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<u>Soils of New York State</u>

I. Definitions.

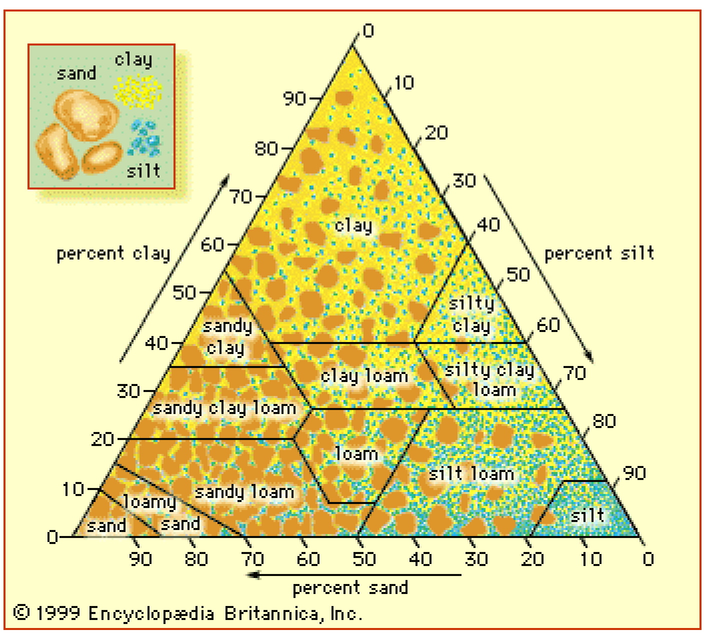
A. Soil: The top layer of the earth composed of organic and inorganic material created over time in reaction to the geology, topography and climate of the area. Together these variables give a soil its unique composition.

B. Formation. Soils are slowly created over a very long period of time by the interaction of several factors of the physical environment that produce its inorganic and organic components. These include **parent material** (both bedrock and surface material as glacial deposits and water and wind-blown deposits), **climate** (the amount of heat and moisture received), **topography** (the slope of the land, the drainage of water and whether it is sun-facing or in the shade), **biological factors** (live and dead plants, animals, and insects, micro-organisms, plant roots, and **time** (the period that the decay and chemical reaction processes have worked to break down the organic and inorganic material.)

II. Soil Factors.

A. Texture (the sand-silt-clay ratio) and Structure (adhesion).

Texture refers to the grain size of soils, expressed as proportions of sand (coarse enough for the grains to be seen), silt (too fine for grains to be seen) and clay (very fine particles). Structure refers to the way in which the soil particles hold together.



When a sand or gravel predominates, the soil texture is coarse; the soils are known as sand or loamy sand. Such materials are loose and incoherent, are low in nutrients (plant food), and retain little water. There are very permeable (water can easily pass through).

Additional proportions of silt and clay increase the soil's water- and nutrient-holding capacities. The best soils for agriculture, called loams, have a medium texture with almost equal proportions of sand, silt and clay. They are easy to work because of the sand content, yet are able to retain water and nutrients because of the silt and clay content.

However, too great a proportion of silt and clay is detrimental. The extremes are called sandy clays, silt clays and clays. Although the nutrient content increases with the higher proportion of silt and clay, the structure becomes less favorable. These soils are sticky when wet, making them difficult to work, and when dry they form a hard surface crust. Drainage become poor with highest content clay soils preventing water from passing through and limiting the water interchange with plant root systems.

Coarse texture soil is apt to develop in areas of sandstone, granite and gneiss which the finest textures form from clay, shale, slate and schist. In limestone areas loam or silty loam is the characteristic soil.

B. Drainage – retention of water

The drainage quality of a soil refers to the degree to which it retains water. In very porous and permeable material, such as sand, water drains away quickly, leaving too little for plant growth. Well drained soils retain enough water for plant growth but dry out enough to be worked in the spring (as the soil thaws) and after heavy rains. Moderately well drained soils may remain too wet to cultivate for several weeks in the spring and after heavy rains, and this makes them unsuitable for water-sensitive crops as certain grains and fruit trees. Poorly drained soils are wet most of the time and can be used only for hay or pasture unless they are artificially drained. In very poorly drained areas water actually stands at or near the surface. Some grasses may grow in such spots but most crops are unable to tolerate this much water. These areas support marsh and other wetland biomes.

Drainage quality is influenced by both soil texture and slope. Coarser materials tend to be highly permeable, with good drainage, while an increase in clay reduces the permeability and the movement of water through the soil. As regard to slope, drainage is best on convex slopes, where the gradient increases down hill. It is poor in the lower parts of uniform or concave slopes, on nearly flat surfaces and in depressions.

Leaching prefers to the removal of materials (nutrients) in solution by the passage of water through a soil. Water from rain, snow melt and irrigation will move down through the layers of a soil carrying the nutrients to plant roots as it moves to the lowest levels. In some cases, the nutrients are carried away from an area when they are drawn into groundwater systems.

C. Soil pH –acidity or alkalinity of a soil- and its potassium and phosphorus content

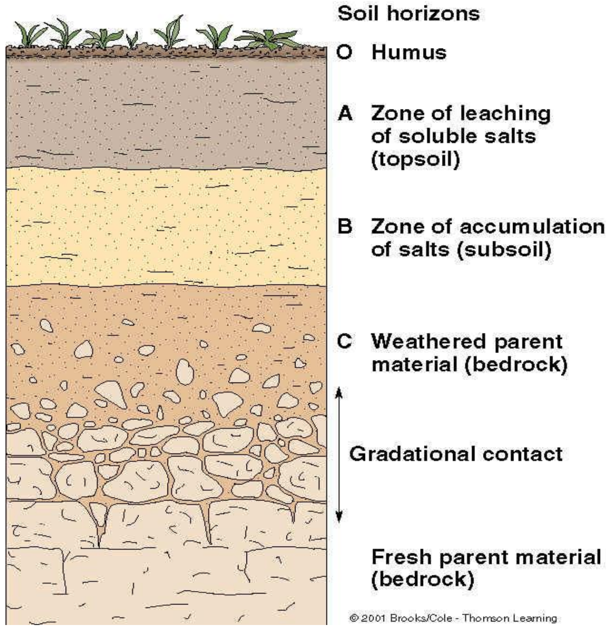
High acidity soils retard the action of nitrogen-fixing bacteria and other micro-organisms, make phosphorus less available to plant roots, and may be associated with harmful accumulation of compounds in the soil. In some cases these acid soils have dense compact subsoils that impede the circulation of air and water and the spread of plant roots. The result is low crop yields. Application of lime (an alkaline) counteracts the acidity and this is necessary in many parts of New York State. The supply of potassium also varies from one area to another, as does that of phosphorus. Adding them to the soil (fertilizers) may help to increase yields.

D. Soil Horizons – layers of a soil or soil profile

Difference in textures, structure and composition may be found in the layers of a soil. These layers are call horizons and a vertical slice through a soil from the surface to the bedrock is called a profile. The soil profile reflects the geology, topography, climate, and vegetation that prevail in the area and the length of time which the soil has been exposed to these influences.

The layers of a soil are:

1. the **O Layer**, the surface of the soil where **o**rganic (humus) material collects;
2. the **A Horizon** or **top soil**, the zone of well-decomposed organic material (humus) that has the richest concentration of nutrients; it includes the zone of leaching where nutrients from organic and inorganic materials are moved into lower layers of the soil by water;
3. the **B Horizon** the zone of accumulation of these soluble minerals;
4. the **C horizon**, the zone of coarsely broken bedrock or weathered parent material; and
5. **bedrock,** the parent material upon which soil develops.



Leaching and vertical differentiation are least marked on recent deposits (alluvium) in valley bottoms where the top layer is very thick. These soils are rich in nutrients and generally very fertile. In other areas, where distinct horizons have developed, fertility varies with the composition of the layers.

Soil develops its thickest layers in valley bottoms and the thinnest soils are found on steep slopes. The steepest slopes do not support soil formation.

II. Soil Pattern of New York State

Applying these general principles to New York State, its soil pattern becomes understandable.

The soils of New York State are relatively young having been laid down 21,000-10,000 years ago as the glaciers retreated. Most of it was formed from glacial till. Freshly scoured parent material is close to the surface so it is not depleted of soluble minerals.

For all parts of the state, the humid climate and associated vegetation, dominantly forest, have had essentially the same influence on the soils making them leached and acid with the widespread need for lime and other fertilizers. Humus accumulation (top soil) in the upper horizon is slight to moderate except in certain areas of the state.

The effects of both the underlying bedrock and the topography are clearly evident. In the Adirondacks and the New England Upland, which are areas of resistant igneous and metamorphic rock, sandy or stony spoils dominate and on the steep slopes of the uplands the soil is often thin or lacking altogether. These conditions prevail to some degree in the sandstone areas of the Tug Hill Plateau, the Catskills and in the rugged southwestern portion of the state on the Alleghany Plateau. On much of the Alleghany Plateau sandstone and shale occur together in varying proportions and the soils grade from sandy to clayey in texture. Similar relationships in other parts of the state occur in lowland areas. In limestone areas, such as on the Erie-Ontario Lake Plain, there are loams and silty loams with high lime content. In the Hudson Valley, slate and schist have yielded silty soils. On Long Island, glacial and fluvioglacial materials are at the surface creating a sandy soil except for local areas were clay and silt were deposited by glacial melt water.

These relationships are recognizable in spite of the fact the most of the soils of the state are either transported soils (containing material not native to NYS or a specific region of the state) or formed since the end of the last Ice Age. All of the state except for a small area in the southwestern portion was overlain by the glaciers and the surface material therefore mainly glacial till. In the areas of more resistant rocks, the moraine is markedly stony. In the valleys finer deposits are common from material spread out by glacial melt water and the silts and clays that accumulated on the floors of glacial lakes. Close to streams are deposits of recent alluvium. Even the local topographic features are reflected in soil texture with the valley bottoms being most favorable for agriculture because of their finer soils as well because they are on relatively level areas. Muck soils, the highly organic black dirt created in areas once occupied by glacial lakes, are extremely fertile. The largest concentrations are found in Orange County and in the area between Rochester and Syracuse.