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FEEDBACK ON OTHER INDICATORS CONSIDERED BY THE PARTIES FOR TARGET 15

Table 1. Feedback from CDC Biodiversité on the CBD's list of proposed alternative or additional headline indicators for Target 15 (CBD 2022).

PROPOSED ALTERNATIVE OR ADDITIONAL HEADLINE INDICATOR (CBD 2022)	FEEDBACK FROM CDC BIODIVERSITÉ
"Dependencies and impacts of businesses on biodiversity and related human rights"	This is very broad, and both MSA and MSA.km² are specific indicators to track impacts of businesses on biodiversity.
"Ecological footprint"	This is not used by companies and is not directly related to biodiversity.
"Extent of natural vegetation/terrestrial ecosystems converted due to commodity/soft production"	We believe it is more relevant to directly measure condition-weighted impact in MSA.km² (and to cover the whole value chain, not just commodity production).
"Indicator on dependencies, impacts, risks, and opportunities from the Taskforce on Nature-related Financial Disclosures (TNFD)"	As for the indicator mentioning dependencies above, this seems too broad. Furthermore, at this stage, the TNFD does not suggest metrics or indicators.
"Number of companies assessing and reporting on their net impact on biodiversity"	We believe the word "net" is not useful here: companies should report separately on their negative and positive impacts.
"Number of companies publishing sustainability reports"	This seems too broad.
"Number of production sectors in each country that use biodiversity includes certification schemes or biodiversity practice guidelines"	This does not seem to be what is needed to achieve a 50 % reduction (it would be insufficient).
"Policies and measures in place that prevent and regulate impacts on biodiversity and biodiversity related human rights."	This seems too broad.
"Proportion of total revenue, of business (a) assessing and disclosing material biodiversity impacts and dependencies of their operations and supply chains through quantitative metrics; (b) having set science-based targets for nature; and (c) having set science-based targets for climate"	The mention of science-based targets for climate does not seem necessarily relevant here. Furthermore, the proportion of total revenue/of business is interesting but seems hard to achieve in practice (the number of businesses may be easier to quantify).

DETAILED ASSESSMENT OF THE FITNESS OF MSA AND MSA.KM² AS CBD INDICATORS

Annex 1 of SBSTTA recommendation 24/2 presents six criteria "the indicators in the monitoring framework for the post-2020 global biodiversity framework should meet, or be able to meet by 2025" (CBD 2022). Justifications are provided below on how MSA and MSA.km² fit, or are expected to fit in the future, these criteria.

> "The data and metadata related to the indicator are publicly available"

MSA (and by extension MSA.km²) have been constructed using peer-reviewed literature (Alkemade et al. 2009; Schipper et al. 2016). The data underpinning the indicators are thus publicly available (although not necessarily open source). For instance the global MSA values at a 300x300m resolution are available through the GLOBIO-IMAGE publications.

> "The methodology underpinning the indicator is either published in a peer reviewed academic journal or has gone through a scientific peer review process and has been validated for national use"

For MSA, a number of peer-reviewed publications provide details on the methodology underpinning the indicator (Alkemade et al. 2009; Schipper et al. 2020). For MSA.km², CDC Biodiversité is working on setting up a consortium to collaborate on peer-reviewed publications. These will include methodological publications on the MSA.km² indicator at a global scale and a fine spatial resolution.

> "The data sources and indicators should be compiled and regularly updated with a time lag of less than five years between updates, if possible"

For MSA, the publications cited for the criterion above demonstrate regular updates. Other non peer-reviewed publications that justify this include (Schipper et al. 2016). Furthermore, the indicator is used in the CBD's Global Biodiversity Outlooks, including the last two (Secretariat of the Convention on Biological Diversity 2020; 2014), as well as by IPBES, for example in its assessment report (Brondízio et al. 2019). For MSA. km², the consortium mentioned in the criterion above will aim to regularly (every 1 to 2 years) publish regional and global MSA.km² values.

> "There is an existing mechanism for maintaining the indicator methodology and/or data generation […] including providing nationally applicable guidance on the use of the indicator"

For MSA, the PBL (Netherlands Environmental Assessment Agency) is regularly missioned to contribute to Global Biodiversity Outlook exercises and publish MSA values for these. For MSA.km², the consortium mentioned in the criteria above will be commissioned in part to produce regular updates of the indicator methodology and values. Long-term funding for this consortium is thus being searched for.

> "Indicators should be able to detect trends relevant to the components of the goals and targets of the post-2020 global biodiversity framework"

Please see the main text for the justification of this criteria (paragraphs 2 and 3).

> "When possible, indicators are aligned with existing intergovernmental processes under the United Nations Statistical Commission"

The consortium mentioned in the criteria above will engage with the GEOBON to align with the work carried out on essential biodiversity variables, as well as with the UN SEEA with regards to accounting of biodiversity gains/losses with MSA and MSA.km².

FEEDBACK ON OTHER INDICATORS CONSIDERED BY THE PARTIES FOR GOAL A

Table 2. Feedback from CDC Biodiversité on the CBD's list of proposed headline and component indicators for Goal A (CBD 2022a). The characteristics marked with * are cited from Annex 1 of the SBSTTA recommendation 24/2, as criteria "the indicators in the monitoring framework for the post-2020 global biodiversity framework should meet, or be able to meet by 2025", while those marked with # are cited from Annex 1 of the Technical analysis of indicators proposed for the monitoring framework for the post-2020 global biodiversity framework(CBD 2022b).

The evaluation of the criteria marked # was performed in CBD (2022b) for the headline and component indicators: #Relevance ("Whether the indicators were of relevance to the corresponding draft goals or target of the post-2020 global biodiversity framework"), #Nationally feasible ("The feasibility that the indicators can be measured at national […] scales"), #Globally feasible with national disaggregation ("The feasibility that the indicators can be measured at […] global scales"), #Available ("Whether the indicator is ready for use"). The evaluation for all other criteria was performed by CDC Biodiversité without external review. Indicator developers are invited to provide feedback if they feel CDC Biodiversité's evaluation is inexact.

CHARACTERISTICS	MSA	MSA.km²	HEADLINE INDICATORS — A.0.1 Extent of [selected] natural and [seminatural and] modified [sustainable[y]] [managed] ecosystems [in all biomes of the IUCN ecosystem typology] by type [(e.g. forest, [desert,] savannahs and grasslands, wetlands, [lakes, rivers,] [alpine vegetation,] mangroves, saltmarshes, coral reef, seagrass, macroalgae and intertidal habitats)]	A.0.2 Species Habitat Index	A.0.3 Red list index	A.0.4 The proportion of populations within [umbrella] species with a [genetically] effective population size > 500	COMPONENT INDICATORS — A.3.1 Ecosystem Integrity Index
Reflects ecosystem condition			We believe this indicator is indeed mandatory to maintain as a headline indicator. As indicated in Appendix 1 of the SBSTTA recommendation 24/2, this indicator does not cover ecosystem integrity (CBD 2022a); MSA.km² would thus be particularly useful also as a headline indicator, to fill this gap in the headline indicator suite.		This indicator is complementary to MSA.km² (species component of biodiversity): we believe it is thus very valuable as a headline indicator.	This indicator is complementary to MSA.km² (genetic component of biodiversity): we believe it is thus very valuable as a headline indicator.	
Reflects ecosystem extent	(1)						
Considers ordinary biodiversity							
Can be calculated at multiple scales through cause effect relationships							
Can be used to set no biodiversity loss targets (including no net loss)							
Used by businesses and financial institutions							(1)
*"The data and metadata related to the indicator are publicly available"							
*"The methodology underpinning the indicator is either published in a peer reviewed academic journal or has gone through a scientific peer review process and has been validated for national use"							
*"The data sources and indicators should be compiled and regularly updated with a time lag of less than five years between updates, if possible"		(2)(4)	See comment above		See comment above		
*"There is an existing mechanism for maintaining the indicator methodology and/or data generation […] including providing nationally applicable guidance on the use of the indicator"		(3)					
*"Indicators should be able to detect trends relevant to the components of the goals and targets of the post-2020 global biodiversity framework"							
*"When possible, indicators are aligned with existing intergovernmental processes under the United Nations Statistical Commission"	(1)	(5)					
#Relevance							Not provided in (CBD 2022b)
#Nationally feasible							
#Globally feasible with national disaggregation							
#Available							

Caption CBD (2022b) for text in between quotation marks. ■ "The indicator meets the assessment criteria" ■ "The indicator partially meets the assessment criteria" ■ "No data or information can be found for the suggested indicator" or the indicator does not meet this criteria. □ Not assessed

(1) MSA does not meet this criteria (not even in part).
(2) The goal is for it to be used by business and financial institutions in the future.
(3) MSA.km² does not (yet) meet this criteria (not even in part).
(4) Work is under way to provide regular calculations of the indicator at global and sub-national scales, see Appendix 3.
(5) Xxxxxx

THE MEAN SPECIES ABUNDANCE (MSA)

The Mean Species Abundance (MSA) is the metric used in GLOBIO cause-effect relationships. It describes biodiversity changes with reference to the undisturbed state of ecosystems. It is defined as the average abundances of originally occurring species relative to their abundance in the undisturbed ecosystem. Undisturbed ecosystem is understood here as equivalent to a pristine state, intact and undisturbed by human activity. The MSA is defined as (Schipper et al. 2016):

$$MSA = \frac{1}{N_{reference\ species}} \sum_{i=1}^{N_{reference\ species}} \mathrm{Min}\left(\frac{A_{observed}(i)}{A_{intact}(i)}, 100\%\right),$$

Where

MSA = mean abundance of native species,

$N_{reference\ species}$ = total number of species in an undisturbed ecosystem,

$A_{observed}(i)$ = abundance of species i in the observed ecosystem,

$A_{intact}(i)$ = abundance of species i in an undisturbed ecosystem,

MSA is applicable to both land and aquatic ecosystems. MSA varies between 0% and 100%[1]. The abundance of invasive alien species is not included in the calculation of MSA (they are not "native species" present in the undisturbed ecosystem): if the growth of their population is detrimental to native species, then it will result in a decline of the MSA of the ecosystem. Similarly, if some species (temporarily) grow above their undisturbed abundance (their abundance would still be 100% as it is capped) in a way that is detrimental to other species (e.g. ungulates overgrazing vascular plants), the overall abundance of the ecosystem declines. Other cases exist where one species temporarily overshoots the undisturbed abundance (e.g. saplings with a higher density per hectare than mature trees) without negatively impacting other species, thus not negatively impacting MSA.

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(1)   The ceiling at 100% is caused by the "minimum" function in the MSA formula.