A olivier physical science grade 10 pdf download

A olivier physical science grade 10 pdf download.

Plutonio-240, 240pugeneralSymmbol240punamesPlutonium-240, PU-240protons94Neutrons146 Nuclide data Natural abundance0 (artificial) Half-Life6561 (7) Years [1] Isootope Mass240.0538135 (20) [2] Decay Energy (MEV) Alpha Decadement5.25575 (14) [2] Isotopes of plutonium Full table of Nuclides Plutonium-240 (240pu, PU-240) is a plutonium isotope formed when plutonium-239 captures a neutron. The detection of its spontaneous fission will bring to its discovery in 1944 in Los Alamos and had important consequences for the Manhattan project. [3] 240PU suffers spontaneous fission as a secondary decay mode at a small but significant rate. The presence of 240pu limits the use of plutonium in a nuclear bomb, because the flow of neutrons from spontaneous fission begins the reaction of the chain prematurely, causing an early release of energy that physically disperses the core before full implosion is reached. [4] [5] decays by alpha emission to uranium-236. Nuclear properties about 62% to 73% of the time in which 239PU captures a neutron, undergoes fission; The rest of the time, 240pu form. Longer a nuclear fuel element remains in a nuclear reactor, the greater the relative percentage of 240pu in fuel. The 240pu isotope has about the same transversal section of capture of thermal neutrons of 239pu (289.5 ± 1.4 vs 269.3 Â ± 2.9 barns), [6] [7] but only a small transversal section of fission of thermal neutrons (0.064 barns). When the 240pu isotope captures a neutron, it is about 4500 times more likely to become plutonium-241 that fission. In general, the isotopes of odd mass numbers are more likely to absorb a neutron, and can suffer fission to absorption of neutrons more easily of isotopes of even mass number. So, even mass isotopes tend to accumulate, especially in a thermal reactor. Nuclear weapons The inevitable presence of about 240pu in a headboard based on plutonium complicates its design, and pure 239Pu is considered optimal. [8] This is for some reasons: 240Pu has a highof spontaneous fission. A single stray neutron that is introduced while the nucleus is supercritical, will detonate it almost immediately, even before it has been crushed to an optimal configuration. The presence of 240PU would then randomly cause fizzles, with an explosive yield well below the potential yield. [8] [5] Isotopes in addition to 239PU release significantly more radiation, which complicates its management by workers. [8] Isotopes in addition to 239PU produce more heat decay, which can cause distortions of the modification phase of the precision nucleus if allowed to accumulate [8]. The problem of spontaneous fission was widely studied by scientists from the Manhattan project during World War II. [9] Blocked the use of plutonium in the Gun type nuclear weapons in which the Assembly of fissile material in its optimal supercritical mass configuration may require a millisecond to complete, and made it necessary to develop implosion-style weapons in which the assembly occurs in a Microseconds. [10] Even with this design, it was estimated in advance of the Trinity test that the impurity 240PU could cause a probability of 12% of the explosion that fails to achieve its maximum yield. [8] The minimisation of the amount of 240PU, as in the PLUTONIO of the degree of weapons (less than 7% 240PU) is obtained by reprocessing the fuel after only 90 days of use. Such rapid fuel cycles are highly inexpensive for civil power reactors and are normally performed only with dedicated Plutonium weapons production reactors. The Plutonium from the fuel of the civil power reactor spent generally has 70% 239PU and about 26% 240PU, the rest is made up of other Plutonium isotopes, making it more difficult to use for the production of nuclear weapons. [4] [8] [11] [12] For the drawings of the nuclear weapon introduced after the 1940s, however, there isa remarkable debate in how 240PU poses a barrier for the construction of weapons; Look at the plutonium of the reactor of the article. See also burned isotopes of plutonium references ^ Audi, Audi,Besillon, Olivier; Blachot, Jean; Wapstra, AAldert Hendrik (December 2003). "The NBASE evaluation of nuclear properties and decay". Nuclear physics A. 729 (1): 3-128. Bibcode: 2003NUPHA.729 .... 3a. CITESEERX 10.1.1.692.8504. doi: 10.1016 / j.nuclphysa.2003.11.001. ^ A B AUDI, GEORGES; Wapstra, Aaldert Hendrik; Thibault, Catherine (December 2003). "Atomic mass evaluation AME2003". Nuclear physics A. 729 (1): 337â € "676. Bibcode: 2003NUPHA.729..337A. doi: 10.1016 / j.nuclphysa.2003.11.003. ^ Farwell, G. W. (1990). "Emilio Segre, Enrico Fermi, PU-240 and the atomic bomb". Symposium to commemorate the 50th anniversary of the discovery of the transuranium elements. ^ A B Åžahin, SÃ¼mer (1981). "References on the Plutonium-240 induced pretext problem in a nuclear device". Nuclear technology. 54 (1): 431-432. DOI: 10.13182 / NT81-A32795. The energy efficiency of a nuclear explosive decreases by one and two magnitude orders if the content of 240 can increases respectively from 5 (almost plutonium at weapons level) to 15 and 25%. ^ A B Bodansky, David (2007). Nuclear bombs, nuclear energy and terrorism. Nuclear energy: principles, practices and perspectives. Science & Business Media of Springer. ISBN 978-0-387-26931-3. ^ MughaBghab, S. F. (2006). Atlas of neutron resonances: resonance parameters and thermal cross sections Z = 1-100. Amsterdam: Elsevier. ISBN 978-0-08-046106-9. ^ "Actual data: transversal sections of thermal neutrons, integral resonance and WestCott factors". Nuclear data for security guards. International Atomic Energy Agency. URL consulted on 15 September 2016. ^ A B C D E F Mark, J. Carson; Hippel, Frank von; Lyman, Edward (2009-10-30). "Explosive property of Plutonium Reactor-Gradio" (PDF). Science & Global Security. 17 (2â € "3): 170â €" 185. Bibcode: 2009s & Gs ... 17 ... 170m. DOI: 10.1080 / 08929880903368690. ISSN 0892-9882. S2CID 219716695. ^ Chamberlain, or.; Farwell, G. W.; Segr, E. (1954). "PU-240 and the Spontaneous Fission ". Physical review. 94 (1): 156. Bibcode: 1954phrv ... 94.156c. Bibcode: 1954phrv ... 94.156c. ^ Hoddeson, Lillian (1993). "The discovery of spontaneous plutonium fission during the Second World War". Historical studies in physical and biological sciences. 23 (2): 279â € "300. Doi: 10.2307 / 27757700. JStor 27757700. ^ Åžahin, SÃ¼mer; Ligou, Jacques (1980). "The effect of spontaneous fission of Plutonio-240 on the release of energy in a nuclear explosive". Nuclear technology 50 (1): 88. doi: 10.13182 / NT80-A17072. ^ Åžahahe Distantn, SÃ¼mer (1978). "The effect of PU-240 on the life of neutrons in nuclear explosives". 5 (2): 55-58. Doi: 10.1016 / 0306-4549 (78) 90104-4. External links NLM dangerous substances DataBank â € "Plutonium, Radioactive Lighter: Plutonio-239 Plutonium-240 is a heavier plutonium isotope: Plutonium-241 Decay Product of: Curium-244 (Î ±) Neptunium-240 (Î²-) Decay Chain of Plutonio-240 Decay A: Uranium-236 (Î ±) Recovered by " Mixture of organic matter, minerals, Gas, liquids and organisms that together claim life for other uses, see Soil (Disambiguation). Look for land in Wiktionary, the dictionary free. A, B, and C represent the profile of the soil, a first notation coined by Vasily Dokuchaev (1846-1903), the father of the pedology; A is the topsoil; B is a Regolith; There is a saprolite (a less wet regulation); The lower-most layer represents the rock. Surface-water-gley developed in glacial up, Northern Ireland. The soil is a mixture of organic matter, minerals, gases, liquids and organisms that together claim life. The body of the ground soil, called the pedosphere, has four important functions: as a means of plant growth as a means of water storage, procurement and purification as an earth's atmosphere modifier as a habitat for organisms all these functions, In turn, they change the soil and its properties. The soil is also commonly referred to as land or dirt; Some definitions distinguish the dirt from the soil by limiting the former term deadline on the ground. The pedosphere interfaces with the lithosphere, hydrosphere, atmosphere and biosphere. [1] The term pedolito, commonly used to refer to the ground, translates into ground stone in the basic stone sense, from the ancient Greek πέδον 'land, land'. The soil consists of a solid phase of minerals and organic matter (the soil matrix), as well as a porous phase that holds gas (the soil atmosphere) and water (the soil solution). [2][3] As a result, soil scientists can predict soils as a three-state system of solids, liquids and gases. [4] The soil is a product of several factors: the influence of the climate, the relief (highening, orientation and slope of the soil), the organisms and the parent materials of the soil (original minerals) that interact over time. [5] It continually undergoes development through numerous physical, chemical and biological processes, which include meteorism with associated erosion. Due to its complexity and strong internal connection, soil echoes consider soil as an ecosystem. [6] Most soils have a dry mass density (soil density taking into account the gaps when drying) between 1.1 and 1.6 g/cm3, while the density of soil particles is much higher, in the range from 2.6 to 2.7 g/cm3. [7] Little of the earth of the planet Earth is older than the Pleistocene and no one is older than the Cenozoic,[8] although the fossilized soils are preserved since the Archean. [9] The science of soil has two fundamental branches of study: ephology and pedology. Hedonthology studies the influence of soils on living things. [10] Pedology focuses on formation, description (morphology), and on the classification of soils in their natural environment. [11] In terms of engineering, soil is included in the broader concept of regolith, which also includes other loose materials found above the rock, as can be found on the Moon and oncelestial objects. [12] Processes The soil works as the main component of the Earth's ecosystem. World ecosystems are influencedWays for processes carried out in the ground, with effects ranging from ozone exhaustion and global warming to destruction of the rainforest and water pollution. As regards the carbon cycle of the earth, the soil acts as an important carbon tank, [13] and is potentially one of the most reactive to human disorder [14] and on climate change. [15] While the planet heats up, it was expected that the land add carbon dioxide to the atmosphere due to the increase in biological activity at higher temperatures, positive feedback (amplification). [16] This forecast has however questioned more recent knowledge on soil carbon turnover. [17] The land acts as a means of engineering, a habitat for soil organisms, a recycling system for nutrients and organic waste, a water quality regulator, an atmospheric composition modifier and a means for plant growth , making it a critical supplier of ecosystem services. [18] Since the land has a tremendous range of niches and habitats available, it contains most of the genetic diversity of the earth. A gram of land can contain billions of organisms, belonging to thousands of species, mostly microbial and largely unexplored. [19] [20] The land has an average procarrotic density of about 108 bodies per gram, [21] considering that the ocean has no more than 107 prokaryotic organisms per milliliter (gram) of sea water [22]. In the end the organic carbon held in the ground is returned to the atmosphere through the breathing process carried out by heterotrophic organisms, but a substantial part is maintained in the ground in the form of a organic substance of the soil; The processing of the land usually increases the speed of soil breathing, leading to the depletion of the organic soil matter [23]. The roots of the plants need oxygen, aeration is an important characteristic of the soil. This ventilation can be carried out through networks of interconnected soil pores, which absorb and also hold rainwater that make it readily available for plant absorption. Because plants require almost continuous continuous Of water, but most regions receive sporadic rainfall, the ability to hold the water of the soils is vital for plant survival. [24] Pains can effectively remove impure, [25] kill illness agents, [26] and degrade contaminants, this property is called natural attenuation. [27] Typically, soils maintain a net absorption of oxygen and methane and suffer a net release of carbon dioxide and nitrous oxide. [28] The land offer plants physical support, air, water, temperature moderation, nutrients and protection from toxins. [29] The lands provide nutrients readily available to plants and animals by converting the dead organic matter into various nutrients. [30] Terrain profile: The obscured and reddish subsoil layers are typical of a climate climate regions damp components of a linen sewage ground percent water (25%) gas (25%) Sand (18%) SILT (18 %) Clay (9%) Organic matter (5%) Typical terrain is about 50% Variable solids (45% minerals and 5% organic matter), and 50% empty (or pores) of which one is occupied From short water and half gas [32] the space Pore allows infiltration and movement of air and water, both critics for life existing in the ground. [33] Compaction, a common problem with soils, reduces this space, preventing air and water to reach vegetable roots and soil organisms. [34] Given enough time, undifferentiated plot evolve a soil profile consisting of two or more layers, called soil horizons. These differ in one or more properties as in their texture, structure, density, porosity, consistency, temperature, color and reactivity. [8] The horizons differ greatly in the thickness and generally lacking boundaries; their development depends on the Of parent material, processes that modify those materials of parents and factors that form the soil that influence these processes. The biological influences on soil properties are stronger near the surface, while geochemical influences on soil properties increase with depth. The mature soil profiles typically include three basic master horizons: A, B and C. The Solum normally includes the horizons A and B. The living component of the ground is largely limited to the solum, and is generally more prominent in the 'horizon. [35] It was suggested that the pedestrian, a soil column that extends vertically from the surface to the underlying parent material and large enough to show the characteristics of all its horizons, could be divided into the humodone (the living part, where They are most of the housing soil bodies, corresponding to the humus form), the copdon (in the intermediate position, where most of the atmospheric agents of the minerals) and the lithopedon (in contact with a subsoil) takes place. [36] The structure of the soil is determined by the relative proportions of the individual particles of sand, limo and clay that make up the ground. The interaction of the individual mineral particles with organic matter, water, gas through biotic and abiotic processes sits that those floccier particles (attack together) to form aggregates or peds. [37] Where these aggregates can be identified, one can be said to develop, and can be further described in terms of color, porosity, consistency, reaction (acidity), etc. Water is a critical agent in the development of the soil due to its involvement in dissolution, precipitation, erosion, transport and deposition of the materials of which it is composed of a ground [38]. The mixture of water and dissolved or suspended materials occupying the space of the soil pore is called the solution of the terrain. From That soil water is never pure water, but it contains hundreds of dissolved organic and mineral substances, it could be more carefully called the soil solution. The water is central for Precipitation and smoothing of minerals from the soil profile. Finally, the water affects the type of vegetation that grows in a soil, which in turn affects soil development, a complex feedback that is exemplified in the dynamics of band vegetation patterns in semi-arid regions. [39] The soils provide plants with nutrients, most of which are placed in the position of clay particles and organic matter (colloids) [40] The nutrients can be absorbed on clay mineral surfaces, linked within clay minerals (absorbed), or linked within organic compounds as part of living organisms or the organic matter of dead soil. These related nutrients interact with soil water for the buffer of soil solution composition (detail changes in soil solution) such as wet or dried soils, since plants occupy nutrients, since salts are smoothed, or as acids or alkali are added. [41] [42] The availability of nutrients of plants is influenced by the soil pH, which is a measure of the ion activity of hydrogen in the soil solution. Soil PH is a function of many soil formation factors and is generally lower (more acid) where the weather is more advanced. [43] Most of the nutrients of the plants, except for nitrogen, come from the minerals that make up the parent material of the soil. Some nitrogen comes from rain as diluted and ammonia nitric acid, [44], but most nitrogen is available in soil due to the fixing of nitrogen by bacteria. Once in the soil plant system, most nutrients are recycled through living organisms, plant residues and microbial (soil organic matter), mineral forms and soil solution. Both organisms of living soil (microbes, animals and plant roots) andOrganic of the soil are of critical importance for this recycling, and therefore to the formation of soil and soil fertility [45]. Microbial soil enzymes can issue nutrients from minerals or organic matter for use by plants and other microorganisms, seizer (embedded) into living cells, or cause their loss from the soil for volatilization (loss to the Al as gas) or leaching. [46] main article training: pedogenesisfurther information: soil mechanics Â§ genesis soil formation, or pedogenesis, is the combined effect of physical, chemical, biological and anthropogenic processes that work on the parent material of the soil. It is said that the soil is felt when the organic matter has accumulated and the colloids are washed down, leaving deposits of clay, humo, iron oxide, carbonate and chalk, producing a distinct layer called the horizon b. this is a somewhat arbitrary definition like the mixtures of sand, lemon, clay and humo will support biological and agricultural activities before that time. [47] These constituents are moved from one level to another from water and animal activity. Consequently, the shape of the levels (horizons) in the soil profile. the alteration and movement of materials within a soil causes the formation of distinctive soil horizons. However, the most recent definitions of the soil embrace the soil without any organic substance, such as those adjustable that are formed on mars [48] and similar conditions in the deserts of the planet earth. [49] an example of the development of a soil would begin with the atmospheric agents of the lava washing container, which would produce the parent material purely mineral marked from which the forms of soil structure. the development of the soil would proceed more quickly from the naked rock of recent flows in a warm climate, in a heavy and frequent rain. in such conditions, plants (in a first stage fixing nitrogen and cyanobacteria so the highest epilithic plants) were established very quickly on basaltic lava, although there is very little organic material. [50] commonly atmospheric basaltic minerals relatively quickly, according to the goldich dissolution series [51.] plants are supported by the porous rock since it isof water carriers that carries minerals loose from the rocks. Crevasse and pockets, local topography of the rocks, take precious materials and harbor roots. The roots of developing plants are associated with a Mycorrhizi mushrooms [52] which help break the porous lava, and with these organic matter and more fine mineral ground accumulate with time. These initial phases of soil development have been described on volcanoes, [53] Inselbergs, [54] and glacial moraines. [55] As the formation of the soil proceeds is influenced by at least five classic factors that intertwine in the evolution of a ground. I am: parent material, climate, topography (relief), organisms and time. [56] When reordered to the climate, relief, organisms, parent material and time, form the acronym Cropt. [57] Physical properties Main article: soil physical properties for academic discipline, see soil physics. The physical properties of soils, in order to reduce the importance for ecosystem services such as the production of crops, are the texture, structure, mass density, porosity, consistency, temperature, color and resistance. [58] The weaving of the soil is determined by the relative proportion of the three types of soil mineral particles, called soil separates: sand, limo and clay. In the subsequent larger scale, the soil structures called peds or more commonly aggregated of the soil are created by the terrain separates when iron oxides, carbonates, clay, silica and humus, coating particles and cause them to join more secondary structures large and relatively stable. [59] The mass density of the soil, when determined at standardized moisture conditions, is an estimate of the soil compaction. [60] The terrain of the soil is the part of nothing of the volume of the soil and is occupied by gas or water. The consistency of the soil is the capacity of the materials of the terrain to remain united. The temperature and color of the ground are self-defined. Resistance refers to the resistance to conducting electric currents and affects the corrosion rate of metal structures and Which are buried in soil. [61] These properties vary through the depth of a soil profile, that is through soil horizons. Most of these properties determine soil ventilation and water capacity of And to be held inside the ground. [62] Main article of soil humidity: soil moisture The soil moisture refers to the content of water of the ground. It can be expressed in terms of volume or weight. The soil moisture measurement can be based on in situ probes (for example, capacity probes, neutron probes) or remote detection methods. Main soil gas article: soil gas the soil atmosphere, or soil gas, is very different from the atmosphere above. The consumption of oxygen by microbes and roots of plants and their release of carbon dioxide, reduce oxygen and increase the concentration of carbon dioxide. The concentration of atmospheric CO_2 is 0.04%, but in the space of the soil pore can vary from 10 to 100 times that level, potentially potentially contributing to the inhibition of root breathing. [63] The calcareous land regulate the concentration of CO_2 by carbonate buffering, contrary to acid soils in which all CO_2 were accumulated in the soil pore system. [64] At extreme CO_2 levels is toxic. [65] This suggests a possible negative control of the feedback of CO_2 soil concentration through its inhibitory effects on root and microbial breathing (also called "soil breathing"). [66]. Furthermore, the soil voids are saturated with water vapor, at least to the point of igroscopic maximum, beyond which a steam pressure deficit occurs in the soil pore space [33]. It is necessary an adequate porosity, not only to allow water penetration, but also to allow gas to spread inside and out. The gas movement is through diffusion by high concentrations to lower, the diffusion coefficient decreasing with soil compaction [67]. Oxygen from the top atmosphere spreads into the soil in which it is consumed and the levels of carbon dioxide beyond of atmosphere spread with other gases (including greenhouse gases) and water. [68] soil structure and structure strongly influence soil porosity and gas diffusion. is the total space of the pores (porosity) of the soil, not the size of the pores and the degree of interconnection of the pores (or the sealing of the pore on the contrary,) on the contrary,)With the water content, turbulence and air temperature, which determine the rate of gas diffusion in and out of the ground [69] [68] The soil structure of platy and soil compaction (low porosity) prevent the gas flow, and an oxygen deficiency can encourage anaerobic bacteria to reduce (oxygen of the strip) from nitrate no. 3 to gases n2, no, In this way by moving the nitrogen soil, a malicious process called denitrification. [70] The aerated soil is also a net sink of methane CH_4 [71], but a net producer of methane (a strong greenhouse gas that absorbs heat) when the soils are oxygen esasuits and subject to high temperatures [72]. The atmosphere of the soil is also the seat of the emissions of birds other than carbon and nitrogen oxides from various soil organisms, e.g. roots, [73] bacteria, [74] fungi, [75] animals. [76] These birds are used as chemical signals, making the atmosphere of the soil the seat of the interaction networks [77] [78] which play a decisive role in the stability, dynamic and evolution of soil ecosystems [79]. Biogenic soil volatile organic compounds are exchanged with the subdivided atmosphere, in which they are only 1 â€ "2 orders of magnitude lower than those of vegetation on the ground. [80] Humans can have an idea of the soil atmosphere through the well-known scent "after the rain", when Inforteing's rain water cancels the entire soil atmosphere after a drought period, or when the soil is dug, [81] a blurred property attributed in a reductionist way to particular biochemical compounds such as Petrichor or Geosmin. Main article of solid phase (ground matrix): The soil particles of the soil matrix can be classified by their chemical composition (mineralogy) and their size. The distribution of the size of theOf a land, its structure, determines many of the properties of that soil, in particular hydraulic conductivity and water potential, [82] but the mineralogy of those particles can strongly modify these properties. Mineralogy of the best soil particles, clay, clay, particularly important. [83] chemistry for academic discipline, see soil chemistry. the chemistry of a soil determines its ability to provide plant nutrients available and affects its physical properties and health of its living population. Moreover, the chemistry of a soil also determines its corrosion, stability and ability to absorb pollutants and filter water. is the superficial chemistry of mineral and organic colloids that determines the chemical properties of the soil. [84] a colloid is a small insoluble particle that ranges from 1 nanometer to 1 micrometer, so small enough to remain suspended from the brownian movement in a fluid medium without fixing. [85] most soils contain organic colloidal particles called humo and inorganic colloidal particles of clay. the very high surface of colloids and their net electrical charges give the ground its ability to retain and release ions. negatively uploaded sites on colloids attract and issue cations in what is referred to as cation exchange. the ability to exchange cations (cec) is the quantity of exchangeable cations for unitary weight of dry land and is expressed in terms of milliquivalent ions charged positively for 100 grams of land (or centimeters of positive charge per kilogram of land; cmolc/kg). Similarly, positively uploaded sites on colloids can attract and release anions in the ground giving the ability to exchange soil anion (aec.) more information: cational exchange capacity, which takes place between colloids and soil water, buffers (moderates) soil ph, alters soil structure and purifies percolating water by absorbing cations of all types, useful and harmful. negative or positive charges on colloid particles make them able to contain cations or anions, respectively, to their surfaces.Accusations derive from four sources. [86] Isomorfa replacement occurs in clay during its training, when the stock cups replace the most Altavalza Altavalenza In the crystal structure. [87] The replacements in the most external layers are more effective than for the internal layers, since the electric charge force drops as the distance square. The net result is oxygen atoms with net negative charge and the ability to attract cathions. The oxygen atoms on board-of-clay are not in ionically equilibrium as the tetraedral and octeat structures are incomplete. [88] Hydrossils can replace silica layers oxides, a process called hydroxylation. When the hydrogen of clay hydroys are ionized in solution, they leave oxygen with a negative charge (anonone clay). [89] Humbling hydroxyth group hydrogens can also be ionized in solution, leaving, in the same way as clay, an oxygen with a negative charge. [90] The cations held back to the negatively loaded colloids resist that they are washed down from the water and are out of reach of the roots of the plants, thus preserving the fertility of soils in moderate precipitation areas and low temperatures. There is a hierarchy in the cation exchange process on colloids, as the cations differ in the absorption force by the colloid and therefore their ability to replace each other (exchange of IIONE). If present in equal quantities in the ground solution: AL3 + replaces H + replaces CA2 + replaces MG2 + replaces K + same of NH4 + [93] If a cation is added to large quantities, it can replace others with the pure strength of its numbers. This is called mass action law. This is largely what happens with the addition of cationic fertilizers (potash, lime). [94] Because the solution of the terrain becomes more acid (low pH, which means abundance of H +), the other weaker cations related to colloids are pushed in solution as hydrogen ions occupy the exchange sites (protonation). A low pH Cause hydrogen of hydroxyl groups to be pulled in solution, leaving the sites loaded on the colloid available to be occupied by other cations. This ionization of hydroxic groups on the surface of soil colloids creates what is As an accusation of surface dependent on pH. [95] Unlike permanent accusations developed by isomorphic replacement, pH-dependent expenses are variable and increase with growing pH [42] released tickets can be made available to plants but are also inclined to be leached from the ground, possibly Making the ground less fertile. [96] The plants are able to expel H + in the soil through the synthesis of organic acids and with that means, change the pH of the ground near the root and pushing the attention from the colloids, thus making those available for the plant. [97] Cation exchange capacity (CEC) Cation exchange capacity should be designed as the capacity of the soil to remove attention from the solution of soil water and seize those to be exchanged later as the roots of the plants release Hydrogen ions to the solution. [98] CEC is the quantity of interrogen hydrogen (H +) which combines with 100 grams of dry soil weight and whose measure is a milliequivalents for 100 grams of land (1ã, meq / 100 g). Hydrogen ions have a single charge and a thousandth gram of hydrogen ions for 100 grams of dry soil give a measure of a milliequivalent of hydrogen ions. Football, with an atomic weight 40 times that of hydrogen and with a value of two, converted into (40/2) x 1 milliequivalente = 20 milliequivalents of hydrogen ions per 100 grams of dry terrain or 20 mi / meq / 100 g. [99] The modern measure of the CEC is expressed as a positive charging centers per kilogram (CMOL / kg) of dry oven ground. Most soil CEC occurs on clay and humus colloids, and the lack of those in warm, humid and humid climates (eg tropical rain forests), due to leaching and decomposition, respectively, explains the apparent Tropical land steriliths [100] live vegetable roots also have CEC, connected to their specific surface. [101] cation exchange capacity for land; soil textures; Soil colloids [102] soil state cec meq / 100g charlotte beautiful sand florida 1.0 ruston beautiful sandy loam texas 1.9 glouchester loam new jersey 11.9 grampy silt loam illinois illinois Gleason Clay Loam California 31.6 Susquehanna Clay Loam Alabama 34.3 Davie Mucky Fine Sand Florida 100.8 Sands ------ 1 Ã ¢ â,¬ "Fine Sandy Blams ------ 5 - 10 LOAMS and FIT BLAMS titles - ---- 5Ã, â,¬ "15 clay in filami ----- 15 - 30 clays ----- over 30 sesquioxidi ----- 0 - 3 caoolinitis ----- 3 - 15 illetes - ---- 25Ã ¢ â,¬ "40 Montmorillonite ----- 60 - 100 Vermiculite (similar to illetes) ----- 80 - 150 humus ----- 100 â,¬" 300 anion exchange capacity (AEC) Anion exchange capacity should be designed as the capacity of the soil to remove the Anions (eg nitrate, phosphate) from the solution of soil water and seize those for the next exchange since the roots of the plants release the Inns of carbonate to the solution of soil water. [103] Those colloids who have Lasso CEC tend to have an AEC. Amorphous and sesquiexide clays have the highest AEC, [104] followed by iron oxides [105]. AEC levels are much lower than CEC, due to the generally higher rate of positively loaded surfaces (against negatively) on soil colloids, with the exception of variable charging land. [106] Phosphates tend to be held in anion exchange sites. [107] Aluminum hydroxide iron and clays are able to exchange their hydroxide anions (OhÃ ¢ ') for other anions. [103] The order that reflects the strength of the accession of the anion is as follows: H2PO4 "replaces SO42" replaces no3, "replaces clÃ ¢ 'The quantity of exchangeable anions is of greatness of tenths to a few milliequivalenti per 100 g. [102] While pH rises, there are relatively more hydroxyiles, which will gossy the anions from the colloids and will force them in solution and out of space; then AEC decreases with the increase of pH (alkalinity). [108] reactivity € (PH) Main items: soil pH and land pH Ã ¢ â§ã, the effect of soil pH on plant growth soil reactivity is expressed in terms of pH and is one of the acidity or soil alkalinity. More specifically, it is a measure of the hydronium concentration in an aqueous solution and varies in values from 0 to 14 (acidic based) but practically speaking for PH ranges from 3.5 to 9,5, as pH values beyond extreme ones are toxic to life forms. [109] At 25 ° C an aqueous solution that has a pH of 3.5 has 10.3.5 H3O piers + (ions of hydronium) per liter of solution (and also 10â '10.5 mole / liter oh'). A pH of 7, defined as neutral, has 10 piers of hydronium ions per liter solution and also 10 oH's piers per liter; Since the two concentrations are equal, they say they neutralize each other. A pH of 9.5 has 10'9,5 hydronium ions per liter solution (and also 10â'2.5 molecules per liter ohâ '). A pH of 3.5 has a million times more ions of hydronium per liter than a solution with a pH of 9,5 (9.5 - 3.5 = 6 or 106) and is more acidic. [110] The effect of the pH on a soil is to remove from the soil or to make certain ions available. High acidity soils tend to have toxic amounts of aluminium and manganese. [111] As a result of a compromise between toxicity and requirements most nutrients are available to moderate pH plants, [112], although most minerals are more soluble in acid soils. The soil organisms are hampered by high acidity, and most agricultural crops do better with mineral soils of PH 6.5 and organic soils of pH 5.5. [113] Since low pH toxic metals (e.g. Cadmium, zinc, lead) are positively loaded as cations and organic pollutants are in non-ionic form, so both made more available to organisms, [114] [115] has been suggested that plants, animals and microbes that commonly live in acidic soils are pre-adaptted to any kind of pollution, whether natural or human. [116] In high rainy areas, soils tend to acidify as the bases are forced off the soil colloids by the mass action of hydronium ions from the usual or unusual rain acidity against those attached to colloids. TheRain rates can therefore wash nutrients, leaving the land inhabited only by these organisms that are particularly efficient to absorb nutrients in very acid conditions, such as tropical tropical Once the colloids are saturated with H_3O +, the addition of other hydronium ions or aluminum hydroxylic cations drives the pH even lower (more acid) as the soil has not been left without buffering capacity. [118] In extreme rain areas and high temperatures, clay and humus can be washed out, further reducing the buffering capacity of the soil. [119] In low rainfall areas, undistributed calcium pushes pH to 8.5 and with the addition of exchangeable sodium, soils can reach pHÂ 10. [120] Beyond a pH of 9, the growth of plants is reduced. [121] High pH results in low micro-nutrient mobility, but hydrosoluble chelates of those nutrients can correct the deficit. [122] Sodium can be reduced by the addition of chalk (calcium sulphate) since calcium adheres to clay more closely than sodium causing sodium to be pushed into the solution of soil water where it can be washed by an abundance of water. [123] [124] Basic saturation percentage There are acid cations (e.g. hydronium, aluminum, iron) and there are basic formation cations (e.g. calcium, magnesium, sodium). The fraction of the negative-loaded terrain colloids exchange sites (CEC) which are occupied by basic training cations are called basic saturation. If a soil has a CEC of 20 MEQ and 5 MEQ are aluminium and hydronium cations (acid forming), the rest of the positions on colloids (20-5 = 15 mIQ) are taken from basic formation cations, so that the basic saturation is 15/20 x 100% = 75% (the compliment of 25% is assumed acid formation cations). The base saturation is almost directly proportional to pH (increases with the increasing pH). [125] It is useful to calculate the amount of lime required to neutralize an acidic soil (calce requirement). The amount of lime required to neutralize a soil must take into account the amount of lime required to neutralize a soilAcid training on colloids (interchangeable acidity), not only those in soil water solution (free acidity). [126] Adding a lime sufficient to neutralize the solution of soil water will be insufficient insufficient The pH, since acid formation tickets stored on the terrain colloids will tend to restore the original condition of the pH as those colloids from the calcium of the added lime are pushed. [127] Further information Buffering: soil conditioner The soil resistance to change in pH, due to the addition of acid or basic material, is a measure of the buffering capacity of a ground and (for a particular type of terrain) Increase as the CEC increases. Thus, pure sand has almost no buffering ability, while high terrain in colloids (both minerals or organic) have a high buffering capacity. [128] Buffering takes place by exchange of cations and neutralization. However, colloids are not the only soil pH regulators. The role of carbonates should also be stressed. [129] More generally, according to pH levels, different buffer systems take precedence over each other, from the range of calcium carbonate buffers to the range of iron buffers [130]. The addition of a small amount of highly basic aqueous ammonia to a terrain will cause the ammonium to move hydronic ions from the colloids, and the final product is water and fixed colloidal ammonium, but little permanent change overall in the pH of the soil. The addition of a small amount of lime, CA (OH) 2, will move idronium ions from the terrain colloids, causing calcium fixation to colloids and the evolution of CO_2 and water, with little permanent change in pH of soil. The above are soil pH buffering examples. The general principal is that an increase in a particular precaution in the solution of soil water will cause the cation to be fixed to the colloids (buffered) and a decrease in the solution of this action will withdraw from the colloid and shift in solution (bufferized) . The degree of buffering is often related to the soil CEC; The greater the CEC, is the buffering capacity of the soil. [131] Nutrient nutrients, their chemical symbols and common hyonic forms in soils and available for plant uptake [132] ionic symbol elementMNUM carbon C CO_2 (mostly through leaves) Hydrogen H +, HOH (ACQUA) Oxygen or O2Â ', Oh, CO32Â ', SO42', CO_2 phosphor P H2PO4 Â ', HPO42Â' (phosphates) Potassium k + nitrogen NH_4 +, NO3 nutrients of the plant in soil, plant nutrition and soil pH â§no of PH soil on plant growth Seventeen nutrients or nutrients are essential for plant growth and reproduction. They are carbon (c), hydrogen (h), oxygen (O), nitrogen (N), phosphorus (P), potassium (K), sulphur (i), calcium (CA), magnesium (mg), iron (Fe), Boron (B), Manganese (MN), Copper (CU), Zinco (ZN), Molybdenum (MO), Nichel (NI) and chlorine (CL). [133] [134] [135] The nutrients needed for plants to complete their life cycle are considered essential nutrients. The nutrients that improve plant growth but are not necessary to complete the plant life cycle are considered not essential. With the exception of carbon, hydrogen and oxygen, which are supplied by carbon dioxide and water and nitrogen, supplied by nitrogen fixing, [135] the nutrients come from the mineral component of the soil. The law of the minimum expresses that when the available form of a nutrient is not quite proportionate in the solution of the soil, then other nutrients cannot be taken into an optimal rate by a plant. [136] A particular ratio of nutrients of the soil solution is therefore mandatory to optimize the growth of plants, a value that could differ from nutrient relationships calculated by the composition of the plant [137]. The absorption of nutrient plants can only proceed when present in a formIn the plant. In most situations, nutrients are absorbed in an ion form by (or together with) soil water. Although minerals are the origin of most nutrients and mostMost nutrients in the soil are crystalline in primary and secondary minerals, they are too slowly to support rapid growth of plants. For example, the application of minerals finely on the ground, feldspar and apatitis, on the ground rarely provides the necessary amounts of potassium and phosphorus at a sufficient rate for good plant growth, since most nutrients remain bound in the crystals of those minerals. [138] The nutrients absorbed on the surfaces of clay colloids and soil organic matter provide a more accessible reservoir of many plant nutrients (e.g. K, CA, MG, P, ZN). When plants absorb nutrients from soil water, the soluble pool is replenished by the pool on the surface. The decomposition of the organic soil matter of microorganisms is another mechanism in which the soluble pool of nutrients is reintegrated - this is important for the supply of N, P, P and B of the soil. [139] Gram per Gram, the ability to humus to hold nutrients and water is much larger than that of clay minerals, most of the ability to exchange soil from carboxylic groups loaded on organic matter [140]. However, despite Humus' great ability to retain water once immersed in the water, its high hydrobicity decreases its wetability. [141] All in all, small amounts of humus can greatly increase the soil capacity to promote plant growth. [142] [139] Main article of organic soil: Organic soil conditions The section may contain an excessive amount of intricate details that could only affect a particular audience. Specifically, details could be moved to the main article. Please help turn or reposition any informationAnd removing excessive details that can be against Wikipedia's inclusion policy. (April 2021) (find out how and when to remove this message Message) The organic terrain is composed of organic compounds and includes plant material, animal and microbial, both living and dead. Typical terrain has a biomass composition of Microorganisms, 22% macro-macauna and the roots of 8%. The living component of an acre of land can include 900 lb of earthworms, 2400 pounds of mushrooms, 1500 pounds of bacteria, 133 pounds of protozoa and 890 pounds of arthropods and algae. [143] A couple percent of the organic soil matter, with a small residence time, is constituted by the microbial biomass and metabolites of bacteria, molds and actinomycets working to break down the dead organic matter. [144] [145]. They were for the action of these microorganisms, the entire part of carbon dioxide of the atmosphere would be seized as an organic matter in the soil. However, at the same time soil microbes contribute to the seizure of carbon in the topsoil through the formation of stable humus. [146] In order to seize more carbon in the ground to alleviate the greenhouse effect which would be more efficient in the long term to stimulate humification compared to decomposing waste. [147] The main part of the organic soil matter is a complex assembly of small organic molecules, called collectively humus or human substances. The use of these terms, which are not based on a clear chemical classification, was considered obsolete. [148] Other studies have shown that the classic notion of the molecule is not convenient for the humus, which has escaped most of the attempts made over two centuries to solve it in components of the unit, but it is still chemically separate from Polysaccharides, lignini and protein. [149] Most living things in land, including plants, animals, bacteria and mushrooms, depend on organic matter for nutrients and / or energy. The land have organic compounds in various degrees of decomposition that the rate depends on temperature, soil humidity and aeration. Bacteria and mushrooms feed on raw organic matter, which are fed by protozoa, which in turn are fed by annelydic and arthropods, themselves able to consume and transform raw or humid organic matter. This has been called the web of the soil, through which all organicIt is processed as in a digestive system. [150] Organic matter keeps open land open, allowing air and water infiltration, and can contain double its weight in water. Many lands, including desert land and rock gravel, have little or no organic matter. The land all organic matter, like the peat (iStosols), are sterile. [151] In its first decomposition phase, the original organic material is often called raw organic matter. The final decomposition phase is called humus. In meadows, much of the organic matter added to the ground is from the deep, fibrous, grass root systems. On the contrary, the leaves of the tree falling on the forest floor are the main source of the organic soil matter in the forest. Another difference is the frequent event in fires grasslands that destroy large quantities of above ground material but stimulate even greater contributions from the roots. Furthermore, much greater acidity under the forests inhibits the action of some soil bodies that would otherwise mix much of the litter of the surface in the mineral ground. Consequently, the lands under the grasslands generally develop a more often horizon with a deeper distribution of organic matter comparable under the forests, which will comprise most of their organic matter in the forest floor (or horizon) and subtle A horizon. [152] Humus humus refers to the organic matter which was decomposed by the microflora and the fauna of the soil to the point where it is resistant to further break. Humus is usually only five percent of the soil or less in volume, but it is an essential source of nutrients and adds important fundamental technical qualities for soil health and plant growth. [153] Humus also feeds arthropods, termites and earthworms that improve The ground. [154] The final product, humus, is suspended in colloidal form in soil solution and forms a weak acid that can attack silicate minerals by chelando their iron and aluminum atoms [155]. Humus has a high cation and anionCapacity that on a dry weight base is many times greater than that of clay colloids. It also acts as a buffer, such as clay, against the variations of pH and soil moisture. [156] The acids and the fawn acids, which begin as a raw organic matter, are major constituents of the huge. After the death of plants, animals and microbes, the microbes begin to feed on residues through their production of extracellular soil enzymes, with consequent human humus. [157] Since the residues spread, only the molecules made of aliphatic and aromatic hydrocarbons, assembled and stabilized by oxygen and hydrogen bonds, remain in the form of complex molecular assemblies collectively called humus. [156] While the structure of the Humus has a few nutrients (except for constitutive metals such as calcium, iron and aluminum) is able to attract and connect, from weak ties, nutritious and anion that can be further released in the solution of the land in response to the selective absorption of the root and the changes of the pH of the soil, a process of fundamental importance for the maintenance of fertility in tropical soils. [158] The lignin is resistant to breaking and accumulates inside the ground. It also reacts with proteins, [159] which further increases its resistance to decomposition, including enzymatic decomposition from microbes. [160] Fats and waxes of vegetable material still have more resistance to decomposition and persist in soils for a thousand years, so their use as vegetation trackers passed into buried soil layers. [161] Clay soils often have higher organic contents that persist longer than soils without clay because organic molecules adhere and are stabilized by clay. [162] Proteins normally decompose promptly, to the exception of scleroproteins, but when linked to particles Clay become more resistant to decomposition. [163] As regards concerns The protein clay particles absorb enzymes exuded by microbes, reducing enzyme activity by protecting extracellular enzymes from degradation. [164] The addition of organic matter for clay soils can make that organic matter and any additional nutrient inaccessible to plants and microbes for many years, [165] while a study showed an increase in soil fertility after adding mature compost to a clay soil. [166] The content of high soil tannins can cause the seizure of nitrogen as tannins-protein-resistant complexes. [167] [168] The formation of Humus is a process dependent on the amount of plant material added each year and the type of base soil. Both are affected by the climate and the type of organisms present. [152] The soils with humus may vary in nitrogen content, but usually have 3 to 6% nitrogen. Raw organic matter, as a reserve of nitrogen and phosphorus, is a vital component that influences soil fertility [151]. Humus also absorbs water and expands and shrinks between dry and humid states to a greater extent than clay, increasing soil porosity [169]. Humus is less stable than the mineral constituents of the soil, since it is reduced by microbial decomposition, and over time its concentration decreases without the addition of new organic matter. However, Humus in its most stable forms can persist for centuries if not millennia. [170] Carboncino is a highly stable source of humus, called black carbon, [171] which had traditionally been used to improve the fertility of poor nutrient tropical soils. This very ancient practice, as established in the Genesis of the Amazonian Eardi Darde, has been renewed and became popular under the name Biochar. It has been suggested that Bio Card could be used to seize more carbon in the fight against greenhouse effect. [172] Climate influence Lathe accumulation and degradation of organic matter depend greatly on the climate. For example, when an event occurs, the flow of soil gas with atmospheric gas is significantly significantly significantlyTemperature, soil moisture and topography are the main factors that influence the accumulation of organic matter in soils. Organic matter tends to accumulate in wet or cold conditions where decomposition activity is prevented from low temperature [174] or excess moisture resulting in anaerobic conditions. [175] Conversely, excessive rain and high temperatures of tropical climates allows a rapid decomposition of organic matter and smoothing of plant nutrients. Forest ecosystems on these soils are based on an efficient recycling of nutrients and plants by the living plant and microbial biomass to maintain their productivity, a process that is disturbed by human activities [176]. Excessive slope, especially in the presence of cultivation for the good of agriculture, can encourage erosion of the upper layer of the soil that holds most of the raw organic material that otherwise will eventually become humus. [177] Residual plant types and percentages of plant residual components Â cellulose (45%) Â lignina (20%) Â hemicellulose (18%) Â Â protein (8%) Â Â sugars and starches (5%) Â Fats and waxes (2%) cellulose and hemicellulose undergo rapid decomposition by fungi and bacteria, with a half-life of 12 days 18 days in a temperate climate. [178] Brown brown mushrooms can decompose cellulose and hemicellulose, leaving behind lignina and phenolic compounds. starch, which is an energy storage system for plants, undergoes rapid decomposition by bacteria and fungi. Lignina consists of polymers composed of 500 to 600 units with a very ramified amorphous structure, connected to cellulose, hemicellulose and pectin in cellulose walls. Lignina undergoes very slow decomposition, mainly from white mushrooms and actinomycetes; His half-life under conditionsIt's about six months. [178] Horizons Main article: Horizon of the soil A horizontal layer of the soil, whose physical characteristics, composition and age are distinct from those above and below, is indicated as the ground horizon. The name of aaIt is based on the type of material of which it is composed. These materials reflect the duration of specific soil formation processes. They are labeled using a shorthand of notation of letters and numbers that describe the horizon in terms of color, dimensions, textures, structure, consistency, quantity of root, pH, empty, contour characteristics and presence of nodules or concretion. [179] No soil profile has all the main horizons. Some, called entisols, can have only one horizon or currently considered as non-horizon, in particular irreputing lands from non-declared mining deposits, [180] Mounaines, [181] volcanic cones [182] sand dunes or alluvial terraces. [183] The horizons of the upper soil can be lacking in truncated soils after the wind or water ablation, with concomitant in the evening of the horizons of the soil, a natural process aggravated by agricultural practices such as processing processing. [184] The growth of the trees is another source of disturbance, creating a microbree heterogeneity that is still visible in soil horizons once the trees died. [185] Passing from one horizon to the other, from top to bottom of the soil profile, go back over time, with past events recorded in soil horizons as in sediment layers. Sampling pollen, the Head of Amebae and the plant remains in the horizons of the soil can help reveal environmental changes (for example climate change, the change of soil use) took place during the formation of the soil [186]. The soil horizons can be dated by different methods such as radiocarbon, using coal pieces that are of a doubt that are of sufficient dimensions to escape the pitch using the earthworm activity and other mechanical disorders. [187] The horizons of the fossil soil from PaleoSols can be found inside Sedimentary rock sequences, allowing the study of past environments. [188] The exhibition of the parent material to favorable conditions produces marginal mineral terrain suitable for plant growth, as in the case in eroded land. [189] The growth of vegetation causes the production of Residues falling to the ground as waste for vegetable aerial parts (litter leaf) or are produced directly below for the bodies of underground plants (root beds), therefore release the dissolved organic matter. [190] The remaining supressual organic layer, called or horizon, produces more active ground due to the effect of the organisms that live inside it. The organisms colonize and reduce organic materials, making the nutrients available on which other plants and animals can live. [191] After a sufficient time, humus moves down and is deposited in a layer of distinctive organic mineral surface called a horizon, in which organic matter is mixed with mineral matter through the activity of dug animals, a Process called Pecorification. This natural process does not go to the completion in the presence of harmful conditions for soil life as a strong acidity, cold climate or pollution, stemming in the accumulation of non-candidate organic matter within a single organic horizon who dominated the Mineral terrain [192] and in the juxtaposition of humified organic matter and mineral particles, without underwear, in underlying mineral horizons. [193] Classification Main article: The soil classification The soil is classified in categories in order to understand the relationships between different land and determine the suitability of land in a particular region. One of the first classification systems was developed by the Russian scientist Vasily Dokuchaev around 1880. [194] A number of times by American and European researchers has been modified and developed in the system commonly used until the 1960s. It was based on the idea that lands have a particular morphology based on materials and the factors that form them. In the 1960s, a different classification system began to emerge what is on soil morphology instead of parental materials and soil formation factors. Since then he has undergone further changes. The world reference base for soil resources (WRB) [195] [195]establish an international reference base for soil classification. Use the land is used in agriculture, where it acts as an anchor and primary nutritious base for plants. The types of land and the available humidity determine the species of plants that can be cultivated. The science of agricultural soil was the primordial domination of soil knowledge, for a long time before the advent of pedology in 19th century. However, as demonstrated by Aeropone, Aquaponics and Hydroponics, soil material is not an absolute essential for agriculture, and slippery clipping systems such as the future of agriculture for an infinite humanity were claimed. [196] The soil material is also a fundamental component in mining, construction and landscape industries. [197] The land acts as a foundation for most construction projects. The movement of massive volumes of the ground can be involved in surface mining, road construction and dam construction. The land of land supply is the architectural practice to use the ground for the external thermal mass against construction walls. Many building materials are based on the soil. Loss of land through urbanization is growing at a high rate in many areas and can be fundamental for maintaining subsistence agriculture. [198] Soil resources are fundamental to the environment, as well as food and fiber production, producing 98.8% of food consumed by humans. [199] The soil provides minerals and water to plants according to different processes involved in plant nutrition. The soil absorbs rainwater and releases it later, thus preventing floods and security, flooding regulation is one of the main ecosystem services provided by the ground. [200] The soil cleans the water while perculates through it. [201] IL is the habitat for many organisms: most of the known and unknown biodiversity is in the soil, in the form of lombrics, wood, milliphes, cents, snails, snails, acari, springs, enchytraeids, nematodi, protiste), bacteria, Archaea, fungi and algae; And most organisms living above the ground are part ofThey (plants) or spend part of their life cycle (insects) underground. [202] The biodiversity above ground and under the ground are closely interconnected, [152] [203] doing the protection of the ground of fundamental importance for any restoration or conservation plan. The soil biological component is an extremely important carbon sink since about 57% of the biotic content is carbon. Even in deserts, cyanobacteria, lichens and muski form organic crusts of the soil that capture and sequestes a significant amount of carbon by photosynthesis. The bad farmers and grazing methods have degraded land and released most of this carbon seized to the atmosphere. The restoration of the worlds of the world could compensate for the effect of the increases in greenhouse gas emissions and slow global warming, while improving the yields of crops and reduce water needs. [204] [205] [206] Waste management often has a component of the soil. Septic exhaust fields treat the effluent of the septic tank using aerobic soil processes. The application of the wastewater territory is based on soil biology to aerobically BOD treatment. Alternatively, the landfills use the soil for daily coverage, isolating waste deposits from the atmosphere and preventing unpleasant odors. The composting is now widely used to treat aerobically solid household waste and dried effluents of the accommodation basins. Although the compost is not the soil, the biological processes that take place during composting are similar to those that occur during the decomposition and humification of the organic soil matter [207]. Organic land, especially the peat, serve as a significant fuel and horticultural resources. The peat ground are also commonly used for the good of agriculture in the Nordic countries, Peterbini sites, when they have been drained, provide fertile land for food production [208]. However, large areas of peat production, such as sphagnum peat bogs, also called blankets or raised swamps, are now protected because of their asset interest. For example, the country of flow, which covers 4,000 square kilometers of rolling distance of blanket swamps in Scotland, is now now To be included in the world heritage list. Under the peat grounds of global warming today it is believed that they are involved in a self-strengthening process (positive feedback) of increased greenhouse gas emissions (methane and carbon dioxide) and greater temperature, [209] a contention that is ¨ still under debate when replaced on a fieldscale and including the growth of stimulated plants. [210] Geofagia is the practice of eating substances similar to the ground. Both the animals and humans occasionally consume soil for medicinal, recreational or religious purposes. [211] It has been shown that some monkeys consume soil, along with their favorite food (foliage and trees), in order to relieve tannin toxicity. [212] The land filter and purify water and influence its chemistry. Rainwater and water grouped by ponds, lakes and rivers / rivers through soil horizons and upper rock layers, becoming so underground waters. Parasites (viruses) and pollutants, such as persistent organic pollutants (chlorinated pesticides, polychlorinated bifenyls), oils (hydrocarbons), heavy metals (lead, zinc, cadmium) and excess nutrients (nitrates, sulphates, phosphates) are filtered off the ground. [213] The soil bodies metabolize them or immobilizes them in their biomass and necromass, [214] in this way incorporating them into a stable humus. [215] The physical integrity of the soil is also a prerequisite to avoid landslides in robust landscapes. [216] Degrado Main articles: Soil retrofession and degradation and degradation of the soil conservation ground refers to a process-induced process or natural that compromises the capacity of the Earth to function. [217] The degradation of the soil involves acidification, contamination, desertification, erosion or saluution. [218] Soil acidification is advantageous in the case of alkaline land, but degrades Earth when he lowers the productivity of crops, the organic soil activity and increases soil vulnerability to contamination and erosion. Soils are initially acid and remain such when their parent materials are In basic cations (soccer, magnesium, potassium and sodium.) On base materials rather rich in atmospheric minerals the acidification occurs when the basic cations are linked by the soil profile from precipitation or exported by the collection of forest or agricultural crops . The acidification of the soil is accelerated by the use of acid-shaped nitrogen fertilizers and the effects of acid precipitation. Deforestation is another cause of soil acidification, mediated by a greater leaching of soil nutrients in the absence of canopy. [219] Soil contamination at low levels is often within the capacity of the soil to treat and assimilate the waste material. The soil biota can treat waste by transforming it, mainly through the microbial enzymatic activity. [220] The organic soil material and soil minerals can absorb the waste material and decrease its toxicity, [221] although when in colloidal form they can transport contaminants adsorbed into sub-suficial environments. [222] Many process treatment processes are based on this capacity of natural biorimediation. The excessive treatment capacity can damage the soil biota and limit the function of the soil. Derelitti soils occur when industrial contamination or other development activities damage the soil so that the earth cannot be used safely or productively. The reclamation of the derelict soil uses principles of geology, physics, chemistry and biology to degrade, mitigate, isolate or remove soil contaminants to restore the functions and soil values. Techniques include leaching, air sparging, soil, phytomediation, biorimediation and natural monitored attenuation (MNA.) An example of widespread pollution with contaminants is the accumulation of copper in vineyards and orchards to which mushrooms are repeatedly applied, also biological agriculture. [223] Desertification is an environmental process of degradation of the ecosystem in the arid and semiard regions, often caused by poorly adapted human activities such as overlap or excess firewood collection. It is a common common That sanctà causes desertification. [224] Siccità are common in arid and semiard lands. The well-managed lands can recover from the saint when the rains return. The soil management tools include maintaining the levels of nourishing substance of the soil and organic matter, reduced processing and increased coverage. [225] These practices help control erosion and maintain productivity during periods in which humidity is available. Continuous earth abuse during siccity, however, increases ground degradation. The increase in the population and pressure of livestock on marginal lands accelerates desertification. [226] It is now questioned if the climate of the climate of present day will favor or discuss desertification, with contradictory relationships related to the trends provided for precipitation associated with greater temperature and the strong discrepancies between the regions, even in the same country. [227] The erosion erosion erosion of the terrain is caused by water, wind, ice and movement in response to gravity. More than a type of erosion can occur simultaneously. The erosion stands out from atmospheric agents, since the erosion also carries the eroded ground away from its place of origin (soil in transit can be described as sediment). Erosion is an intrinsic natural process, but in many places has greatly increased from human activity, particularly unsuitable for soil use practices. [228] These include agricultural activities that leave naked ground during heavy rain periods or strong winds, overload, deforestation and improper construction activity. Improved management can limit erosion. The soil storage techniques used include the changes in soil use (such as the replacement of crops on erosion with grass or other soil binding plants), changes to or type of agricultural operations, terrace building, use of erosion suppression cover materials (including cover crops and other plants), limiting the disorder during construction and avoiding the construction during periods subject to erosion and in places erosions like steep slopes [229]. [229]. [229]. [229]. [229]. Historically, one of Best examples of large-scale soil erosion due to unsuitable land use practices is wind erosion (the so-called bowl of dust) that ruined American and Canadian grasslands during the 1930s, when immigrant farmers , encouraged by the federal government of both countries, have established and converted the original Shortgrass prairie to agricultural crops and livestock ranching. In China there is a serious and long water erosion problem, along the borders of the Yellow River and the high streets of the Yangtze river. From the Yellow River, over 1.6 billion tons of sediments flows every year in the ocean. The sediment is mainly from the water erosion (belly erosion) in the Loess Plateau region of north-western China. [230] The treatment of the soil is a particular form of soil erosion that occurs under the soil surface. [231] Causes the insufficiency of the levers and the dam, as well as the formation of the sink hole. The turbulent flow removes the soil starting from the mouth of the infiltration flow and the erosion of the subsoil advances up-gradient. [232] The term boiling of sand is used to describe the appearance of the exhaust of an active soil tube. [233] The saloon of the soil is the accumulation of free salts in this measure that leads to the degradation of the agricultural value of the soils and vegetation. The consequences include corrosion damage, reduction in plant growth, erosion due to the loss of vegetable coverage and soil structure, and water quality problems due to sedimentation. Salination takes place due to a combination of natural processes and caused by man. The arid conditions favor the accumulation of salt. This is particularly evident when the ground parent material is saline. The irrigation of the arid lands is particularly problematic. [234] All irrigation water a certain level of salinity. Irrigation, especially when it comes to losses from channels and overirrigation in the field, often lifts the water table below. The rapid salting occurs when the earth's surface is inside the capillary fringe of saline underground waters. Control of soil salinity involves water control and andWith higher levels of water applied in combination with tile drainage or another form of subsurface drainage. [235] [236] Main article of reclamation: Ground regeneration soils contain high levels of particular clays with high inflatable properties, such as imperno, are often very fertile. For example, the resounding land of Smectite-rich central plains of Thailand are among the most productive in the world. However, the excessive use of mineral nitrogen fertilizers and pesticides in irrigated intensive intensive production has jeopardized these lands, forcing farmers to implement integrated practices based on operational principles of cost reduction (harvest). [237] Many farmers in tropical areas, however, struggle to maintain organic matter and clay in working soils. In recent years, for example, productivity has decreased and soil erosion has increased in low clay soils in northern Thailand, following the abandonment of cultivation of displacement for more permanent use. [238] The farmers initially responded by adding organic matter and clay from the material of the mound of the termite, but this was unsustainable in the long term because of the rarefaction of the mounds of the termite. Scientists have experimented with the addition of Bentonite, one of the families of broken clays, to the ground. In field trials, conducted by scientists from the International Water Management Institute in collaboration with Khon Kaen University and local farmers, this has had the effect of helping maintain water and nutrients. Integrating the usual practice of the farmer with a single application of 200 Kg Bentonite for RAI (6.26 Rai = 1 hectare) resulted in an average yield increase of 73%. [239] Other studies have shown that Bentonite's application to degrade sandy soil has reduced the risk of failureharvested during the years of drought.

[240] in 2008, three years after initial tests, iwmi scientists conducted a survey of 250 farmers in the north-east of Thailand, half of which applied bentonite to their fields. the average improvement for those using the addition of clay was 18% 18%Compared to non-clayey users. The use of clay had allowed some farmers to move on to vegetable growth, which need more fertile ground. This helped to increase their income. The researchers estimated that 200 farmers in the north-east of Thailand and 400 in Cambodia had adopted the use of clays and another 20,000 farmers were introduced into the new technique. [241] If the soil is too high in clay or salts (for example the saline sodium soil), adding the chalk, the washed sand of the river and organic matter (E.G.Galizing solid waste) balance the composition. [242] Adding organic matter, such as wood or compost of the chipped ramial, to the ground that is exhausted in nutrients and too high in the sand will increase its quality and improve production. [243] [24] The special mention must be made with the use of wood coal and more generally biocograph to improve poor nutritious tropical land, a process based on the highest fertility of the pre-Colombian anthropogenic sweethearts, also called Earth preta de Ãƒ ndi, due to interesting physical and chemical properties of the black carbon soil as a stable humus source. [245] However, the uncontrolled application of charred waste products from all kinds can endanger soil life and human health. [246] History of studies and research The history of the study of the soil is intimately linked to the urgent of man needed to provide food alone and fodder for their animals. During history, civilizations have prospered or refused according to the availability and productivity of their land. [247] Soil fertility studies Main article: soil fertility This section can contain an excessive amount of intricate details that could only affect a particular audience. Specifically, the details be moved to the main article. Please help turn or reposition any relevant information and remove excessive details that may be against Wikipedia's inclusion policy. (April 2021) (Discover how and when to remove this message) is accredited the Greek historian Xenophon (450 € "355 ECB)The first to explode on the merits of green maneuver crops: "But then any weed is on the ground, being transformed into the ground, enriching the soil as much as the sterco." [248] Columella's of Hearbry, about 60 ce, supported the use of lime and that the clover and the medical grass (green lumber) should be transformed under, [249] and has been used by 15 generations (450 years) under its Roman Empire up to the ground. [248] [250] From the fall of Rome to the French revolution, knowledge of soil and agriculture was transmitted by parent to son and consequently, yields of crops were low. During the European Middle Ages, Yahya Ibn Al-'wwam's manual, [251] with its emphasis on irrigation, led the people of North Africa, Spain and the Middle East; A translation of this work has finally been transported to the southwest of the United States when under Spanish influence [252]. Olivier de Serres, considered as the father of French agronomy, was the first to suggest the abandonment of the collection and its replacement by hay meadows within the crop rotations, and stressed the importance of the soil (the French terroir) in the management of the vineyards. His famous book Le ThÃ ¢ Tre d'Agricoltura Et Mesnage des Champs [253] contributed to the increase of modern and sustainable agriculture and to the collapse of ancient agricultural practices such as soil Amendment for crops by the raising of the forest litter and the tasting , which ruined the land of Western Europe during the Middle Ages and even later in the regions. [254] Experiments in what the plants made grow first led to the idea that the ashes left behind when the plant matter was burned was the essential element but neglected the role of nitrogen, which is not left to the ground after combustion, a conviction that took until the 19th century. [255] In about 1635, the chemistJan Baptist Van Helmont thought he had shown that water was the essential element from his famous five-year experiment with a cultivated willow tree with only the addition of rainwater. The conclusion of him conclusion from the fact that the weight gain of the plant had apparently been produced only by the addition of water, without any reduction of the weight of the soil. [256][257][258] John Woodward (d. 1728) experimented with various types of water ranging from clean to mud and finds the muddy water the best, and thus concluded that earthly matter was the essential element. Others concluded that it was humus in the soil that passed some essence to the growing plant. Others still believed that the main vital of growth was something passed from dead plants or animals to new plants. At the beginning of the 18th century, Jethro Tull demonstrated that it was beneficial to cultivate (stir) the soil, but his opinion that agitation made the thin parts of the soil available for the absorption of plants was incorrect. [257] [259] As chemistry developed, it was applied to soil fertility survey. The French chemist Antoine Lavoisier demonstrated in 1778 that plants and animals must [combuste] oxygen internally to live and was able to deduce that most of the weight of 165 pounds of van Helmont willow derived from air.[260] He was the French farmer Jean-Baptiste Boussingault who through experiments or trials that showed that the main sources of carbon, hydrogen and oxygen for plants, while the blue. [261] Justus von Liebig in his book Organic chemistry in his applications for agriculture and physiology (published 1840), stated that chemicals in plants had to come from soil and air and that to maintain soil fertility, used minerals should be replaced. [262] Liebig believed that nitrogen was supplied by air. The enrichment of the soil with the Incas guan was rediscovered in 1802, by Alexander von Humboldt. This led to its mining and the mining of Chilean nitrate and its ground application in the United States and inAfter 1840. [263] Liebig's work was a revolution for agriculture, and so more He started experimentation based on it. In England John Bennet Lees and Joseph Henry Gilbert worked in the Rothamsted experimental station, founded by the first, and (Re) discovered that the plants taken away from the ground, and that the salts had to be in a state available to be absorbed by the plants. Their investigations also produced the superfosphate, consisting in the acid treatment of phosphate rock. [264] This has led to the invention and use of potassium salts (K) and nitrogen (N) as fertilizers. The ammonia generated by the production of coca coca was recovered and used as a fertilizer. [265] Finally, the chemical base of nutrients delivered to the ground in the soil of the manure and the chemical fertilizers of half of the 19th century has been understood. However, the dynamic interaction of the soil and its life forms are still expected discovered. In 1856 J. Thomas Way discovered that the ammonia contained in fertilizers was transformed into nitrates, [266] and twenty years later Robert Warington showed that this transformation was made by living organisms. [267] In 1890 Sergei Winogradsky announced that he had found the bacteria responsible for this transformation. [268] It was known that some legumes could resume nitrogen from the air and staring at it to the ground, but he took the development of bacteriology towards the end of the nineteenth century to involve an understanding of the role played in the nitrogen setting by bacteria . The symbiosis of bacteria and leguminous roots, and the fitting of the nitrogen by bacteria, were simultaneously discovered by the German agronome Hermann Hellriegel and the Dutch Microbiologist Martinus Beijerinck. [264] The rotation of crops, mechanization, chemical and natural fertilizers led to a doubling of wheat yields in Western Europe between 1800 and 1900. [269] soil training studies See also: Pedogenesis Who have studied the ground in relation to agricultural practices considered it mainly as a static substrate. However, the land is the result of the oldest ancient evolution Materials, under the action of biotic and abiotic processes. After studying the improvement of the initiated soil, other researchers started studying the genesis of the soil and consequently also types of land and classifications. In 1860, in Mississippi, Eugene W. Hilgard (1833-1916) studied the relationship between rocky material, climate, vegetation and the type of developed soils. He realized that the land were dynamic and considered the classification of soil types [270] unfortunately the work of him was not continued. At the same time, Friedrich Albert Fallou was describing soil profiles and related soil characteristics to their training as part of his professional work that evaluates the forest and the agricultural land for the Principality of Saxony. His book from 1857, AnfangsgrsgsgsgrÃƒÂ¼nde der Bodenkunde (first principles of soil science) established modern soil science. [271] Contemporary with the work of Fallou, and guided by the same need to accurately evaluate the Earth for Equa Taxation, Vasily Dokuchaev brought a team of soil scientists in Russia who led a wide terrain survey, observing that types of basic rocks, climatic and vegetation similar leads to similar soil stratification and types and have established concepts for soil classifications. Due to linguistic barriers, the work of this team was not communicated to Western Europe until 1914 through a German publication from Konstantin Glinka, a member of the Russian team [272]. Curtis F. Marbut, influenced by the work of the Russian team, translated the publication of Glinka in English, [273] and since it was paused to the National Cooperative Survey of US Terraines, applied it to a national classification system of the soil. [257] See also Wikimedia Commons has a support for land. Wikiquote has quotes related to: soil Sulphate Terrain Agrophysics crust Agricultural scientific factors affecting the permeability of soil index of articles related to soil mycorrhizal fungi and soil Carbon storage Shrink-€ "Swell capacity Biodiversity of soil Biodiversity Liquefaction LiquefactionMoisture Velocity Equation Zoology Trails erosion World Museum Museum References ^ Chesworth, Department, Ed. (2008). Encyclopedia of soil science (PDF). Dordrecht, Netherlands: Springer. IsbnÃ, 978-1-4020-3994-2. Filed by the original (PDF) on 5 September 2018. ^ Voroney, R. Paul; Heck, Richard J. (2007). "The soil habitat" (PDF). In Paul, Eldor A. (ed.). Microbiology of soil, ecology and biochemistry (3rdÃ ¢ ed.). Amsterdam, Netherlands: Elsevier. Pp. 25 Ã ¢ â,¬ "49. doi: 10.1016 / b978-08-047514-1.50006-8. IsbnÃ, 978-0-12-546807-7. Filed by the original (PDF) on 10 July 2018. ^ Taylor, Sterling A.; Ashcroft, Gaylen L. (1972). Physical Educology: the physics of irrigated and non-grinded land. San Francisco, California: Wh Freeman. Isbnã, 978-0-7167-0818-6. ^ McCarthy, David F. (2006). Essentials of Soil Mechanics and Foundations: Basic geotechnics (PDF) (7 Â °.). Upper Saddle River, New Jersey: Prentice Hall. IsbnÂ, 978-0-13-114560-3. Recovered On January 17, 2021. ^ Gilluly, James; Water, Aaron Clement; Woodford, Alfred Oswald (1975). Geology principles (4 Â °). San Francisco, California: Wh Freeman. IsbnÂ, 978-0-7167-0269 -6. ^ Ponge, Jean-FranÃ§ois (2015). "The land as an ecosystem". Biology and fertility of land. 51 (6): 645 - 48. doi: 10.1007 / s00374-015-1016-1. S2cidÂ , 18251180. Recovered on January 24, 2021. ^ Yu, Charley; Kamboj, Sunita; Wang, Cheng; Cheng, Jing-JE (2015). "Data collection manual for Support the impacts of modeling of radioactive material in soil and construction structures "(PDF). Argonne National Laboratory. Pp.ã, 13 - 21. Filed (PDF) from the original August 4, 2018. Recovered on January 24, 2021. ^ A B Buol, Stanley W.; Southard, Randal j.; Graham, Robert C.; McDaniel, Paul A. (2011). Genesis of the soil and classification (7 Â °.). Ames, Iowa: Wiley-Blackwell. IsbnÂ, 978-0-470-96060-8. ^ Retalleck, Gregory j.; Krinsley, David H.; Fischer, Robert; Razink, Joshua J.; Langworthy, A. (2016). "Archean coastal-planar paleosoli and life on earth" earth"40: 1â € "20. Bibcode: 2016Gondr..40 .... 1R. Doi: 10.1016 / j.gr.2016.08.003. Filed (PDF) from the original on November 13, 2018. URL consulted on January 24, 2021. ^ "Glossary of Terms in Soil Science". Agriculture and Agri-Food Canada. 13 December 2013. Filed by the original October 27, 2018. URL consulted on January 24, 2021. ^ Amundson, Ronald. "Landmark of the soil and future of pedology" (PDF). Faculty of natural resources. Songkhla, Thailand: Prince of Songkla University. Filed (PDF) from the original on 12 June 2018. URL consulted on January 24, 2021. ^ KÃ¼ppers, Michael; Vincent, Jean-Baptiste. "Impacts and training of Regolith". Max Planck Institute for solar system search. Filed by the original August 4, 2018. URL consulted on January 24, 2021. ^ Amelung, Wulf; Bossio, Deborah; De Vries, Wim; KÃ¶gel-Knabner, Ingrid; Lehmann, Johannes; Amundson, Ronald; Bol, Roland; Collins, Chris; LAL, Rattan; Leifeld, Jens; Minasny, Buniman; Pan, Gen-Xing; Ruusbadlia; Keith "Towards a global soil climate mitigation strategy". Nature communication. 11 (1): 5427. Bibcode: 202020NATCO..11.5427A. Doi: 10.1038 / s41467-020-18887-7. ISSN 2041-1723. PMC 7591914. AmpD 33110065. ^ Pouyat, Richard; Groffman, Peter; Yesilonis, Ian; Hernandez, Luis (2002). "Small and urban ecosystem carbon fluxes". Environmental pollution. 116 (Supplement 1): S118 S107â. doi: 10.1016 / S0269-7491 (01) 00263-9. PMID 11833898. Retrieved on 7 February 2021. Our analysis of pedestrians data from different soil profiles disturbed suggests that physical ailments and anthropogenic inputs of various materials (direct effects) can significantly affect the amount of C stored in these "facts" land human. ^ Davidson, Eric A .; Janssens, Ivan A. (2006). "Heard 'of soil carbon decomposition temperature and feedback to climate change" (PDF). Nature. 440 (March 9 165 --73. Bibcode: 2006Natur.440..165D. DOI: 10.1038 / Nature04514. PMIDA S2CIDÂ 16525463. 4404915. Retrieved 7 February 2021. ^ Powlson, David (2005). "The soil amplifies climate change?" (PDF). Nature. 433 (January 20, 2005): 204 '05. Bibcode: 2005natur.433..204p. DOI: 10.1038 / 433204A. PMIDA S2CIDÂ 15662396. 35007042. Retrieved 7 February 2021. ^ Bradford, Mark A .; Wieder, william r .; Bonan, Gordon B .; Fierer, Noah; Raymond, Peter A .; Crowther, Thomas W. (2016). "Managing the uncertainty in the soil carbon feedback to climate change" (PDF). Nature climate change. 6 (27 July 2016): 751 Ã ¢ â ¬ "58. bibcode: 2016NATCC ... 6..751b. DOI: 10.1038 / NClimate3071. HDL: 20.500.11755 / C1792DBF-CE96-4DC7-8851-1CA50A35E5E0. Recovered 7 February 2021. ^ Dominated, Estelle; Patterson, Murray, Mackay, Alec (2010). "A framework for the classification and quantification of natural capital and ecosystem services." ecological Economics land. 69 (9): 1858Ã ¢ â ¬ '68. DOI: 10.1016 / J.ECOLECON.2010.05.002. Filed (PDF) from the original on August 8, 2017. Retrieved 14 February 2021. ^ Dykhuizen, Daniel E. (1998). " Santa Rosalia revisited: © because there are so many species of bacteria? ". Antonie van Leeuwenhoek. 73 (1): 25 '33. DOI: 10.1023 / a: 1000665216662. PMIDA 9602276. S2CidÂ ¢ 17779069. Retrieved February 14 2021. ^ Torsvik, Vigdis; vREA Ã ~ Â ¥ s, lise (2002). "Diversity and microbial function in the soil: from genes to ecosystems." current Opinion in microbiology. 5 (3): 240 '45. DOI : 10.1016 / S1369-5274 (02) 00324-7. PMIDA 120576 76. Retrieved February 14 2021. ^ Raynaud, Xavier; Nunan, Naoise (2014). "Spatial Ecology of the bacteria at the microscale in the ground". Plos one. 9 (1): E87217. Bibcode: 2014Plo ... 987217R. Doi: 10.1371 / Journal.pone.0087217. PMCA 3905020. PMID 24489873. ^ Whitman, William B .; Coleman, David C .; Wiebe, William J. (1998). "Prokyotes: the invisible majority". Proceedings of the National of Sciences of the USA. 95 (12): 6578 --83. Bibcode: 1998PNAS ... 95.6578W. DOI: 10.1073 / PNAS.95.12.6578. PMCÂ 33863. PMIDÂ 9618454. ^ ^ William H.; Andrews, Jeffrey A. (2000). "Soil breathing and global carbon cycle". Biogeochemistry. 48 (1): 7 '20. DOI: 10.1023 / A: 1006247623877. S2CIDÂ ¢ 94252768. Recovered on February 14, 2021. ^ DenMead, Owen Thomas; Shaw, Robert Harold (1962). "Availability of soil water to plants as struck by soil moisture content and weather conditions". Journal Agronomy. 54 (5): 385Ã ¢ â,¬ '90. DOI: 10.2134 / AGRONJ134 / AGRONJ1962.00021962005400050005X. Recovered on February 14, 2021. ^ House, Christopher h.; Bergmann, well a.; Stomp, Anne-Marie; Frederico, Douglas J. (1999). "Combination of wetlands built and water filters and land for reclamation and re-use of water". Ecological engineering. 12 (1 Ã ¢ â,¬ "2): 27 Ã ¢ â,¬" 38. doi: 10.1016 / s0925-8574 (98) 00052-4. Recovered on February 14, 2021. ^ Van Bruggen, Ariane H.C.; Semenov, Alexander M (2000). "Looking for biological indicators for the suppression of soil health and disease". Ecology of the applied soil. 15 (1): 13 Ã ¢ â,¬ "24. doi: 10.1016 / s0929-1393 (00) 00068-8. Recovered on February 14, 2021. ^" Guide to a citizen to monitor natural attenuation "(PDF) . Recovered on February 14, 2021. ^ Linn, Daniel Myron; Doran, John W. (1984). "Effect of the space of the port filled by water on carbon dioxide and the production of nitrogen oxide oxide in cultivated land â €