SOURCES OF SOIL POLLUTION

AAUE1003 SOIL POLLUTION
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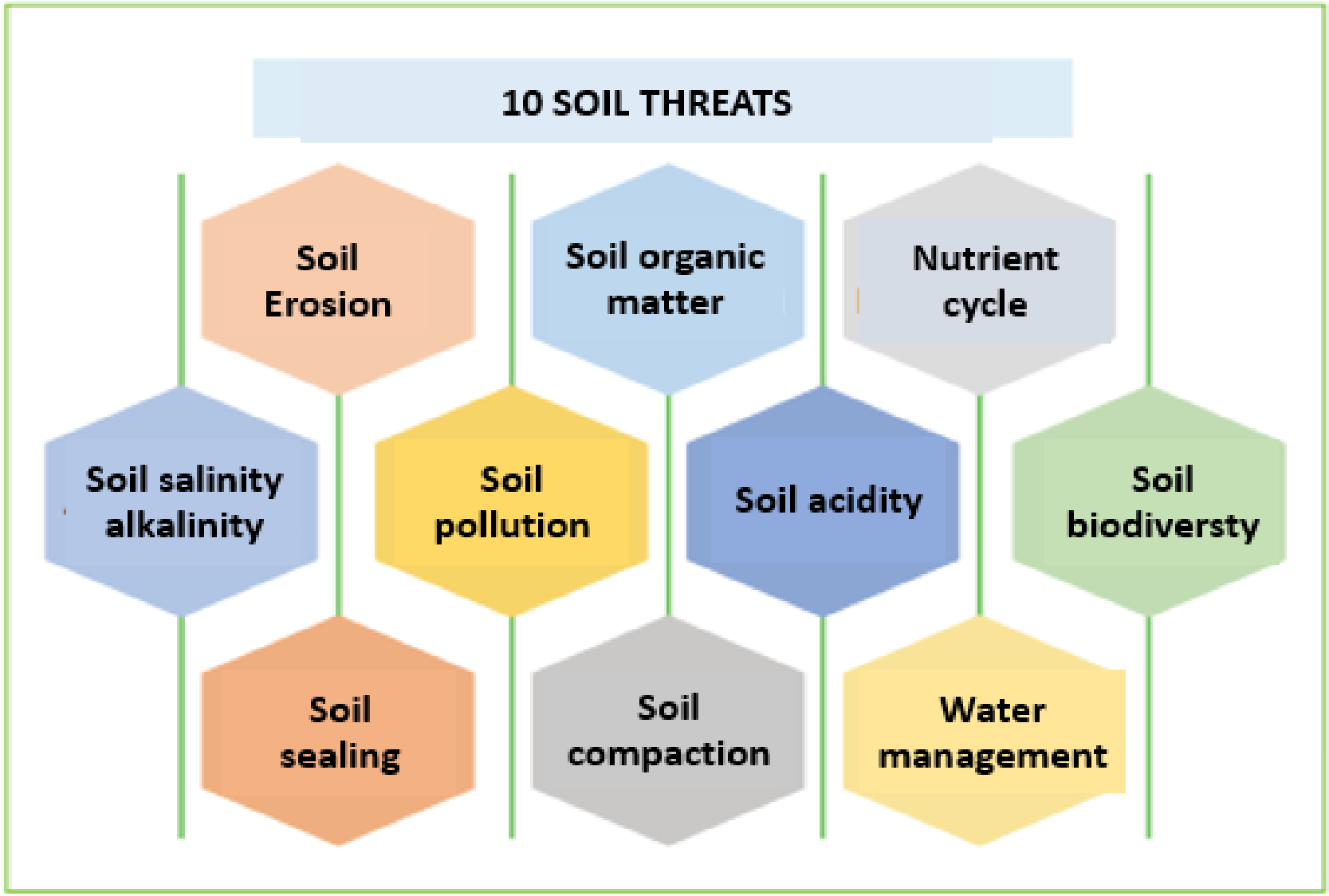
SOIL ALWAYS WORKS HARD!

GLOBAL SOIL THREATS



FAO, 2017. Voluntary Guidelines for Sustainable Soil Management Food and Agriculture Organization of the United Nations Rome, Italy.

What is soil pollution?

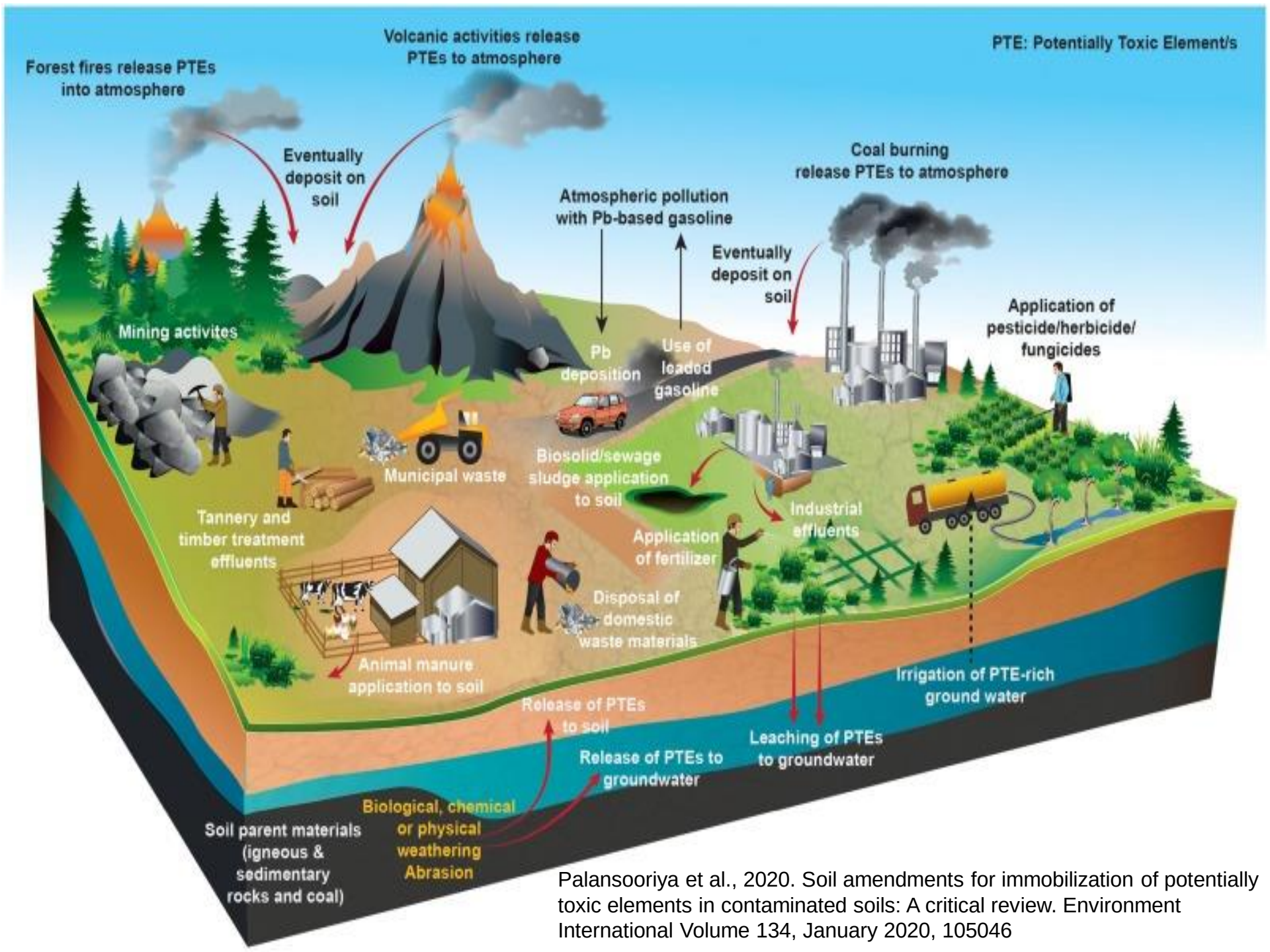
Soil pollution is inclusion and / or accumulation of substances and living things (that do not normally exist) in the soil environment. It is a big concern, threatening public health and environmental life by deteriorating existing soil quality and soil health.

Why is soil pollution important?

- **Soil pollution is a great risk for surface and underground water resources (which is an important matter for agricultural production and ecosystem services (howework!)**

- **However soil is a perfect receiver that can hold pollutants for a long time and also it is a bioreactor that can convert harmfull compounds to harmless end-products**

Storage, elimination, filtering, buffering of pollutants are great services of soil ecosystems



Palansooriya et al., 2020. Soil amendments for immobilization of potentially toxic elements in contaminated soils: A critical review. Environment International Volume 134, January 2020, 105046

Resources of Soil pollution

1) Point-source pollution is resulted from a specific event or a series of events within a particular area in which pollutants are released to the soil, and the source and identity of the pollution can be easily identified. Anthropogenic activities are main reasons for point-source pollution.

- **former factory sites,**
- **inappropriate waste and waste water disposal,**
- **uncontrolled landfills,**
- **excessive application of agrochemicals,**
- **spills and leaks of fossile crude oil**
- **Mining and smelting activities**

Point source soil pollution....Zheng Zhong Su, China

Point-source pollution...The case of Fukushima Daiichi Nuclear Power Plant)

the release of radioactive material into the atmosphere due to the damage caused by 2011 Tohoku earthquake and tsunami and is still continuing.

https://www.youtube.com/watch?v=25gLi5Y_PTM
https://www.youtube.com/watch?v=b9HH_iYAn5Y
https://www.youtube.com/watch?v=ItOLgSYySGg

Point-source pollution...The Bhopal Industrial disaster

The Bhopal disaster, 1984, Madhya Pradesh, India. The worlds deadliest industrial disaster occurred on Dec 2, 1984, when 40 tons of toxic gas from the Union Carbide pesticide plant leaked into the surrounding area, killing thousands and causing ongoing long-term effects.

Fatalities

Kal Penn, Mischa Barton, Martin Sheen ...

My film on Bhopal gas tragedy a...

https://www.dw.com/en/a-poisoned-legacy-the-bhopal-disaster/av-52946722

https://www.youtube.com/watch?v=_zXFxwYao2Y

Howework: Please go through wikipedia for the details of Bhopal disaster nd read it to make a brief oral summary in the coming lesson

Bhopal disaster

From Wikipedia, the free encyclopedia

Coordinates: 23°16'5

The **Bhopal disaster**, also referred to as the **Bhopal gas tragedy**, was a gas leak incident on the night of 2–3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh, India. It is considered among the world's worst industrial disasters.[1][2] Over 500,000 people were exposed to methyl isocyanate (MIC) gas. The highly toxic substance made its way into and around the small towns located near the plant.[3]

Estimates vary on the death toll. The official immediate death toll was 2,259. In 2008, the Government of Madhya Pradesh had paid compensation to the family members of 3,787 victims killed in the gas release, and to 574,366 injured victims.[4] A government affidavit in 2006 stated that the leak caused 558,125 injuries, including 38,478 temporary partial injuries and approximately 3,900 severely and permanently disabling injuries.[5] Others estimate that 8,000 died within two weeks, and another 8,000 or more have since died from gas-related diseases.[6] The cause of the disaster remains under debate. The Indian government and local activists argue that slack management and deferred maintenance created a situation where routine pipe maintenance caused a backflow of water into a MIC tank, triggering the disaster. Union Carbide Corporation (UCC) argues water entered the tank through an act of sabotage.

The owner of the factory, UCIL, was majority owned by UCC, with Indian Government-controlled banks and the Indian public holding a 49.1 percent stake. In 1989, UCC paid $470 million (equivalent to $860 million in 2019) to settle litigation stemming from the disaster. In 1994, UCC sold its stake in UCIL to Eveready Industries India Limited (EIIL), which subsequently merged with McLeod Russel (India) Ltd. Eveready ended clean-up on the site in 1998, when it terminated its 99-year lease and turned over control of the site to the state government of Madhya Pradesh. Dow Chemical Company purchased UCC in 2001, seventeen years after the disaster.

Civil and criminal cases filed in the United States against UCC and Warren Anderson, UCC CEO at the time of the disaster, were dismissed and redirected to Indian courts on multiple occasions between 1986 and 2012, as the US courts focused on UCIL being a

Bhopal disaster

Memorial by Dutch artist Ruth Kup
for those killed and disabled by the
gas release

Date	2 December 1984 – 3 December 1984


POINT SOURCE
Direct discharge into water
NON-POINT SOURCE
Indirect discharge into water
Sewage Treatment Plants
Dumping Toxins
Industrial Facilities
Urban Runoff
Agricultural Runoff

Resources of Soil pollution

2) Diffuse (non-point) soil pollution is spread over very wide areas; accumulates in soil for long periods, and is not caused by a single and easily identified source. It occurs where emission, transformation and dilution of contaminants in other media have occurred before their transfer to soil. Diffuse pollution occurs by the transport of pollutants over air-soil-water systems.

- **Nuclear power and weapons activities;**
- **uncontrolled waste disposal and contaminated effluents released in and near catchments;**
- **land application of sewage sludge;**
- **the agricultural use of pesticides and fertilizers**
- **atmospheric transport and deposition (erosion)**

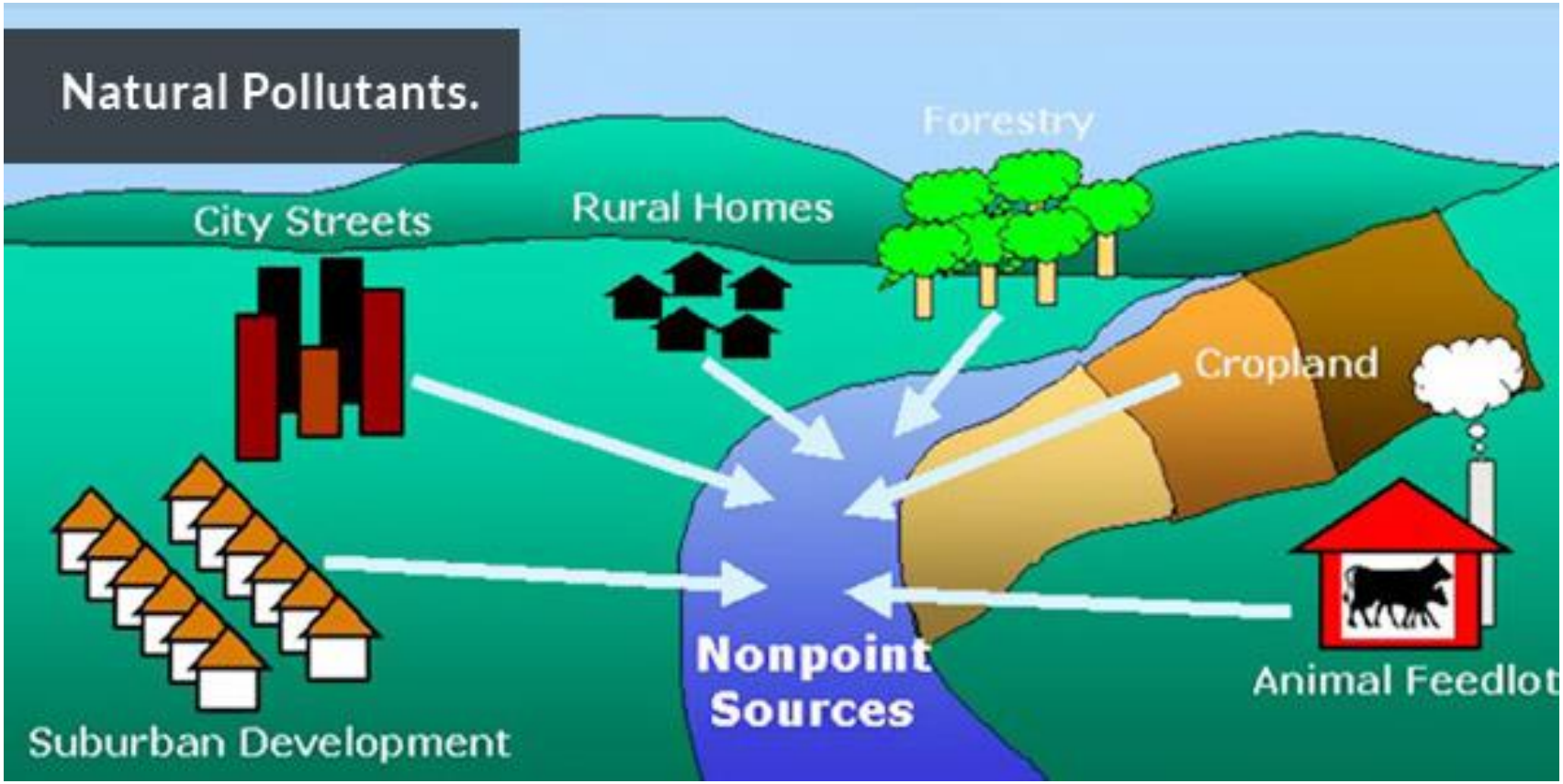
Diffuse pollution has a deep impact on the human and environmental health, although its severity and extent are difficult to measure

uncontrolled waste disposal and contaminated effluents released in and near catchments

land applications of sewage sludge

Diffuse (non-point) soil pollutions

(surface runoff due to agricultural activities such as fertilization and pest applications

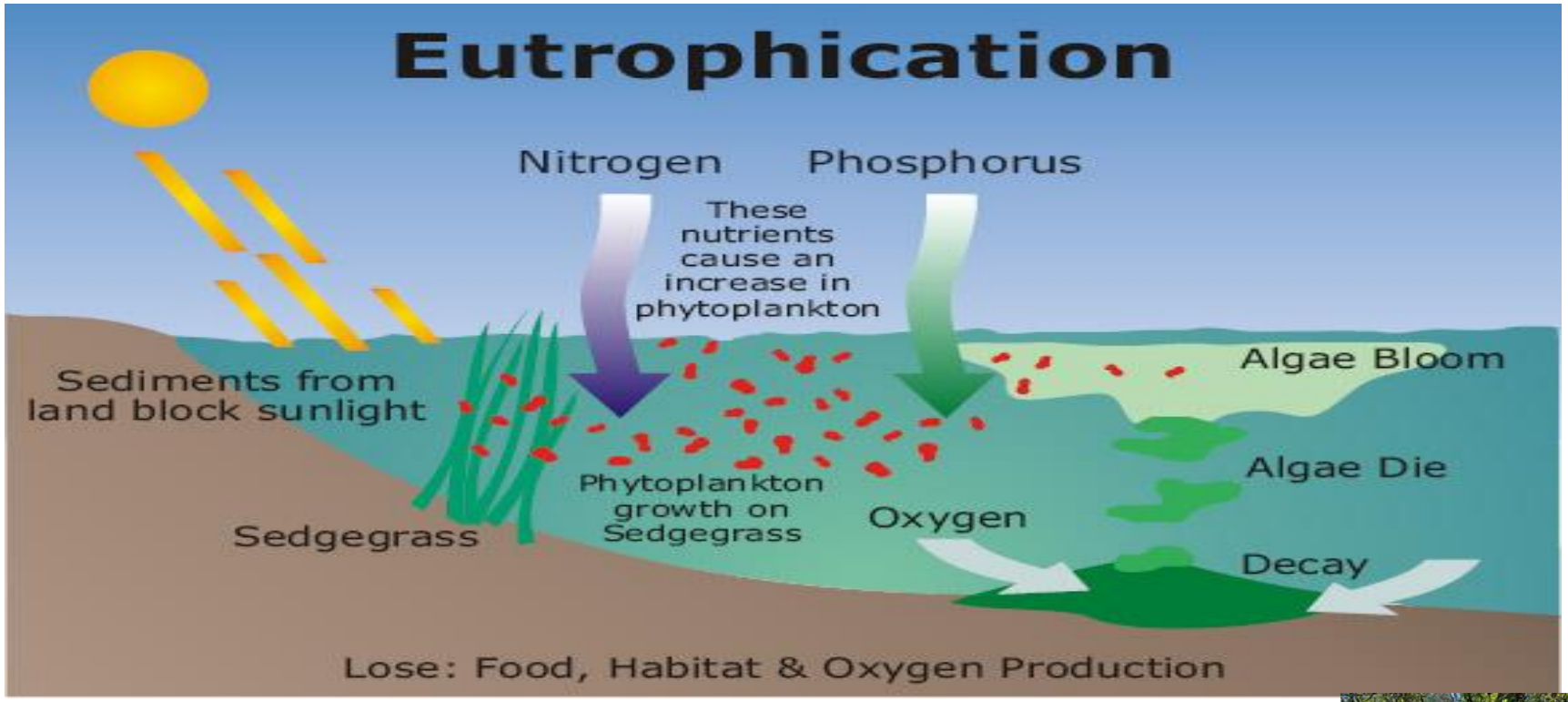


Diffuse (non-point) soil pollutions

(surface runoff due to agricultural activities such as fertilization and pest applications

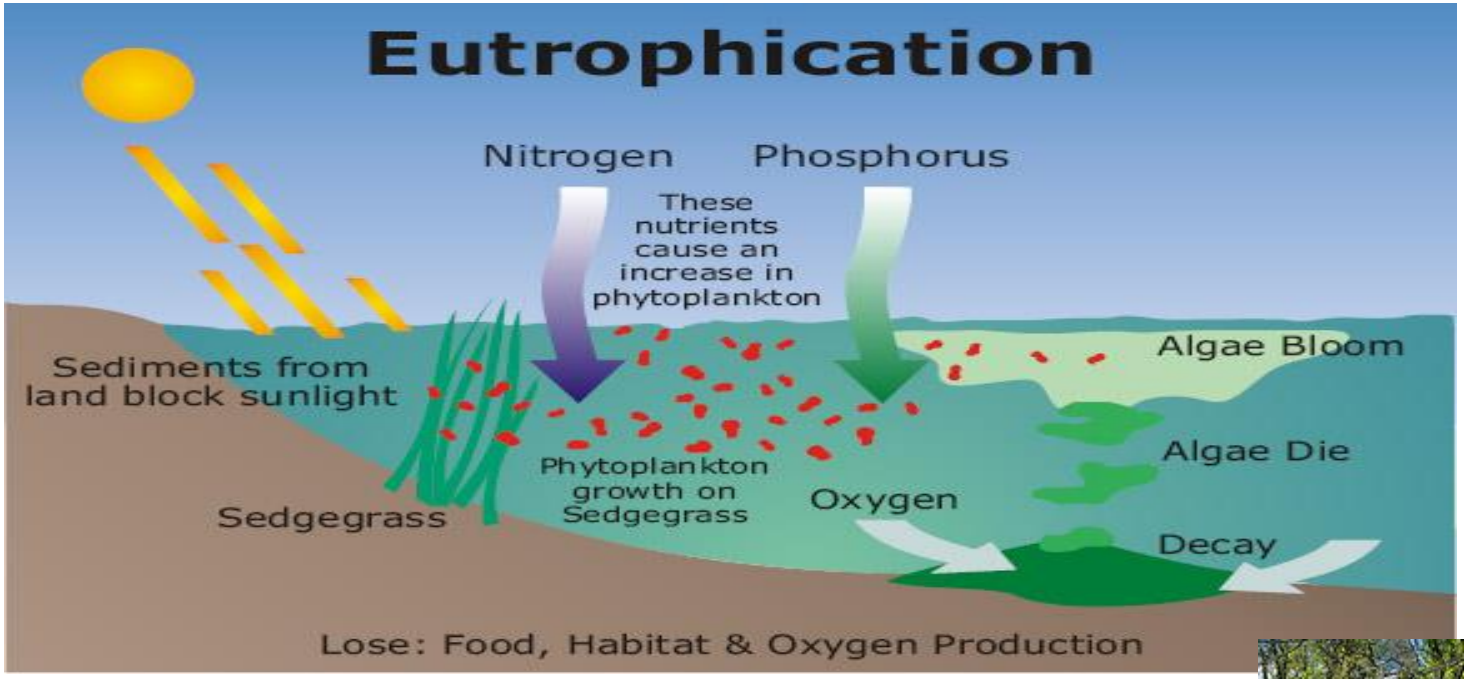
Contaminations by surface runoff is caused by the transport and accumulation of fertilizer and pest residues from one area to another by melting snow, heavy rains and irrigations

Eutrophication as a significant consequence of diffuse (non-point) soil pollutions



Eutrophication is the alterations in water chemical and biological conditions. The amount of nitrogen phosphorus increases in fresh water sources due to transports of fertilizer residues by surface runoffs. This triggers increases in the populations of phytoplankton and algae and thereby, disbalances water biodiversity.

Diffuse (non-point) soil pollutions….Eutrophcation



What happens under the conditions of eutrophcation?

decrease in dissolved O_2 ; increase in anaerobic biomass; accumulation of partly decomposed organic matter in the lake bed; water color change to green; unpleasent odor due to H_2S formations.

Mining and smelting activities…water and soil pollution due to acid mine drainage (ARD)

- In mining sites containing metals such as pyrite, sulphurous metallic minerals, base metals (Cu-Pb-Ni), uranium and gold, underground waters become acidic because of oxidation (reduction) of the sulfur in the environment by microbial activity.
- During mining activities, such water wastes turn into a highly toxic material by dissolving various metalic elements on the rock surfaces that they contact and contaminate the water and soil resources during their discharge.

$$FeS_2 + 15/4O_2 + 7/2H_2O \rightarrow 4H^+ + 2SO_4^{-2} + Fe(OH)_3 \quad (1)$$

Brown color indicates excess of ferric iron (Fe^{+2}) in water (Idaho Blackbird Creek, Lemhi County, Idaho USA)