

## Chapter 1: Basic Concepts

HWR 201 Lecture  
Thursday, August 23, 2007  
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## Environmental Technology

- involves the application of engineering principles to the planning, design, construction, and operation of:
  1. Drinking water treatment & distribution
  2. Sewage disposal and water pollution control
  3. Stormwater drainage and control
  4. Solid and Hazardous waste management
  5. Air & Noise Pollution Control
  6. General Community Sanitation

## Practice of Environmental Technology

1. Public Health Protection – *spread of diseases, Condition of physical, mental and social well-being, and comfort*
2. Environmental Health Protection – *preserve water, land, air, vegetation, & wildlife*

**Environmental Technology:** Interdisciplinary field: Hydraulics, hydrology, biology, ecology, geology, chemistry and others...

**I.- We want to build a new community!**  
(residential, commercial and industrial centers)



### 1. Water Supply

- Is there existing public water system nearby with sufficient **capacity**?
- What is best, centralized treatment & distribution system for whole community or use individual wells?
- What **types of water treatment processes** will be required to meet **water standards (federal, state)**?
- What is the optimal hydraulic design of the storage, pumping, & distribution network?

### 2. Sewage Disposal & Water Pollution Control

- Where do we dispose the “sewage”?
- Contains human wastes, wash water, dishwater, chemicals from industrial and commercial areas, micro-org., etc.
- Is there a nearby municipal sewerage system with the capacity?
- Are the local geological conditions adequate for on-site subsurface disposal of waste water (septic systems) or is a centralized sewage treatment plant necessary?
- If so, is there a stream nearby for discharge?



## 2. Sewage Disposal & Water Pollution Control

- What is required **level of treatment** to prevent water pollution?
- Is the flow of **industrial wastewater** important factor?
- Is it possible to use **land disposal** (i.e. spray irrigation)?
- What methods to treat and dispose of sludge or biosolids?
- What is optimum layout and hydraulic design for sewage collection sys. To convey wastewater to treatment facility with min. pumping?

## 3. Stormwater Management

- Development of land and use increases volume and rate of stormwater runoff from rain or melting snow
- Construction of roads, pavements, etc.
- Optimal layout, hydraulic design, design intensity and storm duration
- Best Management Practices (BMP) for reducing peak runoff and protecting water quality during wet weather periods?

**In Tucson:** <http://dot.tucsonaz.gov/stormwater>  
**Alternatives???**

## 4. Solid & Hazardous Waste Management

- Production of **municipal refuse** and industrial waste materials
- Responsibility of local municipality
- Improper disposal can lead to **diseases** such as typhus and plague
- Contamination of GW by leachate from landfills (synthetic organic compounds ass'd with cancer)
- Incineration leads to **air pollution**

## 5. Air & Noise Pollution Control

- Fuel combustion, industrial and manufacturing processes, automotive traffic, short term construction
- Apply appropriate air pollution control technology
- Environmental impact statement (EIS)
- Construction noise - Hours of operation

The coal-fired Navajo Generating Station near Page, Arizona



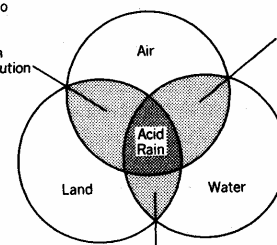
## 6. Other Environmental Factors

- Impacts on local vegetation and wildlife
- Impacts on Endangered species
- Soil Erosion, & stream sedimentation
- Displacement of wildlife
- Impacts on wetlands (marshes and swamps)



## Environmental Interrelationships

Incineration of solid wastes to conserve and protect land resources can cause air pollution problems.



Certain air pollution control systems, such as "scrubbers," produce a flow of dirty water that can cause water pollution.

Leachate seeping through sanitary landfills can contaminate surface water and groundwater resources.

## Goal of Environmental Technology

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## II. Public Health

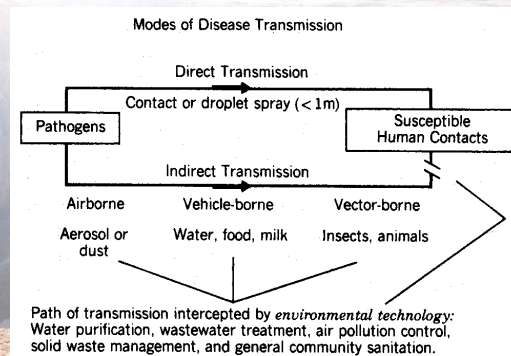
- Goal is to prevent the spread of disease
- Construction of and operation of modern water treatment and pollution control systems



## Two broad groups of diseases:

1. **Communicable diseases** – transmitted from person to person, caused by microbes (typhoid, cholera, malaria, bubonic plague, etc.)
2. **Non-Infectious diseases** – not transmitted person to person (contaminated air, water or food), heavy metals (Pb, Mercury, PCB)

## Modes of Transmission – Communicable diseases



Ref: Streeter (2003) The Population Health Approach in Historical Perspective. Public Health then and now. American Journal of Public Health, 93(3)

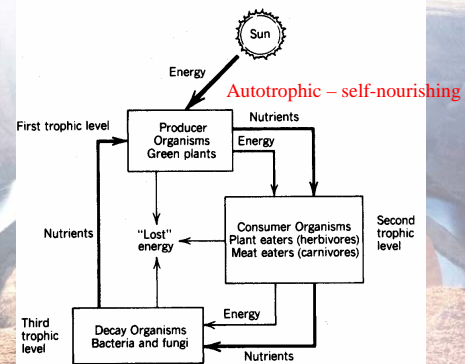
## III. Ecology

- Branch of biological science concerned with the relationships and interactions between living organisms and their physical surroundings or environment
- Living organisms & environment in which they exchange materials and energy make the **ecosystem**
  - **Biotic components** – living plants and animals
  - **Abiotic components** – air, water, minerals, and soil
  - **Energy** – usually from the sun
- Terrestrial ecosystems: forest, deserts, jungles, and meadows...
- Aquatic Ecosystems: streams, rivers, lakes, marshes ...

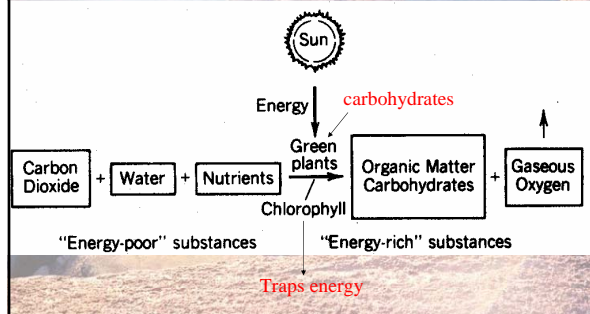
## Food Chains and Metabolism

- Laws of Ecology = one way flow of energy and circulation of materials
- Metabolism – biological and chemical process by which an organism sustains life (*photosynthesis and respiration*)

## Diagram of Food Chain

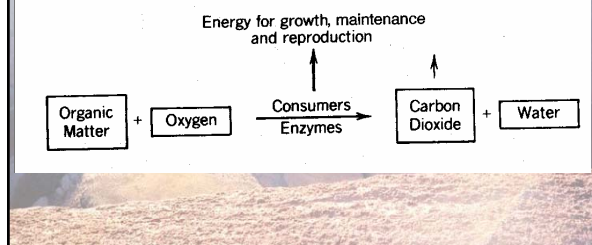


## Photosynthesis



## Respiration

•Process by which consumers obtain energy from organic material stored in plants and animals they eat



## Aerobic Decomposition

- Aerobic decomposition occurs in the presence of free Oxygen; oxidation of C, H, S, N, Ph  $\rightarrow$   $\text{CO}_2$ ,  $\text{H}_2\text{O}$ ,  $\text{SO}_4$ ,  $\text{NO}_4$
- Aerobes – microbes thriving in Oxygen
- Energy released in decomposition used by microbes for growth and reproduction
- Does not produce offensive odors

## Anaerobic Decomposition

