

UNIT TEN: ECOLOGY AND THE ENVIRONMENT

Upon completion of this unit you will be able to:

1. Compare and contrast ecology, conservation and environmentalism.
2. **Distinguish between an ecosystem and a biome, noting both the similarities and differences between them.**
3. **List several terrestrial ecosystems.**
4. **List several biotic and abiotic factors which constitute the environment.**
5. **Discuss the Law of Limiting Factors as it was proposed by Justis von Liebig.**
6. **Provide definitions for each of the following:**

species	population	community	habitat
symbiosis	environment	niche	autotroph
ecology	disclimax	heterotroph	ecosystem.
7. **Identify the groups in a typical food chain: distinguish between a food chain and a food web in terms of complexity or numbers of potential interactions.**
8. Relate the second law of thermodynamics to the events in a food chain.
9. **State the three Principles of Ecosystem Functioning.**
10. **Provide several examples of symbiotic relationships.**
11. **Distinguish between intraspecies and interspecies competition.**
12. Describe how competitive exclusion and coexistence result from interactions between populations.
13. **Provide a list of climatic factors which influence plant distribution.**
14. Discuss the events which occur during ecological succession.
15. **Distinguish between primary and secondary ecological succession.**
16. Discuss the development of a climax community.
17. **Define carrying capacity.**
18. **List and describe factors contributing to the carrying capacity of any system.**
19. Appreciate that humans alter and interfere with natural ecological processes.

Unit References: [Text Chapters 15, 16, 17](#)

<http://www.mhhe.com/enger13>

An Online Biology Text Book

ECOLOGY- (Text pg 312) (Objective #1)

branch of biology that studies the relationships between organisms and their environment.

ENVIRONMENT- anything that affects an organism during its lifetime (broad)
Ecologist vs. Environmentalist (Ecology not in danger, environment is)

"Environmental Issues"; "Ecological Concerns"

**We are an integral part of our environment!!!
Unfortunately we tend to exploit rather than coexist.

Organization of Living Systems

I. **Biosphere** - largest biological system, thin skin of life on planet; intersection of air, water and land; bottom of ocean to the tops of the highest mountains

*if Earth were the size of an apple, the biosphere would be about the thickness of its skin.

Closed system

II. Biosphere divided into distinct regions called **Biomes** (Objective #2, 3, 13) text pgs 342-354

Biome- characterized by a distinct climate and characteristic assemblage of plants and animals adapted to it, plants usually determine the other kinds of plants and animals present (temperature, moisture biggest physical factors)

North America: Tundra

Taiga

Temperate deciduous forest

Temperate Grassland

Semidesert, arid grassland

Desert

Mountain (complex zonation)

Check out:

[Deserts- Geology and Resources](#)

[Prairies in the Prairie State](#)
[National Estuary Program](#)

[Major Biomes](#)

Ecosystem (Objective #2)- System consisting of organisms and their environment (biotic and abiotic) and all of the interactions that exist between these components

Environment of any organism is complex and interrelated, everything influenced or modified by other factors:

(Objective #4) text pg 312- 316; 319-325

Abiotic Factors -Physical: gravity, light, heat, humidity

Chemical: water, nutritional elements, minerals

Temporal: Normal changes, gradual environmental changes

Justus von Liebig- **Law of limiting factors** (Objective #5) Pg 380

Range of Tolerance; Zones of Physiological Stress; Zones of Intolerance

Check Out:

[What is the Carbon Cycle?](#)

Water On The Web- Understanding Lake Ecology

Limiting Factors

Limiting Factors II

Biotic Factors (Objective#7) text pg 312- living things that affect organisms

1. **Producers-** (Autotrophs)- produce own food.
2. **Consumers-** (Heterotrophs)- "other" feeders

Primary consumers- herbivores

Secondary consumers- carnivores, omnivores

3. **Decomposers/ detritivores** - bacteria, fungi- use dead organisms as energy
4. **Omnivores**

ECOSYSTEM FUNCTIONING (Objective #7) text pg 313-316

*Food and Energy flow through food chains that are generally part of much larger food webs in ecosystems

Food Chain pg 314, 317- series of organisms, each feeding on the organism preceding it.

Food Web pg 333- more complex network of feeding interactions; several food chains interacting together.

Check Out : [From the Top of the World to the Bottom of the Food Web](#)

**Chains provide avenues for the flow of energy and the cycling of nutrients through the environment.

**Organisms of a food chain exist on different trophic levels.

Trophic level ("feeding level")

Ex. producer, primary consumer, secondary consumer. . .

(Objective #8) pg 316-319

ENERGY FLOW- 2nd law of Thermodynamics; energy conversions are never 100%, there will always be a loss of useful energy as heat

1935, Charles Elton: Animal Ecology

"The animals at the base of a food-chain are relatively abundant, while those at the end are relatively few in numbers, and there is a progressive decrease in between the two extremes. . . . This arrangement of numbers in a community, the relative decrease in numbers at each stage in a food-chain, is characteristically found in animal communities

all over the world, and to it we have applied the term 'pyramid of numbers'."

Pyramid of Energy
Pyramid of Mass
Pyramid of Numbers

Principles of Ecosystem Functioning (objective #9):

1. Resources are supplied and wastes are disposed of by recycling all elements (Carbon cycle, nitrogen cycle, etc.)
2. Ecosystems run on solar energy, which is exceedingly abundant, nonpolluting, relatively constant, and everlasting.
3. Large biomasses cannot be supported at the end of long food chains. Increasing population means moving closer on the food chain to the source of production.

Organism Interactions/ symbiosis (Objective #10, 11) text pgs. 334-341

Symbiosis- biotic interactions within a community; "living together"

Population- group of organisms of the same species occupying a specific region

Community- several populations existing together

Habitat- description of the place where an organism lives

Niche- how an organism "fits" into its habitat and all of its relationships in the environment.

-niche not always constant, complex sets of items inventory of influences, activities and impacts.

**many organisms have the same habitat but occupy a different niche and therefore don't compete for resources.

**niches do overlap somewhat, this leads to competition

Competitive Exclusion Principle (Objective #12)

- find something else to do
- move
- die

Specific Symbiotic Relationships in Ecosystems (Objective#10, 11) text pgs 336-341

Check out:

Symbiosis I

Symbiosis II

Mutualism - two species, both benefit from association Lichens; termites; pollination

Predation - benefit to one at the expense of another

*In predation, individual harmed but population may benefit by the elimination of old, sick, injured or poorly adapted individuals. Predation prevents overpopulation

Parasitism - organism living on or in another to obtain nourishment

Commensalism - one organism benefits, other not affected

Competition - competitive exclusion; winner loser; limited resource

Intraspecies- within same species; Elk vs. Elk

Interspecies- between two different species; Tomato vs. Weeds

Amensalism - one member harmed but other unaffected; Penicillium and bacteria

Neutralism - hard to come by; impossible to prove, one cannot assert positively that there is no relation whatsoever between two organisms.

Ecological succession (Objective #14, 15, 16) text pg 354-358 : Process of changing from one type of community to another

-Intermediate stages leading to climax community are known as seres.

Check Out:

Succession

Role of Fire in Succession

PRIMARY SUCCESSION- plants and animals develop where none existed before. Major step is formation of soil

Pioneer organisms/ Keystone species pg 355

*difficult to observe because few places on earth lack communities of organisms
Ex. mountain tops, volcanic islands

SECONDARY SUCCESSION- organisms disturbed by a natural or human related event (hurricane, fire, forest harvest) and start over at a previous stage.

*Abandoned field, Yellowstone, (farming expense to prevent)

CLIMAX COMMUNITY- stable, long lasting community, dependent on physical environment. (EX. Why is Western Nebraska primarily grassland? What would it take to change our grassland into a temperate forest?) Successional rates variable

DISCLIMAX COMMUNITY - succession disturbed or misdirected due to changes in environmental pressures

Ex. Grassland---> over grazing ---> sagebrush disclimax

CARRYING CAPACITY (Objective #17, 18) text pgs 382-389 - maximum # of consumers which can be supported by the producers. Limiting factors determine population size.

-raw materials, energy available, waste, interactions

Check Out:

Carrying Capacity

Footprints

Carrying Capacity II

Back to General Biology at WNCC