

The Coalition for Conservation Genetics statement on genetic diversity in the CBD post-2020 Global Biodiversity Framework and Proposed Indicators. June 2022



Towards a mutual aim of conserving all biodiversity, achieving sustainable use, and shared benefits, we the Coalition for Conservation Genetics¹ provide this Statement on genetic diversity in the First draft of the Framework (CBD/WG2020/3/3 and CBD/WG2020/3/3/Add.1), the Co-Chair's Reflections on OEWG 3 (CBD/WG2020/3/6), the Report of the OEWG 3 (part II: CBD/WG2020/3/7) and the Report by SBSTTA 24 (CBD/SBSTTA/24/12). This statement builds on our [prior Statements](#). Similar comments and suggestions were made by Parties at [SBSTTA 24](#).

¹The Coalition for Conservation Genetics is composed of the GEO BON Genetic Composition Working Group, IUCN Conservation Genetics Specialist Group, Society for Conservation Biology Conservation Genetic Working Group, and EU Cost Action Genomic Biodiversity Knowledge for Resilient Ecosystems, G-BiKE, and other participants

Genetic diversity is a basic pillar of all biodiversity that *must be maintained, protected, managed, and monitored* to enable all species to adapt to environmental change, ensure resilient ecosystems, support ecosystem function, and benefit humanity. Genetic diversity of populations is also a key barrier against diseases, invasive pests, and climate change. Loss of genetic diversity will reduce adaptation, increase extinctions, destabilize ecosystems, and harm human well-being and economies (see [Hoban et al 2021](#)).

We welcome that the first draft includes a 2050 Goal (Goal A) and a 2030 Milestone (A.3) for **genetic diversity of all species**. We also welcome that a 2030 Action Target (Target 4) references genetic diversity of all species. Further, we welcome and strongly support the proposed Headline Indicator “The proportion of populations within species with a genetically effective population size (N_e) >500” (A.0.4) and additional indicators on genetic diversity (see below).

To align the post-2020 Global Biodiversity Framework with the best available scientific knowledge, we suggest wording and clarifications in the Table below. These are scientifically based and peer reviewed. A policy brief on genetic diversity in >25 languages is available [here](#). A webinar on this topic was presented jointly by GEO BON, the CBD Secretariat, and the UN, described [here](#); watch it on youtube [here](#). For questions, comments, contacts to experts, or for assistance to Parties in drafting genetic diversity language in their comments to the CBD, please write to linda.laikre@popgen.su.se, shoban@mortonarb.org, cristiano.vernesi@fmach.it or gernot.segelbacher@wildlife.uni-freiburg.de. Emails in languages other than English are welcome.

Bracketed text after Geneva meeting (CBD/WG2020/3/7)	Coalition for Conservation Genetics Suggestions	Comment
Goal A: [All genetically distinct populations and] [[[a] A]t least [90][95][X] per cent of] genetic diversity among and within [all] [known] [populations of] [wild and domesticated] species is [maintained][safeguarded, maintaining their adaptive potential].]	“...all genetically distinct populations are maintained, and at least 97% of genetic diversity within populations is maintained, and large effective population sizes and appropriate genetic exchange are ensured”	*Our suggestion resolves numerous brackets. It makes clear that distinct populations must be maintained, and that within population genetic diversity is maintained by large effective sizes and genetic exchange. Progress can be measured by effective size $N_e > 500$ (Indicator A.0.4) and populations are maintained (Indicator A.8.1).
2030 Milestone A.3. It is unclear if Milestones will be kept, but this is an achievable Milestone by 2030 that would show significant progress.	“The proportion of populations large enough to maintain genetic diversity and adaptive potential (N_e 500), has increased by at least 25%, all genetically distinct populations are maintained, and long-term genetic conservation strategies are developed.”	This milestone has more specificity for Parties reporting, and can be measured by the Headline Indicator A.0.4 on effective size and populations are maintained (Indicator A.8.1), and on monitoring, see Hoban et al 2020.

Bracketed text after Geneva meeting (CBD/WG2020/3/7)	Coalition for Conservation Genetics Suggestions	Comment
<p>Action Target 4. [Ensure active]... management actions... [to][enable] ... recovery and conservation of [threatened] species... and maintain the genetic diversity ... [and restoration of genetically depleted populations]... (Bracketed text is long, only excerpts included here)</p>	<p>“Ensure active management actions to enable the recovery and conservation of species including the restoration of genetically depleted populations and the long-term maintenance and protection of genetic diversity within and among all native species populations”</p>	<p>Our suggested text resolves numerous brackets. This wording specifies that active management actions to recover species must include action on genetically depleted populations and a goal of long term maintenance and protection of genetic diversity. It is connected to Indicators A.0.4, Indicator A.8.1, and a.48 (CBD/WG2020/3/INF/2).</p>

Science based, feasible, relevant, measurable indicators exist to support this wording.

Several are already in the CBD monitoring framework and are supported by several Parties.

- **Headline Indicator A.0.4.** “The proportion of populations within species with a genetically effective population size > 500”. Ideal for reporting on Goal A and Target 4. Maintaining populations’ effective size >500 will maintain 97% of genetic diversity, as in Goal A, and is appropriate for Target 4 on recovery actions for species and their genetic diversity, which has wide support. This indicator is already being compiled in several countries. It is measurable and well developed- see [INF document from GEO BON](#), Hoban et al 2021, Laikre et al 2021.
- **Component indicator A.8.1:** “The proportion of genetically distinct populations maintained within species.” (CBD/WG2020/3/INF/2) Should be elevated to a Headline indicator, for reporting on Goal A, Milestone A.3, and Target 4, to maintain genetic diversity among distinct populations. Loss of distinct populations will result in large losses of genetic diversity including loss of local adaptations. Among population *and* within population genetic diversity are *both* essential. This indicator is measurable and is being compiled by several countries. Hoban et al 2020, [Hollingsworth et al 2020](#), [O'Brien et al 2022](#)
- **Complementary indicator a.48** “Genetic scorecard for wild species” A.48 should be elevated to a Component indicator as it has been successfully deployed at a country level (Scotland) and it is accessible to all signatory nations.
- **Complementary indicator monitoring using DNA methods** An indicator proposed by Hoban et al (2020) should be added as a Complementary indicator: “The number of populations and species in which genetic diversity is being monitored using DNA methods” Monitoring using DNA methods is feasible for many countries, and contributes to sound management of genetic diversity, see Hoban et al 2021, Andersson et al. 2021

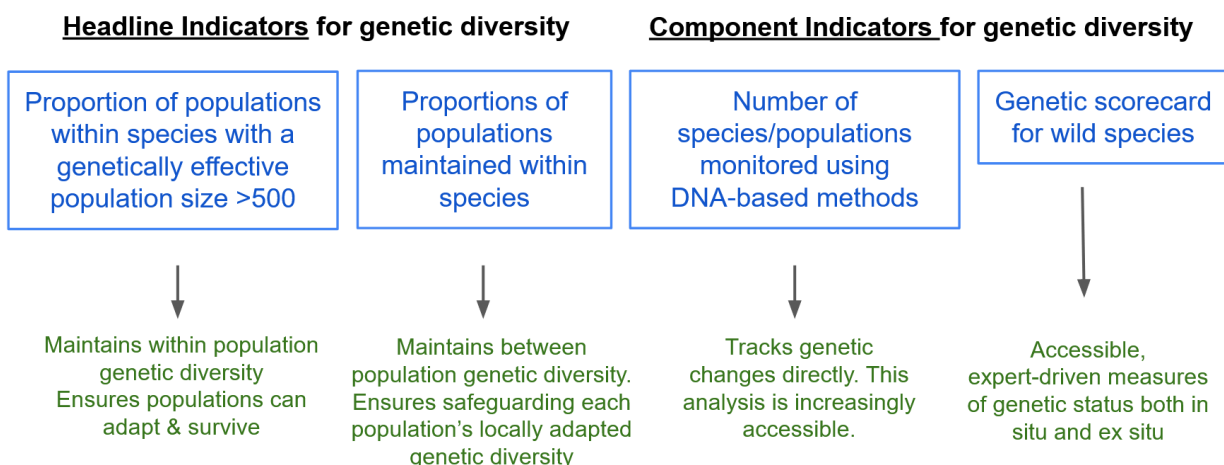


Figure 1. Indicators proposed for monitoring of genetic diversity in the CBD post-2020 Global Biodiversity Framework. All indicators support Goal A and Target 4.

Frequently Asked Questions on genetic diversity

1. **Question: Are the Goal and indicators SMART?**
Yes, [Hoban et al 2021](#) Table 2 details how each is SMART- Specific, Measurable, Achievable, Relevant, and Time Bound
2. **Q: Do genetic diversity Goals, Target 4, or indicators involve submitting or sharing Digital Sequence Information (DSI)?**
No. The first two genetic diversity indicators are counts of populations meeting a criteria (effective size threshold or being extant). Only the counts and proportions would be reported. *Parties do not submit DSI.* The indicator on counts of genetic diversity studies produced for conservation purposes (e.g. genetic studies of threatened species) is simply a count of studies and *no DSI is shared.*
3. **Q: Why are there multiple suggested headline indicators- maintaining an effective size (Ne) of 500 within populations, and maintaining all distinct populations?**
Genetic diversity *within* populations allows sufficient variation within each population to adapt to local conditions over time and to avoid inbreeding consequences. Genetic diversity *among* populations ensures the whole species can maintain enough adaptation for changing environments. *Both are essential for species survival* and for supporting resilient ecosystems.
4. **Q: What does the phrase “genetically depleted populations are under restoration” mean?**
Genetically depleted populations have undergone substantial loss of genetic diversity but can often be rescued by translocating individuals from other populations (if available), active management to increase population size, habitat connectivity and other means. This may not fully restore genetic diversity but it can partially restore it and prevent further losses. Genetic diversity must also be protected
5. **Q: What does it mean to “ensure adaptive potential”?**
This means that the facilitation/ management of conditions suitable to adaptive evolution: populations must be kept large, natural levels of connectivity maintained, and natural levels of reproduction occur.
6. **Q: Do the two suggested headline indicators require using DNA-based techniques?**
No. Genetic data/ molecular techniques are not required. The indicators can be reported using only census counts of individuals and field observations, which many national biodiversity programs have. When genetic data is available for some species, it can be used to directly measure effective population size (Ne), and/or to help define populations. (Even if it is used for these tasks, genetic data is not reported in reporting these indicators- again, DSI is not submitted in reporting.)
7. **Q: Is guidance in place to start applying the two suggested headline indicators, for reporting on Goal A and Target 4 on genetic diversity?**
Several countries are already compiling data for these indicators. Supporting materials are being produced to support all countries in reporting on these indicators in a reliable, robust manner, and will be available in 2022.
8. **Q: Is any country using the genetic indicators now?**
Answer: Several nations are committed to applying the genetic indicators and several are starting work to compile them and develop guidance documents for their use. [A recent effort in Sweden](#) assessed data availability for more than 20,000 species (20-30% had suitable data) and calculated the indicator for approximately 100 mammals, reptiles and amphibians.

Terms suggested for addition to CBD Glossary (CBD/WG2020/4/2)

Concept/ term	Annotation/ explanation	Goal/ Target
effective population size	A measure reflecting the maintenance of genetic diversity within populations. Usually Ne is approximately 1/10th of the census size (number of adult individuals). Ne below 500, or Nc below 5000, will result in populations losing genetic diversity rapidly.	Goal A/ Target 4
appropriate genetic exchange	The natural or native level of gene movement (movement of reproducing individuals, or in plants of pollen) between populations or subpopulations.	Goal A/ Target 4
genetic conservation strategies	Plans at national or regional level to ensure maintenance of genetic diversity	Goal A/ Target 4
ensuring adaptive potential	Populations have sufficient genetic diversity to maximize their capacity for adapting to changing environments. Requires a combination of Ne ≥ 500 per population, appropriate genetic exchange, and not losing populations	Goal A/ Target 4

References

- Allendorf FW, Ryman N 2002. The role of genetics in population viability analysis. In: Beissinger SR, McCullough DR (eds) Population Viability Analysis. University of Chicago Press: Chicago, IL, USA. pp 50–85. <https://press.uchicago.edu/ucp/books/book/chicago/P/bo3637258.html>
- Andersson et al. 2021. Mapping and monitoring genetic diversity of an alpine freshwater top predator by applying newly proposed indicators. Authorea. December 08, 2021. DOI:10.22541/au.163900315.52745564/v1
- Coalition for Conservation Genetics, “Statement on genetic diversity in CBD, December 2020” General comment submitted to CBD Secretariat <https://attachments.cbd.int/341b6bf4f8d6c15231897915ef7d4336/GenDivCoalition.pdf>
- Díaz et al 2020 in Science: <https://science.sciencemag.org/content/370/6515/411>
- GEO BON GCWG “Inclusion of genetic diversity in the post-2020 global biodiversity framework: scientific and technical knowledge” SBSTTA 24 INF Doc <https://www.cbd.int/doc/c/e412/2a57/9b80a568456cfad443180ea5/sbstta-24-item3-geobon-monitor-genetic-diversity-en.pdf>
- Hoban, S., et al., 2020. Genetic diversity targets and indicators in the CBD post-2020 Global Biodiversity Framework must be improved. *Biol Cons*, 248, p.108654. <https://www.sciencedirect.com/science/article/pii/S0006320720307126>
- Hoban, S., et al., 2021. Effective population size remains a suitable, pragmatic indicator of genetic diversity for all species, including forest trees. *Biol Cons*, 253, p.108906. <https://www.sciencedirect.com/science/article/pii/S0006320720309642>
- Hoban, S., et al., 2021. Genetic diversity is considered important but interpreted narrowly in country reports to the Convention on Biological Diversity: Current actions and indicators are insufficient. *Biol Cons*, 261, p.109233. <https://www.sciencedirect.com/science/article/pii/S0006320721002858>
- Hoban, S., et al., 2021. Global commitments to conserving and monitoring genetic diversity are now necessary and feasible. *BioScience*. <https://doi.org/10.1093/biosci/biab054>
- Hollingsworth, P.M., et al. 2020. Scotland’s Biodiversity Progress to 2020 Aichi Targets: Conserving Genetic Diversity – Development of a national approach for addressing Aichi Biodiversity Target 13 that includes wild species. Inverness, Scottish Natural Heritage <https://www.nature.scot/scotland-world-first-genetic-diversity>
- Hollingsworth, P.M., O’Brien, D., et al, 2020. Scotland’s biodiversity progress to 2020 Aichi targets: Conserving genetic diversity–Development of a national approach for addressing Aichi Biodiversity Target 13 that includes wild species. <http://nora.nerc.ac.uk/id/eprint/526707/>
- Laikre, L., et al., 2020. Post-2020 goals overlook genetic diversity. *Science*, 367(6482), pp.1083-2. <https://science.sciencemag.org/content/367/6482/1083.2>
- Laikre, L., et al., 2021. Authors’ Reply to Letter to the Editor: Continued improvement to genetic diversity indicator for CBD. *Cons Gen*, pp.1-4. <https://link.springer.com/article/10.1007/s10592-021-01359-w>
- O’Brien, D., Laikre, L., Hoban, S., Bruford, M.W., Ekblom, R., Fischer, M.C., Hall, J., Hvilsom, C., Hollingsworth, P.M., Kershaw, F. and Mittan, C.S., 2022. Bringing together approaches to reporting on within species genetic diversity. *Journal of Applied Ecology* doi.org/10.1111/1365-2664.14225
- Policy brief in 25 languages available at: <https://q-bikegenetics.eu/en/pubs-policy-briefs/policy-briefs>
- Thurfjell, H., Laikre, L., Ekblom, R., Hoban, S. and Sjögren-Gulve, P., 2022. Practical application of indicators for genetic diversity in CBD post-2020 Global Biodiversity Framework implementation. *bioRxiv*. <https://www.biorxiv.org/content/10.1101/2022.02.18.481087v2.full>