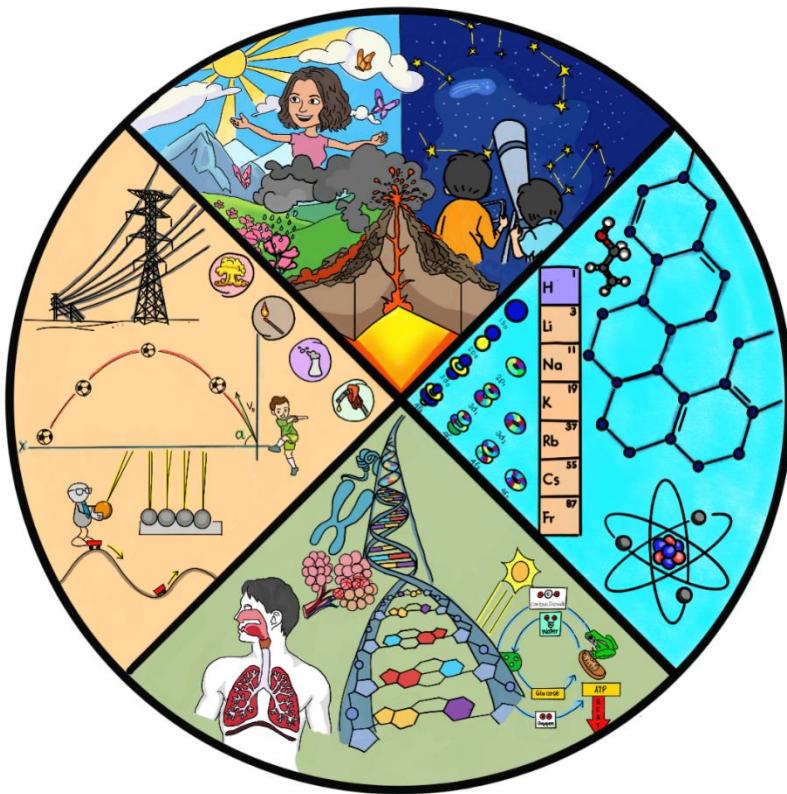


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Department of Education
National Capital Region
SCHOOLS DIVISION OFFICE
MARIKINA CITY

Science

Quarter 1 – Module 4 **Adaptation and Species Extinction**

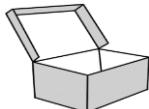


Samuel P. Songcayauon



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What I Need to Know

The purpose of this module is to help you understand the concepts about adaptation and causes of species extinction among organism in an ecosystem.

This module contains the following lessons:

- Lesson 1 - Patterns of Population Distribution
- Lesson 2 - Factors causing Species Extinction

After going through this module, you should be able to **relate species extinction to the failure of certain populations to adapt to abrupt changes in the environment. S9LT-Ig-j-31**

Specifically, you are expected to;

1. describe the distribution of species in a community;
2. compute for the population density in an area;
3. determine the patterns of population distribution;
4. explain the probable causes of species extinction; and
5. relate some local and global environmental issues to species extinction.



What I Know

Read and understand each item carefully and encircle the letter corresponding to the word or group of words that completes the sentence.

1. Which is the correct sequence of classification from highest to lowest level?
 - A. genus-species-order-phylum-class—kingdom
 - B. kingdom-class-phylum-order-family-genus-species
 - C. kingdom-phylum-class-order-family-genus-species
 - D. phylum-kingdom-class-order-family-genus-species
2. Which mechanism of evolution takes place among organisms as suggested by Charles Darwin?

A. genetic drift	C. mutation
B. gene flow	D. natural selection
3. The number of individual species per unit area at a given time is called population _____.

A. age structure	C. demographics
B. density	D. dispersion



4. A grass plot with an area of 4 square inch is occupied by 100 termites. What is the population density?
- A. 0.004 termites per sq. inch C. 25 termites per sq. inch
B. 0.04 termites per sq. inch D. 100 termite per sq. inch
5. The maximum population size that an environment can support is _____.
A. biodiversity C. carrying capacity
B. biotic potential D. community
6. The maximum reproductive capacity of an organism under optimal environmental conditions is referred to as _____.
A. biodiversity C. carrying capacity
B. biotic potential D. community
7. Which one will not happen to a population size when the environment nears its carrying capacity?
A. reproductive rate decrease D. population size remains stable
B. death rate increase
C. population size decrease
8. Which factor below naturally limits the growth of insects in a community?
A. application of pesticides
B. presence of insect eating animals
C. slow rate of reproduction due to human intervention
D. over collection
9. Philippine monkey-eating eagle, Visayan warty pig and Tamaraw are species of animals classified as _____.
A. extinct C. threatened
B. critically endangered D. vulnerable
10. Which human activities do not support the government's program in the prevention of extinction among organism?
A. breeding endangered animals in captivity
B. conserving natural resources
C. draining a swamp for agricultural purposes
D. reforestation campaign



Lesson 1

Adaptation and Species Extinction



What's In

You have learned the importance of biodiversity in the ecosystem and the different types of interaction to maintain balance. Thus, all species present in an ecosystem remain in their respective habitat as long as the resources needed are available and they can freely reproduce. If some of these requirements are not met, the organism tends to migrate and settle to another place to survive. Before you start this new lesson, take time to read the following major concepts about biodiversity to help you connect and understand better this new lesson.

Can you identify who is in the picture?

Carolus Linnaeus, the Father of Modern Classification classified living things based on **Binomial Nomenclature** or the two-name classification system.

The table **of classification** below was developed by **Carolus Linnaeus** where he used the **two-named classification** comprised of **Genus** and **species**. This classification is also used in writing the **scientific name** of both plants and animals.



Figure 1. Carolus Linnaeus
<https://bit.ly/3h0c1UZ>



Classification of Organism

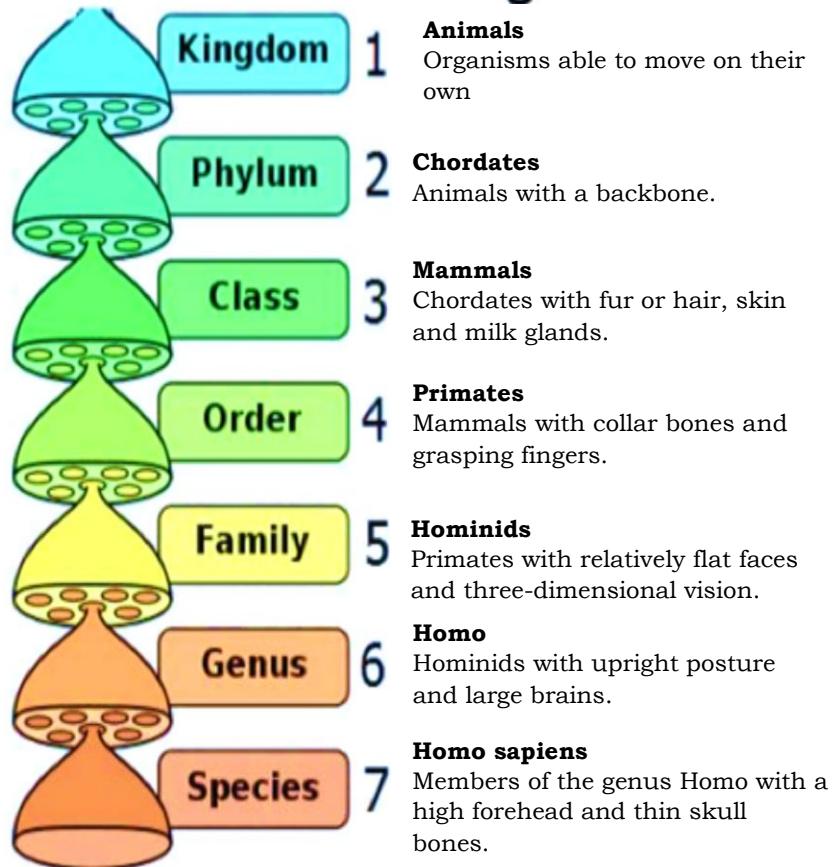


Figure 2. Linnaean Classification System

<https://bit.ly/2UK3WuV>

Guide Questions:

Answer the following questions after analyzing the Table of Classification above.

1. Identify the highest level of classification.

2. What type of organism occupies this classification?

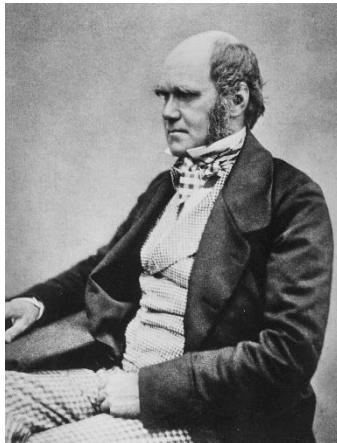
3. How about the lowest level of classification?

4. What organism in the animal kingdom with scientific name *Homo sapiens*?



The following are prominent scientists in the field of Evolution.

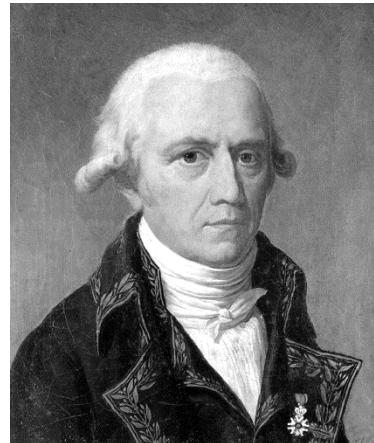
Charles Darwin



<https://bit.ly/3w4cE3Y>

Theory of Natural Selection

Jean Baptiste de Lamarck



<https://bit.ly/3w4cE3Y>

Theory of Use and Disuse



What's New

In studying population distribution, we cannot do away mentioning population density, patterns of distribution, adaptation, and species extinction, because they present details which affect biodiversity. Table 1 shows the Summary of the Evidences of Evolution.

Table 1. Evidences of Evolution

Evidences	FEATURES
1.The Fossil Record	Includes bones, shells, exoskeletons, and stone imprints of animals or microbes, objects preserved in amber, hair, petrified wood, oil, coal, and DNA remnants.
2.The Chemical and Anatomical Similarities	Comparative anatomy has long served as evidence for evolution. It indicates that organisms share a common ancestor. It also assists scientists in classifying organisms based on similar characteristics of their anatomical structures.
3.The Geographic Distribution of Related Species	Biogeography is the study of the geographic distribution of living things and the abiotic factors that affect their distribution. Abiotic factors such as temperature and rainfall vary mainly based on latitude and elevation. As these abiotic factors change, the distribution of plant and animal communities also changes.



4. The Recorded Genetic Changes	Genetic variation is the presence of differences in sequences of genes between individual organisms of a species.
---------------------------------	---

Table 1 summarizes the different mechanism of evolution that occurs among organisms. All living organisms evolved in order to adapt, survive, and reproduce in a new environment. Another factor that causes the distribution of organisms is the constant movement of the earth crust due to earthquake and volcanic eruption as explained by Alfred Wegener, the earth separates and changes its land formation and elevation thus drifted apart into seven continents. This is one of the reasons why living organisms of the same species separates and disperses unevenly in different types of environments in the world.



What Is It

In a natural setting an ecosystem tends to be balanced or self-regulating because of the different natural ecological relationships that take place in it. This condition provides an opportunity for an organism to stay in their natural habitat. All species of plants and animals are adapted to live in habitats with specific environmental conditions. When their environment changes, they have to adapt themselves in order to continue to live and reproduce.

Do you want to know how organisms were distributed on earth? Study closely the table below.

Table 2. Summary of Factors that Influenced the Distribution of organism

Factors	Influence	Illustration
1. Temperature	Temperature is a factor that influences species distribution because organisms must either maintain a specific internal temperature or live in an environment that will keep the body within a temperature range that supports their metabolism.	 Figure 6. Temperature
2. Water	Water links and maintains all ecosystems on the planet. As nature's most important nutrient, organisms need water to survive. Water helps to transport oxygen, minerals, nutrients, and waste products to and from the cells.	 Figure 7. Water source



2.Light	The two most important climatic factors for ecosystems are sunlight and water. Sunlight is necessary for plants to grow, and to provide energy to warm the earth's atmosphere. Light intensity controls plant growth. Light duration affects plant flowering and animal/insect habits.	
3.Soil Ph	Soil pH affects the amount of nutrients and chemicals that are soluble in water and the amount of nutrients become available to plants. Some nutrients are more available under acid conditions while others are more available under alkaline conditions	
4.Salinity	Soil salinity is a measure of the minerals and salts that can be dissolved in water.	Figure 9. Types of Soil https://bit.ly/3vVob5G

Guide Questions:

Answer the following questions. Write your answers on a separate sheet of paper.

1. Choose two factors from the table above and explain what happen when these not present in the environment?

2. Choose one factor from Table 2 and explain how it affects population distribution?

Let us be familiar with these terms:

Biotic Potential- ability of a population of living species to increase under ideal environment.

Carrying Capacity- maximum population size that can be sustained by a specific environment.

Population density -number of people per unit of area, usually measured in per square kilometer or square mile, and which may include or exclude for example areas of water or glaciers.



Distribution patterns- how the individuals in a population are distributed in space at a given time. The individual organisms that make up a population can be equally spaced, dispersed randomly with no predictable pattern, or clustered in groups. Look at study the different patterns below.

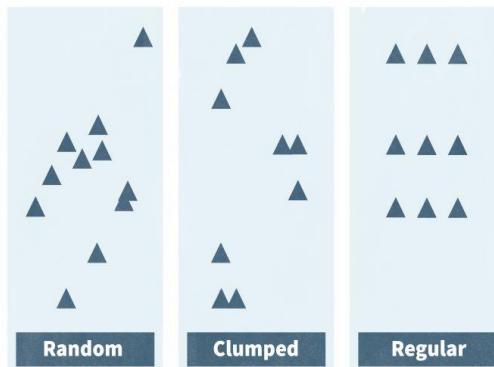


Figure 10. Spatial Distribution Patterns

<https://bit.ly/35ZGrjI>

Activity 1. Measuring Population Density

Objectives:

1. Determine the pattern of population density using mathematical formula.
2. Describe pattern of distribution of different population.

What to do:

1. Study the three patterns of population distribution in the figure below.
2. Use the formula on **Population Density**.
D= number of individuals/sizes of area
3. Copy the table on the paper you have prepared. Count the total number for each population and record it on the table.

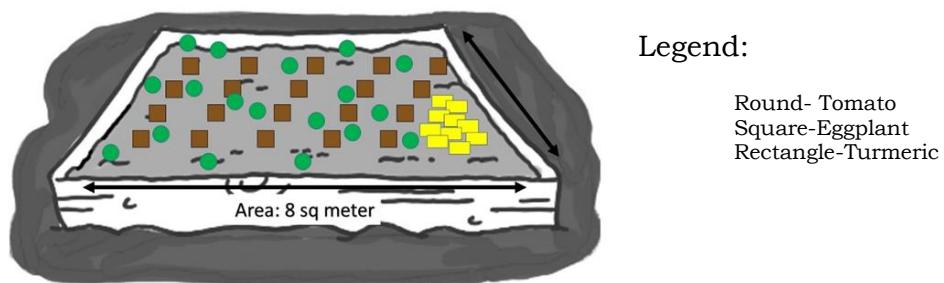


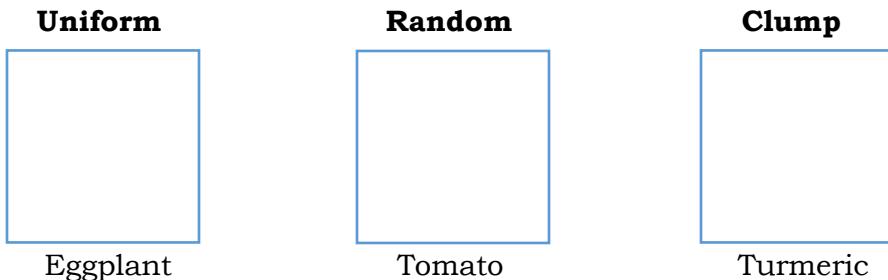
Figure 11. The Garden Plot

Table 1. Data for Measuring Population Density

Population Name	Number of Organism	Population Density	Type of Distribution
Example : Eggplant	20	2.5	uniform
1.			
2.			

Guide Questions:

1. What group of plant is considered highest in population density?
2. Which group of plants is considered lowest in population density?
3. Which of the three types of pattern of distribution is more beneficial to an organism? Explain why?
4. Illustrate the different patterns of population distribution.
Use the shapes in the legend to represent the three populations.



A limiting factor is a supply or environmental condition which limits the growth, distribution or abundance of an organism or population within an ecosystem. This can either be physical or biological factor or both which can be identified through increased or decreased growth, abundance, or distribution of population.

One of the limiting factors in this activity is density-independent factors. These factors have effect on the size or growth of the population and the population density. Density-independent factors include food or nutrient limitations, pollutants in the environment, and extreme climate, including seasonal cycles such as monsoons. In the natural world, limiting factors mentioned might result to species extinction.

Charles Darwin's Theory of Evolution, "Natural Selection", says that if an organism meets the requirements identified as abiotic factors in their respective habitat, they can freely reproduce, and remain stable in their place.

Probable Causes of Species Extinction

Extinct - refers to a species, family, or other larger group of organisms having no living members to date. (e.g. "trilobites and dinosaurs are already extinct")



Extinction occurs when species are diminished because of environmental forces such as:

1. loss of habitat;
2. global warming;
3. natural disaster;
4. overexploitation of species for human use; and
5. evolutionary changes in their members (genetic inbreeding, poor reproduction, decline in population numbers).

The Philippines contains a large and diverse group of mammalian species in the past. They are widely distributed across the archipelago. However, they became extinct due to several factors.

Let us consider *Dugong* as an example. This mammal is threatened by coastal development and poor catchment management resulting in siltation and therefore the loss of sea grass beds. Isolated *Dugong* populations are prone to local extinction as a result of losing sea grass beds after events like floods or typhoons. The *Dugong* is also vulnerable by incidental mortality in commercial gillnets, entanglement in shark nets and collisions with boats. In view of the above points, the Scientific Committee is of the opinion that the *Dugong*, (*Dugong dugon*), is likely to become endangered unless factors threatening its survival or evolutionary development cease to operate, and is therefore eligible for listing as an endangered species.

Another animals native in the Philippine is Monkey-eating eagle with only an estimated 400 left in the wild, the race is on to save the Philippine eagle —one of the biggest and strongest raptors in the world. Rare footage of a Philippine eagle family over the course of five months shows parents intensively caring for a single eaglet and the eaglet learning to fly.

The island of Mindoro in the Philippine Archipelago is considered as a biodiversity “**hotspot**”. It is home to the tamaraw (*Bubalus mindorensis*), a dwarf buffalo solely native to the island and the only wild cattle species living. The tamaraw has suffered from heavy hunting and continuous habitat destruction during the last century. It has gradually been confined within the mountainous interior of the island. The species is now listed as **Critically Endangered** on the International Union for Conservation of Nature or IUCN Red List of threatened species.

The Philippine tarsier, as its name suggests, is endemic to the Philippine archipelago. *Carlito syrichta*, Philippine tarsier populations are generally found in the southeastern part of the archipelago. Established populations are present primarily on the islands of Bohol, Samar, Leyte and Mindanao.

Several laws have been passed to protect and conserve the Philippine tarsier. DENR Administrative Order No. 38, Series of 1991 (DAO No. 38) included the Philippine tarsier among the national protected wildlife species and proposed its listing under Appendix 1 of the Convention on International Trade in Endangered Species (CITES). Moreover, the IUCN/SSC Primate Specialist Group had given the



species Conservation Priority Rating 4, which means that the species is highly vulnerable and threatened by habitat destruction and/or hunting.

The Asian elephant was introduced to the Philippines, originally transported to the sultanates of Sulu and Maguindanao, but later became extinct on those areas or were transported back to Sabah for unknown reasons that was sometime during the 13th to 16th century. While *Dugong*, a marine mammal inhabiting the warm coastal waters of the Indian and Pacific Oceans that feeds on sea grasses, was classified as vulnerable species.

There are **four** categories of **endangered species** they are: vulnerable, endangered, critically endangered, and extinct.

1. **Vulnerable** - is a species which has been categorized by the International Union for Conservation of Nature as likely to become endangered unless the circumstances that are threatening its survival and reproduction improve. Vulnerability is mainly caused by habitat loss or destruction of the species home.
2. **Endangered (EN)** - a species considered to be facing a very high risk of extinction in the wild.
3. **Critically endangered** - a species facing an extremely high risk of extinction in the wild.
4. **Extinct** - having no living member remaining anywhere, not in the wild, in a naturalized population, nor in captivity, as categorized by the IUCN Red List

Mitigation

Republic Act No. 9147 otherwise known as the Wildlife Resources Conservation and Protection Act is an act providing for the conservation and protection of wildlife resources and their habitats, appropriating funds therefor, and for other purposes.

There are two ways you can understand the process and causes of extinction among flora and fauna and ways how to protect them from vanishing. One way is by defining the word in context. The way the word is defined in this module gives you a clue as to its meaning.

Another way is by organizing data based on the information provided in the discussion and the use of graphic organizer in order to give a picture of the concept. Each word part can give you a clue for the meaning of the whole concept of adaptation and species extinction.

To further increase your knowledge on adaptation and species extinction, watch a video presentation on <https://www.youtube.com/watch?v=Z5clNWbRp6I>. Take



note of the important concepts discussed in the video to answer the guide questions and other tasks at the end of the lesson.

Guide Questions:

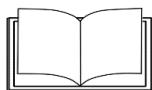
1. What makes up biodiversity?

2. Enumerate the two components of an ecosystem? Explain.

3. Identify the advantage of Philippines biodiversity compared to other countries in the world?

4. Why is Philippines included in the list of global hotspots?

5. In what way can you extend support for the care of Philippine biodiversity?



What's More

Activity 2. Picture Analysis

Analyze all the pictures below and identify the word or group of words (found in the box below) that best describes the picture. Write your answer on a separate sheet of paper.

Evolutionary changes in members of species

Global warming

Loss of habitat

Natural disaster

Overexploitation of species for human use

Reforestation



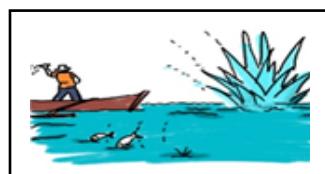
1. _____



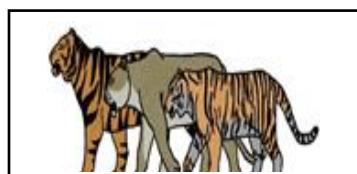
2. _____



3. _____



4. _____



5. _____





What I Have Learned

Mitigation

Republic Act No. 9147, also known as the Wildlife Resources Conservation and Protection Act. is an act providing conservation and protection of wildlife resources and their habitats, appropriating funds, and for other purposes.

Activity 3: Categories of Endangered Species

Classify the following into vulnerable, critically endangered, and extinct. Then put a check mark (/) on the succeeding columns that correspond to the reason why a particular animal becomes endangered. Use the example below as your reference. Write your answers on a separate sheet of paper.

List of animals	Classification	Elements of Extinction				Ways of Mitigation
		Habitat loss	Competition	Climatic Change	Man-made Activity	
Ex: Philippine Crocodile	critically endangered	/			/	1.Create crocodile sanctuary 2.Engage local communities in conservation through education and awareness campaigns
1.Dugong						
2.Asian Elephant						
3.Philippine Eagle						
4.Tamaraw						
5.Tarsier						

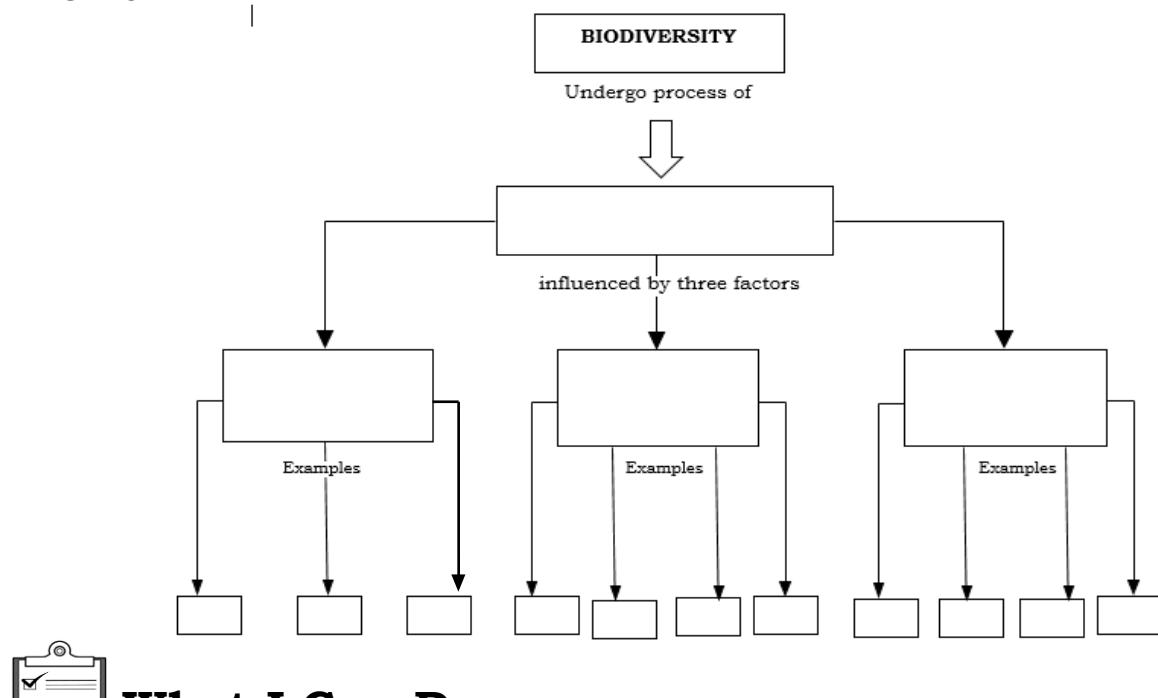


In this part of the module, you are going to summarize the concepts learned from population distribution and species extinction using the flow chart below. Fill in the flow chart of biodiversity with words from the word box.

Use the following words to complete the flow chart

- | | |
|---------------------------------------|------------------------------------|
| Climate change | Natural disaster |
| Cluster | Pattern of population distribution |
| Diseases | Probable cause of extinction |
| Evolution | Random |
| Exploitation of species for human use | Space |
| Food | Temperature |
| Limiting factors | Uniform |
| Loss of habitat | |

FLOW CHART



What I Can Do

Mitigation is the effort of disasters. For mitigation to be effective we need to take action now—before the next disaster—to reduce human and financial consequences later (analyzing risk, reducing risk, and insuring against risk)

Activity 4. Mitigation Plan for Wildlife Conservation and Protection

Describe the type of community you are living and think of activities which are feasible in support of the government's program on wildlife mitigation. The first one is done for you.



Advocacy	Activity	Person/s Involved
Example: Reforestation	Tree Planting	Barangay personnel, students and family members
1.		
2.		

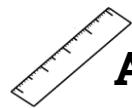


Additional Activities

Make your own **Personal Contract** in response to Marikina's City-wide Clean-up Drive and Tree Planting Activity. Use the sample below. You may opt to write your personal contract in Filipino to make it substantial.

<i>PERSONAL NA KONTRATA</i>	
<p>Ako si _____ mag-aaral sa Mataas na Paaralan ng Marikina, nasa ika-9 na baitang ay sumusumpa bilang kabataan ng lungsod na :</p> <ul style="list-style-type: none"> 1. kukumbinsihin ko ang bawat kasapi ng aking pamilya na tumulong sa pag-aalaga, pagpapaunlad at pagliligtas ng ating kalikasan; 2. ibahagi ang natutunan sa tamang pamamahala at pangangasiwa ng ating kalikasan at pinagkukunang-yaman; 3. tumulong upang mabawasan ang polusyon sa hangin, tubig at lupa; 4. hikayatin ko ang aking mga kaibigan upang maging bahagi sa gawaing pangkalikasan at; 5. magkaroon ng sariling disiplina at gawin ang nararapat para sa ikabubuti ng ating mundong ginagalawan. 	
Aking Lagda	Petsa
_____ Saksi:	_____ Petsa





Assessment

Read and understand each item carefully and encircle the letter corresponding to the word or group of words that completes the sentence.

1. Which is the correct sequence of classification from highest to lowest level?
 - A. genus-species-order-phylum-class—kingdom
 - B. kingdom-class-phylum-order-family-genus-species
 - C. kingdom-phylum-class-order-family-genus-species
 - D. phylum-kingdom-class-order-family-genus-species

2. Which mechanism of evolution takes place among organism as suggested by Charles Darwin?

A. genetic drift	C. mutation
B. gene flow	D. natural selection

3. The number of individual species per unit area or volume at a given time is called population _____.

A. age structure	C. demographics
B. density	D. dispersion

4. A grass plot with an area of 4 square inches is occupied by 100 termites.
What is the population density?

A. .004 Termites per sq. inch.	C. 25 Termites per sq. inch.
B. .04 Termites per sq. inch.	D. 100 Termite per sq. inch.

5. The maximum population size that an environment can support is _____.

A. biodiversity	C. carrying capacity
B. biotic potential	D. community

6. The maximum reproductive capacity of an organism under optimal environmental conditions is referred to _____.

A. Biodiversity	C. carrying capacity
B. biotic potential	D. community

7. Which one will not happen to population size when the environment nears the carrying capacity?

A. reproductive rate increases	C. population size decreases
B. death rate increases	D. population size remains stable



8. Which factors naturally limits the growth of insects in a community?
 - A. application of pesticides
 - B. presence of insect eating animals
 - C. slow rate of reproduction
 - D. over collection

9. Philippine monkey-eating eagle, Visayan warty pig and Tamaraw are species of animals classified as
 - A. extinct
 - B. critically endangered
 - C. threatened
 - D. vulnerable

10. Which human activities does not support the government program in the prevention of extinction among organisms?
 - A. breeding endangered animals in captivity
 - B. conserving natural resources
 - C. draining a swamp for agricultural purposes
 - D. reforestation campaign



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