

# Genetic diversity analysis with molecular marker data: Learning module

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## Glossary

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**AFLP:** Amplified fragment length polymorphism. A highly sensitive method for detecting polymorphisms in DNA. DNA first undergoes restriction enzyme digestion, and a subset of DNA fragments is then selected for PCR amplification and visualization.

**Allele:** One of the alternative forms of a gene that can exist at a single locus.

**Allogamy:** Transfer of pollen (i.e. pollination) from the anther of the flower of one plant to the stigma of the flower of a genetically different plant. Also called cross-breeding, outcrossing, and xenogamy. See *also* Outbreeding.

**AMOVA:** The analysis of molecular variance is a method for studying molecular variation within a species.

**Asexual reproduction:** The formation of new individuals from the cell(s) of a single parent. It does not entail recombination or mixing of parental forms.

**Autogamy:**

- Transfer of pollen (pollination) from the anther of a flower to the stigma of the same flower or sometimes to that of a genetically identical flower (as of the same plant or clone)
- The ability of many plant species to naturally and successfully fertilize within one individual. Also called self-pollination.

**Biodiversity:** The totality of genes, species, and ecosystems in a given region, be it a microhabitat or the world. Also called biological diversity.

**Breeding:** The propagation and genetic manipulation by hybridization or deliberate self-crossing of plants, for the purpose of selecting improved offspring.

**Breeding system:** The system by which a species reproduces. There are several natural systems in plants, for example, see *also* Outbreeding and Inbreeding.

**Characterization:** Assessment of plant traits that are highly heritable, easily seen by the eye, equally expressed in all environments, and usable for distinguishing phenotypes.

**Collection (of plant genetic resources):**

- The gathering together of domesticates (landraces, old and modern cultivars and breeding lines), and related wild or weedy species.
- The material gathered by the act of collecting, is termed a collection.

**Conservation:** The management of human use of the biosphere so that it may yield the greatest sustainable benefit to current generations while maintaining its potential to meet the needs and aspirations of future generations. Thus, conservation is positive, embracing preservation, maintenance, sustainable use, restoration, and enhancement of the natural environment.

**Diploid:** A full set of genetic material, consisting of paired chromosomes, with one chromosome from each parental set. Most animal cells, except the gamete, have a diploid set of chromosomes.

(*cf. Haploid*)

**Domestication:** The evolution of plants or animals either naturally or through artificial selection, to forms more useful to man, e.g. nonshattering seed.

**ex situ conservation.:**

- A conservation method that entails removing germplasm resources (seeds, pollen, sperm, individual organisms) from their original habitat or natural environment.
- Keeping components of biodiversity alive outside their original habitat or natural environment.

(*cf. in situ conservation*)

**Gene:** The basic physical and functional unit of heredity, which passes information from one generation to the next. It is a segment of DNA that includes a transcribed section and a regulatory element, which allows its transcription.

**Gene flow:** The exchange of genetic material between populations. This may be used in the sense of plant reproduction (i.e. due to the dispersal of gametes and zygotes) or due to human influences, such as the introduction of new crop varieties by farmers.

**Genetic distance:** The degree of relatedness between subgroups or populations as measured by various statistics.

**Genetic diversity:** Variation in the genetic composition of individuals within or among species; the heritable genetic variation within and among populations.

**Genetic drift:** The unpredictable changes in allele frequency that occur in small populations.

**Genetic erosion:** Loss of genetic diversity between and within populations of the same species over time, or reduction of the genetic base of a species.

**Genetic marker:** An allele, a band in a gel or trait that serves experimentally as a probe to identify an individual or one of its characteristics.

**Genome:** The entire complement of genetic material in an organism.

**Haploid:** A single set of chromosomes (half the full set of genetic material), present in each egg and sperm cell of animals and in each egg and pollen cell of plants (*Gk.* haploos, single).  
(*cf.* *Diploid*)

**Haplotype:** A specific allelic constitution at a number of loci within a defined linkage block.

**Hardy-Weinberg equilibrium:** The stable frequency distribution of genotypes, AA, Aa, and aa, in the proportions  $p^2$ ,  $2pq$ , and  $q^2$ , respectively (where p and q are the frequencies of the alleles, A and a), that is a consequence of random mating in the absence of mutation, migration, natural selection or random drift.

**Heterozygote:** A diploid individual that has different alleles at one or more genetic loci (*Gk.* heteros, other)  
(*cf.* *Homozygote*)

**Homozygote:** A diploid individual that has identical alleles at one or more genetic loci (*Gk.* homos, same)  
(*cf.* *Heterozygote*)

**Inbreeding:** The mating of genetically related individuals or between relatives. Breeding through a succession of parents belonging to the same stock. Also called endogamy or self-breeding.  
(*cf.* *Outbreeding*)

***in situ* conservation:** A conservation method that attempts to preserve the genetic integrity of gene resources by conserving them within the evolutionary dynamic ecosystems of the original habitat or natural environment.  
(*cf.* *ex situ conservation*)

**Isozyme:** Multiple forms of an enzyme whose synthesis is controlled by more than one gene.

**Locus (*pl.* loci):** The specific place on a chromosome where a gene or particular piece of DNA is located.

**Marker:** An identifiable physical location on a chromosome whose inheritance can be monitored (e.g. gene, restriction enzyme site or RFLP marker).

**Mating system:** The pattern of mating between individuals of a population, including such factors as extent of inbreeding, pair-bonding, and number of simultaneous mates. The mating system is of major importance in determining both the genetic structure and evolutionary potential of natural populations.

**Microsatellite DNA:** A type of repetitive DNA based on very short repeats such as dinucleotides, trinucleotides or tetranucleotides. Also called simple sequence repeats (SSRs).

**Migration:** Movement of individuals between otherwise reproductively isolated populations.

**Multiple alleles:** The existence of several known alleles of a gene.

**Mutation:** The term to describe an abrupt change of phenotype that is inherited. Any permanent and heritable change in DNA sequence. Types of mutations include point mutations, deletions, insertions, and changes in number and structure of chromosomes.

**Outbreeding:** An allogamous mating system in which mating is between individuals that are less closely related than are average pairs chosen from the population at random. Also called exogamy or cross-breeding.  
(*cf. Inbreeding*)

**Outcrossing:** see Allogamy.

**Phylogeny:** Evolutionary history of a species. A diagram illustrating the deduced evolutionary history of populations of related organisms.

**Polymorphism:** The appearance of different forms associated with various alleles of one gene or homologous of one chromosome.

**Population:** In genetics, a group of individuals who share a common gene pool and have the potential to interbreed.

**Population genetics:** The quantitative study and measurement of populations in statistical terms, e.g. the study of genetic phenomena in terms of standard statistical parameters such as frequency tables and distributions, means, variance and standard deviations.

**Purine:** A nitrogen-containing, double-ring, basic compound that occurs in nucleic acids. The purines in DNA and RNA are adenine and guanine.

**Pyrimidine:** A nitrogen-containing, single-ring, basic compound that occurs in nucleic acids. The pyrimidines in DNA are cytosine and thymine. The pyrimidines in RNA are cytosine and uracil.

**RAPD:** Random amplified polymorphic DNA. A technique for amplifying anonymous stretches of DNA, using PCR with arbitrary primers.

**Recombination:** The production of a DNA molecule with segments derived from more than one parental DNA molecule. In eukaryotes, this is achieved by the reciprocal exchange of DNA between non-sister chromatids within a homologous pair of chromosomes during prophase of the first meiotic division. Recombination allows the chromosomes to rearrange their genetic material, thereby increasing the potential of genetic diversity. Also known as crossing-over.

**Regeneration (of genetic resources collections):**

- The process of restoring a whole plant from individual cells by manipulating an *in vitro* culture.
- The growing of a sample of seeds from an accession to replenish the viability of the original accession. It is usually done when the viability of the original material drops to less than 85%.

**Restriction enzyme:** An endonuclease that will recognize a specific sequence and cut the DNA chain at that point.

**RFLP:** Restriction fragment length polymorphism. Variation between individuals as detected by differences in DNA fragment sizes after restriction digestion.

**Selfing:** To fertilize by means of pollen from the same plant.

**Self-pollination:** see Autogamy.

**Sexual reproduction:** The production of new individuals, following the mixing in a single cell of the genes of two different cells, usually gametes and usually from different parents.

**Species diversity:** A function of the distribution and abundance of species, similar in meaning to 'species richness'. In more technical literature, includes considerations of the evenness of species abundances. An ecosystem is said to be more diverse, according to the more technical definition, if species present have equal population sizes and less diverse if many species are rare and some are very common.

**SSR:** See Microsatellite DNA.

**Sympatric:** Occurring in the same geographic area.

**Weed:**

- In agriculture, an individual plant or species growing where it is not wanted.
- In ecology, a plant that is adapted to grow in disturbed or open habitats, e.g. after fire or human disturbance.

**Wild relative:** A relative of a crop species that grows in the wild and is not used for agricultural purposes.