# AP Biology Summer Assignment 2025

Welcome to AP Biology!

I look forward to meeting you. My name is Mrs. Wadad Sharif, and I have been teaching for 21 years. This is my fifth year at BBS as AP Biology teacher and Sustainability coordinator.

This summer you will delve into the world of ecology, which will allow you to spend time on more challenging topics throughout the year (i.e. Genetics, biotechnology, biochemistry, molecular biology).

This summer assignment has been designed to keep your mind sharp! It is an opportunity to earn 100% on your first quiz, as this assignment will be graded for the completion of all the learning objectives. However, at the same time you have to do your best. Please have this assignment completed by AUGUST 25, 2025 and email it to

**wadad.elcharif@student.bbs.edu.kw**. You will also have a written summative assessment at the beginning of the third week.

While I would not recommend procrastinating until the last days, I would suggest holding off on this until the end of July, as it will not take a lot of time (it varies depending on the speed you watch the videos), but I want it to be relatively fresh in your mind. Do not wait until the day before class starts, though...as I do not want you to burn yourself out before we even begin!

The two main goals of AP Biology are to:

1- Help you develop a conceptual framework for modern biology

2- Gain a deeper appreciation of science as a process (as opposed to an accumulation of facts).

The AP Biology Curriculum centers around the four Big Ideas and you will need to not only know these but also understand how they all relate:

- Big Idea 1: The process of evolution drives the diversity and unity of life.
- Big Idea 2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
- Big Idea 3: Living systems store, retrieve, transmit and respond to information essential to life processes.
- Big Idea 4: Biological systems interact, and these systems and their interactions possess complex properties.

# Assignment - Unit 8: Ecology

Resources: https://learn-biology.com/ap-biology-v2-0-main-menu/ap-bio-unit-8-ecology-main-menu/#topic8.2

# Food Chain/ Web

 Podcasts:
 http://www.bozemanscience.com/055- biodiversity

 http://www.bozemanscience.com/020-biotic-and-abiotic-factors

 http://www.bozemanscience.com/014-environmental-matter-exchange

 http://www.bozemanscience.com/047-ecosystems to 8:27 ONLY

 http://www.bozemanscience.com/ap-bio-labs-part-2 4:50 - 8:00 ONLY

- 1. What's the difference between a food chain and a food web?
- 2. Why are the arrows always drawn from the prey towards the predators?
- 3. The four plants and algae at the bottom of your food web are the only organisms that do not have any arrows pointing at them. What is their source of energy?
- 4. If you were to take a walk through a part of Yellowstone National Park, which level of the food web would you expect to see the most of? Least of? Why?
- 5. One trophic level not shown on this food web is the decomposer. These organisms, which include bacteria, fungi, and some invertebrates, eat dead and decomposing organic matter. If you were to draw a decomposer on this food web, what arrows would be pointing to it?

Calories transferred to	<u>Circle all words that apply:</u>		
	producer consumer predator		
	prey heterotroph autotroph		
Calories transferred to snake:	producer consumer predator prey heterotroph autotroph		
Calories transferred to grasshopper:	producer consumer predator prey heterotroph autotroph		
Calories available from grass: 10,000	producer consumer predator prey heterotroph autotroph		

#### **Density Dependent vs. Density Independent Factors**

#### Resource: http://www.bozemanscience.com/046-communities

**Directions:** Read each of the statements below involves a situation that will affect the growth of a population. Classify each of the statements as D (density dependent factors) or I (density independent factors).

	Description	Туре
6.	A severe flood brings a lot of sediment and silt into Lake Winnipeg. The turbidity of the lake increases greatly.	
7.	A drought decreases the water level in Lake Winnipeg. The carrying capacity of the lake decreases.	
8.	Due to the introduction of rainbow smelt, Lake Winnipeg becomes crowded and some fish species do not survive.	
9.	Since northern pike prey on yellow perch, an increase in the perch population causes an increase in the pike population.	
10	. Many fish die due to an increase in water temperature.	
11	. Due to over-fishing, the number of walleyes in Lake Winnipeg decreases.	
12	A population is growing quickly when parasites cause disease to spread quickly.	
13	. Since lake sturgeon migrate long distances to spawn, many do not survive the trip.	
14.	Competition among ferns for space to grow on the forest floor.	
15	A population of field mice increases after a farmer leaves his field unharvested for a season.	

#### **Response to Stimulus**

**Directions:** Read each description, identify the stimulus and response, and write one word in the box.

Description	Stimulus	Response
16. A prairie dog spies a hawk and squeals a warning.		
17. Plants grow towards the light.		
18. Pill bugs will move towards dark, cool, damp locations (Note: Movement is called taxis; directed movement is kinesis).		
19. Plant secretes a foul-tasting and foul-smelling chemical when broken (bitten).		
20. Birds sing to attract a mate and to identify their territory.		
21. Orange and red coloration in animals usually warns of poison or toxins.		
22. I hear a rattling sound when on a hike, freeze, identify the source (snake), and move slowly away.		
23. A stegosaurus spots a T-rex in the distance and starts swinging its thagomizers (tail spikes) rapidly.		

#### Invasive vs. Keystone

Podcast: Dunit 8 Part 2

## http://www.bozemanscience.com/050-populations

**Directions:** Read each description and mark it as "I" for Invasive or "K" for Keystone.

Description	Туре
23. Kudzu was introduced to the United States in 1876 at the Philadelphia Centennial Exposition. It	
was promoted as a forage crop, an ornamental plant, and a check on erosion. It can grow up to a	
foot a day allowing it to easily outcompete and kill other plants including trees and shrubs.	
24. Gray wolves in the Greater Yellowstone Area were eliminated by 1924 due to concerns about elk,	
bison, and livestock. Their absence caused elk populations to surge, leading to overgrazing and a	
decline in plants vital to beavers, fish, and birds, disrupting the ecosystem.	
25. The European crab, transported by ships and sold as bait, has spread to coasts around the world,	
including North and South America, Australia, South Africa, and Japan. It preys on shore animals	
like worms and mollusks, and in some areas, has harmed local ecosystems and shellfish industries.	

26. Sea stars were the primary predators of mussels and barnacles in the ecosystem. Without the	eir
control, mussels dominated the area, crowding out other species and eliminating benthic alg	ae,
which led to the collapse of snail, limpet, and bivalve populations that depended on the algae	<b>e</b> .
27. Sea otters are influential to aquatic environments because of their feeding habits. Kelp is allo	wed
to flourish which leads to absorption of high amounts of CO2, preservation of the organisms	which
rely on kelp for survival, as well as protecting coastlines.	
28. Native to Papua New Guinea and parts of Australia, the brown tree snake was accidentally	
introduced to Guam after World War II. It has decimated native bird populations on the island	d,
leading to the extinction of several species.	
29. On African grasslands, elephants play a vital role in shaping the landscape and supporting oth	ier
species. They feed on shrubs and trees, often knocking down large ones, which prevents the	area
from turning into forest. This helps preserve the open grassland ecosystem.	
30. Cane toads, native to Central and South America, were brought to Australia in the 1930s to	
manage pests in sugarcane fields. They have since spread throughout the country, poisoning	
native predators and disturbing local ecosystems.	

#### Survivorship Curves

Directions: Read each description and Identify the survivorship category and circle the correct number.

Species			S
<b>Humans:</b> Typically experience low death rates early in life, with an increase in mortality as they age.	I	П	Π
Birds: Experience a relatively steady rate of mortality throughout their lifespan.	Ι	П	Ш
<b>Trees:</b> Face high mortality rates in early stages, with only a few surviving to maturity.	Ι	П	=
<b>Fish:</b> Exhibit high mortality early in life, with only a few individuals reaching adulthood.	Ι	П	=
Squirrels: Experience a fairly consistent mortality rate throughout their life.	Ι	П	=
Elephants: Have low mortality during their early years, but mortality increases as they age.	Ι	П	=
Butterflies: Suffer high mortality early in life, with only a few surviving to reach adulthood.	I	П	=
<b>Bears:</b> Generally experience low mortality in early life, but face higher mortality as they get older.	Ι	П	П
Frogs: Have high early-life mortality, with only a small percentage reaching maturity.	I	П	П
<b>Grasshoppers:</b> Experience high mortality in early life, with few individuals surviving to adulthood.	Ι	II	II

#### Symbiotic Relationships

**Directions:** Read each description, identify how each species is affected, and then identify which relationship is being described (Parasitism, Mutualism, Commensalism, Predation, Competition).

31. Coyotes and Foxes are predators that eat the same species in the same area. Fights for land among these two species occur frequently.						
Coyotes: + / - / 0	Foxes: + / – / 0	Parasitism	Mutualism	Commensalism	Predation	Competition
32. Marine creatures somet these empty shells whic longer using the shell.	times outgrow their shells l h provides them with prot	eaving the ection and	em on the c shelter, wh	ocean floor. He nile the previo	rmit crabs us inhabit	inhabit ant is no
Marine Creatures: + / – / 0	Hermit Crabs: + / – / 0	Parasitism	Mutualism	Commensalism	Predation	Competition
<ol> <li>Tapeworms are segmen such as cows, pigs, and host of nutrients.</li> </ol>	ted flatworms that attach t humans. They get food by	hemselves eating the	s to the insi animal's pa	ides of the inte artly digested	estines of food, depr	animals iving the
Tapeworm: + / – / 0	Mammals: + / – / 0	Parasitism	Mutualism	Commensalism	Predation	Competition
34. A wolf is a natural environwolves can bring down	onmental carnivore. The w and eat a whole moose.	olf can hui	nt as a pack	c or as an indiv	vidual. A pa	ack of
Wolf: + / – / 0	Moose: + / – / 0	Parasitism	Mutualism	Commensalism	Predation	Competition
35. One particular type of for unknowingly transport t ants. The fungus then ta	ungus attaches itself to ant the fungus to fungus garde akes over and destroys the	s' bodies a ns located garden.	is they fora in the ant	ge for food. Th colony that se	nese ants rve as food	d for the
Fungus: + / – / 0	Ant: + / – / 0	Parasitism	Mutualism	Commensalism	Predation	Competition
36. Male Horned Rams will their horns together un	36. Male Horned Rams will fight with each over for the right to mate with females. The rams will run and slam their horns together until one gives up.					
Rams: + / – / 0	Rams: + / – / 0	Parasitism	Mutualism	Commensalism	Predation	Competition
37. Acacia ants inhabit the depends on the ants for can survive successfully	37. Acacia ants inhabit the Bullhornacacia (a type of tree). The ants obtain food and shelter, and the acacia depends on the ants for protection from browsing animals, which the ants drive away. Neither member can survive successfully without the other.					e acacia nember
Ants: + / – / 0	Tree: + / – / 0	Parasitism	Mutualism	Commensalism	Predation	Competition
38. Mycorrhizal fungi grow the fungi with sugars m	on plant roots and help the ade during photosynthesis.	e plant abs	orb water a	and nutrients.	The plant	provides
Giraffe: + / – / 0	Zebras: + / – / 0	Parasitism	Mutualism	Commensalism	Predation	Competition
39. A Remora fish attaches itself to a shark so it can eat the scraps of food left by the shark. It does not harm the shark when it attaches.						
Fish: + / – / 0	Shark: + / – / 0	Parasitism	Mutualism	Commensalism	Predation	Competition
40. Honey Guide birds show delicious honey. Afterw	40. Honey Guide birds show the badgers where the beehives are. The badgers rip open the hives and eat the delicious honey. Afterwards, the Honey Guide birds eat.					nd eat the
Birds: + / – / 0	Badgers: + / – / 0	Parasitism	Mutualism	Commensalism	Predation	Competition
41. Different plants and animals are harvest to make the different parts of the cheeseburger. Plants are used to make the bread, milk and other ingredients are used to make the cheese, cows are used to make the beef patty. Humans eat a cheeseburger.						

Plants/Animals: $+ / - / 0$	Humans: + / – / 0	Parasitism	Mutualism	Commensalism	Predation	Competition
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#### Population Distribution

**Directions:** Analyze each photo, determine what type of population distribution the species follows, and write down the answer in the space provided. (Random, Uniform, Clumped)

Elk	Brush	Flowers	Spiders
42.	43.	44.	45.
Trees	Birds	Penguins	Elephants
46.	47.	48.	49.

#### **Ecology Vocab**

**Directions:** Circle the vocabulary term that includes all of the rest.

50.	Trophic Level	Food Web	Food Chain	Arrow
51.	Parasitism	Commensalism	Mutualism	Symbiosis
52.	Organism	Ecosystem	Population	Community
53.	Omnivore	Consumers	Carnivore	Herbivore
54.	Producers	Plants	Algae	Bacteria
55.	Ecosystem	Biotic Factor	Biosphere	Abiotic Factor
56.	Grasslands	Biome	Rainforest	Boreal Forest
57.	Evaporation	Precipitation	Water Cycle	Transpiration

58.	Low Temperature	Little Rainfall	Tundra	Permafrost
59.	Community Ecology	Invasive Species	Symbiosis	Keystone Species
60.	Abiotic Factors	Biomass	Biodiversity	Ecosystem

#### Simpson's Diversity Index

**Resources:** <u>https://www.khanacademy.org/science/ap-biology/ecology-ap/community-ecology/v/simpsons-index-of-diversity</u>

**Directions:** Complete the following problems using the equation:  $D = 1 - \Sigma \left(\frac{n}{N}\right) D = 1 - \Sigma \left(\frac{n}{N}\right)_2$ 

Students are not required to memorize this formula but must know the meaning of the symbols:D = diversity index $\Sigma$  = the sum ofN = total number of organisms of all species foundn = number of individuals of a particularspeciesspecies

Calculate the Diversity Index for each location and determine which has a higher value. 61. An area of the Black Forest in Germany contains 134 pitch pines, 24 Douglas firs, and 53 red pines.

62. Mindo (a city in Ecuador) has 832 toucans, 392 red headed barbets, 3 golden headed quetzals, 500 tanagers, 899 parrots, and 50 white capped dippers.

#### **Exponential vs. Logistic Growth**

N = Population size	r = growth population	rate of	K = Carrying Capacity	dN/dt = growth rate of population
Exponential Growth: dN	I Growth: dN/dt = rN		wth: dN/dt = rN <u>(K – N)</u> K	r = (Births – Deaths)/N

**Directions:** Read each question below carefully, determine the correct equation to use, and calculate for the variable being asked for in the question. Show your work.

- 63. A population of 20 velociraptors has 4 babies in one breeding season. However, 2 of the older velociraptors die off due to old age. What is the growth rate of this population of velociraptors?
- 64. A population of 100 mice has a growth rate of 0.2.

- a. In an exponential growth environment, what is the population growth rate for this population?
- b. What if the population of mice had a carrying capacity of 1000?
- 65. A population of 500 mice live in a similar environment. They also have a growth rate of 0.2.
  - a. In an exponential growth environment, what is the population growth rate for this population?
  - b. What if the population of mice had a carrying capacity of 1000?

## Ecosystem Energy Problems

**Directions:** Read each question carefully, calculate the answer, and show your work. (Remember the 10% rule)

- 66. A wolf in a simple food web feeds on elk and rodents, which feed on plant material.
  - a. The ecosystem intakes 600,000 kcal/m<sup>2</sup>/year. If this ecosystem covers approximately 10,000 m<sup>2</sup>. What is the total energy (kcal) supplied to wolves within the ecosystem over a year period?
  - b. A single wolf can survive on 120,000 kcal/year. How many wolves can be supported in the ecosystem?

# Energy Pyramid Problems

Directions: Read each problem, calculate your answer, show your work, and circle your answer.

- 67. In a wetland environment, there is 20,810 kcal/m<sup>2</sup>/year captured by producers. In the primary consumer, 3,368 kcal/m<sup>2</sup>/year moved to the next trophic level. In the secondary consumers, 383 kcal/m<sup>2</sup>/year was taken in. The tertiary consumers took in 21 kcal/m<sup>2</sup>/year.
  - a. Draw the Energy Pyramid for the ecosystem.
  - b. Calculate the ecological efficiency of each trophic level.
  - c. If there were 5,060 kcal/m<sup>2</sup>/year of decomposers in this ecosystem, what would be the total biomass?

# **Geochemical Cycles**

## Resources:

- <u>https://www.khanacademy.org/science/biology/ecology/biogeochemical-cycles/v/biogeochemical-cycles</u>
- https://www.khanacademy.org/science/biology/ecology/biogeochemical-cycles/v/the-water-cycle
- <u>https://www.khanacademy.org/science/biology/ecology/biogeochemical-cycles/v/carbon-cycle</u>

- <u>https://www.khanacademy.org/science/biology/ecology/biogeochemical-cycles/v/nitrogen-cycle</u>
- <u>https://www.khanacademy.org/science/biology/ecology/biogeochemical-cycles/v/phosphorous-cycle</u>

Create a **one-page infographic or visual summary** for **each** of the following cycles:

- 1. Water Cycle
- 2. Carbon Cycle
- 3. Nitrogen Cycle
- 4. Phosphorus Cycle

Each infographic must include:

- A labeled diagram showing movement of the element through abiotic and biotic components
- Key processes (e.g., nitrogen fixation, evaporation, combustion)
- Human impacts (e.g., deforestation, fossil fuel combustion, fertilizer use)
- Why the cycle is important for life

Submission Format for infographics: Hand-drawn (must be neat and organized) as digital ones are not accepted.