

SOIL POLLUTION

The background image depicts a stark landscape where a single, vibrant green seedling with three leaves is the only sign of life. It grows from a parched, brown soil surface that is deeply fissured with a network of cracks. Above the horizon, a massive, billowing cloud formation is illuminated from below, creating a dramatic, golden-orange glow that fills the upper half of the frame.

MGU>CBCS> ENVS> Dr Smarajit Maiti, 5.10.21

(Curtsy: Web information)

What is soil?

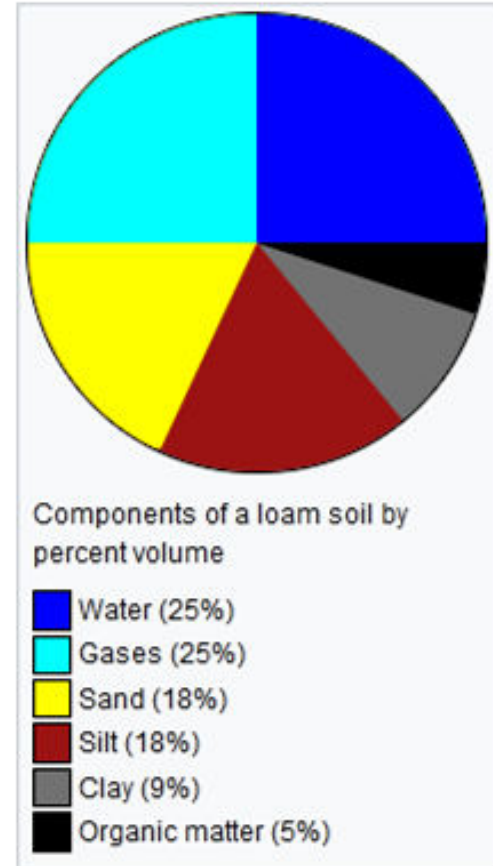
Soil is a mixture of organic matter, minerals, gases, liquids, and organisms that together support life. Earth's body of soil, called the pedosphere, has four important functions:

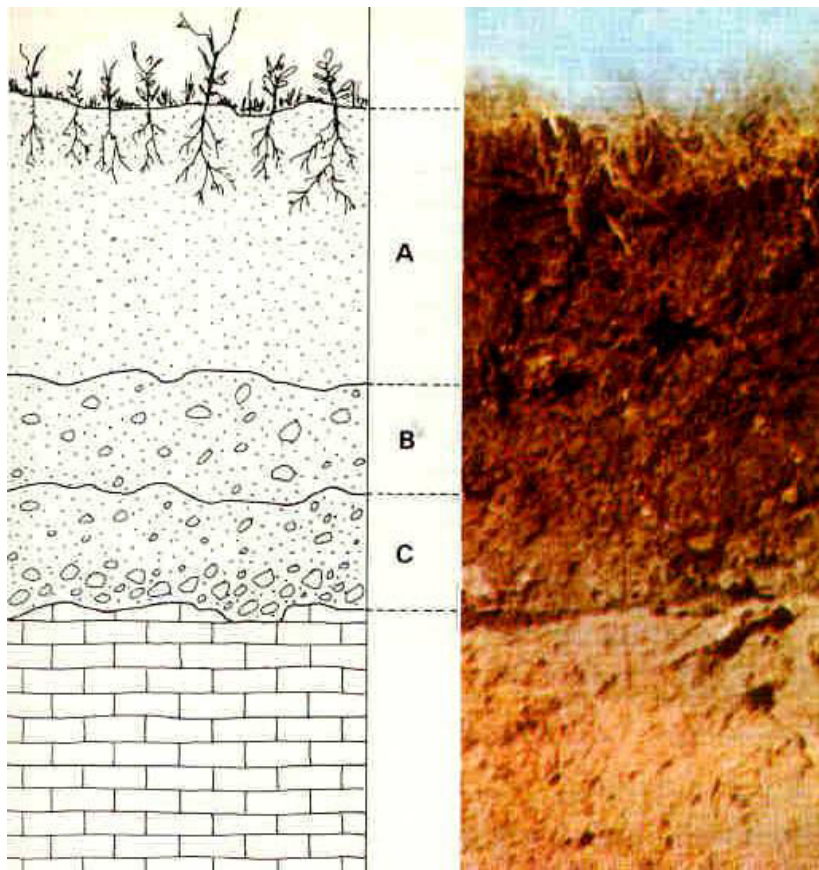
as a medium for plant growth

as a means of water storage, supply and purification

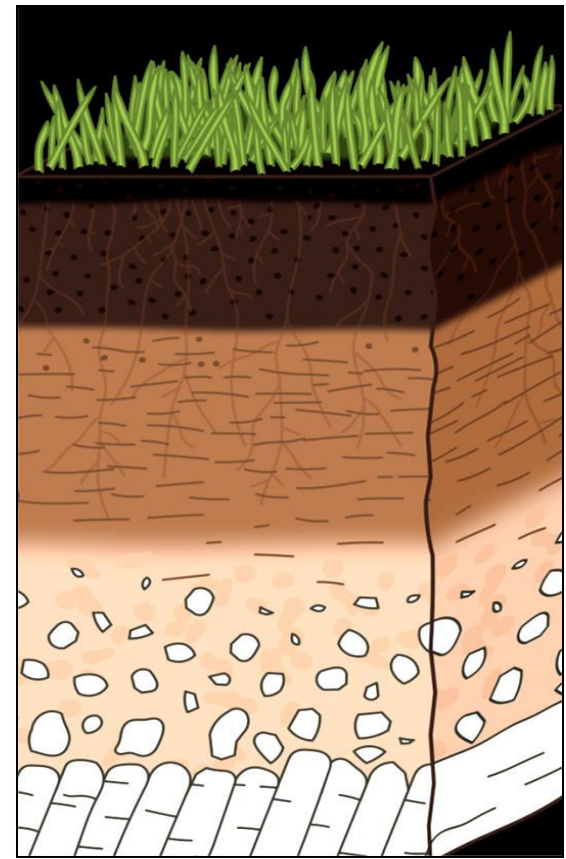
as a modifier of Earth's atmosphere

as a habitat for organisms





A, B, and C represent the [soil profile](#), a notation firstly coined by [Vasily Dokuchaev](#) (1846–1903), the father of [pedology](#); A is the [topsoil](#); B is a [regolith](#); C is a [saprolite](#) (a less-weathered regolith); the bottom-most layer represents the [bedrock](#).



Soil profile:
Darkened topsoil and reddish subsoil layers are typical of [humid subtropical climate](#) regions

CAUSES

NATURAL CAUSES



MANMADE CAUSES



NATURAL CAUSES:

LANDSLIDES , HURRICANES ...

MAN-MADE CAUSES:

- URBANISATION...
- INDUSTRIAL WASTES...
- MINING...
- AGRICULTURAL WASTES...
- DOMESTIC WASTES AND

GARBAGE...

RADIOACTIVE WASTES...

Soil pollution can be caused by the following (non-exhaustive list)

- [Microplastics](#)
- [Oil spills](#)
- [Mining](#) and activities by other heavy industries
- Accidental spills may happen during activities, etc.
- Corrosion of [underground storage tanks](#) (including piping used to transmit the contents)
- [Acid rain](#)
- [Intensive farming](#)
- [Agrochemicals](#), such as [pesticides](#), [herbicides](#) and [fertilizers](#)
- [Petrochemicals](#)
- [Industrial accidents](#)
- [Road debris](#)
- Drainage of contaminated [surface water](#) into the soil
- [Ammunitions](#), [chemical agents](#), and other agents of war

- Waste disposal
 - Oil and fuel dumping
 - Nuclear wastes
 - Direct discharge of industrial wastes to the soil
 - Discharge of sewage
 - Landfill and illegal dumping
 - Coal ash
 - Electronic waste
 - Contaminated by rocks containing large amounts of toxic elements.
 - Contaminated by Pb due to vehicle exhaust, Cd, and Zn caused by tire wear.
 - Contamination by strengthening air pollutants by incineration of fossil raw materials.

URBANISATION:

CONTAMINATION OF SOIL
DUE TO WASTE
WATER.UNFIT OF
AGRICULTURAL LAND DUE
TO CONSTRUCTION OF
DAMS , PROJECTS ... IN
NEAR BY PLACES.

INSUSTRIAL

WASTE:

DISCHARGE OF LARGE
QUANTITIES OF
TOXIC,FLAMMABLE,NON-
BIODEGRADABLE SUBSTANCES
ON LAND RESULTS IN SOIL
ROLLUTION.



MINING:

MINING REFERS TO
PROCESS BY WHICH NON-
RENEWABLE SUBSTANCES
AND VALUABLE MINERALS
ARE
EXTRACTED FROM EARTH.IT
LEADS TO CHANGE IN
COMPOSITION OF SOIL.

AGRICUTURAL

WASTE:

WASTES LIKE LEAVES
,GRASS... AND CHMICAL
FERTILIZERS LIKE
PESTICIDES, INSECTICIDES
FOR AGRICULTURAL



DOMESTIC

WASTE:

IT INCLUDES WASTES SUCH AS FOOD WASTES, PAPER., GLASS, PLASTIC MATERIALS... CONTRIBUTE TO SOIL POLLUTION.



RADIOACTIVE

WASTE:

NUCLEAR POWER PLANTS, NUCLEAR TESTING, AND EXPLOSION... ADD VARIABLE AMOUNT OF RADIOACTIVE MATERIALS TO SOIL.



CASE STUDIES...

•LAND DEGRADATION AND DROUGHT IN INDIA:

It is important to protect the land from deforestation, fragmentation, degradation and drought. About 69% of India's total geographical area is under dry lands .These areas incidentally are highly populated which makes the people impacts livelihoods directly . An estimated 32 percent of India's total land area is affected by land degradation.

Effects of Soil pollution

Health effects

via inhalation of soil contaminants which have vaporized; infiltration of soil contamination into groundwater [aquifers](#) used for human consumption, This tends to result in the development of [pollution-related diseases](#).

Chronic exposure to [chromium](#), [lead](#) and other metals, Arsenic, petroleum, solvents, and many pesticide and herbicide formulations can be carcinogenic, can cause [congenital disorders](#), or can cause other chronic health conditions.

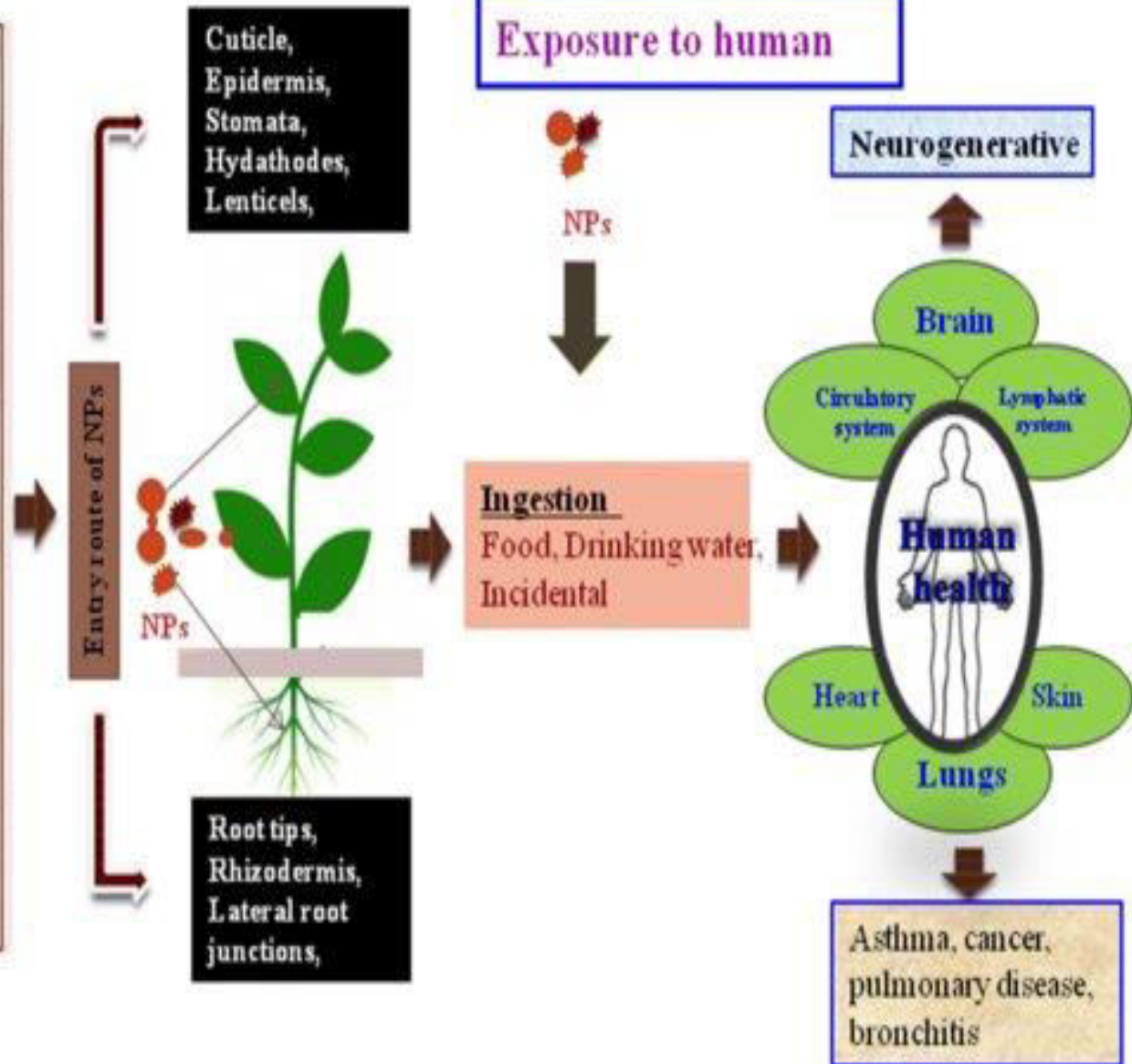
Chronic exposure to benzene at sufficient concentrations is known to be associated with higher incidence of leukemia.

Mercury and [cyclodienes](#) are known to induce higher incidences of kidney damage

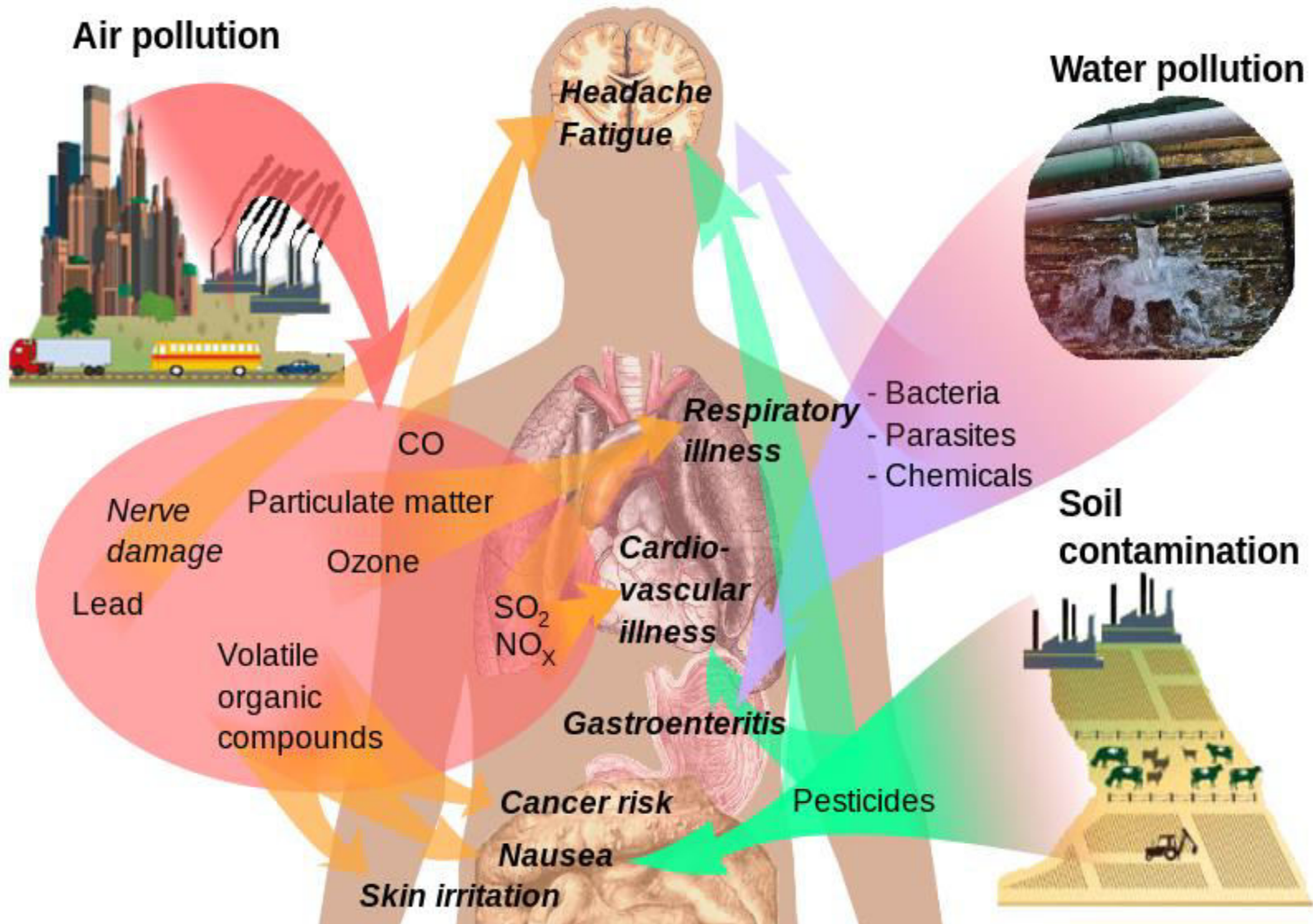
Polychlorinated Biphenyls (PCBs) PCBs and cyclodienes are linked to liver toxicity. [Organophosphates](#) and [carbonates](#) can induce a chain of responses leading to [neuromuscular blockage](#). Many chlorinated solvents induce liver changes, kidney changes and depression of the central nervous system.

Sources of Nanoparticles to the soil

- Agrochemicals
- Accidental releases
- Leakage from landfills
- Commercial products
- Used for remediation
- Atmospheric fallout



Health effects of pollution



Ecosystem effects

Many hazardous chemicals exerts effects on the contaminant species. These changes can manifest in the alteration of [metabolism](#) of endemic [microorganisms](#) and [arthropods](#) resident in a given soil environment.

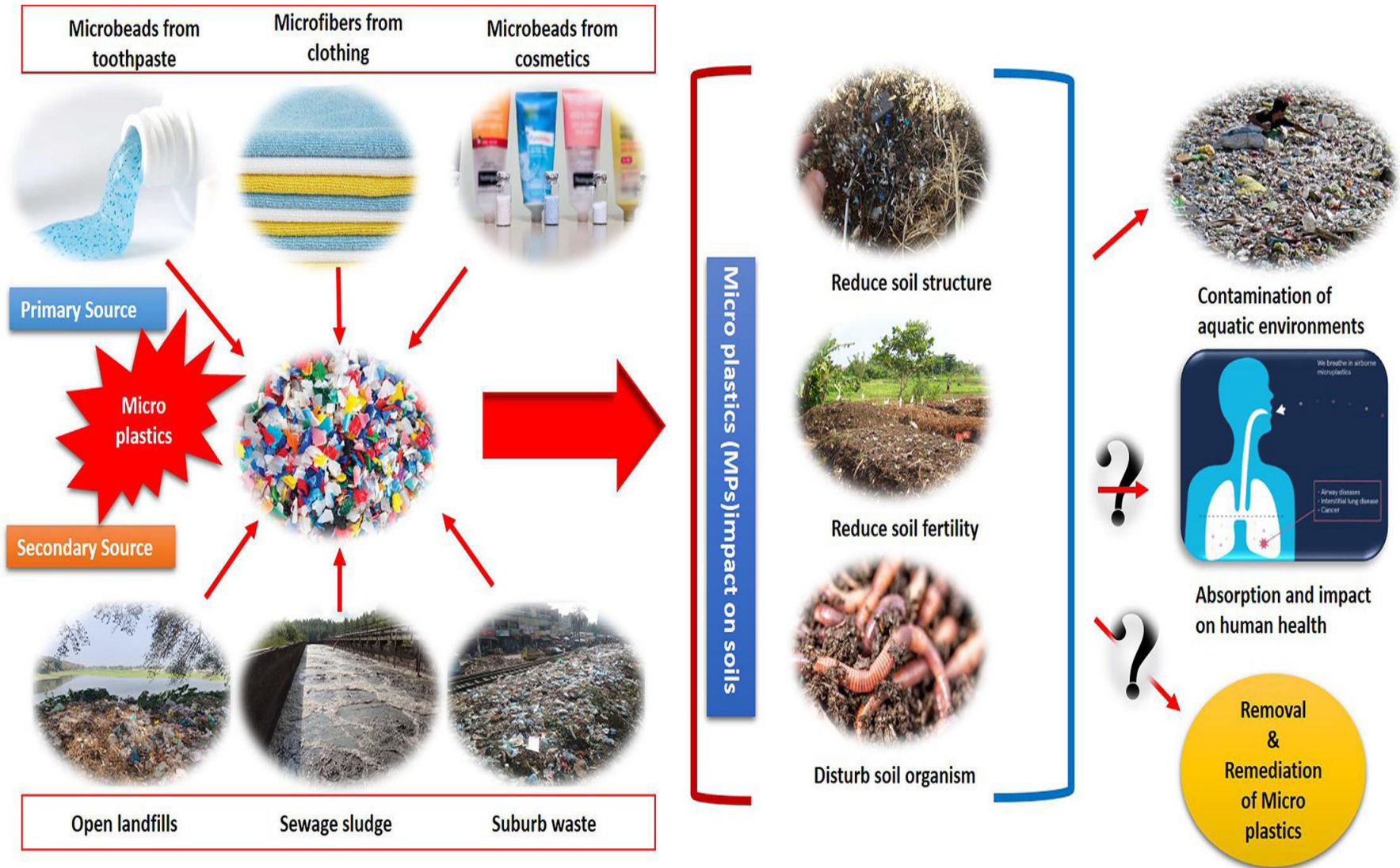
The result can be virtual eradication of some of the primary food chain, which in turn could have major consequences for [predator](#) or consumer species. Such as the concentration of persistent DDT materials for avian consumers, leading to weakening of egg shells, increased chick [mortality](#) and potential extinction

Effects occur to [agricultural](#) lands which have certain types of soil contamination. Contaminants typically alter plant metabolism, often causing a reduction in crop yields.

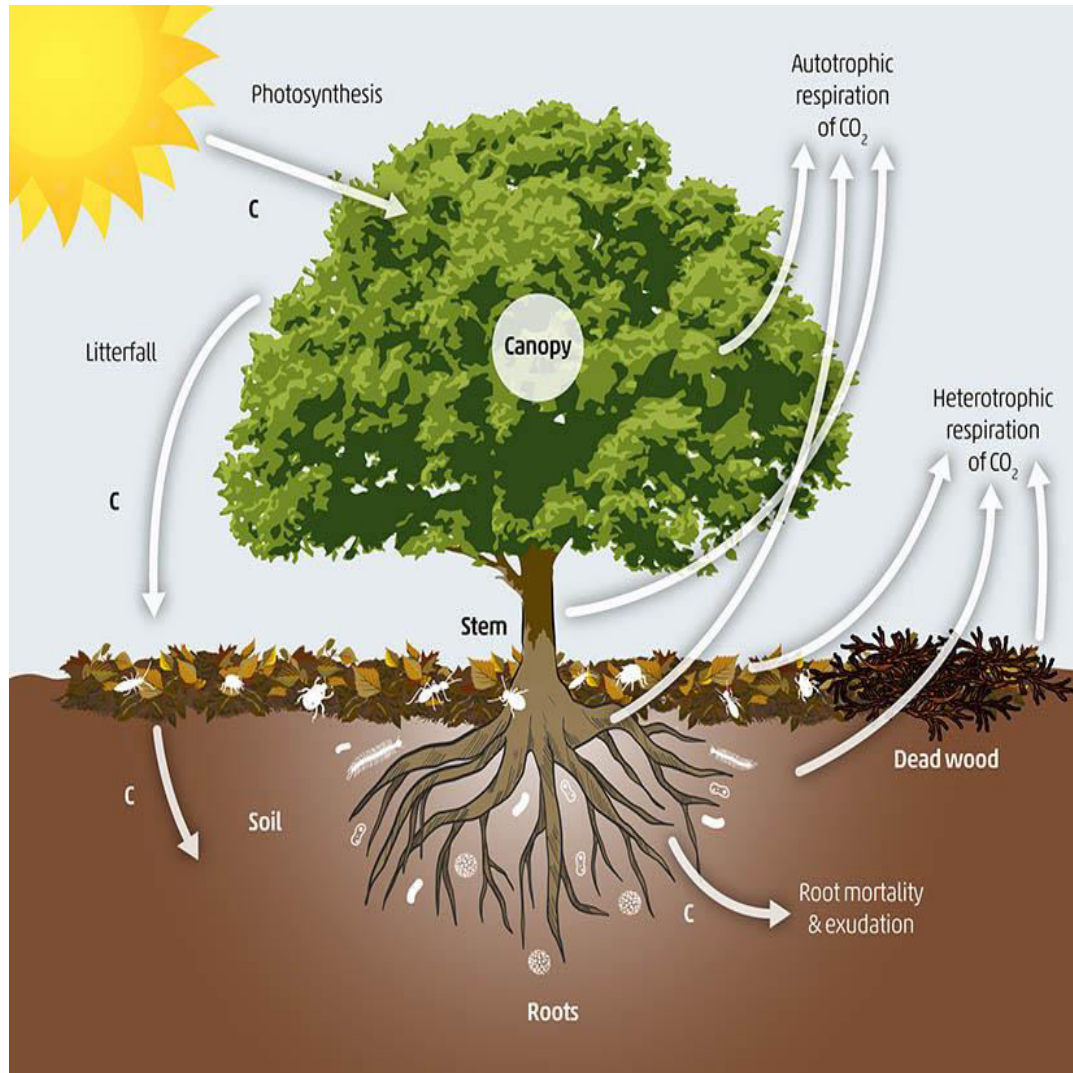
This has a secondary effect upon [soil conservation](#), since the languishing crops cannot shield the Earth's soil from [erosion](#).

Some of these chemical contaminants have long [half-lives](#) and in other cases derivative chemicals are formed from decay of primary soil contaminants

Soil pollution effects on ecosystem



Soil pollution effects on ecosystem



Comb Chem High Throughput Screen , 2020;23(9):972-980.

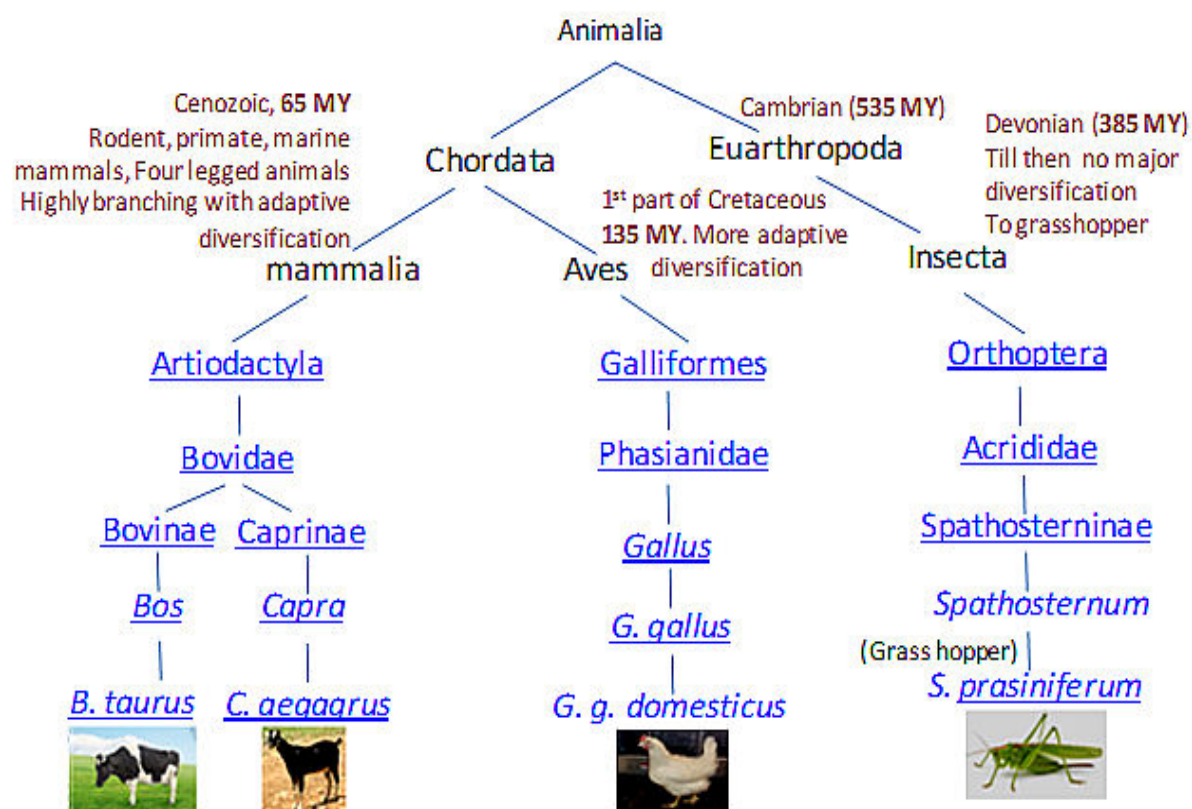
doi: 10.2174/1386207323666200415110745.

Oxidative Stress-induced Toxicity and DNA Stability in Some Agri-field Based Livestock/Insect by Widely used Pesticides

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•DOI: [10.2174/1386207323666200415110745](https://doi.org/10.2174/1386207323666200415110745)



Field-insects are highly integrated into the ecosystem and the local bio-geo-chemical cycle, which may be impaired. Pesticides may have toxic effects on higher vertebrates and may sustain in the soil after being metabolized into their different derivatives. Some of the sensitive biochemical parameters of this organism may be used as a biomarker for pesticide toxicity.

Adaptive diversification and
Phylogenetic branching, DNA stability against experimental pesticides

Prevention of the soil pollution and Cleaning up the Contaminated/polluted Soil

Cleanup or [environmental remediation](#) is analyzed by [environmental scientists](#) who utilize field measurement of [soil chemicals](#)

Scientists apply [computer models](#) ([GIS in Environmental Contamination](#)) for analyzing transport

Various technologies have been developed for remediation of oil-contaminated soil and sediments : like; Excavate soil and take it to a disposal site.

This technique also applies to dredging of [bay muds](#) containing toxins.

Aeration of soils at the contaminated site (with attendant risk of creating [air pollution](#))

Thermal remediation by introduction of heat to raise subsurface temperatures sufficiently high to volatilize chemical contaminants out of the soil for vapor extraction.

Technologies include [electrical resistance heating \(ERH\)](#),

[Bioremediation](#), involving microbial digestion of certain organic chemicals.

Techniques used in bioremediation include [landfarming](#), [biostimulation](#) and [bioaugmentating soil biota](#) with commercially available microflora.

Extraction of [groundwater](#) or soil [vapor](#) with an active [electromechanical](#) system,

[Phytoremediation](#), or using plants (such as willow) to extract heavy metals.

[Mycoremediation](#), or using [fungus](#) to metabolize contaminants and accumulate heavy metals.

Remediation of oil contaminated sediments with self-collapsing air [microbubbles](#).

[Surfactant leaching](#)

How we can prevent Soil pollution?

- By reducing the use of plastics, we can reduce soil pollution.
- By controlling the use of chemical fertilizers and pesticides
- Treating industrial waste before releasing.

Soil erosion is the natural process in which the topsoil of a field is carried away by physical sources such as wind and water. Soil erosion can be controlled by the following measures:

- Plant trees on barren lands to limit erosion of soil.
- Add mulch and rocks to prevent the plants and grass underneath to prevent soil erosion.
- Mulch matting can be used to reduce erosion on the slopes.
- Put a series of fiber logs to prevent any water or soil from washing away.
- A wall at the base of the slope can help in preventing the soil from eroding.
- Every household should have a proper drainage system so that water flows down into proper water collecting systems.



Thank you