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
\[ \frac{dN}{dt} = rN \]
\( dN / dt \) = rate of population change
\( r \) = reproduction or growth rate
\( N \) = population size

opportunist species - weeds & insects
- small organisms in unstable environment
- low survival rate, need high reproduction rate

S-curve - logistic growth curve
\[ \frac{dN}{dt} = rN \frac{(K-N)}{K} \]
\( K \) = 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

<table>
<thead>
<tr>
<th>year (bp)</th>
<th>pop (billion)</th>
<th>% h-g</th>
</tr>
</thead>
<tbody>
<tr>
<td>10,000</td>
<td>0.01</td>
<td>100.0</td>
</tr>
<tr>
<td>500</td>
<td>0.35</td>
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<tr>
<td>100</td>
<td>3.0</td>
<td>0.001</td>
</tr>
<tr>
<td>now</td>
<td>5+</td>
<td>0.0...</td>
</tr>
</tbody>
</table>

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 / mi²)

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?