Water section 3

Water Pollution

- The introduction into water of chemical, physical, or biological agents into water that degrade water quality and adversely affect the organisms that depend on the water
- Almost all of the ways that we use water contribute to water pollution.
- **Two** underlying causes of water pollution are:
  1. industrialization and
  2. rapid human population growth.

Water Pollution

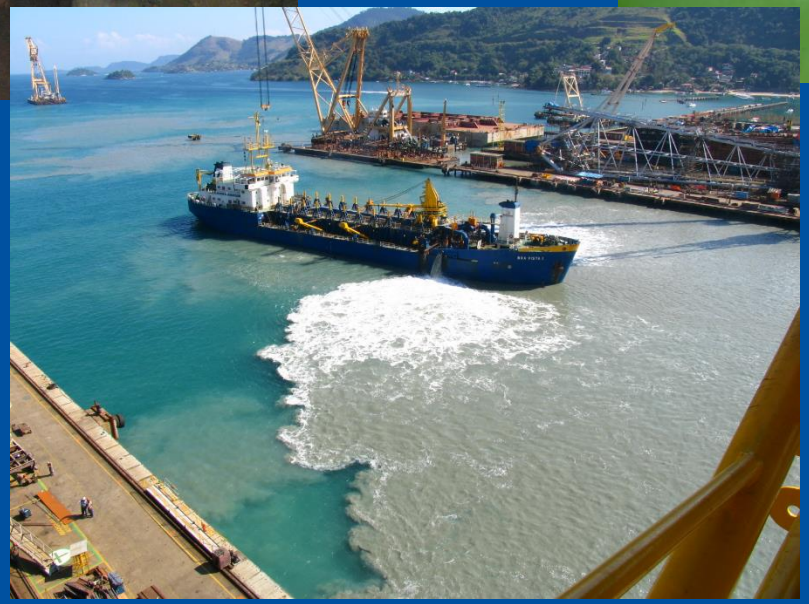
- Developed countries
  - have made great strides in cleaning up many polluted water supplies,
  - but some water is still dangerously polluted.
- In developing parts of the world,
  - water pollution is a big problem
  - because often the only water available for drinking is polluted with sewage and agriculture runoff, which can spread waterborne diseases.

Water pollution

- Comes from **three** types of sources:
  1. point
  2. nonpoint sources.
  3. Background pollution

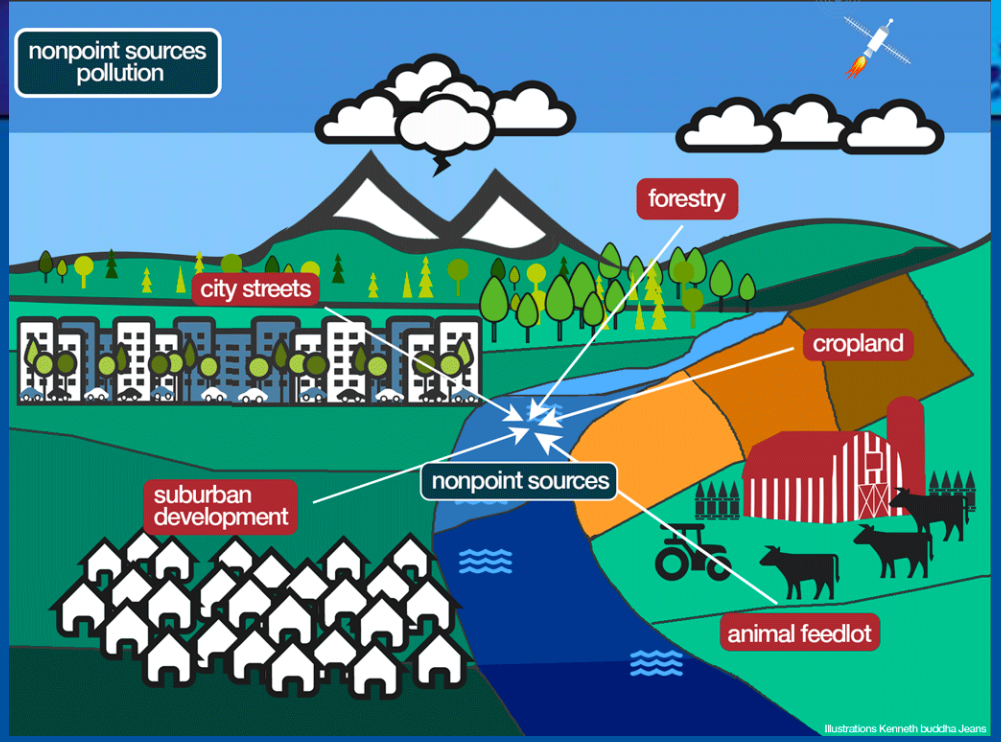
Point-source pollution

- Comes from a **specific** site.
- Can often be **identified** and **traced** to a source,
- But *enforcing cleanup* is sometimes *difficult*.
- When you think of water pollution, you probably think of a **single** source, such as _ ?__.
  - a factory,
  - a wastewater treatment plant, or
  - a leaking oil tanker.
- These are all examples of point-source pollution.



Nonpoint-Source Pollution

- Comes from many sources rather than from a single specific site.
- *Example*:
  - Surface Run-off from a city or a farm.
- The accumulation of small amounts of water pollution from many sources is a **major pollution problem**.
- Controlling nonpoint-source pollution depends to a great extent on public awareness of the effects of activities such as spraying lawn chemicals.



Point and Nonpoint Sources of Pollution

Sources of Point Pollution

- leaking septic-tank systems
- leaking storage lagoons for polluted waste
- unlined landfills
- leaking underground storage tanks that contain chemicals or fuels such as gasoline
- polluted water from abandoned and active mines
- water discharged by industries
- public and industrial waste-water treatment plants

Nonpoint Sources of Pollution

- chemicals added to road surfaces (salt and other de-icing agents)
- water runoff from city and suburban streets that may contain oil, gasoline, animal feces, and litter
- pesticides, herbicides, and fertilizer from residential lawns, golf courses, and farmland
- feces and agricultural chemicals from livestock feedlots
- precipitation containing air pollutants
- soil runoff from farms and construction sites
- oil and gasoline from personal watercraft

Background Pollution

- Results of ongoing natural processes.
    - Example: Decomposition of animals/plants in water

Principal Water Pollutants

Pollutant Types and Sources		
Type of pollutant	**Agent**	**Major sources**
Pathogens	disease-causing organisms, such as bacteria, viruses, protozoa, and parasitic worms	mostly nonpoint sources; sewage or animal feces, livestock feedlots, and poultry farms; sewage from overburdened wastewater treatment plants
Organic matter	animal and plant matter remains, feces, food waste, and debris from food-processing plants	mostly nonpoint sources
Organic chemicals	pesticides, fertilizers, plastics, detergents, gasoline and oil, and other materials made from petroleum	mostly nonpoint sources; farms, lawns, golf courses, roads, wastewater, unlined landfills, and leaking underground storage tanks
Inorganic chemicals	acids, bases, salts, and industrial chemicals	point sources and nonpoint sources; industrial waste, road surfaces, wastewater, and polluted precipitation
Heavy metals	lead, mercury, cadmium, and arsenic	point sources and nonpoint sources; industrial discharge, unlined landfills, some household chemicals, and mining processes; heavy metals also occur naturally in some groundwater
Physical agents	heat and suspended solids	point sources and nonpoint sources; heat from industrial processes and suspended solids from soil erosion

Major Sources of Pollution

- Urban: Pollution from Cities
  - Example: Run-off, land fills

- Industrial: industries that use water
  - Ex: Thermal Pollution: returning heated water to stream
  - Ex: Radioactive Materials: emit radiation
  - Ex: Organic Chemicals: industry & agriculture
  - Ex: Inorganic Chemicals: manufactured products

Major Sources of Pollution

- Agricultural: Growth of plants and animals to feed people
  - Ex: Animal wastes, pesticides, fertilizers

Wastewater

- Contains wastes from homes or industry.
- After water flows down the drain in the sink,
  - it usually flows through a series of sewage pipes that carry it, along with all the other wastewater in your community,
  - to a wastewater treatment plant.
- At a wastewater treatment plant,
  - water is filtered and
  - treated to make the water clean enough to return to a river or lake.
  - Uses chemical and physical treatments

Most of the Wastewater from homes

- Contains biodegradable material that can be broken down by living organisms. (bacteria)
- Example,
  - wastewater from toilets and kitchen sinks contains
    - animal and plant wastes,
    - paper, and
    - soap.

all of which are biodegradable

But, some household and industrial water and some storm-water runoff contains toxic substances that cannot be removed by the standard treatment.

Sewage Sludge

- One of the solid products that remains after a wastewater treatment

If it contains dangerous concentrations of toxic chemicals,

- it must be disposed of as a hazardous waste.
- It is often incinerated, and
- then the ash is buried in a secure landfill.

- Sludge can be an expensive burden to cities as the volume of sludge that has to be disposed of every year is **enormous.**

The problem of Sewage Sludge

- Prompted many communities to look for new uses for this waste.
  - **Fertilizer**
    - If the toxicity of sludge can be reduced to safe levels
  - **bricks**
    - sludge is combined with clay
    - used in buildings.

Federal Laws Designed to Improve Water Quality in the United States

1972 Clean Water Act (CWA) The CWA set a national goal of making all natural surface water fit for fishing and swimming by 1983 and banned pollutant discharge into surface water after 1985. The act also required that metals be removed from wastewater.

1972 Marine Protection, Research, and Sanctuaries Act, amended 1988 This act empowered the EPA to control the dumping of sewage wastes and toxic chemicals in U.S. waters.

1975 Safe Drinking Water Act (SDWA), amended 1996 This act introduced programs to protect groundwater and surface water from pollution. The act emphasized sound science and risk-based standards for water quality. The act also empowered communities in the protection of source water, strengthened public right-to-know laws, and provided water system infrastructure assistance.

1980 Comprehensive Environmental Response Compensation and Liability Act (CERCLA) This act is also known as the Superfund Act. The act makes owners, operators, and customers of hazardous waste sites responsible for the cleanup of the sites. The act has reduced the pollution of groundwater by toxic substances leached from hazardous waste dumps.

1987 Water Quality Act This act was written to support state and local efforts to clean polluted runoff. It also established loan funds to pay for new wastewater treatment plants and created programs to protect major estuaries.

1990 Oil Pollution Act This act attempts to protect U.S. waterways from oil pollution by requiring that oil tankers in U.S. waters be double-hulled by 2015.

Main