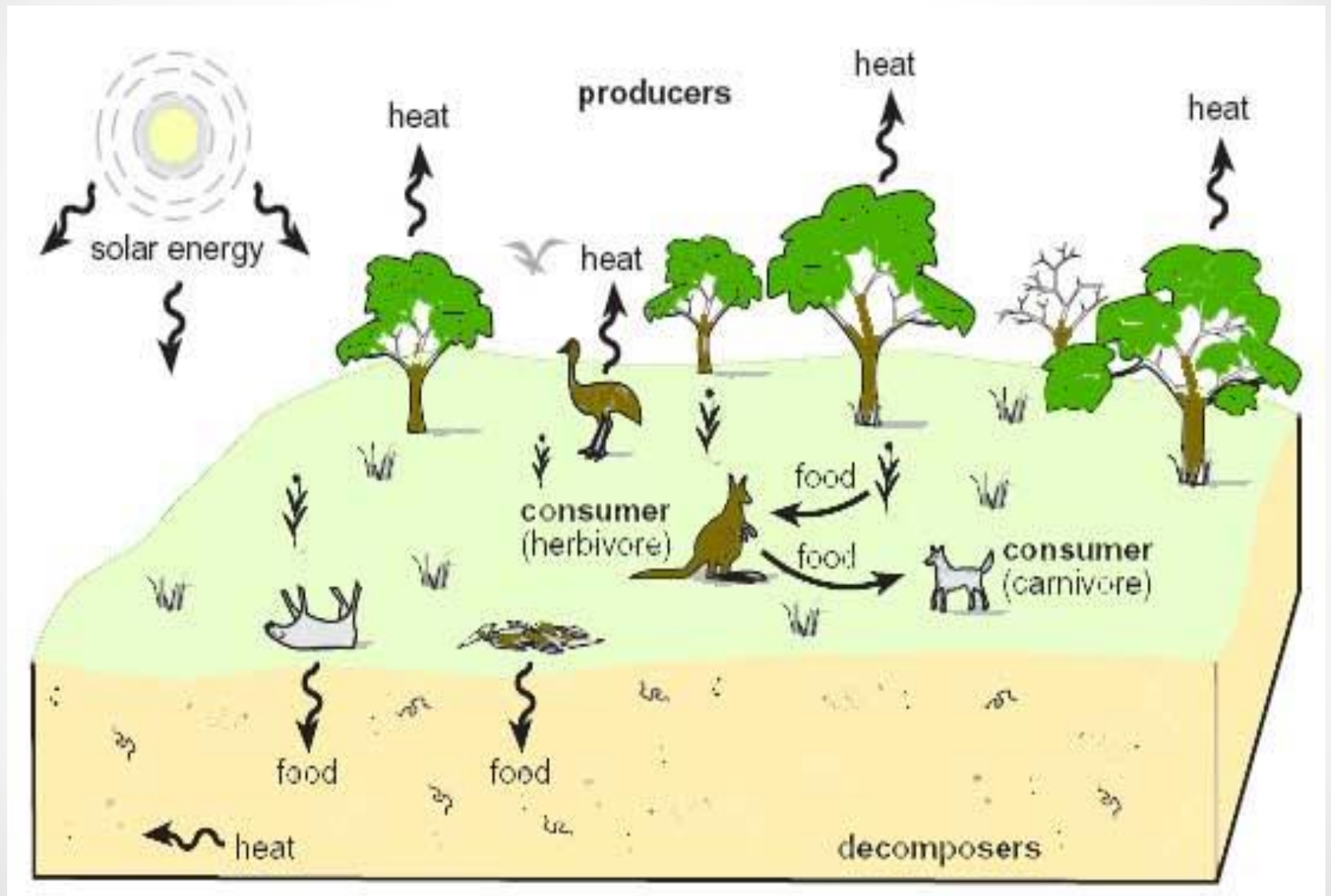


# Ecosystem Components



- An ecosystem consists of the biological community that occurs in some locale, and the physical and chemical factors that make up its non-living or abiotic environment. There are many examples of ecosystems -- a pond, a forest, an estuary, a grassland. The boundaries are not fixed in any objective way, although sometimes they seem obvious, as with the shoreline of a small pond. Usually the boundaries of an ecosystem are chosen for practical reasons having to do with the goals of the particular study.
- The study of ecosystems mainly consists of the study of certain processes that link the living, or biotic, components to the non-living, or abiotic, components. **Energy transformations** and **biogeochemical cycling** are the two main processes that comprise the field of ecosystem ecology. As we learned earlier, ecology generally is defined as the interactions of organisms with one another and with the environment in which they occur. We can study ecology at the level of the individual, the population, the community, and the ecosystem.
- Studies of **individuals** are concerned mostly about **physiology, reproduction, development or behavior**, and studies of **populations** usually focus on the **habitat and resource needs of individual species, their group behaviors, population growth, and what limits their abundance or causes extinction**. Studies of **communities** examine **how populations of many species interact with one another, such as predators and their prey, or competitors that share common needs or resources**.
- In ecosystem ecology we put all of this together and, in so far as we can, we try to understand how the system operates as a whole. This means that, rather than worrying mainly about particular species, we try to focus on major functional aspects of the system. These functional aspects include such things as the amount of energy that is produced by photosynthesis, how energy or materials flow along the many steps in a food chain, or what controls the rate of decomposition of materials or the rate at which nutrients are recycled in the system.

# Components

- Non-Living Components
- Living Components

| <b>ABIOTIC COMPONENTS</b>                                           | <b>BIOTIC COMPONENTS</b> |
|---------------------------------------------------------------------|--------------------------|
| Sunlight                                                            | Primary producers        |
| Temperature                                                         | Herbivores               |
| Precipitation                                                       | Carnivores               |
| Water or moisture                                                   | Omnivores                |
| Soil or water chemistry<br>(e.g., P, NH <sub>4</sub> <sup>+</sup> ) | Detritivores             |
| etc.                                                                | etc.                     |

# Sun Light

- The fate of sun light

The amount of solar radiation which reach the atmosphere 2 calories per cm<sup>2</sup> (1376 W/m), this value known as **solar constant**

1. 50 percent of sun energy travelling through the atmosphere to reach the earth.
2. If we consider that the amount of solar radiation which reach to the earth is 100 percent, this energy will undergoing the following process:
  - a- 25% is reflected by the clouds and atmosphere layers to the space.
  - b- 5 % is reflected by earth surface
  - c- 25% is absorbed by dust, water vapor, and carbon dioxide.So, 55 % of reached energy reflected and absorbed.
  - d- 45 % is absorbed by earth surface as short-wave radiation, then will be radiated again as long-wave radiation.

# light

- Visible light wave length is between 400-740nm (**photosynthetically active radiation PAR**)
- Infared wave length is between 740-5000nm, the longer waves called **thermal radiation** is between 5000-100000 nm.
- UV wave length is between 280-320 which is the short wave length.

## Light Characteristics

Intensity (daily, seasonally) (angle of incidence which depend on the altitude of the sun(the height of the sun on the horizon))

Duration

Directionality

# Temperature

- Thermal Environment characterised by heat and temperature.
- **Heat:** is a form of energy possessed by all substances that results from the random motion of molecules within the substances.
- **Temperature:** is the immediate direct measure of the average kinetic energy possessed by individual molecules of substances.
- **Environmental temperature** experienced by organisms result from the solar radiation. Which in turn depend on time of the year, slope, cloud cover, time of the day
- Organisms need the temperature to carry out the metabolic processes
- Low temperature slow the reaction while the high temperature denaturise the enzymes system.
- **Define the Eurytherm and Stenotherm?**

# Water & Element Nutrients

- Water is the driver of nature
- The Water structure
- The water Properties: Specific Heat, Cohesion, Adhesion, Capillarity, Surface Tension.

## Element Nutrients

There are about 30-40 chemical elements for growth, development and metabolism.

- Micronutrients: Organisms need some elements in small amount such as Cooper, Ma, Molybdenum, Zn, Ag, Idion, Se, Silica, Fe.
- Macronutrients: Organisms need some of these elements in large amount such as C, H, O, N, Ca, Phosphorus, P, Mg, Su, Na, Chlorine



The source of terrestrial elements :

- 1- weathering of mineral soil
- 2- decomposition of organic matters
- 3- nitrogen fixation
- 4- atmospheric gases
- 5- deposition of atmospheric particles
- 6- precipitation
- 7- Ocean salt spray

Aquatic Nutrients:

- 1- input from surrounding land
- 2- organic matter
- 3- sediment
- 4- precipitation

# Soil

**Soil** Definition: is the stratum below the vegetation and above hard rock.

**Soil**: is a natural product formed from weathered rock by the action of climate and living organisms.

There are more definitions, Please see the lecture paper.

Soil Characteristics:

Colour

Texture

Depth

Moisture

# Living Organisms

## (Biotic Components)

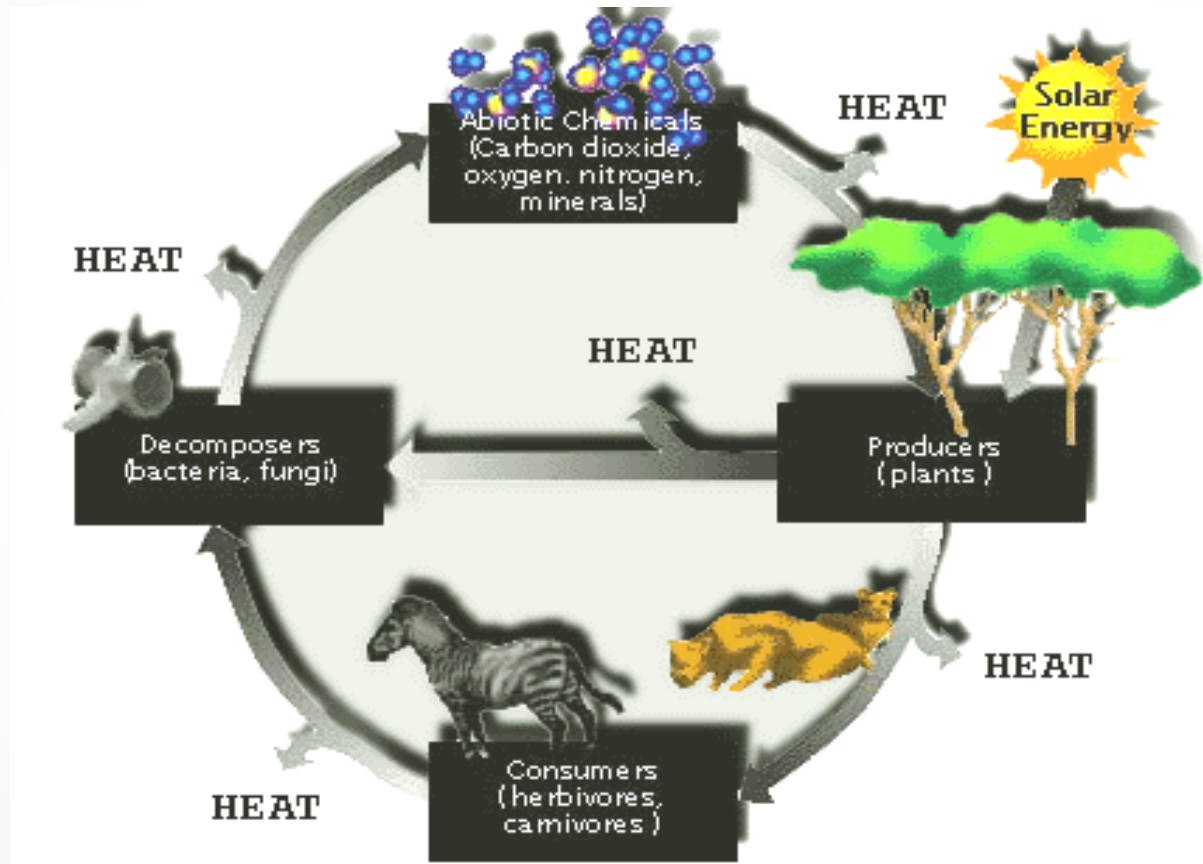
- Autotrophic Organisms
- Heterotrophic Organisms (consumers) (decomposer look likes the fungi)

There are two main types of consumers:

1- Phagotrophs: depends on the food types, this group can be divided to three divisions: Herbivores, Carnivores and Omnivores.

2- Osmotrophs: Saprophytic organisms.

# Process of Ecosystem



Energy flows and material cycles.

# The Transformation of Energy

- The transformations of energy in an ecosystem begin first with the input of energy from the sun. Energy from the sun is captured by the process of photosynthesis. Carbon dioxide is combined with hydrogen (derived from the splitting of water molecules) to produce carbohydrates (CHO). Energy is stored in the high energy bonds of adenosine triphosphate, or ATP (see lecture on photosynthesis).
- The prophet Isaah said "all flesh is grass", earning him the title of first ecologist, because virtually all energy available to organisms originates in plants. Because it is the first step in the production of energy for living things, it is called **primary production**. **Herbivores** obtain their energy by consuming plants or plant products, **carnivores** eat herbivores, and **detritivores** consume the droppings and carcasses of us all.

# Biogeochemistry

- The term Biogeochemistry is defined as the study of how living systems influence, and are controlled by, the geology and chemistry of the earth. Thus biogeochemistry encompasses many aspects of the abiotic and biotic world that we live in.
- here are several main principles and tools that biogeochemists use to study earth systems. Most of the major environmental problems that we face in our world today can be analyzed using biogeochemical principles and tools. These problems include global warming, acid rain, environmental pollution, and increasing greenhouse gases. The principles and tools that we use can be broken down into 3 major components: **element ratios, mass balance, and element cycling.**