Genomics in Society
Forest Sciences Centre 2045 // 2424 Main Mall, Vancouver BC V6T 1Z4
https://genomics.forestry.ubc.ca // genomics.forestry@ubc.ca

Vocabulary List

Species range: the geographic distribution of a species.[1]

Species range core: of the geographic space that a species occupies, the core is the central region of that space.

Species range margins: of the geographic space that a species occupies, the margins are the outside edges of that space.

Pattern: a repeated/regular/consistent way that something occurs.

Range-wide patterns: patterns in observable traits and behaviors that occur throughout a species' range and are often associated with specific variations throughout the range.

Patterns of adaptions: patterns in the way species adapt to climate, disturbances, the environment, etc. over time.

Phenotypic patterns: patterns in the observable traits of species that are often associated with specific biotic or abiotic conditions.

Genomic patterns: patterns in the genomic sequences within a species genome that are consistently observed across multiple individuals from the population of a species.

(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.

Genomic selection: refers to the use of genomics technology to identify and subsequently select for specific genetically-controlled traits (phenotypes) in a study species; these traits are selected for by identifying markers and/or differences in the study species genome that are associated with the selected trait/trait of interest.

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.

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.

Climate (change) adaptation: Climate change adaptation refers to actions that reduce the negative impact of climate change, while taking advantage of potential new opportunities. It involves adjusting policies and actions because of observed or expected changes in climate. Adaptation can be reactive, occurring in response to climate impacts, or anticipatory, occurring before impacts of climate change are observed. In most circumstances, anticipatory adaptations will result in lower long-term costs and be more effective than reactive adaptations.[2]

Climate adaptive traits: Traits that improve the fitness of an individual in response to climate change, i.e. phenotypic changes that have been selected for to help individuals and/or populations persist in the rapidly changing climate.

Greenhouses: A protective building made of glass/translucent materials where plants are germinated, grown and/or cultivated in large amounts for various usages. The materials of the building allow ample sunlight and heat to be retained in the internal environment that is conducive to productive plant growth.

Common garden (experiment): also known as a transplant experiment; an experiment to test the effect of the environment by moving two or more species from their native/origin environments into a common environment. In a forestry context, seeds are often collected from a single tree species throughout its range and planted in a common environment to analyze genetic adaptation and variation within the species, or foresters use common garden experiments to test multiple tree species adaptation to determine where they should be planted as the climate changes. These experiments are a classical way to test if there is a genetic component to differences in traits within and among populations.[3]

Provenance/provenance trials:

a) Provenance: the place of origin/where something originally came from. In a forestry context, the location within a tree species native range where an individual's seed established, grew to maturity, and reproduced seed. Also refers to the particular location where a population of trees within a species native range originate from.
b) Provenance trials are a special type of long-term plantation experiment that help researchers understand how trees are adapted to different environmental conditions through genetic adaptation or *phenotypic plasticity*. Seeds are collected throughout the species' range or specific areas of interest. Two or more test site locations are established throughout the species range that represent different environments and the seeds collected from different locations are planted at these test sites. Test sites will include seed that originates from that location and seed that originates from different locations.[4]
c) *Phenotypic plasticity*: ability to change phenotype (morphology, behaviour, etc.) due to environmental changes; the expression of a different phenotype by the same genotype in a different environment (e.g. tree height is controlled by the genotype for height, but in southern populations a tree grows tall, but seeds planted from the southern population in a northern population grow shorter).

Physiological trait(s): in plants, these are fundamental processes such as photosynthesis, respiration, nutrient uptake & transport, seed germination, water regulation, and many more processes that are essential to the plants growth and survival in its environment.[5]

(Statistical) model(s):

a) A simplified, formal mathematical way to approximate reality and make predictions from this approximation. The statistical model is the mathematical equation that is used. The models include a dependent/response/y-axis variable (the one we want to describe) and independent/predictor/explanatory/x-axis variables (the ones we use to use to describe the dependent variable).[6]
b) The simplest statistical model is y = mx + b, where y is the dependent variable, x is the independent variable, m is the slope of the line, and b is the intercept. Essentially, climate models follow this simple form by using a bunch of independent/predictor/x variables to explain the output of the dependent/response/y variable. For example, researchers can use temperature, wind, and precipitation as explanatory variables to model the response of tree growth—this model will tell researchers what height trees grow under different temperature, wind, and precipitation conditions. If the model is good, it can also be used to predict how tall trees will grow in temperature, wind, and precipitation conditions that have not occurred yet, but are likely to occur with climate change.

(Habitat) suitability:

a) The ability of a habitat to support a population over time by providing food/nutrition, shelter/protection, water, and niche requirements for individuals of the population.
b) Often measured on a numerical scale from 0-1, where habitat units are rated across a landscape, with 0 being the least suitable habitat and 1 being the most suitable habitat.

Assisted migration:

a) The human-assisted movement of plants or animals to more climatically suitable habitats.[7]
b) Moving plants/planting seed beyond/outside their current native ranges to facilitate adaptation to a changing climate, e.g. planting seedlings further north (colder climate) outside the range as the current northern portion of a species range becomes warmer.
c) In a forestry context, moving seed outside of its native range.

Assisted gene flow:

a) The managed movement of individuals or gametes between populations within species ranges to mitigate local maladaptation in the short and long term.[8]
b) Within a species range, planting seed from one population in another population to help a population adapt to a changing climate, e.g. planting seed from southern (warmer) populations in northern (colder) populations as northern populations are expected to become warmer as the climate changes.
c) In a forestry context, moving seed within its native range.

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]

(Ecological) community: all of the species that interact with each other in a certain area.[1]

(Ecological) population: a group of individuals of the same species living in the same geographic area at the same time.[1]

Resilience: in an ecological community; a measure of how quickly a community recovers following a disturbance.[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 history:

a) Phylogeny**:** the evolutionary history of a group of organisms.[1]
b) The history of all genetic changes and adaptations a species has incurred previous to its current state.

Evolutionary/Phylogenetic tree: a diagram that depicts the evolutionary history of a group of species and the relationships among them.[1]

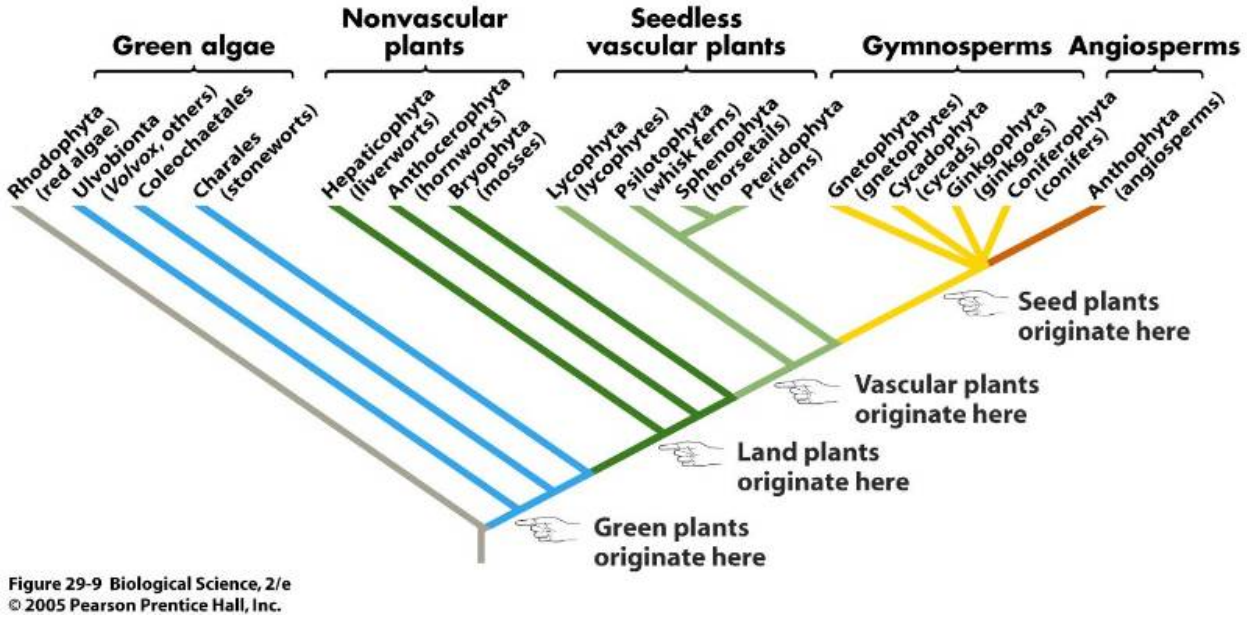

Fig 1. Example of a phylogenetic tree depicting the evolution of cell structures within the kingdom Plantae.[1]

Forest management: The process of planning and implementing practices for the stewardship and use of forests and other wooded land targeted at specific environmental, economic, social and cultural objectives.[9]

Social scientists: Scientists who study all aspects of society, including history, human behaviour, relationships among groups, and more related topics. Their research provides insights into the different ways individuals, groups, and institutions make decisions, exercise power, and respond to change.[10]

Population genetics: A field of biology that studies the genetic composition of biological populations and the changes in genetic composition that result from the influence of several biological processes, including natural selection.[11]

Plant/forest genetics: The study of the heredity, variation, and genetic makeup of plants and forest species.[12]

Plant/forest pathology: The study of the essential nature of diseases in plant and forest species and the structural and functional changes produced by them in these species.[14]

Plant/forest physiology:

a) The study of the functions and activities of life or living matter (such as plant and forest species' tissues and cells) and of the physical and chemical processes involved.[13]
b) The internal physical process (e.g. metabolism) that provide functions in plant and forest species.

Pathogen(s): any entity capable of causing disease, such as a microbe, a virus, or a fungus.[1]

Disease resistance:

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 pathogenic infection based on genetic variation within the genome that conveys resistance traits, i.e. the ability of a species to defend itself against disease due to its genetic composition.

Tree breeders/breeding: 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. Tree breeders are professionals who are involved in this process and are informed by researchers who study forest genomics.[15]

Breeding families: the family or group of related trees that have been selected for desirable phenotypes and that have been reproducing offspring with those desirable phenotypes for multiple generations in a controlled environment (e.g. plantation).

Reforestation: Replanting trees in an area that has been logged, clear-cut, or disturbed to allow the regeneration and renewal of forest structure and cover throughout a landscape.

Competition: in ecology, the interaction of two species or two individuals trying to use the same limited resource (e.g. water, food, living space). May occur between individuals of the same species (intraspecific competition) or different species (interspecific competition).[1]

Mutualism(s): a symbiotic relationship between two organisms (mutualists) that benefits both.[1]

Climate-Based Seed Transfer (CBST):

a) Climate Based Seed Transfer (CBST) is an important climate change adaptation strategy that promotes healthy, resilient and productive forests and ecosystems through the matching of seedlings/seedlots to future (projected) planting site climates.[16]

b) CBST provides better control of adaptation; seed transfer based on climate instead of geography.

c) CBST facilitates assisted migration as a climate change adaptation strategy.

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