

## Conservation of evolutionary heritage supports the transformative change required for the CBD post2020 Framework: proposed phylogenetic diversity indicators as a contribution from non-state actors

#### Summary

The post 2020 global biodiversity framework seeks to bring about a transformation in society's relationship with biodiversity. Such transformative change needs to address the CBD Vision's<sup>1</sup> dual challenges to better appreciate the value of biodiversity and to halt its loss.

The IUCN Species Survival Commission's Phylogenetic Diversity Task Force (PDTF), here submits views<sup>2</sup> on proposed species-level indicators for Phylogenetic Diversity. Such indicators fit within Goal 2 (or subsequent iterations of this) in the zero-draft of the post-2020 global biodiversity framework<sup>3</sup>. They can also serve in any potential suggestions for a proposed species-focused target(s) framed around improving the status of threatened species. In addition to Goal 2, other goals and targets from the zero-draft including the call for new social norms and better integration of biodiversity values, are informed by our indicators. The commitment to the tracking and reporting of these indicators by the PDTF and partners as non-state actors recognises the transformative power of better recognising neglected values of biodiversity.

The central element of this commitment is the recognition of a critical and often overlooked aspect of biodiversity; the evolutionary heritage represented by a set of species called Phylogenetic Diversity (PD; Faith 1992). The use of PD to capture evolutionary heritage also already serves as an indicator for one of "*nature's contributions to people*", the "*maintenance of options*" (IPBES 2019; Diaz *et al.* 2019). This global option value of biodiversity is often neglected in policy and assessment (Faith 2018) but is essential if we are to capture the full value of biodiversity for humanity. Thus, our PD indicators address an important but to date neglected value of a set of important species and lineages. Our proposed indicators enable the tracking of trends in the status of unique and overlooked threatened species forming a key aspect of the value of biodiversity.

The tracking of these two indicators represents an important contribution by non-state actors in support of the transformative change required to address the CBD Vision of living in harmony with nature.

#### Authors:

Owen N (<u>nishaowen@ontheedge.org</u>), Chaudhary A, Daru B, Gray C, Forest F, Gumbs R, Hernandez JA, Kowalska A, Scherson R, Pellens, R, Pollock L, Rosindell J, Wallis D, and Faith DP (<u>Dan.Faith@austmus.gov.au</u>)

IUCN SSC Phylogenetic Diversity Task Force: <a href="https://www.pdtf.org/">https://www.pdtf.org/</a>

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<sup>&</sup>lt;sup>1</sup> https://www.cbd.int/decision/cop/?id=12268

<sup>&</sup>lt;sup>2</sup> Notification 2019/108 from the Executive Secretary of the Secretariat of the Convention of Biological Diversity: Submission of views on possible targets, indicators and baselines for the post-2020 global biodiversity framework

<sup>&</sup>lt;sup>3</sup> CBD/WG2020/2/3/ hereafter referred to as CBD zero-draft framework



## CBD post-2020 Framework: challenges requiring transformative change

The CBD zero draft framework notes that the post-2020 global biodiversity framework seeks to "bring about a transformation in society's relationship with biodiversity". Similarly, the Vision of the Strategic Plan for Biodiversity<sup>4</sup> states that "By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people". In particular, the Vision calls for biodiversity to be better recognised and appreciated as valuable. Transformative change therefore needs to address these dual goals to both better appreciate the value of biodiversity and to halt its loss.

Biodiversity value is not only a reference to the values of individual species, ecosystems and genes, but also critically refers to the value of all species collectively – that is, the value of this overall variety itself. Thus, new targets and indicators to address that transformation in society's relationship with biodiversity should not only reference species extinctions, but also how these losses could impact the bigger picture of biodiversity and its values.

This perspective supports a strong CBD post-2020 Mission statement with preliminary statements<sup>5</sup> emphasising that "the mission statement should .... encapsulate the importance of biodiversity for human society", stated that "an ambitious framework ... galvanizes global level actions for biodiversity" and "generates a societal sense of responsibility to act for biodiversity." Such a mission therefore needs to highlight not only the intrinsic and societal benefits of individual species, but also a normative value of overall biodiversity.

Fulfilling the Vision requires overcoming the current acknowledged gap regarding availability of indicators for biodiversity value – a gap recognised in recent documents<sup>6</sup>. Recent work on biodiversity value points to a way forward<sup>7</sup>, emphasising the need for a post 2020 framework to report on Nature's Contributions to People (NCP; IPBES 2019; Diaz *et al.* 2019). NCP extends beyond the concept of just ecosystem services to include a valuable contribution provided by biodiversity: maintenance of options. This responsibility to keep options open for future generations provides that desired *"societal sense of responsibility to act for biodiversity"* (Faith 2017, 2018). This global option value of biodiversity is as yet under-appreciated (Faith 2017, 2018, 2019), and addressing this provides one ingredient of the needed transformative change. IPBES Regional and Global Assessments (IPBES 2019; Diaz *et al.* 2019) recognises and applies Phylogenetic Diversity (PD) as one indicator of maintenance of options<sup>8</sup>.

<sup>&</sup>lt;sup>4</sup> <u>https://www.cbd.int/decision/cop/?id=12268</u>

<sup>&</sup>lt;sup>5</sup> CBD/POST2020/PREP/1/INF/2

<sup>&</sup>lt;sup>6</sup> CBD/SBSTTA/23/INF/4 and CBD/SBSTTA/23/INF/3

<sup>&</sup>lt;sup>7</sup> CBD/POST2020/PREP/1/INF/2

<sup>&</sup>lt;sup>8</sup> For review, see Faith et al. (2018) and background information available from the SSC Phylogenetic Diversity Task Force



## Linking to a species-level target

The CBD zero-draft framework states five long-term goals related to the 2050 Vision for Biodiversity. Goal 2 is the primary statement of the need to reduce extinctions; however, the listed targets for 2030 in the zero-draft do not explicitly link to this, and therefore do not enable adequate implementation or tracking of progress towards this Goal.

The goal of halting species extinctions by improving the status of threatened species should be at the core of a new species-level target. This is essential given the biodiversity crisis and recent assertion that one million species may be at risk of extinction<sup>9</sup>. IPBES also highlighted how this loss of species, and therefore biodiversity (in the sense of variety), means also a loss of nature's contributions to people.

A recent IUCN submission<sup>10</sup> proposed a new species target as a successor to Aichi Target 12: *"Halt overall species' population declines by 2030 such that they have recovered by 2050, prevent extinctions of all species, and improve the status of at least 30% of species by 2030 and 100% by 2050."* The recent IUCN proposal for targets submitted to the CBD<sup>11</sup> also noted that a species-level target could include consideration of phylogenetic diversity. Any species target framed around improving the status of threatened species would be well served by our proposed indicators, encapsulating the importance of conserving our evolutionary heritage.

## Links to other proposed goals and targets related to the zero-order draft

Additionally, other goals and targets from the draft are relevant, demonstrating the power of these aspects of transformative change to integrate various goals and targets.

**Goal 4** in the zero-order draft refers to "*Nature provides benefits to people*" and cites clean water and other such services. Noting that such benefits are expanded by IPBES as Nature's Contributions to People (NCP), NCP18: maintenance of options, is an important contribution of biodiversity itself and our two indicators therefore will be informative for Goal 4. There remains a need to address NCP18 maintenance of options as an important contribution of biodiversity itself.

**Target 13** refers to better integration of biodiversity values "*ensuring by 2030, that biodiversity values are mainstreamed*" The zero-draft notes that indicators remain to be identified. Our two indicators will be informative for Target 13.

**Target 20** is described as *"Foster diverse visions of a good quality of life and unleash values of responsibility, to effect by 2030 new social norms for sustainability."* This target further reinforces the need for transformative change that better addresses normative values of biodiversity. There is a strong compelling case that the two indicators, in reflecting maintenance of options, and responsibility or normativity<sup>12</sup> provide the flagship indicators for Target 20.

<sup>12</sup> This argument for an ethic of biotic diversity for future benefits for future generations traces back to Haskins 1970 and other early papers. See also Faith 2017, 2018

<sup>&</sup>lt;sup>9</sup> IPBES Global Assessments & Executive Summary for Policy Makers (2019); Diaz et al. (2019)

<sup>&</sup>lt;sup>10</sup> <u>https://www.cbd.int/conferences/post2020/submissions/2019-108</u>

<sup>&</sup>lt;sup>11</sup> https://www.iucn.org/sites/dev/files/iucn proposed targets based on sbstta23-2-add.4 121119.pdf



## Global recognition and conservation of evolutionary heritage

The value of biodiversity/variety to future generations relates to both insurance and maintenance of future options (or investment)<sup>13</sup>. In this context, IPBES and many others refer to Phylogenetic Diversity as a core aspect of biodiversity. PD measures the evolutionary history represented by a set of species. PD is a biodiversity measure because the tree of life captures the variety of evolutionary novelties or features. We cannot know the scale and scope of all the features, but the tree of life provides a proxy for this variety. The extinction of a species that represents an entire branch of the tree also means a significant loss of feature diversity, and consequent loss of the maintenance of options for future generations. The amount of PD expected to be lost can be tracked through time in relation to the endangerment of species. Phylogenetic diversity is recognised by IPBES as an indicator for the maintenance of options, building on the link between phylogenetic diversity, feature diversity, and biodiversity option value (Faith 1992; Faith *et al.* 2018).

It is clear that there are critical aspects of biodiversity conservation which require greater attention in order to achieve transformative change under the post 2020 framework. One challenge is to consider both the global loss of biodiversity and its global value in an integrated way. Maintenance of options delivered by biodiversity can provide the desired moral and normative reasons to protect biodiversity. Further, this link to maintaining possible benefits for future generations forges the tight relationship between biodiversity and sustainability. Phylogenetic diversity, in providing a biodiversity measure reflecting richness of evolutionary novelties or features, could be more widely adopted as an indicator of maintenance of options for multiple taxonomic groups.

A practical methodology to apply the concept of phylogenetic diversity to conservation is embodied in the EDGE lists produced by the Zoological Society of London (ZSL). EDGE (Evolutionarily Distinct and Globally Endangered) species are those which disproportionately represent threatened phylogenetic diversity. The evolutionary novelties of EDGE species provide a two-fold link to values for humanity: their novel features are awe-inspiring for the current generation, and those features (or others still to be discovered) represent possible benefits for future generations.

EDGE species have been identified for mammals (Isaac *et al.* 2007; Collen *et al.* 2011; Gumbs *et al.* 2018), amphibians (Isaac *et al.* 2012; Gumbs *et al.* 2018), birds (Jetz *et al.* 2014; Gumbs *et al.* 2018), corals (Huang 2012; Curnick *et al.* 2015), reptiles (Gumbs *et al.* 2018), gymnosperms (Forest *et al.* 2018) and elasmobranchs (Stein *et al.* 2018). EDGE species collectively represent not only the major opportunities to avert loss of PD and maintenance of options, but also, as highly distinctive species, represent heritage and existence values (Owen *et al.* 2019). Reflecting this, in 2012, IUCN adopted a resolution<sup>14</sup> that recognised the importance of conserving threatened evolutionarily distinct lineages.

One effective way to avert loss of threatened PD and its option value is to prioritise the conservation of EDGE species to complement current conservation approaches in which they are typically overlooked.

<sup>&</sup>lt;sup>13</sup> Refer to Faith (2018) for a history of biodiversity and variety

<sup>&</sup>lt;sup>14</sup> WCC-2012-Res-019-EN: Halting the loss of evolutionarily distinct lineages



These two themes for transformative change – overcoming neglected values, and overcoming neglected species, also highlight another ingredient of transformative change: much can be gained by moving beyond the common notion of biodiversity as covering a whole range of possible aspects of nature or ecology, and instead better appreciating its core meaning as the variety of life – a variety that itself has value to humanity<sup>4</sup>.

## Two proposed Phylogenetic Diversity indicators

The IUCN SSC Phylogenetic Diversity Task Force, the Zoological Society of London's EDGE of Existence programme, and partners, are committing to reporting on two existing indicators 1) the IPBES Phylogenetic Diversity (PD) indicator for expected PD loss, and 2) the changing status of Evolutionarily Distinct and Globally Endangered (EDGE) species.

We noted above that the value of biodiversity/variety to future generations relates to both insurance and the maintenance of future options (or investment). We referred to the link between maintenance of options and a form of biodiversity called phylogenetic diversity, which measures the evolutionary history captured by a set of species (Faith 1992; Faith 2018; Faith 2019). By conserving phylogenetic diversity globally, we conserve the variety of different evolutionary features of species, and so future options for humanity. The amount of PD expected to be lost (through probable extinctions of threatened species) can be tracked through time, by taking into account the changing IUCN Red List status of species. Similarly, the EDGE metric for a particular species is compiled from the combination of its phylogenetic uniqueness and the level of threat it faces. Top EDGE species are those that have above median evolutionary distinctiveness for their taxonomic group and fall into one of the three threatened categories on the IUCN Red List. EDGE species not only represent the major opportunities to avert loss of PD and maintenance of options, but also, as highly distinctive species, represent heritage and existence values (Owen et al., 2019) and loss of feature diversity (e.g. Redding & Mooers 2015).

The two indicators capture different important aspects of the changing status of phylogenetic diversity: (1) expected PD loss reflects the loss of biodiversity and its value; (2) change in status of EDGE species reflects success or failure for those species where the stakes are high. It is a goal to avert particularly large losses of PD and other values related to the distinctiveness of these species.

## **Indicator Details**

#### Indicator 1: The IPBES Phylogenetic Diversity (PD) indicator for expected PD loss

We propose to use the existing IPBES PD indicator. This simply estimates "*expected PD loss*" (and so loss of maintenance of options) by summing the ED scores (Evolutionary Distinctiveness) of the threatened species in the taxonomic group (Faith et al 2018). Thus, the total ED of threatened species (VU, EN, CR, EW), from each taxonomic group having existing ED scores (amphibians, birds, mammals, reptiles, gymnosperms, corals, elasmobranchs), will be tracked through time to estimate the amount of PD expected to be lost. This can be disaggregated for each threatened Red List category status to determine how the expected loss of PD shifts through time given changes in extinction risk.



#### Indicator 2: the changing status of Evolutionarily Distinct and Globally Endangered (EDGE) species

EDGE (Evolutionarily Distinct and Globally Endangered) species are those species which uniquely contribute a greater than median amount to total phylogenetic diversity and are threatened with extinction (VU, EN, CR on the IUCN Red List). The corresponding indicator tracks the change in extinction risk of EDGE species through time. Reductions in extinction risk of EDGE species will represent the averted loss of phylogenetic diversity.

Furthermore, any indicators relating to identified trends in species' extinction risk have counterpart trends related to expected PD loss and status of EDGE species: number of species becoming extinct; number of extinctions prevented through conservation actions; and proportion of threatened species that have improved in status. Thus, our indicators may serve as sub-indicators for various species-level indicators, and for the zero-draft's Goal 2.

### Baselines, milestones, and actions and responses

Baseline information for the two indicators will be calculated by referencing past Red List status reports. For example, we can estimate that estimated expected PD loss increased by ~3.2% from 2007-2017.

Milestones for the two indicators should parallel milestones for species-level indicators. For example, if a milestone is that the number of species becoming Extinct, Extinct in the Wild or Critically Endangered owing to genuine deterioration is to reduce to 20 during 2020-2025 and 0 during 2025-2030, then the corresponding milestone for indicator 2 (EDGE species status) would refer to the number of EDGE species and/or lineages reducing by a similar proportion. Similarly, if the proportion of threatened species that have improved in status relative to 2020 is to exceed 15% by 2025 and 30% by 2030, then this milestone can also apply and be reported for EDGE species, and also interpreted for expected PD loss.

Proposed actions for the two indicators must also address knowledge gaps. IPBES noted that in maintenance of options, the phylogenetic diversity indicator is established as decreasing, but recognises that there is incomplete information as more assessed taxonomic groups are needed.

Hence key actions underway or planned include:

- Number of taxonomic groups comprehensively assessed for EDGE
- Number of taxonomic groups assessed for expected PD loss
- EDGE lists and expected PD calculations to be carried out for at least 15 monophyletic groups by 2030.



# Transformative change needs implementation and contributions by both state and non-state actors

The CBD has long recognised the importance of non-state actors' contributions to its work programs and in recent documentation<sup>15</sup>, and both the CBD and other key conservation consortiums and groups (such as IUCN, WWF, etc) see such contributions as critical for the post 2020 framework.

We agree with this perspective, and note here that we commit, as a consortium of non-state actors, to tracking and reporting on the two indicators we have proposed. This marks a contribution to the range of actions needed by both state and non-state actors to developing, implementing, measuring and reporting on the global state of conservation and biodiversity.

This is in line with IUCN views on the preparation, scope and content of the post-2020 global biodiversity framework, which also proposed that contributions from non-state actors would be essential to "ramp up biodiversity conservation and unleash transformational systems change", and that the framework "should capture the contributions of all involved in the implementation of the framework, including national level commitments, and contributions by non-state actors"<sup>16</sup>.

This integration of phylogenetic diversity, as an indicator of biodiversity value, within the core species level targets notably serves the recent recognition that "A composite scale that combined species, genetic and ecosystem diversity would allow the public to follow and understand, to vote and to lobby for biodiversity conservation." <sup>17</sup>

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 $<sup>^{\</sup>rm 15}$  CBD/WG2020/1/L.1 30 August 2019 and CBD/POST2020/PREP/1/INF/2

 $<sup>^{\</sup>rm 16}$  IUCN response to CBD Notification 2018-063; 24 August

<sup>&</sup>lt;sup>17</sup> CBD/WG2020/1/5



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