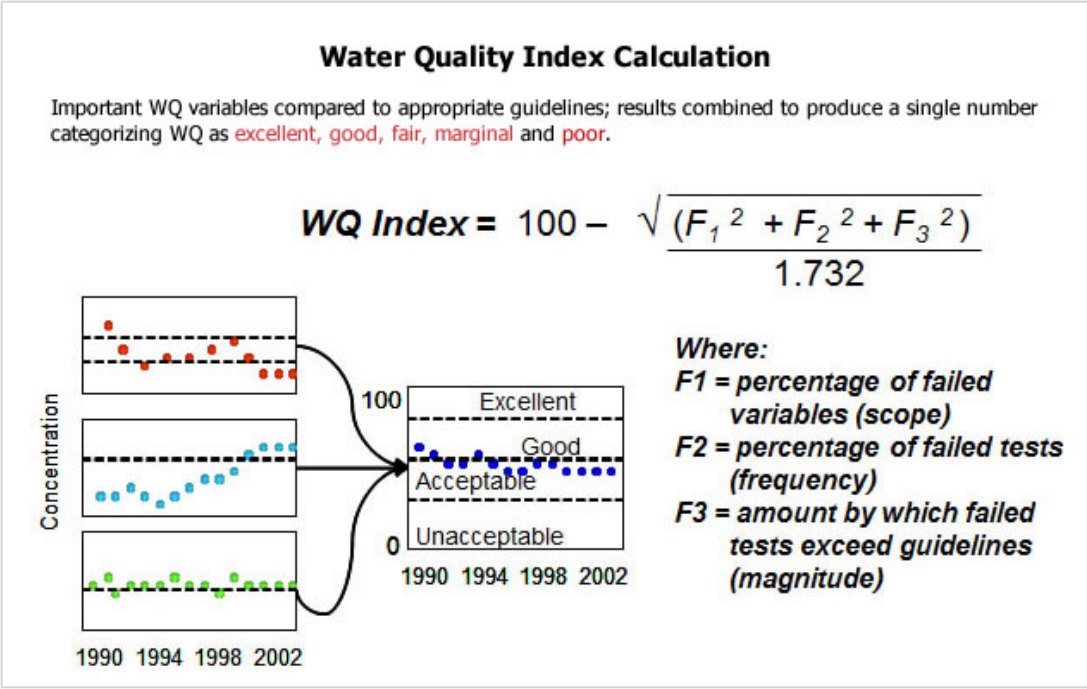


Figure 3.6.2 GEMS/Water Water Quality Index Calculation

However, the existing index has some deficiencies that need to be resolved before it can be used as SDG indicator: it relates to the WHO drinking water guidelines, temporal and spatial aggregations conducted during calculation lack hydrologic consistency and most importantly it is only available for about 90 countries due to limited availability of data.

Many countries lack the capacity to monitor ambient water quality in a systematic manner. If water quality is being monitored countries are often hesitant to share their monitoring data. Regional and global water quality assessments such as the World Water Quality Assessment that is currently conducted clearly show the deficits in spatio-temporal water quality monitoring data coverage and the limits of data-driven approaches. Large-scale water quality modelling can help to bridge the data gaps and support indicator application but requires careful analysis and clear communication of model-related uncertainties.

3.6.5 Ontologies

The use of ontologies to enhance ambient water quality monitoring systems and ease data exchange among stakeholders and across borders is still in its infancies. Over the last couple of years, the OGC

Hydrology Domain Working Group co-shared by WMO has developed WaterML 2[18], a data standard to exchange hydrological time series. This standard has recently been extended by a best practice profile for water quality that uses ontologies (ChEBI) and linked open data principles to describe water quality specific content, i.e. the properties/variables being observed. Further work is needed to fully describe water quality related metadata such as geographical features and analytical methods by means of ontologies.

There are ontologies for the wastewater domain such as WaWO but these have not been used yet to support global wastewater monitoring mechanisms or indicator development processes. However, there is a large potential in harmonizing terms and using ontology-based monitoring systems in the WaSH and WWQM domains as many terms being used are inconsistent resulting in misinterpretations and limited comparability.

3.6.6 Conclusions

- Water quality is relevant to social, environmental and environmental aspects of sustainable development.
- A dedicated water-specific SDG covering WaSH, WRM and WWQM is required.
- The Global Expanded Monitoring Initiative coordinates the development of an integrated and comprehensive global water monitoring system including indicator development for SDGs.
- Water quality is closely linked to the other environmental themes. These links need to be considered in future indicator development. A closer collaboration especially with the biodiversity and chemicals & waste communities is necessary.
- The five proposed core indicators are feasible but their implementation requires additional efforts in terms of monitoring coordination.
- Ontologies could augment global monitoring systems and indicator application but considerable harmonization work is necessary.

4. Conclusions

Numerous processes are currently ongoing at the global, regional, sub-regional and national levels that aim to promote and support the development and use of indicators, but much more work is needed to allow measuring progress in an integrated and systematic way.

The 6 areas: air quality, water quality, biodiversity, chemicals and waste, land tenure and oceans are relevant to all proposed SDGs, and influence the three pillars of sustainable development. The thematic working groups identified links between themes and cross-cutting indicators that speak to different thematic areas, and possible cross-cutting indicators.

It is important that indicators and or indices are not developed in thematic isolation, but that different experts across themes work together. Well-aligned domain ontologies can assist in developing coherent and robust standards and are critical to highlight the links between indicators in an integrated indicators framework.

Key Conclusions and Way Forward

1. Integrated indicators, based on universal data and information sources, need to be developed for the SDGs. The indicators will need to be balanced, robust, coherent, comprehensive, accurate and comparable.

2. To ensure the integrity of the SDG indicators it will be crucial that the inter-linkages amongst concepts and classes of processes and entities are clearly defined. This allows data gathered from one

[18] http://www.opengeospatial.org/standards/waterml

domain to be deployed successfully in another. For example, being able to use sectoral data such as catches from local fisheries in analyses of nutrition and food security.

3. Ontologies are well recognized in this regard. They are widely used in knowledge engineering, artificial intelligence and computer science; in applications related to areas such as knowledge management, natural language processing, e-commerce, intelligent information integration, bio-informatics, education; and in new emerging fields such as the semantic web.

4. The design of indicators based on the use of ontologies and the semantic web avoids the risk of extensive redundancy in data gathering and ensures that different data and statistics standards can be used together.

5. A series of indicator-ontology workshops are currently underway with a view to offering a pilot set of integrated indicators in the areas linked to a minimum level of social and environmental protection, ensuring equity and prosperity within the Earth's life support systems and increasing capital for greater resilience and intergenerational equity. These workshops involve scientists and researchers from all the major disciplines plus ontology engineers, in order to rapidly progress the underpinning framework for the SDGs.

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Annex 1: Review of relevant air quality indicators

	Existing indirect indicators
	Existing direct indicators
	New direct indicators

Open Working Group proposal Targets		Indicator
Goal 3: Ensure healthy lives and promote well-being for all at all ages **Indicative Linkages:** Health and well-being is influenced by air pollution		
3.2	By 2030 end preventable deaths of newborns and under-five children.	Under-five mortality rate (MDG Indicator 4.1)
		Infant mortality rate (MDG Indicator 4.2)
3.4	By 2030 reduce by one-third pre-mature mortality from non-communicable diseases (NCDs) through prevention and treatment, and promote mental health and wellbeing.	Healthy life expectancy at birth (SDSN Indicator #32)
3.9	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination.	Mean urban air pollution of particulate matter (PM10 and PM2.5) (SDSN Indicator #34)
		Existence of a population-representative exposure-response relationship
		Air pollution related mortality statistics (cardiovascular, cerebrovascular, respiratory, cancers)
		Air pollution related hospital admissions (cardiovascular, cerebrovascular, respiratory)
		Lost work days/lost school attendance due to air pollution related illness
Goal 7: Ensure access to affordable, reliable, sustainable, and modern energy for all **Indicative Linkages:** Modern energy use can reduce air pollution.		
7.1	By 2030 ensure universal access to affordable, reliable, and modern energy services	Share of population with access to modern cooking solutions, by urban/rural (SDSN Indicator #55/56)
7.2	Increase substantially the share of renewable energy in the global energy mix by 2030	Share of renewable energy in total final energy consumption (%) (CES Indicator #62)
7.3	Double the global rate of improvement in energy efficiency by 2030	Human activity-related energy intensities (Energy Indicators for SD Indicator #ECO6)
Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all **Indicative Linkages:** Sustainable economic growth can increase air pollution; an economic equilibrium can limit air pollution		
8.1	Sustain per capita economic growth in accordance with national circumstances, and in particular at least 7% per annum GDP growth in the least-developed countries.	Gross domestic product (GDP) per capita in US$ (CES Indicator #3)
Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation **Indicative Linkages:** Sustainable industrialization can increase air pollution		

Open Working Group proposal Targets		Indicator
9.4	By 2030 upgrade infrastructure and retrofit industries to make them sustainable, with increased resource use efficiency and greater adoption of clean and environmental sound technologies and industrial processes, all countries taking action in accordance with their respective capabilities.	Total energy and industry-related GHG emissions by gas and sector, expressed as production and demand-based emissions (tCO2e) (SDSN Indicator #69)
		Percentage of cleaner and energy-efficient industrial manufactures
Goal 10: Reduce inequality within and among countries **Indicative Linkages:** Reducing inequality within countries can reduce the vulnerability to air pollution of the poor. Reducing inequality among countries can avoid the export of polluting industries and waste.		
10.1	By 2030 progressively achieve and sustain income growth of the bottom 40% of the population at a rate higher than the national average.	Percentage of households with incomes below 50% of median income ("relative poverty") (SDSN Indicator #71)
Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable **Indicative Linkages:** Sustainable urbanization can reduce air pollution		
11.1	By 2030, ensure access for all to adequate, safe and affordable housing and basic services, and upgrade slums	Percentage of urban population living in slums or informal settlements (SDSN Indicator #72)
		Proportion of houses in zones vulnerable to particular environmental health issues, natural extreme events and disasters
11.2	By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.	Percentage of trips travelled by public transport and non-motorized transport (reduction of air pollution)
		Percentage of cleaner fuels
		Percentage of cleaner and energy-efficient vehicles
		Percentage of inspection & maintenance
11.5	By 2030 significantly reduce the number of deaths and the number of affected people and decrease by Y% the economic losses relative to GDP caused by disasters, including water-related disasters, with the focus on protecting the poor and people in vulnerable situations.	Number of people killed
		Number of people affected (injured, displaced, etc.)
11.6	By 2030, reduce the adverse per capita environmental impacts of cities, including by paying special attention to air quality, municipal and other waste management.	Annual mean urban exposure to particulate matter (PM10 and PM2.5)
		Emissions of particulate matter (CES Indicator #48)
		Urban exposure to ozone (8-hour mean)
		Emissions of ozone precursors (CES Indicator #50)
		Emissions of acidifying substances (CES Indicator #51)

Open Working Group proposal Targets		Indicator
		Emissions of additional compounds (Black carbon, volatile organic compounds, polycyclic aromatic hydrocarbons, methane, carbon dioxide, carbon monoxide, mercury, sulphur dioxide, nitrogen oxides
Goal 12: Ensure sustainable consumption and production patterns **Indicative Linkages:** Sustainable consumption (food and water) and production to satisfy basic needs can reduce air pollution Sound management of chemicals and wastes (e.g. open burning) can reduce air pollution		
12.4	By 2020 achieve environmentally sound management of chemicals and all wastes throughout their life cycle in accordance with agreed international frameworks and significantly reduce their release to air, water and soil to minimize their adverse impacts on human health and the environment.	Consumption of ozone-depleting substances (SDSN Indicator #79)
		Emissions of particulate matter (CES Indicator #48)
		Emissions of ozone precursors (CES Indicator #50)
		Emissions of acidifying substances (CES Indicator #51)
		CO2 emissions, total, per capita and per $1 GDP (PPP) (MDG Indicator 7.2)
12.6	Encourage companies, especially large and trans-national companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle.	Share of companies valued at more than [$1 billion] dollars that publish integrated reporting (SDSN Indicator #81)
		Proportion of companies with ISO 14001 certification
		Country implements and reports on System of Environmental-Economic Accounting (SEEA) accounts
Goal 13: Take urgent action to combat climate change and its impacts **Indicative Linkages:** Some air pollutants are greenhouse gases		
13.1	Strengthen resilience and adaptive capacity to climate related hazards and natural disasters in all countries	CO2 emissions, total, per capita and per $1 GDP (PPP)(MDG 7.2)
		National natural extreme event and disaster preparedness and management systems
13.2	Integrate climate change measure into national policies, strategies and planning.	Availability and implementation of a transparent and detailed deep decarbonization strategy, consistent with the 2C or below global carbon budget, and with GHG emission targets for 2020, 2030 and 2050 (SDSN Indicator #82)
		CO2 intensity in the power sector, and of new power generation capacity installed (gCO2 per kWh) (SDSN Indicator #83)
		CO2 intensity in the transport sector (gCO2/vKM) and of new cars (gCO2/pkm) and trucks (tCO2/tkm) (SDSN Indicator #84)
		Net GHG emissions in Agriculture, Forest and other Land Use (AFOLU) sector (tCO2e) (SDSN Indicator #85)
Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development **Indicative Linkages:** Air pollutants can contaminate water and accumulate in the food chain		
14.1	By 2025, prevent and significantly reduce marine pollution of all kinds, particularly from land-based activities, including marine debris and nutrient pollution	Nitrogen deposition (Aichi 8)

Open Working Group proposal Targets		Indicator
Goal 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development **Indicative Linkages:** Implementation of air quality standards is decisive for combating air pollution The global partnership for sustainable development is important for the abatement of global air pollution		
17.6	Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation, and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, particularly at UN level, and through a global technology facilitation mechanism when agreed.	X number of innovative south-south co-operation
17.7	Promote development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed.	Promote open access, sharing, processing, and use of scientific research and knowledge
17.8	Fully operationalize the Technology Bank and STI (Science, Technology and Innovation) capacity building mechanism for LDCs by 2017, and enhance the use of enabling technologies in particular ICT.	Capacity enhancement with respect to human, institutional and societal Science, Technology and Innovation to ensure evidence-based policies
17.16	Enhance the global partnership for sustainable development complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technologies and financial resources to support the achievement of sustainable development goals in all countries, particularly developing countries.	Increased multi-stakeholder collaboration across the policy science - society spectrum

Annex 2a: Overview of the relevance of existing BIP indicators to the SDG targets

OWG proposal SDG	Existing BIP indicators relevant to single SDGs	Existing BIP indicators relevant to multiple SDGs
1. End poverty in all its forms everywhere		5
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	4	3
3. Ensure healthy lives and promote well-being for all at all ages		1
4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all		7
5. Achieve gender equality and empower all women and girls		
6. Ensure availability and sustainable management of water and sanitation for all	3	2
7. Ensure access to affordable, reliable, sustainable and modern energy for all		
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all		1
9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation		3
10. Reduce inequality within and among countries		
11. Make cities and human settlements inclusive, safe, resilient and sustainable		5
12. Ensure sustainable consumption and production patterns	4	14
13. Take urgent action to combat climate change and its impacts*		1
14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	9	6
15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	15	14
16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels		
17. Strengthen the means of implementation and revitalize the global partnership for sustainable development		

Annex 2b: Matching BIP indicators to the SDG targets

SDG targets	Existing BIP indicators	Potential indicators	UNSDSN indicators
Goal 1. End poverty in all its forms everywhere			
1.4 by 2030 ensure that all men and women, particularly the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership, and control over land and other forms of property, inheritance, natural resources, appropriate new technology, and financial services including microfinance	Ratification status of the Nagoya protocol	What does the Nagoya protocol mean for individual citizens? Ratification does not necessarily translate to implementation.	
1.a. ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation to provide adequate and predictable means for developing countries, in particular LDCs, to implement programmes and policies to end poverty in all its dimensions	Official Development Assistance provided in support of the CBD objectives	Is this funding specific for SDG Target 1?	
	Funding provided by the Global Environment Facility		
	Global funds committed towards environmental policy, laws, regulations and economic instruments		
1.b create sound policy frameworks, at national, regional and international levels, based on pro-poor and gender-sensitive **development strategies** to support accelerated investments in poverty eradication actions	Status of NBSAPs		
Goal 2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		Nitrogen surplus	13
2.4 by 2030 ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that progressively improve land and soil quality	Wild Bird Index for farmland birds	FOBES - % food production incorporating trees and other native vegetation	
	Area under organic agriculture		
	Area under conservation agriculture		
	Red List Index for pollinators (birds & mammals)		
2.5 by 2020 maintain genetic diversity of seeds, cultivated plants, farmed and	Genetic diversity of terrestrial domesticated	More indicators around seed banks	

SDG targets	Existing BIP indicators	Potential indicators	UNSDSN indicators
domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at national, regional and international levels, and ensure access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge as internationally agreed	animals	being developed by BIP	
2.a increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development, and plant and livestock gene banks to enhance agricultural productive capacity in developing countries, in particular in least developed countries		Investment in seed banks as an indicator?	
2.b. correct and prevent trade restrictions and distortions in world agricultural markets including by the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round	World Trade Organisation (WTO) agricultural subsidies		
2.c. adopt measures to ensure the proper functioning of food commodity markets and their derivatives, and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility	World Trade Organisation (WTO) agricultural subsidies		
Goal 3. Ensure healthy lives and promote well-being for all at all ages			
3.1 by 2030 reduce the global maternal mortality ratio to less than 70 per 100,000 live births		Nutrition - access to nutritious foods, etc.	
3.2 by 2030 end preventable deaths of newborns and under-five children		Nutrition - access to nutritious foods, etc.	
3.3 by 2030 end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, water-borne diseases, and other communicable diseases		Consider indicators of ecosystem health and pharmaceuticals and ILK	
3.9 by 2030 substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination	Red List Index for birds showing trends driven by pollution		

SDG targets	Existing BIP indicators	Potential indicators	UNSDSN indicators
Goal 4. Ensure inclusive and equitable quality education and promote life-long learning opportunities for all			
4.1 by 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes	Investment in environmental education		
	Biodiversity Barometer (% of respondents that have heard of biodiversity)		
	Biodiversity Barometer (number of respondents giving correct definition of biodiversity)		
	Online interest in biodiversity		
4.4 by 2030, increase by x% the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship		Graduates in environmental disciplines - education stats from UNESCO?	
4.7 by 2030 ensure all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development	Funds committed to environmental research	Index of linguistic diversity	
	Knowledge transfer (number of biodiversity papers published over time)		
	Number of Global Biodiversity Information Facility (GBIF) records over time		
	Investment in environmental education		
	Biodiversity Barometer (% of respondents that have heard of biodiversity)		
	Biodiversity Barometer (number of respondents giving correct definition of biodiversity)		

SDG targets	Existing BIP indicators	Potential indicators	UNSDSN indicators
	Online interest in biodiversity		
4.b by 2020 expand by x% globally the number of scholarships for developing countries in particular LDCs, SIDS and African countries to enrol in higher education, including vocational training, ICT, technical, engineering and scientific programmes in developed countries and other developing countries	Investment in environmental education		
4.c by 2030 increase by x% the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially LDCs and SIDS	Investment in environmental education?	More funding? GEF?	
Goal 5. Achieve gender equality and empower all women and girls			
5.a undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance, and natural resources in accordance with national laws		Aichi Target 14 relevant here?	
5.c adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels		Aichi Target 14 relevant here?	
Goal 6. Ensure availability and sustainable management of water and sanitation for all			52
6.1 by 2030, achieve universal and equitable access to safe and affordable drinking water for all	Percentage of global rural population with access to improved water resources		49
6.3 by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse by x% globally	Nitrogen surplus		
6.5 by 2030 implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	Water footprint		52
6.6 by 2020 protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	Protected area coverage of freshwater ecoregions	Harness Ramsar criteria, regulations, etc.	

SDG targets	Existing BIP indicators	Potential indicators	UNSDSN indicators
	Wetland Extent Index	potential disaggregation of RLI and LPI by biome	
Goal 7. Ensure access to affordable, reliable, sustainable, and modern energy for all		Check long list of GBO4 indicators - renewable energies	
7.1 by 2030 ensure universal access to affordable, reliable, and modern energy services		No. Of hydro schemes following agreed protocols? Hydropower sustainability assessment protocol (World Bank)	
7.2 increase substantially the share of renewable energy in the global energy mix by 2030		And EIAs. Siting of off-shore wind farms.	
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all			
8.4 improve progressively through 2030 global resource efficiency in consumption and production, and endeavour to decouple economic growth from environmental degradation in accordance with the 10-year framework of programmes on sustainable consumption and production with developed countries taking the lead	Investment in Environmental Impact Assessment (EIA)?		
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation			
9.1 develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all	Investment in Environmental Impact Assessment (EIA)	Possibly EIAs but sustainable should have implications for biodiversity	
9.5 enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, particularly developing countries, including by 2030 encouraging innovation and increasing the number of R&D workers per one million people by x% and public and private R&D spending	Knowledge transfer (number of biodiversity papers published over time)		

SDG targets	Existing BIP indicators	Potential indicators	UNSDSN indicators
	Funds committed to environmental research		
9.b support domestic technology development, research and innovation in developing countries including by ensuring a conducive policy environment for inter alia industrial diversification and value addition to commodities		African countries move towards Green Economy	
Goal 10. Reduce inequality within and among countries			
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable			
11.3 by 2030 enhance inclusive and sustainable urbanization and capacities for participatory, integrated and sustainable human settlement planning and management in all countries	Investment in Environmental Impact Assessment (EIA)		
11.4 strengthen efforts to protect and safeguard the world's cultural and natural heritage	Protected area management effectiveness	Investment in botanical gardens, etc. Cultural heritage. WHC databases?	
	Funds towards nature reserves	City Biodiversity Index?	
	Protected area coverage of Important Bird and Biodiversity Areas		
	Protected area coverage of Alliance of Zero Extinctions sites		
11.6 by 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality, municipal and other waste management		CBD programme area on cities and urban areas?	
Goal 12. Ensure sustainable consumption and production patterns			
12.1 implement the 10-Year Framework of Programmes on sustainable consumption and production (10YFP), all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries	Area of forest under sustainable management: total FSC and PEFC forest management certification	Species in Trade CITES	
	Marine Stewardship Council engaged fisheries (Tonnage)		

SDG targets	Existing BIP indicators	Potential indicators	UNSDSN indicators
12.2 by 2030 achieve sustainable management and efficient use of natural resources	Ecological Footprint		
	Human Appropriation of Net Primary Productivity		
	Red List Index for birds, mammals & amphibians showing trends driven by utilisation		
12.4 by 2020 achieve environmentally sound management of chemicals and all wastes throughout their life cycle in accordance with agreed international frameworks and significantly reduce their release to air, water and soil to minimize their adverse impacts on human health and the environment	Insecticide use	Loss of reactive nitrogen to the environment	
	Nitrogen surplus	Nitrogen deposition	
	Red List Index for birds showing trends driven by pollution		
12.6 encourage companies, especially large and trans-national companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	Area of forest under sustainable management: total FSC and PEFC forest management certification	Species in Trade CITES, Sustainable levels of abstraction of natural resources (incl. From certified sources)	
	Marine Stewardship Council engaged fisheries (Tonnage)		
	Area under organic agriculture		
	Area under conservation agriculture		
12.7 promote public procurement practices that are sustainable in accordance with national policies and priorities		All wood products from certified forests, etc.	
12.8 by 2030 ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	Biodiversity Barometer (% of respondents that have heard of biodiversity)	Indicator on description of local biodiversity? CG? Biodiversity International?	
	Biodiversity Barometer (number of respondents giving correct definition of biodiversity)	Google ngram biodiversity in books?	
	Online interest in biodiversity		

SDG targets	Existing BIP indicators	Potential indicators	UNSDSN indicators
	Investment in environmental education		
12.a support developing countries to strengthen their scientific and technological capacities to move towards more sustainable patterns of consumption and production	Funds committed to environmental research		
	Knowledge transfer (number of biodiversity papers published over time)		
	Number of Global Biodiversity Information Facility (GBIF) records over time		
	Funding provided by the Global Environment Facility		
Goal 13. Take urgent action to combat climate change and its impacts Acknowledging that the UNFCCC is the primary international, intergovernmental forum for negotiating the global response to climate change **.**			
13.1 strengthen resilience and adaptive capacity to climate related hazards and natural disasters in all countries		Ecosystem resilience? Forest cover? Aichi Targets 13, 14 & 15?	
13.2 integrate climate change measures into national policies, strategies, and planning	Status of NBSAPs	NBSAPs? REDD+?	
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development			
14.1 by 2025, prevent and significantly reduce marine pollution of all kinds, particularly from land-based activities, including marine debris and nutrient pollution	Red List Index for birds showing trends driven by pollution	Disaggregate by marine	
	Ocean Health Index		82
14.2 by 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration, to achieve healthy and productive oceans	Protected area coverage of marine ecoregions	% of estuary, etc. classified as highly eutrophic (FOBES), is there something around dead zones?	
	Mean polar sea ice extent		
14.4 by 2020, effectively regulate harvesting, and end overfishing, illegal, unreported and unregulated (IUU) fishing and destructive	Funding of sustainable fisheries	Data from RFOs?	
	Marine trophic index		

SDG targets	Existing BIP indicators	Potential indicators	UNSDSN indicators
fishing practices and implement science-based management plans, to restore fish stocks in the shortest time feasible at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	Marine Stewardship Council engaged fisheries (Tonnage)		
	Proportion of fish stocks in safe biological limits		83
	Red List Index for seabirds	Species in Trade database CITES	
	Global effort in bottom-trawling		
14.5 by 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on best available scientific information	Protected area coverage of Important Bird and Biodiversity Areas	Disaggregate by marine but add habitat cover	
	Coverage of protected areas (Marine)		
	Protected area management effectiveness	Disaggregate by marine	
14.7 by 2030 increase the economic benefits to SIDS and LDCs from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism	Funding of sustainable fisheries	Marine protected areas - benefits for people...	
14.a increase scientific knowledge, develop research capacities and transfer marine technology taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular SIDS and LDCs	Knowledge transfer (number of biodiversity papers published over time)	The CBD CHM - the level of development of national CHMs and the categories of info that they are able to provide.	
14.c ensure the full implementation of international law, as reflected in UNCLOS for states parties to it, including, where applicable, existing regional and international regimes for the conservation and sustainable use of oceans and their resources by their parties	Percentage of Category 1 CITES Parties		
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss		PES?	

SDG targets	Existing BIP indicators	Potential indicators	UNSDSN indicators
15.1 by 2020 ensure conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	Coverage of protected areas (Terrestrial)	Restoration is difficult to measure at the moment. Also a gap in the indicators for the Aichi Targets. An area in need of work. Models? Invest, Predicts, etc. Ramsar have data on wetland restoration. Change in species diversity, etc.	
	Protected area management effectiveness		
	Funds towards nature reserves		
	Protected area coverage of bird, mammal and amphibian distributions		
	Protected area coverage of freshwater ecoregions		
	Protected area coverage of terrestrial ecoregions		
	Natural habitat extent		84
	Protected area coverage of Important Bird and Biodiversity Areas		87
	Protected area coverage of Alliance of Zero Extinctions sites		87
	Wild bird Index for habitat specialists		
15.2 by 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests, and increase afforestation and reforestation by x% globally	Area of forest under sustainable management: total FSC and PEFC forest management certification	Global Forest Watch,	85

SDG targets	Existing BIP indicators	Potential indicators	UNSDSN indicators
15.3 by 2020, combat desertification, and restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land-degradation neutral world	Area under conservation agriculture	Degraded land = degraded soil. Any biotic indicators? UNCCD? CBD has a programme under dry and sub-humid land.	
15.4 by 2030 ensure the conservation of mountain ecosystems, including their biodiversity, to enhance their capacity to provide benefits which are essential for sustainable development	Glacial mass balance	Protected area coverage of mountain regions? And forest coverage in mountain regions? Global Forest Watch?	
15.5 take urgent and significant action to reduce degradation of natural habitat, halt the loss of biodiversity, and by 2020 protect and prevent the extinction of threatened species	Living Planet Index		
	Red List Index (birds, mammals, amphibians and corals)		86
	Financial support for species protection		
	Mammal and bird extinctions	Species in Trade database CITES	
15.6 ensure fair and equitable sharing of the benefits arising from the utilization of genetic resources, and promote appropriate access to genetic resources	Ratification status of the Nagoya protocol		
15.7 take urgent action to end poaching and trafficking of protected species of flora and fauna, and address both demand and supply of illegal wildlife products	Percentage of Category 1 CITES Parties	CITES biennial reports, also Trafic, Interpol, WCO? National enforcement agencies.	
		Other sources with info incl TRAFIC, interpol, WCO	
15.8 by 2020 introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems, and control or eradicate the priority species	Trends in invasive alien species vertebrate eradications	Global Invasive Species Database	
	Red List Index for birds showing trends driven by invasive alien species		
	Trends in numbers of invasive alien species introduction events		

SDG targets	Existing BIP indicators	Potential indicators	UNSDSN indicators
	Adoption of national legislation relevant to the prevention or control of invasive alien species	Decisions taken by MEAs on invasives	
15.9 by 2020, integrate ecosystems and biodiversity values into national and local planning, development processes and poverty reduction strategies, and accounts	Status of NBSAPs	Countries that have undertaken ecosystem accounting	
	Investment in Environmental Impact Assessment (EIA)	WAVES target and Strategic Plan target	
	Number of research studies involving economic valuation		
15.a mobilize and significantly increase from all sources financial resources to conserve and sustainably use biodiversity and ecosystems	Official Development Assistance provided in support of the CBD objectives	Develop an indicator around PES?	
	Funding provided by the Global Environment Facility		
	Global funds committed towards environmental policy, laws, regulations and economic instruments		
15.b mobilize significantly resources from all sources and at all levels to finance sustainable forest management, and provide adequate incentives to developing countries to advance sustainable forest management, including for conservation and reforestation	Area of forest under sustainable management: total FSC and PEFC forest management certification		
15.c enhance global support to efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities	Percentage of Category 1 CITES Parties		
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels			

SDG targets	Existing BIP indicators	Potential indicators	UNSDSN indicators
Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development			

Annex 3: Proposed indicators related to chemicals and wastes for selected SDGs and associated targets (Indicators in blue are multi-dimensional and applicable to multiple goals/targets)

Targets	Indicators	Comments
Proposed goal 1. End poverty in all its forms everywhere		
1.5 by 2030 build the resilience of the poor and those in vulnerable situations, and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	**1.5.1 Percentage of people living in or within x distance to uncontrolled dumpsites and other "hot spots" emitting and releasing hazardous chemical** **1.5.2 Percentage of major toxic hotspots/contaminated sites/stockpiles with chemical risk management measures applied** **1.5.3 Number of countries that integrated chemicals and waste into their national development plans or strategies** **1.5.4 Percentage of national budgets allocated to sound management of chemicals and waste** 1.5.5 Number of countries with response mechanisms for environmental accidents involving chemicals as well as associated emergency preparedness policies	Applicable to target 1.5 and to the goal in general Also applicable to Cities and Means of Implementation
Proposed goal 2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture		
2.1 by 2030 end hunger and ensure access by all people, in particular the poor and people in vulnerable situations including infants, to safe, nutritious and sufficient food all year round	**2.1.1 Number of countries implementing and enforcing the Codex Alimentarius or equivalent national standards related to reducing chemical contamination in food** **2.1.2 Levels of hazardous pesticides and industrial chemicals in food** **2.1.3 Number of countries that have taken action to identify and replace highly hazardous pesticides**	

Targets	Indicators	Comments
2.2 by 2030 end all forms of malnutrition, including achieving by 2025 the internationally agreed targets on stunting and wasting in children under five years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women, and older persons 2.3 by 2030 double the agricultural productivity and the incomes of small-scale food producers, particularly women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets, and opportunities for value addition and non-farm employment 2.4 by 2030 ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that progressively improve land and soil quality	See 2.1.1, 2.1.2 and 2.1.3 See 2.1.1, 2.1.2 and 2.1.3 2.4.1 Number of countries with operational evaluation and registration systems for pesticides 2.4.2 Number of countries where national policy supports integrated pest management (IPM) 2.4.3 Number of countries where integrated vector management (IVM) national strategies, plans and implementation are in place 2.4.4 Proportion of obsolete pesticides disposed of in an environmentally sound manner / total obsolete pesticides 2.4.5 Number of countries effectively implementing and reporting on the requirements of the Rotterdam Convention 2.4.6 Proportion of bio-pesticides to chemical pesticides registered for use in agriculture 2.4.7 Accident rate involving poisoning by chemicals / pesticides 2.4.8 Number of farmers trained in integrated farm management system	
Proposed goal 3. Ensure healthy lives and promote well-being for all at all ages		
3.1 by 2030 substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination	**3.1.1 Mean population blood lead levels [and other heavy metals/chemicals] in children** 3.1.2 Concentration of hazardous organic compounds in human breast milk 3.1.3 Levels of persistent toxic substances and heavy metals present in subsistence food supplies such as fish and game. 3.1.4 Use of a water source at the household or plot that reliably delivers enough water to meet domestic needs, complies with WHO guideline values for Escherichia coli, arsenic and fluoride, and is subject to a verified risk management plan.	Same as the indicator on Education

Targets	Indicators	Comments
3.4 by 2030 reduce by one-third pre-mature mortality from non-communicable diseases (NCDs) through prevention and treatment, and promote mental health and wellbeing	3.4.1 Proportion of the urban population exposed to small/fine urban particulates (PM_{10} or $PM_{2.5}$) in concentrations exceeding WHO Air Quality Guidelines 3.4. 2 Estimated burden of disease from urban air pollution	
Proposed goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all		
4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and nonviolence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development.	**4.7.1 Mean population blood lead levels [and other heavy metals/chemicals] in children**	Same indicator as 3.1.1 for health
Proposed goal 6. Ensure availability and sustainable management of water and sanitation for all		
6.1 by 2030, achieve universal and equitable access to safe and affordable drinking water for all 6.3 by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse by x% globally	**6.1.1 Proportion of the population for whom all domestic waste water is treated to national standards in either collective or individual facilities.** **6.3.1 Proportion of industrial and point source agricultural wastewater flows not collected in public systems that is treated to national standards.** **6.3.2 Proportion of the flows of treated municipal wastewater that are directly and safely reused** **6.3.3 Proportion of the flows discharged by industrial waste water treatment plants that are safely re-used.** **6.3.4 Proportion of receiving water bodies meeting water quality standards (nitrogen & phosphorous as a minimum)**	Same as the indicators on oceans The indicator 6.3.2 does not include water directly re-used without leaving the factory

Targets	Indicators	Comments
Proposed goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all		
8.4 improve progressively through 2030 global resource efficiency in consumption and production, and endeavour to decouple economic growth from environmental degradation in accordance with the 10-year framework of programmes on sustainable consumption and production with developed countries taking the lead	8.4.1 Annual global production and sales of chemicals	
8.8 protect labour rights and promote safe and secure working environments of all workers, including migrant workers, particularly women migrants, and those in precarious employment	8.8.1 Number of safe and decent jobs involving chemicals and waste in manufacturing, and design, processes and productions, including resources recovery and recycling	
Proposed goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation		
9.2 promote inclusive and sustainable industrialization, and by 2030 raise significantly industry's share of employment and GDP in line with national circumstances, and double its share in LDCs	9.2.1 Number of deaths/occurrence of diseases attributable to chemicals exposure in the workplace. 9.2.2 Number of workers employed in sectors with exposure to chemicals and waste where little or no individual and collective protective measures are in place. 9.2.3 Number of job created in the field of environmentally sound waste management and decontamination. 9.2.4 Numbers of working days with limited or no ability to work due to occupational chemical poisoning.	Same as the 12.4.7 and 12.4.8 under SCP
9.4 by 2030 upgrade infrastructure and retrofit industries to make them sustainable, with increased resource use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, all countries taking action in accordance with their respective capabilities	**9.4.1 Number of countries that developed sound chemicals management corporate policies and practices throughout the value chain, including extended producer responsibility, communication about chemical hazards and risks both for chemicals and chemicals in products as well as the promotion of green design and BAT/BEP.** **9.4.2 Number of regulations and financial incentives developed to reduce the use of chemicals of highest concerns and to promote and substitute with safer alternatives**	Same as the 12.4.6 under SCP
9.5 enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, particularly developing countries, including by 2030 encouraging innovation and increasing the number of R&D workers per one million people by x% and public and private R&D spending	**9.5.1 Investments (in monetary terms) in research and development to promote green product design and safer alternatives, including non-chemical alternatives**	

Targets	Indicators	Comments
Proposed goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable		
11.1 by 2030, ensure access for all to adequate, safe and affordable housing and basic services, and upgrade slums	**11.1.1 Percentage of people living in or within x distance to uncontrolled dumpsites and other "hot spots" emitting and releasing hazardous chemical.**	Same as indicators on Poverty Eradication
11.6 by 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality, municipal and other waste management	**11.1.2 Percentage of major toxic hotspots/sites/stockpiles with chemical risk management measures applied**	Same as indicator 3.4.1 on Health
	11.6.1 Number of deaths as well and environmental and economic losses from industrial/technological disasters/emergencies	Same as indicators on wastes under Sustainable Consumption and Production
	11.6.2 Concentration of hazardous pollutants in the air	
	11.6.3 Proportion of the urban population exposed to small/fine urban particulates (PM_{10} or $PM_{2.5}$) in concentrations exceeding WHO Air Quality Guidelines	
	11.6.4 Waste generation rates (kg per capita/year, overall and by economic sector)	
	11.6.5 Percentage of waste materials recovered, reused and recycled, including for energy generation	
	11.6.6 Number of cities with infrastructure in place for sustainable waste collection, separation, re-use, transport, recycling, resource recovery, and disposal	
Proposed goal 12. Ensure sustainable consumption and production patterns		
12.4 by 2020 achieve environmentally sound management of chemicals and all wastes throughout their life cycle in accordance with agreed international frameworks and significantly reduce their release to air, water and soil to minimize their adverse impacts on human health and the environment	**12.4.1 Number of Parties to international multilateral environmental agreements on hazardous chemicals and waste such as the Basel, Rotterdam and Stockholm Conventions, the ILO Chemicals Conventions, the International Health Regulations and the Minamata Convention**	
	12.4.2 Number of national reports on the implementation of relevant multilateral environmental agreements on hazardous chemicals and waste	

Targets	Indicators	Comments
	12.4.3 Number of countries with institutional, legal, and regulatory frameworks for the sound management of chemicals and waste, including enforcement of national legislation and prevention of illegal traffic 12.4.4 Number of countries with multi-sectoral and multi-stakeholder coordination mechanisms in place for a coordinated implementation of chemicals and wastes conventions and SAICM 12.4.5 Number of countries that have adopted a full policy chain of instruments and approaches that stretch across the lifecycle from the entry of chemicals into the market to the management of chemicals at their disposal **12.4.6 Investments (in monetary terms) in research and development to promote green product design and safer alternatives, including non-chemical alternatives** **12.4.7 Number of countries that developed sound chemicals management corporate policies and practices throughout the value chain, including extended producer responsibility, communication about chemical hazards and risks both for chemicals and chemicals in products as well as the promotion of green design and BAT/BEP.** **12.4.8 Number of regulations and financial incentives developed to reduce the use of chemicals of highest concerns and to promote and substitute with safer alternatives**	Same as the 9.4.1 and 9.4.2 under Industrialization
12.5 by 2030, substantially reduce waste generation through prevention, reduction, recycling, and reuse	**12.5.1.Waste generation rates (kg per capita/year, overall and by economic sector)** **12.5.2 Percentage of hazardous wastes and other wastes, including obsolete stockpiles of pesticides, recovered, reused and recycled, including for energy generation** **12.5.3 Number of facilities for environmentally sound management of hazardous waste**	
Proposed goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development		
14.1 by 2025, prevent and significantly reduce marine pollution of all kinds, particularly from land-based activities, including marine debris and nutrient pollution	**14.1.1 Proportion of industrial and point source agricultural wastewater flows not collected in public systems that is treated to national standards.** **14.1.2 Proportion of the flows of treated municipal wastewater that are directly and**	Same as the indicators on water

Targets	Indicators	Comments
	safely reused **14.1.3 Proportion of the flows discharged by industrial waste water treatment plants that are safely re-used. (This indicator does not include water directly re-used without leaving the factory)**	
	14.1.4 Proportion of receiving water bodies meeting water quality standards (nitrogen & phosphorous as a minimum) 14.1.5 Quantities of plastics and other wastes entrained in ocean gyres	
Proposed Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss		
15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	15.5.1 Number of unmanaged obsolete pesticide stockpiles and improperly managed waste disposal sites **15. 5.2 Percentage of hazardous wastes and other wastes, including obsolete stockpiles of pesticides, recovered, reused and recycled, including for energy generation** **15.5.3 Number of facilities for environmentally sound management of hazardous waste** 15.5.4 Levels of hazardous chemical pollutants in freshwater ecosystems	Same as the indicator on wastes under Sustainable Consumption and Production
Proposed Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development		
17.9 Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South and triangular cooperation	17.9.1 Number of public-private partnerships to promote the implementation of sound chemical management policies and strategies as a contribution to economic development plans and processes **17.9.2 Number of countries that integrated chemicals and waste into their national development plans or strategies** **17.9.3 Percentage of national budgets allocated to sound management of chemicals and waste**	Same and indicators 1.5.3 and 1.5.4 under Poverty Eradication
17.14 Enhance policy coherence for sustainable development	**17.14.1 Number of countries with multi-sectoral and multi-stakeholder coordination mechanisms**	Same as indicators 12.4.1 and 12.4.3

Targets	Indicators	Comments
	in place for a coordinated implementation of chemicals and wastes conventions and frameworks **17.14.2 Number of countries with institutional, legal, and regulatory frameworks for the sound management of chemicals and waste, including enforcement of national legislation and prevention of illegal traffic**	under SCP
17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts	**17.18.1 Number of national reports on the implementation of relevant multilateral environmental agreements on hazardous chemicals and waste**	Same as indicators 12.4.2 under SCP

Annex 4: Land related indicators, proposed SDGs and targets

Security of tenure	1. Extent to which national legal frameworks recognize and protect rights and uses, for women and men, of common land and natural resources, derived through either customary or statutory regimes, in line with UNDRIP and other voluntary agreements 2. Percentage of IPLC who are aware of their legal rights to common lands and natural resources	1.4, 2.4 10.3, 10.6, 11.4, 11.a, 15.1,
	3. An **Index** comprising of: A) Women and men who are members of indigenous peoples and local communities with tenure [ownership, control, access, manage and use] over common land and natural resources that is legally recognized, secured, documented, and protected. B) Area of common land held by indigenous peoples and local communities that is given enforceable legal recognition guaranteeing access and use for both women and men. This index could be summarized as: **Proportion (area) of common land under the tenure of indigenous peoples and local communities that is legally recognized, secured, documented, and protected, and that guarantees equitable access and use to women and men**	
Loss of land and natural resources under control of indigenous peoples and local communities	4. Percentage change of area of common land held, accessed and used by women and men who are members of indigenous peoples and local communities in the reporting period. 5. Net primary productivity of common lands	1.4, 2.3, 15.1
Distribution of benefits on and from common lands and natural resources	6. Percentage of contribution of common lands and their natural resources to national GDP+, and to agrarian portion of GDP+	1.2 8.1 10.1, 10.2, 10.3
	7. Percentage change in GDP+ derived from the use of common land and natural resources by women and men who are members of indigenous peoples and local communities.	1.5 2.3, 2.5 7.2 8.1 10.1 11.a 15.6, 15.9
	8. Percentage and distribution of benefits derived from the use of common land, natural resources, and ecosystem services retained by the women and men who are members of indigenous peoples and local communities with tenure over those resources.	1.4, 1.5 2.3, 2.4, 2.5 5.a 7.2 8.2 10.1 11.a 15.6
	9. Percentage of remote and mobile communities, disaggregated by gender, age, ethnicity, with access to renewable energy, sustainable water, primary health care, and primary education	Goals 1, 3, 4, 5, 6 and 10
	10. Value of Multi-dimensional Poverty Index for IPLC from common land and natural resources, as compared to national averages.	Goal 1 and 10
	11. Existence of basic functional infrastructure on common lands,	Goal 10

	compared to national average (km of tertiary roads, number of primary mobile/remote schools and clinics, formal markets, etc. 12. Budget of local governments allocated to basic infrastructure on common lands as a percentage of all budget 13. Value of investments on basic infrastructure on common lands funded by revenues from IPLC (as % of local government budget, or as absolute value monitored for change over time)	
Governance and accountability	14. Extent to which policies and institutional mechanisms ensure the equitable participation, and representation of local communities in decision-making for common lands, including women,	5.a 8.2, 8.4, 8.9, 10.6 11.a 16.3, 16.7
	15. Percentage of agreements, arrangements and transactions affecting common land and resource use women and men who are members of IPLC that fulfill FPIC requirements	7.2, 7.b 8.2, 8.4, 8.9, 10.4 12.b 14.5 16.1, 16.3, 16.7
	16. Extent to which policies, legal and institutional mechanisms are set up and implemented effectively to reduce conflict and redress complaints and violations of rights to common land of both men and women 17. Percentage of common land, water, forest and pasture resources subject to conflict or complaints on rights, or use violations	8.2, 8.4, 8.9, 13.3 16.1, 16.3
	18. Reported cases of involuntary resettlements and forced evictions of women and men who are members of indigenous peoples and local communities from common land, and corresponding area of common land	8.2, 8.4, 8.9, 16.3
	19. Availability of information about land ownership on public registers and the % of common land and resource ownership which is included in this register	8.2, 8.4, Goal 17
Sustainable natural resources	20. Trends in area of community forest, agricultural, rangeland and aquaculture land under sustainable management	2.4, 12.2, Goal 15
	21. Extent to which national legal frameworks recognize and protect rights of women and men who are members of the community to use and manage water resources on common land	2.4, 6.5, 6.6, 6.b 9.1 11.4 12.2, 12.4 Goal 15
	22. Extent to which public consultation of both women and men occurs over environmental/social impact assessments [integrated impact assessments] conducted managing hazardous activities on common lands in a reporting period, compared to national average 23. Extent of dumping of hazardous wastes and pollution of soil and water on common lands	2.4, 3.9 11.7 12.2, 12.4 Goal 15
Practices and management	24. Percentage of common lands with local and customary regulations that ensure sustainability of shared and multiple use of natural resources, by women and men, in line with international standards and agreements	2.4, 6.5 8.2, 12.2, Goal 15
	25. Extent to which sustainable practices and management by women and men pastoralists, farmers, fishers, forest dwellers on common lands are protected and enhanced by policies and regulations	1.5 2.4, 6.5 8.2, 8.3, 8.5 9.3 10.7, 11.4 12.2,

		13.1 14.7, 14.b Goal 15
	26. Legal recognition of national and trans-national movement of women and men land users that is critical for sustainable management of common natural resources	10.7 11.a 13.1
	27. Consumption of products and services from resilient/viable traditional practices that provide incentives for continuation of sustainable management practices on common lands	2.5, 2.c 4.7 8.4, 8.9 12.8