Genomics in Society
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Vocabulary List

(Disease) resistance/tolerance:

a) In an ecological community; a measure of how much a community is affected by a disturbance.[1]

b) The ability of an individual and/or population to resist or tolerate pathogenic infection based on genetic variation within the genome that conveys resistance or tolerance traits, i.e. the ability of a species to defend itself against disease due to its genetic composition.

A/T/G/C nucleotides:

a) A/T/G/C stands for the four types of bases found in a DNA molecule: adenine (A), cytosine (C), guanine (G), and thymine (T). A DNA molecule consists of two strands wound around each other, with each strand held together by bonds between the bases. Adenine pairs with thymine, and cytosine pairs with guanine. The sequence of bases in a portion of a DNA molecule, called a gene, carries the instructions needed to assemble a protein.[3]

b) Nucleotide: the basic building block of nucleic acids. RNA and DNA are polymers made of long chains of nucleotides. A nucleotide consists of a sugar molecule (either ribose in RNA or deoxyribose in DNA) attached to a phosphate group and a nitrogen-containing base. The bases used in DNA are adenine (A), cytosine (C), guanine (G), and thymine (T). In RNA, the base uracil (U) takes the place of thymine.[3]

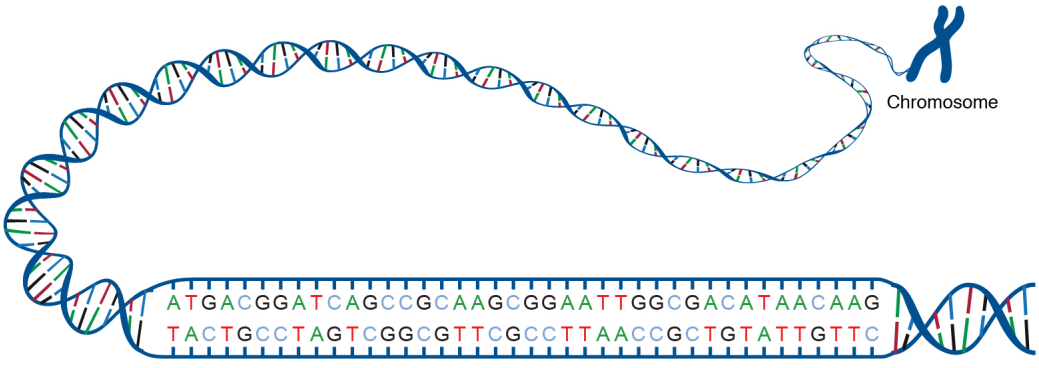

Fig 1. A visual representation of how A/C/T/G nucleotides pair and build DNA molecules.[3]

Adaptation:

a) Any heritable trait that increases the fitness of an individual with that trait, compared with individuals without that trait, in a particular environment.[1]
b) The outcome of selection; change in genes due to environmental changes.

Allele: A particular version of a gene.[1]

Base pair: A pair of nucleotides found in a double-stranded DNA molecule. Used as a unit of length when describing DNA.[1]

Biodiversity: The diversity of life considered at three levels: 1) genetic diversity (variety of alleles in a population, species, or group of species), 2) species diversity (variety and relative abundance of species present in a certain area), and 3) ecosystem diversity (variety of communities and abiotic components in a region).[1]

Candidate genome region:

a) Candidate gene: a gene whose chromosomal location is associated with a particular disease or other phenotype. Because of its location, the gene is suspected of causing the disease or other phenotype.[3]
b) Similarly, a candidate genome region is a location spanning a specific length of the chromosome that is associated with a particular phenotype that has been found to convey a particular response of function. It is a candidate because evidence suggests it conveys particular qualities, and then the specific region can be tested in further detail since it has been identified as a candidate region for selection.

Climate change adaptation: Changes in genes due to environmental changes that have been driven by climate change, i.e. adaptation that is the outcome of selection due to climate change.

Climate change: Changes in long-term weather conditions due to human activities and natural processes. Climate change results from changes in the chemical composition of the atmosphere with the accumulation of greenhouse gases, which trap heat and reflect it back to the surface of the Earth.[1]

Coding language(s): Specific syntax, instructions, and commands that makeup a unique language that instructs a computer to complete certain functions. Coding languages are used in and are designed to work in specific computer software/platforms.

Computational biology: A branch of biology that involves that application of computers and computer science to be able to understand and model the structures and processes of life. It entails the use of computational methods (e.g. algorithms) for the representation and simulation of biological systems, as well as for the interpretation of experimental data, often on a very large scale.[4]

Computational pipeline: also known as a data pipeline, it is a set of data processing elements and instructions connected in a series, where the output of one element is the input of the next one. The elements of a pipeline are often executed in parallel or in time-sliced fashion. Genomic data is processed through these pipelines to analyze patterns, associations, variation, and more.[5]

Computer coding: Computer coding is the use of computer programming languages to give computers and machines as set of instructions on what actions to perform.[6]

Conifer: Cone-bearing trees and shrubs that are usually evergreen with needle or scale-like leaves; some conifers bear fruits as well.

Conservation biology: The effort to study, preserve, and restore threatened populations, communities, and ecosystems.[1]

Conservation policy: The guiding procedure, philosophy or course of action for preserving and renewing human and natural resources.[7]

Convergence; convergent adaptation/evolution: The independent evolution of analogous (comparable, similar) traits in distantly related organisms due to adaptation to similar environments and a similar way of life.[1]

DNA amplification: The production of multiple copies of a sequence of DNA. Repeated copying of a piece of DNA.[8]

DNA sequence: The arrangement and order of A/T/C/G nucleotides that make up a specific portion (i.e. sequence) of DNA on the chromosome.

DNA/RNA extraction: The process of removing tissues and/or substances from a study organism that contain DNA/RNA, and then using lab techniques & tools to isolate the tissues only containing DNA/RNA. The process of extracting DNA/RNA from an organism so it can be analyzed.

Ecosystem: All the organisms that live in a geographic area, together with the nonliving (abiotic) components that affect or exchange materials with the organisms; a community and its physical environment.[1]

Evolution:

a) The theory that all organisms on Earth are related by common ancestry and that they have changed over time, predominantly via natural selection.[1]
b) Any change in the genetic characteristics of a population over time, especially a change in allele frequencies.[1]

Evolutionary biology: a discipline of biology concerned with the processes and patterns of biological evolution especially in relation to the diversity of organisms and how they change over time.[9]

Genetic diversity: The diversity of alleles in a population, species, or group of species.[1]

Genetic resource: In this context, a research-based resource that can provide guidelines to forest managers, tree breeders, and several other stakeholders on how to select and breed trees with desired qualities that will be best suited for future climate scenarios and biotic & abiotic disturbances.

Genetic variation:

a) The number and relative frequency of alleles present in a particular population.[1]
b) The proportion of phenotypic variation in a trait that is due to genetic rather than environmental influences in a certain population in a certain environment.[1]

Genome:

a) All the hereditary information in an organism, including not only genes but also other non-gene stretches of DNA.[1]
b) All of the genetic information in a cell and/or organism.

Genomics: The field of study concerned with sequencing, interpreting, and comparing whole genomes from different organisms.[1]

Genotype/genotyping:

a) Genotype: all of the alleles of every gene present in a given individual. May refer specifically to the alleles of a particular set of genes under study.[1]
b) Genotyping: the process of identifying genotypes in a study organism.

Heredity/heritability:

a) Heredity: the transmission of traits from parents to offspring via genetic information.[1]
b) Heritable: referring to traits that can be transmitted from one generation to the next.[1]

High-throughput sequencing: Also known as next-generation sequencing (NGS), a comprehensive term used to describe technologies that sequence DNA and RNA in a rapid and cost-effective manner.[10]

Local adaptation:

a) At the population level, adaptation of a particular group; population has evolved to have highest fitness in its home environment than in any other environment.
b) The 'home-site advantage hypothesis' refers to local adaptation, i.e. individuals do best (have the highest fitness) in their provenance/individuals do best where they are originally from.

Mutation: Any change in the hereditary material (DNA sequence) of an organism (DNA in most organisms, RNA in some viruses).[1]

Natural selection: The process by which individuals with certain heritable traits tend to produce more surviving offspring than do individuals without those traits, often leading to a change in the genetic makeup of the population. It is a major mechanism of evolution.[1]

Phenotype/trait: The detectable physical and physiological traits of an individual, which are determined by its genetic makeup. Also the specific trait associated with a particular allele.[1]

Polymorphism:

a) The occurrence of more than one allele at a certain genetic locus in a population.[1]
b) The occurrence of more than two distinct phenotypes of a trait in a population.[1]

Population: A group of individuals of the same species living in the same geographic area at the same time.[1]

Protein(s): A macromolecule consisting of one or more polypeptide chains composed of several amino acids linked together. Each protein has a unique sequence of amino acids and, in its native state, a characteristic three-dimensional shape.[1]

Python (software): A high-level and general purpose coding language and platform.

R (software): A coding language and platform for statistical computing and graphics.

Selection/breeding tools: The application of genetic principles to the genetic improvement and management of forest trees. Specific phenotypes are identified and selected from natural populations of trees and then offspring/seed from trees with those phenotypes are planted in plantations. This is done to increase the occurrence of the desired phenotype by continuing to reproduce trees from those that express the phenotype of interest.[2]

Selective growing: also known as **artificial selection:**

a) Deliberate manipulation by humans of the genetic composition of a population by allowing only individuals with desirable traits to reproduce, as in animal and plant breeding.[1]
b) Choosing individuals from a population with specific traits to be bred such that the frequency of that trait is increased and/or retained in subsequent generations.

(DNA) Sequencing: DNA sequencing is a laboratory technique used to determine the exact sequence of bases (A, C, G, and T) in a DNA molecule. The DNA base sequence carries the information a cell needs to assemble protein and RNA molecules. DNA sequence information is important to scientists investigating the functions of genes.[3]

SNP = Single Nucleotide Polymorphism: A site on a chromosome where individuals in a population have different nucleotides. Can be used as a genetic marker to help track the inheritance of nearby genes.[1]

SNP array: In simple terms, a snapshot of all the SNPs detected in a sample or multiple samples of an organism shown in a detailed arrangement (i.e. array) in a computer program.

Species range (natural distribution): The geographic distribution of a species.[1]

Stakeholder: A person, group of people, committee, organization, community or other established & organized group that is involved in policy making, business dealings, or other activities that influence a decision making process. Stakeholders are also often impacted by or connected to the subject or concern in question. For example, stakeholders in forest management can include Indigenous nations, scientific research, Parks Canada, NGOs and a government ministry.

Swiss Needle Cast (SNC): A foliage disease that is specific to Douglas-fir and is caused by the fungal pathogen *Nothophaeocryptopus gaeumannii*. SNC disease symptoms include chlorotic (yellow) needles and decreased needle retention, resulting in sparse crowns and reduced diameter and height growth. It is known as a cast disease, because it causes the tree to prematurely shed, or cast, its needles.[11]

Transcription: The process by which RNA is made from a DNA template.[1]

Translation: The process by which proteins and peptides are synthesized from messenger RNA.[1]

Tree biotechnology: An emerging field of study that works to develop a collection of tools for modifying tree physiology and genetics to aid breeding, propagation, and research.[12]

Upstream studies: In this context, the research and/or work that will be later informed by current research findings.

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