

# Energy and Environment Engineering

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# Energy and Environmental Engineering CEME106

## ENVIRONMENT AND ECOSYSTEMS

Introduction: Concept of an ecosystem- structure and functions of ecosystem. Components of ecosystem - producers, consumers, decomposers, Food chains, food webs, ecological pyramids, Energy flow in ecosystem. Bio-geo- chemical cycles, Hydrologic cycle Components of Environment and their relationship, Impact of technology on environment, Environmental degradation. Environmental planning of urban network services such as water supply, sewerage, solid waste management.

## ENVIRONMENTAL POLLUTION

Water, air, soil, noise, thermal and radioactive, marine pollution: sources, effects and engineering control strategies. Drinking water quality and standards, Ambient air and noise quality standards

## GLOBAL ENVIRONMENTAL ISSUES AND ITS MANAGEMENT

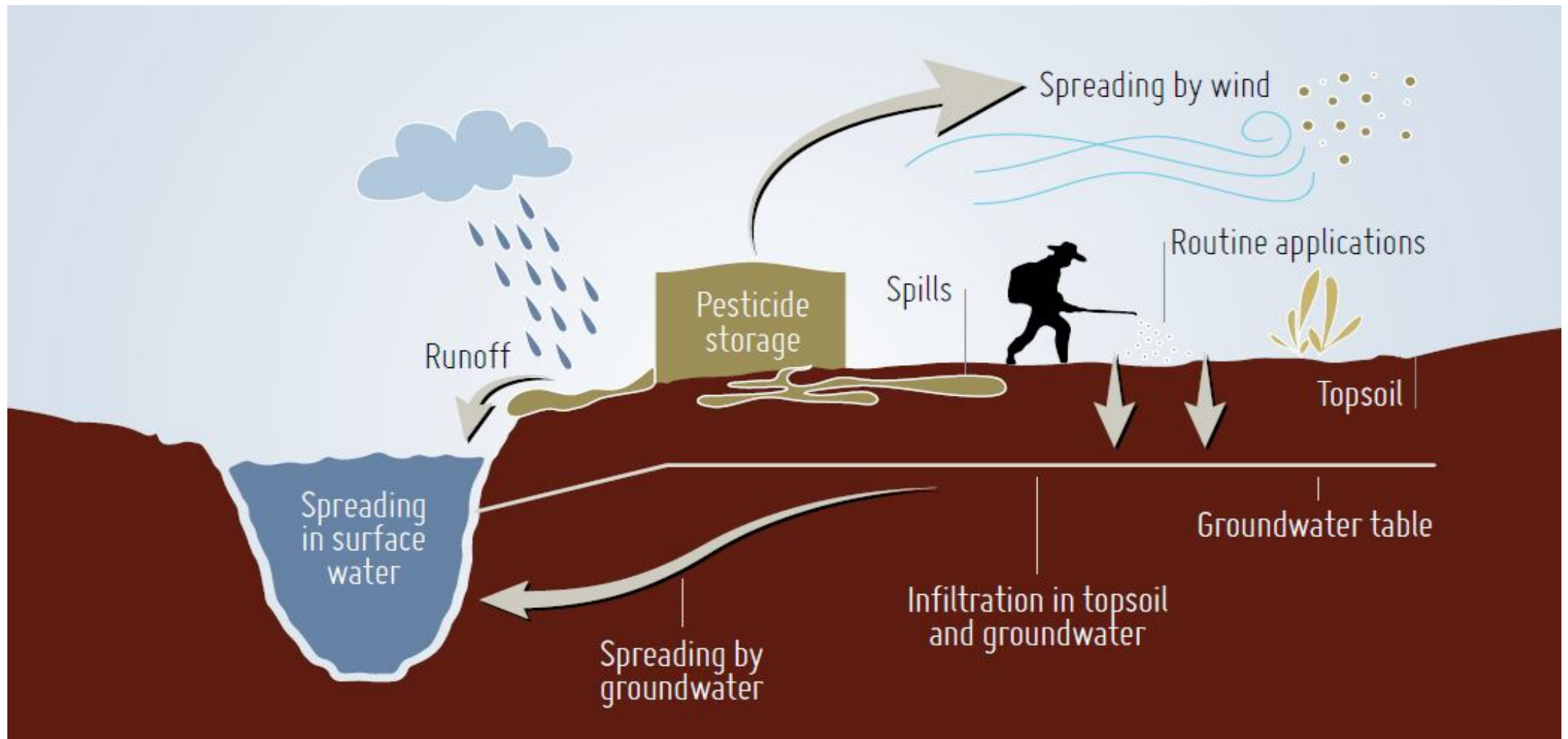
Engineering aspects of climate change. Acid rain, depletion of ozone layer. Concept of carbon credit. Concepts of Environmental impact assessment and Environmental audit. Environmental life cycle assessment

# Soil Pollution

# Soil pollution?

- “Soil pollution” refers to the presence of a chemical or substance out of place and/or present at a **higher than normal concentration** that has adverse effects on any non-targeted organism.
- The diversity of contaminants is constantly evolving due to agrochemical and industrial developments.
- The presence of certain pollutants may also produce nutrient imbalances and soil acidification, two major issues in many parts of the world.

# Point-source and diffuse soil pollution



Transport pathway of pesticides in the environment. (Source: FAO, 2000)

# Sources of soil pollutants

- Natural, geogenic sources
- Anthropogenic sources
  - Industrial activities
  - Mining
  - Urban and transport infrastructures
  - Waste and sewage generation and disposal
  - Military activities and wars
  - Agricultural and livestock activities

## Waste and sewage generation and disposal

- Municipal waste disposal in landfills are the most common ways to manage waste.
- Leachate generation are inevitable consequences of practice of solid waste disposal in landfills.
- Pollutants, such as heavy metals, pharmaceutical compounds etc. accumulate in the soil, from landfill leachates
- It is essential that the volume of leachate generated be kept to a minimum and also ensure that the ingress of groundwater and surface water is minimized and controlled.

# Main pollutants in soil

- Heavy metals and metalloids
- Nitrogen and phosphorus
- Pesticides
- Polycyclic aromatic hydrocarbons
- Persistent organic pollutants
- Radionuclides
- Emerging pollutants
- Pathogenic microorganisms
- Antimicrobial resistant bacteria and genes



# Interaction of pollutants with soil constituents

## Sorption of contaminants

- Sorption is a process whereby the molecules of a fluid interact with a solid and are retained on the solid for a time.
- Sorption may be chemical in nature (as with ionic and hydrogen binding) or purely physical (as with van der Waals forces).

## Bioavailability, mobility and degradation of contaminants

- Bioavailability refers to the physical, chemical and biological interactions that determine the exposure of organisms to chemicals associated with soils.
  - *Metals*
  - *Radionuclides*
  - *Pesticides*
  - *Persistent organic pollutants*
  - *Nitrogen and phosphorus*

# The impacts of soil pollution on the food chain and ecosystem

- Soil pollution, plant uptake and food chain contamination
- Impact on ecosystem services of soil pollution from agriculture
  - Synthetic fertilizers
  - Acidification and crop loss
  - Pesticides
  - Manure
  - Urban wastes in agriculture
- Human health risks associated with soil pollution
  - Pathways of exposure of humans to soil pollutants and their effects on human health
  - Soils as reservoir of antimicrobial resistant bacteria and genes

# Control measures

- Soil erosion can be controlled
- Proper dumping of unwanted materials
- Production of natural fertilizers
- Proper hygienic condition
- Public awareness
- Recycling and Reuse of wastes
- Ban on toxic chemicals

Thank You