A

Seminar report

On

Soil Profile

Submitted in partial fulfillment of the requirement for the award of degree
Of Civil

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Preface

I have made this report file on the topic **Soil Profile;** I have tried my best to elucidate all the relevant detail to the topic to be included in the report. While in the beginning I have tried to give a general view about this topic.

My efforts and wholehearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude to ……..who assisting me throughout the preparation of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

Acknowledgement

I would like to thank respected Mr…….. and Mr. ……..for giving me such a wonderful opportunity to expand my knowledge for my own branch and giving me guidelines to present a seminar report. It helped me a lot to realize of what we study for.

Secondly, I would like to thank my parents who patiently helped me as i went through my work and helped to modify and eliminate some of the irrelevant or un-necessary stuffs.

Thirdly, I would like to thank my friends who helped me to make my work more organized and well-stacked till the end.

Next, I would thank Microsoft for developing such a wonderful tool like MS Word. It helped my work a lot to remain error-free.

Last but clearly not the least, I would thank The Almighty for giving me strength to complete my report on time.

Formation of Soil

The soil has taken thousands of years to form. Soil formation takes place in the following ways:

- Big rocks break down into smaller rocks by continuous action of wind and rain. It takes many years for these rocks to break down into smaller rocks.
- Rocks are mainly broken by two types of weathering- physical weathering and chemical weathering. A number of natural force, called agents, work to break down the parent rock into tiny particles of soil. These agents include wind, water, sun's heat and plants and animals.
- These pieces get further broken down to form sand and silt and, ultimately, into finer particles and the process continues. This process is very slow. It takes thousands of years to form just 1cm layer of soil. These fine particles form the top layer of the soil.

Soil Profile

The soil is found in layers, which are arranged during the formation of soil. These layers called horizons, the sequence of layers is the soil profile. The layers of soil can easily be observed by their color and size of particles. The main layers of the soil are topsoil, subsoil and the parent rock. Each layer has its own characteristics.

These features of the layer of soil play a very important role in determining the use of the soil. Soil that has developed three layers, is mature soil. It takes many years under a favourable condition for the soil to develop its three layers. At some places, the soil contains only two layers. Such soil is immature soil.

Horizons of the Soil

A soil consists of the following horizons:

1. Horizon A or Topsoil

It is also called humus layer, which is rich in organic material. This layer consists of decomposed material and organic matter. This is the reason, the topsoil has dark brown color. The humus makes the topsoil soft, porous to hold enough air and water. In this layer, the seeds germinate and roots of the plants grow. Many living organisms like earthworms, millipedes, and centipedes, bacteria and fungi are found in this layer of soil.

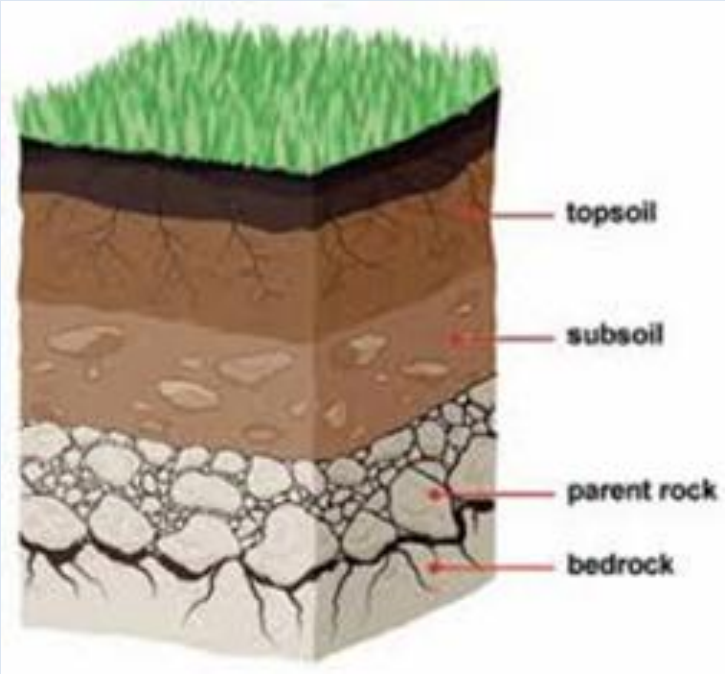
2. Horizon B or Subsoil

Just below the topsoil lies another layer called subsoil or horizon-B. It is comparatively harder and compact than topsoil. It is lighter in color than the topsoil because there is less humus in this layer. This layer is less organic but is rich in minerals brought down from the topsoil. It contains

metal salts, especially iron oxide in a large proportion. Farmers often mix horizon-A and horizon-B when ploughing their fields.

3. Bedrock or Horizon C

Bedrock is also known as parent rock and lies just below the subsoil. It contains no organic matter and made up of stones and rocks, so it is very hard. This layer represents a transition zone between the earth's bedrock and horizon A and B.



Soil Horizons and Profiles

A residual soil forms over many years, as mechanical and chemical weathering slowly change solid rock into soil. The development of a residual soil may go something like this.

Figure 3. Soil is an important resource. Each soil horizon is distinctly visible in this photograph.

1. The bedrock fractures because of weathering from ice wedging or another physical process.
2. Water, oxygen, and carbon dioxide seep into the cracks to cause chemical weathering.
3. Plants, such as lichens or grasses, become established and produce biological weathering.
4. Weathered material collects until there is soil.
5. The soil develops **soil horizons**, as each layer becomes progressively altered. The greatest degree of weathering is in the top layer. Each successive, lower layer is altered just a little bit less. This is because the first place where water and air come in contact with the soil is at the top.

A cut in the side of a hillside shows each of the different layers of soil. All together, these are called a **soil profile** (figure 3).

The simplest soils have three horizons: topsoil (A horizon), subsoil (B horizon), and C horizon.

Topsoil

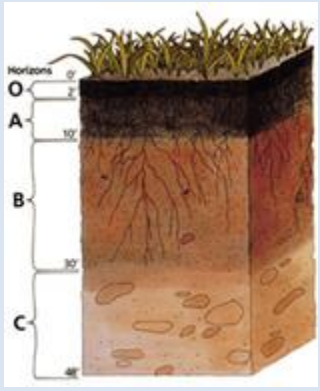


Figure 4. A soil profile is the complete set of soil layers. Each layer is called a horizon.

Called the A horizon, the **topsoil** is usually the darkest layer of the soil because it has the highest proportion of organic material. The topsoil is the region of most intense biological activity: insects, worms, and other animals burrow through it and plants stretch their roots down into it. Plant roots help to hold this layer of soil in place. In the topsoil, minerals may dissolve in the fresh water that moves through it to be carried to lower layers of the soil. Very small particles, such as clay, may also get carried to lower layers as water seeps down into the ground.

Subsoil

The **B horizon** or **subsoil** is where soluble minerals and clays accumulate. This layer is lighter brown and holds more water than the topsoil because of the presence of iron and clay minerals. There is less organic material. Look at figure 4.

C horizon

The **C horizon** is a layer of partially altered bedrock. There is some evidence of weathering in this layer, but pieces of the original rock are seen and can be identified.

Not all climate regions develop soils, and not all regions develop the same horizons. Some areas develop as many as five or six distinct layers, while others develop only very thin soils or perhaps no soils at all.

Types of Soils

Although soil scientists recognize thousands of types of soil—each with its own specific characteristics and name—let's consider just three soil types. This will help you to understand some of the basic ideas about how climate produces a certain type of soil, but there are many exceptions to what we will learn right now (figure 5).

Figure 5. Just some of the thousands of soil types.

Pedalfer

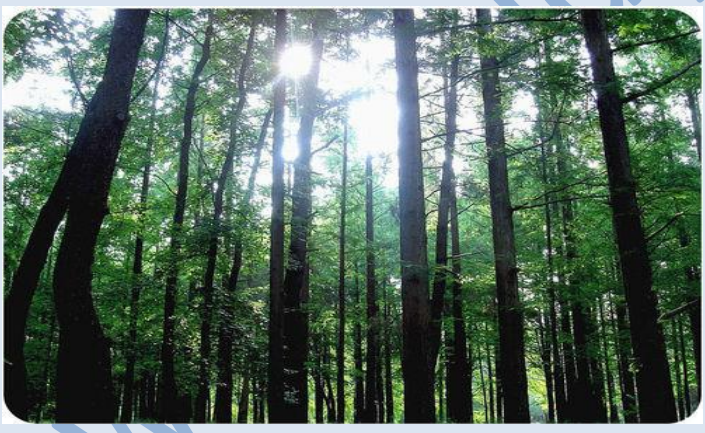


Figure 6. A pedalfer is the dark, fertile type of soil that will form in a forested region.

Deciduous trees, the trees that lose their leaves each winter, need at least 65 cm of rain per year. These forests produce soils called **pedalfers**, which are common in many areas of the temperate, eastern part of the United States (figure 6).

The word pedalfer comes from some of the elements that are commonly found in the soil. The *Al* in ped**al**fer is the chemical symbol of the element aluminum, and the *Fe* in pedal**fe**r is the chemical symbol for iron.

Pedalfers are usually a very fertile, dark brown or black soil. Not surprising, they are rich in aluminum clays and iron oxides. Because a great deal of rainfall is common in this climate, most of the soluble minerals dissolve and are carried away, leaving the less soluble clays and iron oxides behind.

Pedocal

Figure 7. A pedocal is the alkaline type of soil that forms in grassland regions.

Pedocal soils form in drier, temperate areas where grasslands and brush are the usual types of vegetation (figure 7). The climates that form pedocals have less than 65 cm rainfall per year, so compared to pedalfers, there is less chemical weathering and less water to dissolve away soluble minerals so more soluble minerals are present and fewer clay minerals are produced. It is a drier region with less vegetation, so the soils have lower amounts of organic material and are less fertile.

A pedocal is named for the calcite enriched layer that forms. Water begins to move down through the soil layers, but before it gets very far, it begins to evaporate. Soluble minerals, like calcium carbonate, concentrate in a layer that marks the lowest place that water was able to reach. This layer is called caliche.

Laterite

Figure 8. A laterite is the type of thick, nutrient poor soil that forms in the rainforest.

In tropical rainforests where it rains literally every day, **laterite** soils form (figure 8). In these hot, wet, tropical regions, intense chemical weathering strips the soils of their nutrients. There is practically no humus. All soluble minerals are removed from the soil and all plant nutrients are carried away. All that is left behind are the least soluble materials, like aluminum and iron oxides. These soils are often red in color from the iron oxides. Laterite soils bake as hard as a brick if they are exposed to the sun.

Many climates types have not been mentioned here. Each produces a distinctive soil type that forms in the particular circumstances found there. Where there is less weathering, soils are thinner but soluble minerals may be present. Where there is intense weathering, soils may be thick but nutrient poor. Soil development takes a very long time, it may take hundreds or even thousands of years for a good fertile topsoil to form. Soil scientists estimate that in the very best soil-forming conditions, soil forms at a rate of about 1mm/year. In poor conditions, soil formation may take thousands of years!

Importance of Soil

1. ***Medium for plant growth***

Soils serve as the only medium for plant growth. Plants are the basis of life because they are the primary producers which means, life on earth would be impossible without the soil. Soil support roots and keep them erect for growth. Soil also avail for plants vital nutrient and minerals and provides for gaseous exchange between the atmosphere and roots. Soils also protect plants from the destructive biological, physical, and chemical activities and equally shield them against erosion. Finally, soil ensures moderation of moisture and holds water which can be utilized for plant growth.

2. ***Filtration system for surface water***

The storm water after rainfall and snowmelts normally flows and discharges into surface water bodies. However, most of it infiltrates into the ground which is a possibility because of the various layers of the soil. As the excess storm water infiltrates into the ground, it undergoes filtering from chemicals, dust, and other contaminants. This process filters water and provides both plants and humans with clean, unpolluted water required for healthy growth and good health respectively. It is the reason underground water (aquifers) qualifies as one of the purest water sources.

3. ***Habitat for several organisms and supports biodiversity***

Numerous microbes (minute single cell organisms) and insects live in the soil and depend on it for air, shelter, and food. Soils are also homers to a diverse population of organisms including termites and worms. Soils also support biodiversity by creating an enabling environment for plant growth and home to many organisms. For example, insects and some reptiles lay and hatch eggs in the soil. The decomposition of organic matter is a possibility because of the soil which offers the required air and moisture for breaking down the materials.

4. ***Carbon storage and maintaining the balance of atmospheric gases***

Soils help to maintain the balance of atmospheric gases by regulating the amount of atmospheric carbon dioxide (CO_2) by serving a carbon store. In the process of humification where soil organisms form stable and complex organic matter, some organic materials do not break down completely particularly in soils such as peat because of the high water content and acidity.

As a result, there is the buildup of carbon content in the soil. Soils store about twice the carbon quantity available in the atmosphere are about thrice the carbon quantity stored in vegetation. Other elements such as nitrogen and oxides are also stored, transformed and cycled in the soil thus maintaining the balance of atmospheric gases.

Reference

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