Name:

Unit 2: Ecology & Biodiversity

I. Introduction to Biodiversity *(1,2,8,14,15,17)* II. Ecosystem Services *(2,29,59,65)* III. Island Biogeography *(21)* IV. Tolerance *(17)*	V. Natural Disruptions to Ecosystems *(8,61,63)* VI. Adaptations *(15)* VII. Ecological Succession *(21,41)*
Textbook: Modules 1, 2, 8, 14, 15, 17, 21, 29, 41, 59, 61, 63, 65	

Vocabulary

- Adaptation
- Adaptive trait
- Anthropogenic
- Biodiversity
- Cultural service
- Disruption
- Disturbance
- Diversity index
- Ecosystem
- Ecosystem services
- Environmental stress
- Episodic
- Evolution
- Generalist
- Genetic diversity
- Habitat diversity
- Indicator species
- Island biogeography
- Keystone species
- Limiting factors
- Migration
- Natural selection
- Periodic
- Pioneer species
- Population bottleneck
- Primary succession
- Provisioning service
- Regulating service
- Resilience
- Resistance
- Secondary succession
- Specialist
- Species diversity
- Species evenness
- Species richness
- Supporting service
- Tolerance

I. Introduction to Biodiversity

Objective:

- Explain levels of biodiversity and their importance to ecosystems.

Biodiversity: _____

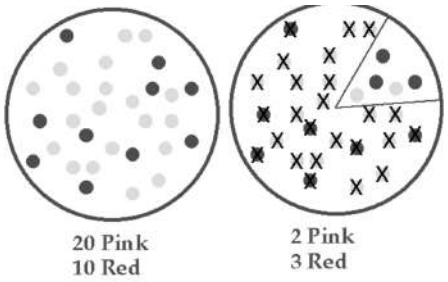
Three Scales of Biodiversity

1. _____: Genetic variation among individuals in a **population** (_____ species)

What are examples of **environmental stressors?** (disturbance/disruption)
What would enable a *population* to bounce back more easily (have more **resilience**) after environmental stress/disturbance—high or low **genetic diversity**? Explain why, with an example.

_____:

A drastic and sudden reduction in the size of a population leads to a change in the gene pool



What could cause bottlenecks?

2. _____: The number of species in a region or habitat (in a **community** or **ecosystem**)

(Review: What defines a species? _____)

Identified and catalogued by scientists: _____

Estimate of actual total number on earth: _____

Most common estimate: _____

Most common animal: _____

Most common organism: _____

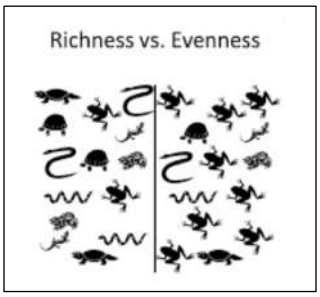
The species diversity of a region is considered a **critical environmental indicator.** Why? *(ex: Frogs)*
What would enable a *community* to show more resilience after environmental stress—**high** or **low species diversity**? Explain why, with an example.

3. _____: The variety of habitats that exist within a given region

_____ :	_____:
can live under a wide range of biotic/abiotic conditions *Examples:*	live under a very narrow range of conditions or feed on one or a very small group of species *Examples:*

What impact would **habitat loss** have on these two categories of species? Which group is in much more danger of extinction?
Can you think of a reason why it might be advantageous to be a specialist?
What impact would **habitat loss** have on animals with large or small territories?

Biodiversity Indices *(plural of "index")*: Measures of biodiversity that take into account both **richness** and **evenness**



- Species _____: # of total species
- Species _____: Abundance of individuals within each species

Two useful indices: _____ and _____

→ See ***Simpson's Index worksheet*** and ***Quadrat Lab***

II. Ecosystem Services

- Describe ecosystem services.
- Describe the results of human disruptions to ecosystem services.

What do ecosystems do for **HUMANS?** (Important consideration for many!)

_____ value:

Moral/spiritual/religious/philosophical

_____ value: 4

categories (CRiSP)

Type of Ecosystem Service	What anthropogenic activities could affect these services negatively?	Consequences of these activities	
		Ecological	*Economic*
1. Provisioning			
2. Regulating			
3. Support			
4. Cultural			

III. Island Biogeography

Objective
- Describe island biogeography and its role in evolution.

→ *See Lab Activity!*

Theory of Island Biogeography

Graph the data given below on the grid. Label axes, use correct units, and title the graph.

Island area (ha)	# of bird species
27	8
45	13
55	14
95	16
123	19
152	20
179	22

What other term could be used for "# of bird species"?

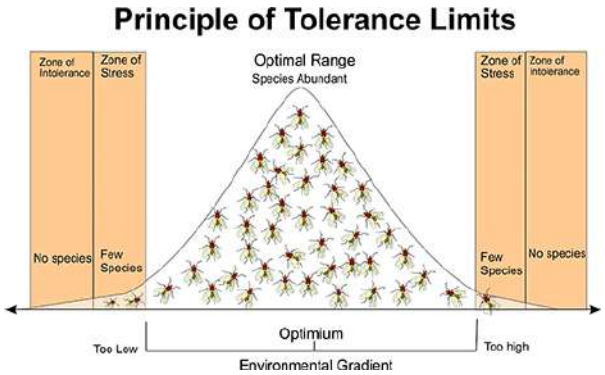
_____

Considering the information displayed in the above graph, what is the relationship the Theory of Island Biogeography predicts between species richness and habitat size?

IV. Tolerance

Objective
- Describe ecological tolerance.

→ *See Pill Bug Lab*



Range of Tolerance:

A **generalist** species, like a city pigeon, rat, or raccoon would be likely to have *narrow* or *broad* ranges of tolerance?	
A **specialist** species, like a koala, would be likely to have a *narrow* or *broad* range of tolerance?	

Consider an endangered tropical songbird from Indonesia and a city pigeon from San Francisco. How could you compare these two animals in terms of the Law of Tolerance? *(Mention specific factors)*

How does the Law of Tolerance relate to the reasons why some organisms become endangered and some don't?

Limiting factors:

Fill in the Limiting Factors:	
Location	**Limiting Factor**
Soil	
The open ocean	
Freshwater lakes and rivers	
Bays and estuaries	
The fish tank	
Desert plants	
Small plants on the rainforest floor	

V. Natural Disruptions to Ecosystems

Objective:
- Explain how natural disruptions, both short- and long-term, impact an ecosystem.

What are some **natural** disturbances that could impact ecosystems?

Resistance:	Resilience:

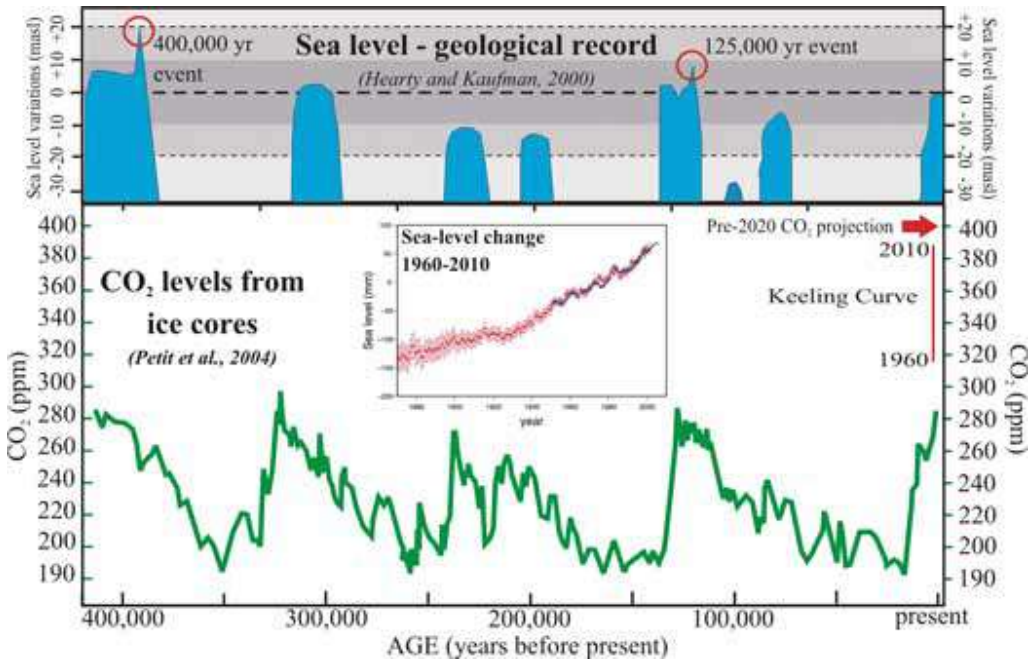
Intermediate Disturbance Hypothesis:

A. Historical Changes in Climate

→ *See HHMI Computer Activity worksheet*
https://www.biointeractive.org/sites/default/files/Paleoclimate-student-worksheet.pdf

B. Historical Changes in Sea Level

With your partner, note at least 5 interesting pieces of information you can interpret from these graphs. Make notations directly on the figure or written around it.



C. Habitat changes

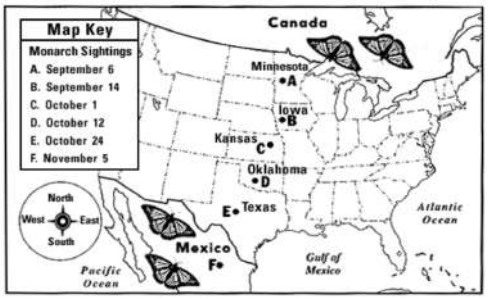
Natural Causes for Habitat Change:
Come up with a fictional (but realistic) example of a population being forced to change their habitat due to a natural occurrence.

D. Wildlife migration

Watch videos, take notes in the following 2 columns

Amazing Animal Migrations by Land, Air, and Sea (2:13)
https://www.youtube.com/watch?v=Mc3YIrs19fw

Animal Migration (1:20)
https://www.youtube.com/watch?time_continue=1&v=zdUkJfW_xmY



Which animals migrate?	What are some reasons for migration?
We will be revisiting migration when we discuss the effects of climate change later on. Predict: How does climate change impact migrating animals?	

What makes modern-day change, with anthropogenic causes, different from all the previous natural change?

_____ and _____

VI. Adaptations

Objectives:

- Describe how organisms adapt to their environment.
- Define natural selection and the three conditions that are necessary for evolution of a population by natural selection.
- Summarize and address two common misconceptions about evolution.

The **theory of natural selection** was developed by _____ and first presented in his book _____, published in 1859.

_____**:** Differential ability to survive and reproduce

_____**:** Any behavioral or physical characteristic that increases fitness

Natural Selection	
1.	*What do organisms "struggle"/compete for?*
2.	*What are some examples of **human** variation?*
3.	*Is it possible for completely opposite adaptations to be most advantageous in different situations/for different species? Use the tortoise and the hare as an example (scientifically).*
4.	

_____: Every living species has descended, with changes, from other species over time.

1.

2.

3.

What are three adaptations that have allowed humans to become such a successful and widespread species? 1. 2. 3.
Why can't humans evolve to cope with our changing environmental conditions?

Evolution Myths	*Write a true statement to counteract this myth*
1. "Fitness" means strongest, fastest, or biggest.	
2. Organisms develop new traits in order to help them in their environment.	
3. Evolution is a constant progression towards some perfect ideal.	

What processes and events have an effect on evolution?

Geological Processes	
	1.
	2.
	3.
	4.
	5.
Climate Change	
	6.

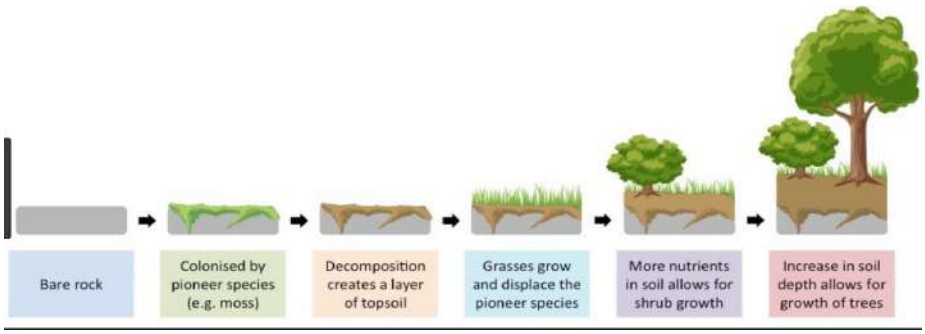
VII. Ecological Succession

Objectives:
- Describe ecological succession.
- Define and give examples of keystone and indicator species.
- Describe the effect of ecological succession on ecosystems.

_____ in the types of species that live in an area;

the gradual replacement of one plant community by another through natural processes over time

Type of Succession	Where it Happens	Other info
Climax Community:		



→ Succession Interactive: https://biomanbio.com/HTML5GamesandLabs/EcoGames/succession_interactive.html

- Choose "start a new game" and "primary succession".

What type of island are you starting with? What are its characteristics?
Why is the process you are about to model an example of **primary succession**?

- As you select organisms to colonize your island, fill out the table in order.

Type of organism	How did it colonize?	What did it need to be established?
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

- Run through the **Secondary Succession** simulation quickly.

What was the initial disturbance?
What is the major difference between primary and secondary succession?
What are the two groups of organisms you are able to skip when setting up this community?

→ Return to the main menu and complete the **Quiz.**

_____ : give early warning signs of damage or danger to a community
i.e. absence of trout in areas that are within their range of tolerance indicates poor water quality
Common indicator species:

Why are amphibians declining?

_____: have a larger impact on the community, if removed, than other species

Why?
What happens when you lose a keystone species?
Examples of keystone species:
What's going on with the bees? *https://abcnews.go.com/US/40-decline-honey-bee-population-winter-unsustainable-experts/story?id=64191609*

Article: These Animals Make Homes for Other Species https://www.nationalgeographic.com/animals/2019/06/elephant-footprints-frog-habitat-ecosystem-engineers/ Bulletpoint 3 animals from the article with a short description of what they provide to other species.
Article: Environmentalists Want to Declare Mountain Lions an Endangered Species https://www.lamag.com/citythinkblog/mountain-lions-endangered-species/ For what reasons might mountain lions be considered a **keystone species**?