Glossary

Abaxial  located on the side furthest from the axis, e.g., the lower side of a leaf
Abiotic  not directly caused or induced by organisms
Absorbance  fraction of radiation incident on a surface that is absorbed
Abscisic acid, ABA  phytohormone (15-carbon compound that resembles the terminal portion of some carotenoid molecules) involved in stress responses; its name is derived from its involvement in leaf abscission; it reduces cell expansion and causes stomatal closure
Acclimation  Increased tolerance to stress and/or improved plant performance as a result of structural and physiological adjustment by individual plants to specific environmental conditions (see also plasticity)
Accumulation  build-up of storage products resulting from an excess of supply over demand; also termed interim deposition
Acidifuge  avoiding acid soils; with a preference for a substrate that does not have a low pH
Active (or reactive) oxygen species (ROS)  hydrogen peroxide (H$_2$O$_2$), superoxide radicals (O$_2^{−}$), and hydroxyl radicals (OH), the compounds can cause cell damage, but are also involved in signal transduction
Active transport  transport of molecules across a membrane against an electrochemical gradient through expenditure of metabolic energy
Acyanogenic  not releasing cyanide
Adaptation  evolutionary adjustment of the genetic basis of a trait that enhances the performance in a specific environment
Adaxial  located on the side nearest to the axis, e.g., the upper side of a leaf
Adsorption  binding of ions or molecules to a surface (e.g., of a soil particle or a root)
Advection  net horizontal transfer of gases
Aerenchyma  tissue with large air spaces that facilitate transport of gases in plants
Agglutinin  synonym for lectin
Albedo  fraction of the incident short-wave radiation reflected by a surface (typically plant cover or bare soil or rock)
Alkaloid  secondary plant compound (often toxic), characterized by its alkaline reaction and a heterocyclic ring (e.g., nicotine, caffeine, and colchicine)
Allelochemical  secondary metabolite, released by living plants or decomposing plant litter that (either negatively or positively) affects other organisms
Allelopathy  suppression of growth of one plant by another of a different species due to the release of toxic substances
Allocation  proportional distribution of products or newly acquired resources among different organs or functions in a plant
Alternative oxidase  mitochondrial enzyme catalyzing the transfer of electrons from ubiquinol (the reduced form of ubiquinone) to O$_2$
Alternative pathway (of respiration) nonphosphorylating electron-transport pathway in the inner membrane of plant mitochondria, transporting electrons from ubiquinol (the reduced form of ubiquinone) to O₂, catalyzed by the alternative oxidase

Amphistomatous with stomata at both the adaxial (upper) and abaxial (lower) sides of a leaf

Amylase starch-hydrolyzing enzyme

Anion negatively charged ion

Anisotropic not equal in all directions; for example, the longitudinal walls of anisotropic cells have different chemical and biophysical properties from those of the radial walls

Anoxia absence of oxygen in (part of) a plant’s environment

Annual species with a life cycle of less then a year; the short life cycle can be environmentally or developmentally determined

Antiport Co-transport of one compound in one direction coupled to transport of another compound (mostly H⁺) in the opposite direction

Apatite Ca₅(PO₄)₃(OH,F); it accounts for 95% of the total P in igneous rock, and it constitutes a major substrate for weathering, which releases inorganic phosphate for plants and microorganisms

Apoenzyme Enzymatic protein that requires a coenzyme to function

Apoplast (=apoplasm) space in a plant’s tissue outside the space enclosed by plasma membranes (symplast); it includes the cell walls and the dead tissues of the xylem

Apoplastic (=apoplasmic) phloem loading transport of assimilates from mesophyll to the sieve tubes of the phloem occurring partly through the apoplast

Aquaporin water-channel protein in a membrane

Arbuscular mycorrhiza a type of mycorrhiza that forms arbuscules (highly branched exchange structures) within cortical cells of the root

Assimilation incorporation of an inorganic resource (e.g., CO₂ or NH₄⁺) into organic compounds (in the case of CO₂ assimilation also used as a synonym for photosynthesis)

ATPase enzyme catalyzing the hydrolysis of ATP, producing ADP and Pᵢ; the energy from this hydrolysis is used to pump protons across a membrane (e.g., plasma membrane, tonoplast), thus generating an electrochemical gradient

ATPase/ATP synthase enzyme complex in the inner membrane of mitochondria and the thylakoid membrane of chloroplasts catalyzing the formation of ATP, driven by the proton-motive force (pmf)

Autotoxicity deleterious effect of a chemical compound released by plants of the same species

Autotrophic growth increment in mass, volume, length, or area of plants or parts thereof which depend on carbon fixed in photosynthesis by the growing organism itself (see also heterotrophic growth)

Autotrophic respiration respiration by autotrophic plants and their associated mycorrhizas and symbiotic N₂-fixing structures (see also heterotrophic respiration)

Auxin phytohormone (indole-3-acetic acid) involved in growth promotion and meristem differentiation; the name literally means enhancing and is derived from its growth-promoting action; there are also synthetic auxins

Avoidance plant strategy of resisting adverse conditions by preventing deleterious effects of these conditions, e.g., winter seed dormancy

Bacteroid state of rhizobia after they have penetrated the root and the symbiosis has been established

Bark Tissue with both a protective (outer bark) and transport (inner bark) function; inner bark consists of secondary phloem that carries sugars, amino acids, and minerals from a source to a sink

Biennial species whose individuals typically live for two growing seasons, vegetative growth in the first year and continued growth and seed production in the second year; several species known as biennials can, however, have an extended vegetative period (monocarpic perennial), others are strictly biennial

Biomass Mass of plants (and other living organisms)

Biomass density dry mass of plant tissue per unit of fresh mass or volume (in the first case, the presence of intercellular air spaces is not taken into account)

Biotic caused or induced by organisms

Biotic filter biotic interactions, which eliminate species that would otherwise have survived the abiotic environment of a site

Blue-light receptors two classes of photoreceptors, cryptochromes and phototropins, that absorb in the blue region of the spectrum; the receptors are involved, e.g., in the perception of irradiance and the directional component of light and thus affect photomorphogenesis

Bolting rapid extension of the flowering stalk

Boundary layer thin layer of air, water, or soil around the leaf or root with reduced mass
transport and increased reliance on diffusion for transport processes, conditions differ from those further away

**Boundary layer conductance/resistance** conductance/resistance for transport of CO₂, water vapor, or heat between the leaf surface and the atmosphere measured across the boundary layer

**Bowen ratio** the ratio between sensible heat loss and heat loss due to transpiration

**Bulk density** mass of dry soil per unit volume

**Bulk soil** soil beyond the immediate influence of plant roots (see boundary layer)

**Bundle sheath cells** cells surrounding the vascular bundle of a leaf

**C₃ photosynthesis** photosynthetic pathway in which the first step of CO₂ assimilation is the carboxylation of ribulose 1,5-bisphosphate (RuBP) by Rubisco; the first product is phosphoglyceric acid (PGA), a three-carbon intermediate

**C₄ photosynthesis** photosynthetic pathway in which the first step of CO₂ assimilation is the carboxylation of phosphoenolpyruvate (PEP) by PEP carboxylase during the day; the first product is oxaloacetic acid (OAA) a four-carbon intermediate

**Calcicole** species with a preference for calcareous soils and is absent from calcareous or high-pH soils

**Calcifuge** species that typically occupies acidic soils and is absent from calcareous or high-pH soils

**Callose** β-(1-3)-polymer of glucose, synthesized in sieve tube elements of the phloem in response to damage, sealing of the sieve tubes; callose is also produced in other cells upon microbial attack, thus providing a physical barrier

**Calmodulin** ubiquitous Ca²⁺-binding protein whose binding to other proteins depends on the intracellular Ca²⁺ concentration; component of signal-transduction pathways

**Calvin cycle (Calvin—Benson cycle, carbon reduction cycle)** pathway of photosynthetic CO₂ assimilation beginning with carboxylation of RuBP by Rubisco

**Canopy conductance/resistance** conductance/resistance for transport of CO₂, water vapor, or heat between the plant canopy and the atmosphere measured across the boundary layer of the canopy

**Carbamylase** reaction between CO₂ and an amino group; in many species, Rubisco is activated by carbamylation, catalyzed by Rubisco activase

**Carbonic anhydrase** enzyme catalyzing the interconversion of HCO₃⁻ and CO₂

**Carboxylate** organic acid minus its protons

**Carboxylation** binding of a CO₂ molecule to a CO₂-acceptor molecule

**Carboxylation efficiency** initial slope of the CO₂-response curve of photosynthesis

**Carotenoid** accessory photosynthetic pigment; carotenoids of the xanthophyll cycle play a role in dissipation of excess energy

**Carrier** protein involved in ion transport across a membrane

**Caruncle** (=strophiole) an outgrowth of a seed coat, near the hilum; preformed weak site in the seed coat

**Casparian band/strip** waxy suberin impregnation on the radial and transverse wall of endodermis and exodermis cells that renders the wall impermeable to water

**Cation** positively charged ion

**Cavitation** breakage of a water column in a xylem conduit due to air seeding

**Cellulose** structural polymer of glucose; major component of plant cell walls giving tensile strength

**Cell wall** structural matrix surrounding plant cells; part of the apoplast

**Cell-wall elasticity** reversible change in cell-wall dimensions

**Cell-wall extensibility** irreversible extension of cell walls, due to structural changes

**Chaperones** group of stress proteins that are encoded by a multigene family in the nucleus; chaperones bind to and stabilize an otherwise unstable conformation and, thus, mediate the correct assembly of other proteins

**Chelate** compound that combines reversibly, usually with high affinity, with a metal ion (e.g., iron, copper, or calcium)

**Chelator** cation-binding organic molecule, such as citric acid, malic acid, and phytosiderophores

**Chemiosmotic model** theory accounting for the synthesis of ATP driven by a proton-motive force

**Chilling injury/tolerance** injury caused by exposure of plants or tissues to low temperatures (> 0°C); tolerance of such temperatures

**Chitin** polymer of N-acetylgalactosamine; component of the exoskeleton of arthropods and the cell wall of fungi, but not of plants

**Chitinase** chitin-hydrolyzing enzyme that breaks down fungal cell walls

**Chlorenchyma** tissue containing chloroplasts

**Chlorophyll** green pigment in the photosynthetic membrane (thylakoid) involved in light capture as the first step in photosynthesis
Chloroplast  organelle (plastid) in which photosynthesis occurs

Chromophore  light-absorbing constituent of a macromolecule (photoreceptor) that is responsible for light absorption

Citric acid cycle  Tricarboxylic acid cycle

Climax species  species that are confined to later stages of succession in a plant community; as opposed to pioneer

Clonal growth  asexual production of physiologically complete plants; a form of vegetative reproduction

Cluster roots  bottle-brush-like or Christmas-tree-like structures in roots with a dense packing of root hairs, releasing carboxylates into the rhizosphere, thus solubilizing poorly available nutrients (e.g., phosphate) in the soil

CO₂-compensation point  CO₂ concentration at which the rate of CO₂ assimilation by photosynthesis is balanced by the rate of CO₂ production by respiration

Coenzyme  a nonproteinaceous organic substance that combines with a specific protein, the apoenzyme

Coevolution  evolution of two (or more) species of which at least one depends on the other as a result of selection by mutual interactions

Cofactor  inorganic ion or coenzyme required for an enzyme’s activity

Cohesion theory  accounts for the ascent of sap in the xylem due to the cohesive forces between ascending water molecules under high tension and the adhesive forces between water and capillaries in the wall of xylem conduits

Companion cell  cell type in the phloem, adjacent to sieve element, involved in phloem loading

Compartmentation  restriction of compounds or processes to specific cells, or parts of a cell, such as storage of secondary metabolites in vacuoles

Compatible interaction  response of a susceptible host to a virulent pathogen; positive interaction between pollen and pistil allowing guidance of the sperm cells toward the ovule

Compatible solute  solute that has no deleterious effect on metabolism at high concentrations

Compensation point  conditions (temperature, [CO₂], light) where net CO₂ exchange by a leaf or plant is zero (i.e., photosynthesis equals respiration)

Competition  interaction among organisms (of the same or different species), which utilize common resources that are in short supply (resource competition), or which harm one another in the process of seeking a resource, even if the resource is not in short supply (interference competition)

Competitive ability  probability of winning in competition with another species in a particular environment

Conductance  flux per unit driving force (e.g., concentration gradient); inverse of resistance

Constitutive  produced in constant amount (as opposed to regulated) (e.g., genes can be expressed constitutively)

Constitutive defense  background level of plant defense in the absence of induction by herbivores or pathogens

Construction cost  carbon and nutrients required to produce new tissue, including the respiration associated with the biosynthetic pathways

Contractile roots  mature roots that decrease in length, while increasing in diameter, thus pulling the plant deeper in the soil, as in geophytes

Convective heat transfer  direct transfer of heat (e.g., from leaf to air) and further transport by turbulent movement

Convergent evolution  process whereby, in organisms that are not closely related, similar traits evolve independently as a result of adaptation to similar environments or ecological niches

Coupling factor  ATP synthetase in thylakoid membrane of chloroplasts and inner membrane of mitochondria

Crassulacean acid metabolism  photosynthetic pathway in which the first step of CO₂ assimilation is the carboxylation of phosphoenolpyruvate (PEP) by PEP carboxylase; the first product is oxaloacetic acid (OAA)—a four-carbon intermediate; in contrast to C₄ photosynthesis, the CO₂ assimilation occurs predominantly during the night with open stomata

Crista  fold of the inner mitochondrial membrane

Critical daylength  length of the night triggering flowering

Cross-resistance  The phenomenon in which an organism that has acquired resistance to one pathogen or herbivore through direct exposure simultaneously has acquired resistance to other pathogens or herbivores to which it has not been exposed. Cross-resistance arises because the biological mechanism of resistance is the same and arises through identical genetic mutations

Cross-talk  Communication between different signal transduction pathways

Cryptochrome  blue-light-absorbing photoreceptor, involved in photomorphogenesis

Cuticle  waxy coating of external plant surfaces
Cuticular conductance/resistance  conduction/resistance for transport of CO₂ or water vapor movement through the cuticle

Cutin  waxy substances that are part of the cuticle; polymer consisting of many long-chain hydroxy fatty acids that are attached to each other by ester linkages, forming a rigid three-dimensional network

Cyanogenic  releasing cyanide

Cytochrome  colored, heme-containing protein that transfers electrons in the respiratory and photosynthetic electron transport chain

Cytochrome oxidase  mitochondrial enzyme catalyzing the final step in the transfer of electrons from organic molecules to O₂

Cytochrome P450  element in the synthesis of anthocyanins and in the detoxification of xenobiotics

Cytochrome pathway  phosphorylating electron-transport pathway in the inner membrane of plant mitochondria, transporting electrons from NAD(P)H or FADH₂ to O₂, with cytochrome oxidase being the terminal oxidase

Cytokinin(s)  a class of phytohormones, involved, e.g., in the delay of leaf senescence, cell division, cell extension, release of dormancy of buds, and chloroplast differentiation

Cytoplasm  contents of a cell that are contained within its plasma membrane, but outside the vacuole and the nucleus

Cytosol  cellular matrix in which cytoplasmic organelles are suspended

Dark reaction  carbon fixation during photosynthesis; does not directly require light but uses the products of the light reaction (see also Calvin cycle)

Dark respiration  processes in the cytosol, plastids, and mitochondria that break down carbon-containing compounds and generate ATP; it produces CO₂ and consumes O₂ when aerobic; when referring to gas exchange, all decarboxylation and O₂-consuming processes are included, apart from photorespiration

Deciduous  Having leaves that fall off or are shed seasonally in response to specific environmental cues, such as that occurs during or preceding unfavorable seasons (see also evergreen)

Decomposition  breakdown of organic matter through fragmentation, microbial and chemical alteration, and leaching

Defense compound  secondary metabolite conferring some degree of protection from pathogens or herbivores

Dehydrins  immunologically distinct family of proteins (Lea D11 family) that typically accumulate in plants during the late stages of embryogenesis or in response to any environmental influence that has a dehydrating effect

Delayed greening  pattern of leaf development typical of shade-tolerant rain-forest species; leaves are initially white, red, blue, or light-green during the stage of leaf expansion, reflecting their low concentration of chlorophyll and associated photosynthetic proteins

Demand  requirement; the term is used in the context of the control of the rate of a process (e.g., nutrient uptake, CO₂ assimilation) by the amount needed

Demand function  dependence of net CO₂ assimilation rate on the intercellular or chloroplast CO₂ concentration, irrespective of the supply of CO₂ at ambient atmospheric CO₂ concentration

Denitrification  microbial conversion of nitrate to gaseous nitrogen (N₂ and N₂O); nitrate is used as an electron acceptor

Desiccation tolerance  tolerance of extreme water stress, with recovery of normal rates of metabolism shortly following rehydration

Desorption  the reverse of adsorption

Diapheliotropism  solar tracking in which the leaf or flower remains perpendicular to incident radiation

Differentiation  cellular specialization

Diffuse porous  wood in which wide and narrow xylem vessels are randomly distributed throughout each annual growth ring

Diffusion  net movement of a substance along a concentration gradient due to random kinetic activity of molecules

Diffusion shell  zone of nutrient depletion around individual roots caused by active nutrient uptake at the root surface and diffusion to the root from the surrounding soil (see also boundary layer)

Disulfide bond  covalent linkage between two sulfhydryl groups on cysteines

Divergent evolution  naturally selected changes in related species that once shared a common characteristic, but have come to be different during the course of their evolution

Dormancy  state of seeds or buds that fail to grow when exposed to an environment that would otherwise have favored germination or growth

Dorsiventral  having structurally different upper and lower surfaces (see also isobilateral)

Down-regulation  decrease of the normal rate of a process, sometimes involving suppression of
genes encoding enzymes involved in that process

**Ecophysiology** study of the physiological mechanisms by which organisms cope with their environment

**Ecosystem** ecological system that consists of all the organisms in an area and the physical environment with which they interact

**Ecosystem respiration** sum of plant and heterotrophic respiration

**Ecotone** environmental gradient

**Ecotype** genetically differentiated population that is restricted to a specific habitat

**Ectomycorrhiza** mycorrhizal association in some trees in which a large part of the fungal tissue is found outside the root

**Efficiency** rate of a process per unit plant resource

**Elastic modulus** force needed to achieve a certain reversible change in cell volume

**Embolism** see cavitation

**Emissivity** coefficient that describes the thermal radiation emitted by a body at a particular temperature relative to the radiation emitted by an ideal black body

**Endocytosis** uptake of material into a cell by an invagination of the plasma membrane and its internalization in a membrane-bound vesicle

**Endodermis** innermost layer of root cortical cells that surrounds the vascular tissue; these cells are surrounded by a suberized Casparian strip that blocks apoplastic transport

**Exodermis** outer cortical cell layer in roots, immediately below the epidermis; these cells are surrounded by a suberized Casparian strip that blocks apoplastic transport

**Extrusion** ion transport from root cells to the external medium, dependent on respiratory metabolism

**Exudate** compounds released by plants (mostly by roots); also xylem or phloem fluid that appears when the stem is severed from the roots or a cut is made in the stem

**Exudation** release of exudates, or the appearance of fluid from cut roots or stems

**Facilitation** positive effect of one plant on another

**Facultative CAM plants** plants that photosynthesize by Crassulacean Acid Metabolism (CAM) during dry periods and by C₃ or C₄ photosynthesis at other times

**Feedback** influence of a product of a later step in a chain on an earlier step; fluctuations in rate of the process or concentration of metabolites are minimized with negative feedbacks or amplified with positive feedbacks

**Feedforward** response in which the rate of a process is affected before any deleterious effect of that process has occurred; for example, the decline in stomatal conductance before the water potential in leaf cells has been affected

**Fermentation** anaerobic conversion of glucose to organic acids or alcohol

**Field capacity** water content that a soil can hold against the force of gravity

**Flavanols, flavines, flavones** families of flavonoids

**Flavonoid** one of the largest classes of plant phenolics, in which two aromatic rings are connected by a carbon link to a third phenyl ring; representatives of this class play a role in the symbiosis between rhizobia and legumes, as phytoalexins, as antioxidants, in the colors of flowers and as defense compounds
Fluence response  response to a dosage of light
Fluorescence  photons emitted when excited electrons return to the ground state
Frost hardening  acclimation of a plant as a result of exposure to low temperatures that make it frost tolerant (e.g., hardening in autumn)
Frost hardness/tolerance  physiological condition that allows exposure to subzero temperatures without cellular damage

Geotropism  growth response of plant organs with respect to gravity
Germination (of a seed)  emergence of a part of the embryo through the seed coat, normally the radicle
Gibberellin  class of phytohormones; the first gibberellin was found in the fungus Gibberella fujikura, from which these phytohormones derive their name; gibberellins are involved, e.g., in the promotion of seed germination, stem extension, and bolting
Giga-  prefix denoting 10⁹
Glass  Solidlike liquid with an extremely high viscosity; examples of a glass are macaroni and “glass” as we know it from everyday life (which is not a solid, but a fluid, as apparent from the gradually changing properties of glass when it gets old); glass formation, rather than the formation of ice crystals, is essential to prevent damage incurred by the formation of ice crystals
Glaucousness  shiny appearance (of leaves), due to the presence of specific wax compounds
Glucoside (or glycoside)  compound in which a side chain is attached to glucose by an acetal bond
Glucosinolate  secondary sulfur-containing metabolite in Brassicaceae (cabbage family) which gives these plants a distinct sharp smell and taste
Glutathione  tripeptide (γ-glutamyl-cysteinyl-glycine) that acts as a reducing agent, protecting the cell against oxidative stress, and guards against chemical toxicity, via modification of (modified) xenobiotics
Glycolipid  membrane lipid molecule with a short carbohydrate chain attached to a hydrophobic tail
Glycolysis  ubiquitous metabolic pathway in the cytosol in which sugars are metabolized to pyruvate and/or malate with production of ATP and NADH (when pyruvate is the end product)
Glycoyte  species restricted to nonsaline soils
Glycoprotein  any protein with one or more covalently linked oligosaccharide chains
Glycoside (or glucoside)  compound in which a side chain is attached to a sugar by an acetal bond
G protein  intracellular membrane-associated proteins activated by several receptors
Grana  stacked region of photosynthetic membranes (thylakoids) in chloroplasts that contains photosystem II with its light-harvesting complex
Gross photosynthesis  amount of carbon dioxide assimilated in chloroplasts; it is measured as net photosynthesis plus dark respiration
Growth  increment in mass, volume, length, or area of plants or parts thereof
Growth respiration  amount of respiration required per unit increment in biomass; it is not a rate
Guard cells  specialized epidermal cells that surround the stomata and regulate the size of the stomatal pore
Guttation  water exuded by leaves due to root pressure
Halophyte  species that typically grows on saline soils
Hartig net  hyphal network of ectomycorrhizal fungi that have penetrated intercellularly into the cortex of a higher plant
Haustorium  organ that functions in attachment, penetration, and transfer of water and solutes from a host to a parasitic plant
Heartwood  central mass of xylem in tree trunks not functioning in water transport; it often contains substances that prevent decay and has a darker color than the surrounding sapwood
Heat-shock protein  protein produced upon heat or other stresses
Heavy metal  metal with a mass density exceeding 5 g mL⁻¹
Heliotropism  solar tracking; movement of a leaf or flower that follows the angle of incident radiation
Heme  cyclic organic molecule that contains an iron atom in the center which binds O₂ in leghemoglobin and carries an electron in cytochromes
Hemicellulose  heterogeneous mixture of neutral and acidic polysaccharides, which consist predominantly of galacturonic acid and some rhamnose; these cell-wall polymers coat the surface of cellulose microfibrils and run parallel to them
Heterodimer  protein complex composed of two different polypeptide chains
Heterotrophic growth  growth of plants or parts thereof which depend on carbon supplied by another organism or organ of the plant (see also autotrophic growth)

Heterotrophic respiration  respiration by nonautotrophic organisms (see also autotrophic respiration)

Hexokinase  enzyme catalyzing the phosphorylation of hexose sugars while hydrolyzing ATP; a specific hexokinase is involved in sugar sensing

Hilum  Seed scar where the funiculus (the stalk of the ovule) was once attached

Historical filter  historical factors that prevent a species from arriving at a site

Homeostasis  tendency to maintain constant internal conditions in the face of a varying external environment

Homodimer  protein complex composed of two identical polypeptide chains

Hormone  organic compound produced in one part of a plant and transported to another, where it acts in low concentrations to control processes (phytohormone)

Humic substances  high-molecular-weight polymers with abundant phenolic rings and variable side chains found in humus

Humus  amorphous soil organic matter

Hydraulic lift  upward movement of water from deep moist soils to dry surface soils through roots along a water potential gradient

Hydrenchyma  water-storing tissue; during dehydration of a plant, water is predominantly lost from the cells in the hydrenchyma, while other cells lose relatively less water

Hydrolysis  cleavage of a covalent bond with accompanying addition of water, —H being added to one product and —OH to the other

Hydrophyte  plant that grows partly or wholly in water, whether rooted in the mud, as a lotus, or floating without anchorage, as the water hyacinth

Hygrophyte  species typically occurring on permanently moist sites; see also mesophyte and xerophyte

Hydrotropism  morphogenetic response (of roots) to a moisture gradient

Hyponasty  Upward bending of a plant organ (see also epinasty)

Hypostomatic  with stomates at the abaxial (lower) side of the leaf only

Hypoxia  low oxygen concentration in (part of) a plant’s environment

Immobilization  nutrient absorption from the soil solution and sequestering by soil microorganisms

Incompatible interaction  response of a resistant host to a virulent pathogen; interaction between pollen and pistil preventing sperm cells from reaching the ovule

Induced defense  increased levels of plant secondary metabolites in response to herbivory or pathogen attack

Infiltration  movement of water into the soil

Infrared radiation  radiation with wavelengths between approximately 740 nm and 1 mm; short-wave infrared is emitted by the sun (<3 μm), long-wave infrared is emitted at Earth temperatures (>3 μm)

Interception  acquisition of nutrients by roots as a result of growing through soil; the nutrients contained in the soil volume displaced by the growing root; precipitation water remaining in a plant canopy that does not reach the soil

Intercrop  one crop plant grown in combination with at least one other crop on the same plot at the same time (e.g., an annual crop grown between trees)

Interference competition  competition mediated by production of allelochemicals by a plant

Intermediary cell  phloem cell in plants with a symplastic pathway of phloem loading; sucrose moves from the mesophyll into these cells, where it is processed to form oligosaccharides that move to the sieve tube

Internal conductance/resistance  conductance/resistance for transport of CO₂ between the substomatal spaces and its carboxylation at the site of Rubisco in the chloroplast

Ion channel/ion-selective channel  pore in a membrane made by a protein, through which ions enter single file; channels are specific and either open or closed, depending on membrane potential or the presence of regulatory molecules

Isobilateral  having structurally similar upper and lower surfaces (see also dorsiventral)

Isohydric  maintaining a constant water status

Isoprene  small unsaturated hydrocarbon, containing five carbon atoms (2-methyl-1,3-buta-diene); volatile compound, synthesized from mevalonic acid and precursor of other isoprenoids; can be produced in large amounts by photosynthesizing tissue at high temperatures

Isotope discrimination  alteration of the isotopic composition of an element via processes of diffusion, evaporation, and chemical transformation,
due to small differences in physical and chemical properties of isotopes; typically discrimination against the rare (heavy) isotope

**Isotope effect** end result of various processes that have different rate constants for different isotopes of the same element

**Isotope fractionation** process that occurs when different isotopes of the same element have different rate constants for the same reaction or process, or chain of reactions or processes

**Isotropic** similar in all directions

**Jasmonic acid** secondary plant compound [3-oxo-2-(2'-cis-pentenyl)-cyclopropane-1-acetic acid], named after its scent from jasmine; stress signaling molecule in plants as well as between plants

**Juvenile phase** stage in the life cycle of a plant between the seedling and reproductive phases; the vegetative phase in herbaceous plants; typically a period of rapid biomass accumulation

**$k_{\text{cat}}$** catalytic constant of an enzyme: rate of the catalyzed reaction expressed in moles per mole catalytic sites of an enzyme (rather than per unit protein, as in $V_{\text{max}}$)

**$K_i$** concentration of an inhibitor that reduces the activity of an enzyme to half the rate of that in the absence of that inhibitor

**$K_m$** substrate concentration at which a reaction proceeds at half the maximum rate

**K strategy** suite of traits that enable a plant to persist in a climax community

**Kranz anatomy** specialized leaf anatomy of C_{4} species with photosynthetic bundle sheath cells surrounding vascular bundles

**Krebs cycle** tricarboxylic acid cycle; metabolic pathway in the matrix of the mitochondrion oxidizing acetyl groups derived from imported substrates to CO_{2} and H_{2}O

**Latent heat** energy consumed or released by evaporation or condensation, respectively, of water (enthalpy of transformation); it results in respectively loss and gain of heat

**Law of the minimum** obsolete concept that plant growth is always limited at any point in time by one single resource; it is not valid in this strict sense

**Leaf area index** total leaf area per unit area of ground

**Leaf area ratio (LAR)** ratio between total leaf area and total plant biomass

**Leaf conductance/resistance** conductance/resistance for transport of CO_{2} or H_{2}O (vapor) of a leaf (it includes the conductance/resistance for the stomatal and the boundary layer pathways in the case of H_{2}O, and additionally for the internal mesophyll pathway in the case of CO_{2})

**Leaf-mass density** leaf dry mass per unit of fresh mass or volume (in the first case, the presence of intercellular air spaces is not taken into account)

**Leaf mass per unit leaf area (LMA)** leaf mass expressed per unit leaf area

**Leaf mass ratio (LMR), or leaf mass fraction (LMF)** ratio of leaf and whole plant biomass

**Leaf turnover** replacement of senescing leaves by new ones, not accounting for a change in leaf area

**Lectin** protein with noncatalytic sugar-binding domains; lectins are involved in defense and cellular interactions

**Leghemoglobin** Hemoglobin-like protein in nodules that associates with O_{2} by means of a bound heme group

**Light-compensation point** irradiance level at which the rate of CO_{2} assimilation in photosynthesis is balanced by the rate of CO_{2} production in respiration

**Light-harvesting complex** complex of molecules of chlorophyll, accessory pigments, and proteins in the thylakoid membrane that absorbs quanta and transfers the excitation energy to the reaction center of one of the photosystems

**Light reaction** transfer of energy from absorbed light to ATP and NADP(H) in the photosynthetic membrane (thylakoid)

**Light saturation (of photosynthesis)** range of irradiances over which the rate of CO_{2} assimilation is maximal and insensitive to level of irradiance

**Lignan** phenolic compound with antifungal, antifeeding, and antitumor activity; minor component in most plants and tissues, but quantitatively more important in the wood of some tree species (e.g., redwood)

**Lignin** large amorphous polyphenolic polymer that confers woodiness to stems

**Litter** dead plant material that is sufficiently intact to be recognizable

**Litter quality** chemical properties of litter that determine its susceptibility to decomposition, largely determined by concentrations of secondary metabolites and nutrients
Lockhart equation equation that describes cell expansion in terms of turgor pressure and cell-wall properties.

Long-day plant plant whose flowering is induced by exposure to short nights.

Long-wave infrared radiation with wavelengths larger than approximately 3 μm emitted at Earth temperatures.

Lumen cavity, such as the space surrounded by the thylakoid membrane or the trap of Utricularia surrounded by cells.

Luxury consumption uptake of nutrients above the rate that enhances plant growth rate.

Lysigenous aerenchyma Gas-transport tissue in plants that is formed from spatially selective death of expanded cells (see also schizogenous aerenchyma).

Macronutrients inorganic nutrients that a plant requires in relatively large quantities: K, Ca, Mg, N, S, P.

Macrosymbiont larger partner (i.e., higher plant) in a symbiosis with a microorganism.

Maintenance respiration respiration required to maintain the status quo of plant tissues.

Mass flow movement of substances at equal rates as the fluid or gas in which they occur (e.g., transport of solutes in flowing water and CO₂ in flowing air).

Matric potential component of the water potential that is due to the interaction of water with capillaries in large molecules (e.g., clay particles in soil).

Matrix a substance in which other structures or organelles are embedded; used for the compartment inside chloroplasts or mitochondria, not including the membrane system; also used for the substance in which cell-wall macromolecules are embedded.

Mean residence time (of a nutrient in a plant) time a nutrient remains in the plant, between uptake by the roots and loss (e.g., due to leaf shedding, consumption by a herbivore).

Mega- prefix (M) denoting 10⁶.

Membrane (phospholipid) bilayer that surrounds cells (plasmalemma), cell organelles, and other cell compartments.

Membrane channel transmembrane protein complex that allows inorganic ions, small molecules, or water to move passively across the lipid bilayer of a membrane.

Membrane fluidity loose term to describe the extent of disorder and the molecular motion within a lipid bilayer; fluidity is the inverse of viscosity.

Mesophyll photosynthetic cells in a leaf; in a dorsiventral leaf often differentiated in palisade and spongy parenchyma cells.

Mesophyte plant that typically grows without severe moisture stresses (see also hygrophyte and xerophyte).

Metallophyte species that typically grows in areas with high concentrations of certain heavy metals in the soil.

Micro- prefix (μ) denoting 10⁻⁶.

Microclimate local atmospheric zone where the climate differs from the surrounding atmosphere. (e.g., near a leaf, within a forest and near a body of water).

Microfibril structural component in cell walls, consisting of bundles of around 50 cellulose molecules, that provides the tensile strength of the wall.

Metallothionein low-molecular-mass metal-binding protein.

Micronutrients inorganic nutrients that a plant requires in relatively small quantities: Mo, Cu, Zn, Fe, Mn, B, Cl (see macronutrients).

Microsymbiont smaller partner (i.e., microorganism) in a symbiosis with a higher plant.

Mimicry resemblance of an organism to another organism or object in the environment, evolved to deceive predators, prey, pollinators, etc.

Mineralization breakdown of organic matter releasing inorganic nutrients in the process.

Mistletoe xylem-tapping stem parasite.

Mitochondrion organelle in which part of the respiratory process (tricarboxylic acid cycle, respiratory electron transport) occurs.

Monocarpic life cycle that ends after a single seed production event; the plant flowers only once during its lifetime, which can be after several years or even decades of vegetative growth.

Mycorrhiza (plural is mycorrhizae or mycorrhizas) structure arising from a symbiotic association between a mycorrhizal fungus and the root of a higher plant (from the Greek words for fungus and root, respectively).

Mycorrhizal dependency (of plant growth) the ratio of dry mass of mycorrhizal plants to that of plants of the same genotype grown without mycorrhizal fungus under the same environmental conditions.

Nano- prefix (n) denoting 10⁻⁹.

Net assimilation rate (NAR) rate of plant biomass increment per unit leaf area; synonym is unit leaf rate (ULR).
Net ecosystem carbon balance (NECB) net change in ecosystem carbon content due to all processes, including photosynthesis, respiration, loss of biomass, leaching, and lateral movements and transfers

Net ecosystem production (NEP) organic carbon accumulation that equals gross photosynthesis minus ecosystem respiration or net primary production minus heterotrophic respiration

Net primary production (NPP) quantity of new plant material produced annually per unit ground area including lost plant parts; equals gross photosynthesis minus autotrophic respiration

Nitrification microbial process that transforms ammonia, via nitrite, into nitrate

Nitrogen assimilation incorporation of inorganic nitrogen (nitrate, ammonium) into organic compounds

Nitrogen fixation reduction of dinitrogen gas to ammonium by specialized microorganisms

Nod factor product of nod genes required for successful nodulation in the legume—rhizobium symbiosis

Nod gene rhizobial gene involved in the process of nodulation

Nodulation formation of nodules in symbiotic N2-fixing plants

Nodulins class of plant proteins that are synthesized in legumes upon infection by rhizobia

Normalized difference vegetation index (NDVI) greenness index used to estimate above-ground net primary production from satellites, based on reflectance in the visible and near infrared

Nuclear magnetic resonance (NMR) spectroscopy technique used to make a spectrum of molecules with a permanent magnetic moment, due to nuclear spin; the spectra are made in a strong magnetic field that lines up the nuclear spin in all the molecules; it can, for instance, be used to measure the pH in different cellular compartments in vivo because the site of the peak in a spectrum depends on the pH around the molecule

Nutrient productivity rate of plant biomass increment per unit nutrient in the plant

Nutrient resorption withdrawal of nutrients from a plant part during senescence before shedding

Nutrient-use efficiency growth per unit of absorbed plant nutrient which equals nutrient productivity times mean residence time of the nutrient; ecosystem nutrient-use efficiency is the ratio of litterfall mass to litterfall nutrient content (i.e., the amount of litter produced per unit of nutrient lost in senescence)

Opportunity costs diminished growth resulting from diversion of resources from alternative functions that might have yielded greater growth

Osmoregulation adjustment of the concentration of osmotic solutes in plant cells in response to changes in soil water potential

Osmosensor system involved in sensing a change in the concentration of solutes in cells; osmosensors were first extensively studied in yeasts and subsequently also identified in plants

Osmotic potential component of the water potential that is due to the presence of osmotic solutes; its magnitude depends on solute concentration

Oxidative pentose phosphate pathway metabolic pathway that oxidizes glucose and generates NADPH for biosynthesis

Oxidative phosphorylation formation of ATP (from ADP and P_i) coupled to a respiratory electron-transport chain in mitochondria and driven by a proton-motive force

Oxygenation the binding of O2 to a substrate, without changing the redox state of O (e.g., ribulose-1,5-bisphosphate by Rubisco); it also refers to the addition of O2 to a medium (e.g., water)

Palisade mesophyll transversally oriented elongated photosynthetic cells at the adaxial side of a dorsiventral leaf

PAR photosynthetically active radiation (400—700 nm)

Paraheliotropism leaf movement that positions the leaf more or less parallel to the incident radiation throughout the day

Parent material rock and other substrates that generate soils through weathering

Pectin cell-wall polymer rich in galacturonic acid

Perennial species whose individuals typically live more than 2 years; the length of the life cycle can be indeterminate or end after a single seed production event (monocarpic)

Peribacteroid membrane plant-derived membrane that surrounds one or more bacteroids in root nodules

Pericarp matured ovulary wall in a seed

Pericycle layer of outermost stelar cells, adjacent to the endodermis
Permanent wilting point  soil water potential at which a plant can no longer absorb water from the soil; it is species specific but is generally taken to be −1.5 MPa

Peta- prefix (P) denoting 10^15

Phenol compound that contains a hydroxyl group on an aromatic ring

Phenolics aromatic hydrocarbons, many of which have antimicrobial and anti-herbivore properties

Phenology time course of periodic developmental events in an organism that are typically seasonal (e.g., budbreak or flowering)

Phenotypic plasticity range of variation of a trait in a genotype as a result of growth in contrasting environmental conditions

Phenylalanine ammonia lyase enzyme that catalyzes the first step in the conversion of the amino acid phenylalanine into phenolics

Phloem long-distance transport system in plants for mass flow of carbohydrates and other solutes

Phosphatase enzyme hydrolyzing organic phosphate-containing molecules

Phospholipid major category of membrane lipids, generally composed of two fatty acids linked through glycerol phosphate to one of a variety of polar groups

Phosphorylation process involving the covalent binding of a phosphate molecule; many enzymes change their catalytic properties when phosphorylated

Photodamage/photodestruction damage to/ destruction of components of the photosynthetic apparatus as a result of exposure to high irradiance, frequently in combination with other stress factors; the result is photoinhibition

Photoinhibition decline in photosynthetic efficiency upon exposure to high irradiance; the decline can be transient (less than 24 hours), which is related to protection of the photosynthetic apparatus, or it can be longer lasting, which implies photodamage

Photomorphogenesis Plant development affected by light; generally under control of photoreceptors

Photon discrete unit of light that describes its particle-like properties (quantum); light also has wavelike properties

Photon flux density (PFD) A measure of the level of irradiance in the (near) visible spectral region; it is expressed as photons incident on a (horizontal) plane per unit of time; photosynthetic photon flux density (PPFD) refers to the photosynthetically active part of the spectrum; see also quantum flux density

Photoperiod length of the daylight period each day

Photoperiodic responding to the length of the night

Photoreceptor A protein with chromophore that absorbs light in a specific spectral region; it is typically the start of a signal-transduction pathway leading to photomorphogenetic events

Photorespiration production of CO₂ in the metabolic pathway that metabolizes the products of the oxygenation reaction catalyzed by Rubisco; see also respiration

Photosynthesis process in which light energy is used to reduce CO₂ to organic compounds; occurs in chloroplasts in higher plants and algae

Photosynthetic efficiency efficiency of the use of light for photosynthesis (quantum yield); mostly used in conjunction with chlorophyll fluorescence

Photosynthetic nitrogen-use efficiency rate of photosynthesis expressed per unit (organic) nitrogen in the photosynthesizing tissue

Photosynthetic quotient ratio between CO₂ uptake and O₂ release in photosynthesis

Photosynthetic water-use efficiency ratio between photosynthetic carbon gain and transpirational water loss

Photosynthetically active radiation (PAR) radiation used to drive photosynthesis (400—700 nm); the spectral region is similar to that of visible light, but the spectral sensitivity is different from that of the human eye

Photosystem unit comprising pigments and proteins where the excitation energy derived from absorbed photons is transferred to an electron; there are two types of photosystems (I and II) that are embedded in the photosynthetic membrane (thylakoid)

Phototropism growth of plant organs in response to the directional component of light perceived by the blue-light photoreceptor phototropin

Phreatophyte plant species that accesses deep layers of water

Phyllosphere immediate surroundings of a leaf

Phylogenetic constraint genetic constitution of a population or taxon that restricts evolutionary change; it can prevent the development of particular traits

Physiological filter physiological limitations due to intolerance of the physical environment, which prevent survivorship of plant species that arrive at a site

Phytate calcium salt of myo-inositol hexakisphosphate; organic P-storage compound in seeds and endodermis of some plant species and major fraction of organic P in soils
Phytoalexin plant defense compound against microorganism, whose synthesis is triggered by components of microbial origin

Phytoanticipin constitutively produced plant defense compound against microorganism

Phytochrome photoreceptor absorbing red or far-red radiation (depending on its configuration); this pigment is involved in the perception of the presence of light, light quality, and daylength

Phytohormone plant compound produced in one part of the plant and having its effect in another part at minute concentrations (nanomolar and picomolar range)

Phytomining use of green plants to remove, contain, or render harmless environmental contaminants

Phytosiderophore iron-chelating organic molecule in grasses

Pico- prefix (p) denoting $10^{-12}$

Pioneer species that is a major component of a vegetation at early stages of succession; used in contrast to climax species

Pit narrow channel through the thick secondary walls of vessel elements in xylem

Pit membrane relatively thin structure in each pit which is formed from the primary cell wall and consists of a dense network of hydrophilic cellulose polymers

Plasmalemma plasma membrane; external membrane surrounding the cytoplasm

Plasmodesma(s) minute membrane-lined channels that traverse the plant cell wall to provide a cytoplasmic pathway for transport of substances between adjacent cells

Plasmolysis separation of the cytoplasm from the cell wall due to water loss; only happens in water, not in air

Plasticity the ability of an organism to adjust depending on the external environment

Pneumatophore specialized portion of the root that emerges from water-logged soils, believed to be used for gas exchange

Poikilohydric plants or plant parts (seeds, pollen) that can dry out without losing their capacity to function upon rehydration

Post-illumination CO$_2$ fixation CO$_2$ fixation that occurs briefly after a light pulse

ppb part per billion; $1\ \text{nmol mol}^{-1}$; $1\ \text{ng g}^{-1}$; $\mu\text{l l}^{-1}$ (not an acceptable SI unit)

Pressure chamber chamber in which a plant or part thereof can be pressurized; it is, among others, a part of the equipment used to determine the water potential in the xylem of plant stems

Pressure potential pressure component of the water potential; it is positive in nonplasmolyzed living plant cells (turgor) and negative in the xylem of transpiring plants (suction)

Pressure probe microcapillary that is injected into a living cell to measure cell turgor

Protease/protease protein-hydrolyzing enzyme

Protein turnover breakdown and synthesis of proteins that does not account for a change in protein concentration

Proteoid root (=cluster root) cluster root; a short-haired dense package of root hairs that exudes nutrient solubilizing compounds; the name stems from the family of the Proteaceae

Protocarnivory capability of plants to digest arthropods or other organic items that are trapped on sticky surfaces or in “tank” traps and absorb the breakdown products of the trapped material

Proton co-transport transport mechanism that allows movement of a compound against the electrochemical gradient for that molecule, using the proton-motive force

Proton-motive force driving force across cell membranes due to a membrane potential and/or proton gradient

Protoplasmic streaming flow of the cytoplasm, mediated by the cytoskeleton

Protoplast cell membrane with cytoplasm and cell organelles inside; it is isolated after enzymatic removal of the cell wall

Pulvinus “joint” in a petiole that allows the movement of a leaf, due to transport of ions between cells in the pulvinus, followed by changes in turgor (e.g., in many legumes)

Q$_{10}$ change in rate of a reaction in response to a 10°C change in temperature

Qualitative defense compound highly toxic secondary plant metabolite that protects against attack by herbivores at low concentration

Qualitative long-day plant plant that will not flower unless the length of the night gets below a critical value

Qualitative short-day plant plant that will not flower unless the length of the night gets above a critical value
Quantitative defense compound secondary plant metabolite that gives some protection against attack against a broad range of herbivores when present in large amounts.

Quantitative long-day plant plant whose flower induction is promoted by exposure to short nights.

Quantitative short-day plant plant whose flower induction is promoted by exposure to long nights.

Quantum flux density a measure of the level of irradiance; it is expressed as quanta incident on a (horizontal) plane per unit of time; see also photon flux density.

Quantum yield moles of CO₂ fixed or O₂ evolved in photosynthesis, or electrons transported in the photosynthetic membrane, per mole of quanta absorbed; in the context of gas exchange often restricted to the linear, light-limited part of the photosynthesis—irradiance curve; when measuring chlorophyll fluorescence, it refers to the full range of photosynthetic irradiance.

Recalcitrant organic matter soil organic matter that takes a long time to be decomposed.

Recalcitrant seeds seeds that do not tolerate desiccation and are consequently difficult to store for longer periods; they typically germinate shortly after dispersal without first going through a phase of dormancy.

Receptor protein with a high affinity and specificity for a signaling molecule (e.g., a phytohormone), which is the start of a signal-transduction pathway.

Reductive pentose phosphate pathway metabolic pathway that utilizes NADPH produced in the light reaction of photosynthesis and produces triose-phosphate.

Reflectance fraction of radiation incident on a surface that is reflected (e.g., a leaf, or the Earth surface).

Relative humidity water vapor concentration of air relative to the maximum water vapor concentration at that temperature.

Relative water content water content of a plant tissue relative to the water content at full hydration.

Reserve formation build-up of storage products that result from diversion of plant resources to storage from alternative allocations, such as growth.

Resistance (against stress) plant capacity to minimize the impact of stress factors in the environment, either by the presence of tolerance mechanisms or by avoidance of the stress.

Resorption translocation of nutrients and soluble organic compounds from senescing tissues prior to abscission.

Resource competition use of the same pool of growth-limiting resources by two or more plants.

Respiratory quotient ratio between CO₂ release and O₂ consumption in dark respiration.

Resurrection plant plant that withstands complete dehydration and resumes functioning upon rehydration.

Rhizobia collective term for bacteria that fix N₂ in symbiosis with legumes or Parasponia of the genera Rhizobium, Bradyrhizobium, Sinorhizobium, Mesorhizobium, and Azorhizobium.

Rhizosphere zone of soil influenced by the presence of a root.

Ring porous wood in which xylem vessels produced early in the growing season are longer and wider than those produced in late wood, adding to the distinction of annual growth rings.

Rock phosphate Inorganic phosphate compound with very low solubility.

Root density total root length per unit soil volume.

Root-mass density see biomass density.

Root-mass ratio (RMR) ratio between root biomass and total plant biomass, synonym is root mass fraction (RMF).

Root pressure positive water potential in the xylem due to ion transport into the xylem of roots and subsequent osmotic uptake of water.

Root shoot ratio ratio between root biomass and shoot biomass.

Root turnover replacement of (old) roots by new ones, not accounting for a change in the total amount of roots.

Roughness unevenness of a surface that creates turbulence and enhances convective exchange between the surface and the atmosphere.

Rubisco ribulose-1,5-bisphosphate carboxylase/oxygenase; enzyme catalyzing the primary step in the Calvin-cycle, the attachment of CO₂ to the CO₂-acceptor molecule ribulose 1,5-bisphosphate (RuBP); also catalyzes the oxygenation of RuBP.

Rubisco activase protein catalyzing the carbamylation of Rubisco that regulates its activity; chaperone protein protecting the catalytic sites of Rubisco at extreme temperatures and in darkness.
Ruderal species  species that flourish on disturbed sites and complete their life cycle relatively rapidly
Runoff gravitational water loss from an ecosystem; the difference between precipitation and evapotranspiration (surface and groundwater runoff)
Saline soils soils with high salt concentration
Salt gland group of cells involved in salt excretion
Saponin secondary plant compound with soap-like properties
Sapwood most recent wood in the xylem of a tree trunk, with open xylem conduits that still function in water transport; it has often a lighter color than the innermost heartwood
Scarification breaking, scratching, or softening the seed coat to allow moisture penetration
Schizogenous aerenchyma Gas-transport tissue in plants that is the outcome of highly regulated and species-specific patterns of cell separation and differential cell expansion that creates spaces between cells (see also lysigenous aerenchyma)
Sclerenchyma tissue that can consist of two types of cells: sclereids and fibers, which both have thick secondary walls and are frequently dead at maturity
Scleromorph containing a relatively large amount of sclerenchyma
Sclerophyllous leaves that are scleromorph; they are thick, tough and have a thick cuticle
Secondary metabolites compounds produced by plants that are not essential for normal growth and development; they are frequently involved in the interaction with a plant’s biotic and abiotic environment
Seedling phase recently germinated plants that still have their cotyledons attached
Self-thinning reduction in plant density due to increased mortality as a result of competition
Senescence programmed series of metabolic events that involve metabolic breakdown of cellular constituents and transport of the breakdown products out of the senescing organ that ultimately dies
Serotinous state of cones on a tree that remain closed with release of seeds delayed or occurring gradually
Serpentine soil soils that naturally contain high levels of various heavy metals and magnesium, but low concentrations of calcium, nitrogen, and phosphate
Short-day plant plants whose flowering is induced by exposure to long nights
Signal-transduction pathway chain of events by which a chemical messenger (e.g., a phytohormone or other signaling molecule) or physical (e.g., radiation) signal is sensed and relayed into a chain of molecular events that lead to a response; it can operate at the cellular or whole-plant level, involving long-distance transport of the signal
Sink part of the plant that shows a net import of a compound (e.g., a root is a sink for carbohydrates and a leaf is a sink for inorganic nutrients); see also source
Soil texture particle size distribution in a soil, e.g., the relative proportions of sand, silt, and clay
Solar tracking movement of a leaf or flower that positions this organ at a more or less constant angle relative to the incident radiation throughout the entire day
Source part of a plant that shows a net export of a compound (e.g., a leaf is a source for carbohydrates and a root is a source for inorganic nutrients); see also sink
Specific leaf area (SLA) leaf area per unit leaf dry mass
Specific leaf mass leaf dry mass per unit leaf area (LMA)
Specific root length (SRL) root length per unit root dry mass
Spongy mesophyll loosely packed photosynthetic cells at the abaxial side of a dorsiventral leaf
Stomata structures in the leaf epidermis formed by specialized epidermal cells; mostly the term refers to the pores, as well as to the stomatal apparatus
Stomatal pore opening in the leaf epidermis between two guard cells of stomata
Starch polymer of glucose; storage compound in plastids
Stomatal conductance/resistance conductance/resistance for transport of CO₂ or water vapor through the stomata
Storage build-up of a metabolically inactive pool of compounds that can subsequently serve to support growth or other physiological functions; see reserve formation
Strategy complex suite of traits allowing adaptation to a particular environment
Stratification breaking of seed dormancy by exposure of moist seeds to low temperatures
Stress environmental factor that reduces plant performance
Stress protein  protein that is produced only or in greater quantities upon exposure to stress

Stress response  the immediate detrimental effect of stress on a plant process causing reduced plant performance

Stroma  matrix within the chloroplast containing Calvin-cycle enzymes and in which the thylakoid membrane system is suspended

Strophiole (= caruncle)  an outgrowth of a seed coat, near the hilum; preformed weak site in the seed coat that allows entry of water when sufficiently weathered

Suberin  polymer containing long-chain acids, hydroxy acids, alcohols, dicarboxylic acid, and phenols; the exact structure is not fully understood; cell-wall component in many locations (e.g., Casparian strip, corky periderm)

Subsidiary cell  epidermal cell type around many stomata, located distally and laterally to a guard cell

Succession  directional change in plant species composition resulting from biotically driven changes in resource supply

Succulence  thick fleshy state of herbaceous tissues due to high water content; it is quantified as the volume of water in the leaf at a relative water content of 100% divided by the leaf area

Succulent  plant with tissue of high degree of succulence

Sugar sensing  the perception of internal sugar concentrations that is at the start of a signal-transduction pathway

Summer annual  species whose seeds germinate after winter and completes its life cycle before the start of the next winter

Sunfleck  short period of high irradiance that interrupts the background of low diffuse radiation in and under leaf canopies caused by direct sunlight that penetrates small holes in the canopy

Supercooling  refers to the noncrystalline state of water at sub-zero temperatures

Supply function  equation describing CO₂ diffusion from the atmosphere into the leaf, supplying substrate for photosynthesis

Symbiosis  intimate association between two organisms of different species (in this text, the term is used when both symbionts derive a long-term selective advantage)

Symbiosome  membrane-surrounded space containing one or more rhizobia in an infected cell of a root nodule in a legume

Symplast  space comprising all the cells of a plant’s tissues connected by plasmodesmata and surrounded by a plasma membrane

Symplastic phloem loading  occurs in plants in which photosynthates moves from the cytoplasm of the mesophyll cells of the leaves, via plasmodesmata, to intermediary cells; after chemical transformation into oligosaccharides, these move, again via plasmodesmata, to the sieve tubes

Symport  Co-transport of one compound in one direction coupled to transport of another compound (mostly H⁺) in the same (uniport) or opposite (antiport) direction

Systemic resistance  resistance that is induced by a herbivore or a microorganism at a location that differs from the plant part that has been primarily affected; the organisms that induce the resistance may be parasitic or have a growth-promoting effect

Tannin  class of protein-precipitating polymeric phenolic secondary plant compound; typically a quantitative defense compound

TCA cycle  Tricarboxylic acid cycle

Terpenoid  class of secondary plant compounds containing C and H, produced from the precursor mevalonic acid

Testa  seed coat

Thermogenic respiration  respiration that increases the temperature of an organ, such as the flowers of Arum lilies

Thigmomorphogenesis  altered growth of plant organs in response to a physical force (touch, wind, vibrations, rain, turbulent water flow)

Thylakoid  photosynthetic membrane suspended in the stroma in chloroplasts; it encloses a lumen and contains the photosynthetic pigments, electron-transport chain components and ATP-synthase

Tissue-mass density  dry mass per unit volume of a tissue

Tissue tension  result of differences in turgor and/or cell-wall elasticity between different cells in a tissue or organ; the tension is relaxed when the organ is cut, resulting in deformation; tissue tension plays an important role in the closing mechanism of the carnivorous Venus fly trap (Dionaea)

Tolerance  endurance of unfavorable environmental conditions

Tracheid  cell type in the xylem
Trade-off  balancing of investment in mutually exclusive traits (e.g., protective structures vs. photosynthetic machinery in leaves)

Transfer cell  cell involved in transport that has a proliferation of the plasma membrane causing surface enlargement (e.g., in the phloem of plants using the apoplastic phloem-loading pathway, in the epidermis of aquatic plants using bicarbonate)

Translocation  transport of solutes through the phloem

Transmittance  fraction of radiation incident on a body that passes through the body; mostly used with reference to leaves

Transpiration  water loss from leaves or whole plants due to evaporation from within a leaf or other plant parts

Tricarboxylic acid cycle (TCA cycle)  conversion of malate or pyruvate to CO₂ within the mitochondria

Trichome  epidermal hair on a leaf or stem

Trypsin  protein-hydrolyzing enzyme (in animals)

Turgor  positive hydrostatic pressure in live plant cells

Uncoupler  chemical compound that enhances the membrane conductance for protons and so uncouples electron transport from phosphorylation

Unit leaf rate (ULR)  synonym for net assimilation rate (NAR)

Up-regulation  increase in the normal rate of a process, sometimes involving increased transcription of genes encoding enzymes involved in that process

\( V_{\text{max}} \)  substrate-saturated rate of a chemical conversion catalyzed by an enzyme (expressed per unit protein, rather than per mole catalytic sites as in \( k_{\text{cat}} \))

Vacuole  membrane-bound cell compartment filled with water and solutes; among others used for storage of sugars, nutrients, and secondary metabolites

Vapor pressure deficit (VPD)  difference in actual vapor pressure and the vapor pressure in air of the same temperature and pressure that is saturated with water vapor

Vapor pressure difference (Δ\( w \))  difference in vapor pressure between the intercellular spaces and the atmosphere

Vegetative reproduction  asexual reproduction of plants through detachment of a part that develops into a complete plant; clonal growth

Vegetative storage protein  proteins accumulating in vegetative plant parts (leaves and hypocotyls) at a high supply of nitrogen (e.g., in Glycine max)

Vernalization  induction of flowering by exposure to low temperatures (from the Latin word ver = spring)

Vessel  water-conducting element of the xylem

Viscoelastic creep  mixture of viscous and elastic processes during cell-wall expansion; also unsavory character met in dark alleys

Viviparous seeds  seeds that germinate prior to abscission from the maternal plant (e.g., mangrove species)

Wall loosening  refers to the process during which covalent or noncovalent bonds between cellulose microfibrils and other macromolecules are broken, so that the cell under turgor can expand

Water channel  pore for water transport in membranes consisting of a specialized protein (aquaporin); water moves single file

Water potential  chemical potential of water divided by the molar volume of water, relative to that of pure water at standard temperature and pressure

Water status  loose term referring to aspects of the plant’s relative water content, turgor, water potential, etc.

Water stress  stress due to shortage of water

Water-use efficiency  ratio between the gain of (above-ground) biomass in growth or CO₂ in photosynthesis and transpirational water loss

Wilting point  water potential at which turgor pressure is zero

Winter annual  species whose seeds germinate before or in winter and completes its life cycle before the start of the next summer; typically found in Mediterranean-type climates

Xanthophyll cycle  chemical transformations of a number of carotenoid molecules in the chloroplast that avoid serious damage by excess radiation

Xenobiotic  potentially toxic chemical that is found in an organism where it is normally not occurring; can be restricted to synthetic compounds, but is also used in a wider sense
Xerophyte — plant that typically grows in dry environments, see also mesophyte and hygrophyte

Yield coefficient — a proportionality constant in the Lockhart equation that refers to the plasticity of cell walls

Yield threshold — minimum turgor pressure for cell expansion

Zeatin — a phytohormone belonging to the cytokinins, the name stems from Zea mays (corn), from which it was first isolated
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