Comments on CBD/WG2020/2/3

ZERO DRAFT OF THE POST-2020 GLOBAL BIODIVERSITY FRAMEWORK

With this submission, we respond to CBD notification 2019-108. Following up on the zero draft of the post-2020 global biodiversity framework (CBD/WG2020/2/3, "*Zero draft*" hereafter) presented by the Open Ended Working Group on the Post-2020 Global Biodiversity Framework in preparation for its second meeting in Rome, Italy, from February 24-29 2020, we wish to

i) provide recommendations regarding the implementation of the framework, addressed, mainly in sections E. through H. of the *Zero draft*,

ii) provide comments on specific goals and targets suggested in the *Zero draft.*

The comments and recommendations we provide here are based on important advances in the field of biodiversity research and were developed by an international group of over 50 experts (see Annex for a list of contributors) during a two-day workshop hosted by the German Centre for Integrative Biodiversity Research (iDiv) Halle, Jena, Leipzig, Germany.

i) Recommendations regarding the implementation of the framework

Assessments taking stock of the progress made towards the Aichi targets of the current global biodiversity framework reveal a sobering picture[1]. Most targets have not been met and in some cases biodiversity trends have worsened. One reason for this failure is the lack of appropriate implementation of actions promoting the manifold facets of biodiversity. Implementation gaps and obstacles occur at several geographic (i.e. global, national, local) and organizational (i.e. individual, institutional, governmental) levels. Gaps include lack of accountability, lack of clear action plans, insufficient integration of social capital and stakeholder participation, insufficient integration of biodiversity values across sectors (mainstreaming), lack of policy coherence, and insufficient enforcement of existing legislation. The gap between strategies, actions, and responses needs to be reduced through accountability across sectors (biodiversity mainstreaming), legislation (legal power) and reporting (improved monitoring). In order to address this shortcoming, we recommend a three-step framework that should guide the implementation of the 2030 targets and 2050 goals for biodiversity. We also propose associated targets and indicators.

Step 1: Identify actions and responsibilities for all scales and sectors.

Biodiversity conservation should be mainstreamed as a way to reach SDGs and other international agreements. Mainstreaming is needed across governmental departments and key economic sectors, from the city scale to the supranational scale. Biodiversity, or at least, reduction of negative impacts on biodiversity should be an objective of sectoral strategies, including in production sectors such as agriculture, fisheries and forestry, but also other sectors, e.g. transport, extractive industries etc. Therefore stakeholders at different levels in different sectors should identify the actions they need to take to contribute to the 2030 targets and goals. This identification should recognize the multiple values of biodiversity to people and take into account barriers and other (complementary or conflicting) policies requiring change**.** Methods to identify actions include positive future visioning and transformative pathways examination through participatory stakeholder engagement methods (including decision makers, scientists, local knowledge holders, businesses) for context and place specific biodiversity actions. National biodiversity platforms can play a key role in this process. By 2023, revised NBSAPs

[1] e.g., IPBES Global Assessment Report, 2019; IPBES Assessment Report on Land Degradation and Restoration, 2018

should describe sector specific-biodiversity actions and commitments and their expected contribution to global targets.

Suggested indicators: 1) Number of national sectoral strategies/programmes that consider the value of biodiversity and their contribution to biodiversity conservation. 2) Share of businesses with biodiversity management plans. 3) Quantification of direct and indirect biodiversity impacts of all sectors, including telecoupling, using a systems approach[2];

Step 2: Take actions and create ownership

Stakeholders need to implement the planned actions and a supporting environment for those needs to be created. For example, legislation should ensure integrated planning processes and conservation finance mechanisms could support the economic viability of biodiversity sound businesses. Accountability for the different stakeholders in each country needs to be implemented by rewarding stakeholders that have implemented their commitments and penalizing those that have not. Fiscal policy can be an important tool to implement accountability mechanisms in countries, for instance in fiscal transfers to municipalities or in taxation of businesses. The implementation of the strategic plan and targets/goals in NBSAPs need to be reported in subsequent National Reports (NRs). This requires continuity between the NBSAPs and NRs for monitoring and evaluation over time. At the international level, accountability mechanisms could also be considered, through access to GEF funding and World Bank loans.

Suggested indicators: 1) Proportion of actions planned already implemented by each stakeholder; 2) Proportion of fiscal transfers modulated by biodiversity performance; 3) Expected improvement on biodiversity based on actions already implemented for each sector;

Step 3: Assess biodiversity impacts

Temporal change in species composition and numbers depend on spatial scale, and particularly on grain and extent. The change includes species gains, invasions, losses, extinctions, extirpations, temporal turnover, and changes in spatial beta diversity. For example, a systematic loss of diversity at local sites can be disconnected from the loss at regional or global scales. Yet, biodiversity data and monitoring do not yet cover a representative sample of ecosystems as well as biodiversity facets. National biodiversity monitoring programs should be implemented to assess and report biodiversity impacts of the actions taken. Those programs should have appropriate taxonomic depth, be carried out over representative spatial and temporal scales, across ecosystems and across multiple facets of biodiversity. Such programs can be supported by novel and innovative methods for monitoring biodiversity change, such as Big Data and remote sensing. It is important that monitoring programs results are comparable across countries and that the data can be aggregated or disaggregated to sub-national, regional and global scales. Those data should be made publicly available through data repositories such as GBIF. Implementation could be facilitated by bodies such as GEO BON and IUCN. Because there is a delay between actions and biodiversity response, models to project the potential impact of conservation actions should be part of the monitoring systems. Models can also help fill temporal, spatial and taxonomic gaps. Progress realized or projected towards the 2030 and 2050 goals should be assessed and additional actions implemented when needed.

Suggested indicators: 1) Number of parties with nation biodiversity monitoring schemes, and number of taxa and facets of biodiversity monitored; 2) Proportion of monitoring data publically available; 3) Comparison between expected and actual improvement of biodiversity.

[2] Marques, A., et al (2019) Increasing impacts of land use on biodiversity and carbon sequestration driven by population and economic growth. *Nature Ecology & Evolution*, **3**, 628–637.

ii) Recommendations for specific goals, targets and indicators suggested in the Zero draft

In Table 1 we provide recommendations regarding specific goals and targets. We base our recommendations on recent and relevant scientific findings and provide suggestions for modification of the targets, possible indicators and recommendations for implementation. For further reference, we also provide links to relevant scientific literature. Importantly, we chose to consider only those goals and targets addressing areas of our expertise. This choice is not intended to imply higher priority of the addressed issues over those that were not addressed here.

Zero draft goal/target number	New scientific findings / rationale	Proposed changes to zero draft goals/targets	Additional indicators proposed	Recommendations for implementation	References
Appendix 1. Monitoring framework 2030 and 2050 goals					
(a) No net loss by 2030 in the area and integrity of freshwater, marine and terrestrial ecosystems, and increases of at least [20%] by 2050, ensuring ecosystem resilience	1) In addition to a percentage of area, species behaviour, habitat quality and ecological processes are important for ecosystem resilience and should be protected (eg. incl species composition or role of megafauna on biodiversity change) (1, 2, 3, 4,5). 2) Soil biodiversity is crucial for a plethora of ecosystem functions and services. Notably, recent research highlights that the distribution of soil biodiversity globally significantly differs from plants and aboveground taxa (e.g. 6-10); this needs to be considered when assessing biodiversity and designing new protected areas (7)	"… ensuring ecosystem resilience **and functioning**"	This is connected to Target 1 and could also be assessed with the bidimensional rewilding score (Torres et al. 2018)	To avoid replacement of high quality habitats with low quality habitat, compensation and offsetting should be done with comparable, and equally high quality areas (11). For instance, protection of old-growth forest cannot be replaced by forestry areas.	1. Visconti et al. (2019), https://science.sciencemag.org/content/364/6437/239/tab-pdf 2. Young et al. (2016) https://doi.org/10.1146/annurev-ecolsys-112414-054142 3. Niner et al. (2018) https://doi.org/10.3389/fmars.2018.00053 4. Bull et al. (2014) https://doi.org/10.1111/cobi.122431. 5. Torres et al., 2018, https://royalsocietypublishing.org/doi/full/10.1098/rstb.2017.0433 6. Tedersoo et al (2014) https://science.sciencemag.org/content/346/6213/1256688.full 7. Cameron et al. (2919) https://doi.org/10.1111/cobi.13311 8. Eisenhauer & Guerra (2019) 10.1038/d41586-019-02197-0 9. Philipps et al. (2019) 10.1126/science.aax4851 10. Eisenhauer et al. (2019) https://doi.org/10.1038/s41467-018-07916-1 11. Gonçalves, et al (2015) https://doi.org/10.1016/j.cosust.2015.03.008

(b) The percentage of species threatened with extinction is reduced by [X%] and the abundance of species has increased on average by [X%] by 2030 and by [X%] by 2050;	1) Current global extinction rates in select vertebrate taxa have been confirmed to exceed background rates (1-5). 2) Significant range contractions have been observed or predicted into the near future for some taxa (6-9). 3) Local extinctions and range shifts due to climate change have already been documented. 4) Disproportionate losses have been observed or predicted for large organisms and trophically apex species (10-12). 5) Importantly, populations of common and moderately common species are also declining (at least in Europe and North America), leading to a decline in total number of individuals and biomass (13).6) Both, local extirpations and local colonisations are accelerating (14).7) Only a minor fraction of total soil biodiversity has been described (e.g. ~0.2-2% of all soil nematodes) and now the first soil taxa are considered on IUCN red list (15,16) , challenging current biodiversity assessments.	By 2030 the population sizes of functionally relevant species have stabilized, and by 2050, the curve loss of taxonomic, genetic, functional, and interaction diversity is bent upwards at local, regional, and global scales.	Several Essential Biodiversity Variables based indicators are developed by the GEO BON community and described in (17)	1) The status of biodiversity should be monitored, including the status of non-threatend species. This is important specifically in underrepresented areas and at underrepresented taxonomic level (soil organisms, microorganisms) 2) Implementation of general monitoring schemes is needed including the development of automated (sensor) systems. 3) Increase funding on soil biodiversity monitoring.	1. Rosenberg et al. (2019), 10.1126/science.aaw1313 2. Barnosky et al. (2011), https://doi.org/10.1038/nature09678 3. Alroy (2015) 10.1073/pnas.1508681112 4. Ceballos et al. (2015) 2015;1:e1400253 5. Pimm et al. (2014) 10.1126/science.1246752 6. La Sorte & Jetz (2010) 10.1098/rspb.2010.0612 7. Wolf & Ripple (2017), http://dx.doi.org/10.1098/rsos.170052 8. Wiens (2016) 10.1371/journal.pbio.2001104 . 10.1098/rsos.170052. 9. Powney et al (2019) https://doi.org/10.1038/s41467-019-08974-9, 10. Lindenmayer et al (2012) 10.1126/science.1231070 11. Estes et al. (2011) 10.1126/science.1205106, 12. Schweiger & Svenning (2019) 10.1002/pan3.10066 13. Rosenberg, K.V et al. (2019) https://doi.org/10.1126/science.aaw1313 14. Dornelas et al (2019) https://doi.org/10.1111/ele.1324215. Phillips et al. (2017) 10.1038/s41559-017-0103 16. Eisenhauer et al. (2019) https://doi.org/10.1038/s41467-018-07916-1 17. Kim et al (2018). https://doi.org/10.5194/gmd-11-4537-2018
(c) Genetic diversity is maintained or enhanced on average by 2030, and for [90%] of species by 2050.	A focus on soil biodiversity is highly promising given the focus on next-generation sequencing approaches in this field.				

(d) Nature provides benefits to people contributing to (i) Improvements in nutrition for at least [X million] people by 2030 and [Y million] by 2050;(ii) Improvements in sustainable access to safe and drinkable water for at least [X million] people, by 2030 and [Y million] by 2050;(iii) Improvements in resilience to natural disasters for at least [X million] people by 2030 and [Y million] by 2050;(iv) At least [30%] of efforts to achieve the targets of the Paris Agreement in 2030 and 2050.			Several indicators have been proposed by the InVEST team which address this target well (1)		1. Chaplin-Kramer, R. et al (2019) 10.1126/science.aaw3372
(e) The benefits, shared fairly and equitably, from the use of genetic resources and associated traditional knowledge have increased by [X] by 2030 and reached [X] by 2050.	Not discussed during the workshop				

Appendix 2. 2030 action targets					
Reducing threats to biodiversity					
1. Retain and restore freshwater, marine and terrestrial ecosystems, increasing by at least [50%] the land and sea area under comprehensive spatial planning addressing land/sea use change, achieving by 2030 a net increase in area, connectivity and integrity and retaining existing intact areas and wilderness.	1) Functional diversity and species interactions (e.g. pollination, pest control, mycorrhization) are important for ecosystem functions and services and contribute to ecological restoration (1, 2); 2) Rewilding has large potential for ecological restoration as this supports three key processes: trophic complexity, stochastic disturbances, and dispersal (3); 3) Restoration success is not only strongly limited by dispersal limitation, connectivity is also key factor that should be taken into account while defining the restoration objectives (3,4). 4) Ecological restoration needs a multiscale approach combining local and large scale areas (3,4).The diversity of biotic interactions, drive ecosystem multifunctionality (5)	Re-formulate to include ecosystem functioning: "…achieving by 2030 a net increase in area, including integrity **and connectivity of biodiversity contributions to ecosystem functioning**, and retaining existing intact areas and wilderness.	1) Bi-dimensional rewilding score (6) 2) Restoration index or recovery completeness (8,9). 3) Evaluation of successional trends (7). 4) Functional connectivity (4), including between target species in restoration initiatives.	1) Standards for ecological restoration need to be established that ensure ecosystem resilience (e.g., number of species, number of functional types, functional diversity). These standards should apply to all ecosystems, including land managed for agriculture, forestry and urban areas. 2) Implement structured monitoring before and after restoration to gain better understanding and reporting of actual changes. 3) Apply an operational framework for rewilding in order to design, evaluate and measure rewilding intitatives and projects (3,6).	1. Jordano (2016), doi:10.1371/ journal.pbio.1002559 2. Kaiser-Bunbury et al. (2017), doi: 10.1038/nature21071 3. Perino et al. 2019, https://science.sciencemag.org/content/364/6438/eaav557019. 4. Volk et al (2018) https://link.springer.com/article/10.1007/s10980-018-0611-6 5. Hines et al. (2015) https://doi.org/10.1016/bs.aecr.2015.09.001 6. Torres et al., 2018, https://royalsocietypublishing.org/doi/full/10.1098/rstb.2017.0433 7. Prach & Walker (2018)https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2745.13078 8. Prach et al. (2019),https://doi.org/10.1111/rec.13011 9. Jones et al (2018) https://doi.org/10.1098/rspb.2017.2577

2. Protect sites of particular importance for biodiversity through protected areas and other effective area-based conservation measures, by 2030 covering at least [60%] of such sites and at least [30%] of land and sea areas with at least [10%] under strict protection.	1) Privately owned areas have great potential to protect biodiversity (1) 2) Integrity of protected areas needs to be secured, to reduce their fragmentation e.g. by roads and other infrastructure (2). 3) Different types of protected areas have different effectiveness (3) 4) Outcome based indicators for protected areas can be more effective than generic aerial targets (4)	Re-formulate to include ecosystem functioning: Protect sites of particular importance for biodiversity **and ecosystem function** through protected areas and other effective area-based conservation measures, by 2030 covering at least [x%] of such sites and at least [x%] of land and sea areas with at least [x%] under strict protection.	1. Outcome based indicators have been proposed by (3) and (4). 2. Area under different types of protected areas (e.g. I-III and IV-VI).	1) appropriate management of protected areas, with major focus on restoring self-regulating complex, biodiverse ecosystems. 2) compensation for habitat loss. 3) incentives to protect biodiversity outside-protected areas and in privately owned land (1).	1. Shumba et al (2020 https://doi.org/10.1016/j.gecco.2020.e00935, https://www.sciencedirect.com/science/article/pii/S2351989420300342 2. Ibisch et al. (2016) 10.1126/science.aaf7166 3. Leberger et al. (2019) https://doi.org/10.1016/j.biocon.2019.108299 4. Visconti et al. (2019),https://science.sciencemag.org/content/364/6437/239/tab-pdf

3. Control all pathways for the introduction of invasive alien species, achieving by 2030 a [50%] reduction in the rate of new introductions, and eradicate or control invasive alien species to eliminate or reduce their impacts by 2030 in at least [50%] of priority sites.	1) Non-native species of several taxa increase in numbers per region over time (1). 2) Human activities (modifying habitats, climate change, trade and transport) translating to both propagule and colonization pressure are much more important than the characteristics of species for invasions (2). 3) Species introductions in combination with extinctions can decrease phylogenetic diversity at a national/regional scale while increasing species richness (3). 4) Alien species can cause changes in composition and diversity of different biodiversity facets (taxonomic, functional, phylogenetic) (4). 5) Poleward and latitudinal range expansions due to climate change are now ubiquitous (5), including agricultural pests and disease vectors (6).	1) Halting the loss of biodiversity caused by invasive alien species by 2030, by preventing their impacts in [100% of] the most vulnerable areas, regulating [50% of] the most harmful invasive alien species, and effectively managing [50% of] the most significant pathways of introduction, such that their impacts are reversed through restoration and recovery by 2050. 2) A new target on climate change should also include preventing range expansions of pest species from warmer regions.	Indicator with global coverage specifying an xx% reduction compared to a baseline period (e.g. 2000-2020) as 1) number of species introductions per region over time, and 2) Impact of known invasive species per region over time. 3) Spread, impact and interventions EBV indicator framework (7)	1) Assess invasive species according to threat and high threat levels should be prioritzed for removal/prevention.2) Stricter regulations and control of use/imports of invasive species (e.g. for agriculture, gardens, pets, pest control, etc) 3) implementation of monitoring schemes, especially at ports/trade hubs 4)The status of biodiversity incl invasive species should be consistently monitored (incl. microrganism and underrepresented habitats such as soils).	1. Seebens et al. (2017) https://doi.org/10.1038/ncomms14435 2. Seebens et al. (2015) https://doi.org/10.1111/gcb.13021 3. Winter et al. (2009) https://doi.org/10.1073/pnas.0907088106 4.Vila et al. (2011) https://doi.org/10.1111/j.1461-0248.2011.01628.x Shirmel et al. (2012) https://doi.org/10.1007/s10530-012-0352-4 5. Gillings et al. (2014) https://doi.org/10.1111/gcb.12823; Auer & King (2014) https://doi.org/10.1111/geb.12174 6. Bebber et al. (2015) https://doi.org/10.1146/annurev-phyto-080614-120207 7. McGeoch, M. and Jetz, W. (2019) https://doi.org/10.1016/j.oneear.2019.10.003

4. Reduce by 2030 pollution from excess nutrients, biocides, plastic waste and other sources by at least [50%].	1) Pollution, including "invisible" forms and their combinations (e.g. microplastic, organic micropollutant mixtures including pesticides, pharmaceutical and personal care products (PPCP)(1-6), illegal drugs (7), etc.), has important consequences for both human health and biodiversity. 2) Most studies use single substances, but their toxicity will depend on combined effects in realistic concentrations in the environment.	Target should be more specific, enlisting key sources of pollution that have to be mapped and significantly reduced by 2030.	1) List of key sources of pollution. 2) Quantification of each pollutant; 3) Change in the rate of pesticide use (aquatic ecosystem): eg. SPEAR index (9); 4) Change in amount of other pollutants (micropollutants in water): Lines of evidence (LOEs) that provide complementary evidence on the presence and potential ecological impact of complex chemical pollution (10).	1) Assessing micropollutant complex mixtures in waterbodies: a) identify relevant contaminants, b) assess the impact of contamination in aquatic ecosystems, c) quantify cause–effect relationships between contaminants and adverse effects (10) ; using i) component-based methods that allow a predictive mixture risk modeling; ii) effect-based methods; iii) in situ tests; iv) field-derived species inventories (11).	1. Hölker et al 2010 https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/j.1365-2664.2012.02212.x 2. Barra Caracciolo et al (2015) J Pharm Biomed Anal 106:25-36. 3. Rehman, et al (2015). Chemosphere, 138, 1045-1055. 4. Cizmas et al. (2015) https://doi.org/10.1007/s10311-015-0524-4 5. Ebele et al. (2017). https://doi.org/10.1016/j.emcon.2016.12.004 6. Grenni et al. (2018) https://doi.org/10.1016/j.microc.2017.02.006 7. Bartrons & Peñuelas (2017). Trends in Plant Science 22(3):194-203. 8. Pal et al. (2013). Science of the Total Environment, 463, 1079-1092. 9. Beketov et al. (2009) https://doi.org/10.1016/j.envpol.2009.01.021. 10. Altenburger et al. (2019) https://doi.org/10.1186/s12302-019-0193-1 11.Backhaus et al. (2019). https://doi.org/10.1186/s12302-019-0276-z
5. Ensure by 2030 that the harvesting, trade and use of wild species, is legal and at sustainable levels.	Not discussed during the workshop				

6*. Contribute to climate change mitigation and adaptation and disaster risk reduction through nature-based solutions providing by 2030 [about 30%] [at least XXX MT CO2=] of the mitigation effort needed to achieve the goals of the Paris Agreement, complementing stringent emission reductions, and avoiding negative impacts on biodiversity and food security.	1) Ecological restoration can be used as a tool, target and objective for sustainable development, nature based solutions (1), climate mitigation and adaptation, carbon sequestration and biodiversity conservation (4) 2) Peatland conservation and restoration is urgent to avoid dramatic carbon losses from degrading areas (5) 3) Climate adaptation through nature-based solutions applies especially to wetlands and urban areas, here biodiversity can form a solution. Also for forestry and agriculture, nature-based solutions are critical for enhanicng the contribution of these sectors to climate change mitigation and building resilience of these sectors to climate change impacts. 4) The agricultural sector needs to reduce greenhouse gas emissions (6).		1) Climate change mitigation indicators (e.g. tCO2eq avoided emissions per ha; tC stored per ha) including indicators from soil systems (e.g. soil respiration rate, litter decomposition) (7, 8). 2) Indicators relevant for adaptation: water cycle (e.g. water retention; nutrient retention; water quality; etc.) soil protection and erosion control. 3) Biodiversity indicators (species composition, native species, etc.).	1) Invest in peatland and wetland conservation and restoration. 2) Restore degraded soils for food security 3) Restore degraded areas to reduce risk of natural disasters 4) Climate and biodiversity goals should be aligned and adapted to the particular challenges of sectors in order to build cross-sectoral synergies and avoid trade-offs. 5) Intelligent solutions for integrated combination of Nature-based solutions and grey insfrastructure for CC adaptation in cities need to be found 6) Monitoring should (also) be performed by sectors such as agriculture, forestry, water.	1.Bronson et al. (2017) https://www.pnas.org/content/114/44/11645 2. Jørgensen (2015) https://www.ecologyandsociety.org/vol20/iss4/art43/ 3. Kabisch et al. (2017) https://www.springer.com/de/book/9783319537504. 4. Kabisch et al. (2016) http://dx.doi.org/10.5751/ES-08373-210239 5. Bonn et al. (2016) 10.1017/CBO9781139177788.021 6. Pe'er et al. (2019) 10.1126/science.aax3146

Meeting people's needs through sustainable use and benefit-sharing**					
7. Enhance the sustainable use of wild species providing, by 2030, benefits, including enhanced nutrition, food security and livelihoods for at least [X million] people, especially for the most vulnerable, and reduce human-wildlife conflict by [X%].	Not discussed during the workshop				
8. Conserve and enhance the sustainable use of biodiversity in agricultural and other managed ecosystems to support the productivity, sustainability and resilience of such systems, reducing by 2030 related productivity gaps by at least [50%].	The concept of "sustainable intensification" (SI) has recently been questioned and revisited (1-3) given insufficient evidence that SI is truly reachable. Beyond local successes, the concept usually leads to intensification. While yield gaps do exist, there is also clear indication of over- rather than under-production.	This target may need to be carefully re-assessed to include a precautious addition of "productivity gaps" where these hamper self-sustainability and can be addressed without enhancing anthropogenic pressures and loss of natural habitats (e.g. small-scale landscape features)".	Land-cover and Land-use indicators, combined with yield and income data, may offer efficient indicators to assess impacts of agriculture and avoid intensification and loss of natural landscape features.	Implementation of this target requires identifyig target areas (e.g. comparing yield gap mapping with biodiversity-richness and hotspot mapping) and accompanying them by development of detailed development programmes, support-funding and long term monitoring to ensure success of such programs.	1. Cook, et al. (2015) https://pubs.iied.org/pdfs/14651IIED.pdf 2. Mahon, et al. (2017) https://doi.org/10.1016/j.ecolind.2016.11.001 3. Smith et al. (2015) https://doi.org/10.1016/j.geoforum.2015.03.017
9. Enhance nature-based solutions contributing, by 2030, to clean water provision for at least [XXX million] people.	Not discussed during the workshop				

10. Enhance the benefits of green spaces for health and well-being, especially for urban dwellers, increasing by 2030 the proportion of people with access to such spaces by at least [100%].	1) Biodiversity can contribute to mental and physical health (1-9). 2) Contact with nature can faciliate pro-environmental behaviours (10)	1) By 2030, countries have [doubled] the per-capita access of urban green to urban citizens.2) Enhance the benefits of green spaces for health and well-being **derived from clean air provision, regulation of extreme temperatures and opportunities for outdoors recreation, especially for urban dwellers, by** increasing by 2030 **the area of urban green space per capita and by increasing** the proportion of people with access to such spaces by at least [100%].	1) WHO accessibility indicators to greenspace that meets certain ecological and social standards [e.g. UK green flag award]. 2). Social interventions to increase use of urban green space (e.g. Number of school field trips, creation of a national health walk programme).3) Area of publicly accessible green space per person. 4) Cities green space exposure (% green area) 5) Urban planning include co-benefits of biodiverse greenspaces for human health into health programmes and planning decisions.	For indicator 1) Ensure accessibility to nature for humans living in urban environments in daily life, and sufficient exposure to nature in terms of dose and nature-quality (biodiverse, quiet, etc) (11, 12). For indicator 2) facilitate use or contact with biodiverse natural environments for children who live in urban environments (e.g. 1 week school trips to nature areas; Daily Green Mile (see Scotland))biodiversity benefits are included in teaching curricula) 3) public health professional and city planners know about and include co-benefits of biodiverse greenspaces for human health into health programmes and city/landscape planning decisions.	1. Hunter et al 2019 https://link.springer.com/chapter/10.1007/978-3-030-02318-8_17). 2. WHO&CBD report (2015) https://www.who.int/globalchange/publications/biodiversity-human-health/en/ ; 3. Aerts et al (2018) British Medical Bulletin https://doi.org/10.1093/bmb/ldy021 ; 4. Lovell et al (2014) Toxicology Health & Env Health doi:10.1080/10937404.2013.856361 ; 5. Dallimer et al (2012) BioScience https://doi.org/10.1525/bio.2012.62.1.9 ; 6. Marselle, et al. (2019) https://link.springer.com/book/10.1007/978-3-030-02318-8 ; 7. IEEP (2017) https://ieep.eu/publications/new-study-on-the-health-and-social-benefits-of-biodiversity-and-nature-protection ; 8. Engemann et all (2019) http://bit.ly/gremenPNAS 9. White, M.P., et al. (2019) 10.1038/s41598-019-44097-3 10. Alcock et al (2019) https://www.sciencedirect.com/science/article/pii/S0160412019313492?via%3Dihub 11. WHO report (2017) http://www.euro.who.int/en/health-topics/environment-and-health/urban- 12. The Access to Natural Green Space Standard. https://webarchive.nationalarchives.gov.uk/20140605111422/http://www.naturalengland.org.uk/regions/east_of_england/ourwork/gi/accessiblenaturalgreenspacestandardangst.aspx
11. Ensure that benefits from the utilization of genetic resources, and related traditional knowledge, are shared fairly and equitably, resulting by 2030 in an [X] increase in benefits.		Re-formulate to address data standards (FAIR, open-access)	Proportion FAIR and open access data (global and national)	Sequences should be Open access	

Tools and solutions for implementation and mainstreaming					
12. Reform incentives, eliminating the subsidies that are most harmful for biodiversity, ensuring by 2030 that incentives, including public and private economic and regulatory incentives, are either positive or neutral for biodiversity.	1) Harmful subsidies or subsidies with undesirable impacts on biodiversity are a risk (1-5). For example, supporting policies to meet the increasing demand for bioenergy are posing risks to biodiversity. 2) Climate change mitigation measures need to be streamlined with biodiversity targets to avoid negative impacts. While climate change mitigation debates bring up a need to streamline climate in our taxation system, internalization of biodiversity in our economy is not yet done. 3) Growth-oriented economy, endorsed by national and international agreements, conflicts with biodiversity protection aims.	1) Relevant targets need to be formulated that allow fiscal systems to internalize biodiversity in our economy. 2) Market prices in all economic sectors are corrected to reflect biodiversity values in private decision making.		1) Implement coherent policies and harmonise policies on different levels (International, Regional, National levels). 2) Develop and implement binding policies (e.g. policies based on the precautionary principle and polluter pay principle). 3) Internalise cost on the environment of different activities. 4) Non-internalisation of actions that have negative impact on the environment (ex: pollution is acting indirectly as a subsidy (TEEB). 5) Eliminate or reform harmful subsidies. 6) Create positive economic incentive for conservation and sustainable use of resources. 7) Implement also coercion and regulation enforcement.	1. Pe'er et al. 2019, Science 2. Benra et al (2019) https://doi.org/10.1016/j.landurbplan.2019.103589 3. Eisner et al. (2016) https://www.sciencedirect.com/science/article/abs/pii/S000632071630060X 4. Sumaila et al. (2019) https://doi.org/10.1016/j.marpol.2019.103695 5. https://www.cbd.int/doc/publications/cbd-ts-56-en.pdf

13. Integrate biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts, ensuring by 2030 that biodiversity values are mainstreamed across all sectors and that biodiversity-inclusive strategic environmental assessments and environmental impact assessments are comprehensively applied.	1) Multiple non-market benefits of biodiversity (insurance value, regulating services, recreation, existence values, etc) play an important role in biodiversity conservation. 2) There is increasing scientific knowledge on the trade-offs and synergies between these multiple non-market benefits. 3) Effective implementation of biodiversity policy requires mainstreaming accross governmental ministries and key economic sectors.	Include into target: 1) multiple biodiversity values and ecosystem services (ES)/nature contributions to people (NCP) to be fully reflected in national accounts, national planning and governmental decision making and spendings. 2) nature based solutions and biodiversity-enhancing activities are supported.	1) Financial incentives are aligned with biodiverity benefits in all economic sectors; 2) countries have adopted a widely accepted and binding biodiversity value concept; 3) all countries have implemented natural capital accounting (following the SEEA-EEA framework (1)) and include biodiversity values in planning process and social cost-benefit analysis; 4) countries have removed disincentives (including subsidies) for biodiversity-friendly forestry and farming; 5) Biodiversity checks at legislative levels for all sectors using a systems approach as recommended by TEEB for Agriculture and Food (2). 6) Existence of legislation foreseeing integrated land-use planning / or more broadly, integrated planning processes. 7) Quantify indirect biodiversity impacts of different sectors (e.g. transport via land occupation for infrastructure and associated emissions). 8) National sectoral strategies/programmes that consider the value of biodiversity and their contribution to biodiversity conservation. 9) Biodiversity footprint of sectors and products (e.g. land use in ha) as a measure for policy	1) Countries start a dialogue process to define a legally binding concept of biodiversity values 2) Countries evaluate processes in government decision making affecting biodiversity; 3) Countries list all biodiversity harmful subsidies and their financial amount to enable a monitoring of their phase-out; 4) Countries continue the development of natural capital accounts. 5) Implementation facilitated by supranational bodies (UN, EU, etc.) and incorporated into (sub)-national as well as supra-national laws, regulations, treaties and policies. 6) Holistic policies to be implemented across ministries. 7) Specific sectoral strategies, i.e. biodiversity conservation should be discussed in the agricultural, fisheries, and forestry programmes, amongst other. 8) Strengthening the co-design of management and policy options at the science-policy-practice	1. SEA-EEA (2014) https://seea.un.org/content/natural-capital-and-ecosystem-services-faq 2. TEEB (2018). http://teebweb.org/agrifood/measuring-what-matters-in-agriculture-and-food-systems/

			impact (1); 10) percentage of biodiversity relevant policy decisions that are based on the consideration of biodiversity values. 11) Biodiversity benefits are included in teaching curricula.	interface in order to enable transformative changes that biodiversity loss in an inclusive, cross-sectoral and policy coherent manner; 9) Promote action-oriented research at the science-policy-practice interface that takes into account the knowledge, motivation and concerns of the different actors involved;	

14. Reform economic sectors towards sustainable practices, including along their national and transnational supply chains, achieving by 2030 a reduction of at least [50%] in negative impacts on biodiversity	1) Telecoupling (including trade, urban-rural relationships, feedback loops, general notion of leakages, remote responsibility, growing awareness about the concept of environmental footprint and indirect impacts of consumption on biodiversity) have all been major themes of research in the recent years. 2) A number of biodiversity footprint indicators have been developed, refined or are under development (no standard yet). 3) Indicators of remote responsibility for biodiversity impacts into corporate sector are available. 4) National policies have to acknowledge and account for impacts processes on their national territory have on systems outside.	1) The target should explicitly address direct and indirect drivers of change (e.g., remote biodiversity impacts and telecoupling). By 2030, countries have enforced regulation to fully monitor and disclose biodiversity-impacts along the value chain (including imports), and have disclosed them for consumption products. By 2030, countries have reduced trade-related biodiversity impacts by at least [50%]. 2) Indicators on the use of and impacts on biodiversity are included in Life Cycle Assessments, reported in a transparent manner and included in decision making on supply chain management, following established guidance such as the SEEA EEA (1)), TEEB 2018 (2) and the Natural Capital Protocol 2016 (16).	1) Companies disclose biodiversity impacts throughout the value chain. 2) Countries implement biodiversity footprint lables and metrics by 2030. 3) Countries assess the biodiversity impacts embodied in their international trade (4). 4) Countries have reduced their total consumption-related biodiversity footprint by XX in 2050%. 5) percentage of stock-exchange-listed companies in each country that mention biodiversity in their corporate reponsibility statements, or that participate in zero-deforestation commitments or other initiatives.	1) Countries implement labels on consumer products on environmental-friendlyness (e.g., traffic light system). 2) Countries enforce minimum biodiversity standards for imported agricultural products. 3) Countries and sectors adopt binding goals to reduce biodiversity footprints. 4) Countries monitor biodiversity footprints using established guidance such as SEEA EEA (2014), TEEB 2018 and the Natural Capital Protocol (2016). 5) Life Cycle thinking approaches should be used to quantify biodiversity impacts (For example multi-regional input-output analysis, Life Cycle Assessment, biophysical accounting methods for impacts embodied in international trade).	1. SEA-EEA (2014) https://seea.un.org/content/natural-capital-and-ecosystem-services-faq 2. TEEB (2018). http://teebweb.org/agrifood/measuring-what-matters-in-agriculture-and-food-systems/ 3. Natural Capital Coalition. 2016. www.naturalcapitalcoalition.org/protocol 4. Marques et al. (2019), https://doi.org/10.1038/s41559-019-0824-3 5. Vanham et al. (2019) https://doi.org/10.1016/j.scitotenv.2019.133642 6. Lenzen et al (2012), https://doi.org/10.1038/nature11145 7. Chaudhary and Kastner, 2016, https://doi.org/10.1016/j.gloenvcha.2016.03.013 8. Schröter et al. (2018) https://doi.org/10.1016/j.ecoser.2018.02.003 9. Koellner et al. (2019) https://doi.org/10.1016/j.ecoser.2018.04.012 10. Moran & Kanemoto (2017) 10.1038/s41559-016-0023 11. Wilting et al. (2017) https://doi.org/10.1021/acs.est.6b05296 12. Sterner et al. (2019) https://doi.org/10.1038/s41893-018-0194-x 13. Hicks et al. (2019) https://www.nature.com/articles/s41586-019-1592-6 14. United Nations (2014) System of Environmental Economic Accounting 2012 - Experimental Ecosystem Accounting. New York. https://ec.europa.eu/eurostat/documents/3859598/6925551/KS-05-14-103-EN-N.pdf 15. Crenna et al. (2019) https://doi.org/10.1016/j.jclepro.2019.04.054. 16. Asselin, et al. (2019) https://doi.org/10.1016/j.jclepro.2019.119262.

15. Resources, including capacity-building, for implementing the framework have increased from all sources so that by 2030 resources have increased by [X%] and are commensurate with the ambition of the targets of the framework.	Not discussed during the workshop				
16. Establish and implement measures in all countries by 2030 to prevent potential adverse impacts of biotechnology on biodiversity.	Not discussed during the workshop				
17. People everywhere take measurable steps towards sustainable consumption and lifestyles, taking into account individual and national cultural and socioeconomic conditions, achieving by 2030 just and sustainable consumption levels.	Not discussed during the workshop				
18. Promote education and the generation, sharing and use of knowledge relating to biodiversity, in the case of the traditional knowledge, innovations and practices of indigenous peoples and local communities with their free, prior and informed consent, ensuring by 2030 that all decision makers have access to reliable and up-to-date information for the effective management of biodiversity.	1) Biodiversity benefits of the cross-cultural projects through top-down directives and policies (1,2). 2) Larger efforts on integrating different sources of knowledge are still needed.	Re-formulate to address data standards (FAIR, open-access)	Proportion of FAIR and open access data (global and national)	1) Strengthening the co-design of management and policy options at the science-policy-practice interface in order to enable transformative changes that address biodiversity loss in an inclusive, cross-sectoral and policy coherent manner; 2) Promote action-oriented research at the science-policy-practice interface that takes into account the knowledge, motivation and concerns of the different actors involved;	1. Ens et al. (2016) https://link.springer.com/article/10.1007/s10531-016-1207-6 2. Tourinho et al. (2017) https://periodicos.ufpa.br/index.php/ncn/article/view/3350

19. Promote the full and effective participation of indigenous peoples and local communities, and of women and girls as well as youth, in decision-making related to the conservation and sustainable use of biodiversity, ensuring by 2030 equitable participation and rights over relevant resources.	1) Community based conservation and citizen science as a tool for empowerment 2) increasing threats and (lethal) violence against indigenous and local conservationists		1) Number of projects and of participants in community based conservation projects. 2) Number of projects and of participants in citizen science projects. 3) Number of people involved in ecological restoration (public involvement in conservation) 4) Decline in the frequency of violence against conservationists	1) Use community based conservation and citizen science as a tool for empowerment and behavioural change 2) Promote law, policies and enforcement of these policies to protect indigenous communities and local conservationists	Hecker et al. (2018) http://doi.org/10.5334/cstp.114 Kelly et al. (2019) https://doi.org/10.5751/ES-10704-240116 Ballard et al. (2017) https://doi.org/10.1016/j.biocon.2016.05.024 Hecker et al. (2018) http://discovery.ucl.ac.uk/10058422/.
20. Foster diverse visions of good quality of life and unleash values of responsibility, to effect by 2030 new social norms for sustainabilty.	1) Evidence shows the importance of moving beyond awareness towards behavioural and transformative change. 2) Scenarios and positive futures are developped (e.g. Nature futures IPBES) (1). 3) Determinants and barriers to pro-environmental behavior change have been identified (2)		1) Number of people with diets close to WHO standards. 2) Number of km/flights/person Less flying. 3) Number of people that value biodiversity. 4) Declining cognitive distance knowledge to action.	1) Apply behavioral change theories to frame actions for biodiversity conservation (what needs to be done, who is reponsible, how should it be done) 2) WHO and other UN bodies should include biodiversity into their sets of goals.	1. Rosa et al. (2017) https://www.nature.com/articles/s41559-017-0273-9 2. van den Berg (2019) https://doi.org/10.1016/j.esr.2019.100420

* Target 6 on mitigation of climate change should be moved to Targets-Section b

** Targets-Section b) should be renamed to "Meeting people's needs through sustainable use, nature-based solutions and benefit-sharing", to emphasize the broad importance of nature-based solutions for a multitude of desired biodiversity-benefits for people

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