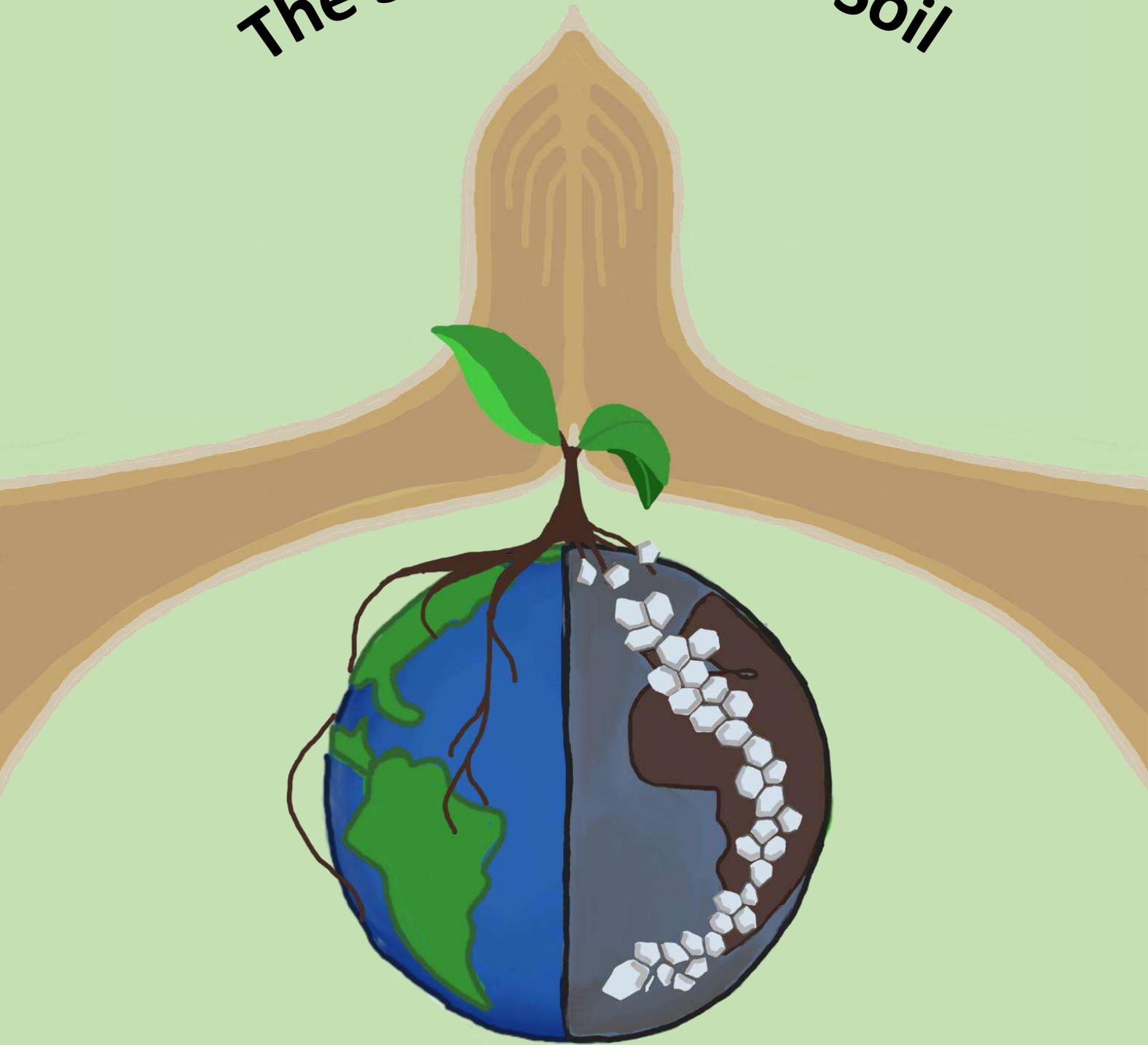


The Story of Salt in Soil



Halt Soil Salinization, Boost Soil Productivity

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Introduction

Soil is the thin layer on top of our planet Earth's crust. It is very thin compared to the size of the other layers of Earth. But soil is the most important layer, as it is the house for living beings as plants, animals and microorganisms.

Plants grow and flourish using nutrients and water from soil. They have the ability to produce food using the energy from sunlight. As other living beings cannot produce food, they depend on plants for nutrition. Plant eating herbivores feed on plants while they become the food for meat eating carnivores through the food chains. As all living beings directly or indirectly depend on the soil nutrients, soil is considered as the foundation of nutrition on Earth.

In agricultural fields, plants are grown in large scale and they need lots of water and nutrients. Therefore, these lands are supplied with irrigation water and fertilizers. However, inappropriate agricultural practices have caused problems in the soils. One of the major problems is "soil salinization" which occur due to high level of "soluble salts" in soil. Plants cannot take up water and grow well when the soil contain high level of salts. Soil salinity also leads to poor soil structure and less soil organisms in affected soils. Correction of saline soils is a very difficult task. Unfortunately, due to the human activities and other reasons as climate change, a large percentage of land area around the world are becoming saline. If the soil salinization process will not be halted, these lands will become useless for agriculture and result in low food production and food scarcity around the world in the future.

This book is written to aware you about the importance of soil as a living system and as the foundation of nutrition on Earth. Different sections are aimed to introduce soil salinity, how it occurs, how to measure salinity and what we can do to halt soil salinization.

Soil salinity is not only a farmers' problem, but a problem for all of us in the future.

Let's march together to halt soil salinization and boost soil productivity.

1. Soil is the Top Layer on Earth

Earth's structure has four layers.

They are "inner core", "outer core", "mantle" and the "crust".

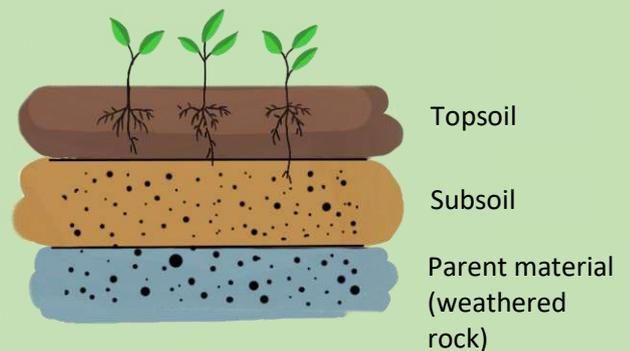
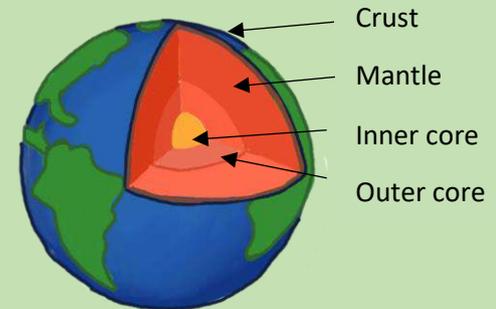
Soil is the thin surface layer on the crust.

Soil can be shallow (millimeters) at some places, and very deep (meters) in some areas.

Soil is the smallest layer among other layers of Earth, but it is the most important one for all living beings.

All plants and animals live and grow on or inside the soil.

Natural environments as forests, rivers and manmade environments such as agricultural fields and parks depend on the soil.



2. Soil is a Living System

Soil is formed of abiotic and biotic components.

Solid particles, water and air are the abiotic matter.

Biotic component consists of living plant roots and organisms and decaying plant and animal debris.

The solid particles of soil are mineral particles as sand, silt and clay and organic matter.

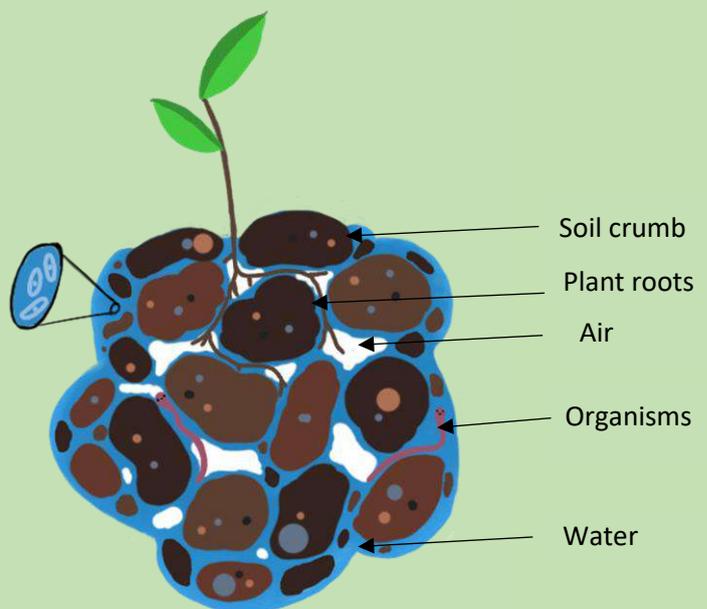
The particles bind together and form the structure of soil. In between the particles, there are empty channels called “soil pores”.

Soil pores are filled by water and air.

During rains all the pores get filled by water. After drainage, pores get filled with air.

Plant roots can easily grow through the pores by absorbing nutrients, air and water found in the pores.

Soil organisms such as earthworms, insects and microorganisms live inside the soil. They make the soil a living system.



3. Soil is the Foundation of Nutrition on Earth

Plants are known as the “primary producers” on Earth as they can produce food using energy of sunlight.

Plants are the starting points of food chains and food webs.

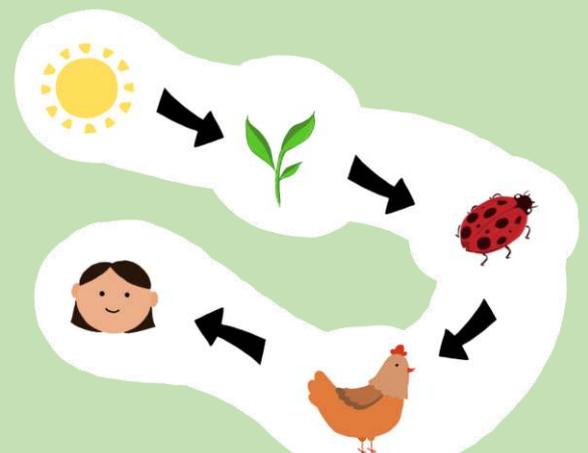
Human beings and animals depend on plants for their nutrition.

Soil is the growth medium for plants and trees. Plants obtain most of their nutrients and water from soil.

These nutrients are dissolved as “ions” in the soil water or attached to the clay particles.

Soil organisms as earthworms and microorganisms decompose and transform organic matter to the nutrients which can be used by the plants.

Therefore, soil supports plant growth and serves as the foundation of nutrition on Earth.



4. Soil Problems in Agricultural Fields

In agricultural fields, plants are grown in large scale as crops.

The crops require lots of nutrients and water within a shorter growing period.

They uptake nutrients and water from the soil.

As a result, at the end of the cropping season, level of soil nutrients become very low.

Farmers apply organic fertilizers (cattle manure, compost) or synthetic fertilizers (urea, potash) to replenish the nutrients to support the crops grown in next season.

However, overuse of fertilizers increases the level of “soluble salts” in the soil.

Crop fields are irrigated with water, during the dry periods. Poor quality irrigation water can add more “salts” in the soil.

Land preparation is an important practice before crop cultivation. It supports the growth of young plants.

However, intensive and improper land preparation leads to soil compaction, erosion and poor drainage.

Pesticides are chemicals that are used to control weeds, insects and other harmful organisms in crop cultivation.

Pesticide residues remain in the soil and become a problem for other organisms and the environment.



5. What is Soil Salinization?

Accumulation of soluble mineral ions or “salts” in soil is known as soil salinization.

These soils are called “saline soils”.

Soils with high sodium salts are named “sodic soils”.

When salts are high, plants think that they are in a drought. Then, plants cannot absorb water and grow poorly.

Soil salinization also result poor structure of soil less soil organisms.

Correction of saline soils is very difficult. Saline agricultural lands finally can become useless lands.

Unfortunately many irrigated crop fields around the world are becoming saline.

If the soil salinization will continue, it results low food production in the world.

Soil salinity is not only a farmers’ problem, but a problem for all of us in the future.



6. Reasons for Soil Salinization

Both natural processes and human activities are causing soil salinization.

Natural processes causing soil salinization are

- weathering of rocks that consists of salts and adding them in soil
- sea water sprays and intrusion in coastal lands
- carrying of sea salts by wind and deposition in coastal areas
- loss of soil water to air by “evapotranspiration” in dry and arid areas.

The manmade or “anthropogenic” processes are

- use of poor- quality irrigation water with high salt content
- overextraction of water from groundwater wells in coastal areas leading to sea water coming into the wells and soil
- Improper land preparation practices in agricultural fields causing water stagnation and preventing removal of salts in soil by leaching
- application of fertilizers in excessive amounts than the needs of plants
- application of pesticides in high amounts and residues remain as salts in soil for a long time



7. How to Identify Soil Salinity?

Soil salinity has become a main problem in soils around the world. Severe salinity causes soil degradation and waste of agricultural lands. Therefore, it is important to identify salinity before too late.

How to identify the salinity development in a soil?

By observations of plants and soil

- Plants become wilted even after irrigation
- Plant leaf burn
- Poor plant growth even with addition of fertilizers
- Poor soil color and structure (white color salt deposits)

By testing soil samples

- Laboratory testing of soil samples to measure the soil salinity

By scanning soil using soil scanners in the field

Electrical conductivity (EC) is the commonly used measurement for soil salinity. The measurement unit is deci Siemens per meter (dS/m). When EC is more than 4 units, soil has become saline.



8. How to Protect Soils from Salinity?

Severe salinity causes soil degradation and loss of soil productivity.

We need to halt soil salinization to boost soil productivity

Prevention is better than cure for soil salinization

How to protect soils from salinization?

- use of good quality irrigation water
- use of efficient irrigation methods as drip irrigation
- turning to rainfed agriculture when possible
- careful land preparation to prevent soil compaction and improve drainage
 - stop overuse of synthetic fertilizers and pesticides

What are the methods to correct saline soils?

- leaching salts down in soil with good quality irrigation water
- improving drainage of the land to flush the salts
- growing saline tolerant plants in the fields – “Phytoremediation”
- application of microorganisms which can uptake salts – “Bioremediation”
- use of chemical treatments
- mechanical removal of affected surface soil

December 5 2021



World Soil Day



Food and Agriculture
Organization of the
United Nations

5 DECEMBER 2021

World Soil Day

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boost soil productivity



**International
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