

WORLD SOIL DAY

05 DECEMBER 2020



**KEEP SOIL ALIVE,
PROTECT SOIL BIODIVERSITY**



**Land Resources Division
MINISTRY OF ENVIRONMENT**



World Soil Day



Keep **soil** alive,
protect **soil** biodiversity

KEEP SOIL ALIVE, PROTECT SOIL BIODIVERSITY

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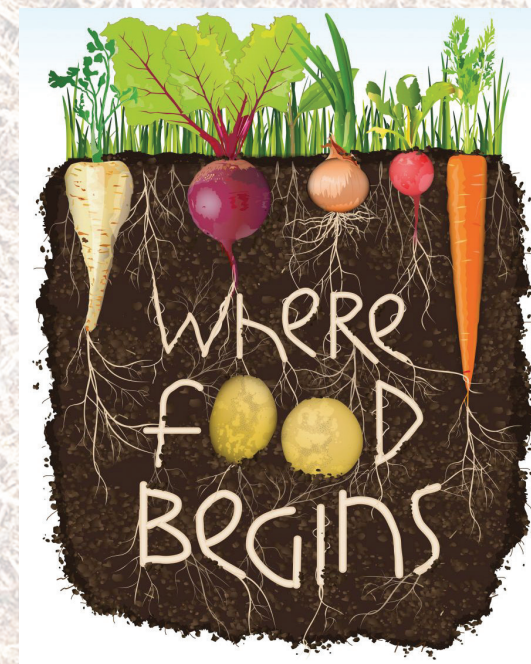
01. Introduction

Soil is a biologically active porous medium that covers most of the Earth's surface and it is the skin of our planet. The life on earth is dependent upon the soil. Soil provides the medium for existence of mammoth number of ecosystems and serves as a residence for large number of animals such as macro-fauna (e.g. earth worms, insects, termites, borrowing animals, etc.) and microorganisms (e.g. bacteria, fungi, protozoans, etc.). The significance of soils in providing ecosystem services, especially its functions in providing food and feed, clean water and energy to living and their well-being is remarkable.

In order to raise the global awareness of soil as a major component in the ecosystem and the contributor for human well-being, upon the request of International Union of Soil Sciences (IUSS), the day 5th of December in every year was declared as the World Soil Day at the 68th UN General Assembly held in December 2013. Since its inception in 2014, Global community is celebrating this world important day in every year based on the thematic areas identified by the United Nations.

The theme of the "World Soil Day" in this year is "**keep soil alive; protect soil biodiversity**". Diverse community of soil biota plays an enormous role in keeping the soil alive and maintaining its fertility. Therefore, the meaning of the healthy soil is another way of expressing its protection of soil biodiversity within their capacity. The maintenance of soil biodiversity provides vast number of benefits to agriculture, industry and to the environment, because 95% of global food requirements are directly or indirectly based on the soil. Biodiversity of soil helps to control the physical, chemical and biological functions of the soil and maintaining its fertility and provides better medium for growing vegetation, circulating plant nutrition and maintaining the proper environmental quality as well. Keeping the soil alive by maintaining its biodiversity supports the production of nutritious food and contribute immensely to assure the global food security.

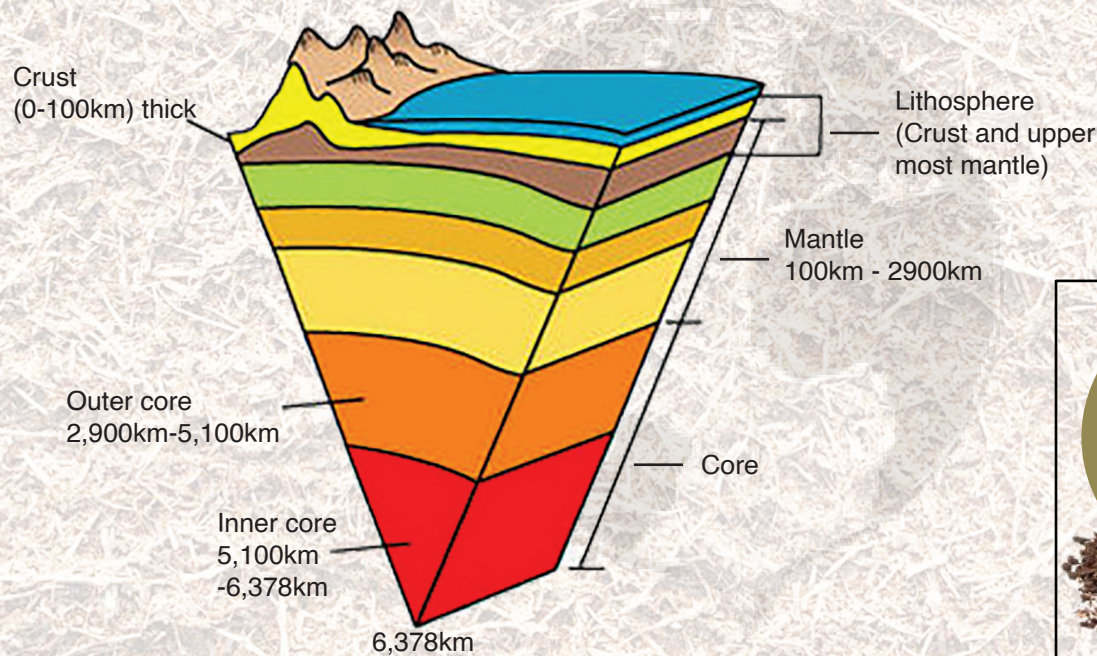
Sustainable Development Goals (SDG's) were adopted by the United Nations at the United Nations General Assembly in 2015 by understanding the need and vitality of food security, ending poverty and ensuring more sustainable future for all the nations (Their targets are aimed to enhance food security as well as the well-being of the population around the world). Most of the goals and their targets have to be achieved by the year 2030. Sustainable Land and Soil Management plays a crucial role in achieving some SDG's.



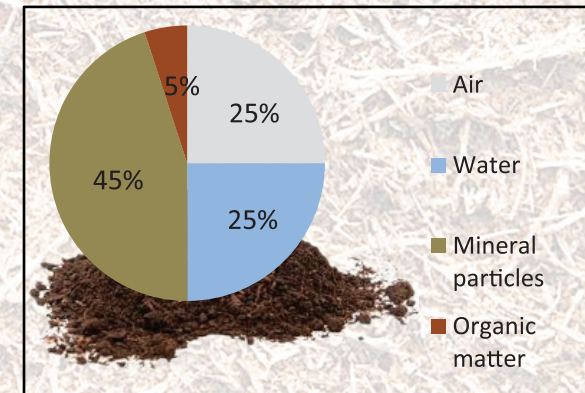


02. What is Soil? How soil is formed? and the composition of the soil

Soil is a biologically active porous medium that covers most of the earth's land surface. In general, soil is made up of different sized mineral particles, organic matter, living organisms, air and water. Soil formation occurs by the weathering of rocks when contact with water, air or living organisms. Weathering process can occur physically, chemically or biologically. Therefore, soil formation is the consequence of combination of biological, physical and chemical processes. This soil formation process occurs at the pedosphere, which is called as the outermost layer of the earth. It exists at the interface of lithosphere, atmosphere, hydrosphere and the biosphere. Lithosphere is consisting of solid rocky crust composed of minerals and covering the entire earth's surface. Therefore, lithosphere interacts with hydrosphere, atmosphere and biosphere are collectively involved to the formation of pedosphere that consists of soil and its biotic and abiotic components as well. When considering the soil composition, soil biota is identified as one of the major contributing factors on formation of soil. In addition to that, other factors affecting soil formation are climate, parent material, topography and the time.



Cross section of the earth

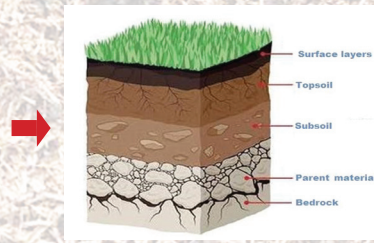


Composition of the soil



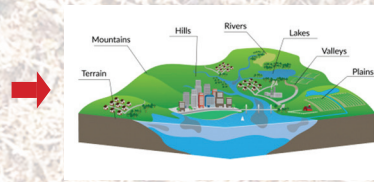
03. Factors affecting the formation of soil

FACTORS OF SOIL FORMATION



01. Parent material

Parent material is an unconsolidated and more or less chemically weathered mineral or organic matter developed under pedogenic process. Parent material considered as an initial stage of the soil system. Therefore, properties of the soil basically derived from its parent material and original supply of nutrient elements released to the soil by weathering processes and leaching at the different depths and it involves to the formation of nutrient cycles of the soil.



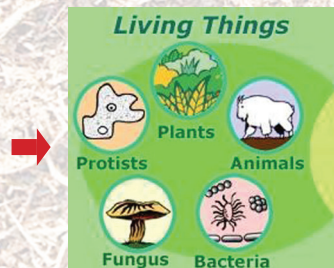
02. Topography

Topography means the configuration (topographic features) of the land surface such as elevation, slope steepness, length, and profile curvature and so on. Topography mainly affects to run off water and steep slopes/un vegetated slopes are more prone to soil erosion. Therefore, topography is highly affected to change the properties of the soil and its formation process.



03. Climate

Temperature and precipitation are major climatic factors that can control the soil formation process. These parameters mainly influence the soil formation by affecting on the biomass production and creating favorable conditions for rock weathering. The presence of moisture and nutrients coming from the weathering processes promote the biological activity, which is a key component of the quality of the soil.



04. Organisms

Living organisms including macro-organisms, micro-organisms and vegetation affect the formation of soil. These living organisms can produce the pores and crevices in the soil and plant roots can grow through them. Plant secretions can promote the growth of some microorganisms around the roots that is called Rhizosphere. In addition, plant and animal debris added to the soil regulate the decomposition process and it involves maintaining the fertility of soil.



05. Time

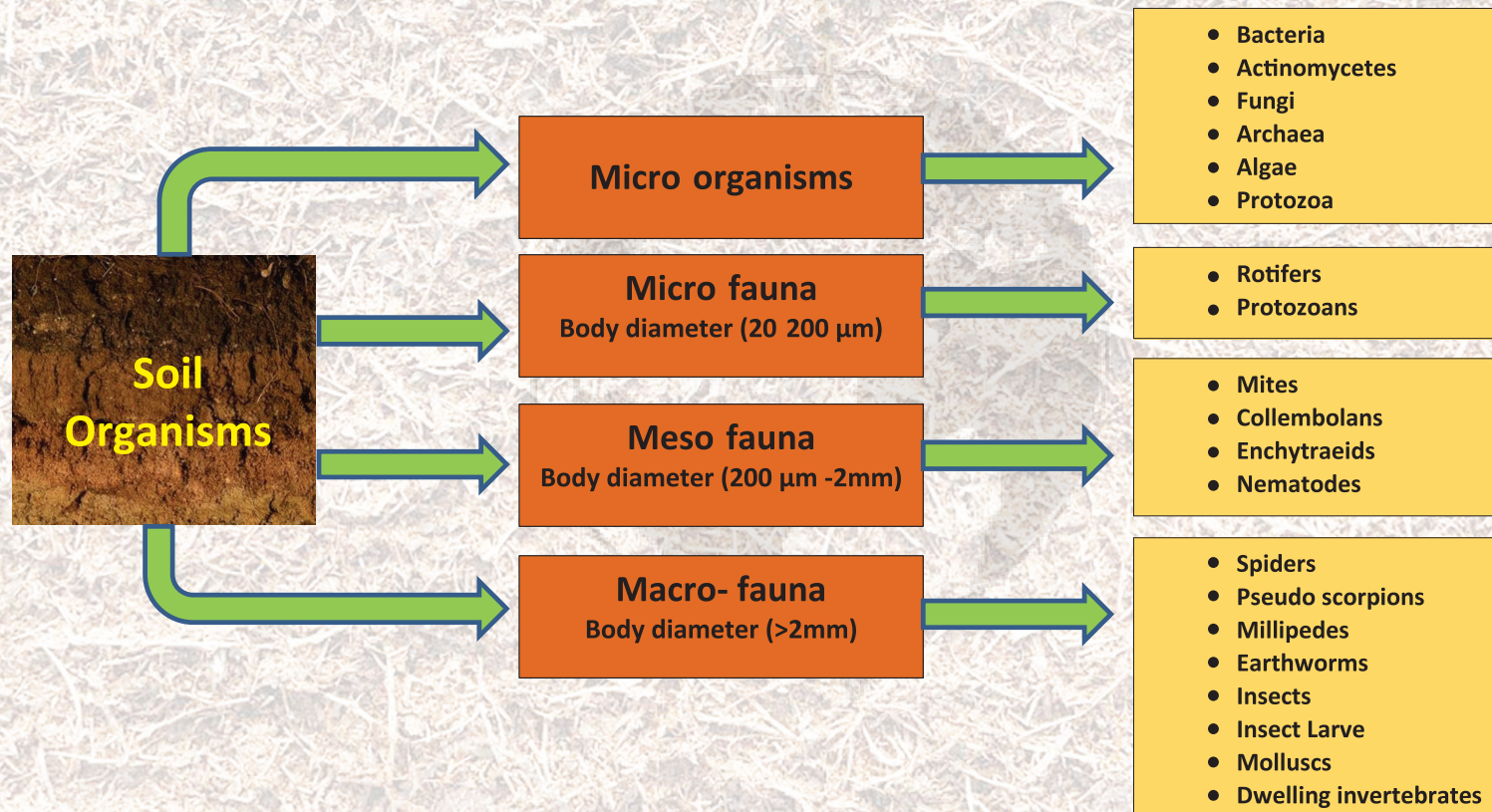
Time is very important factor of the formation of soil. Soil formation is a dynamic process and it takes several thousands of years to significant changes can appear. Time is also important as climate, temperature and moisture content as they can varied time to time and highly influence the weathering of parent materials and decomposition of dead organisms which are involved in the formation of soil.



04. What is Soil Biodiversity?

Soil biodiversity includes the diverse of living organisms ranging from micro-organisms, larger meso-fauna as well as the macro-fauna inhabiting in the soil. These organisms are crucial for the functioning of food webs and they biologically interact with plant materials (e.g. plant roots) and other organisms and buildup symbiotic relationships. Therefore, this variability of living organisms in the soil play a crucial role in the formation of soil, management of nutrient cycles and maintaining the soil fertility, those are essential for the sustainable crop production as well as the forestry management practices.

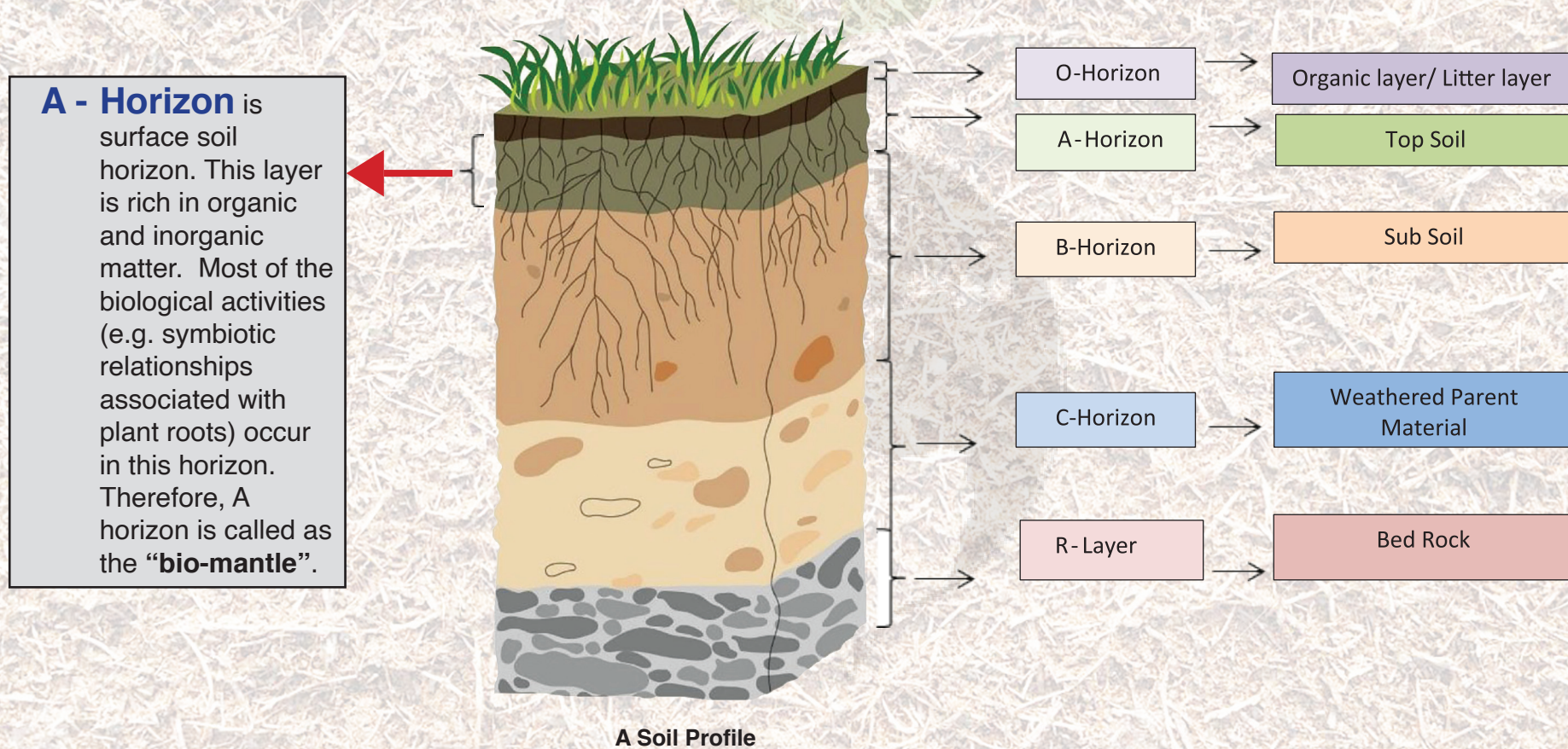
4.1. Major groups of soil organisms representing soil biodiversity





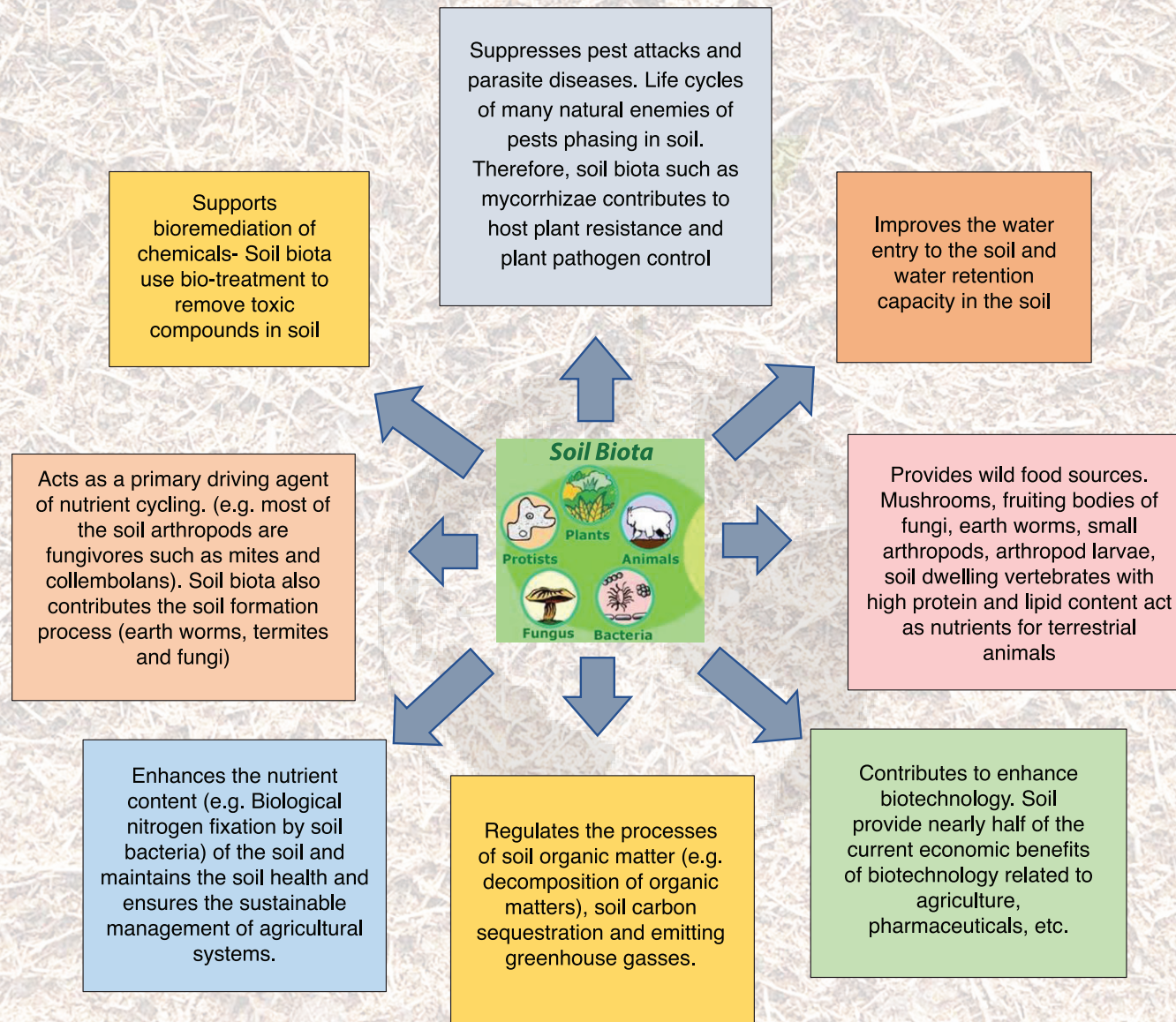
4.2. Distribution of soil organisms in a soil profile

A cross section of a soil is known as a soil profile and it contains a number of soil horizons, namely O, A, B and C. Soil horizon is layer of soil, approximately parallel to the soil surface. Soil horizons are formed as a result of soil forming processes (pedogenesis). Soil layers are different from each other due to their physical properties (e.g. mainly in colour, texture and particle size), chemical properties (e.g. mineral content, cation exchange capacity, pH, Carbon to Nitrogen Ratio, bulk density, etc.) and biological properties. Highest diversity of soil organisms are found in O and A horizons.





05. Importance of soil biodiversity





06. Major causes for the loss of soil biodiversity

Soil biodiversity represents a variety of life present in the soil. It plays a pivotal role for maintaining of soil fertility and regulating nutrient balance and other physical, chemical and biological processes occurring in the soil. Activities such as improper land use practices, waste disposal, indiscriminate use of agrochemicals, pesticides and chemical fertilizer have created very unsuitable conditions for the existence of living organisms inhabiting in the soil. Some of the anthropogenic activities that affect the soil biodiversity are;

01. Intensified and unsustainable land management practices

Large scale land clearing for residential and business purposes, soil compaction due to use heavy machineries, improper agronomic and land management practices have led to damage soil physical and chemical properties. All these impacts are heavily affecting to the loss and damage the diversity of soil organisms that are living in the top soil layers of the soil profile and thereby creating unproductive and infertile soils.

02. Improper farming practices

Large scale, long-term monoculture farming use high amount of chemical inputs (e.g. Agrochemicals such as pesticides, weedicides and over applications of fertilizers) mainly resulted in loss of soil biodiversity and also changing the chemical and physical properties of the soil. Overuse of fertilizer may cause to change the pH level of the soil and it may harm to soil biota. Therefore, Sustainable land management, good agronomic practices, crop rotation and mixed cropping systems can be recognized as some of the feasible solutions to overcome this problem.

03. Human induced soil erosion

Detachment soil particles from the soil and transported to another place by run-off water or wind and get it deposited in another place can be described as soil erosion. Soil erosion removes the top soil layer that is responsible for biological activities of the soil and providing some vital ecosystem services with the help of soil organisms. Therefore, if the soil is not looked after properly, soil fertility and the soil biota will be destroyed due to soil erosion and land degradation.

04. Pollution

Especially, the toxic pollutants and other chemical discharges that are deleterious to the soil biota. Therefore, these pollutants inhibit the existence of the soil biological activities such as regulating nutrient cycles that support to maintain the soil fertility and maintaining the soil structure too.

05. Invasive species

Invasive species are opportunist organisms that are capable of out-competing and suppressing the existence of the associated biota living with them thereby creating monoculture stands. They can become the dominant in a given area quickly if the prevailing conditions become favorable for them. They are responsible for doing so many negative impacts to the native species by invading/ altering their habitats, reducing bio-mass, extinct of some native species that are useful to balance the ecosystems. These invasive species can have mechanisms to inhibit the existence of other species using many mechanisms so that the soil biota also can get disturbed or destroyed.



07. Actions those can be taken to stop the loss of soil biodiversity

01. Introduce better agricultural practices

Good agricultural practices those stimulate macro and micro faunal activities in the soil will influence the well-being of the soil biota. The following practices positively enhance the survival of the soil biota, decreasing the frequent tillage, frequent green manuring, usage of organic fertilizer and pesticides, use of cover crops and crop residues for increasing the quality and quantity of soil, practicing crop rotation, practicing Integrated Pest and Plant Nutrient Management Systems.

02. Application of sustainable land management practices

The surface soil layer is rich in soil organisms and their biological activities. Soil erosion and land degradation in agricultural lands due to various improper agricultural practices, poor soil conservation practices, farming in slopy areas greatly influence the soil erosion and land degradation and enhance the loss of top soil. Therefore, application of better agronomic, soil and land management practices in agriculture can minimize the soil biodiversity losses. Burning of Agricultural lands with crop residues and forest fires will also destroy the top soil and we must pay attention to prevent them in order to save the soil biota.

03. Promote conservation, research and knowledge management for protecting soil biodiversity

Soil biodiversity is a major driver for the maintenance of healthy soil. Healthy lands ensure great harvests. Modern agricultural practices using higher doses of chemical fertilizer, agro-chemicals and pesticides have the potential of causing loss of soil biodiversity and consequently it will lead to land degradation and environmental pollution. It will lead to trigger ground and surface water pollution as well. Ultimately it could influence the ill effects of climatic change. Soil macro and micro diversity plays a very important role in providing ecosystem services including whole fertility management of soil and the formation of soil. Proper awareness of the people regarding the importance of soil as a living substrate and its economic and environment values for the survival of living beings would influence the conservation of soil biota.

04. Create green cities as a solution for the progressive urbanization

Progressive urbanization leads to the consumption of natural resources unsustainably and accumulation of unbearable wastes on land and blocking the waterways and caused floods. Expansion of urban areas causes direct or indirect damages to natural habitats and alter the natural ecosystems (e.g. reclamation of wetlands for building constructions in urban areas). Therefore, urbanization heavily impact the land resources and thereby cause loss of soil biodiversity. The green city concept could be coupled with better management of wastes, water resources, energy and maintaining natural environment with proper landscape practices and good tree planting campaigns help to minimize the loss of soil and its diversity.



05. Reduce, reuse and recycle of pollutants to the environment

Anthropogenic activities create various types of solid, liquid and gaseous pollutants. These wastes could release to the environment in the forms of solid wastes, chemical wastes, effluents and harmful emissions. These wastes must be well treated at least with reduce, recycle or reuse techniques before let them into the environment. Use of degradable products, the use of eco-friendly alternatives and reuse of some the non-degradable products and avoiding single use polythene products could considered best practices. Majority of the pollutants released due to anthropogenic activities will accumulate in the soil and would cause severe damage to the soil by changing the soil properties and their biological function due to loss of its soil biota. Employing proper management practices to dispose the wastes could conserve both environment and enhance the soil biota.

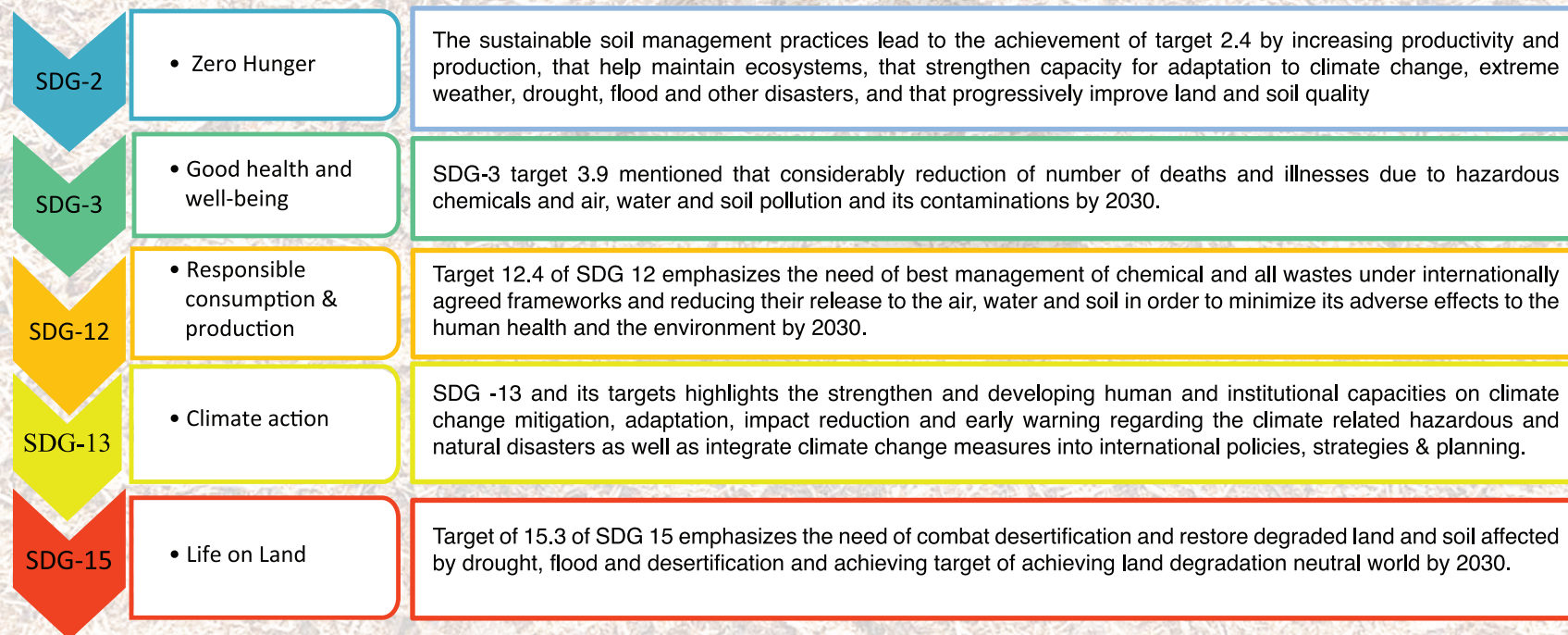




08. Sustainable soil management plays a crucial role in achieving the Sustainable Development Goals (SDG's)

Sustainable Development Goals (SDGs) are a set of 17 interlinked Global Goals that were adopted by the United Nations General Assembly in 2015. There are specific targets identified for each goal those intended to be achieved by the year 2030. Achieving SDG's ensures a better and a more sustainable future for all the nations. Applications of SDG's are highly emphasized the sustainable management of natural resources under the phenomena such as increase in population, decrease in availability of resources (e.g. water, land, nutrients, etc.) and restrictions of food productions due to climate change. Further, some of the major issues such as soil erosion and depletion of soil organic matter content greatly linked with the quality of the whole ecosystems and livelihood of the people around the world. Hence, the SDG's are providing better guidance to enhance sustainable food production, eradicate the poverty and ensure the well-being of the people in the world.

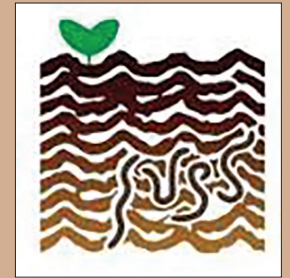
Sustainable land management paves the way for healthy soils and lay a better foundation for plant growth. It in turn gives the world a healthy and productive land and help us to obtain bounty harvests ensuring your food security. Sustainable land and soil management plays a crucial role in achieving some of the SDG's such as;





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INTERNATIONAL
Decade
of
Soils
2015 - 2024

Themes of the World Soil Day (2013 - 2020)



**SOIL
BIODIVERSITY**

*"The Hidden World
Beneath Our Feet"*

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