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| ***Field: Agriproduction***  ***Sub-field: Soil and Land Management***  **Soil Formation**  C:\Users\User\Pictures\soil-formation-limestone-5553889[1].jpg  **Levente Dimen**  **Grigore-Dan Iordachescu**  **2017**  **Boosting Adult System Education In Agriculture - AGRI BASE**  **Erasmus+ K2 Action Strategic Partnership** |

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1. Introduction

Soil is the medium that enables us to grow our food, natural fiber and timber. It is not understatement to say that soil is fundamental to the existence of human society.

Soil in is a natural body comprised of solids (minerals and organic matter), liquid, and gases that occurs on the land surface, occupies space, and is characterized by one or both of the following: horizons, or layers, that are distinguishable from the initial material as a result of additions, losses, transfers, and transformations of energy and matter or the ability to support rooted plants in a natural environment.

The upper limit of soil is the boundary between soil and air, shallow water, live plants, or plant materials that have not begun to decompose. Areas are not considered to have soil if the surface is permanently covered by water too deep (typically more than 2.5 m) for the growth of rooted plants. The horizontal boundaries of soil are areas where the soil grades to deep water, barren areas, rock, or ice. In some places the separation between soil and non-soil is so gradual that clear distinctions cannot be made. The lower boundary that separates soil from the non-soil underneath is most difficult to define. Soil consists of the horizons near the earth’s surface that, in contrast to the underlying parent material, have been altered by the interactions of climate, relief, and living organisms over time. Commonly, soil grades at its lower boundary to hard rock or to earthy materials virtually devoid of animals, roots, or other marks of biological activity. The lowest depth of biological activity, however, is difficult to discern and is often gradual.

For purposes of classification, the lower boundary of soil is arbitrarily set at 200 cm. In soils where either biological activity or current pedogenic processes extend to depths greater than 200 cm, the lower limit of the soil for classification purposes is still 200 cm. In some instances the more weakly cemented bedrocks (paralytic materials, defined later) have been described and used to differentiate soil series (series control section, defined later), even though the paralytic materials below a paralytic contact are not considered soil in the true sense. In areas where soil has thin cemented horizons that are impermeable to roots, the soil extends as deep as the deepest cemented horizon, but not below 200 cm. For certain management goals, layers deeper than the lower boundary of the soil that is classified (200 cm) must also be described if they affect the content and movement of water and air or other interpretative concerns.

# Soil has many properties that fluctuate with the seasons. It may be alternately cold and warm or dry and moist. Biological activity is slowed or stopped if the soil becomes too cold or too dry. The soil receives flushes of organic matter when leaves fall or grasses die. Soil is not static. The pH, soluble salts, amount of organic matter and carbon-nitrogen ratio, numbers of microorganisms, soil fauna, temperature, and moisture all change with the seasons as well as with more extended periods of time. Soil must be viewed from both the short-term and long-term perspective.

2. Soil formation

# Soil formation factors

**Soils formation factors**

Soils are formed through the interaction of five major factors: time, climate, parent material, topography and relief, and organisms. The relative influence of each factor varies from place to place, but the combination of all five factors normally determines the kind of soil developing in any given place.

**Time**

The formation of soils is a continuing process and generally takes several thousand years for significant changes to take place.

**Climate**

Climate, particularly temperature, precipitation and frost action have a profound influence on the soil forming processes which occur within a region. The kind of climate largely determines the nature of the weathering processes that will occur and the rates of these chemical and physical processes. It directly affects the type of vegetation in an area which in turn will affect those soil forming processes related to vegetation.

**Parent Material**

Parent material is the unconsolidated mineral and organic deposits in which soils are developing. It determines the mineralogical composition and contributes largely to the physical and chemical characteristics of the soil. The kind of parent material also influences the rate at which soil forming processes take place.

**Topography and Relief**

The shape of the land surface, its slope and position on the landscape, greatly influence the kinds of soils formed. In Plymouth County soils that formed in similar parent materials with the same climatic conditions exhibit differences as a result of their position on the landscape. These differences are largely a result of varying drainage conditions due to surface runoff or depth to water table.

Soils that developed on higher elevations and sloping areas are generally excessively drained or well drained. Depth to groundwater is generally greater than 6 feet and surface runoff is moderate or rapid. Soil profiles within these areas commonly have a bright coloured strong brown to yellowish brown upper solum grading to a lighter, grayer, unweathered substratum.

Soils that occur at lower elevations such as in swales, adjacent to drainage-ways and water bodies, and within depressions generally receive surface runoff from higher elevations and often have a seasonal high water table at a shallow depth. Soil profiles within moderately well drained and poorly drained areas are mottled with irregular spots of brown, yellow and grey colours. In very poorly drained areas, where the water table is at or near the surface for prolonged periods, soil profiles characteristically have a dark-coloured organic or organic rich surface layer underlain by a strongly mottled or gleyed (gray color indicating a reduced condition) subsoil and substratum.

Permeability of the soil material; as well as the length, steepness, and configuration of the slopes, influence the kind of soil that is formed in an area. The local differences in the soils mapped in Plymouth County are largely the results of differences in parent material and topography.

**Organisms**

All living organisms actively influence the soil forming process. These organisms include bacteria, fungi, vegetation and animals. Their major influence is the effect on the chemical and physical environment of the soils. Some types of micro-organisms promote acid conditions and change the chemistry of the soil which in turn influences the type of soil forming processes that take place. Microbial animals decompose organic materials and return the products of decomposition to the soil.

Larger animals such as earthworms and burrowing animals mix the soil and change its physical characteristics. They generally make the soil more permeable to air and water. Their waste products cause aggregation of the soil particles and improve soil structure.

Man's activities have significantly altered many areas of natural soils in the county. The chemical and physical properties, particularly of the plow layer, have changed with cultivation and the addition of lime and fertilizer. Artificial drainage and filling have altered the environment of some naturally wet soils. Of all the animals, man can have the most beneficial or most detrimental impact on the soil forming processes.

# Formation and composition of soil mineral layer

Soil minerals play a vital role in soil fertility since mineral surfaces serve as potential sites for nutrient storage. However, different types of soil minerals hold and retain differing amounts of nutrients. Therefore, it is helpful to know the types of minerals that make up your soil so that you can predict the degree to which the soil can retain and supply nutrients to plants.

There are numerous types of minerals found in the soil. These minerals vary greatly in size and chemical composition.

Mineral soil material (less than 2.0 mm in diameter) either: 1. Is saturated with water for less than 30 days (cumulative) per year in normal years and contains less than 20 percent (by weight) organic carbon; or 2. Is saturated with water for 30 days or more cumulative in normal years (or is artificially drained) and, excluding live roots, has an organic carbon content (by weight) of: a. Less than 18 percent if the mineral fraction contains 60 percent or more clay; or b. Less than 12 percent if the mineral fraction contains no clay; or c. Less than 12 + (clay percentage multiplied by 0.1) percent if the mineral fraction contains less than 60 percent clay.

Mineral soils are soils that have either of the following: 1. Mineral soil materials that meet one or more of the following: a. Overlie cindery, fragmental, or pumiceous materials and/ or have voids2 that are filled with 10 percent or less organic materials and directly below these materials have either a densic, lithic, or paralithic contact; or b. When added with underlying cindery, fragmental, or pumiceous materials, total more than 10 cm between the soil surface and a depth of 50 cm; or c. Constitute more than one-third of the total thickness of the soil to a densic, lithic, or paralithic contact or have a total thickness of more than 10 cm; or d. If they are saturated with water for 30 days or more per year in normal years (or are artificially drained) and have organic materials with an upper boundary within 40 cm of the soil surface, have a total thickness of either: (1) Less than 60 cm if three-fourths or more of their volume consists of moss fibers or if their bulk density, moist, is less than 0.1 g/cm3 ; or (2) Less than 40 cm if they consist either of sapric or hemic materials, or of fibric materials with less than three-fourths (by volume) moss fibers and a bulk density, moist, of 0.1 g/cm3 or more; or 2. More than 20 percent, by volume, mineral soil materials from the soil surface to a depth of 50 cm or to a glacic layer or a densic, lithic, or paralithic contact, whichever is shallowest; and a. Permafrost within 100 cm of the soil surface; or b. Gelic materials within 100 cm of the soil surface and permafrost within 200 cm of the soil surface.

# Formation and composition of soil organic layer

**Organic Soil Material**

Soil material that contains more than the amounts of organic carbon described above for mineral soil material is considered organic soil material. In the definition of mineral soil material above, material that has more organic carbon than in item 1 is intended to include what has been called litter or an O horizon. Material that has more organic carbon than in item 2 has been called peat or muck. Not all organic soil material accumulates in or under water. Leaf litter may rest on a lithic contact and support forest vegetation. The soil in this situation is organic only in the sense that the mineral fraction is appreciably less than half the weight and is only a small percentage of the volume of the soil.

**Definition of Organic Soils**

Organic soils have organic soil materials that: 1. Do not have andic soil properties in 60 percent or more of the thickness between the soil surface and either a depth of 60 cm or a densic, lithic, or paralithic contact or duripan if shallower; and 2. Meet one or more of the following: a. Overlie cindery, fragmental, or pumiceous materials and/or fill their interstices2 and directly below these materials have a densic, lithic, or paralithic contact; or b. When added with the underlying cindery, fragmental, or pumiceous materials, total 40 cm or more between the soil surface and a depth of 50 cm; or c. Constitute two-thirds or more of the total thickness of the soil to a densic, lithic, or paralithic contact and have no mineral horizons or have mineral horizons with a total thickness of 10 cm or less; or d. Are saturated with water for 30 days or more per year in normal years (or are artificially drained), have an upper boundary within 40 cm of the soil surface, and have a total thickness of either: (1) 60 cm or more if three-fourths or more of their volume consists of moss fibers or if their bulk density, moist, is less than 0.1 g/cm3 ; or (2) 40 cm or more if they consist either of sapric or hemic materials, or of fibric materials with less than three-fourths (by volume) moss fibers and a bulk density, moist, of 0.1 g/cm3 or more; or e. Are 80 percent or more, by volume, from the soil surface to a depth of 50 cm or to a glacic layer or a densic, lithic, or paralithic contact, whichever is shallowest. It is a general rule that a soil is classified as an organic soil (Histosol) if more than half of the upper 80 cm (32 in) of the soil is organic or if organic soil material of any thickness rests on rock or on fragmental material having interstices filled with organic materials.

Soil material that contains more than the amounts of organic carbon described above for mineral soil material is considered organic soil material. In the definition of mineral soil material above, material that has more organic carbon than in item 1 is intended to include

**Distinction between Mineral Soils and Organic Soils**

Most soils are dominantly mineral material, but many mineral soils have horizons of organic material. For simplicity in writing definitions of taxa, a distinction between what is meant by a mineral soil and an organic soil is useful. To apply the definitions of many taxa, one must first decide whether the soil is mineral or organic. An exception is the Andisols (defined later). These generally are considered to consist of mineral soils, but some may be organic if they meet other criteria for Andisols. Those that exceed the organic carbon limit defined for mineral soils have a colloidal fraction dominated by shortrange-order minerals or aluminum-humus complexes. The mineral fraction in these soils is believed to give more control to the soil properties than the organic fraction. Therefore, the soils are included with the Andisols rather than the organic soils defined later as Histosols. If a soil has both organic and mineral horizons, the relative thickness of the organic and mineral soil materials must be considered. At some point one must decide that the mineral horizons are more important. This point is arbitrary and depends in part on the nature of the materials. A thick layer of sphagnum has a very low bulk density and contains less organic matter than a thinner layer of well-decomposed muck. It is much easier to measure the thickness of layers in the field than it is to determine tons of organic matter per hectare. The definition of a mineral soil, therefore, is based on the thickness of the horizons, or layers, but the limits of thickness must vary with the kinds of materials. The definition that follows is intended to classify as mineral soils those that have both thick mineral soil layers and no more organic material than the amount permitted in the histic epipedon. In the determination of whether a soil is organic or mineral, the thickness of horizons is measured from the surface of the soil whether that is the surface of a mineral or an organic horizon, unless the soil is buried. Thus, any O horizon at the surface is considered an organic horizon if it meets the requirements of organic soil material as defined later, and its thickness is added to that of any other organic horizons to determine the total thickness of organic soil materials.

# Soil physical properties

* + 1. **Horizonation**

Soil “horizons” are discrete layers that make up a soil profile. They are typically parallel with the ground surface. In some soils, they show evidence of the actions of the soil forming processes.

**O** horizons are dominated by organic material. Some are saturated with water for long periods or were once saturated but are now artificially drained; others have never been saturated.

**A horizons** are mineral layers that formed at the surface or below an O horizon, that exhibit obliteration of all or much of the original rock structure, and that show one or both of the following:

* an accumulation of humified organic matter intimately mixed with the mineral fraction and not dominated by properties characteristic of E or B horizons
* modification as a result of the actions of cultivation, pasturing, or similar kinds of disturbance

**E horizons** are mineral layers that exhibit the loss of silicate clay, iron, aluminum, humus, or some combination of these, leaving a concentration of sand and silt particles. These horizons exhibit obliteration of all or much of the original rock structure.

**B horizons** are mineral layers that typically form below an A, E, or O horizon and are dominated by obliteration of all or much of the original rock structure and show one or more of the following:

* illuvial concentration of silicate clay, iron, aluminum, humus, carbonate, gypsum, or silica, alone or in combination;
* evidence of removal of carbonates;
* residual concentration of sesquioxides;
* coatings of sesquioxides that make the horizon conspicuously lower in value, higher in chroma, or redder in hue than overlying horizons without apparent illuviation of iron;
* alteration that forms silicate clay or liberates oxides or both and that forms granular, blocky, or prismatic structure if volume changes accompany changes in moisture content; or brittleness.

**C horizons** are mineral layers which are not bedrock and are little affected by pedogenic processes and lack properties of O, A, E or B horizons. The material of C layers may be either like or unlike that from which the overlying soil horizons presumably formed. The C horizon may have been modified even if there is no evidence of pedogenesis.

**R horizons** are layers of hard bedrock, i.e. strongly cemented to indurated bedrock. Granite, basalt, quartzite, limestone, and sandstone are examples of bedrock designated by the letter R. The excavation difficulty commonly exceeds high. The R layer is sufficiently coherent when moist to make hand-digging with a spade impractical, although the layer may be chipped or scraped. Some R layers can be ripped with heavy power equipment. The bedrock may have cracks, but these are generally too few and too small to allow root penetration. The cracks may be coated or filled with clay or other material.

**W layers:** *Water*

This symbol indicates water layers within or beneath the soil. The water layer is designated as *Wf* if it is permanently frozen and as *W* if it is not permanently frozen. The *W* (or *Wf*) designation is not used for shallow water, ice, or snow above the soil surface.

**Transitional and Combination Horizons**

Horizons dominated by properties of one master horizon but having subordinate properties of another.—Two capital-letter symbols are used for such transitional horizons, e.g., AB, EB, BE, or BC. The first of these symbols indicates that the properties of the horizon so designated dominate the transitional horizon. An AB horizon, for example, has characteristics of both an overlying A horizon and an underlying B horizon, but it is more like the A horizon than the B horizon.

In some cases a horizon can be designated as transitional even if one of the master horizons to which it presumably forms a transition is not present. A BE horizon may be recognized in a truncated soil if its properties are similar to those of a BE horizon in a soil from which the overlying E horizon has not been removed by erosion. A BC horizon may be recognized even if no underlying C horizon is present; it is transitional to assumed parent materials.

* + 1. **Soil colour**

In well aerated soils, oxidized or ferric (Fe+3) iron compounds are responsible for the brown, yellow, and red colours you see in the soil.

When iron is reduced to the ferrous (Fe+2) form, it becomes mobile, and can be removed from certain areas of the soil. When the iron is removed, a gray colour remains, or the reduced iron colour persists in shades of green or blue.

Upon aeration, reduced iron can be reoxidized and redeposited, sometimes in the same horizon, resulting in a variegated or mottled colour pattern. These soil colour patterns resulting from saturation, called “redoximorphic features”, can indicate the duration of the anaerobic state, ranging from brown with a few mottles, to complete gray or “gleization” of the soil.

Soils that are dominantly gray with brown or yellow mottles immediately below the surface horizon are usually hydric.

Soil colour is typically described using some form of colour reference chart, such as the **Munsell Color Chart**. Using the Munsell system, colour is described in reference to the color’s “hue”, “value”, and “chroma”. Hue describes where in the color spectrum the soil color exists, which for soils includes the colours yellow, red, blue, green, and gray. Value describes the lightness of the colour. Chroma indicates the strength of the colour. In a Munsell notation, the colour is written in the order hue-value-chroma. The color “5YR 4/3” is an example of a Munsell notation, where 5YR is the hue, 4 is the value, and 3 is the chroma.

* + 1. **Soil Texture**

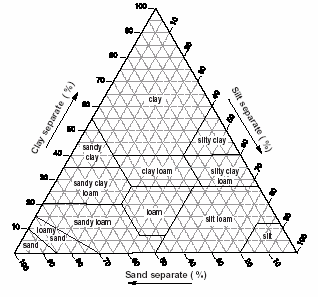
Soil texture refers to the proportion of the soil “separates” that make up the mineral component of soil. These separates are called sand, silt, and clay. These soil separates have the following size ranges:

* Sand = <2 to 0.05 mm
* Silt = 0.05 to 0.002 mm
* Clay = <0.002 mm

Sand and silt are the “inactive” part of the soil matrix, because they do not contribute to a soil’s ability to retain soil water or nutrients. These separates are commonly comprised of quartz or some other inactive mineral.

Because of its small size and sheet-like structure, clay has a large amount of surface area per unit mass, and its surface charge attracts ions and water. Because of this, clay is the “active” portion of the soil matrix.

For all mineral soils, the proportion of sand, silt, and clay always adds up to 100 percent. These percentages are grouped into soil texture “classes”, which have been organized into a “textural triangle”.



*Figure 1. Textural triangle of soils*

Soil texture can affect the amount of pore space within a soil. Sand-sized soil particles fit together in a way that creates large pores; however, overall there is a relatively small amount of total pore space. Clay-sized soil particles fit together in a way that creates small pores; however, overall there are more pores present. Therefore, a soil made of clay-sized particles will have more total pore space than a will a soil made of sand-sized particles. Consequently, clayey soils will generally have lower bulk densities than sandy soils.

Collectively, the soil separates of sand, silt, and clay are called the “fine-earth fraction”, and represent inorganic soil particles less than 2mm in diameter. Inorganic soil particles 2mm and larger are called “rock fragments”.

When the organic matter content of a soil exceeds 20 to 35% (on a dry weight basis) it is considered organic soil material, and the soil is called an organic soil. As this material is mostly devoid of mineral soil material, they cannot be described in terms of soil texture. However, the following “in lieu of” texture terms can be used to describe organic soils:

* “peat”; organic material in which the plant parts are still recognizable
* “muck”; highly decomposed organic material in which no plant parts are recognizable
* “mucky peat”; decomposition is intermediate between muck and peat
  + 1. **Soil Structure**

The soil separates can become aggregated together into discrete structural units called “peds”. These peds are organized into a repeating pattern that is referred to as soil structure. Between the peds are cracks called “pores” through which soil air and water are conducted. Soil structure is most commonly described in terms of the shape of the individual peds that occur within a soil horizon.

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| *Table 1. Types of Soil Structure* | |
| **Graphic Example** | **Description of Structure Shape** |
| https://www.nrcs.usda.gov/Internet/FSE_MEDIA/nrcs141p2_016720.gif | **Granular**– roughly spherical, like grape nuts. Usually 1-10 mm in diameter. Most common in A horizons, where plant roots, microorganisms, and sticky products of organic matter decomposition bind soil grains into granular aggregates |
| https://www.nrcs.usda.gov/Internet/FSE_MEDIA/nrcs141p2_017448.gif | **Platy**–flat peds that lie horizontally in the soil. Platy structure can be found in A, B and C horizons. It commonly occurs in an A horizon as the result of compaction. |
| https://www.nrcs.usda.gov/Internet/FSE_MEDIA/nrcs141p2_016721.gif | **Blocky** – roughly cube-shaped, with more or less flat surfaces. If edges and corners remain sharp, we call it angular blocky. If they are rounded, we call it subangular blocky. Sizes commonly range from 5-50 mm across. Blocky structures are typical of B horizons, especially those with a high clay content. They form by repeated expansion and contraction of clay minerals. |
| https://www.nrcs.usda.gov/Internet/FSE_MEDIA/nrcs141p2_016966.gif | **Prismatic**– larger, vertically elongated blocks, often with five sides. Sizes are commonly 10-100mm across. Prismatic structures commonly occur in fragipans. |
| https://www.nrcs.usda.gov/Internet/FSE_MEDIA/nrcs141p2_017340.gif | **Columna** – the units are similar to prisms and are bounded by flat or slightly rounded vertical faces. The tops of columns, in contrast to those of prisms, are very distinct and normally rounded. |

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| *Table 2. "Structureless" Soil Types* | |
| **Graphic Example** | **Description of Structure Shape** |
| https://www.nrcs.usda.gov/Internet/FSE_MEDIA/nrcs141p2_016845.gif | **Massive** – compact, coherent soil not separated into peds of any kind. Massive structures in clayey soils usually have very small pores, slow permeability, and poor aeration. |
| https://www.nrcs.usda.gov/Internet/FSE_MEDIA/nrcs141p2_016722.gif | **Single grain** – in some very sandy soils, every grain acts independently, and there is no binding agent to hold the grains together into peds. Permeability is rapid, but fertility and water holding capacity are low. |

* + 1. **Soil consistence**

Soil consistence refers to the ease with which an individual ped can be crushed by the fingers. Soil consistence, and its description, depends on soil moisture content. Terms commonly used to describe consistence are:

**Moist soil:**

* loose – noncoherent when dry or moist; does not hold together in a mass;
* friable – when moist, crushed easily under gentle pressure between thumb and forefinger and can be pressed together into a lump;
* firm – when moist crushed under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

**Wet soil:**

* plastic – when wet, readily deformed by moderate pressure but can be pressed into a lump; will form a “wire” when rolled between thumb and forefinger;
* sticky – when wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

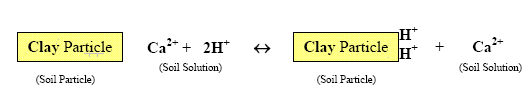
**Dry Soil:**

* soft – when dry, breaks into powder or individual grains under very slight pressure;
* hard – when dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
  1. **Chemical characteristics of soil**

### 

### **Cation Exchange Capacity (CEC)**

* Some plant nutrients and metals exist as positively charged ions, or “cations”, in the soil environment. Among the more common cations found in soils are hydrogen (H+), aluminum (Al+3), calcium (Ca+2), magnesium (Mg+2), and potassium (K+). Most heavy metals also exist as cations in the soil environment. Clay and organic matter particles are predominantly negatively charged (anions), and have the ability to hold cations from being “leached” or washed away. The adsorbed cations are subject to replacement by other cations in a rapid, reversible process called “cation exchange”.



*Figure 2. Cation exchange formula*

* Cations leaving the exchange sites enter the soil solution, where they can be taken up by plants, react with other soil constituents, or be carried away with drainage water.
* The “cation exchange capacity”, or “CEC”, of a soil is a measurement of the magnitude of the negative charge per unit weight of soil, or the amount of cations a particular sample of soil can hold in an exchangeable form. The greater the clay and organic matter content, the greater the CEC should be, although different types of clay minerals and organic matter can vary in CEC.
* Cation exchange is an important mechanism in soils for retaining and supplying plant nutrients, and for adsorbing contaminants. It plays an important role in wastewater treatment in soils. Sandy soils with a low CEC are generally unsuited for septic systems since they have little adsorptive ability and there is potential for groundwater.

**Soil Reaction**

By definition, “pH” is a measure of the active hydrogen ion (H+) concentration. It is an indication of the acidity or alkalinity of a soil, and also known as “soil reaction”.

The pH scale ranges from 0 to 14, with values below 7.0 acidic, and values above 7.0 alkaline. A pH value of 7 is considered neutral, where H+ and OH- are equal, both at a concentration of 10-7 moles/liter. A pH of 4.0 is ten times more acidic than a pH of 5.0.

The most important effect of pH in the soil is on ion solubility, which in turn affects microbial and plant growth. A pH range of 6.0 to 6.8 is ideal for most crops because it coincides with optimum solubility of the most important plant nutrients. Some minor elements (e.g., iron) and most heavy metals are more soluble at lower pH. This makes pH management important in controlling movement of heavy metals (and potential groundwater contamination) in soil.

In acid soils, hydrogen and luminium are the dominant exchangeable cations. The latter is soluble under acid conditions, and its reactivity with water (hydrolysis) produces hydrogen ions. Calcium and magnesium are basic cations; as their amounts increase, the relative amount of acidic cations will decrease.

Factors that affect soil pH include parent material, vegetation, and climate. Some rocks and sediments produce soils that are more acidic than others: quartz-rich sandstone is acidic; limestone is alkaline. Some types of vegetation, particularly conifers, produce organic acids, which can contribute to lower soil pH values. In humid areas such as the eastern US, soils tend to become more acidic over time because rainfall washes away basic cations and replaces them with hydrogen. Addition of certain fertilizers to soil can also produce hydrogen ions. Liming the soil adds calcium, which replaces exchangeable and solution H+ and raises soil pH.

Lime requirement, or the amount of liming material needed to raise the soil pH to a certain level, increases with CEC. To decrease the soil pH, sulfur can be added, which produces sulfuric acid.

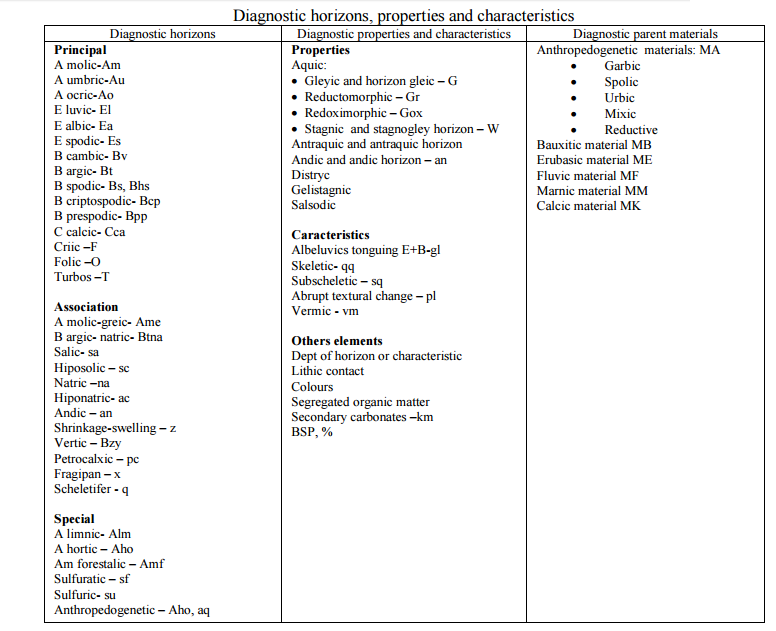
* 1. **Romanian soils**

Romanian Soil Taxonomy System have been prepared of a group of soil scientists during a long time, having as support soil survey and previous soil classification, like Romanian Soil Classification System -1980 and the first edition of Romanian Soil Taxonomy System-2003. A decisive role belong to OSPA, which is a governmental institution active at district level in Romania, responsible for soil survey, soil evaluation and soil testing of agricultural land, co-ordinated by ICPA. It includes the field systematic examination, description and classification of soil profiles, mapping of soils and observations of relationships between soil and soil-farming factors and on land use. Subsequently, soil analyses are performed in the laboratory and office activities are done for preparation of soil maps and soil survey reports (MUNTEANU I, 2009). The International Society of Soil Science has been working to develop a common language for naming the soils of the world and the World Reference Base for Soil Resources (WRB) is designed as an easy mean of communication amongst scientist, in the years of 1998`s and 2006`s. The Romanian Soil Taxonomy System has a good correlation with WRB and also with the USDA Soil Taxonomy (FLOREA N, 2012). The SRTS-2012 is not a final one. It has to be used, discussed, criticised, completed and updated. It has to be transformed in function of the advantages in soil science.

Soil class is the highest, first level, taxonomic category, defined according to soil profile differentiation, i.e. to presence of a specific pedogenetic horizon or basic property. Soil type is the second level taxonomic category, represented by soil bodies with similar features an behaviour resulting from the same kinds of acting under a specific combination of pedogenetic factors.

Soil subtype is the lowest subdivision among the high-level taxonomic categories, the third one. It groups together soil characteristics by a particular expression of features specific for the respective soil type or by a specific horizon sequence, sometimes, marking intergrades to other soil types having special practical importance. Soil variety is the fourth level taxonomic category, a subdivision of soil subtypes, differentiated according to qualitative or quantitative expression of criteria used to separate the respective subtype. Soil species is based on textural soil characteristics of mineral soils and, respectively, on degree of organic matter decomposition in organic soil. Soil family is the sixth level taxonomic, a lithologic subdivision within genetic soil subtypes and soil varieties. It is defined according to the nature of the parent material and to its particle-size composition and sometimes also to kind of underlying rock.

*Table 2. Diagnostic horizons, properties and characteristics*



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