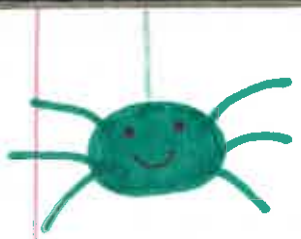
by people; elk population increases w/o out of predation; stick around streams - eat all the little trees, stopping reproduction of trees; streams no longer shady; no more beavers making dams; birds disappear from streams; cool-water fish left b/c too cold
↳ "trophic cascade", one species can cause a lot of changes
- how does this relate to idea of a keystone species?
people function as predators sometimes
- people collectively acting unsustainable
- abundance of big fish in the ocean decreased by ~90% due to overfishing
- no one knows the environmental consequences of these things
- animals at top of food web more likely to go extinct
- remember the features that make a species more susceptible to extinction
Coevolution: reciprocal evolution of two species
- pollination by hummingbird
- able to reach deep for nectar, pollen gets on face of hummingbird, transported physically across hummingbirds
- short-billed flowers
- long-billed birds have greater chance of success
- flower species benefitted only if bird visits other members of that species
~~defens~~ - kind of reminds me of defensive eating
tropical acacia shrub with mutualistic ants:
- ground comparatively barren near these shrubs
- thorn defends shrub from large herbivores
- ants defend against smaller herbivores
- ants dig hole + shelter in thorns
- coevolution always mutualism?
- tree makes ant food
species diversity:
- no one knows all the species in any one community

~~-finish chem followup~~
~~-go t/ disease WB~~

- different communities have different levels of biodiversity
beech maple trees:
- invasive species causes beech trees to die t/ beech bark disease
- how will this affect the ecosystem?
- hard to predict consequences
  - non native plankton in Great Lakes → birds getting botulism
  - plane vine example
ecosystems w/ more species tend to be more stable
- what does stability mean in this context?
- could I talk about stability in terms of resistance?
- COVID horse/human/giraffe/tiger example

november 15th

- variety of measures characterize ecosystem function
- function is better when more species are present
what can cause an ecosystem to lose species? (w/i ecosystem)
- competition (does no competition always increase species diversity?) the increase doesn't really follow for me
  - couldn't it force them to find a niche
- seems like monopoly could happen to me?
- non-native predators
- prey haven't been selected for in the past to have to get away from those predators (no evolutionary history with it)
- native predators increase SD because they decrease competition
  - reduce abundance but don't eliminate species
  - prey on abundant prey preferentially
  - good at competing - less good at evading predation
- isolation from source of colonists
- hard for organisms to get to far away islands
- how does this play with adaptive radiation?
- small habitat size
- limited amount of resources
- small pops have greater chance of extinction
- high level predators cannot persist in small habitats



*look at modified instructions for the lab statistical analysis
- finish draft after redoing analysis
- intermediate disturbance hypothesis simulation

- people make habitats small (main reason we make species distinct)
- "to a fish, a lake is an island surrounded by land" + vice versa for snake
  - isolation via urbanization / habitat destruction creates habitat islands
- recall distinction b/ species and populations
  - ex: I think a workshop where humans had separate populations might help them empathize w/ need for habitat protection
- near and far is relative for each different species (different mobility capabilities)
- are there ecosystems w/o competition for at least certain species?
- is the measure for species diversity the # of species? no!
species richness: # of species
species diversity: ~~takes how~~ considers species richness and relative abundance
- some measurements are indexes (pulls more than one variable and with different units) — and wind chill index, sustainable welfare index
- ex: heat index, accounts for temperature and humidity
- not a right index but an agreed on index in a way to pool them into one value
- new concocted value
- SD considers # of species and their relative abundance
ex. 100 trees, 10 individ / 1 species, 10 species > same SR but different SD
or 100 trees, 91 of one, 1 of the others, 10 species
- closer relative abundance means greater SD
- no right formula for species diversity
- how does this example play with competition?
different aspects of different levels of biodiversity
succession - predictable temporal change in community, structure
  which species are present and how abundant they are
old fields
annual plants - fast at getting to a place and/or have been there all along
- can time, more species will get there (different methods of dispersal / different likelihoods)

how is that different from JD^2?

- notice the best competes for light take a while to get there
some species are faster colonizers and some are better at competitors
largely a terrestrial plant concept
- affects animal succession but easier to measure plants
how do early species change conditions?
- how do early species make it more hospitable? Improve niche conditions?
- sometimes inhibit: invasive grass @ breed (how does this happen if it's not in primary succession)
historically fires didn't grow here b/c fire & human trampling (= disturbances)
disturbance: discrete (not continuous) time event and some resources are more available to some individuals
- typically more light on ground
- setting back the succession
- IDH has to do w/ SD, typically higher SD of intermediate
- enough time for a lot to get there
- not enough time for other species to outcompete (ex. trees)
- ~~how does~~ this plays w/ competition @ ↓SD
plenty of water for trees here, now nothing to prevent them from growing, now outcompeting
- not natural for succession to progress this far b/c humans stopping fires

LECTURE 2-)11/15

- check for missing assignments on Moodle
- LOR?
- find time for OH
- come w/ questions

BEHAVIOR

focus on how it helps you understand evolution & ecology

most creatures aren't animals + don't behave

takes several generations to make monarch migration (no one monarch able to even make the entire trip), go back to one single forest

leatherback turtles lay eggs in one single place

- mind blowing!

birds migrate without being taught where to go

Why do animals behave the way they do?

parent b/c no evolutionary ~~fitness~~ fitness without it (natural selection drives animal behavior)

- if your child dies (bc no parental care), your genes are gone forever

zooplankton in world's oceans

- at the mercies of currents, can't swim against it
- can decide b/ up and down
- cyclical movement up + down 100m with daylight (sun ↓, more ↑)
- a lot of moving up + down for an organism the size of the pinhead

genetic behaviors must be products of natural selection

- (why we do evolution first)
- talking about natural circumstances

what is our definition of instinctive in biology?

- zooplankton go down to avoid being eaten (fish that eat plankton do it by sight)
- surface is where all the food is (bc that's where all the light is)

movement of zooplankton is a widespread, genetic behavior

squirrels going back and forth in the road

- animal behavior can be maladaptive (?) in human-dominated environment
- human disruption can outpace evolution
- genetic behaviors only work for fitness in natural circumstances
- genetic element in behavior ≠ genetically determined

zooplankton might not necessarily know if they're in danger of being eaten

- study questions

proximate: the stimulus of the behavior, the cue
ultimate: why the behavior was selected for
ex. zooplankton proximate: light
cyclical movement ultimate: predator avoidance
creature is just reacting to the environment - don't anthropomorphize

Why do male birds sing?
- attracting female birds or defending territory (female bird attracted to nice territory, genetically determined too)
this is the ultimate cause
- singing is risky
- but what's the proximate cause? they don't sing all the time
- seasonal testosterone thing
- what is the definition of behavior? does it happen on organismal level?
- pathways of behaviors aren't so obvious
have to study generations to detect genetic basis for behavior
- inbreeding the quick to e/ other and the slow to e/ other
- don't know the allele but know there's a genetic basis
- do know the allele for parental care in mice
instinct vs. learning
- don't worry about different types of learning
- automatic behavior doesn't depend on experience
instinct: characteristic behavior made in response to stimulus never previously encountered
- not altered by experience
learned behavior: behavior modified by experience
- could this even be instinct?
goose that moves eggs (grey-legged goose)
- won't be tested
these behaviors often not very sophisticated, but if it works, it works

-LAB REPORT -make list of readings

behavior

parus major
-not born poking through milk bottle lids
reasoning
-very sophisticated - requires more potential to learn
-chimp gets bananas from ceiling
living alone vs. living in a group
-most cats are solitary; lions are kind of unique in this way
-default assumption that this is genetically determined
-how do we know when this is a safe assumption?
different ecological situation → different selection → diff. genetic behavior
most animals aren't territorial but some are very territorial
prairie dog sentries
-the noise alerts the rest of the group and the hawk, so how does it help evolutionary fitness?
-could be reciprocal altruism
-very low cost to making the noise but huge benefits when reciprocated
-reciprocal altruists will quit doing it if they don't return
-could be kin selection
-fitness = how many copies of one's genes left in the next population, not # of offspring (inclusive fitness)
reciprocal altruism in vampire bats
-need other bats to stay warm enough
kin selection in Florida scrub jays
-think of it as the alleles being selected for or against, not the individuals