Introduction to the Genetic Composition Working Group

Sean Hoban, Laura Bertola, Anna MacDonald, Maggie Hunter
The Morton Arboretum (USA), City College of NY (USA), Australia National University, U.S. Geological Survey
Figures developed by Laura Bertola, Jeremy Johnson, Eric Archer, and Catherine Grueber

What is genetic diversity?

Genetic diversity is important for nature, society, economies and well-being. It's the variation within species that helps them adapt to environmental change, avoid inbreeding, and exhibit resilience, allowing to maintain ecosystem function, structure, and services. Genetic diversity has also allowed humans to select for particular traits in domesticated and harvested species through artificial selection. Since its inception in 1992, the Convention on Biological Diversity has considered genetic diversity one of the three essential components of biological diversity.

Objectives of working group

1. Advance the conceptual understanding of the multiple dimensions of genetic diversity, and create simple but comprehensive Essential Biodiversity Variables (EBVs).
2. Encourage and enable rigorous and repeatable use of Genetic EBVs (Fig 1) and other measures by developing standards, models, and best practices for sampling, analysis, and interpretation
3. Support the deployment of Genetic EBVs for policy and management at all scales, including by developing indicators (Fig 2) and showcasing case studies
4. Evaluate correlations between genetic data (e.g. DNA sequences) and proxies of genetic data, to inform models
5. Advance the ability to aggregate genetic information across species and across temporal and spatial scales

Figure 2. Proposed Genetic Goal, Action Target and Indicators with data sources which build on genetic EBVs (see Hoban et al 2020)

Outlook: We can improve our ability to synthesize genetic data and assess change across species, at large spatial scales and in diverse situations.

Aims of Working Group

The GEOBON Genetic Composition working group (WG) aims to develop, test and improve approaches for assessing, monitoring, and interpreting genetic diversity, by helping: **measuring genetic biodiversity change over time, translating this information to policy**, **and ensure maintenance of evolutionary processes in nature** which can be achieved by ensuring large population sizes and population connectivity (see Figure 3). Our mission is to provide the data, tools, and knowledge needed for these tasks.

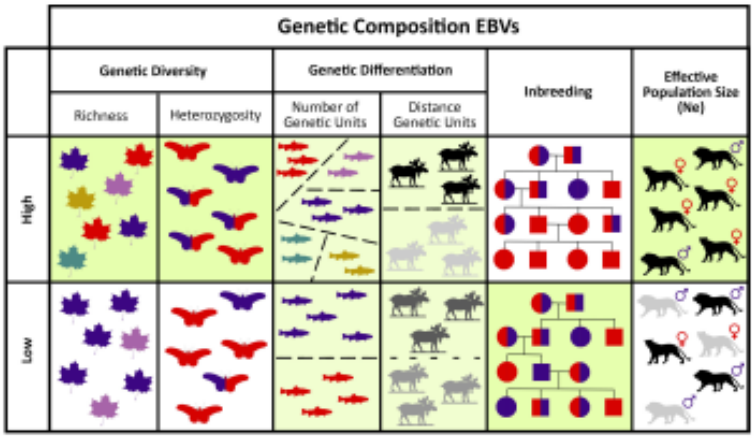

Figure 2. *Four proposed genetic EBVs and visualization of high and low levels of diversity for each.*

Why now?

Genetic diversity is being lost as distinct populations are reduced and disappear. Simultaneously, new techniques in computation and genetic technology are helping to quantify genetic change over space and time. Tens of thousands of species' populations have had their genetic diversity assessed, and hundreds of species have complete genomes sequenced. The genetic community has a strong commitment to open access data, though metadata and fully standardized formats are often lacking. Now, our knowledge can be improved through coordinated genetic monitoring, improved statistical tools, and standardized practices (Fig 3)

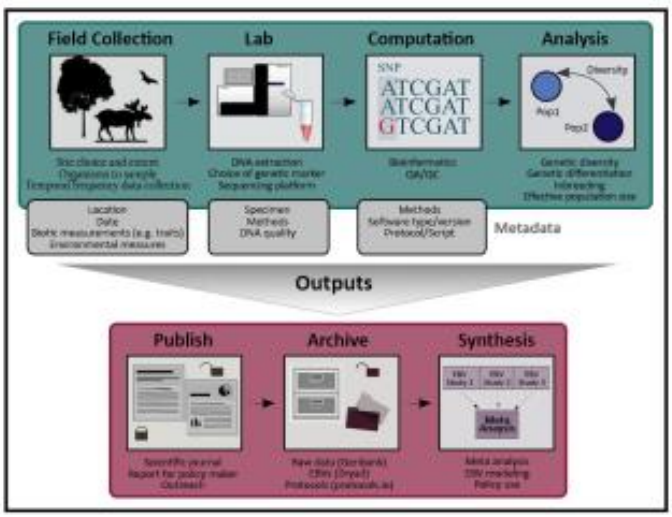

Figure 3. Collation of genetic data (top row) and data use towards operationalizing EBVS (bottom row).

Members Genetic Composition Working Group: 120 members from 35 nations