Conservation of evolutionary heritage supports transformative change: proposed phylogenetic diversity indicators

Phylogenetic Diversity

A critical and often overlooked aspect of biodiversity is the evolutionary heritage represented by a set of species, called Phylogenetic Diversity (PD; Faith 1992[1]). By conserving PD globally, we conserve the variety of different evolutionary features of species, and so options for humanity and nature. This global option value of biodiversity is essential if we are to capture the full value of biodiversity for humanity (Faith 2018[2]). PD is already used by IPBES as an indicator for nature's contributions to people: for maintenance of options (NCP 18) and as relevant to medicinal, biochemical and genetic resources (NCP 14) (IPBES 2019; Diaz *et al.* 2019[3]). For example, PD strongly predicts current pharmaceutical and agricultural uses of the Cape Flora's (Forest et al. 2007[4]). It is important to note that medicinal, biochemical and genetic resources are but one component of the options we maintain when we conserve phylogenetic diversity.

Evolutionarily Distinct and Globally Endangered (EDGE) species

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. EDGE species collectively represent billions of years of threatened evolutionary history (Gumbs *et al.* 2020[5]), meaning not only the major opportunities to avert loss of PD and maintenance of options, but also their heritage and existence values as highly distinctive species (Owen *et al.* 2019[6]). Reflecting this, in 2012, IUCN adopted a resolution[7] that recognised the importance of conserving threatened evolutionarily distinct lineages.

Proposed indicators

The IUCN Species Survival Commission Phylogenetic Diversity Task Force proposes two indicators for the CBD post-2020 biodiversity framework to meet the drafted goals, elements and targets. Our indicators explicitly and uniquely interlink Goal A (preventing extinctions and improving conservation status) and Goal B (valuing nature's contributions to people). These indicators fill an important current gap in the draft monitoring framework relating to Nature's Contributions to People, as well as the lack of linkages with IPBES's work to date. Our proposed indicators recognise both phylogenetic diversity as a valuable aspect of biodiversity, and the neglected species that represent our evolutionary history; enabling conservation, measurement and monitoring into the future.

1. *Expected loss of Phylogenetic Diversity*: already used by IPBES as an indicator for the maintenance of options (NCP 18), and noting that this includes benefits under NCP 14 (medicinal, biochemical and genetic resources) and NCP 15 (learning).

2. *Changing status of Evolutionarily Distinct and Globally Endangered species (EDGE Index)*: a newly developed indicator which adds value to existing broader species measures, as this set of species represents billions of years of evolutionary history, and thus options for humanity. This indicator can be applied to trends in conservation status, extinctions, and recovery.

These indicators capture different important aspects of the changing status of phylogenetic diversity: expected PD loss reflects the loss of biodiversity and its value; while the change in status of EDGE species reflects our success or failure in conserving our evolutionary heritage.

[1] Faith, D.P. (1992). Conservation evaluation and phylogenetic diversity. *Biol Cons* 61, 1–10.
[2] Faith, D.P. (2018) Avoiding paradigm drifts in IPBES Ecology and Society 23(2):40
[3] Diaz et al (2019) Summary for policymakers of the global assessment report on biodiversity and ecosystem services. *IPBES*
[4] Forest, F et al (2007). Preserving the evolutionary potential of floras in biodiversity hotspots. Nature, 445(7129), 757–760.
[5] Gumbs et al (2020) Global priorities for conservation of reptilian phylogenetic diversity in the face of human impacts. *NatComms* 11:2616
[6] Owen, N. R. et al (2019) Global conservation of phylogenetic diversity captures more than just functional diversity. *NatComms* 10:859
[7] WCC-2012-Res-019-EN: Halting the loss of evolutionarily distinct lineages

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. Our indicators therefore link the conservation of phylogenetic diversity, including EDGE species, to the bigger picture of biodiversity's value to humanity, as an effective mechanism to address the CBD Vision's dual challenges to better appreciate the value of biodiversity and to halt its loss. This integration of phylogenetic diversity as an indicator of biodiversity value also 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.*"[8]

The IUCN SSC PDTF commits, 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.

Indicator technical details

Expected loss of Phylogenetic Diversity
Defined as: the total Evolutionary Distinctiveness of threatened species from assessed taxonomic groups tracked to estimate the amount of Phylogenetic Diversity expected to be lost over time (Faith *et al.* 2018[9]).
Applied to the following elements in the draft monitoring framework[10]:
  ➢ GB2. Nature's material contributions, including food, water and others
      o Trends in the provision of medical, biochemical, and genetic resources from biodiversity
Proposed new element in the draft monitoring framework:
  ➢ Under GB3. Nature's non-material contributions including cultural (or under GB2)
      o Maintenance of options
This indicator has already been developed and applied by IPBES in NCP18 (maintenance of options) and listed for NCP14 (medicinal, biochemical and genetic resources). Supporting organization: IUCN SSC Phylogenetic Diversity Task Force & Australian Museum. Baseline: 2020, annually updated. This can be disaggregated for each Red List category, nationally, geographically, or taxonomically.

Changing status of Evolutionarily Distinct and Globally Endangered species (EDGE Index)
Defined as: tracking 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.
Applied to the following elements in the draft monitoring framework[10]:
  ➢ GA3. Prevent extinction and improve the conservation status of species
      o Trends in conservation status of species
      o Trends in species extinctions (subset by numbers of EDGE species that have gone extinct)
  ➢ T3.1 Active recovery and conservation management actions
      o Trends in species recovery and reintroduction programmes (subset by percentage of EDGE species improving in status)
Supporting organisation: IUCN SSC Phylogenetic Diversity Task Force & Zoological Society of London, based on existing ZSL EDGE lists and IUCN Red List data. Baseline: 2020, annually updated. This can be disaggregated for each Red List category, as well as nationally, geographically, or taxonomically.

Disclaimer - The opinions given herein belong solely to the PDTF and do not represent the views or policies of IUCN

---

[8] CBD/WG2020/1/5
[9] Faith, D.P., Veron, S., Pavoine, S. and Pellens, R. (2018). Indicators for the expected loss of phylogenetic diversity In: (R. Scherson and D.P. Faith eds.) Phylogenetic Diversity. Applications and Challenges in Biodiversity Science. Springer
[10] https://www.cbd.int/sbstta/sbstta-24/post2020-monitoring-en.pdf