1 ☐ Community Ecology & Population Ecology

Chapters 8 & 9

2 ☐ structure:

- 1-physical appearance
- 2-species diversity
- 3-species abundance
- 4-niche structure number and how differ (diversity)

3 ☐

4 ☐ stratification

- size
- physical struct: oceans, streams, rocky shores, lakes, wetlands

5 ☐ ecosystems

- mosaic of vegetation patches
- 1-can lead to edges or boundaries
- 2-ecotones

6 ☐ edge effects

- 1-struct change
- 2-phy differences temp, humidity, light
- usually good for diversity, but due to fragmentation can be stressful or harmful
- cut ranges up, predation, man made barriers

7 ☐ most species rich env

1-tropical rain forests

- 2-coral reefs
- 3-deep sea
- 4-tropical lakes

8 ☐

3 factors affect species diversity

- 1-latitude in terrestrial latitudinal species diversity gradient
  - use forest ex 40-100 species in tropical, 10-30 temperate, 1-5 northern coniferous
- 2-depth in aquatic top and bottom not middle
- 3-pollution in aquatic decrease in abundance and decrease in diversity (narrow range of tolerance)

9 Species diversity at different latitudes

10 Species Diversity by Depth

11 Species/abundance in polluted and unpolluted streams

12 species on islands

- MacArthur and Wilson (EO Wilson!)
- island biogeography - species equilibrium
- 1-immigration vs extinction
- 2-effect of island size
- 3-effect distance from mainland

13 **Immigration and extinction rates**

14 **Effect of island size**

15 **Effect of distance from mainland**

16

17

18 Major Characteristics of a population

- Size: N number of individuals
- Density: number of individuals per unit space
- Dispersion: spatial pattern
- Age distribution

19 Dispersion: spatial pattern

20 Population dynamics respond to

- Environmental stress
- Changes in environmental conditions

21 Limits to Population Growth

- Births
- Deaths
- Immigration
- Emigration
- Population change= (births+immigration)-(deaths+emigration)

22 Biotic potential

- Capacity for growth
- If a population is at biotic potential, it is probably colonizing new areas
- Intrinsic rate of increase (r) is the rate of growth, reproductive rate, if there were unlimited resources

23 Growth factors

- Favorable environmental conditions
- High fecundity
- Generalized niche
- Adequate food supply
- Suitable habitat
- Ability to compete for resources
- Ability to protect from predation and diseases or parasites
- Able to migrate
- Able to adapt to environmental change

24 Environmental resistances

- Unfavorable abiotic factors
- Low reproductive rate
- Specialized niche
- Inadequate food supply
- Poor or unsuitable habitat
- Too much competition
- Unable to protect against predation and disease
- Unable to live in other habitats
- Inability to adapt to environmental change

25 Carrying capacity

- No population can grow indefinitely
- Environmental resistances limit population growth
- Carrying capacity (K) of a population is the result of environmental resistances on biotic potential or the population size that can be sustained indefinitely in a given area

26 Opportunistic vs. Equilibrium Species

1
- R selected species
- small bodied
- Mature rapidly
- Highly fecund
- Numerous offspring
- No parental care
- Short lived
- opportunistic

2
- K selected species
- Larger
- Slow maturation (yrs)
- Low fecundity

- Few offspring
- Require parental care
- Live long
- equilibrium

27 ☐ Carrying Capacity

- $\frac{dN}{dT} = rN$ and $\frac{dN}{dT} = rN\frac{(K-N)}{K}$

28 ☐ Exponential growth

- If there are few resource limitations, then exponential growth could occur
- A small population doubles slowly and then as the numbers increase the doubling rate decreases resulting in a J shaped curve

29 ☐ Logistic growth

- Exponential population growth is decreased with the population encounters environmental resistance (no food, no suitable habitat, competition and so on)
- After a sharp increase, the growth decreases resulting in an S shaped curve

30 ☐ Exponential and Logistic growth

31 ☐ Logistic growth

32 ☐ Density Independent Factors on population growth

- Affect population's size regardless of population density
- Floods
- Fires
- Hurricanes
- Unseasonable weather
- Habitat destruction
- pesticides

33 ☐ Density dependent Factors on population growth

- Competition for resources
- Predation
- Parasitism
- disease

34 ☐ Exponential growth followed by population crash

35 ☐ Types of population fluctuations

- Stable
- Irruptive (explosive)
- Irregular (no known pattern or etiology)
- Cyclic (boom and bust)

36 ☐ Types of population fluctuations

37 ☐ Top down control hypothesis

- Predator prey relationship
- Too many predators, reduces prey, predators reduced, increase in prey

38 ☐ Bottom up hypothesis

- Consume food resources faster than replenishing rate
- Have decrease in quantity or quality of food
- Then population decreases, food sources recover, population increases

39 ☐ Asexual versus Sexual Reproduction

1
- All offspring identical
- Reproduction binary fission
- Applies mostly to small unicellular organisms
- Minimal energy

2
- Variability in population due to recombination of genes and alleles
- Females have to produce 2x as much ofspring to maintain the same population size
- Genetic errors
- Big energy-mating rituals, disease transmission, injury inflicted during mating
- Males can gather food for female and young

40 ☐ Minimum Viable Population MVP

- The population size required to support a sustained breeding population
- If fall below MVP then,
- Mates may not be available
- Genetically related individuals may interbreed and produce weak or malformed offspring
- Genetic diversity may be too low to enable adaptation (to little variation in the population) to new environment conditions

41 ☐ Survivorship curves

- Number of survivors of each age group for a particular species at a given point in time
- Early loss curves: r selected species
- Constant loss curves: intermediate reproductive pattern constant rate of mortality in all age classes
- Late loss- K selected

42 ☐ Conservation biology addresses the following questions

- Which species are in danger of extinction?
- What is the status of the ecosystems' functioning, and what ecosystem services are we in danger of losing?
- What measures can we take to help sustain ecosystem functions and viable populations of wild species?

43 ☐ Need to know:

- Current population size
- Project how population size is likely to change with time
- Determine whether existing populations are likely to be sustainable

44 Principles of conservation biology

- Biodiversity is necessary to all life on earth and should not be reduced by human actions.
- Humans should not cause extinctions or disrupt vital ecological processes.
- The best way to preserve biodiversity and ecological functions is the protect intact ecosystems.

45 gen types of species

- native
- nonnative or alien or exotic
- indicator serve as warning of damage or degradation of community or ecosystem

46 amphibians vanish

- habitat fragmentation
- prolonged drought
- Pollution
- increases in UV
- increased parasitism
- Overhunting
- epidemic diseases chytrid fungus and iridoviruses
- immigration or introduction of non-native predators, competitors, and diseases

47 Loss of amphibians indicates:

- world env health deteriorating
- adult amphibians eat moreinsects than birds, extinct of amphib could result in extinct of reptiles, birds, etc
- loss of pharmaceuticals-skin secretions used as painkillers, antibiotics and in treating burns and heart disease

48 Keystone species

- keystone regulate the balance of the ecosystem's populations by virtue of predation on more than one species in differing quantities
- 1-strong interactions w othe species affect health and survival of these species
- 2-process material out of proportion to their numbers of bomass

49 ROLES of keystone species

- pollination of flowering plant species by bees, hummingbirds, bats, mice, rodents....
- bats flying foxes durian fruit pollinated by bats in SE Asian tropical forests
- endangered deforestation and hunting
- important for plant species they pollinate; plant seeds disperse in droppings, other species depend on them
- fruits low due to endangered
- other foods low
- medicine

- timber ebony and mahogany
- fibers, dyes, animal fodder, and fuel
- dispersion of seeds by fruit eating animals

50 Roles (cont)

- 3-habitat modification
- elephants uproot trees create forest openings for herbaceous plants and accelerates nutrient recycling rates
- beaver dams-ponds lakes attracts fish, birds, muskrats, ducks, etc could be bad no trees in forest
- 4-predation by top carnivores
- 5-improving ability of plant species to obtain soil minerals and water
- 6-efficient recycling of animal wastes
- dung beetles remove, bury recycle wastes avail for plant growth eat parasitic worms and maggots in dung

51 species interactions

- 1-interspecific competition
- intraspecific competition
- 2-predation
- 3-parasitism
- 4-mutualism
- 5-commensalism

52 interspecific competition

- 1interference competition one species limits another's access to resource
- 2-exploitation competition-competing species same access one eats more faster sort of thing

53 Intraspecific competition

- territoriality one ex
- factors contrib good territory
- 1-abundant food
- 2-good nesting site
- 3-absence of predators
- 4-absence of env factors that would reduce breeding success

54 Competitive exclusion principle

- competitive exclusion: 2 species cannot coexist indefinitely in an ecosystem in which not enough of the sahred resource is available to meet the needs of both species
- niches cannot overlap completely or significantly for very long

55 resource partitioning

- 1-dividing up of scarce resources so that species w similar needs use them at different times
- 2-different ways
- 3-different places
- resource partitioning is way to create niches that don't overlap in spite of same resource
- realized niche-can't occupy fundamental niche

56 **Each species grown alone**

57 **Both species grown together**

58 Resource partitioning

59 Resource Partitioning

60 Competition results in narrow niche

61 Predator Prey

- do not live on or in the prey; prey may or may not die
- at individual level not happy
- at population level, can benefit prey species kill sick, weak, and aged members
- reducing prey pop gives
- 1-remaining prey greater access to available food supply
- 2-can improve the genetic stock of prey population, enhancing the chance of reproductive success and long - term survival

62 sharks

- cull injured sick
- 100 people bitten/yr 5-15 die/yr
- 100million sharks killed every year
- fins, high levels of mercury toxic to pregnant mothers (babies), killed for liver, meat, hide, curios, and fear and sport, bycatch
- human values: food, cancer research, cornea, skin grafts, infectious disease research
- prone to population declines
- 1-few offspring
- 2-mature late-3-24 years
- 3-lengthy pregnancies (up to 24 months)
- 4-large range sharks not protected well but many are endangered or nearing critical mass for reprod
- evolutionarily unchanged for mya-now losing population battles

63 predator methods:

- 1-herbivores graze
- 2-carnivores-pursuit and ambush
- pursuit-fast, strong, keen eyesight, specialized body parts
- ambush-camouflage, specialized body parts attract or camouflage

64 prey defenses

- 1-move fast

- 2-smell sight to detect predators
- 3-protective armor shells, bark, spines
- 4- distractors lizard tails break off spot looks like eye
- 5-camouflage mimicry
- 6-chemical warfare-poisonous, taste bad, smell bad, irritating secretions
- have warning coloration
- 7-behavioral strategies
- puff up, spread wings-look bigger, mimick predator-spots on moths look bigger animal eyes, groups

65 ☐ Prey defenses

66 ☐ symbiotic

- parasitism
- mutualism
- commensalism

67 ☐ mutualism

68 ☐ Commensalism

69 ☐ **Ecosystems respond to change**

- **succession-**gradual change in species composition of given area

70 ☐ Types of succession

- primary from rock
- secondary reestablishment of biotic communities

71 ☐ primary succession

- 1-bare rock
- 2-lava
- 3-abandoned highway aor parking lot
- 4-newly created shallow pond or reservoir

72 ☐ Soil formation

- need to have soil accretes at 1" every thousand or so years
- pioneer species - attach to rock or oligotrophic waters
- wind dispersed lichens or mosses deal w lack of moisture soil and temp extremes
- 1-start soil formation by trapping wind blown soil and tiny pieces of detritus
- 2-producing bits of organic mater
- 3-secreting mild acids to fragment and break down rock

73 ☐ lichens replaced by

- 1-sm perennial grasses
- 2-herbs

74 early successional plant species

- 1-grow close to ground
- 2-colonize reprodution rates
- 3-short lives

75 Subsequent stages

- midsuccessional plant species
- shrubs
- late successional plant species
- trees

76 **Ecological succession**

77 Primary succession

78 Secondary succession

79 Secondary succession

- abandoned farmland
- fire
- polluted areas
- land dammed flooded

80 Intermediate disturbance hypothesis

81 Clementsian versus Gleasonian Succession

- Clement's model suggests succession orderly and predictable
- Gleason's model suggests that succession is highly variable depending on changing conditions ranging from plant life history strategies to herbivory patterns, to major weather events

82 PRECAUTIONARY PRINCIPLE

- Take precautionary measures to prevent harm even if some of the cause and effect relationships are not fully supported by extensive scientific research
- Look before you leap.
- First do no harm.
- An ounce of prevention is worth a pound of cure.

83

84