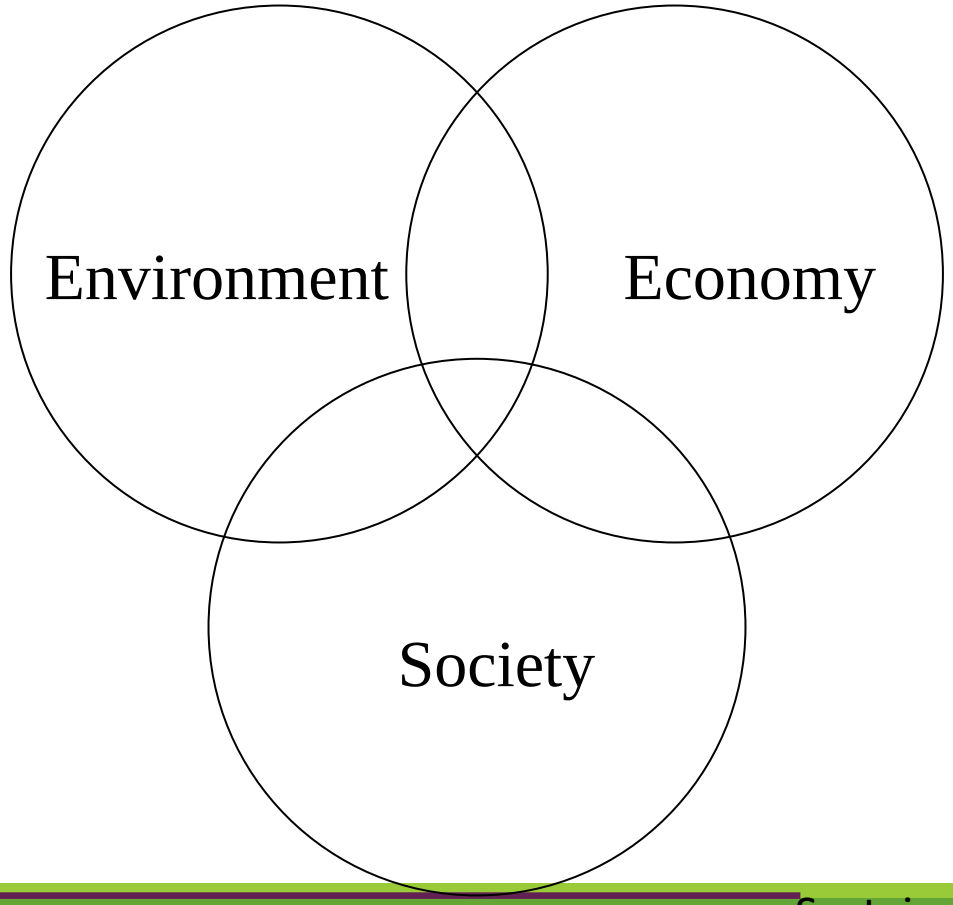
SUSTAINABILITY

INTODUCTION TO SUSTAINABILITY

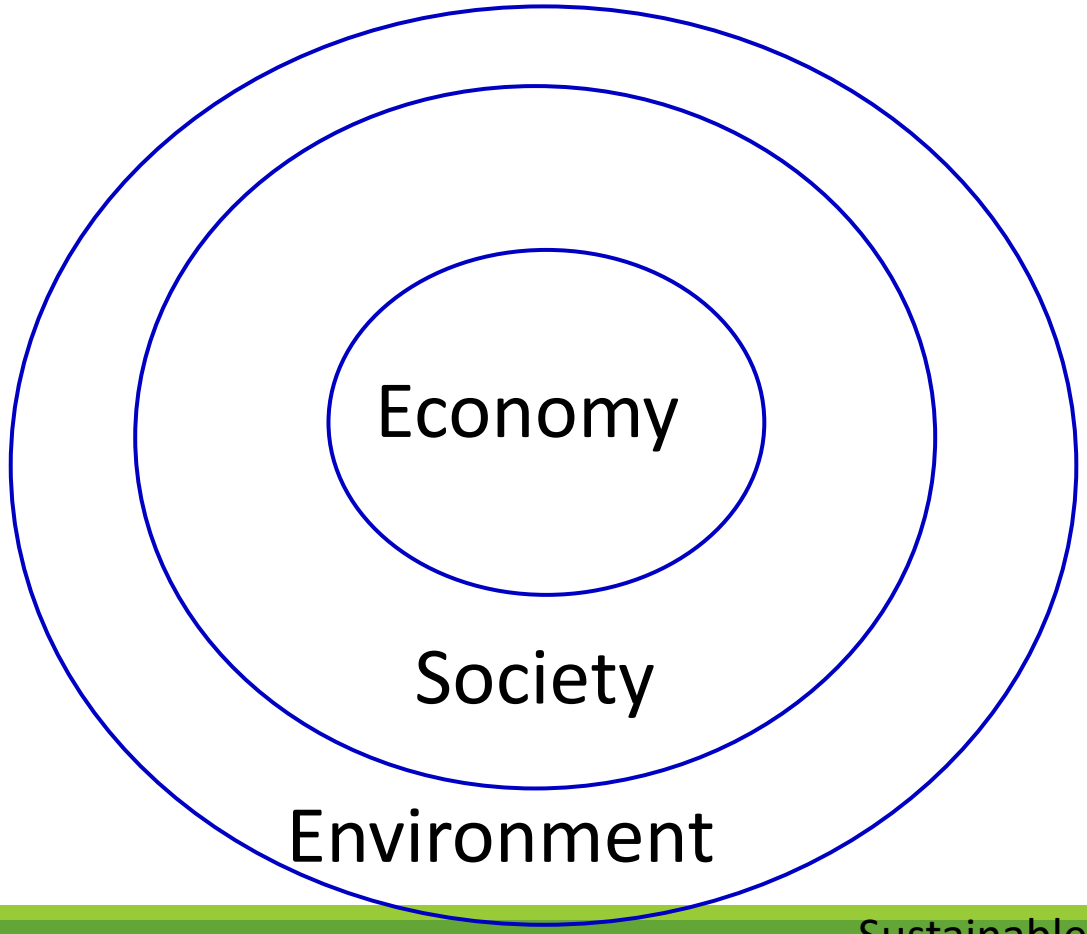
ENERGY EFFECIENCY

CLIMATE, BIOME AND ECOSYSTEM

Traditional View of Community



Sustainable View of Community



Traditional Thinking

Environment	Economy	Society
Water Quality	Stockholder Profits	Education
Air Quality	Materials for Production	Health
Natural Resources	Jobs	Poverty
		Crime

Basic Definitions

- **Sustain -** to keep in existence without diminishing, to provide sustenance and nourishment

- **Develop -** to bring out the capabilities or possibilities of, to bring to a more advanced or effective state

- **Community -** a group of any size whose members reside in a specific locality and share resources needed to survive

Sustainability is:

"..development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

Brundtland Commission

Sustainability is:

"A way of life that safeguards and enhances our resources, prevents harm to the natural environment and human health, and sustains and benefits the community and local economy – for the sake of current and future generations."

Santa Monica Sustainable City Program

Sustainability Concepts

- Long-term balance between economic, social and environmental goals *(look ahead 20-50 years, understand the connections)*
- Limits to natural, social, and built systems *(live off the interest of community capital, don't degrade or use it up)*
- Inter- and intra- generational equity *(share with future generations and current inhabitants, local sustainability in harmony with global sustainability rather than at expense of others)*

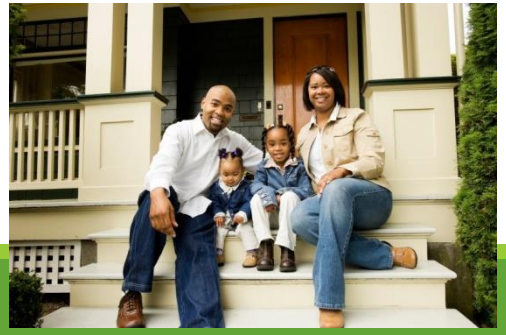
Sustainability Concepts

"A sustainable, green and high-performance building is one that is designed, constructed and operated to make the world a better place by improving the environment through nurturing our lives, restoring our environmental assets and inspiring us,"

Michaella Wittmann

Sustainability and Human Health

- Human health is dependent on environmental health. We all need a healthy environment.
- Environmental health is dependent on human activities, or the lack of human activities.
- Many of the activities that we engage in to be more green or sustainable are for human health.

“The most sustainable energy is saved energy”

Energy itself not of particular interest -but is a means towards desired ends

Clients desire the services which energy can deliver -comfort, illumination, power, transportation . . .

The architectural challenge: ensure energy services are delivered in a sustainable manner -with maximum efficiency, and minimal environmental impact

Holistic perspective: integrated, contextual, whole life cycle, socially aware, economic solution

Sustainable Building Design

“Sustainable design integrates consideration of resource and energy efficiency, healthy buildings and materials, ecologically and socially sensitive land use and an aesthetic that inspires, affirms and enables”

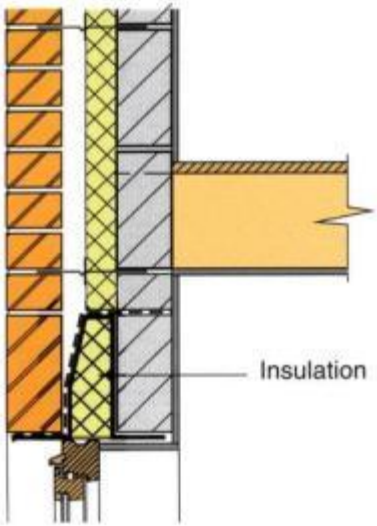
Economic, Social, and Environmental

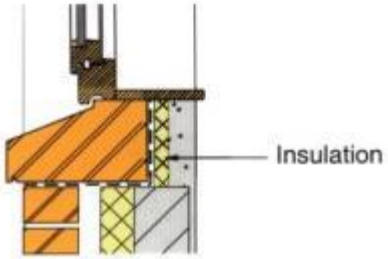
pillars of sustainable development

Energy design strategy

Optimize building envelope, minimize demand through serious conservation, and supply energy with maximum efficiency and using renewables:

- Site micro-climate
- Energy conservation
- Passive solar heating
- Passive cooling and natural ventilation
- Day lighting
- Renewables





Indoor Environmental Quality

Comfort:

Conventional standards seek stasis or ‘optimum’

- Change is the natural state of affairs
- People are more ‘forgiving’ of buildings which offer more control
- Dynamic environments stimulate –within limits!

IAQ

- Ventilation
- Air quality
- Pollutants

Integrated design for high performance building

Know-how and skills

- Design team practice
- Design, specification, procurement, construction, commissioning, testing, operation, maintenance

Replacing Energy with Ingenuity

- New materials, unconventional combinations
- Innovative technologies, appropriate systems
- Smart monitoring and control
- Building Science

Target setting

Design for longevity, flexibility and change

Universal quality

Future Features ?

- **Integrated Design Processes**
- **Evidence-Based Design**
- **Total Quality Managementkmmmmmmm**
- **Risk Analysis**
- **Automation and Intelligent Buildings**
- **Agile Buildings- flexible, adaptable…**
- **Pre-acceptance Testing Protocols**
- **Continuous Commissioning**
- **Post Occupancy Evaluation**

CLIMATE

Climate depends on many factors:

- latitude,
- precipitation,
- elevation,
- topography, and
- distance from large bodies of water.

Green Building

What is green building?

Why build green?

What Is Green Building?

CLIMATE CHANGE

‘warming of the climate system is unequivocal’

- Changes in temperatures
- Hot extremes, heat waves and heavy precipitation events
- Tropical cyclones with larger peak wind speeds
- Heavy precipitation associated with ongoing increases of tropical sea surface temperatures.
- Decreases in snow cover

How will Climate Change?

All parts of the world will experience significant changes in climate over this century. These changes can be summarised as:

- Hotter, drier summers
- Milder, wetter winters
- More frequent extreme high temperatures
- More frequent extreme winter precipitation
- Significant decreases in soil moisture content in the summer
- Net Sea level rise and increases in sea surge height
- Possible higher wind speeds

The Impact on Construction

Climatic factors	Impacts
Soil Drying	Increase will affect water tables and could affect foundations in clay soils
Temperature	Maximum and minimum changes will affect heating, cooling, air conditioning costs and thermal air movement. Frequency of cycling through freezing point will affect durability.
Relative Humidity	Increase will affect condensation and associated damage or mould growth
Precipitation	Increase and decrease will affect water tables (foundations and basements); cleaning costs will be increased in winter, with associated redecoration requirements.
Radiation	Increase may affect need for solar glare control
Cloud	Increase in winter will increase the need for electric lighting; reduction in summer may reduce the need for electric lighting for certain buildings

Biomes and climate

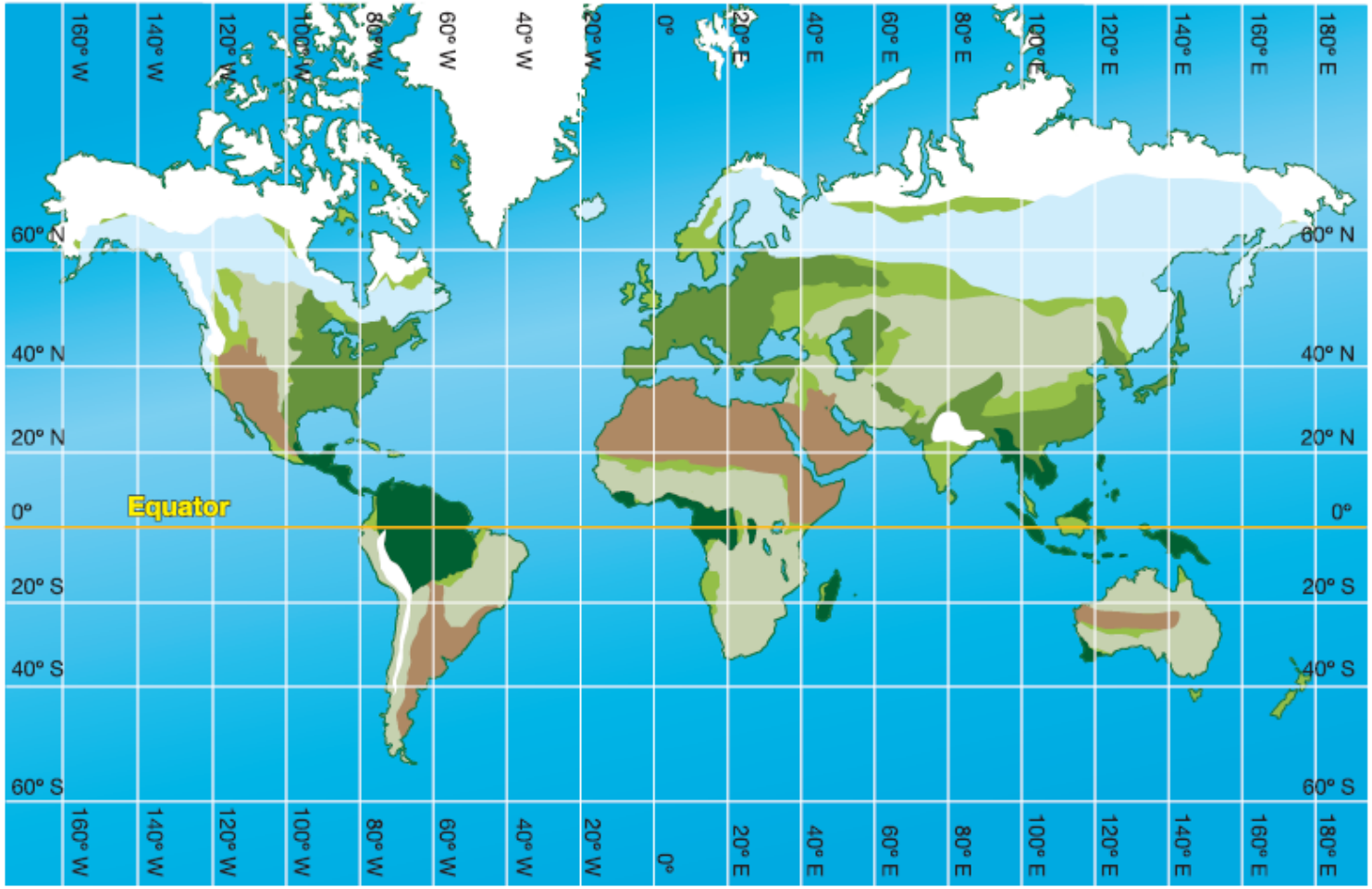
Scientists divide the planet into climate regions called **biomes.**

Earth has six main biomes:

- Deserts
- Grasslands
- Temperate deciduous forests
- Rainforests
- Taiga
- Tundra's.

Each biome has a unique set of plants and animals that thrive in its climate.

Earth's Biomes



Grassland
Desert
Temperate forest
Tropical rainforest
Taiga
Alpine and Arctic Tundra

Biome Design Concept

The Biome Design approach is applicable to urban,suburban and rural development in any and all climatic conditions.

Starting with:

- A comprehensive site analysis
- Integrating the building program (including future growth)

A design can be developed to enhance both the building's occupants and the surrounding landscape, as well.

Biome Design

- Living, self-sufficient ecosystem
- Integration into Natural Order
  - Architectural Design (human needs)
  - Local Environment / Climate / Resources
  - Appropriate Technologies
- Mutual balance between our Buildings and Landscaping with the Natural Environment
- Designing ourselves into the ecosystem

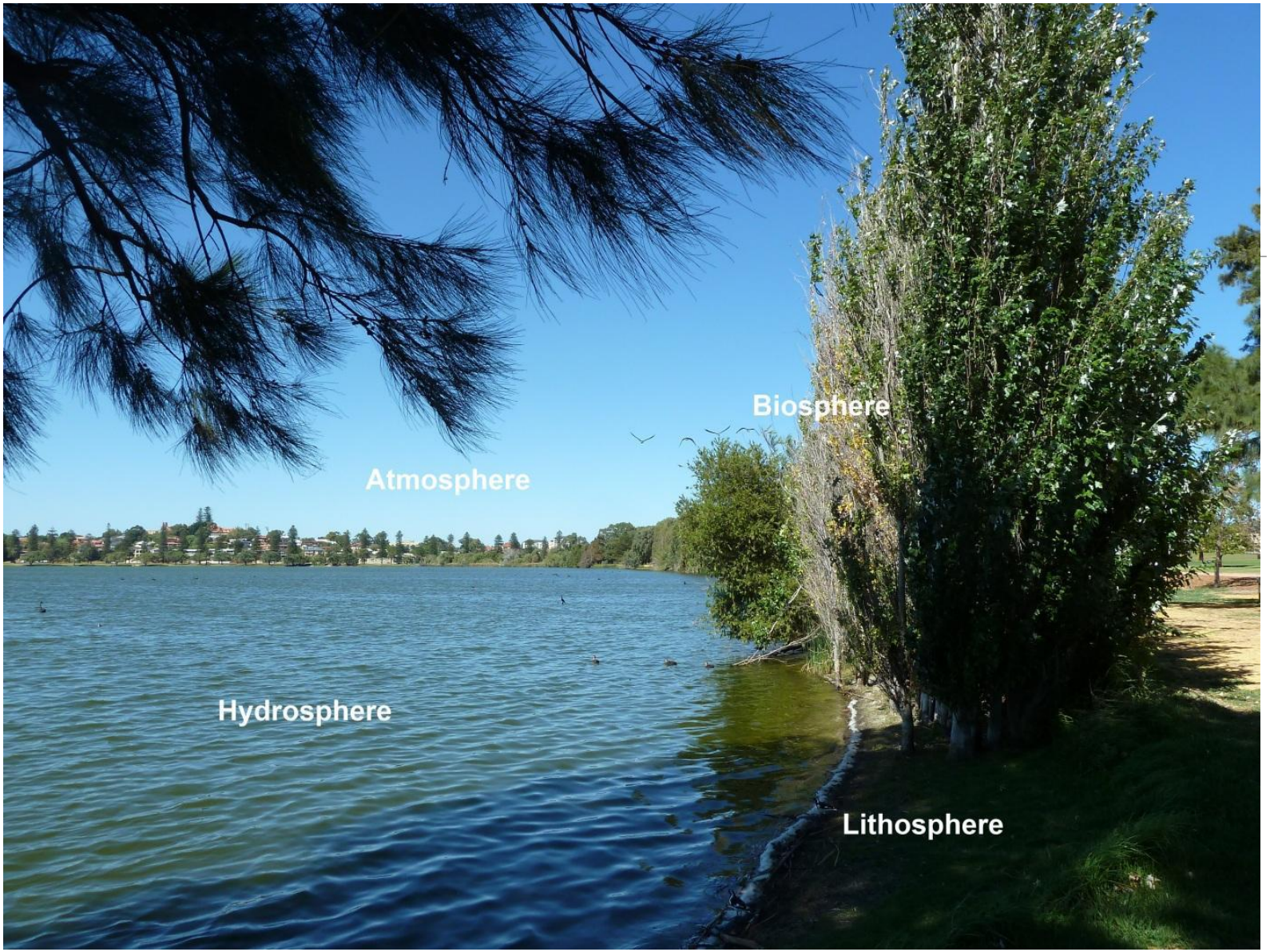
Biome Design Considerations

- Climate cycles and weather patterns
- Topography and geometry
- Vegetation – native and supportive
- Natural Resources – on site and regional
- Indigenous Building Materials
- Appropriate Technologies
- Natural Harmonics and Geometry
- Cultural Landscape and Indigenous Wisdom
- Program – building use and projected growth

Introduction to Ecosystems

Earth's natural environment can be seen as four interacting spheres:

- The solid part of the earth's crust, consisting of rocks and soil, is known as the **lithosphere**.
- All of earth's water bodies, including lakes, rivers, streams, oceans, groundwater and ice caps, are known as the **hydrosphere.**
- The layer of gases surrounding the earth is known as the **atmosphere.**
- The forth sphere of living things, including plants and animals, is known as the **biosphere.**


Biosphere
Atmosphere
Hydrosphere
Lithosphere

Introduction to Ecosystems

Ecosystems are specific areas of the environment that develop as a result of the interaction between the earth's four spheres. They are characterized by a unique collection of living organisms (plants and animals) which have adapted to their surrounding non-living environment (climate, rocks, soils and water).

The sizes of ecosystems vary. They can be as large as the earth's biosphere itself or the Sahara Desert, or as small as a fishpond.

Climatic influence on ecosystems

Climate is arguably the most important factor influencing each of the components of an ecosystem.

- The temperature and amount of precipitation received directly influences the type of vegetation produced.
- Warmer climates with higher rainfall will be the most productive having taller and more closely spaced trees, like that of the tropical rainforest.
- Areas with the coldest climates and lowest rainfall figures have very little vegetation, like that of the Arctic Tundra.

Simple model of an ecosystem