PAPER V: UNIT – V

Process of soil formation, soil profile, soil biota and their role

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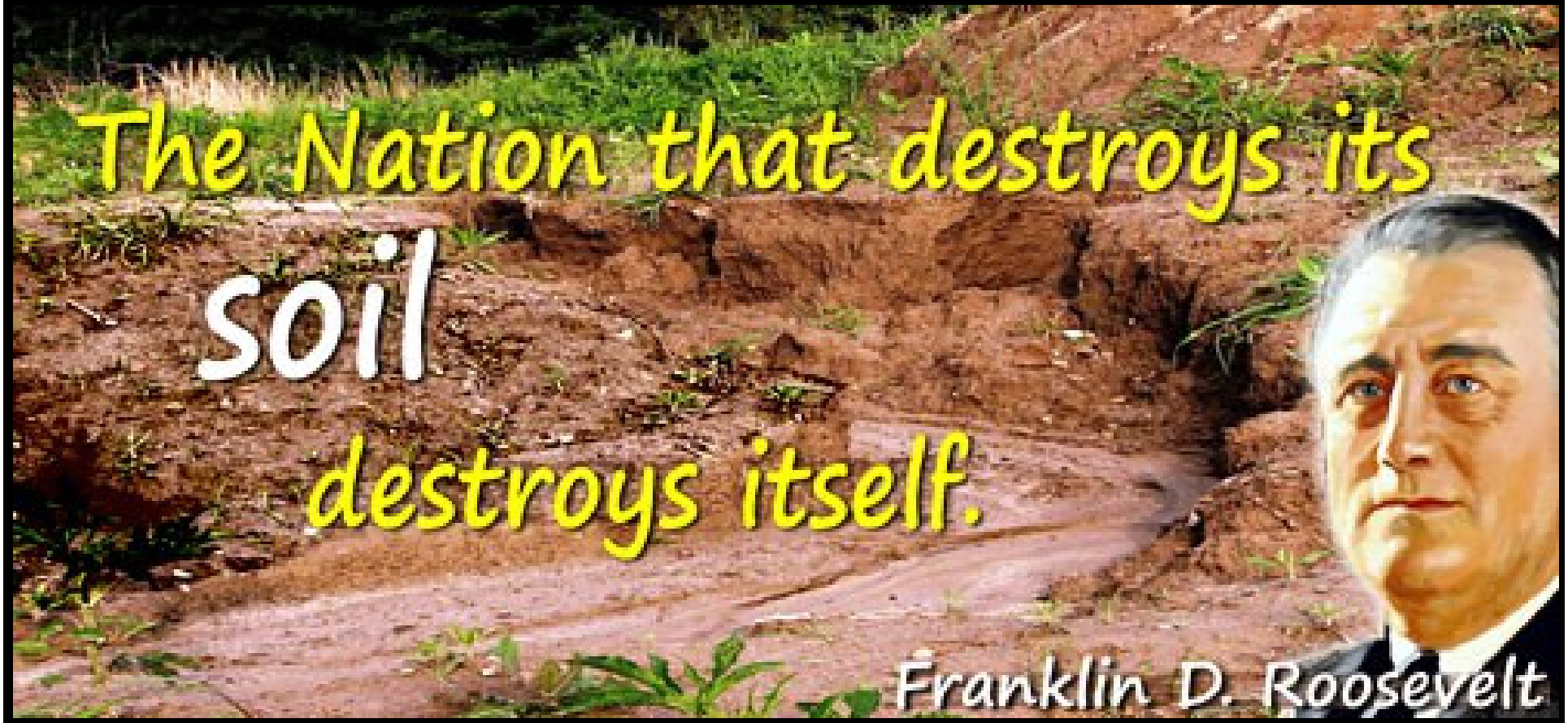
SYLLABUS

Unit – V: Ecology and Environment:

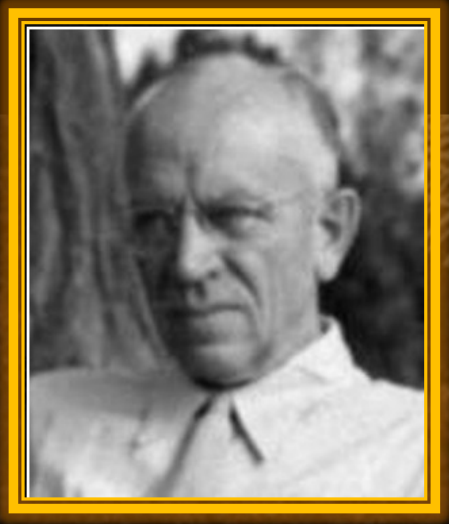
5.1 Concept of environment, Concept and scope of ecology.
5.2 Ecological factors- Climatic- Light, Temperature and Water.
5.3 Atmosphere and its composition.
5.4 Edaphic factor- Process of soil formation, soil profile, soil biota and their role.
5.5 Ecological Adaptations - Morphological and Anatomical adaptation in Hydrophytes, and Xerophytes.

Marathi: Mother Earth is

काळी आई – भूमाता



काळी आई – भूमाता



"Land is not merely soil, it is a fountain of energy flowing through a circuit of soils, plants and animals."

Aldo Leopold, Author, philosopher, scientist and conservationist

माती म्हणजे प्रत्येक सजीवातला दुवा,
इथेच सुरुवात आणि इथेच शेवट!

LetsUp.in
The World Of Infotainment

जागतिक माती दिवस । ५ डिसेंबर

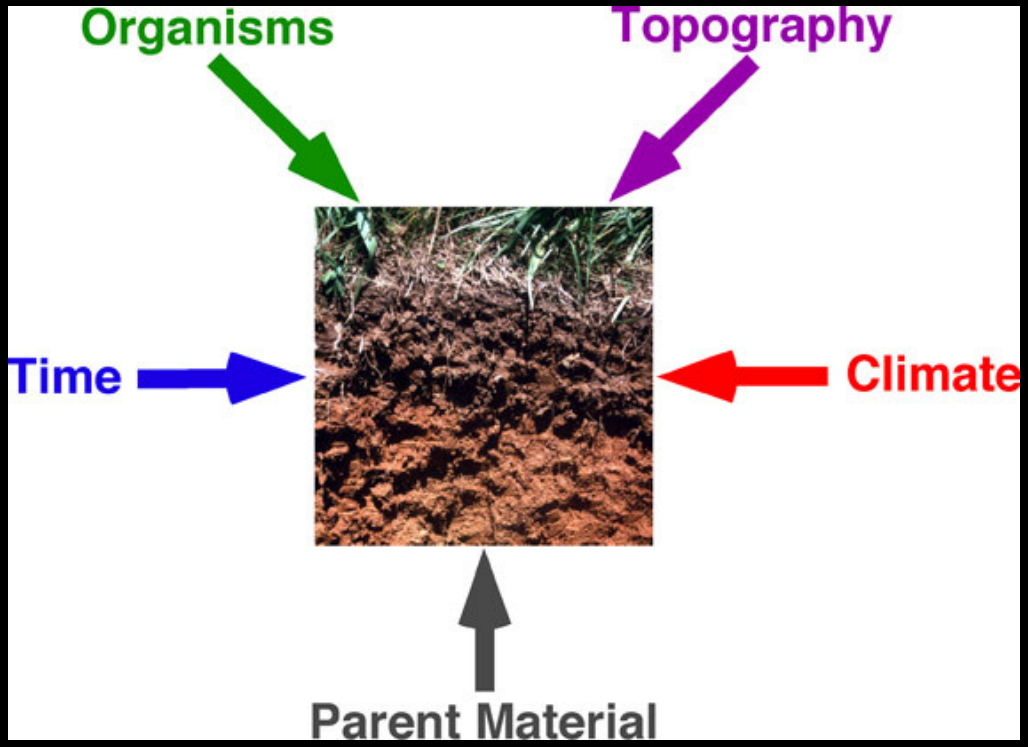
INTERNATIONAL SOIL DAY – 5TH DECEMBER

Soil is the outermost solid and fertile layer of the Earth

A natural product formed from weathered rock by the action of climate & living organisms

A collection of natural bodies of earth that is composed of mineral & organic matter, & is capable of supporting plant growth

How Is Soil Formed



PEDOGENESIS

Greek *pedo*-, or *pedon*, meaning 'soil, earth,' and *genesis*, meaning 'origin, birth'

Pedogenesis is the study of the processes that lead to the formation of soil

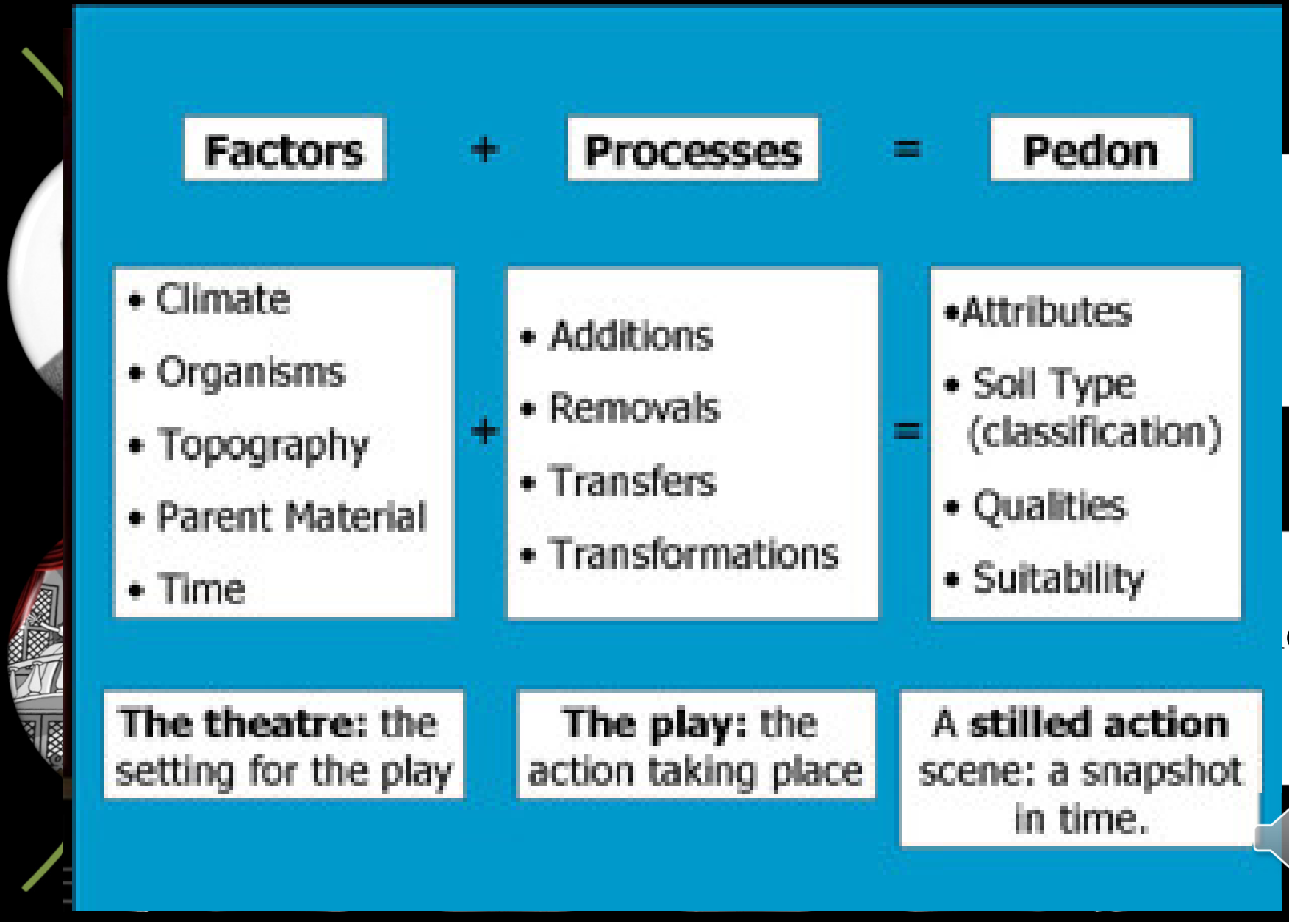
First explored by the **Russian Geologist Vasily Dokuchaev**,

The so-called grandfather of soil science,

He determined that soil formed over time as a consequence of climatic, mineral and biological processes.

Pedology is independent branch to study soil in its natural environment.

PEDOGENESIS - A NATURE'S PLAY



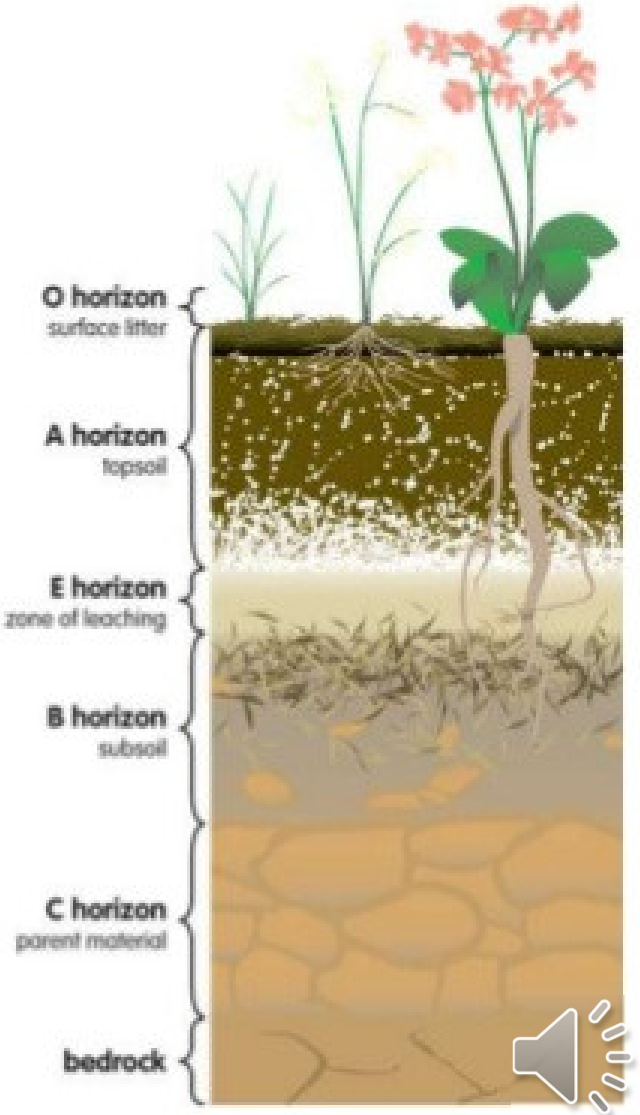
Soil Forming Processes

- Soil formation or pedogenesis is the combined effect of physical, chemical, biological and anthropogenic processes working on soil parent material.

- Soil is said to be formed when organic matter has accumulated and colloids are washed downward, leaving deposits of clay, humus, iron oxide, carbonate and gypsum producing a distinct layer called the B horizon.

- These constituents are moved from one level to another by water and animal activity.

- The alteration and movement of materials within a soil causes the formation of distinctive soil horizons.



SOIL FORMATION

Parent material (Rock): is slowly broken down by biological, chemical and physical weathering.

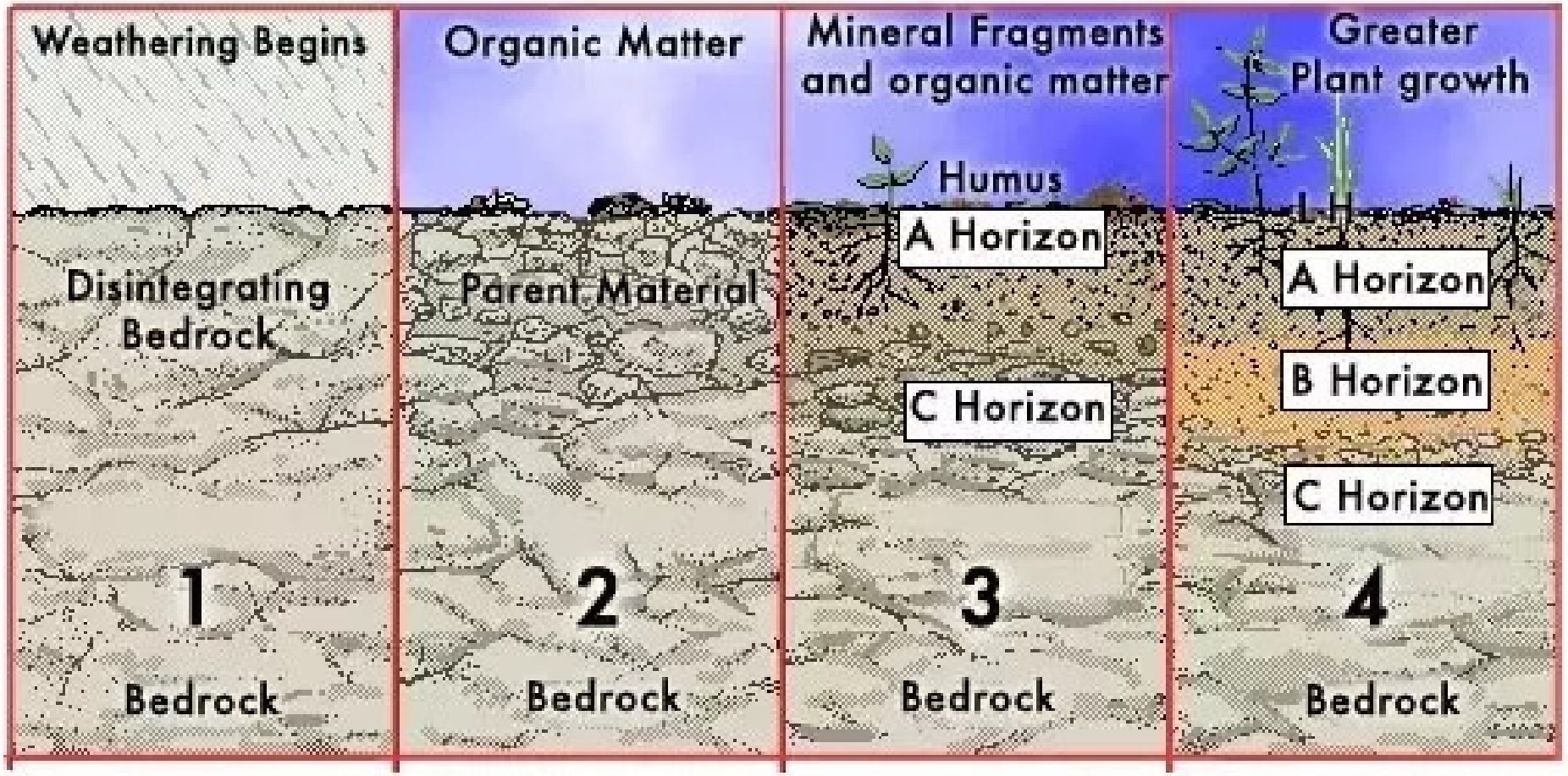
Biological - Respiration of plant roots and other organisms produce CO2, which reacts with soil water to produce carbonic acid (H2CO3).

Chemical - Acids crack rocks, water seeps in, breaks down particles.

Physical - Weathering introduces water that breaks down particles.

Time scale - Formation of 2.5 cm of topsoil takes yrs.

PROCESS OF SOIL FORMATION



FACTORS AFFECTING SOIL FORMATION

Time: Most of the soils of the world have taken more than 10,000 years to form the current state of soils.

Parental Material (PM): Determines the mineralogical composition and widely contributes to the chemical and physical characteristics of the soil.

Climate: especially precipitation, temperature and frost action have a fundamental influence on the soil formation process that takes place within any given location.

Topography : It is the configuration of a land surface and the relations among its man-made and natural features.

Organisms: Fungi, bacteria, animals, humans, and vegetations are the major determinants and they impact on the physical and chemical environments of the soils.

SOIL COMPOSITION

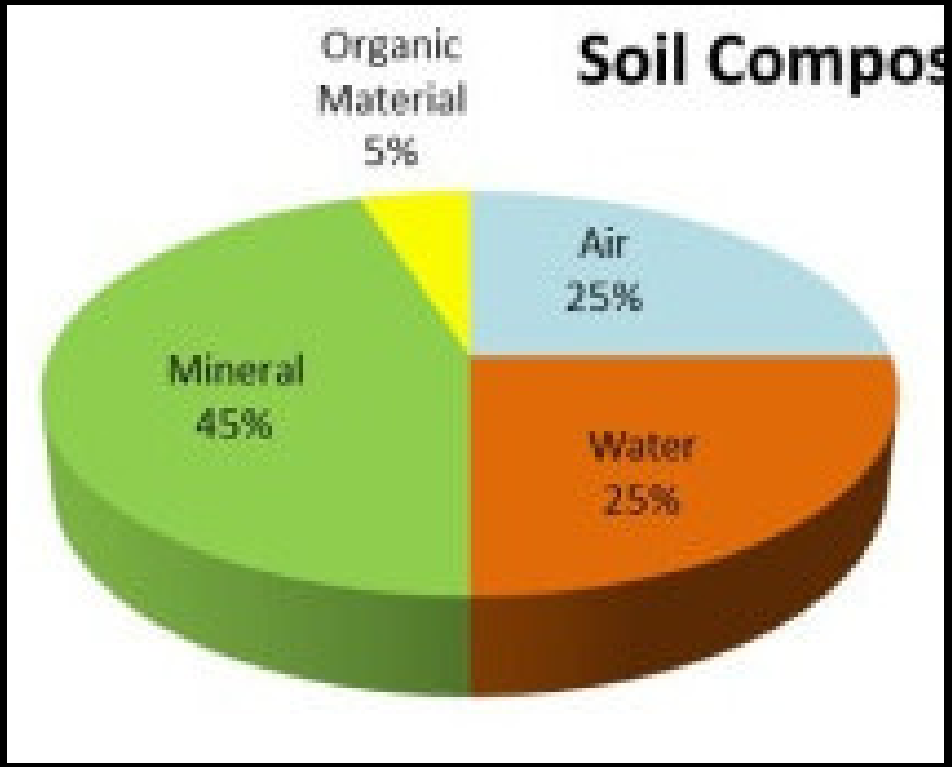
45% Mineral particles (broken down pieces of rock)

5% Organic matter (humus - from dead organisms, worm castings, leaf litter)

25% Water (precipitation)

25% Air (More with sandy soil, less with clay soil)

Soil organisms - Millions in one teaspoon of fertile agricultural soil!- bacteria, fungi, algae, microscopic worms.



SOIL PROFILE

Cross section of soil layers revealing all soil horizons-

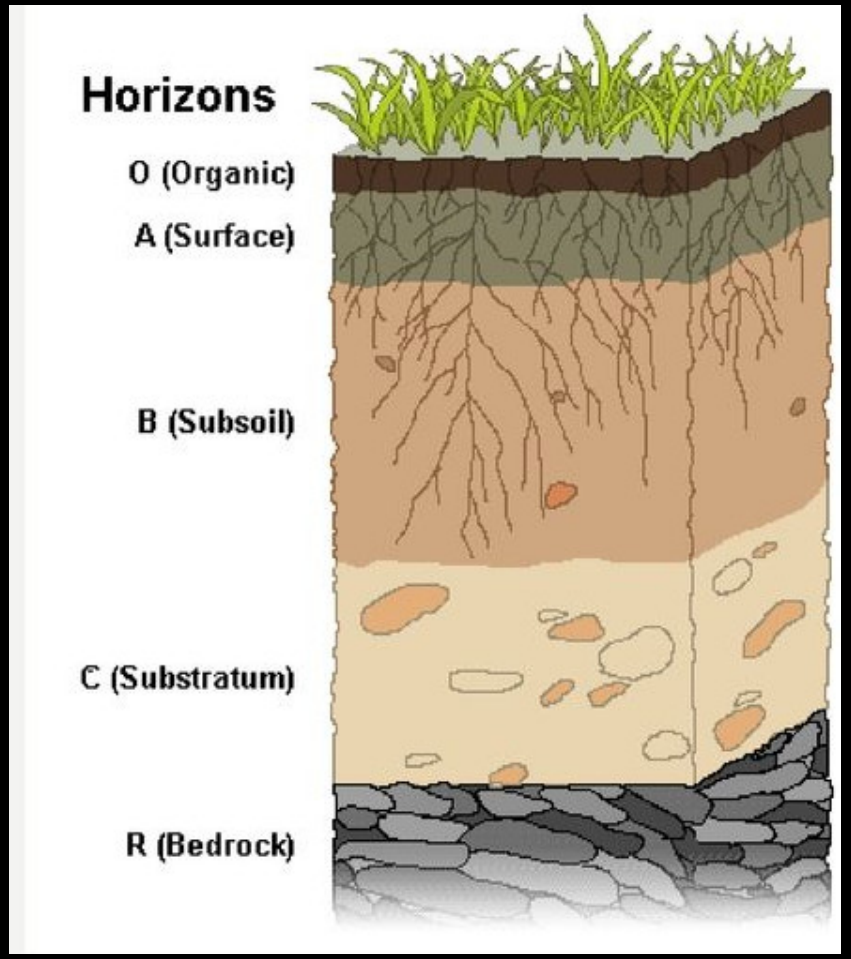
O Horizon = organic material (humus)

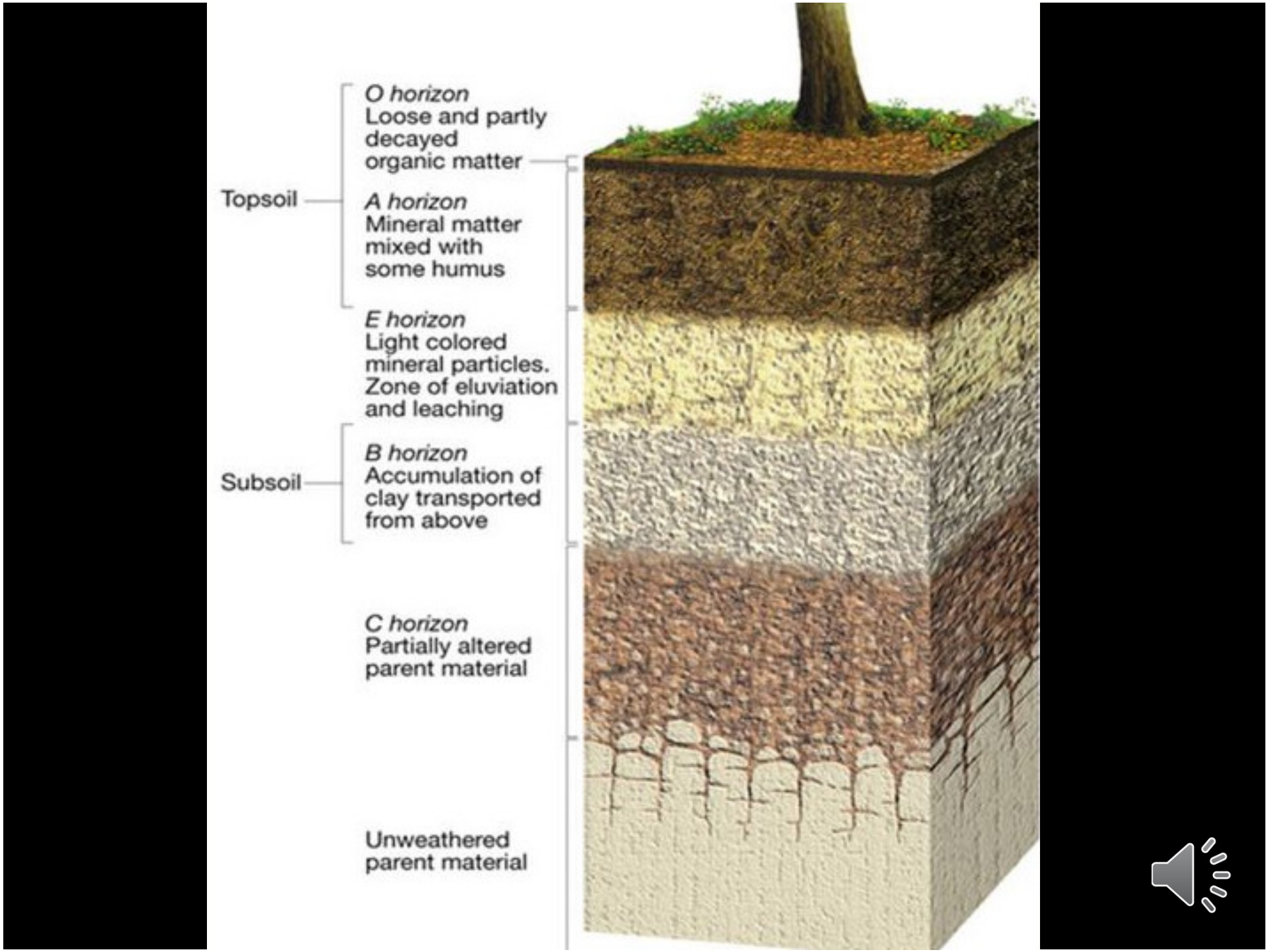
A Horizon = topsoil

B Horizon = subsoil

C Horizon = partially weathered parent material

R Horizon = bedrock



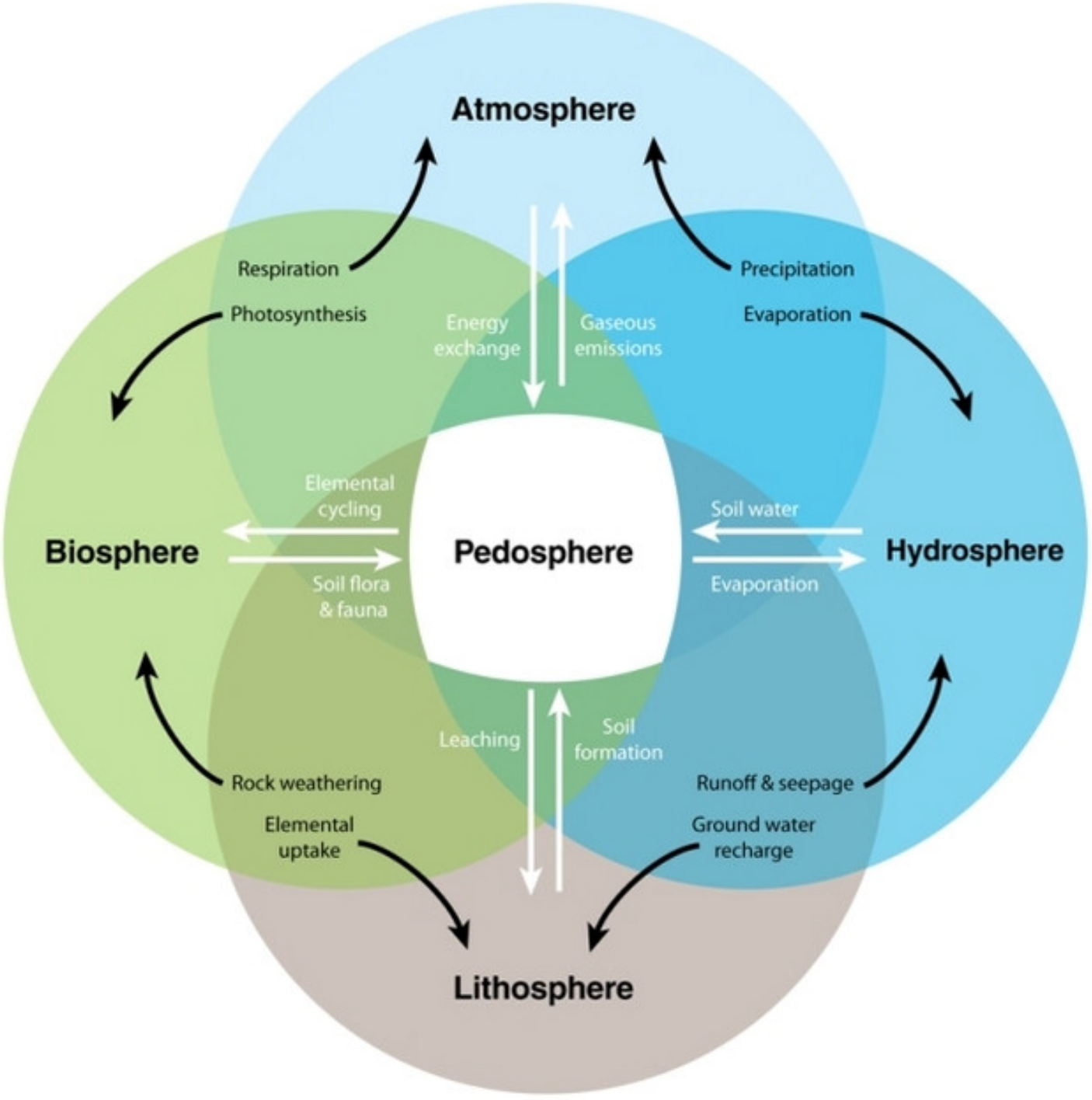

Topsoil
Subsoil
O horizon
Loose and partly decayed organic matter
A horizon
Mineral matter mixed with some humus
E horizon
Light colored mineral particles. Zone of eluviation and leaching
B horizon
Accumulation of clay transported from above
C horizon
Partially altered parent material
Unweathered parent material

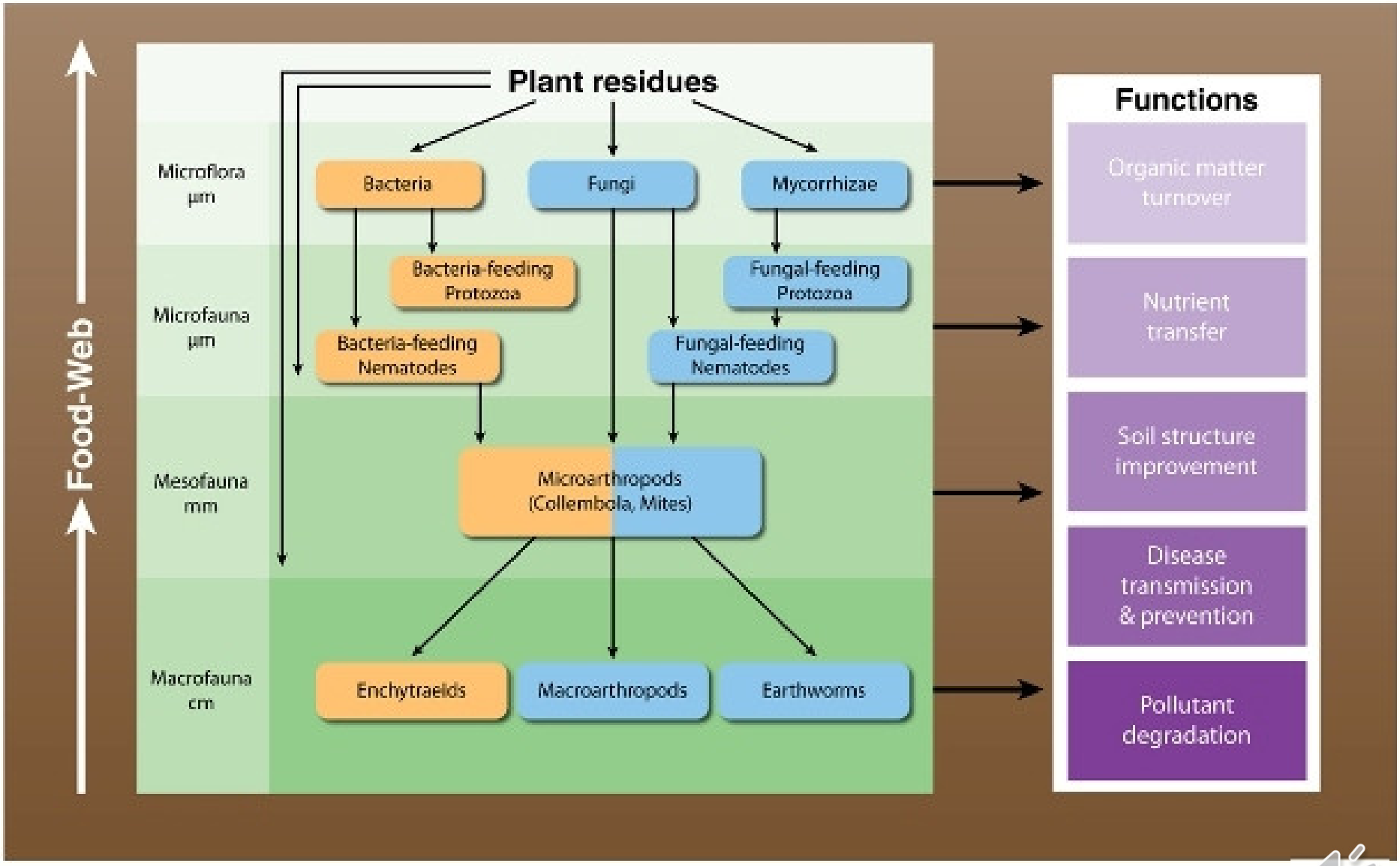
SOIL BIOTA - PEDOSPHERE

A 'biological universe' exists in a gram of soil.

The soil biota within this tiny universe transform energy, create and modify their habitat, influence soil health, and aid in the regulation of greenhouse gases.

Pedosphere: the outermost layer of the Earth that is composed of soil and subject to soil formation processes.


Atmosphere
Respiration
Photosynthesis
Energy exchange
Gaseous emissions
Precipitation
Evaporation
Elemental cycling
Soil flora & fauna
Biosphere
Pedosphere
Soil water
Evaporation
Hydrosphere
Leaching
Soil formation
Rock weathering
Elemental uptake
Runoff & seepage
Ground water recharge
Lithosphere


Food-Web
Plant residues
Microflora
µm
Microfauna
µm
Mesofauna
mm
Macrofauna
cm
Bacteria
Fungi
Mycorrhizae
Bacteria-feeding
Protozoa
Fungal-feeding
Protozoa
Bacteria-feeding
Nematodes
Fungal-feeding
Nematodes
Microarthropods
(Collembola, Mites)
Enchytraelids
Macroarthropods
Earthworms
Functions
Organic matter
turnover
Nutrient
transfer
Soil structure
improvement
Disease
transmission
& prevention
Pollutant
degradation

ROLE OF SOIL BIOTA

The regulation of biogeochemical transformations.

Formation and turnover of soil organic matter (OM) that includes mineralization and sequestration of C,

Nutrient cycling,

Disease transmission and prevention,

Pollutant degradation,

Improvement of soil structure

Soil management practices such as N fertilization and tillage can stimulate specific microbial activities such as **autotrophic nitrification**, **denitrification** and **mineralization**

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Thanks!