Soil and Environmental Science

DICTIONARY

Edited by
E.G. Gregorich
L.W. Turchenek
M.R. Carter
D.A. Angers

CANADIAN SOCIETY OF SOIL SCIENCE

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Soil and Environmental Science DICTIONARY

Don't be surprised we don't know how to describe the world
and only speak to things affectionately by their first names.

Zbigniew Herbert
Never About You

Preface

Judicious treatment of environmental questions and challenges requires an integrated, cross-disciplinary approach. Whether working at a local, national, regional, or global scale, the knowledge and expertise resident in a variety of subject areas comes to bear on all questions of sustainable development. Soil scientists now collaborate with colleagues in many fields, and a basic working knowledge of the vocabulary of those fields improves understanding and enhances the flow of information.

This dictionary brings together the conventional vocabulary of soil science with that of many overlapping disciplines such as geology, hydrology, and meteorology. Its purpose is to define and describe technical words for researchers, students of various levels, librarians, policy- and decision-makers, and interested citizens working and studying in a wide variety of disciplines related to soil science.

The terms and definitions for this dictionary were gathered from a wide variety of sources, including several existing glossaries and dictionaries. The editors invited a panel of thirty reviewers, experts in selected subject areas, to help review, select, and update best definitions. The editors acknowledge and thank Professor Alma Mary Anderson, Art Department, Indiana State University, for drafting the illustrations. To reflect Canada's bilingualism and make the dictionary more useful to the international science community, French equivalents are given for English terms.

Canadian Society of Soil Science

The Canadian Society of Soil Science is a non-governmental, non-profit organization for scientists, engineers, technologists, administrators, students, and others interested in soil science. Its three main objectives are:

- To promote the wise use of soil for the benefit of society
- To facilitate the exchange of information and technology among people and organizations involved in soil science
- To promote research and practical application of findings in soil science

The Society quarterly produces the international scientific publication, the *Canadian Journal of Soil Science,* and each year hosts an international soil science conference. Its well-known practical soils methodology book *Soil Sampling and Methods of Analysis* (Lewis Publishers, CRC Press, 1993) is used throughout the world. The Society publishes a newsletter to share information and ideas, and maintains active liaisons and partnerships with other soil science societies. Collaborative projects are currently under way in Sri Lanka, Costa Rica, and Thailand.

For more information about the Canadian Society of Soil Science, please visit the following Web site: *http://www.csss.ca.*

The Editors

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Using the Dictionary

Each term is printed in bold type, followed by the definition. In the case of multiple definitions for a single term, definitions are listed in a numbered sequence. Where a definition pertains to a specific discipline, the discipline appears italicized in parentheses at the head of that definition.

The French term equivalent to the defined English term or phrase is shown in bold type following the definition. If the French term differs for multiple English definitions listed in a numbered sequence, the French terms are numbered correspondingly at the end of the list of definitions.

A word in italic font within a definition indicates that it is defined elsewhere in the dictionary, unless it denotes a biological genus and species. Where a term is defined elsewhere in the dictionary under a synonymous term, the reader is directed to this other definition with the instruction, "See...". At the end of a definition, the reader is alerted to synonyms for this term with the instruction, "Also called...".

Two indexes, located at the back of the dictionary, group dictionary terms according to discipline and subject area. These sections enable the English or French reader to determine if a particular term, or group of related terms within a discipline, is defined in the dictionary. Terms are arranged alphabetically within each discipline. The English/French index is sorted alphabetically by English term with the corresponding French equivalent, and the French/English index by French term with the corresponding English equivalent. Several appendices provide additional information to aid in understanding certain terms or the context in which terms are used. The literature used to define some of the terms is cited in References: Sources of Terms, and the sources used for some of the illustrations are given in References: Sources of Illustrations.

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α-amino acid A specific organic acid in which an amino group and an alkyl group are attached to the carbon atom residing closest to the carboxyl group. **acide α-aminé**

a axis (*crystallography*) One of the crystallographic axes used as reference in crystal description. It is the axis that is oriented horizontally, from front to rear. See *b axis*, *c axis*. **axe a**

A horizon A mineral soil horizon formed at or near the surface in the zone of removal of materials in solution and suspension, or maximum *in situ* accumulation of organic carbon, or both. The accumulated organic matter is usually expressed morphologically by a darkening of the surface soil (Ah). Conversely, the removal of organic matter is usually expressed by a lightening of the soil color, usually in the upper part of the solum (Ae). The removal of clay from the upper part of the solum (Ae) is expressed by a coarser soil texture as compared to the underlying subsoil layers. The removal of iron is indicated usually by a paler or less red color in the upper part of the solum (Ae) relative to the lower part of the subsoil. The above horizon terms are according to the Canadian system of soil classification. See *Appendix D* for equivalent U.S. Soil Taxonomy and FAO soils terminology. See *B horizon, C horizon, horizon, soil.* **horizon A**

AB horizon A transitional mineral horizon showing properties of both an A and B horizon in which properties of the A predominate. **horizon AB**

abaxial (*botany*) Facing away from the stem of a plant (e.g., the undersurface of a leaf). See *adaxial*. **abaxial**

Abbe refractometer An instrument used for determining the refractive index of liquids, minerals, and gemstones. Its operation is based on the measurement of the *critical angle*. **réfractomètre d'Abbe**

ABC soil A soil that has a complete profile, including an A, a B, and a C horizon. **sol ABC**

abiontic enzyme An enzyme (exclusive of live cells) excreted by live cells during growth and division, attached to cell debris and dead cells, or leaked into soil solution from extant or lyzed cells but whose original functional location was on or within the cell. **enzyme abiontique**

abiotic Non-living, referring to the basic elements and compounds of the environment. **abiotique**

abrasion (*geology*) The mechanical wearing (i.e., scratch, grind, or polish) effect on rocks caused by frictional agents (e.g., sand, pebbles, boulders) transported in various ways: by wind, running water, ocean waves and currents, or glacier ice. **abrasion**.

abscissa The horizontal axis (x axis) in a graph. See *ordinate*. **abscisse**

absolute alcohol Pure alcohol (ethanol). **alcool absolu**

absolute temperature Temperature measured in degrees Celsius from *absolute zero*, –273.16°C. Absolute temperatures are given on a scale of Kelvin (e.g., 150 K). **température absolue**

absolute zero The temperature at which all thermal motion of atoms and

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molecules theoretically ceases; –273.16°C. **zéro absolu**

absorbance The amount of light absorbed by a solution; the measure is used to determine the concentration of certain ions or molecules in a solution. **absorbance**

absorbed water Water held mechanically in a soil mass and having physical properties similar to ordinary water at the same temperature and pressure. **eau absorbée**

absorptance The ratio of the radiant flux absorbed by a body to that incident upon it. Also called absorption factor. **absorptance, facteur d'absorption**

absorption (*physics*) The process by which the energy of *electromagnetic radiation* is taken up by a molecule and transformed into a different form of energy. (*chemistry*) The process by which one substance is taken up by another substance. **absorption**

absorption band A range of wavelengths over which radiant energy is absorbed by a specific material that may be present on the Earth's surface or in the atmosphere. **bande d'absorption**

absorption of radiation The uptake of *radiation* by a solid body, liquid, or gas. The absorbed energy may be transferred or re-emitted. **absorption du rayonnement**

absorption, active Movement of ions and water into the plant root resulting from the root's metabolic processes, usually against an electrochemical potential gradient. **absorption active**

absorption, passive Movement of ions and water into the plant root as a result of diffusion along an activity gradient. **absorption passive**

absorptive power The total flux of radiant energy absorbed in a unit area of absorbing material; measured in watts per square centimeter. **pouvoir d'absorption, pouvoir absorbant**

absorptivity The ratio of the amount of radiation absorbed by a body to the maximum amount it can absorb. A surface that is a poor reflector is a good absorber. If no radiation is reflected, the surface acts as a black body and has an absorptivity and *emissivity* of 1. **absorptivité**

AC horizon Analogous to an *AB horizon*, except the transition is between an A and a C horizon in a profile lacking a B horizon. **horizon AC**

AC soil A soil that has an incomplete profile, including an A and a C horizon, but no clearly developed B horizon. Commonly, such soils are young, like those developing from alluvium or on steep, rocky slopes. **sol AC**

access tube Small diameter tube (typically about 50 mm) inserted through the soil root zone for passage of a *neutron probe* to determine the water content of soil at various depths. **tube d'accès**

accelerated erosion See *erosion*. **érosion accélérée**

acclimation See *acclimatization*. **acclimatation**

acclimatization Physiological and behavioral adjustments of an organism in response to a change in environment. **acclimatation**

accuracy The degree to which calculation, measurement, or set of measurements agrees with a true value or an accepted reference value. Accuracy includes a combination of random error (*precision*) and systematic error (*bias*) components that are due to sampling and analytical operations. **exactitude**

acetylene-block assay A technique used to estimate *denitrification* by determining release of nitrous oxide from acetylene-treated soil. **test de blocage à l'acétylène**

acetylene-reduction assay An estimation of nitrogenase activity accomplished by measuring the rate of acetylene reduction to ethylene. **test de réduction de l'acétylène**

acid A substance that contains hydrogen and dissociates in water to produce positive hydrogen ions (or H_3O^+) (i.e., Arrhenius theory). A substance that exhibits a tendency to release a proton (i.e.,

Lowry-Brønsted theory). An acid is a compound that can accept a pair of electrons, and a *base* is one that can donate an electron pair (i.e., Lewis theory). **acide**

acid deposition Acidic material introduced to the ground or surface waters including wet deposition from precipitation, dry deposition from particle fallout, and acid fog. Air contaminants, such as sulfur oxides and nitrogen oxides, from both *anthropogenic* and natural sources react with water in the atmosphere to form acids. Often called acid rain. **déposition acide**

acid detergent fiber (ADF) Insoluble residue remaining after extraction of herbage with acid detergent; cell wall constituents minus hemicellulose. **fibre au détergent acide (ADF)**

acid detergent fiber digestibility The digestibility of *acid detergent fiber* (ADF) of a forage, calculated as the percent difference ADF measured before and after *in vitro* or *in vivo* digestion. **digestibilité de la fibre au détergent acide**

acid dissociation constant (K_a) The equilibrium constant for a reaction in which a proton is removed from an acid by H_2O to form the conjugate base and H_3O^+; a measure of the strength of the acid. **constante de dissociation d'un acide**

acid gas The anhydrous gaseous form of an acid (e.g., hydrogen chloride). **gaz acide**

acid mine drainage Water contamination by sulfuric acid produced by seepage through sulfur-bearing spoil and tailings from coal and metal mining. **drainage minier acide**

acid rain See *acid deposition*. **pluie acide**

acid soil A soil having a pH of less than 7.0. See *reaction, soil*. **sol acide**

acid spoil Coal and metal mine tailings that contain sulfur and generate acidity. **déblais acides**

acid-base indicator A substance that marks the end point of an acid-base titration by changing color. **indicateur acido-basique**

acid-forming fertilizer See *fertilizer*. **engrais acidifiant**

acidic Having a low pH value (less than 7); the opposite of alkaline. **acide**

acidic cation A cation that, when added to water, undergoes hydrolysis resulting in an acidic solution. Hydrated acidic cations donate protons to water to form hydronium ions (H_3O^+) and thus in aqueous solution are acids (Bronsted definition). Examples in soils are H^+, Al^{3+}, and Fe^{3+}. **cation acidique**

acidic rock Igneous rock that is high in silica, generally greater than 52%. One of four subdivisions of a commonly used system for classifying igneous rocks based on silica content (e.g., acidic, *intermediate rock*, *basic rock*, and *ultrabasic rock*). **roche acide**

acidic solution A liquid whose hydrogen ion concentration is greater than its hydroxyl ion concentration, or whose pH is less than 7.0. **solution acide**

acidimetry Volumetric analysis in which a standard solution of an acid is added to the unknown (base) solution to determine the amount of base present. **acidimétrie**

acidity constant See *acid dissociation constant*. **constante d'acidité**

acidity, exchangeable The amount of exchangeable hydrogen and aluminum ions in soil, as estimated by replacement from a soil by an unbuffered salt solution such as KCl or NaCl. Also called "salt-replaceable acidity." **acidité d'échange**

acidity, residual Soil acidity that is neutralized by lime or other alkaline materials, but which cannot be replaced by an unbuffered salt solution; calculated by subtraction of salt replaceable acidity from total acidity. **acidité résiduelle**

acidity, salt-replaceable The aluminum and hydrogen that can be replaced from an acid soil by an unbuffered salt solution such as KCl or NaCl. **acidité échangeable par un sel**

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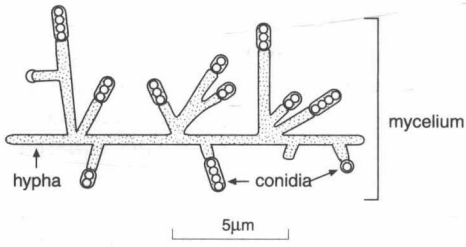
acidity, total The total acidity in a soil or clay, usually estimated by a buffered salt determination of [*cation exchange capacity – exchangeable bases*] = total acidity. Also approximated by the sum of salt replaceable acidity + residual acidity. Often calculated by subtraction of exchangeable bases from the cation exchange capacity determined by ammonium exchange at pH 7.0. It can be determined directly using pH buffer-salt mixtures (e.g., $BaCl_2$ plus triethanolamine, pH 8.0 or 8.2) and titrating the basicity neutralized after reaction with a soil. **acidité totale**

acidophilic Preferring or thriving in a relatively acid environment. **acidiphile, acidophile**

acidulation The process of treating a fertilizer source with an acid or mixture of acids (e.g., treating phosphate rock with sulfuric, nitric, or phosphoric acid). **acidulation**

actinometer An instrument which measures solar radiation. The corresponding term for a recording instrument is actinograph. **pyranomètre, actinomètre**

actinomycetes Gram-positive bacteria that form branching filaments. They may form true *mycelia* or produce conidiospores. The pleasant odor of freshly plowed ground comes from actinomycetes in the soil. See *figure*. **actinomycète**



Actinomycete

activated carbon A highly absorbent form of carbon, used to remove odors and toxic substances from gaseous emissions and dissolved organic matter from wastewater. See *carbon filtration*. **charbon activé ou actif**

activation energy The minimum amount of energy required for a chemical reaction to take place. **énergie d'activation**

active organic matter The portion of soil organic matter composed of material that is relatively easy to decompose by soil microorganisms. Also called active fraction of organic matter. **matière organique active**

active ingredient The chemical component(s) in a pesticide product or formulation that causes the desired effect on the specific pest. Usually expressed as a percent and abbreviated as a.i. **matière active**

active layer The top layer of soil in a permafrost zone, subjected to seasonal freezing and thawing which, during the melt season, becomes very mobile. **couche active**

activity (*chemistry*) (1) A dimensionless measure of the deviation of the chemical potential of a substance from its value in some state which, for convenience, is chosen as a standard state. Defined by the equation: $\mu = \mu^\circ + RT \ln a$, where μ is the chemical potential in a state in which the activity is a, μ° is the chemical potential in the standard state (where $a = 1.0$), R is the molar gas constant, and T is the absolute temperature. (2) The effective concentration of a substance in a solution. **activité**

actual use (range-pasture) The use of forage on any area by livestock and/or game animals without reference to permitted or recommended use; usually expressed in terms of animal unit months or animal units. **utilisation courante (parcours-pâturage)**

adaptation A change in the structure, physiology, or behavior of an organism resulting from natural selection or variation of genetic characteristics by which the organism becomes better fitted to survive in its environment. **adaptation**

adaptive enzyme (enzyme induction) An enzyme produced by an organism in response to the presence of a specific substrate or a related substance. Also called an induced or inducible enzyme. **enzyme induite**

adaptive management Management practice in natural resource exploitation that rigorously combines management, research, monitoring, and means of changing practices so that credible information is gained and management activities are modified by experience. **gestion adaptative**

adaptive zone A unit of environment occupied by a single type of organism, because particular environmental opportunities require similar adaptations for diverse species. Species in different adaptive zones usually differ by major morphologic or physiologic characteristics. **zone adaptative**

adaxial (*botany*) Facing toward the stem of a plant (e.g., the upper surface of a leaf). See *abaxial*. **adaxial**

additive effects (1) The combination of reactions or substances, acting together or independently, to cause a total response equal to or greater than the sum of the separate reactions or substances (e.g., the combined toxic effects of more than one pollutant). (2) Effects on biota of stress imposed by one mechanism, contributed from more than one source (e.g., sediment-related stress on fish imposed by sediment derived from streambank and land surface sources). See also *cumulative effects*. **effets additifs**

adenosine diphosphate (ADP) On hydrolysis, adenosine triphosphate (ATP) loses one phosphate to become adenosine diphosphate (ADP), releasing usable energy. **adénosine diphosphate (ADP)**

adenosine triphosphate (ATP) An energy storage compound common to all biological systems. The high-energy intermediate is formed during photosynthesis or by the breakdown of energy-containing material, such as glucose. Supplies the energy for all cellular reactions and functions. **adénosine triphosphate (ATP)**

adenylate energy charge ratio (EC) A measure of the metabolic state of microorganisms and state of growth of natural microbial communities. The energy charge ratio is calculated using the formula: EC = (ATP + 1/2ADP)/(ATP + ADP + AMP). The denominator represents the total adenylate pool; the numerator, the portion charged with high energy phosphate bonds. **charge énergétique**

adhesion (*chemistry*) A force that acts to hold the molecules of dissimilar substances together. The static attractive force at the contact surface between two bodies of different substances. (*soil mechanics*) The shearing resistance between soil and another material under zero externally applied pressure. **adhésion**

adiabatic process A process that occurs without heat entering or leaving a system. Generally involves a rise or fall in the temperature of the system. **transformation adiabatique**

adobe soil Clayey and silty deposits found in the desert basins of southwestern North America and in Mexico; used extensively for making sun-dried brick. **terre à briques**

adsorbed water Water held in a soil by physicochemical forces and having physical properties substantially different from *absorbed water* or chemically combined water at the same temperature and pressure. **eau adsorbée**

adsorption The process by which atoms, molecules, or ions are taken up and retained on the surfaces of solids by chemical or physical binding (e.g., the adsorption of cations by negatively charged minerals). The two types of adsorption are physisorption, in which the attractive forces are purely *van der Waals*, and chemisorption, where chemical bonds are actually formed between the adsorbent (the material doing the adsorbing)

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and adsorbate (the material being adsorbed). **adsorption**

adsorption complex The group of substances in the soil capable of adsorbing ions and molecules. Organic and inorganic colloidal substances form the greater part of the adsorption complex. The noncolloidal materials, such as silt and sand, exhibit adsorption to a much lesser extent than the colloidal materials. **complexe d'adsorption**

adsorption isotherm A graph of the quantity of a given chemical species bound to an adsorption complex (e.g., soil) at fixed temperature, as a function of the concentration of the species in a solution in equilibrium with the complex. See *Freundlich isotherm, Langmuir isotherm.* **isotherme d'adsorption**

advection The movement of air, water, and other fluids in a horizontal plane. **advection**

adventitious roots Roots that arise from unusual parts of a plant, usually forming on aerial organs, rhizomes, and older parts of the root body. They can develop under normal environmental conditions or in response to pathogens and wounding. They are found among all vascular plants, and in some cases may be essential to normal growth and development. **racines adventives**

aerate To impregnate with a gas, usually air. **aérer**

aerial photograph (*remote sensing*) A photograph of the Earth's surface taken from airborne equipment; sometimes called aerial photo or air photograph. An oblique aerial photograph is taken with the camera axis directed between the horizontal and vertical. In a high oblique photograph, the apparent horizon is shown, and in a low oblique photograph the apparent horizon is not shown. A vertical aerial photograph is made with the optical axis of the camera approximately perpendicular to the Earth's surface and with the film as nearly horizontal as practical. See *remote sensing.* **photographie aérienne**

aerial reconnaissance The collection of information by visual, electronic, or photographic means from the air. **reconnaissance aérienne**

aerial survey A survey using photographic, electronic, or other data obtained from an airborne platform. **levé aérophotogrammétrique**

aerial triangulation See *phototriangulation.* **aérotriangulation**

aerobe Organism requiring oxygen for growth. **organisme aérobie**

aerobic (1) Having molecular oxygen as a part of the environment. (2) Growing only in the presence of molecular oxygen, such as aerobic organisms. (3) Occurring only in the presence of molecular oxygen, as applied to certain chemical or biochemical processes such as aerobic decomposition. **aérobie**

aerobic decomposition The biodegradation of materials by aerobic microorganisms; the process produces carbon dioxide, water, and other mineral products. Generally a faster breakdown than anaerobic decomposition. **décomposition aérobie**

aerosols Particles of matter, solid or liquid, larger than a molecule but small enough to remain suspended in the *atmosphere*. Particles can come from natural sources (e.g., particles from sea spray or clay particles from the weathering of rocks, both of which are carried upward by the wind) or result from human activities. (Such particles are often considered pollutants.) **aérosols**

afforestation The artificial establishment of forest crops by planting or sowing on land that has not previously, or recently, grown tree crops. See also *reforestation.* **boisement**

aflatoxin Toxins produced by the fungus *Aspergillus flavus* in grains or grain-meals stored under moist conditions; a known carcinogen. **aflatoxine**

after-ripening A curing process sometimes required by seeds, bulbs, and related