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Genetic diversity must underpin area-based conservation and restoration targets

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The mid-term review of the Kunming-Montreal Global Biodiversity Framework reveals highly uneven progress in halting biodiversity loss, especially for genetic diversity (Target 4) which underpins ecosystem function and species' adaptive potential in a changing environment (Des Roches et al., 2018). Over 70% of the Parties have set national targets to conserve and restore genetic diversity, yet, so far, only 13% report on the related headline indicator A.4 which measures the proportion of species' populations that are large enough to maintain genetic diversity and evolutionary potential (CBD, 2026). The mid-term review attributes the low reporting rate to the indicator's novelty and limited technical capacity to collect and interpret relevant data. This gap between national targets and implementation capacity calls for urgent action: genetic resources cannot be restored once lost.

Beyond Target 4 itself, we see a significant missed opportunity to strengthen genetic conservation through improving synergies with the Framework's other Targets, especially Target 2 on ecosystem restoration and Target 3 on area-based conservation. Ecosystem, species, and genetic diversity are interdependent, but ecosystem-level action is often erroneously assumed to safeguard species and genetic diversity automatically (Schmidt et al., 2025). The Framework reproduces this misconception by measuring the dimensions of biodiversity through disconnected metrics: Target 2 and 3 indicators track ecosystem extent, representativeness, and connectivity, but do not capture whether the conserved and restored ecosystems actually maintain viable populations or conserve diversity within and among populations across species ranges (CBD, 2022). These gaps are not hypothetical: genetic bottlenecks measurably reduce the growth, survival, and resilience of populations (Frankham, 2015). In a recent global meta-analysis, ecological restoration did not increase genetic diversity, only supplementation (adding individuals to an existing population) did – and that, too, only improved genetic diversity in non-threatened species, not in threatened species or species with unknown

threat status (Shaw et al., 2025). Paradoxically, restoration practices associated with genetic bottlenecks are common especially in projects aiming to mitigate climate change or restore species-rich forests at scale (Jalonen et al., 2018). Corridors add little value if they connect genetic deserts.

This disconnect hurts not only progress towards Target 4 but also the outcomes of Targets 2 and 3. While 85% of countries have set national targets on terrestrial ecosystem restoration (Target 2), less than half link restoration explicitly to biodiversity enhancement (34%), ecosystem services (38%), or ecological integrity and connectivity (41%). Similarly, while 78% of countries have quantitative conservation targets for terrestrial areas (Target 3), less than half explicitly target ecological representativeness (40%), connectivity (46%), or cover areas of particular importance for biodiversity or ecosystem functions (43%) (CBD, 2026). Restoration and conservation actions without genetic considerations risk poor outcomes (Frankham, 2015; Jalonen et al., 2018) and misallocation of limited resources; in one documented case, over AUD\$200,000 was spent on conservation before a genetic study revealed that the target was not even a distinct species (Doyle et al., 2025). Priority setting and intervention design could be improved using the genetic monitoring indicators of Target 4 which do not necessarily require exhaustive genetic data (Hébert et al., 2026). Additionally, countries already collect and report other relevant data to the Commission on Genetic Resources for Food and Agriculture (FAO, 2025) which can be readily used to support genetic monitoring and Target 2 and 3 implementation.

We call for the Parties, the international community, and the funders to urgently close these gaps to halt genetic erosion. This means investing in targeted capacity strengthening to operationalize the headline indicator A.4 and the associated component and complementary indicators of Target 4; systematically integrating genetic diversity indicators in the design, monitoring, and reporting of all ecosystem conservation and restoration actions contributing to Targets 2 and 3; and accelerating monitoring and reporting by aligning the Framework's genetic diversity indicators with existing sectoral processes that already collect relevant data.

Without these actions, the global multi-billion-dollar investments into restoration and conservation will keep yielding 'living dead' ecosystems that count towards the targets on paper but lack the biological foundation to persist.

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