

What's Included?

Unit Planning

- NGSS and APES Standards document
- Unit Pacing Guide for 50 min classes
- Differentiation ideas for honors students and virtual students ***Digital links for virtual learning found here**
- Honors assignment list

Notes

- Unit 3 PowerPoint (19 slides)
 - Biomes
 - Ecological Succession
 - Biodiversity
- Cornell Notes Pages (3 pgs)
- Doodle Notes Pages (3 pgs)
 - Guide to Using Doodle notes
 - Doodle Notes Keys & Examples
- Web-quests (6 pgs) (Can be used as an alternative to notes)

Student Pages

- This folder contains duplicate copies of every student page. They are in order according to the pacing guide for QUICK PHOTOCOPYING if you are using the pacing guide as is.

Activities

- Biome Travel Brochure Research Activity (3 pgs)
- Biome Food Web Poster Project (26 pgs)
- Geocaching Lab (6 pgs)
- Plant Transect Biodiversity Lab (3 pgs)
- Lionfish Invasive Species Panel Discussion (4 pgs)
- Answer Keys for all activities

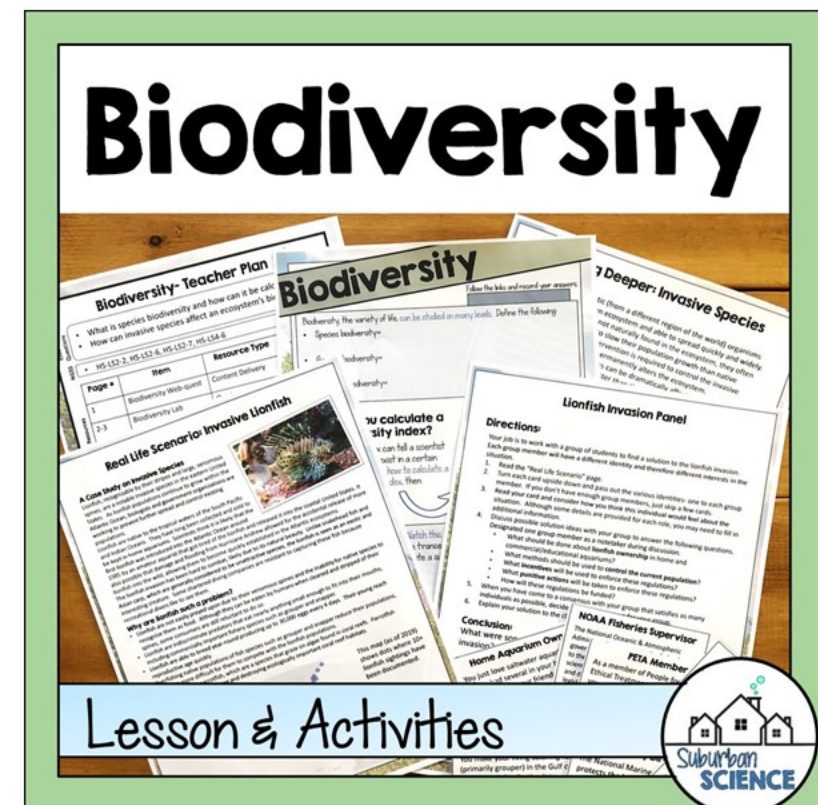
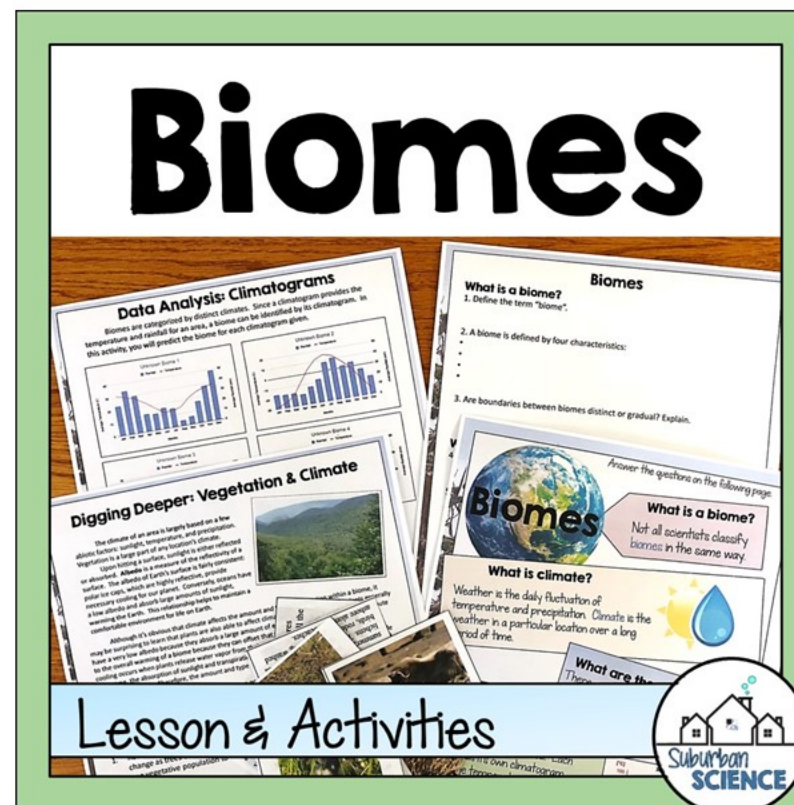
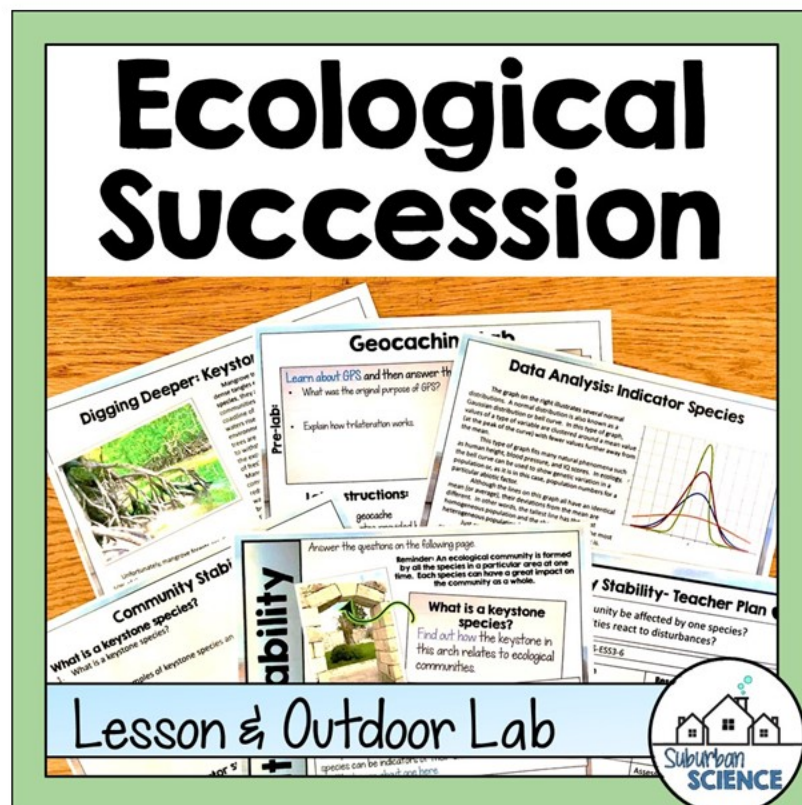
Extensions

- Data Analysis: Climatograms
 - Digging Deeper: Vegetation & Climate
 - Digging Deeper: Keystone Species Project
 - Data Analysis: Indicator Species*
 - Data Analysis: Biodiversity Indices*
 - Digging Deeper: Invasive Species Research
- *Honors Options

Review and Assessment

- Biomes & Succession Online Quiz through Google Forms
- Editable Task Card Review (32 cards) with answer sheet
- Biomes, Succession & Biodiversity Test (paper)- both Honors and Regular versions with answer sheets

Includes the following individual lessons which were previously available separately in my store:



If you have already purchased one of these lessons, please contact me at support@suburbanscience.com for a discount on this unit.

Unit Planning

NGSS and APES Standards Document

If you have specific state standards, contact me by email (support@suburbanscience.com) and I'll help you figure out which ones are covered!

What's Included?

Biosphere: Unit 3

Included Resources by Folder:

Unit Planning

- NGSS Standards document
- Unit Pacing Guide for 50 min classes
- Differentiation ideas for honors students and virtual students
- Honors assignment list

Notes

- Unit 3 PowerPoint (19 slides)
- Species & Speciation
- Population Growth
- Populations: Survivorship

- Cornell Notes Pages (3 pgs)
- Editable Cornell Notes version
- Doodle Notes Pages (3 pgs)
- Guide to Using Doodle notes
- Doodle Notes Keys & Examples

- Web-quests (6 pgs) (Can be used as an alternative to notes)

Activities

- Biome Travel Brochure Research Activity (3 pgs)
- Biome Food Web Poster Project (26 pgs)
- Geocaching Lab (6 pgs)
- Plant Transect Biodiversity Lab (3 pgs)
- Lionfish Invasive Species Panel Discussion (4 pgs)
- Answer Keys for all activities

Extensions

- Data Analysis: Climatograms
- Digging Deeper: Vegetation & Climate
- Digging Deeper: Keystone Species Project
- Data Analysis: Indicator Species*
- Data Analysis: Biodiversity Indices*
- Digging Deeper: Invasive Species Research

*Honors Options

Review and Assessment

- [Biomes & Succession Online Quiz through Google Forms](#) (Make a copy of this file to your Drive. Do NOT assign to students using this link.)
- Editable Task Card Review (14 cards) with answer sheet
- Biomes, Succession & Biodiversity Test (paper)- both Honors and Regular versions with answer sheets

Student Pages

- This folder contains duplicate copies of every student page. They are in order according to the pacing guide for QUICK PHOTOCOPYING if you are using the pacing guide as is.

Supplementary Resources

- [Biome Research Online](#)
- [Video instructions for making a climatogram using Excel](#)
- Website that provides [climate data for climatograms](#)
- Information about [invasive lionfish](#)
- [Data Nuggets extension activity](#) on transects & succession after disturbance
- [Data Nuggets extension activity](#) on biodiversity & invasive species

Materials Needed

- General classroom use: computers, calculators, rulers, colored pencils, paper, scissors
- Biome Food Web Poster Project: posterboard, glue sticks
- Geocaching Lab: cell phones or GPS units, outdoor space with geocaches, plant ID guides or apps (ex: iNaturalist)
- Biodiversity Lab: outdoor space with variety of plants, plant ID guides or apps, tall garden stakes, yarn or fishing line

Not included:

Unit Overview Page
plus
Supplementary Resource Ideas
and Materials Lists

Biosphere Unit 3 Guide

Topic	NGSS Standard	Description	APES Topics
Biomes	HS-LS2-1	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.	1.1: Terrestrial Biomes
	HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.	1.11: Food Chains and Food Webs
	HS-LS4-6	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.	5.10: Impacts of Urbanization
	HS-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.	8.2: Human Impacts on Ecosystems
	HS-ETS1-2	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.	
Ecological Succession	HS-LS2-6	Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.	2.4: Ecological Tolerance
	HS-LS2-7	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.	2.5: Natural Disruptions to Ecosystems 2.7: Ecological Succession 8.4: Human Impacts on Wetlands and Mangroves

Editable Pacing Guides

50 min classes

	Day	Instruct	Assess	Homework
Biodiversity	8	<ul style="list-style-type: none"> Geocaching Lab (Part 2: Creating a Geocache) Materials: water-proof container for each class, trinket/sticker to hide in geocache 	<ul style="list-style-type: none"> Informal assessment of student behavior and participation during geocache creation Quick check of completion and/or accuracy of geocache lab questions 	
	9	<ul style="list-style-type: none"> Finish Geocaching Lab, if necessary Online Quiz on Biomes & Ecological Succession 	<ul style="list-style-type: none"> Formal assessment of student understanding via quiz 	
	10	<ul style="list-style-type: none"> Unit 3 PPT (Section 3) Cornell Notes (Biodiversity) Biodiversity Lab (Introduction only) Materials: 200 beads in a container (at least 3 different colors) 	<ul style="list-style-type: none"> Cornell Notes summary Informal discussion and questions Informal class discussion after introductory lab questions 	
	11	<ul style="list-style-type: none"> Biodiversity Lab (Lab Procedures Page & Discussion questions) Materials: outdoor space with a variety of plants, plant identification guides or apps, tall garden stakes, 50' of yarn or fishing line 	<ul style="list-style-type: none"> Informal assessment of student behavior and participation during lab 	
	*	<ul style="list-style-type: none"> Optional Day: Use Doodle Notes to Review concepts if Cornell Notes have been used for primary note-taking (Biomes, Succession, & Biodiversity pages) 		
	12	<ul style="list-style-type: none"> Digging Deeper: Invasive Species 		
Review	13	<ul style="list-style-type: none"> Real Life Scenario: Invasive Lionfish 		
	14	<ul style="list-style-type: none"> Use Task Cards to review unit concepts (also copy Task Card Answer Sheet) 		
Assess	15	<ul style="list-style-type: none"> Take Unit 3 Test 		

50 min
classes

Biosphere Unit 3 Pacing Guide

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	Day	Instruct	Assess	Homework
Biomes	1	<ul style="list-style-type: none"> Unit 3 PPT (Section 1) Cornell Notes (Biomes) Data Analysis: Climatograms 	<ul style="list-style-type: none"> Cornell Notes summary Informal discussion and questions Informal class discussion to check climatogram questions 	
	2	<ul style="list-style-type: none"> Begin research and creation of Biome Travel Brochure Provide students with Biome Travel Brochure Rubric 	<ul style="list-style-type: none"> Informal progress check during research time 	
	3	<ul style="list-style-type: none"> Finish Biome Travel Brochure Digging Deeper: Vegetation & Climate 	<ul style="list-style-type: none"> Formal assessment using Biome Travel Brochure grading rubric Informal class discussion to check vegetation questions 	
	4	<ul style="list-style-type: none"> Begin Biome Food Web Poster Provide students with printed instructions (Student Instruction Page, Student Notes Page, Grading Rubric, Map, Biome images) 	<ul style="list-style-type: none"> Informal progress check during research time 	
	5	<ul style="list-style-type: none"> Finish Biome Food Web Poster 	<ul style="list-style-type: none"> Formal assessment using Biome Food Web Poster grading rubric 	
Ecological Succession	6	<ul style="list-style-type: none"> Unit 3 PPT (Section 2) Cornell Notes (Community Stability) Digging Deeper: Keystone Species 	<ul style="list-style-type: none"> Cornell Notes summary Informal check of progress and finished Keystone Species flyer 	<u>Honors:</u> Data Analysis: Indicator Species
	7	<ul style="list-style-type: none"> Geocaching Lab (Pre-lab & Part 1: Finding a geocache) Materials: Computers, cell phones or GPS units, location of several geocaches near school, plant and/or tree identification guides or apps 	<ul style="list-style-type: none"> Informal progress check during pre-lab research Quick check of pre-lab questions Informal assessment of student behavior and participation during geocache search 	

Coincide with NGSS document in Unit Planning Folder

***Bold items** must be photocopied.



This icon is found on the top right corner of Honors pages for easy identification.

The daily topics coincide with the previous standards document.

Lesson planning is now quick and easy!

Differentiation Ideas for:

- Student Interest
- Student Ability
- Teaching Pace
- Teaching Environment (Virtual, in-class, or hybrid)

Differentiation

Student Ability

Advanced students

- **Honors options** are included in the student pages. These are for an advanced class or individual students, as needed.
- **Editable Cornell notes** (found in the Notes folder)
 - Delete the fill-in-the-blank notes on the right side for a more independent note-taking experience.
 - Delete the summary and allow students to come up with their own.

Tests:

- Use the "Honors" tests that include additional short-answer questions.

Struggling students

- **Eliminating homework altogether** may work well for students who think independently or have home situations that don't allow for homework. Make sure to account for the extra class time needed for assignments in class.
- **Use multiple methods of note-taking:**
 - Web-quest followed by PPT & Cornell notes will help with understanding rather than just one method. Doodle the end of the topic as a student-led review. This allows the same material presented in three different ways.

Differentiation

Teaching Environment

Virtual or Hybrid students

Digital Options:

- Links for PowerPoints
- Web-quests
- Online Biome Travel Brochure Template
- Digital Student pages using Google Slides™ for students to type on

All found on the following page.

At-home lab alternatives:

- **Biome Poster Project:** Students can complete this at home using research from the internet to create a food web. It can be shown on a Google Slide rather than a poster, if posterboard is not available.
- **Geocaching Lab:** This can be completed using geocaches near any students' home, if you have parent permission. Students can simply download the "Geocaching" app and find caches near them. It would be up to teacher discretion whether you'd like to have students create a geocache and/or hide it near them.
- **Biodiversity Lab:** Students can complete a plant transect at home if they have a backyard or local park with enough plants. If plants aren't

Digital Differentiation:

Web-quests:

- [Biomes Web-quest \(with key\)](#)
- [Community Stability Web-quest \(with key\)](#)
- [Biodiversity Web-quest \(with key\)](#)

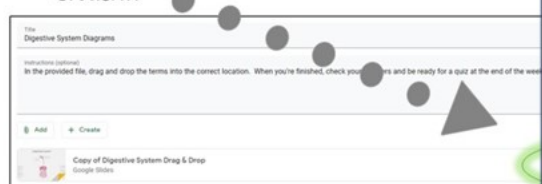
Other:

- [Unit 3 PowerPoint](#)
- [Student Pages for whole unit](#)
- [Digital Travel Brochure Template](#)
- [Biomes & Succession Quiz through Google Forms](#)

Important: Do NOT provide directly to students. Make files to assign for students to use.

To use these files for Google Classroom:

1. Make a copy of each file using the links above.
2. Rename the file in your own Google Drive.
3. Delete any pages you don't want to assign.
4. Make a new assignment in Google Classroom and assign to the assignment. Then, choose "Make a copy for each student."



Differentiation

Differentiation is a key component to any unit. Here are some tips for differentiating based on student interest, ability and teaching environment.

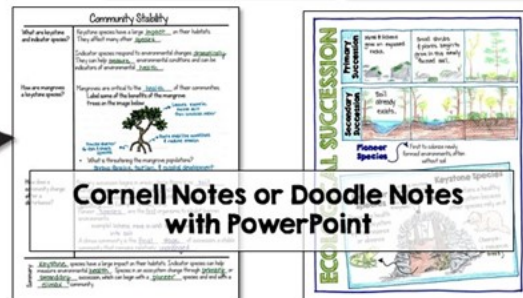
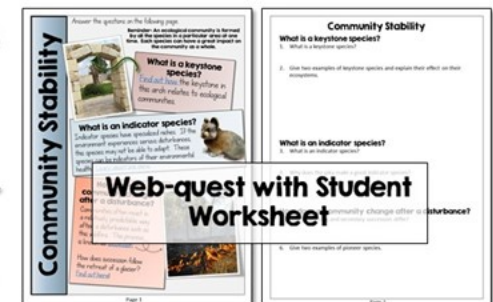
Student Interest/Choice

Three options for content delivery are included in this unit:

- **Web-quests:** Students can explore content through links and answer provided questions on a worksheet. This is ideal for independent learners or sub plans. Find these web-quests on the last page of this document.
- **Cornell Notes:** Teacher lectures with included PowerPoint and students record information in guided Cornell notes. An editable version of the Cornell notes is provided so teachers can adjust the content.
- **Doodle Notes™:** Teacher lectures with included PowerPoint and students record information on Doodle Notes™ pages.

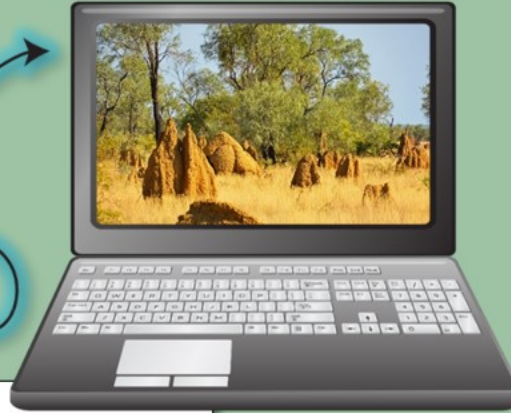
Student-led

Teacher-led



Content Delivery Option I: Student Webquest

Live video
links for
independent
learning on
any device!



Biomes

What is a biome?

1. Define the term "biome".
2. A biome is defined by four characteristics:
 -
 -
 -
 -
3. Are boundaries between biomes distinct or gradual? Explain.

What is climate?

4. Describe the weather and climate in your location.
5. Name and **briefly** describe the 9 world biomes.
 -

Corresponding
Comprehension Questions

-
-

Page 2



Answer the questions on the following page.

What is a biome?

Not all scientists classify biomes in the same way.

What is climate?

Weather is the daily fluctuation of temperature and precipitation. Climate is the weather in a particular location over a long period of time.

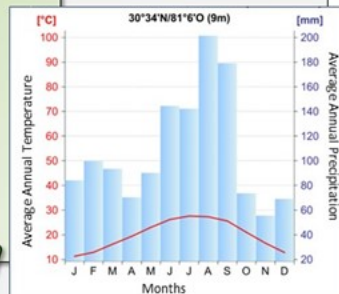


What are the common biomes?

There are 9 common terrestrial (land) biomes.

What is a climatogram?

A climatogram is a graph that displays the temperature and rainfall for a certain area. Each biome has its own climatogram. Average temperatures are displayed in a line graph while average rainfall is displayed in a bar graph. Find out how to make one—because you'll need to!



Page 1

Content Delivery Option 2: PowerPoint Presentation

19 editable, fully-animated slides

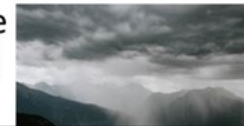
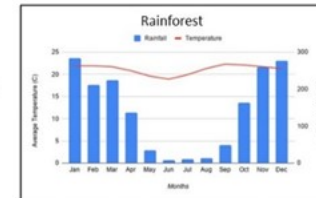
What are the characteristics of the 9 world biomes?

- Tundra – cold, treeless, ground permanently frozen
- Taiga – cold, animals hibernate, largest biome, coniferous
- Grasslands – large, rolling terrain, many grasses, few trees
- Deciduous Forest – Four distinct seasons, many trees, moderate climate



What are climatograms?

- Climatograms provide the **temperature** and **rainfall** for an area and can **identify** biomes
- Climatograms show **changes** in the climate over time and can be used to show the effects of human activity on the climate



How are mangroves keystone species?

Mangroves are critical to the health of coastal communities.

Mangroves **excrete excess salt** from a mixture of salt and fresh water.

Mangroves **stabilize coastlines** & reduce erosion.

Mangroves **provide shelter** for fish and sharks.

Mangroves are threatened by **shrimp farming** and **coastal development**.



Sample Slides

How does a community change after a disturbance?

- Primary succession begins in areas where there is no soil. Ex: newly created volcanic island
- Secondary succession occurs when soil is still present.
 - occurs more **quickly** than primary succession
 - Ex: flood, fire



What are the 3 main types of biodiversity?

- Biodiversity is the **variety** of life
 - Species biodiversity – the variety of **species** within a habitat or region
 - Genetic biodiversity – the variation of **DNA** and **genes** within a species or population
 - Ecological biodiversity – the variation in the network of species present in a certain **location** and the way they **interact** with each other



How is a line transect used?

Line transects are one method of sampling the number of species in an area.

The number of **species** along a specific **line** is measured.

The number of species **touching** the line provides evidence for the amount of **biodiversity** in that location.

Using **several transects** will give a complete picture of the biodiversity in an area.

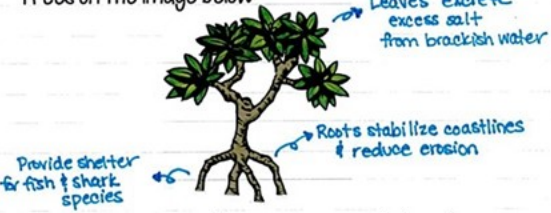


3 pages of Cornell Notes

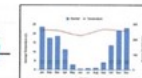
Big
concept
questions

Content
summary for
each page

Community Stability

<p>What are keystone and indicator species?</p>	<p>Keystone species have a large <u>impact</u> on their habitats. They affect many other <u>species</u>.</p> <p>Indicator species respond to environmental changes <u>dramatically</u>. They can help <u>measure</u> environmental conditions and can be indicators of environmental <u>health</u>.</p>
<p>How are mangroves a keystone species?</p>	<p>Mangroves are critical to the <u>health</u> of their communities. Label some of the benefits of the mangrove trees on the image below:</p>  <ul style="list-style-type: none"> What is threatening the mangrove populations? <u>Shrimp farming, tourism, & coastal development</u>
<p>How does a community change after a disturbance?</p>	<p>Primary succession begins in areas where there is no <u>soil</u>. Example: <u>newly created volcanic island</u> Secondary succession occurs when soil is still <u>present</u> (occurs more <u>quickly</u>) Example: <u>flood, fire</u> Pioneer <u>species</u> are the <u>first</u> organisms to inhabit barren environments. example) lichens move in and break down rocks into soil</p> <p>A climax community is the <u>final stage</u> of succession; a stable community that remains relatively <u>unchanged</u>.</p>
<p>Summary: <u>Keystone</u> species have a large impact on their habitats. Indicator species can help measure environmental <u>health</u>. Species in an ecosystem change through <u>primary</u> or <u>secondary</u> succession, which can begin with a <u>pioneer</u> species and end with a <u>climax</u> community.</p>	


Biomes

<p>What is a biome?</p>	<p>A biome is an area of the planet that can be classified according to the <u>plants</u> and <u>animals</u> that live in it.</p> <ul style="list-style-type: none"> What are the 4 characteristics that define a biome? <u>Temperature, soil, amount of light, amount of water</u>
<p>What are the characteristics of the 9 world biomes?</p>	<p>Tundra - cold, treeless, ground permanently frozen Taiga - cold, animals hibernate, largest biome, conifers Grasslands - large, rolling terrain, many grasses, few trees, fire Deciduous forest - four distinct seasons, many trees, autumn foliage Savanna - grassland, few trees, little rainfall, tropical climate Chaparral - hot & dry, mild winter, fire & drought common Rainforest - year-round warmth, near equator, rainy & dry season Desert - cold or hot/dry, little vegetation, nocturnal animals Alpine - mountainous, cold, small vegetation, animals have insulation</p>
<p>How are climate and weather different?</p>	<p>Weather is the <u>daily</u> fluctuation of temperature and precipitation. Climate is the weather in a particular <u>location</u> over a <u>long</u> period of <u>time</u>.</p> <ul style="list-style-type: none"> What is albedo and why is it important? <u>Albedo</u> is the <u>measure of the reflectivity of a surface</u>. Maintaining balanced albedo helps to <u>keep a comfortable environment on earth</u>. <p>Climatograms provide the <u>temperature</u> and <u>rainfall</u> for an area and can <u>identify</u> biomes.</p> <p>Climatograms show <u>changes</u> in the climate over time and can be used to show the effects of human <u>activity</u> on the climate.</p> 
<p>What are climatograms?</p>	<p>Biomes are classified by the <u>plants</u> and <u>animals</u> that live in it, and amount of <u>light</u> and amount of water that falls. <u>Climatograms</u> show temperature and precipitation.</p>

Biodiversity

<p>What are the 3 main types of biodiversity?</p>	<p>Biodiversity is the <u>variety</u> of life.</p> <ul style="list-style-type: none"> Species biodiversity - the variety of <u>species</u> within a habitat or region Genetic biodiversity - the variation of <u>DNA</u> and <u>genes</u> within a species or a population Ecological biodiversity - the variation in the network of species present in a certain <u>location</u> and the way they <u>interact</u> with each other
<p>How is a biodiversity index calculated?</p>	<p>A biodiversity index tells a scientist how many <u>species</u> exist in a certain environment.</p> <p>Write the equation for finding a biodiversity index in the box below:</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> $\frac{\# \text{ of species in an area}}{\text{total indiv. in the area}} = \text{biodiversity index}$ </div> <ul style="list-style-type: none"> What does a higher biodiversity index represent? <u>greater diversity/variety of organisms</u>
<p>How is a line transect used?</p>	<p>A sample of <u>species</u> along a specific physical <u>line</u> is measured. The number of species <u>touching</u> the line provides evidence for the amount of <u>biodiversity</u> in that location.</p> <ul style="list-style-type: none"> What can help give a more complete picture of the biodiversity in an area? <u>More transects / higher number of samples</u>
<p>What impact do invasive species have on biodiversity?</p>	<p>Once introduced into an ecosystem, invasive species can spread <u>quickly</u> and <u>widely</u>, often having fewer <u>limiting factors</u> to slow their growth. Biodiversity in these ecosystems can be dramatically affected because the new species is able to <u>reproduce</u> faster than the native species can <u>adapt</u> to the new <u>competition</u>.</p>
<p>Summary: There are 3 main types of <u>biodiversity</u>: species, genetic, & ecological. A biodiversity index can tell a scientist how many <u>species</u> exist in an area. A line transect can give evidence for the <u>biodiversity</u> in an area. An ecosystem's biodiversity can be dramatically affected by <u>invasive</u> species.</p>	

Community Stability

<p>What are keystone and indicator species?</p>	<p>Keystone species have a large <u>impact</u> on their habitats. They affect many other <u>species</u>.</p> <p>Indicator species respond to environmental changes <u>dramatically</u>. They can help <u>measure</u> environmental conditions and can be indicators of environmental <u>health</u>.</p>
<p>How are mangroves a keystone species?</p>	<p>Mangroves are critical to the <u>health</u> of their communities. Label some of the benefits of the mangrove trees on the image below:</p>  <ul style="list-style-type: none"> What is threatening the mangrove populations? <u>Shrimp farming, tourism, & coastal development</u>
<p>How does a community change after a disturbance?</p>	<p>Primary succession begins in areas where there is no <u>soil</u>. Example: <u>newly created volcanic island</u> Secondary succession occurs when soil is still <u>present</u> (occurs more <u>quickly</u>) Example: <u>flood, fire</u> Pioneer <u>species</u> are the <u>first</u> organisms to inhabit barren environments. example) lichens move in and break down rocks into soil</p> <p>A climax community is the <u>final stage</u> of succession; a stable community that remains relatively <u>unchanged</u>.</p>

Each page is **editable**.

Add and delete text, questions, and summaries to meet the needs of your students.

Every student page also comes in a **digital** version on Google Slides

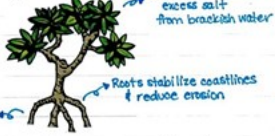
Virtual, hybrid, or
absent students
can stay right on
track!

Community Stability

What are keystone and indicator species? Keystone species have a large impact on their habitats. They affect many other species.

Indicator species respond to environmental changes dramatically. They can help measure environmental conditions and can be indicators of environmental health.

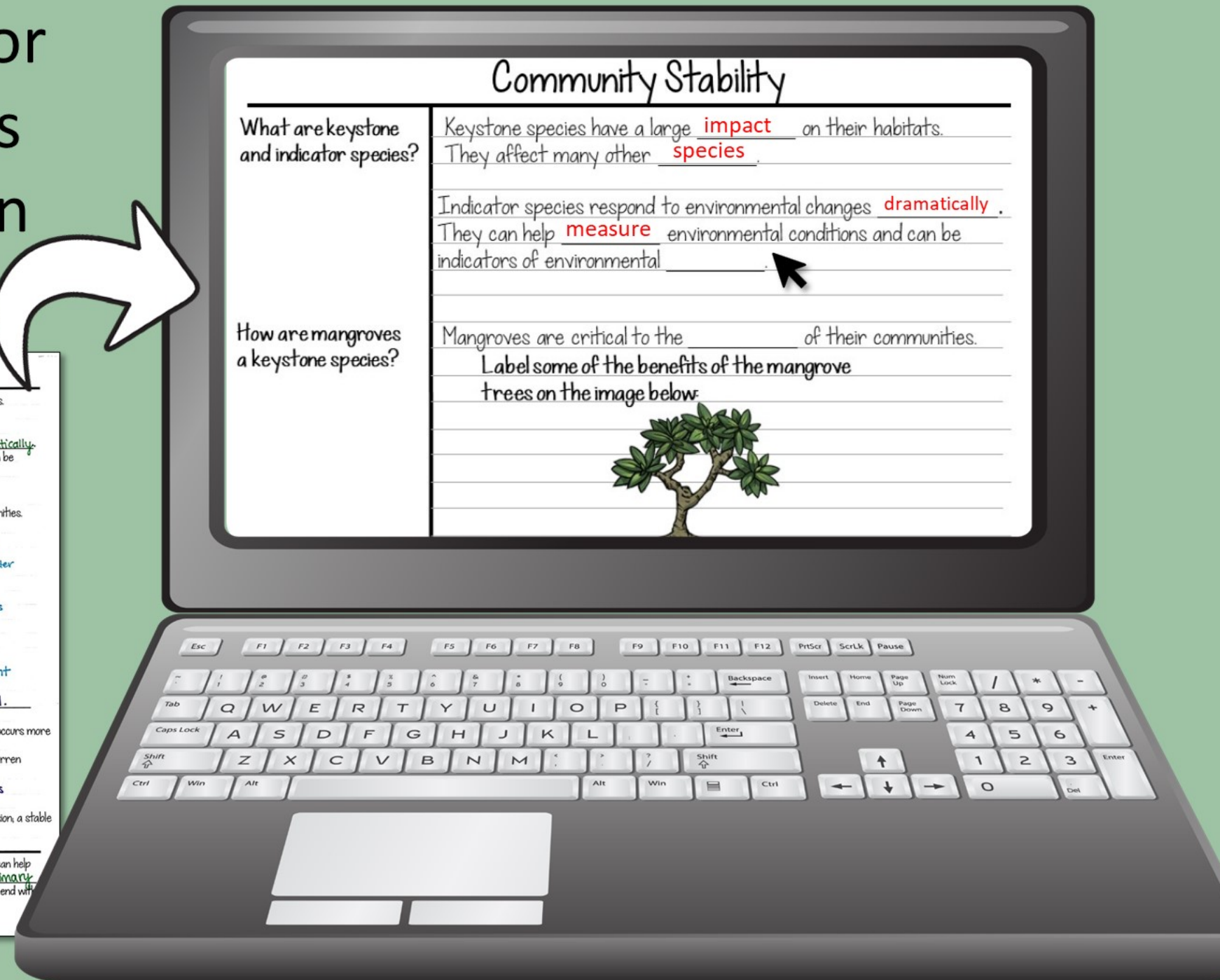
How are mangroves a keystone species? Mangroves are critical to the health of their communities. Label some of the benefits of the mangrove trees on the image below:



- What is threatening the mangrove populations?
Shrimp farming, tourism, & coastal development

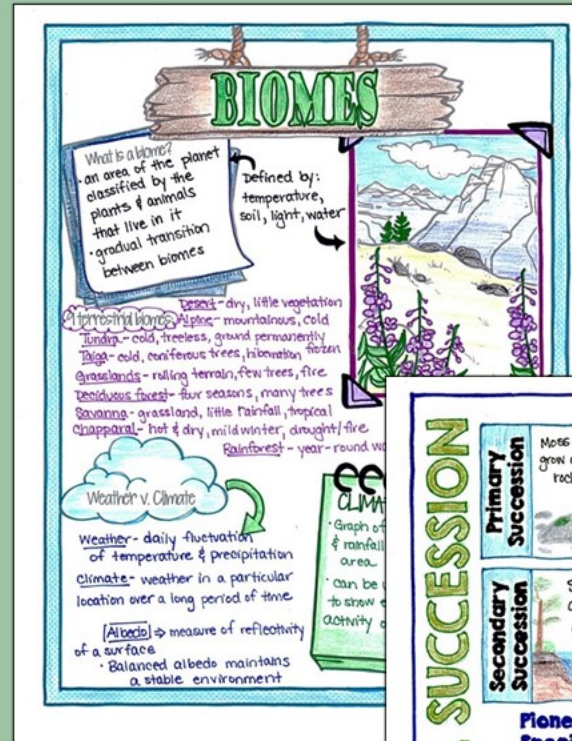
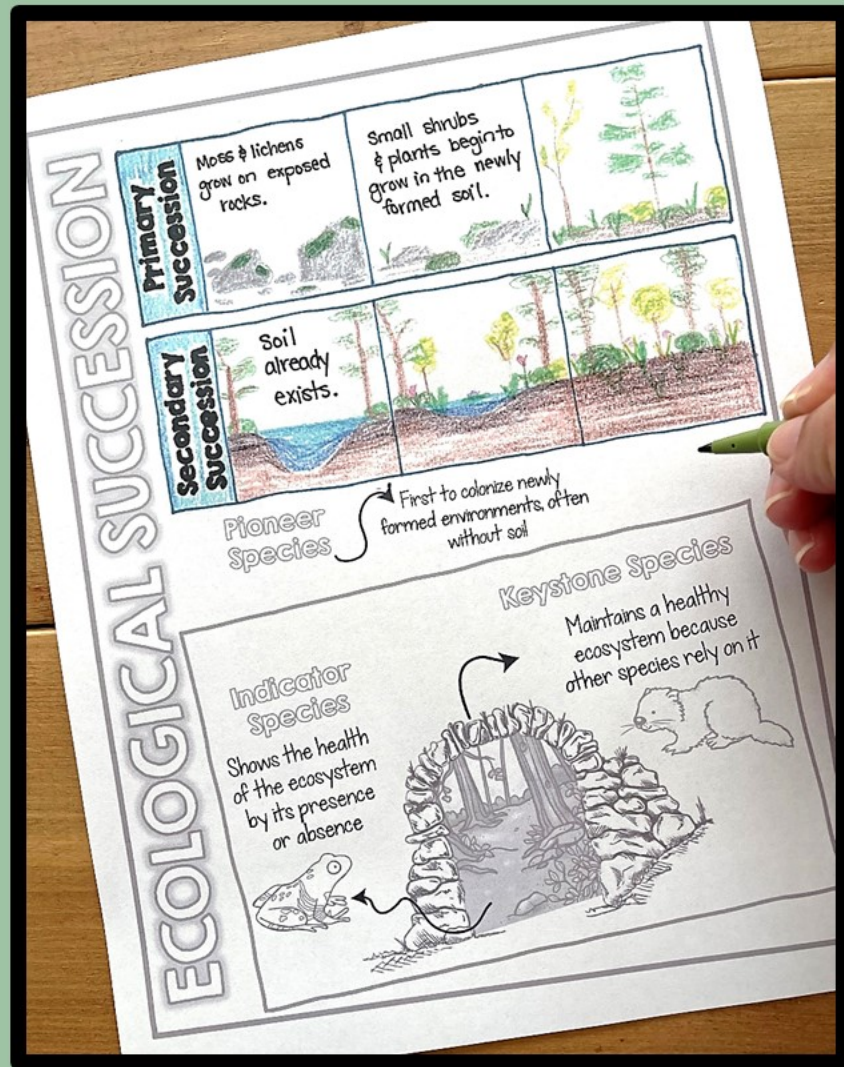
How does a community change after a disturbance? Primary succession begins in areas where there is no soil. Example: newly created volcanic island. Secondary succession occurs when soil is still present (occurs more quickly). Example: flood, fire. Pioneer species are the first organisms to inhabit barren environments. example) lichens move in and break down rocks into soil. A climax community is the final stage of succession, a stable community that remains relatively unchanged.

Summary: Keystone species have a large impact on their habitats. Indicator species can help measure environmental health. Species in an ecosystem change through primary secondary succession, which can begin with a pioneer species and end with climax community.



Can be used in Google Classroom, Microsoft OneDrive or
many other platforms!

3 pages of Doodle Notes for Summarizing & Review



Doodle Notes™ increase student focus and memory- and they're great fun!

A guide for using them in your classroom is included.

Includes 5 Activities

- Biome Travel Brochure Research Activity
- Biome Food Web Poster Project
- Geocaching Lab
- Plant Transect Biodiversity Lab
- Lionfish Invasive Species Panel Discussion

Biome Travel Brochure

Objective:

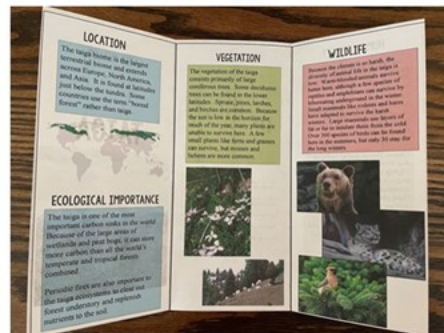
Describe a particular biome and explain the ecological importance of that area.

Research:

- Research a biome of your choice.
- Use the template provided on the following page to make a trifold travel brochure for your biome. You must include all the information that is listed below. You may add more text, images, backgrounds, etc.
- You will be graded using a grading rubric. Please look at the rubric while completing the project.
- (Optional) You may turn in an electronic version of the travel brochure on a computer or tablet if given permission by your teacher.

Items included in the brochure:

- Description of the biome (location, climate, etc.)
- Description of the biome's location (you may use a map to show the location within that geographic region. Then, research the average temperature & rainfall for that city to make your climatogram.)
- Description & images of main vegetation types in the biome
- Description & images of animals in the biome
- Explanation of the biome's ecological importance
- Explanation of how humans have impacted the biome



Biome Poster Project Teacher Instructions

Objective: Students will construct a food web for a specific biome using the photos and descriptions of organisms provided.

1. Print all the pages that follow this one. (pages 3-28) Pages 6-27 are pictures of animals found in each biome and their matching descriptions including information about their diets. **(The pictures and descriptions are arranged to be printed in two-sided format.** Optionally, you could laminate these cards and reuse them year after year. To do this, students can use tape for their poster.)

2. It would be helpful to provide some background information about food chains and food webs prior to this activity. Students should understand how energy is transferred up the food chain and the names of the different levels (producers, primary consumers, secondary consumers, tertiary consumers). Students should also have an idea of the role that scavengers and decomposers play in the food web although they are not represented in this activity.

3. Each group should receive:

- A copy of the directions for the activity
- A copy of the Biome Notes page
- A copy of the grading rubric (you can cut these in half)
- A copy of the world map
- A set of biome pictures (biome title, picture page, description page)

(The pictures and descriptions are arranged to be printed in two-sided format.)

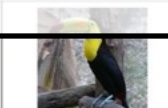
4. Students should follow directions on the student directions page.

5. Information about specific biomes can be found in most life science textbooks or online. For suggested websites, see the "Start Here" document.



Biome Food Web Poster Project Sample Pages

<p>In summer, the Arctic hare feeds on plants such as grass, ferns and leaves. In winter, it eats twigs, the bark from trees, and buds from flowers and plants. Hares have been known to eat dead rodents such as mice due to low availability of protein in an herbivorous diet.</p>	<p>The Bahama Fir is a small to medium sized native evergreen tree. It can grow to be 40 to 80 feet tall. The Bahama fir has a wide base and a narrow top that ends in a slender, spire-like top.</p>
<p>Squirrels are omnivores (they eat plants and meat). They eat seeds, nuts, leaves, bulbs, roots, mushrooms, insects, worms, eggs, small birds, and other small animals. Ground squirrels have pouches in their cheeks in which they carry food to their burrow to store.</p>	<p>The Eastern Red Cedar grows in a pyramid shape. The top rounds off as it grows older. It has two types of leaves. The older leaves are flat and scale-like and only 1/16 of an inch long. The younger leaves are sharp-pointed and may be up to 3/4 of an inch long.</p>
<p>Wolves hunt in packs and often prey upon animals that are much larger than they are. They mostly eat hooved mammals, like</p>	<p>Elk are ruminants and therefore have four-chambered stomachs. Their diets vary somewhat depending on the season (consumed in the</p>



Taiga: Coniferous Forest

Tropical Rain Forest

Geocaching Lab

Using the internet, find the answers the following questions.

- What was the original purpose of GPS?
- Explain how trilateration works.

Pre-lab:

Lab Instructions:

Part I: Finding a geocache

Using the internet, find the answers the following questions. Locate 1 or more geocaches near your school. After arriving at the geocache, take a picture of at least one tree or marker with the geocache in the proof.

Geocaching Lab Sample Page

Part 2: Creating a geocache

In this part of the lab, you will **create a geocache with your class**. This geocache will be educational in nature. The purpose is to teach future geocache hunters about the ecological community around them.

With your teacher and the rest of your class, select a location for your future geocache.

Find and record the information on the following page to include in your geocache.



Biodiversity Lab

Lab Procedures: (Take these outside with you!)

1. Tie one end of your cord to one of the stakes.
2. Push the tent stake into the ground at your team's designated starting point.
3. Stretch the cord to its full length, being careful not to step on the plants that you want to disturb.

to the ground.

not identify. Record and record as you walk the plants that touch

Record the letter of name of the

and rewind the

Biodiversity Lab

Introduction: (Do these before the lab)

1. Look at the container of 200 beads. If you were asked to estimate the number of each color of bead in the container, how might you do it?
2. Choose 18 beads as a "sample" of the bead population. After the 18 beads are collected, list the colors and number of each color below.
3. Calculate the diversity index of the "bead population" by using this formula:

$$\frac{\# \text{ of colors (or species) in sample} \times \# \text{ of individuals in sample}}{\# \text{ of colors (or species) in sample}}$$

4. Circle the population that has the most diversity:

Discussion Questions: (Do these after the lab)

1. Calculate the diversity index for the population that has the most diversity. (Show your work.)
2. Why is it important for scientists to do several sample transects in the same location?
3. What possible sources of error might have occurred during this lab that would affect your diversity index?

Plant Transect Biodiversity Lab Sample Pages

Real Life Scenario: Invasive Lionfish

A Case Study on Invasive Species

Lionfish, recognizable by their stripes and large, venomous spines, are a notable invasive species in the eastern United States. As lionfish populations continue to grow within the Atlantic Ocean, biologists and government organizations are working to prevent further spread and control existing populations.

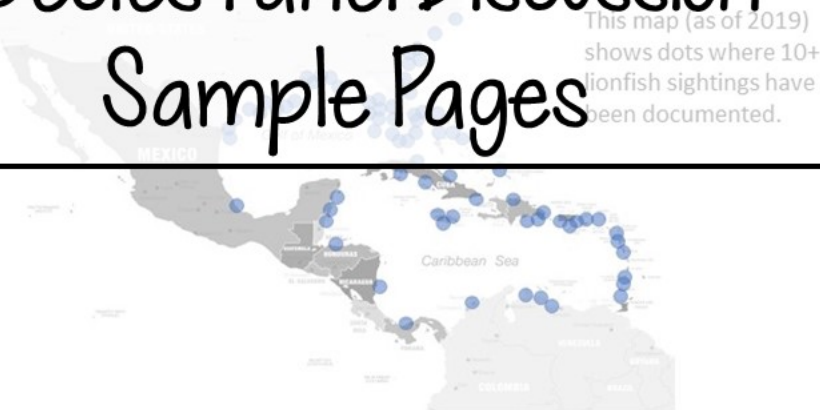
Lionfish are native to the tropical waters of the South Pacific and Indian Oceans. They have long been collected and sold to be kept in home aquariums. Scientists think it is likely that the first lionfish was introduced into the Atlantic Ocean around 1985 by an amateur aquarist that got tired of the lionfish and released it into the coastal United States. It is also possible that damage and flooding from Hurricane Andrew allowed for the accidental release of more lionfish into the wild, allowing them to become quickly established in the Atlantic ecosystems. The lionfish invasion has been hard to combat, likely due to its natural beauty. Unlike snakehead fish and Asian carp, which are generally considered to be unattractive species, the lionfish is seen as an exotic and interesting creature. Some chartered diving companies are resistant to capturing these fish because recreational divers like to see them.



Why are lionfish such a problem?

- Lionfish are not easily preyed upon due to their venomous spines and the inability for native species to recognize them as food. Although they can be eaten by humans when cleaned and stripped of their spines, some consumers are still reluctant to do so.
- Lionfish are indiscriminate predators that eat nearly anything small enough to fit into their mouths, including commercially important fishery species such as grouper and snapper.
- Lionfish are able to breed year-round, producing up to 30,000 eggs every 4 days. Their young reach reproductive age quickly.
- Overfishing native species, such as groupers and snappers, has reduced their populations, making it more difficult for them to compete with the lionfish populations.
- Lionfish feed on parrotfish, which are species that graze on algae found in coral reefs. Parrotfish prevent algae from growing and destroying ecologically important coral reef habitats.

Lionfish Invasive Species Panel Discussion Sample Pages



PETA Member

As a member of People for the Ethical Treatment of Animals (PETA), you are committed to preventing the harm and abuse of any animals. You also don't approve of the use of animals for food.

Home Aquarium Owner

You just love saltwater aquariums. You've had several in your house for 10+ years and your friends love to look at the fish when they come over for dinner. You've even sold fish from local trade shows.

Director of Florida Keys Tourism Council

Tourism accounts for a large portion of the Florida Keys' economy. Many tourists come to enjoy the natural beauty of this location. You work with local businesses and media to attract visitors to the area.

National Marine Sanctuary Director

The National Marine Sanctuary protects the habitats and species of the marine coastlines of the United States. Your job is to safeguard the species of marine life for future generations.

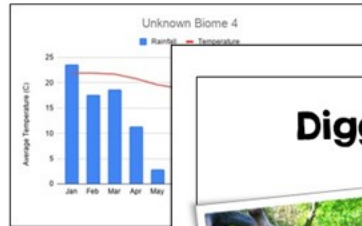
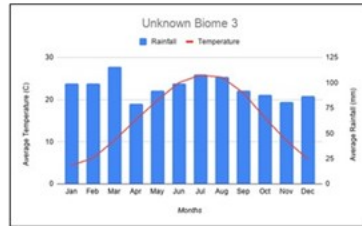
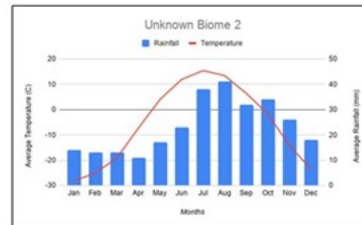
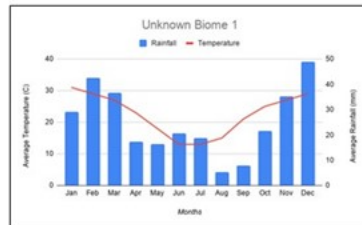
Extension Pages

Math skills check!

(great for standardized test prep)

Data Analysis: Climatograms

Biomes are categorized by distinct climates. Since a climatogram provides the temperature and rainfall for an area, a biome can be identified by its climatogram. In this activity, you will predict the biome for each climatogram given.



1. Determine the identities of the unknown biomes 1-4. Explain each.

Biome 1:

Biome 2:

Biome 3:

Biome 4:

2. How could climatograms be used by scientists? (What is their

3. Which biome (1-4) would they have the greatest biodiversity

Digging Deeper: Keystone Species



Mangrove trees certainly look unusual with dense tangles exposed roots, but as **keystone species**, they are critical to the health of their communities. They grow in tropical latitudes coastline of slow-moving tidal waters. These waters rise and fall at least twice per day- an environmental condition for which these trees are well-suited. Their prop roots allow to withstand daily flooding while their leaves the excess salt absorbed from their **brackish** of freshwater and saltwater) habitats. Mangrove forests provide a great service to communities. Their roots stabilize the coast reduce erosion while also slowing the movement water to allow for sediments to settle on the bottom. The tangle of roots also provides shelter thousands of fish and shark species.

Unfortunately, mangrove forests are disappearing at an alarming speed. Some ecologists estimate 50% of the world's mangroves are already gone. They face significant threats from humans, especially countries such as India, the Philippines, and Vietnam. Even in the United States, they are being destroyed at an alarming rate.

Some of the major threats to mangrove forests include:

Shrimp farming: Shrimp farmers in Asian countries divert the natural flow of water and mangroves to create artificial ponds for raising shrimp. These dense shrimp populations require chemicals and antibiotics, which pollute the surrounding waterways. Mangrove forests are also destroyed as shrimp ponds expand. Shrimp farming also destroys the natural habitat of many species, and the removal of mangroves makes it difficult to maintain these species, tourists often bring in garbage, sewage, and other disturbance harmful to aquatic communities.

Coastal development: As more humans want to live near the beach, pollutants and development can produce more waste than the mangroves can naturally process. This trash is often used for building and other purposes, and the removal of mangroves makes it difficult to maintain these species, tourists often bring in garbage, sewage, and other disturbance harmful to aquatic communities.

Your job: To design a flyer or poster that informs coastal communities about the benefits of mangrove forests and encourages their conservation.

***Note:** Think about where this flyer would be posted (US, Asia, etc.) and focus on the threat that is most applicable to that region.

Include:

- An eye-catching headline, title or slogan
- Visuals (photographs or pictures)
- 2+ benefits of mangrove swamps
- An explanation of how the local community could help to conserve mangrove forests

Data Analysis: Biodiversity Indices



A species biodiversity index is a very basic measure of diversity. It accounts for the number of species (called **species richness**) present but ignores other factors such as the abundance of each species.

Here's an example: You have sampled two different lakes. The sample from the first lake consists of 34 catfish, 9 bass, and 7 sunfish. The sample from the second lake consists of 19 catfish, 17 bass and 14 sunfish.

Both lakes have the same species richness: 3 species within 50 fish. The second sample, however, has a higher **species evenness**. The second sample is more diverse because **a community dominated by one or two species is considered to be less diverse than one in which several species have a similar abundance**.

The Simpson's Diversity Index takes into consideration not only the species richness but also the relative abundance of each species. The Simpson's Diversity Index is as follows:

$$D = 1 - \frac{\sum n(n-1)}{N(N-1)}$$

n = the total # of organisms of a particular species
 N = the total # of organisms of all species

Let's assume you took wildflower samples from a 4x4 ft field area. Here is your data:

Species	Number (n)	n(n-1)
Dandelion	9	72
Chicory	1	0
Black-eyed Susan	3	6
Coneflower	4	12
Total	N=17	$\sum n(n-1) = 90$

Putting the numbers into the formula:

$$D = 1 - \frac{90}{17(16)} = .67$$

Species	Number (n)	n(n-1)
Dandelion	13	132
Chicory	1	0
Black-eyed Susan	1	0
Coneflower	2	2
Total	N=17	$\sum n(n-1) = 134$

Then you took wildflower samples from a different field area. Here is your data:

$$D = 1 - \frac{134}{17(16)} = .43$$

Which field is more diverse? By how much?

Greater depth of knowledge, scientific literacy, & critical thinking

14 Editable Task Cards for Review

1

Describe the tundra & taiga biomes.

2

Describe the grasslands, savanna & chaparral.

3

Describe the rainforest,

4

Describe the desert and

Sample Task Cards

5

Compare and contrast the terms climate and weather.

6



What do the bars

7

What is albedo and how do vegetation and climate change affect it?

8

Why are mangroves considered a keystone species? What threats exist for mangroves?

Using Editable Task Cards 🍏

How to set-up:

1. Print the cards on cardstock or paper.
2. Cut the pages so that each card is separate. If you'd like to use them in future years, it may be worth laminating them to protect them from student writing and other damage.
3. Place each task card at a seat around the room.

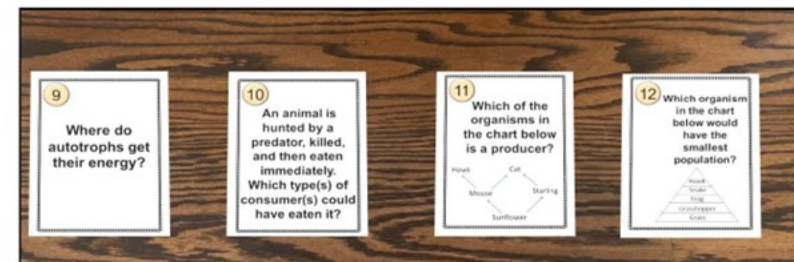
4. Students will rotate to each seat until all cards are finished. Answers are recorded on their "Task Card Answer Sheet" or notebook page.

*TIP: It is important to set a timer for each rotation. Usually 2 minutes is appropriate. Without a timer, students will get backed up while rotating and chaos will ensue. 😊

Teacher Tips

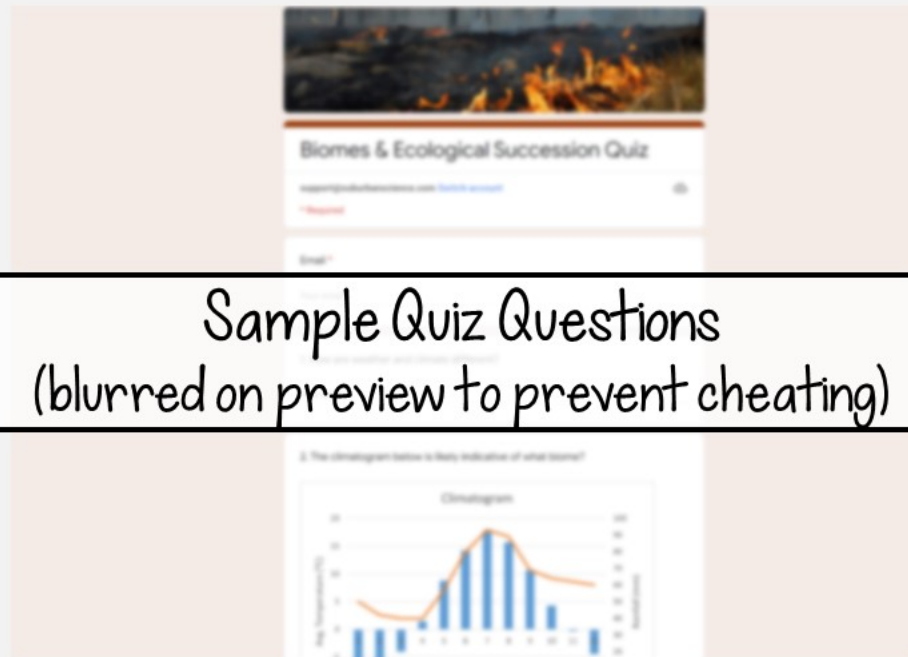
Modifications:

- These task cards are editable so you can change the text on any card.
- There are additional cards at the end of the document for adding questions. Be sure to add the correct number, as well!
- If moving around your room isn't possible, you can have students pass the cards in one direction.
- Other options:
 - Students can use notes or not depending on the level of memorization you expect prior to reviewing.
 - Students can work in pairs, which adds confidence.



Assessments

Editable Online Quiz through Google Forms

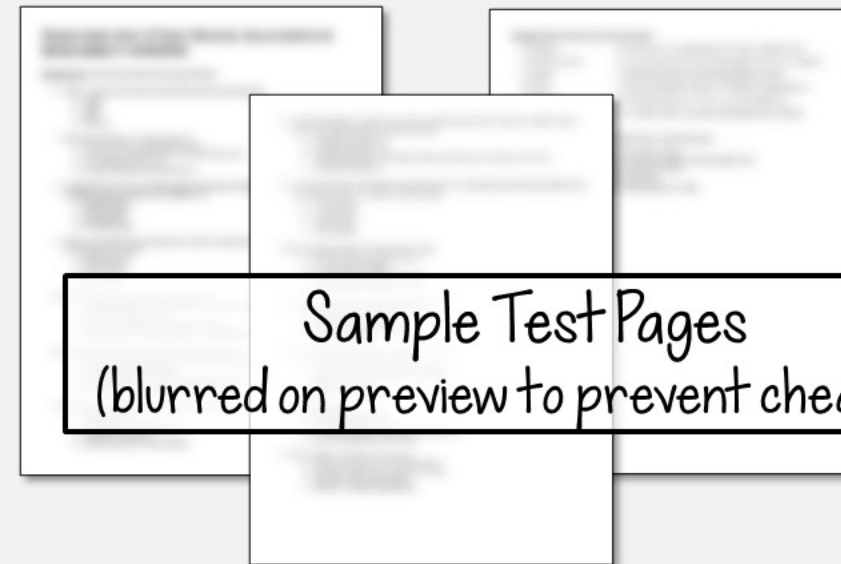


Sample Quiz Questions
(blurred on preview to prevent cheating)

- 11 questions
- Fully editable
- Answer key included for automatic grading

Editable Unit Test

- 14 multiple choice questions
 - 5 free response questions
- Two Versions: Honors & Regular



Sample Test Pages
(blurred on preview to prevent cheating)



Student answer sheet & answer keys included
(both fully editable)

I'd love to hear from you!

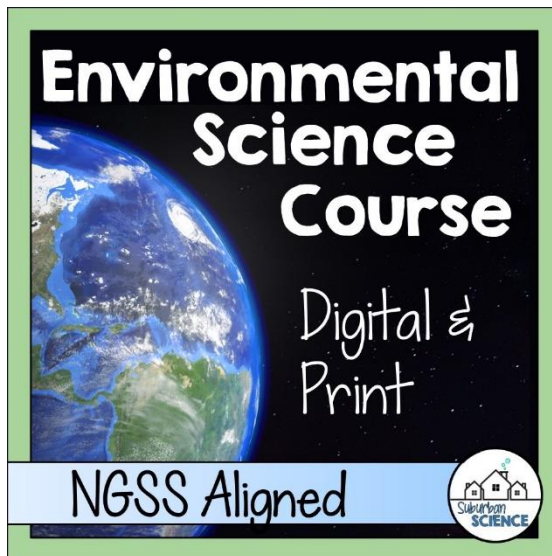
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Sincerely,
Anne from Suburban Science

