Name _____ Date _____ Period _____

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Communities and Biodiversity Study Guide

Biology

Show your work with units. Use complete sentences when a question asks you to explain.

Key relationships	**Percent change** = (new − old) ÷ old × 100	**Amount left after a decrease** = start × (1 − percent ÷ 100)	**Percentage points** = difference between two percents	**Species richness** = number of different species (count kinds, not individuals)

Part 1. Biodiversity and Ecosystem Services

1. Students sample two ponds of the same size with the same net, for the same time (sample data).

Pond A	Count	Pond B	Count
Snail	22	Snail	61
Water strider	14	Midge larva	33
Mayfly nymph	9		
Caddisfly larva	6		
Dragonfly nymph	5		

(a) Find the species richness and the total number of individuals in each pond.

(b) A classmate says Pond B is more diverse because it had more animals. Do you agree? Explain. Then find the percent change in richness from Pond A to Pond B.

2. (a) Classify each benefit of a coastal mangrove forest as a provisioning, regulating, supporting, or cultural service.

Benefit	Type of ecosystem service
(1) People catch shrimp that grow among the roots.	
(2) Roots trap mud and keep coastal water clear.	
(3) Tourists pay for kayak and birdwatching trips.	
(4) Fallen leaves decompose and recycle nutrients.	

(b) Storm waves are 1.5 m tall at the outer edge of the mangroves and 0.3 m tall after passing through 500 m of mangroves (sample data). Find the percent change in wave height. Which type of service is this?

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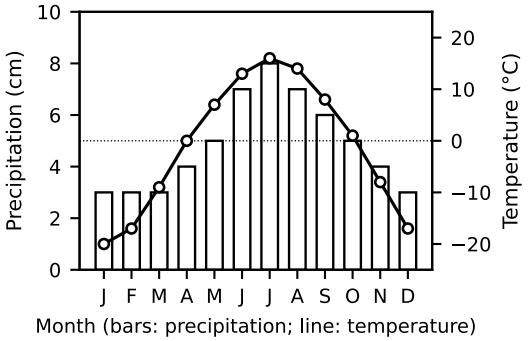
Part 2. Terrestrial Biomes

3. The climograph shows sample data for Site D. Monthly values, January to December: temperature −20, −17, −9, 0, 7, 13, 16, 14, 8, 1, −8, −17 °C; precipitation 3, 3, 3, 4, 5, 7, 8, 7, 6, 5, 4, 3 cm.

(a) Find the average yearly temperature and the total yearly precipitation.

(b) Use the ranges below to choose the best-fit biome. Explain why the other two do not fit.

Biome	Temperature	Precipitation
Boreal forest	−5 to 5 °C	30 to 85 cm
Tundra	below about −5 °C	15 to 50 cm
Temperate grassland	0 to 20 °C	25 to 75 cm



4. Students bury identical bags of dead leaves at a tundra site and at a temperate forest site. After one year, the tundra bags lost 8% of their mass and the forest bags lost 45% (sample data).

(a) How many times faster did the leaves break down in the forest? Explain the difference using decomposers and climate.

(b) Predict which soil holds more undecayed dead plant matter. Explain.

(c) Boreal forest trees have needle-shaped leaves and a cone shape. Explain how one of these traits is an adaptation to the climate.

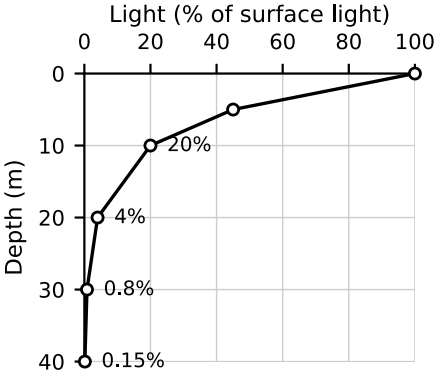
Part 3. Aquatic Ecosystems

5. The graph shows how much surface light reaches different depths in a clear lake (sample data). Assume producers here need at least 1% of surface light for photosynthesis.

(a) About how deep is the photic zone? Explain using the data.

(b) A water plant is rooted at 8 m and another at 35 m. Which can grow? Explain.

(c) Explain why the deep water of this lake depends on food that is made near the surface.



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6. (a) Students measure salinity at four stations from a river out to the sea (sample data). Classify each station as fresh water, estuary, or ocean.

Station	Salinity (ppt)	Type of water
1	0.2	
2	6	
3	19	
4	35	

(b) At a coastal station, surface nitrate was 0.5 units in a calm week and 12 units during a week of strong winds blowing away from shore (sample data). How many times greater was it in the windy week? Explain the cause and its effect on phytoplankton.

Part 4. Competition and Niche Partitioning

7. Two meadow grasses are grown in pots, alone or together. The table shows the mass of one plant after 8 weeks (sample data).

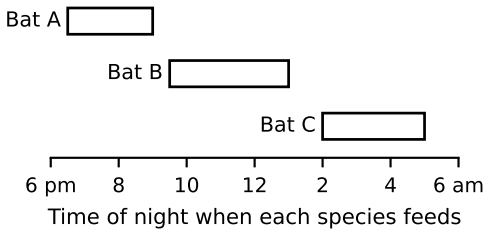
	Grown alone (g)	Grown together (g)	Percent change
Grass X	12.0	9.0	
Grass Y	10.0	2.0	

(a) Complete the table.

(b) Which grass is the stronger competitor? Is the competition between the two grasses intraspecific or interspecific? Use the data to explain.

8. Three bat species hunt over the same field. The model shows when each one feeds, and the table shows its main food (sample data).

Species	Main food
Bat A	Small moths
Bat B	Beetles
Bat C	Small moths



(a) Which two species eat the same food? How does the model show that they partition this resource?

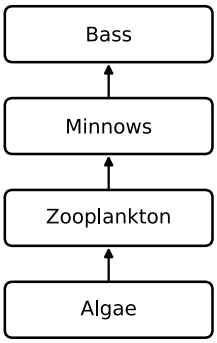
(b) Two bats of species A fight over one roost. Two bats, one of species A and one of species C, chase the same moth. Classify each kind of competition.

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Part 5. Predators, Prey, and Keystone Species

9. Scientists compare lakes with and without bass, a fish that eats minnows (sample data).

Measurement	With bass	Without bass
Minnows per net	12	85
Zooplankton per L	40	9
Algae (µg chlorophyll per L)	3	18
Water clarity (m)	4.0	1.2



(a) Find the percent change in zooplankton from the lakes with bass to the lakes without bass.

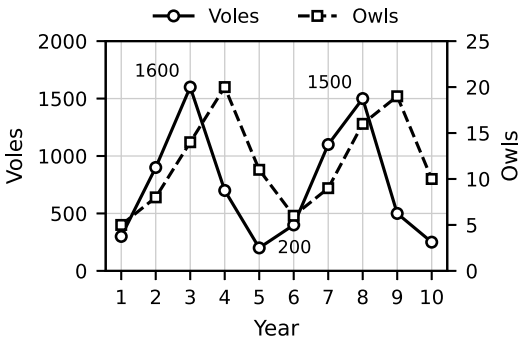
(b) Use the food chain to explain why the water is cloudier without bass. What is this kind of chain of effects called?

10. The graph shows a vole population and the owls that eat them (sample data).

(a) In which years did each population peak? How many years after the voles did the owls peak?

(b) Find the percent change in voles from year 3 to year 5.

(c) Explain why the owl peaks come after the vole peaks.



Part 6. Symbiosis

11. (a) Classify each relationship as mutualism, commensalism, or parasitism.

Relationship	Type
(1) Clownfish hide in a sea anemone and chase away fish that eat the anemone.	
(2) Mistletoe grows into a tree branch and takes water and nutrients.	
(3) Egrets eat insects stirred up by grazing cattle; the cattle are not clearly helped or harmed.	

(b) Rhizobia are bacteria that live in bean root nodules. Bean plants were grown with and without rhizobia (sample data): in low-nitrogen soil, 1.8 g without and 3.6 g with; in high-nitrogen soil, 4.0 g without and 3.7 g with. Find the percent change for each soil. Is the relationship the same in both soils? Explain.

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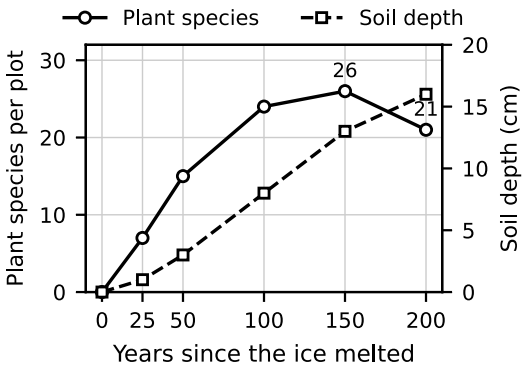
Part 7. Ecological Succession

12. A glacier melted back, leaving bare rock. The graph shows sample data for plots of different ages.

(a) Is this primary or secondary succession? Use the soil data to explain.

(b) Find the percent change in plant species from year 150 to year 200.

(c) The first organisms on the rock were lichens and mosses. What are these called, and how do they help the species that come later?



13. After a forest fire, plant cover reached 50% in 6 years. On a new lava flow nearby, it took 120 years (sample data).

(a) How many times longer did the lava flow take? Explain the difference.

(b) A student says the burned forest will return to exactly the same community it had before the fire. Use the current view of succession to respond.

Part 8. Human Impacts on Biodiversity

14. (a) Name the main threat to biodiversity in each case.

Case	Threat
(1) Zebra mussels from Europe arrive in a lake on boat hulls and spread.	
(2) As summers warm, a mountain wildflower is found only at higher elevations.	
(3) Elephants are killed for ivory faster than the population can replace them.	
(4) Pesticide runoff kills insects in a stream.	

(b) Threats often act together. Explain how one pair of these threats could make a population decline faster than either one alone.

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15. Before zebra mussels arrived, a lake had 40 native mussels per m^2. Ten years later it had 6 native mussels and about 3,000 zebra mussels per m^2 (sample data).

(a) Find the percent change in native mussels.

(b) Write a claim about the cause of the decline, with evidence and reasoning. What other evidence would make the claim stronger?

Part 9. Conservation and Restoration

16. Salamanders cross a road each spring to reach a breeding pond, and 600 were killed per year. A town adds tunnels under the road and low fences that guide animals to them. Deaths fall by 72% (sample data).

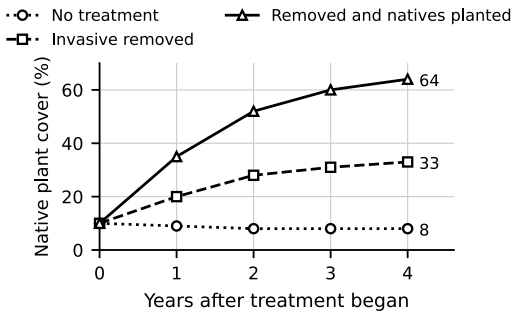
(a) About how many salamanders are now killed per year?

(b) The fences also block turtles that cannot find the tunnels. Name two things to consider when evaluating this solution, and describe how the town could test and improve it.

17. A grassland is invaded by a non-native plant. Scientists try two treatments and keep untreated plots for comparison (sample data).

(a) After 4 years, how many percentage points higher was native cover in the "removed and natives planted" plots than in the "invasive removed" plots?

(b) Which treatment worked best? Use claim, evidence, and reasoning. Why are the untreated plots needed?



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