



Erasmus+

SOIL POLLUTION

ITS INFLUENCE ON HUMANS AND ENVIROMENT



WHAT IS SOIL?

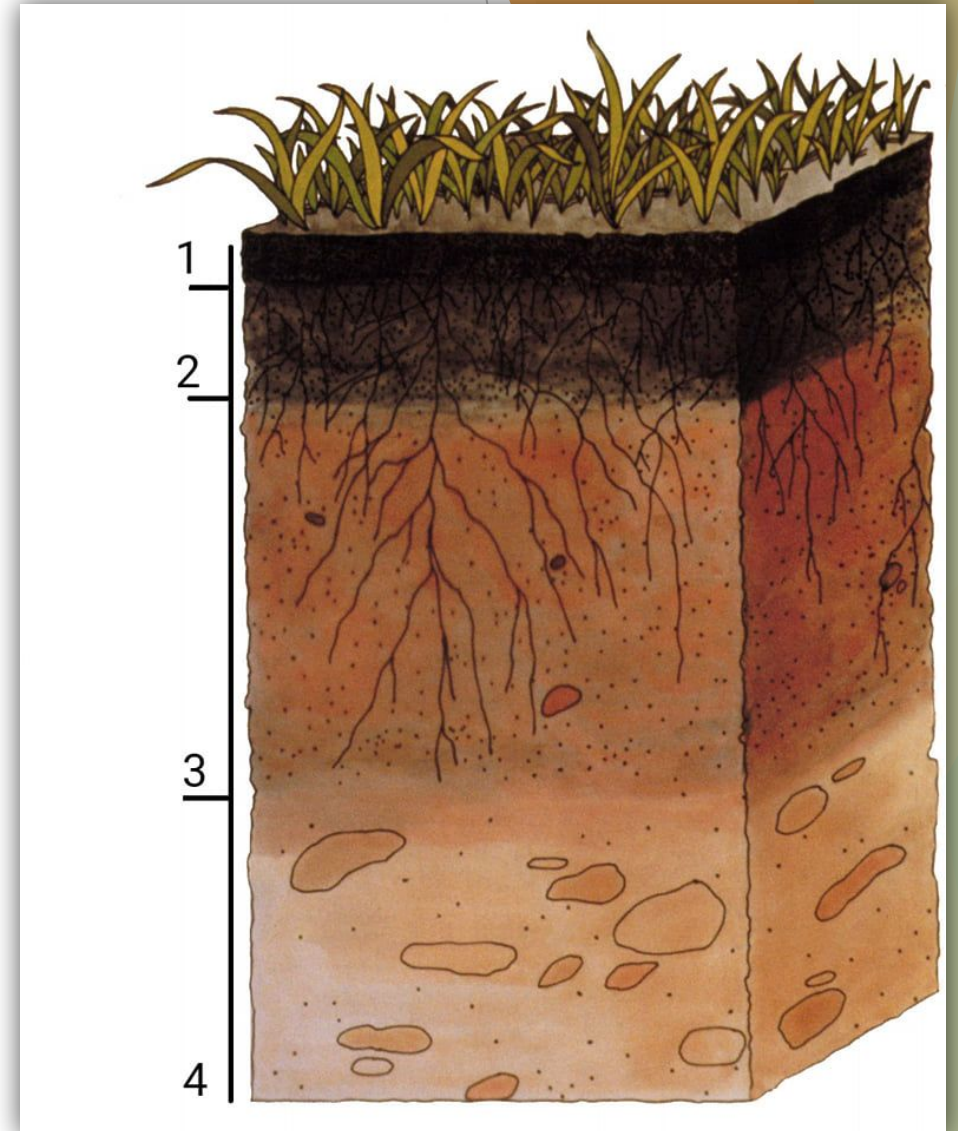
SOIL is the outermost layer of the earth's crust . It has a layered structure and arises as a result of weathering:

- ▶ Biological weathering - a processes occurring as a result of the action of microorganisms
- ▶ Physical weathering - the disintegration of rocks under the influence of e.g. temperature or pressure
- ▶ Chemical weathering - dissolution of rocks as a result of chemical agents, such as karstic phenomena .

SOIL PROFILE

A **soil profile** is a vertical cross section of the soil revealing the different layers of the soil.

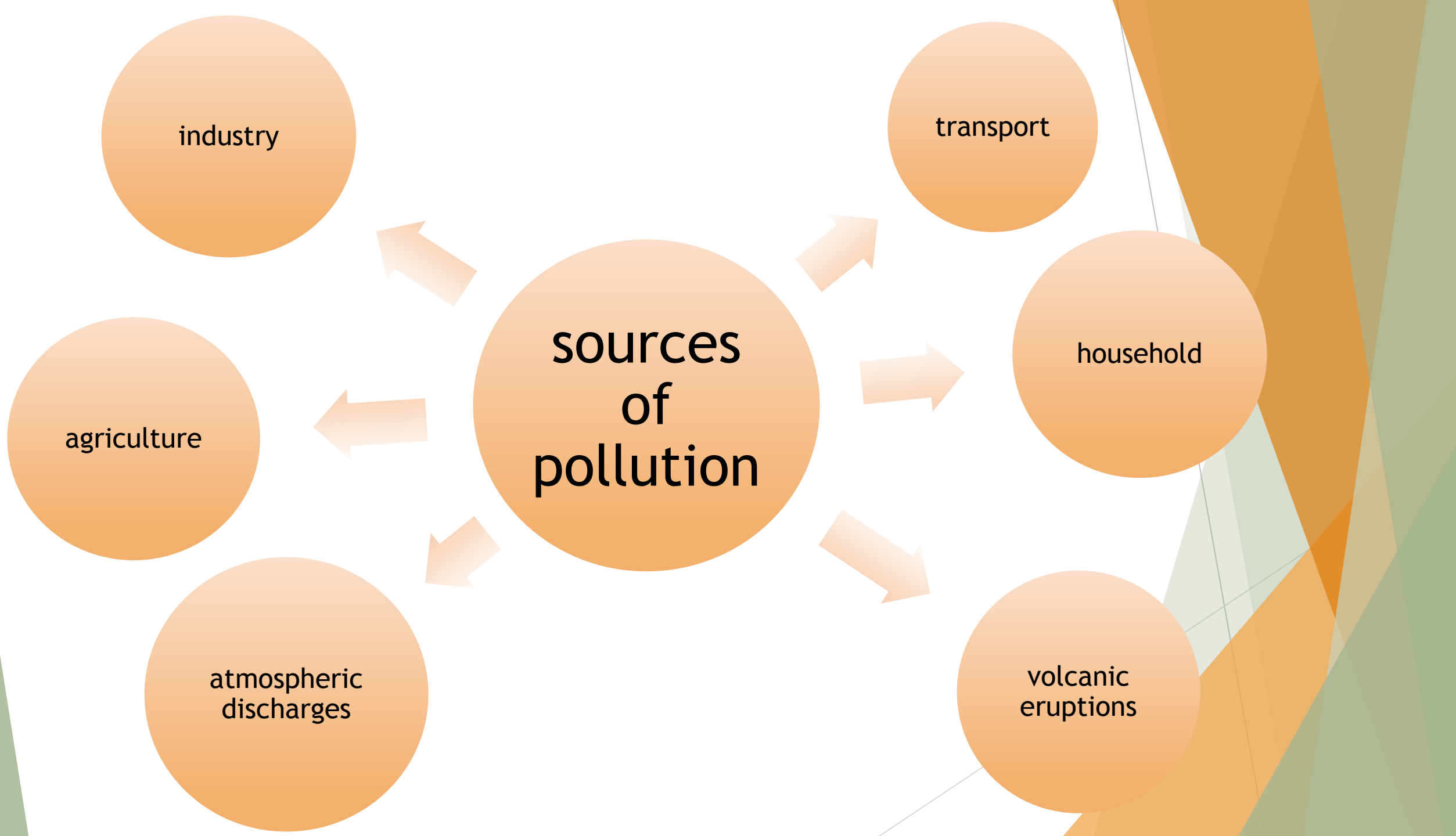
1. The organic layer is rich in carbon compounds
2. The topsoil layer contains many compounds of salt, calcium, magnesium and silicon
3. The third layer is made up of small lumps of rocks, and it is free of organic matter
4. The parent rock layer is built of masses of hard rock



SOIL POLLUTION

Soil pollution occurs when there are increased quantities of chemical compounds
radioactive elements
and microorganisms in soil.

Soil pollution can change the physical and chemical properties of the soil. Pollution makes the soil less fertile, which results in smaller or no crops.



Sorption properties of the soil - the ability of the soil to retain other substances.

Thanks to its sorption properties, soil absorbs many elements and chemical compounds.

Some of them have a positive effect on soil (minerals), others, however, (heavy metals, toxic substances) are absorbed into the soil and cause contamination.

TYPES OF POLLUTION

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graph TD; A[TYPES OF POLLUTION] --> B[constant]; A --> C[liquid]; A --> D[gas]
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constant

liquid

gas

Solid soil pollution

Solid soil pollution is stored on its surface. The solid waste, e.g. ashes, plastics, metals, slag, glass, slowly decays and is washed away by water.



Liquid soil pollution

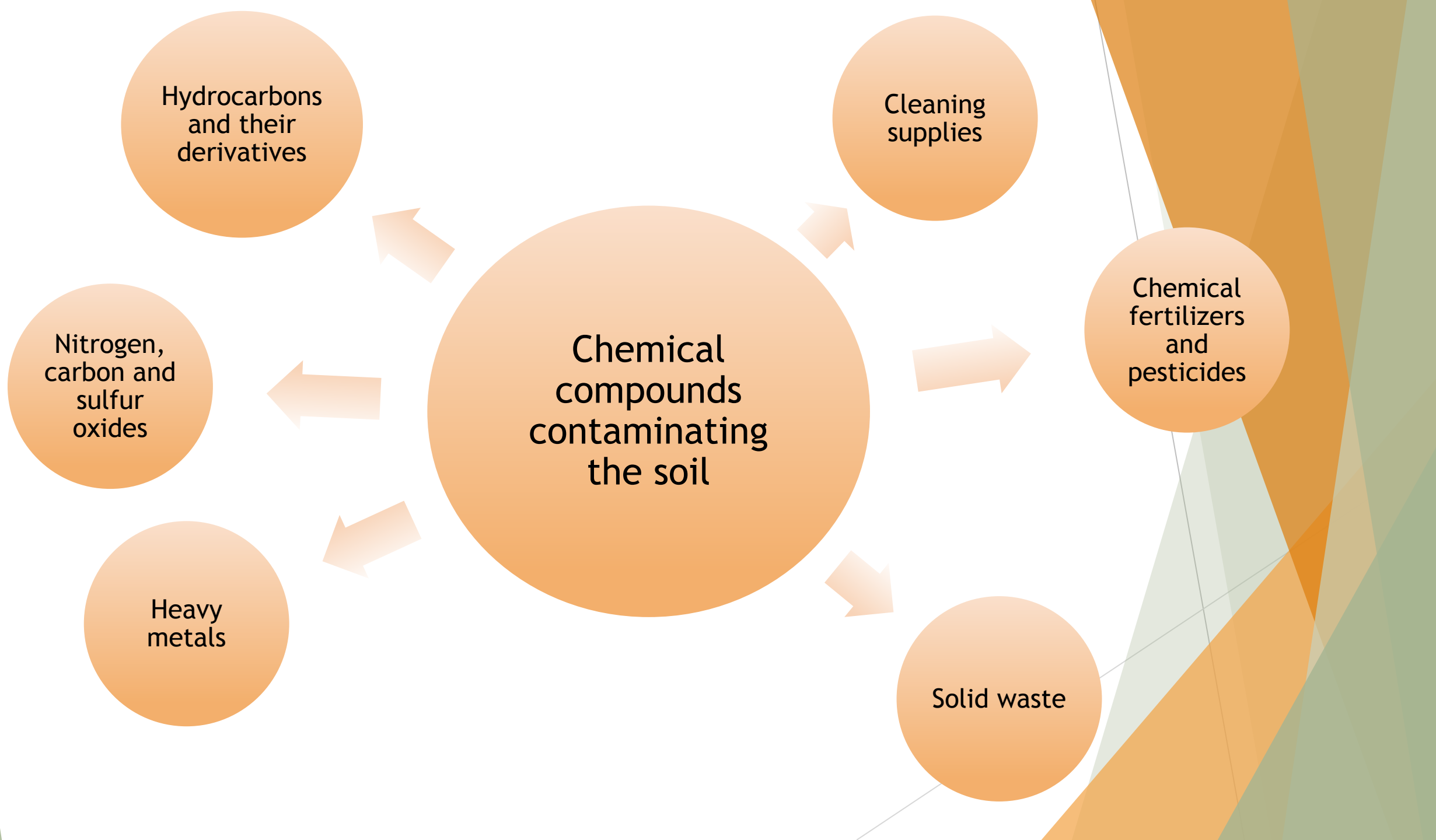
The liquid pollutants are discharged into water reservoirs and enter the soil together with water. They are industrial waste, aerosols, paints, varnishes, cesspool waste.



Gas soil pollution

- ▶ These are harmful substances escaping from home and factory chimneys, absorbed by the soil or accumulated in the clouds and penetrating the soil with rain.
- ▶ They also include car exhaust fumes and volatile substances from different preparations used in agriculture.





Hydrocarbons and their derivatives

Their source is, among others crude oil and its processing products, e.g. petrol, diesel oils.

Solid waste

Ashes, slag, plastics, metals, glass. They are stored in landfills.

Cleaning supplies (detergents)

They are part of municipal sewage that pollutes water reservoirs, and partly gets into the soil. They include detergents, bleaches, dishwashing liquids, shampoos.



Nitrogen, carbon and sulfur oxides

They come mainly from car exhausts. To prevent their negative impact on the environment, **catalytic converters** should be used to reduce the emission of harmful oxides.



Acid rain

- ▶ These are atmospheric precipitation with a pH less than 5.6, i.e. acidic.
- ▶ They contain acids formed by the reaction of water with gases absorbed from the air, such as:
 - carbon dioxide, sulfur trioxide and nitrogen oxides,
 - hydrogen sulfide, carbon dioxide and hydrogen chloride ,

emitted into the atmosphere in the processe of fuel combustion, industrial production, volcanic eruptions, atmospheric discharges and other natural factors.



Heavy metals

They are contained in dust and fumes from ironworks, mines, heavy and energy industries, and transport. They include lead, mercury, copper, zinc, cadmium and manganese.



Lead

- ▶ Metal with highly toxic properties, which is absorbed through the skin, respiratory tract and by ingestion.
- ▶ **Lead compounds do not break down - they accumulate in the body for whole life.** Children and babies, as well as young farm animals, are extremely vulnerable to its high absorption. Lead remains in the fetus and mother's milk.

Mercury

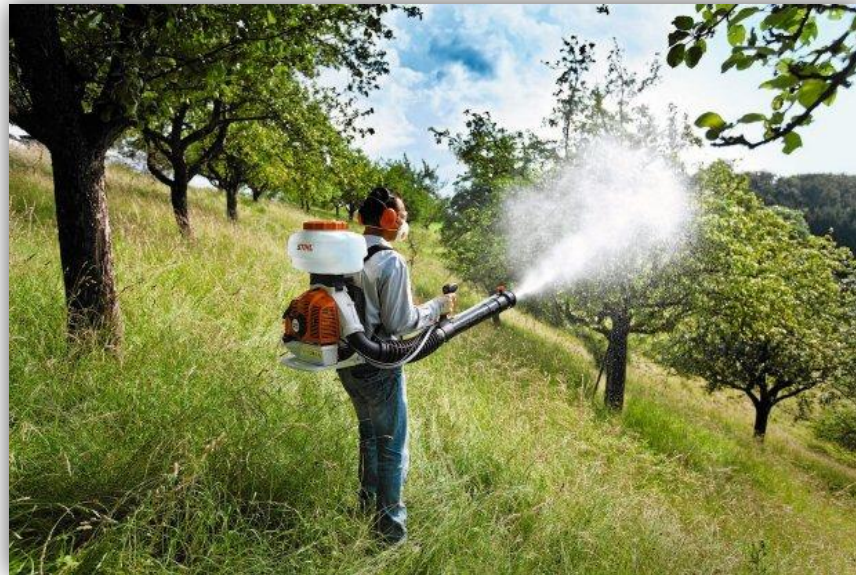
- ▶ Heavy metal whose vapors and compounds are highly toxic. Mercury vapors are an important source of environmental threats. 75 to 85% of mercury is absorbed from the air inhaled into the body's lungs.
- ▶ It occurs most often in nature in the form of mercury sulfide HgS , called cinnabar. In normal conditions it is in the form of a liquid.

Chemical fertilizers and pesticides (plant protection products)

Excessive use of nitrogen fertilizers and plant protection products, i.e. pesticides, results in soil pollution and the removal of valuable components from the soil, including chemical elements, chemical compounds and minerals.

Pesticides

Pesticides - natural or synthetic substances that are used to combat harmful or undesirable organisms, mainly attacking crops, but also farm animals, food and humans. They are produced in liquid form (to spray) or powdered (to dust).



- pesticides
- Fungicides** - fungus control agents
- Insecticides - deal with insect control
- Herbicides- weed control
- Bactericides- fight bacteria

Radioactive elements

Radioactive elements in soil can appear in a natural way (uranium and its compounds) or through human action - radioactive waste repositories, nuclear reactors, fuel processing factories.



- ▶ Small, short-term radiation doses have no effect.
- ▶ Long-lasting radiation emitted by elements contained in soil can lead to:
 - dizziness and vomiting,
 - increased risk of cancer.

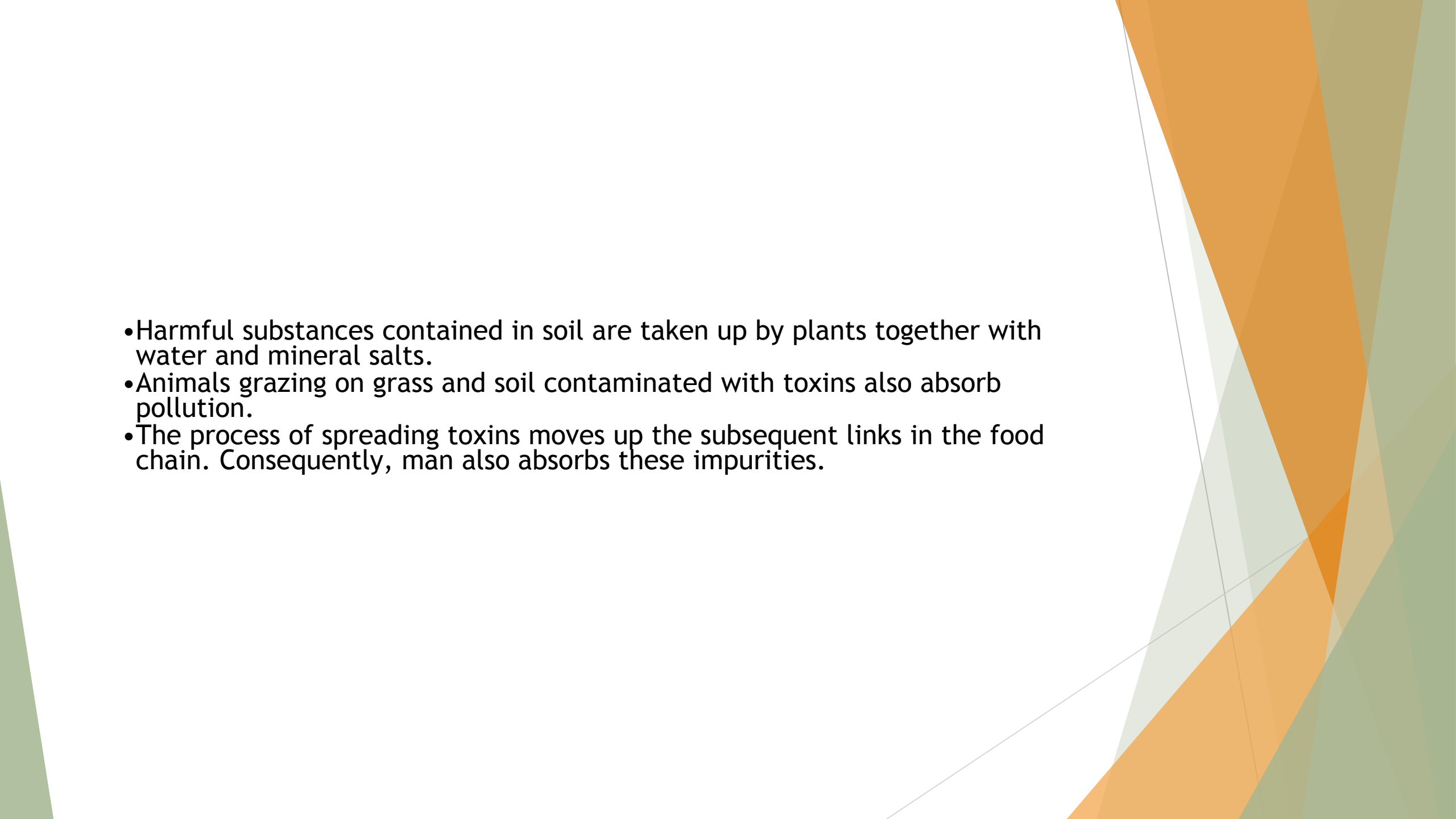
Extreme doses result in death.

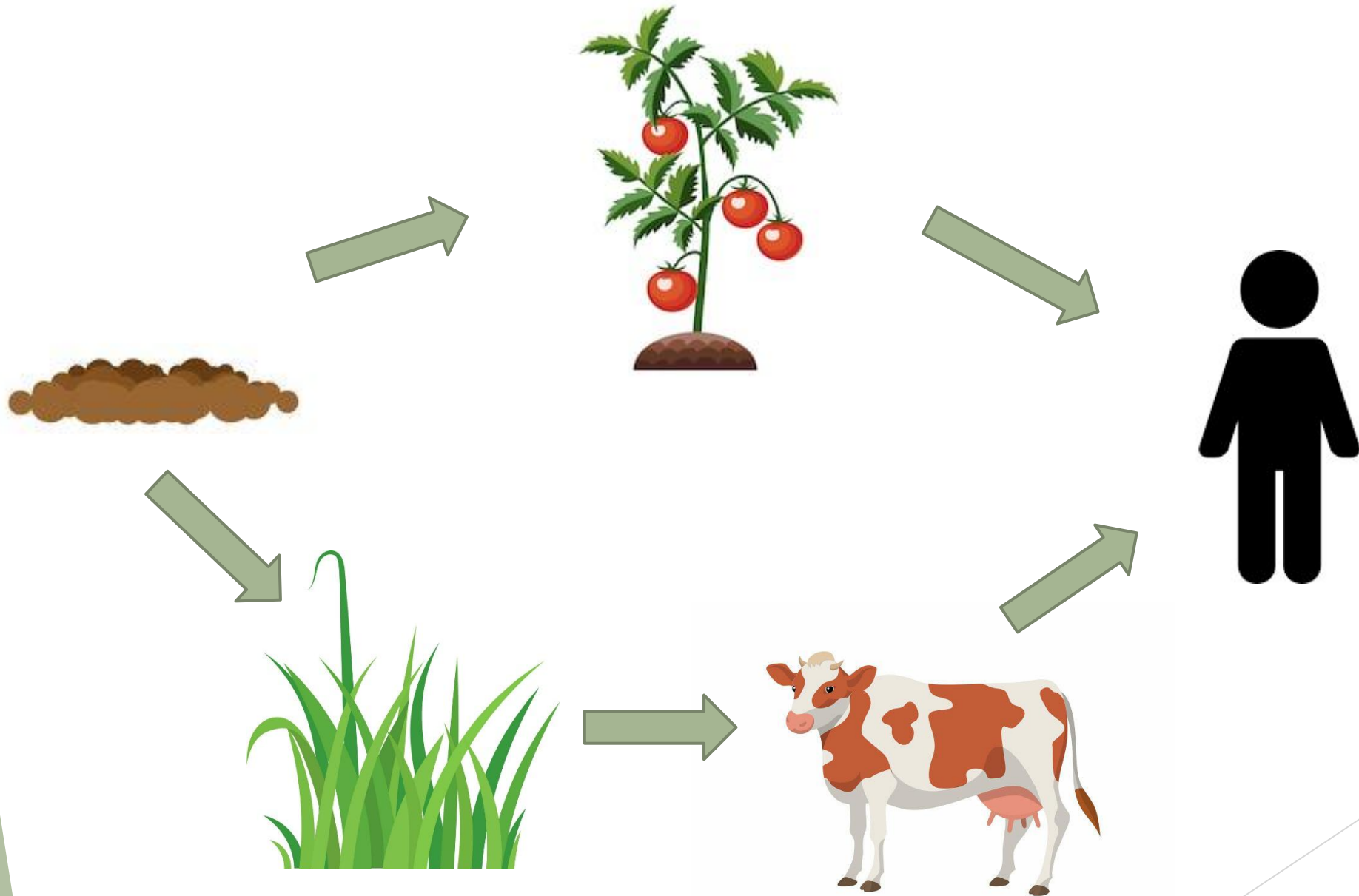


Effects of soil pollution

- ▶ the soil is constantly exposed to pollution from many different sources
- ▶ all harmful substances entering the soil affect its condition
- ▶ soil loses its properties under the influence their negative impact, which reduces management possibilities



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- Harmful substances contained in soil are taken up by plants together with water and mineral salts.
 - Animals grazing on grass and soil contaminated with toxins also absorb pollution.
 - The process of spreading toxins moves up the subsequent links in the food chain. Consequently, man also absorbs these impurities.

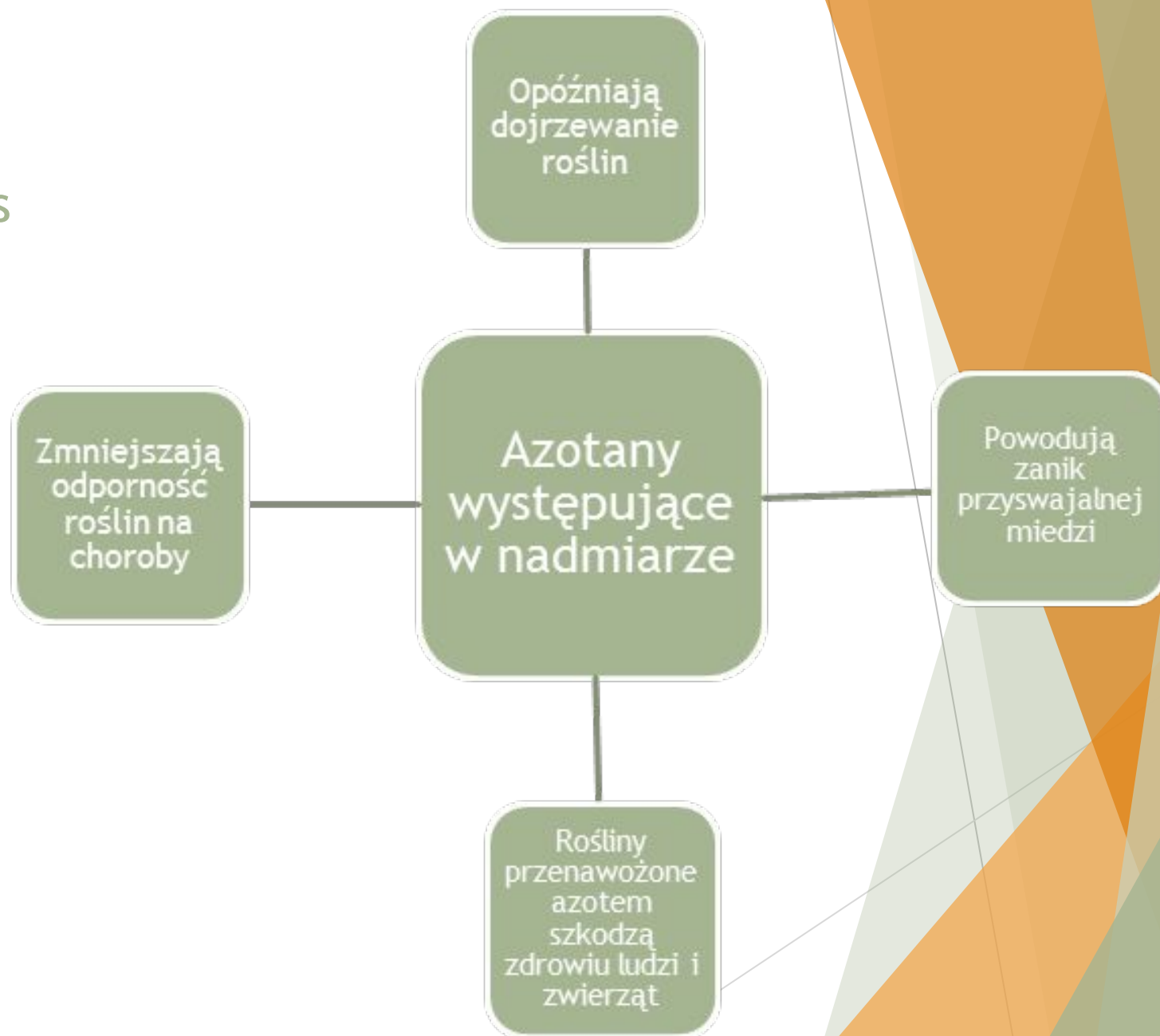


Chemical transformation - pH

Chemical transformation of soil - change in the reaction, salinity or poisoning of the soil as a result of intended or unexpected effects of human activities.



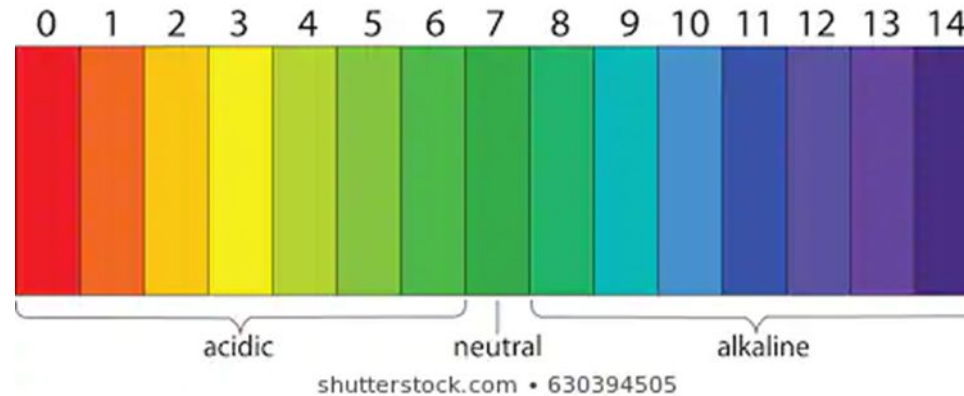
Nitrates occurring in excess due to fertilization of soils with nitrogen, polluted atmosphere and sewage constitute a serious soil pollution



Soil reaction - ratio of hydrogen ion concentration (H^+) to hydroxide ion concentration (OH^-) present in the soil solution. More hydrogen ions change the soil reaction to acidic, and with more hydroxide ions, the soil is alkaline.

Neutral reaction is when H^+ ions occur in soil as much as OH^- ions.

The pH scale



How does soil pollution affect food and humans?

- ▶ food is mainly threatened by pesticides which it is contaminated with directly or by absorbing their residues from soil
- ▶ these pollutants reach the human body also through the food chain



- adult
 - lung, prostate and other organs cancer
 - damage to the nervous system - Alzheimer's disease, Parkinson's disease, multiple sclerosis
 - myeloid leukemia, thyroid disease
 - bad functioning of the pancreas leading to obesity

fetus and baby

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graph TD; A((fetus and baby)) --- B[pesticides get into the fetus through the placenta of a woman, as well as during breast feeding (if the mother had contact with pesticides, e.g. consumed something contaminated)]; A --- C[the concentration of pesticides in the child's body is higher than in adults]; A --- D[children are born weaker and smaller]; A --- E[toxins increase the risk of miscarriage]; A --- F[children have lower intelligence]; A --- G[there is an increased risk of developing leukemia and cancer]; A --- H[a child's brain that is under development is much more sensitive to neurotoxic substances in pesticides than an adult's]; A --- I[toxic substances have a harmful effect on forming organs];
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pesticides get into the fetus through the placenta of a woman, as well as during breast feeding (if the mother had contact with pesticides, e.g. consumed something contaminated)

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toxins increase the risk of miscarriage

children have lower intelligence

there is an increased risk of developing leukemia and cancer

a child's brain that is under development is much more sensitive to neurotoxic substances in pesticides than an adult's

toxic substances have a harmful effect on forming organs

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