CE 107: Introduction to Civil and Environmental Engineering

Lecture 3: Man and Environment, Major components of Environment

What is Environment ?

- All the things around us with which we interact:
- Living things

Animals, plants, forests, fungi, etc.

- Non-living things

Continents, oceans, clouds, soil, rocks

- Our built environment

Buildings, human-created living centers

Social relationships and institutions

What is Environmental Science ?

- **Environmental science** is an interdisciplinary academic field that integrates physical and biological sciences, (including but not limited to Ecology, Physics, Chemistry, Biology, Soil Science, Geology, Atmospheric Science and Geography) to the study of the environment, and the solution of environmental problems. Environmental science provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems.
- Related areas of study include environmental studies and environmental engineering. Environmental studies incorporates more of the social sciences for understanding human relationships, perceptions and policies towards the environment. Environmental engineering focuses on design and technology for improving environmental quality.

What is Environmental Science ?

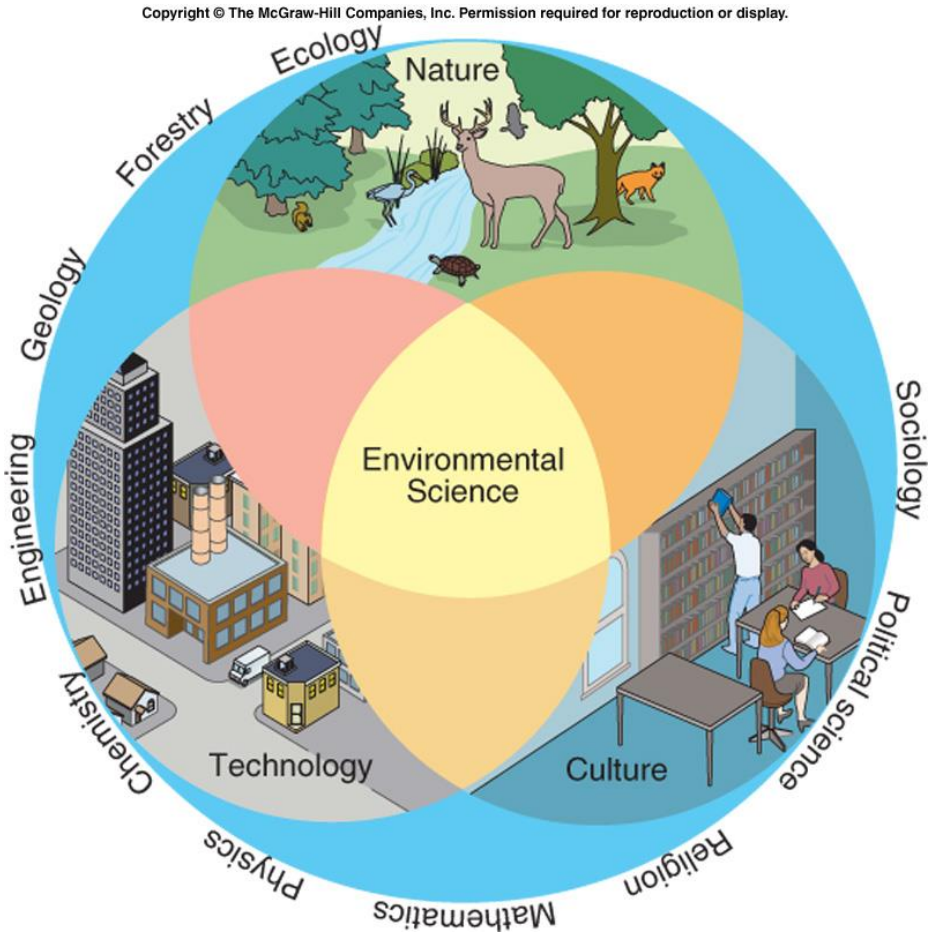


Image taken from Principles of Environmental Science, Cunningham, 2005.

Why Study Environmental Science?

- Can help us avoid mistakes made by past civilizations.
- Human survival depends on how we interact with our environment.
- Our impacts are now global.
- Many great civilizations have fallen after depleting their resources.

What is Environmental Engineering

- BY THE ENGINEER - MAY, 22ND 2014

Environmental engineering is the sister field of civil engineering and involves integrating engineering principles and science to improve natural environment and to protect it while providing potable water, clean air and sustainable life for humans and other organisms. Another crucial task tackled by environmental engineering is that of cleaning up polluted areas/sites. It also deals with tackling issues that are being faced by public.

http://wonderfulengineering.com/what-is-environmental-engineering/

http://wonderfulengineering.com/what-is-environmental-engineering/

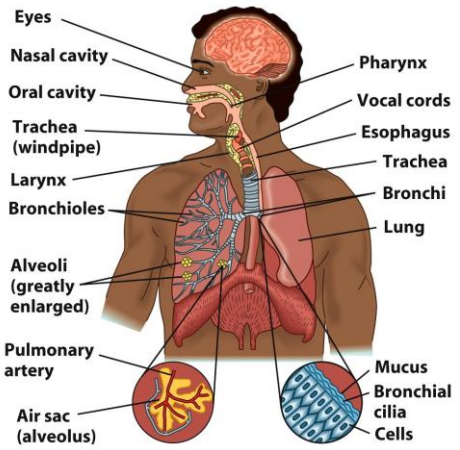
Environmental Engineering ….the link

Environmental Reservoirs

Water, Air and Soil

Pollution control
Waste treatment and disposal
Hazard Management

Impact on Humans



Why there is always a need for Environmental Engineer

- We always need clean water to drink
- We always have wastes to treat and dispose
- We always need clean air to breathe

We always …want cheaper and better ways to improve all of the above….

…….Ensures Job Security !!!!!!!

Excerpt from a presentation by Dr. Annalisa Onnis-Hayden, Assistant Academic Specialist, Department of Civil and Environmental Engineering, Northeastern University, Boston, USA

Basic History of Humans and the Environment

- Hunter-Gatherers (10,000 B.C.)
  - Obtain food by collecting plants and hunting wild animals.
  - Effects on the environment were limited.
    - Hunting of some animal species.
    - Picked up and spread plants/seeds to new areas.

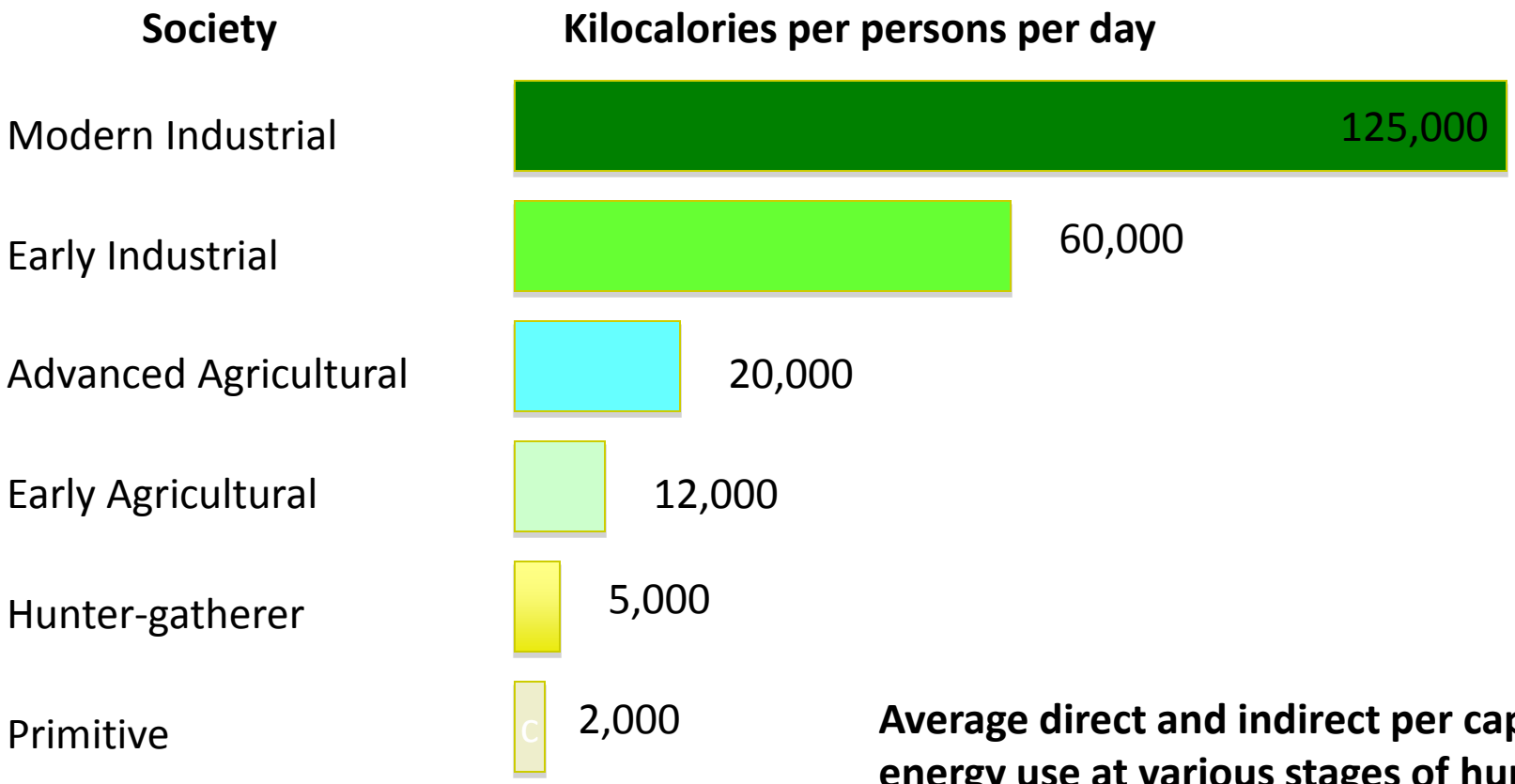
Basic History of Humans and the Environment

- Agricultural Revolution (6000-7000 B.C.)
  - Humans first developed the process of breeding, growing, and harvesting plants for food as well as animal domestication.
  - Effects on the environment:
    - Human population grew more quickly
    - Natural habitats (grasslands, forests) replaced by farmland and villages.
    - New breeds of animals and plants were created.

Basic History of Humans and the Environment

- Industrial Revolution (1800s)
  - Shift in the source of energy to fossil fuels
  - Effects on the environment:
    - More efficient farming
    - Faster human population growth
    - Increased burning of fossil fuels.
    - Introduced synthetic plastics, fertilizers, pesticides.
    - Higher amounts of pollution.

Basic History of Humans and the Environment



Average direct and indirect per capita daily energy use at various stages of human cultural development

Miller (2000), Living in the Environment

The Earth: Before and After

- Earth began approximately 4.6 billion years ago
- Life on earth began app 2 billion years later.
- Several million years ago, human beings appeared on earth and started manipulating this dynamic, evolving system

- The Earth is a closed system.
  - The only thing that enters or leaves the Earth in large quantities is heat.
  - Resources are limited, but the population continues to increase.
  - Wastes do not go away.

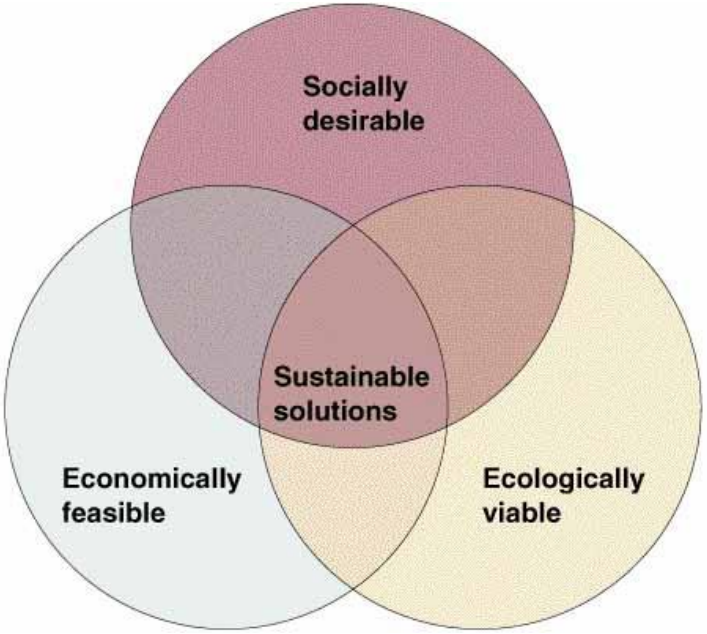
The Earth: Before and After

Do we Understand the magnitude and frequency of processes that maintain dynamic Earth Cycles??????

- Water Resources – evaluate the nature and extent to which natural processes can supply ground water and surface water
- Waste disposal – how the disposal procedure interacts with natural cycles to ensure safety or present and future generations

Sustainability

- **a. Economist's definition:** Will growth be sustained? Is the process efficient? Are resources being wasted?
- **b. Ecologist's definition:** Is the ecosystem sustainable? Are we using resources at a rate
- that is faster than can be produced in nature?
- **c. Sociologist's definition:** Are the social structures sustainable? Is there social cohesion? Are resources distributed in a manner that is socially sustainable?

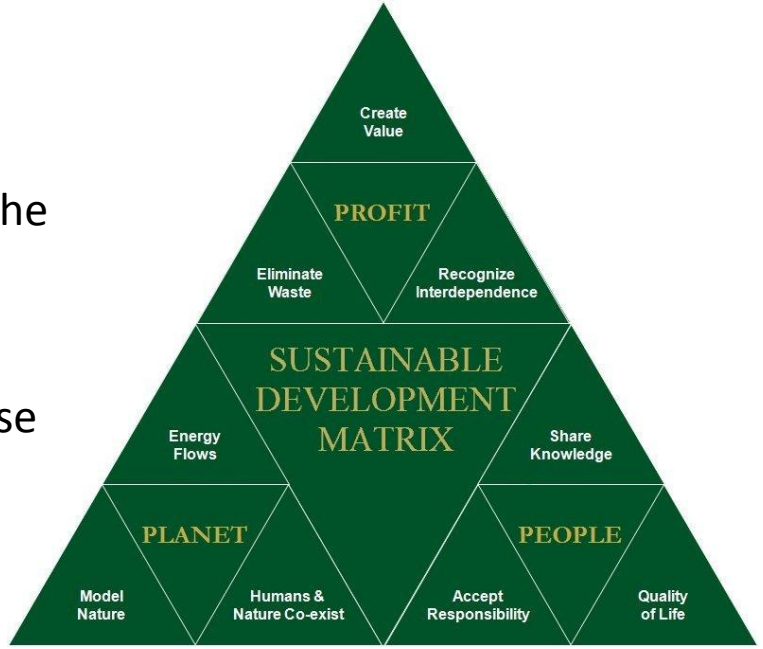


Ability of a system to meet human needs so that the population can survive ***indefinitely.***

Sustainable Development

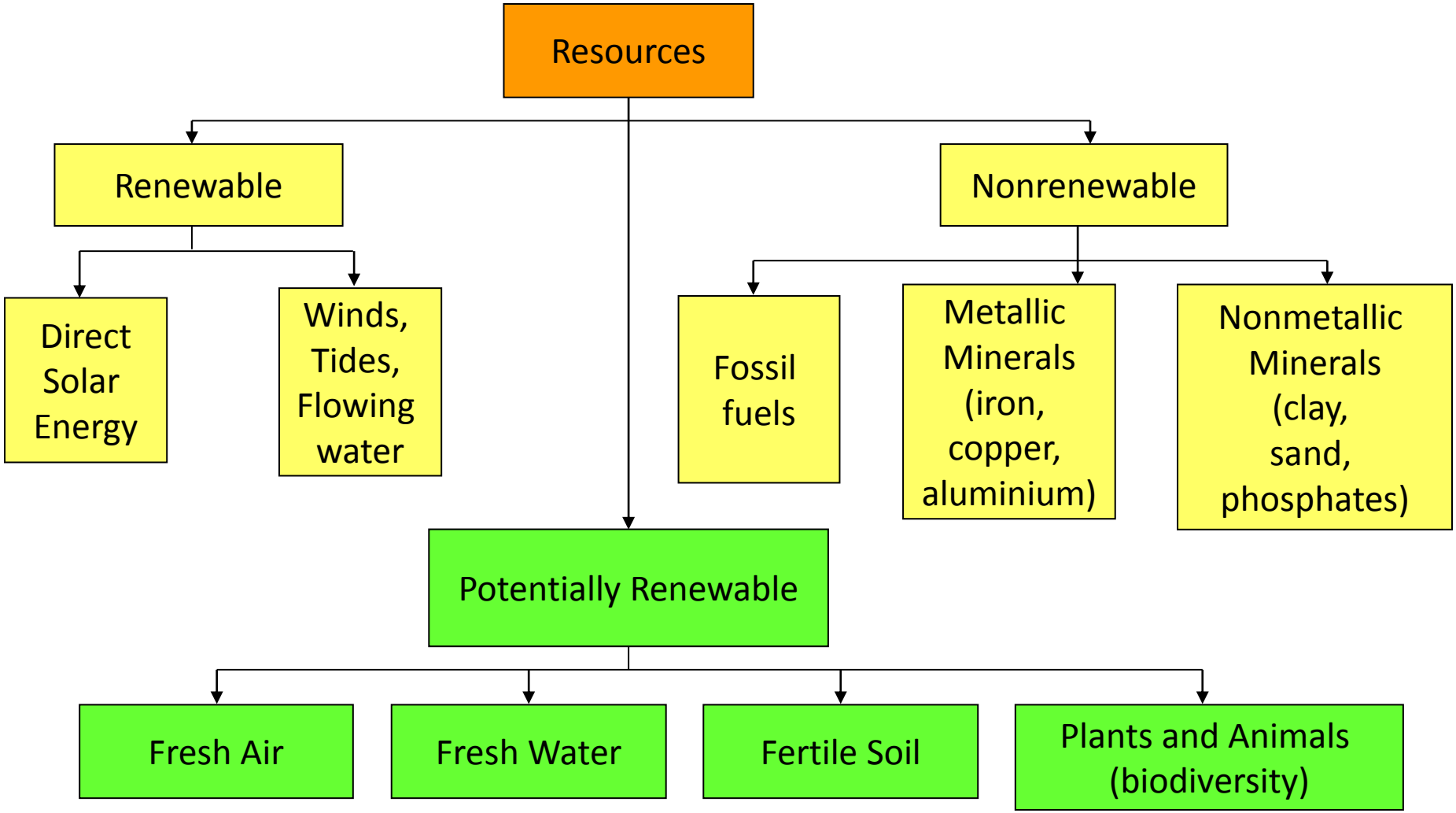
- "Our Common Future" by the World Commission on Environment and Development (also called the "Brundtland Report"), which defines sustainable development as *"which meets the needs of the present without compromising the ability of future generations to meet their own needs".*

- This idea assumes that we have a right to use the earth's resources and earth capital to meet our needs but that we have an obligation to pass on the earth's resources and services to future generations in as good or better shape than these conditions were passed on to us.



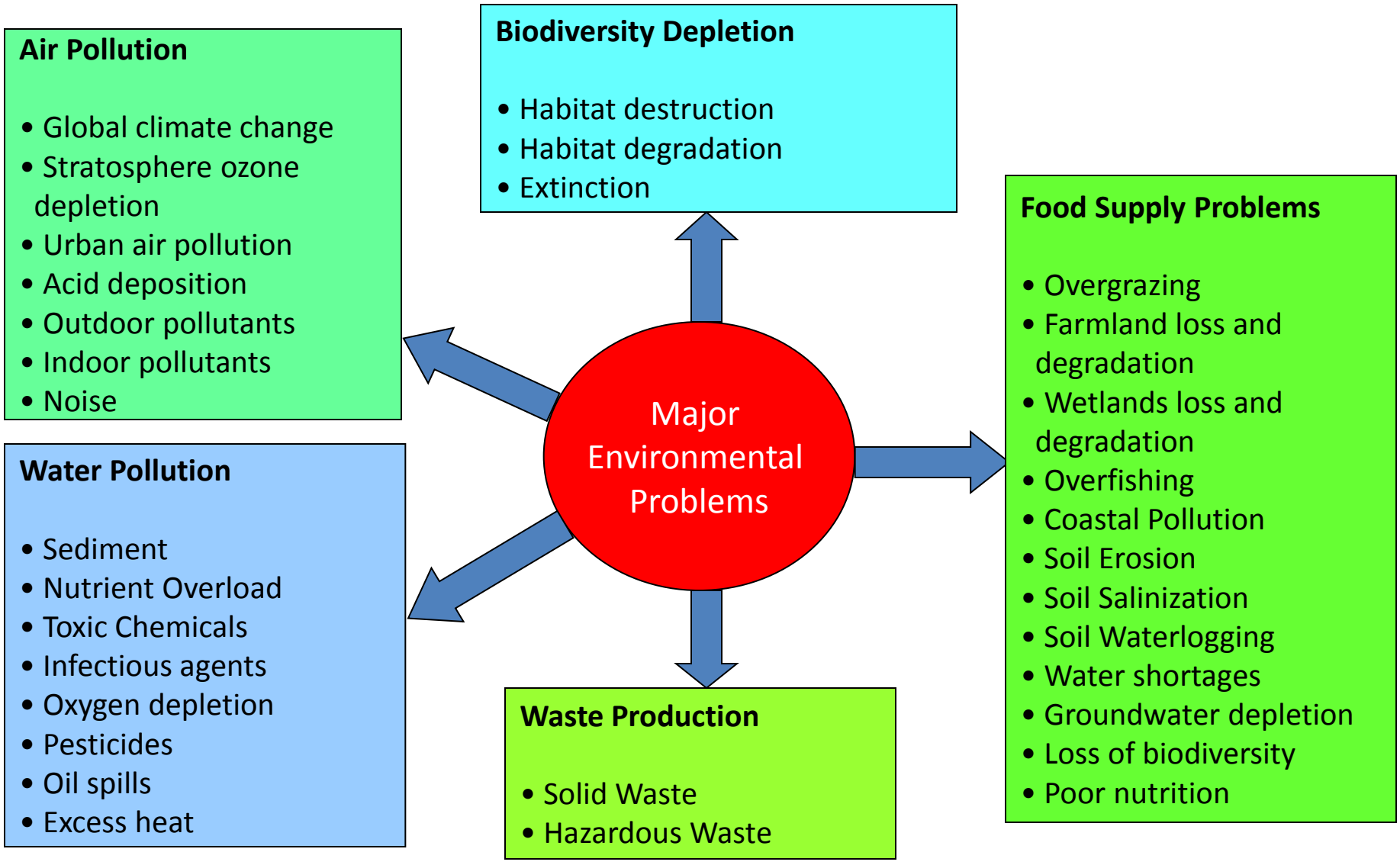
http://www.triplepundit.com/2011/02/universal-principles-sustainable-development/

Resources



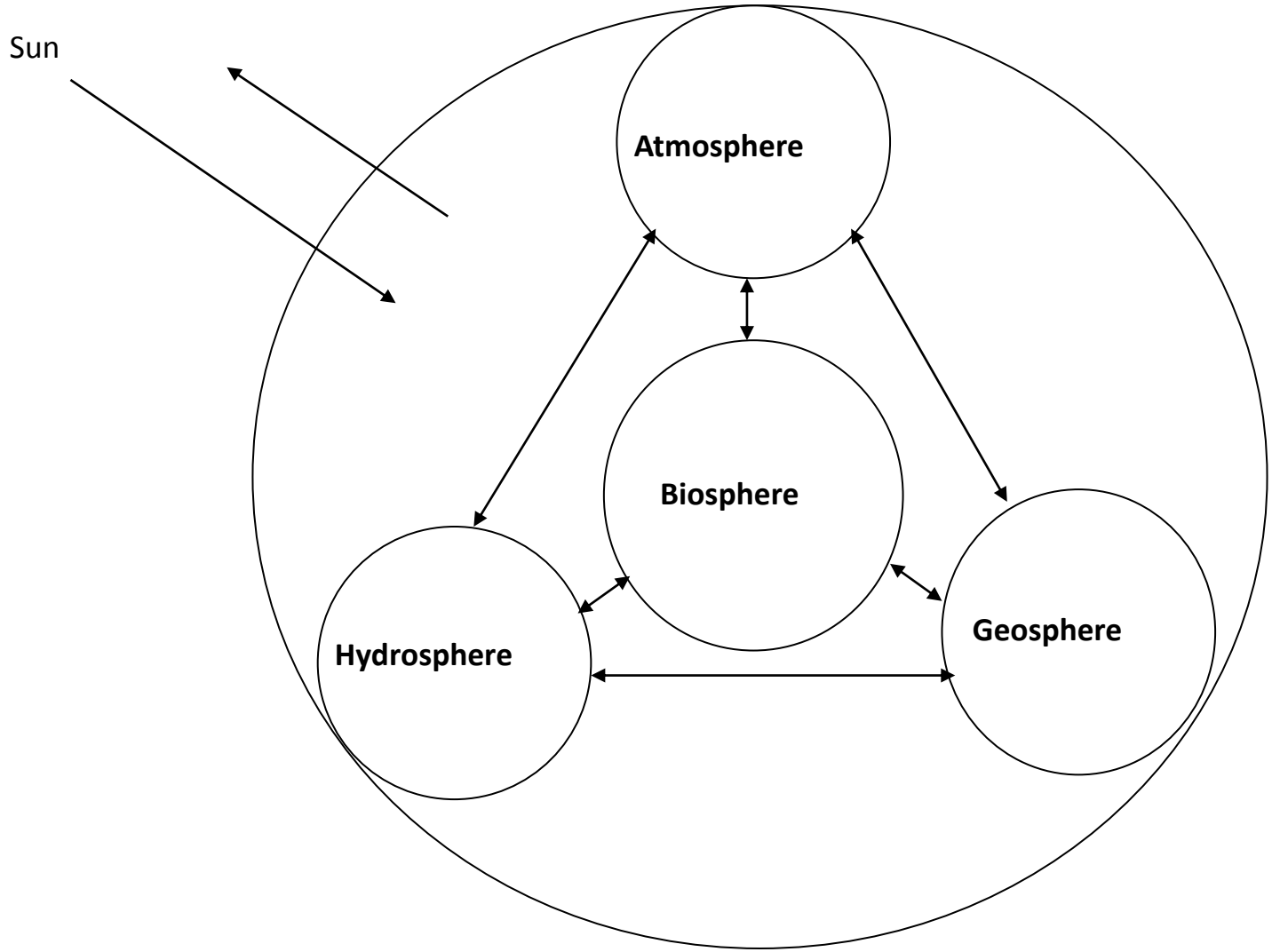
Miller (2000), Living in the Environment

Major Environmental Problems



Miller (2000), Living in the Environment

The Earth System

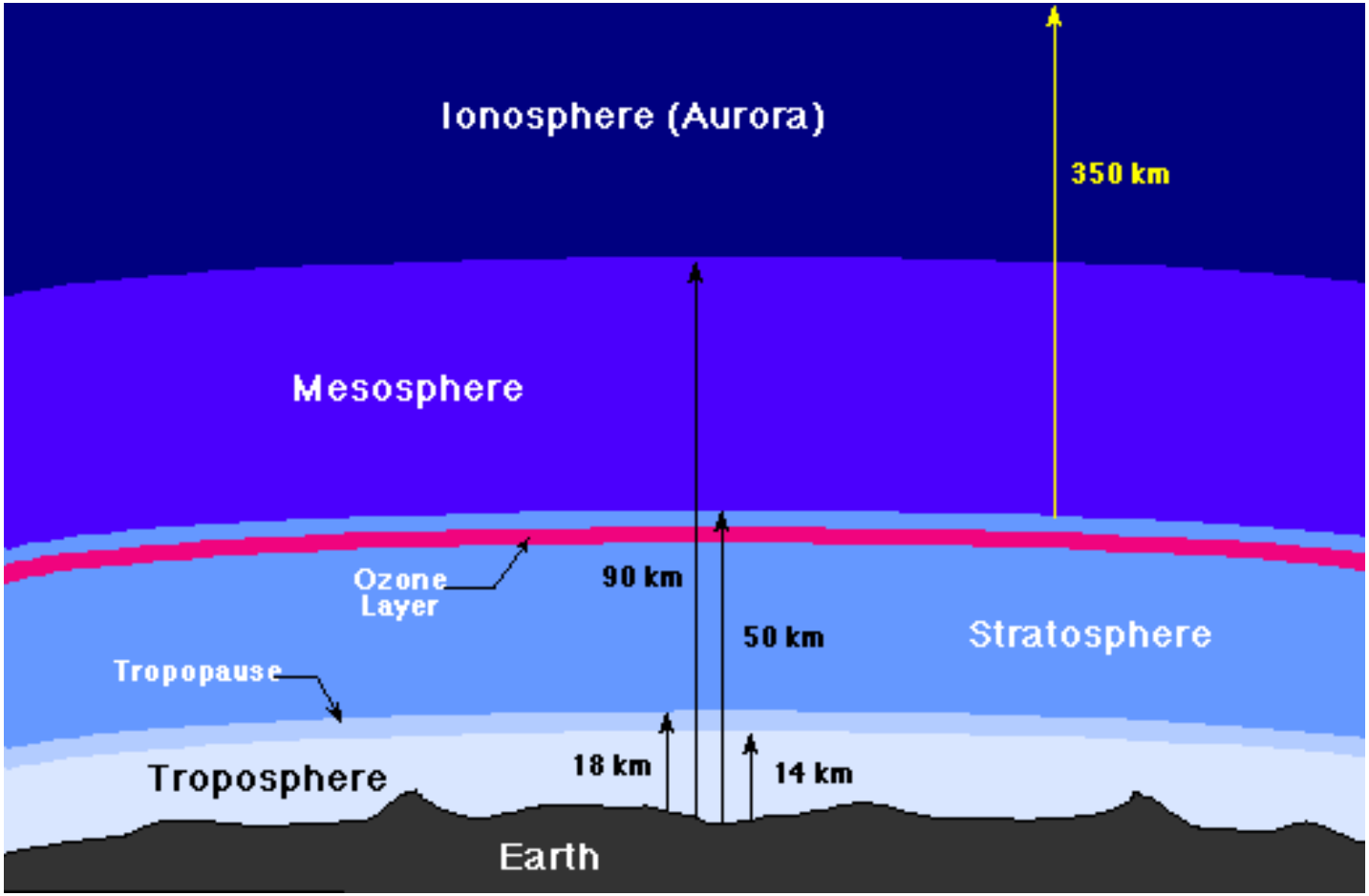


Major Components of Environment

Atmosphere –

- The mixture of Gases that surrounds the earth.
- Predominantly, nitrogen, Oxygen, carbondioxide, and water vapor.
- Climatic conditions affecting the earth occur within this layer
- The atmosphere acts as a shield protecting the earth from cosmic rays and filters out the tissue damaging ultraviolet radiation of the sun
- Without the atmosphere life would not be possible on earth

The Atmosphere



Major Components of Environment

Hydrosphere –

- All of earth's water, including oceans, lakes, streams, underground water, snow, and ice – excluding water vapor in the atmosphere (considered as part of atmosphere)
- The oceans and the seas cover seven-tenths of the earth's surface
- Ninety-seven percent of the total supply of water on earth are held in the oceans and seas whilst the rest is freshwater
- Oceans play an important role in determining the climate of a region and are an important component of the hydrologic cycle

Major Components of Environment

Biosphere –

- All of the earth's organisms, including both animal and plant species.

Comprise of -

- The flora –

Hundreds of thousands of species of plant life, both terrestrial and aquatic

- The fauna –

All species of animals on land and water

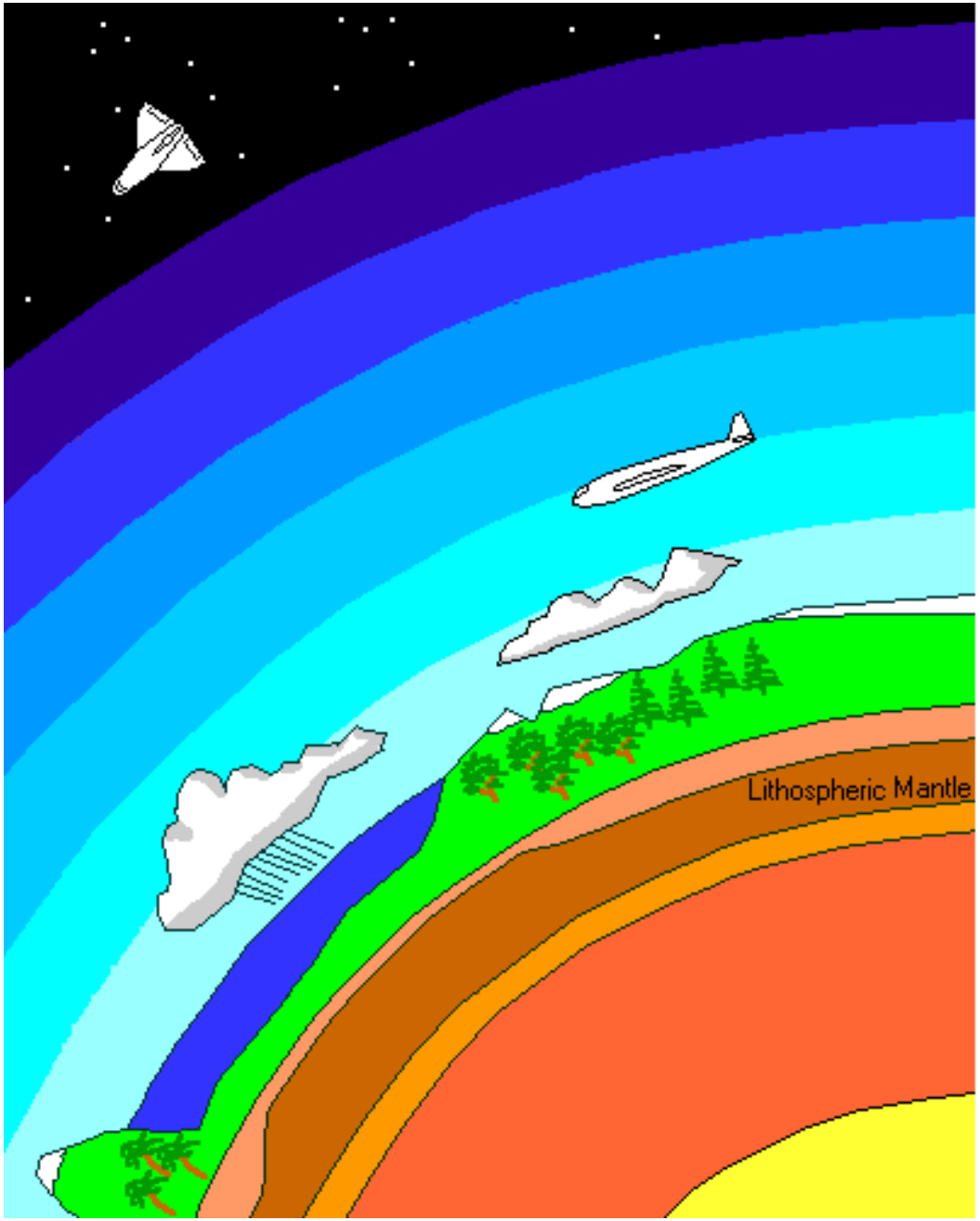
- The biotic community interacts within themselves and with its physical environment. Together they form what is known as the ecosystem.

Major Components of Environment

Geosphere –

- The solid earth, principally composed of rock and regolith (the irregular blanket of loose, uncemented rock particles).
- Most of the earthquake occur along and near these

* Presence of atmosphere and hydrosphere is the only property that made our planet suitable for life, compared to other planets.



Thermosphere

Ionosphere

Mesosphere

Ozone Layer

Stratosphere

Troposphere

Cryosphere

Hydrosphere

Biosphere

Crust

Lithosphere

Asthenosphere

Mantle

Core