

## **ECOLOGY (Ch. 5)**

### **1. BIOSPHERE**

ecology - “the study of interactions between organisms and their environment”

- esp. distribution & abundance

biosphere - 8-10 km of soil-water-air support life

biomes - large regions of similar plants

- tundra
- desert
- grassland
- conifer forest
- deciduous forest
- tropical forest
- + marine
- + estuary
- + freshwater

zoogeographical realms - regions of similar animals

- Nearctic
- Neotropical
- Palearctic
- Afrotropical (Ethiopian)
- Asiotropical (Oriental)
- Australasian (Australian)

ecosystems - specific environment

- includes biotic & abiotic components

ecotones - transition zone, greatest diversity

terrestrial factors - vegetation, sun/temp, rain, soil

aquatic factors - salinity, size, depth, distance to shore

geographic factors - altitude, direction slope, near water

### **2. CYCLE & FLOW**

biogeochemical cycle - atoms preserved in a closed system

- reservoir in soil, water, air, or tissues

energy flow - an open system

- energy from sun, released as heat

trophic levels

- producers (also autotrophs)
  - photosynthesis - plants
  - chemosynthesis - bacteria
- consumers
  - herbivores
  - carnivores - I°, II°, III°
- decomposers

food chain - single pathway

- usually 4 levels (minimum 2 to maximum 5)

food web - combines many food chains

food pyramid - diagrams amounts of energy

- only 10% transferred between levels
- either numbers or biomass

### 3. SUCCESSION

succession - gradual changes in community

- from pioneer to dominant climax
- increase in species diversity & biomass
- decrease in resilience

grasslands - requires sun, water, fire

### 4. SYMBIOSES

symbiosis - any relationship between 2 species

- + if beneficial, - if harmful, 0 if no effect

neutralism      0   0

competition      -   -

predation      +   -  
- parasitism

mutualism      +   +

commensalism   +   0

(amensalism)   0   -

### 5. COMPETITION

interspecific competition - vs **intraspecific** competition

- 2 different species share limited resources
- usually food, water, or space

competitive exclusion principle

- different species evolve to avoid competition

niche - specific role in ecosystem (esp. food)

- fundamental vs realized niche

resource partitioning

- specialize on diff prey or microhabitat

## **6. PREDATION & PARASITISM**

advantages to prey - cull weak, ill, old

- increase species diversity (by suppress competition)

escaping predation

- toxicity - warning coloration
  - Müllerian mimicry (reinforce)
  - Batesian mimicry (bluff)
- concealment - resemble background
  - camouflage (dull coloration)
  - countershading (darker shade on top)
- mimicry - resemble plant or inedible object
  - eyespots (startle or misdirect predators)
- behavior - schooling (confuse predators)
- temporal - nocturnal
  - prime number life cycles (3, 5, 7, 11, 13, 17...)

eyes - binocular in predator species

- peripheral in prey species

predator-prey oscillations

- predator population lag behind prey population

parasites - smaller than host

- consume gradually, evolve not to kill host
- thick skin, reduced organs, high reproduction

parasitoids - lay eggs in paralyzed host

- example: ichneumonid wasp

## **7. POPULATION GROWTH**

J-curve - exponential growth curve

$$dN / dt = r N$$

$dN / dt$  = rate of population change

$r$  = reproduction or growth rate

$N$  = population size

opportunistic species - weeds & insects

- small organisms in unstable environment
- low survival rate, need high reproduction rate

S-curve - logistic growth curve

$$dN / dt = r N \frac{(K-N)}{K}$$

$K$  = carrying capacity

equilibrium species - birds & mammals

- larger animals in stable environment
- decent survival rate, lower reproduction rate

population control - disease, intraspecific competition

- predation, stress, emigration

## 8. EXTINCTION

birds - 100 species extinct. 200 species endangered

mammals - 36 species extinct, 120 species endangered

threatened - low number's thru range

endangered - in immediate jeopardy

extinct - less than 25% natural

- habitat loss - deforestation, desertification
- hunting - market vs poaching
- exotics - pets, ferals, accidental introductions
- pollution - pesticides & toxic chemicals

## 9. CULTURAL ECOLOGY

cultural ecology - interactions between human society & the natural environment

industrial high-energy culture - only 100-200 years

- centralized food production
- economy based manufactured goods
- not adapted to environment

traditional low-energy culture - over 100k years

- basic mode of human existence
- economy based hunting & gathering
- lived within limits of environment

Total Human Population = 80 billion

- 90% hunters & gatherers
- 6% farming
- 4% industrial

Population Growth

year (bp)	pop (billion)	% h-g
10,000	0.01	100.0
500	0.35	1.0
100	3.0	0.001
now	5+	0.0...

## 10. HUNTERS & GATHERERS

lifespan - medium

diet - healthy & varied

- high carbohydrates, medium proteins, low lipids

work - 12-19 hours per week

sex roles - equal, hunting vs gathering

population - low density (1-125 / mi<sup>2</sup>)

nomadic - follow seasonal food supply

swidden agriculture - slash & burn

acculturation - most resisted

- disease, malnutrition, missionaries, slavery, displacement, overpopulation

## 11. INDUSTRIAL CULTURE

overpopulation - just over 6 billion

- over 200k/day, doubling under 39 years

famine - 25% undernourished

- inadequate distribution of food

resource depletion - minerals & nonrenewable energy

decreased biodiversity - loss of wildlife species & habitats

pollution

- air - smog, acid rain, ozone, warm
- land - garbage, nuclear waste
- water - toxic, eutrophication, ground

## 12. DEMOGRAPHIC TRANSITION HYPOTHESIS

Stage birth + death > population growth

**1**    high + high > **low**    (hunter-gatherers)

**2**    high + low > **high**    (early industrial)

**3**    low + low > **low**    (advanced industrial)

industrial - Europe, US-Canada, Japan

- stage 2 (high growth) 100 years ago
- now in stage 3 (low growth)

less-industrialized - Africa, Asia, & Latin America

- still stage 2, advance to stage 3?