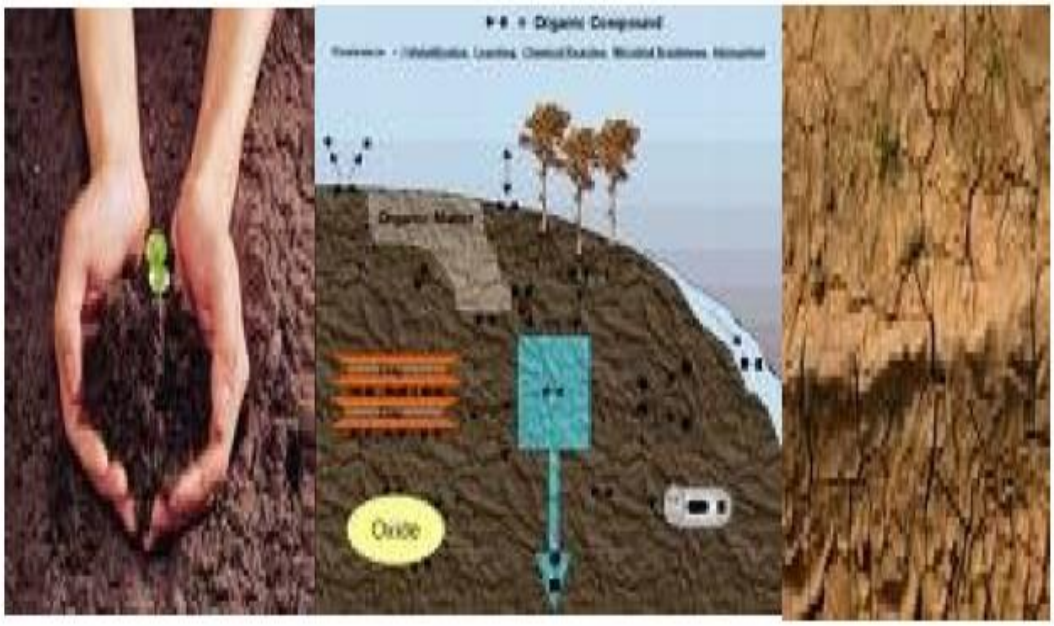
Assistant Prof. Dr. Khitam Abdulhussein Saeed

Al-Mustansiriyah University

Faculty of Civil Engineering

Water Resources Engineering Department

SOIL POLLUTION



CHAPTER ONE

BASIC DEFINITIONS

For Post graduate Students

Faculty of Engineering

Mustansiriyah University

Environmental Engineering Department

Basic Definitions

Soil: Soil is essentially a natural body of mineral and organic constituents produced by solid material recycling, during a myriad of complex processes of solid crust modifications، which are closely related to the hydrologic cycle.

It has four important functions

- as a medium for plant growth
- as a means of water storage, supply and purification
- as a modifier of Earth's atmosphere
- as a habitat for organisms

Soils and their interactions with the environment are major considerations. Furthermore, detailed understanding of the behavior of earth materials is essential for mining, for energy resources development and recovery, and for scientific studies in virtually all the geosciences. To deal properly with the earth materials associated with any problem and project requires knowledge, understanding, and appreciation of the importance of geology, materials science, materials testing, and mechanics. Geotechnical engineering is concerned with all of these. Environmental concerns—especially those related to groundwater, the safe disposal and containment of wastes, and the cleanup of contaminated sites.

Related to formation of soil, It's defined as sediments or other accumulation of mineral particles produced by the physical or chemical disintegration of rock, plus the air, water, organic matter, and other

substances that may be included. Soil is typically a non-homogeneous, porous, and earthen material whose engineering behavior is influenced by changes in moisture content and density. To understand and appreciate the characteristics of any soil deposit require an understanding of what the material is and how it reached its present state. This requires consideration of rock and soil weathering, the erosion and transportation of soil materials, depositional processes, and post depositional changes in sediment.

Soil ecosystem functions

- **What are the six main roles of soil in an ecosystem?**

These soil functions include: air quality and composition, temperature regulation, carbon and nutrient cycling, water cycling and quality, natural "waste" (decomposition) treatment and recycling, and habitat for most living things and their food. We could not survive without these soil functions.

- **What is the role of soil in the ecosystem?**

Soil provides ecosystem services critical for life: soil acts as a water filter and a growing medium; provides habitat for billions of organisms, contributing to biodiversity; and supplies most of the antibiotics used to fight diseases.

- **What are the components of soil and their functions?**

Soil is composed of a matrix of minerals, organic matter, air, and water. Each component is important for supporting plant growth, microbial communities, and chemical decomposition. The largest component of soil

is the mineral portion, which makes up approximately 45% to 49% of the volume.

- **What are 5 main functions of soil?**

  The main ecological functions of soil include nutrient cycling, C storage and turnover, water maintenance, soil structure arrangement, regulation of aboveground diversity, biotic regulation, buffering, and the transformation of potentially harmful elements and compounds (e.g., heavy metals and pesticides.

- **What is an ecosystem service example?**

  Examples of ecosystem services include products such as food and water, regulation of floods, soil erosion and disease outbreaks, and non-material benefits such as recreational and spiritual benefits in natural areas.

- **What are 5 components of soil?**

  In general, soil contains 40-45% inorganic matter, 5% organic matter, 25% water, and 25% air. In order to sustain plant life, the proper mix of air, water, minerals, and organic material is required.

- **What is nature of soil?**

  The soil is a natural body embracing not only the topsoil, but also the subsoil and other layers above its parent rock. ... The dynamic or active soil, as defined in this way, correlates well with the kinds and distribution

of soil organisms, with plant growth, with land capability, and with land use.

- **What is ecosystem system?**

  An ecosystem is a community of living organisms in conjunction with the nonliving components of their environment, interacting as a system. These biotic and abiotic components are linked together through nutrient cycles and energy flows. ... Ecosystems are controlled by external and internal factors.

- **What are the 2 main components of soil?**

  Soil Layers. Soil is composed of both biotic—living and once- living things, like plants and insects—and abiotic materials—nonliving factors, like minerals, water, and air. Soil contains air, water, and minerals as well as plant and animal matter, both living and dead. These soil components fall into two categories.

- **What are the organic components of soil?**

  Soil Organic Matter – Refers to organic component of soil, consisting of three primary parts including small (fresh) plant residues and small living soil organisms, decomposing (active) organic matter, and stable organic matter (humus).

- **What are the main ingredients of soil?**
  Soil is a material composed of five ingredients — minerals, soil organic matter, living organisms, gas, and water.

Contaminant: Contaminants are defined as "substances (i.e. chemical elements and compounds) or groups of substances that are toxic, persistent and liable to bio accumulate, and other substances or groups of substances which give rise to an equivalent level of concern".

- **What are contaminants give an example?**

  These contaminants may be naturally occurring or man-made. Examples of chemical contaminants include nitrogen, bleach, salts, pesticides, metals, toxins produced by bacteria, and human or animal drugs. Biological contaminants are organisms in water. They are also referred to as microbes or microbiological contaminants.

- **Which is a biological contaminant?**

  Biological contamination generally refers to contamination of our food or environment with microorganisms. This means bacteria, viruses, fungi, and parasites.

Leaching. It is the process of a solute becoming detached or extracted from its carrier substance by way of a solvent. Leaching is a naturally occurring process which scientists have adapted for a variety of applications with a variety of methods.

- **What is leaching of soil؟**

Leaching, in geology, loss of soluble substances and colloids from the top layer of soil by percolating precipitation. The materials lost are carried downward and are generally redeposit in a lower layer.

- **What happens during leaching؟**

  Leaching is actually two important actions occurring simultaneously: (1) chemical interactions with surfaces and (2) physical movement of water. As the water passes through the rock and soil, it interacts with the surfaces of the materials. Compounds on the surface of minerals can be become dissolved.

- **Why does leaching occur?**

  Leaching occurs when the air spaces in soil become filled with water and gravity begins to move water downward. The percolating water carries any soluble salts that are present in the soil and is not specific for nitrate. This movement can allow nitrate to flush through soil more rapidly than might be expected.

- **What is the difference between leaching and erosion?**

  Erosion is the natural process by which soil / rock are removed from the Earth's surface by exogenesis processes such as wind or water flow, transported and deposited in other locations. Leaching is the removal of soluble material from soil or other material by percolating water.

- **What is acid leaching used for?**

  Therefore, this study used acid leaching techniques to remove heavy metals from contaminated farmland that can be helpful in understanding the mobility and bioavailability of metals in contaminated soil and to investigate the extraction efficiencies of heavy metals.

- **How does leaching affect soil?**

  Once saturation is reached, any additional irrigation or rain will cause leaching. During the leaching period, we lose valuable plant nutrients in the soil, which can sometimes change the soil structure all together.

Parent Material

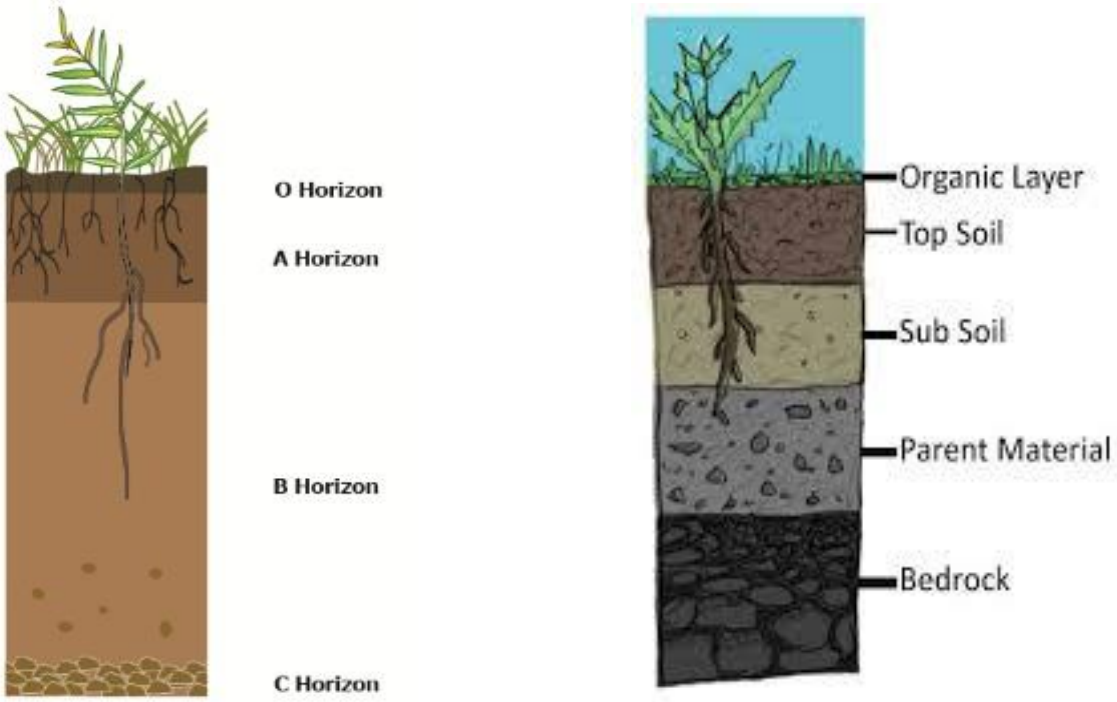
Soil was formed as a result of long-term and complex transformations of its mineral matter called parent material. Primordial, abiotic factors such as properties of the parent material, relief, climate, and time played a key role during the first stage of these transformations. In the course of the second phase, the results of the primary factors became intertwined with.

- **What is the role of parent material in soil formation?**

The parent material of a soil determines the original supply of those nutrient elements that are released by weathering and influences the balance between nutrient loss and retention. Organic acids and exudates produced by microorganisms and plants enhance the weathering of minerals and the release of nutrients.

- **Where is parent material located in the soil profile**?

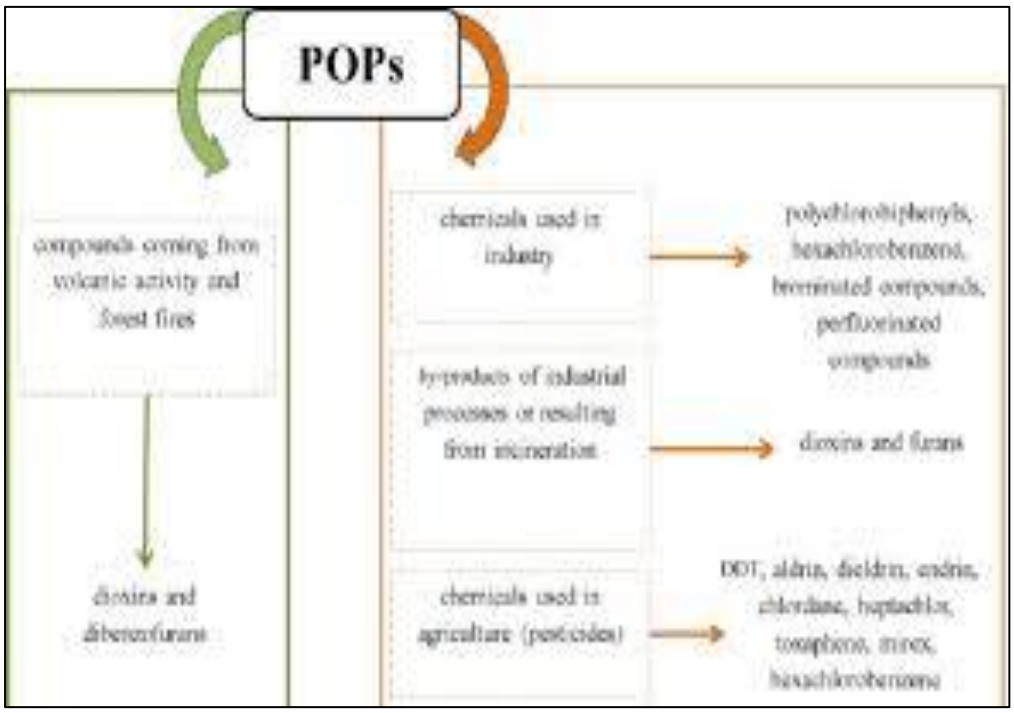
It is usually the parent material of the soil. The R horizon is the underlying bedrock, such as limestone, sandstone, or granite. It is found beneath the C horizon. Soil scientists study the chemical, physical, biological, and mineral characteristics of soil.



- **How does parent material become soil?**

Soil minerals form the basis of soil. They are produced from rocks (parent material) through the processes of weathering and natural erosion. Water, wind, temperature change, gravity, chemical interaction, living organisms and pressure differences all help break down parent material

Persistent organic pollutants (POPs): They are toxic chemicals that adversely affect human health and the environment around the world. They persist for long periods of time in the environment and can accumulate and pass from one species to the next through the food chain.



Classification of persistent organic

- **What causes persistent organic pollutants?**

The most commonly encountered POPs are organ chlorine pesticides, such as DDT,industrial chemicals, most notably polychlorinated biphenyls (PCB), as well as unintentional by-products of many industrial processes, especially polychlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF), commonly known as 'dioxins'.

- **What is a persistent organic pollutant example?**

Examples of persistent organic pollutants include:

Aldrin.

Chlordane.

DDT.

Dieldrin.

Endrin.

Heptachlor.

Hexachlorobenzene.

Mirex.

Soil Health

Soil health, also referred to as soil quality, is defined as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and Unlock the Secrets in the Soil ·

- **What does soil health mean?**

Soil health, also referred to as soil quality, is defined as the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans. This definition speaks to the importance of managing soils so they are sustainable for future generations.

- **What is the difference between soil health and soil quality?**

Soil health describes the biological integrity of the soil community-the balance among organisms within a soil and between soil organisms and their environment." Soil quality is a term that we use when we talk about the physical attributes of soil.

Soil contamination: It is the occurrence of pollutants in soil above a certain level causing a deterioration or loss of one or more soil functions. Also, Soil Contamination can be considered as the presence of man-made chemicals or other alteration in the natural soil environment.

- **Where is soil contamination**?

In urban areas, soil contamination is largely caused by human activities. Some examples are manufacturing, industrial dumping, land development, local waste disposal, and excessive pesticide or fertilizer use.

- **How is soil contamination treated**?

Contaminated soil needs to be remediated to remove contaminants. This involves the soil being excavated and treated on site or transported and treated at a licensed facility. Thermal treatment can be used to destroy or remove organic contaminants within soil reducing waste to landfill.

- **What causes soil contamination?**

Soil contamination or soil pollution as part of land degradation is caused by the presence of xenobiotic (human-made) chemicals or other alteration in the natural soil environment. It is typically caused by industrial activity, agricultural chemicals or improper disposal of waste.

Soil pollution: as part of land degradation is caused by the presence of xenobiotic (human-made) chemicals or other alteration in the natural soil environment. It is typically caused by industrial activity, agricultural chemicals or improper disposal of waste.

There are many different ways that soil can become polluted, such

Seepage from a landfill

Discharge of industrial waste into the soil

Percolation of contaminated water into the soil

Rupture of underground storage tanks

Excess application of pesticides, herbicides or fertilizer

Solid waste seepage

What pollution means?

Pollution is the introduction of harmful materials into the environment. ... These harmful materials are called pollutants. Pollutants can be natural,

such as volcanic ash. They can also be created by human activity, such as trash or runoff produced by factories. Pollutants damage the quality of air, water, and land.

The most common chemicals involved in causing soil pollution are:

Petroleum hydrocarbons

Heavy metals

Pesticides

Solvents