

Resource, Condition or Competitor? Sorting the Words of a Pond

Learning target: I can tell resources apart from conditions, sort resources as living or nonliving, and use the terms population, competition, limiting resource, carrying capacity, ecosystem and biosphere correctly in new situations.

Vocabulary in action

About 30 min

Individual

MS-LS2-1 · supports

MS-LS2-2 · supports

independent practice

writing

Standards connections

MS-LS2-1 (supports): Students cannot analyze data on resource availability until they can say precisely what a resource is and how a limiting resource differs from a carrying capacity. This sheet builds that language; it does not itself produce evidence toward the PE.

MS-LS2-2 (supports): Competition is one of the interaction patterns this PE asks students to predict across ecosystems. Here students only learn to recognize and name it.

Purpose: build · **Time:** about 30 minutes · **Format:** individual

Answers with reasoning

resource

Any material, energy or space a living thing takes in or uses in order to stay alive, grow and reproduce. Food, water, oxygen, light, soil nutrients and nesting space are all resources.

biotic resource

A resource that is, or comes from, a living thing: the grass a deer eats, the insects a frog eats, the dead leaves a snail scrapes up.

abiotic resource

A resource that is not alive: water, oxygen, carbon dioxide, sunlight, minerals in the soil, a space to nest.

condition

A feature of the environment that affects organisms but is not used up by them, such as temperature, how fast water flows, or how acidic the water is. Conditions decide where an organism can live, but they are not resources.

limiting resource

The resource that runs short first. When a population grows until there is not enough of one resource to go around, that resource sets the limit on how large the population can get.

carrying capacity

The largest number of members of one species that an area's resources can keep supporting over time. It changes when the supply of the limiting resource changes.

competition

An interaction in which two or more organisms need the same limited resource, so whatever one takes leaves less for the others. It happens within a species and between species.

organism

One individual living thing: a single heron, a single snail, a single cattail plant.

species

A group of similar organisms whose members can breed with one another and produce offspring that can also reproduce.

population

All the members of one species that live in the same area at the same time, such as all the bullfrogs in one pond.

ecosystem

All the populations in an area together with the nonliving things (water, soil, air, light) that they depend on and interact with.

biome

A very large region of Earth, on land or in water, with a particular set of conditions and resources and the kinds of living things those support, such as a tropical rainforest or a temperate grassland.

biosphere

Every part of Earth where life exists, from the deep ocean floor to the air above the highest peaks: all of Earth's ecosystems together.

Part A: Sort the pond

Twelve things from a farm pond are listed in the table. Decide whether each one is a **biotic resource**, an **abiotic resource**, or a **condition** (not a resource). Write a check mark in one column for each row. Then, in the last column, write the name of one pond organism that uses it (for resources) or is affected by it (for conditions).

1. Sort each item and name one organism that uses it or is affected by it.

Answer: Sunlight: abiotic resource (water plants, algae). Water temperature: condition (fish, frogs). Algae scraped by snails: biotic resource (snails). Dissolved oxygen: abiotic resource (fish, insect larvae). Nitrogen compounds in mud: abiotic resource (water plants, algae). Mosquito larvae: biotic resource (minnows). pH: condition (every organism; snails and amphibians are sensitive). Bank space for egg masses: abiotic resource (frogs). Minnows caught by a heron: biotic resource (heron). Dead leaves: biotic resource (shredder insects). Carbon dioxide: abiotic resource (water plants). Flow speed: condition (insect larvae, plants).

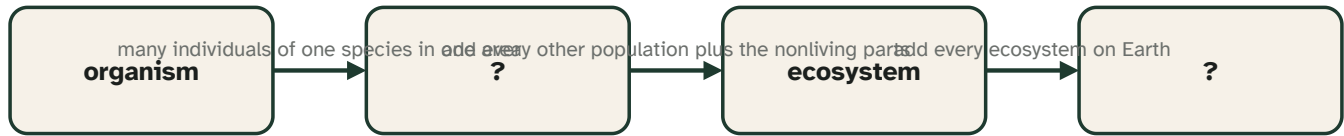
Why: Resources are taken in or occupied; conditions are experienced. Space is a resource because it can be filled. Dead leaves came from living plants, so they are biotic even though the leaves are dead; accept abiotic for dead leaves only if the student argues that the material is no longer alive, and then point out that the convention counts material of living origin as biotic.

Also acceptable: Any pond organism that plausibly uses the resource is acceptable in the last column.

- Temperature, pH and flow speed marked as conditions
- The nine resources marked as resources
- Living-origin resources marked biotic
- A sensible organism named for each row

Part B: Fill the levels

Levels of organization, smallest to largest (two levels are missing)



Each arrow says what gets added to move up a level.

- 2a. The second level (between organism and ecosystem) is called a _____. Write the word and then define it in one sentence using the pond.

Answer: Population. Example definition: all the bullfrogs that live and breed in this one pond make up the pond's bullfrog population.

Why: The arrow label 'many individuals of one species in one area' is the definition of a population.

Also acceptable: Any one-sentence definition that includes one species, one area.

- 2b. The largest level is called the _____. Write the word and then give one reason it must include the air above the pond.

Answer: Biosphere. The air above the pond must be included because organisms live in it and use it: dragonflies and herons fly through it, every organism takes oxygen from it, and plants take carbon dioxide from it.

Why: The biosphere is every place life exists, and the air is both a living space and a source of resources.

Also acceptable: Accept 'birds and insects live in the air' or 'the air holds the oxygen and carbon dioxide the pond organisms use.'

3. Many scientists add a level called a **community** between population and ecosystem. Using the definitions in the word list, what must a community include that a population does not, and what must an ecosystem include that a community does not?

Answer: A community includes all the different populations in the area (frogs, snails, minnows, cattails), while a population is only one species. An ecosystem adds the nonliving parts (water, mud, air, sunlight) that the community depends on; a community is only the living part.

Why: This repairs the textbook's four-level ladder, which skips the community level that most biology references include.

Also acceptable: A student who says 'a community is the living half of an ecosystem' has the idea.

- Community = many populations (all species), living only
- Ecosystem = community plus nonliving parts

Part C: Which word fits?

4. Write the one vocabulary word that best names each description. Each word is used at most once.

Answer: 1 population; 2 competition; 3 limiting resource; 4 carrying capacity; 5 organism; 6 biosphere; 7 ecosystem; 8 biome.

Why: Row 3 describes a resource that ran short and stopped growth, which is a limiting resource (phosphorus). Row 4 is a number of individuals supported over time, the carrying capacity. Row 8 describes a tundra-like region, a biome.

Also acceptable: For row 3 accept 'abiotic resource' only with a note; the intended answer is limiting resource because the description says growth stopped when it ran out.

Part D: Use the words in a new place

5. Snails and tadpoles in the pond both scrape algae off rocks. Name the interaction between them, name the resource, and explain whether this is competition **within** a species or **between** species.

Answer: The interaction is competition; the resource is the algae on the rocks (a biotic resource). Because snails and tadpoles are different species, it is competition between species.

Why: Both organisms need the same limited resource, which is the definition of competition; the species distinction decides 'within' versus 'between.'

Also acceptable: A student who adds that two tadpoles scraping the same rock would be competition within a species has gone further.

- Names competition
- Names algae as the resource
- Says between species

6. A kelp forest off the California coast has kelp (a large seaweed), sea urchins that eat kelp, sea otters that eat urchins, sunlight, and nutrients in the seawater. Write three sentences about the kelp forest. Each sentence must use **two** vocabulary words correctly. Underline the vocabulary words.

Answer: Sample sentences: 'The sea urchin population and the sea otter population both belong to the same kelp forest ecosystem.' 'Kelp needs sunlight, an abiotic resource, and when urchins eat too much kelp, the kelp becomes a limiting resource for the urchins.' 'When otters are removed, urchin numbers can rise past the carrying capacity the kelp can support, and competition among urchins for the last kelp becomes intense.'

Why: Each sentence must use two listed terms in a way that matches the definitions. Check that 'population' is attached to one species and that 'competition' involves a shared limited resource.

Also acceptable: Terms may repeat across sentences as long as each sentence has two. A sentence using 'organism' for a single otter and 'biotic resource' for the urchins it eats is correct.

- Three sentences
- Two vocabulary words per sentence, underlined
- Each word used accurately for the kelp forest

7. Explain the difference between a **limiting resource** and a **carrying capacity** using the pond's bullfrogs. Your answer must say which one is a thing and which one is a number.

Answer: A limiting resource is a thing: the specific resource that runs out first for the bullfrogs, for example the insects they eat or the bank space for egg masses. Carrying capacity is a number: the largest bullfrog population the pond's resources can keep supporting. The limiting resource sets the carrying capacity; if more insects are available, the carrying capacity goes up.

Why: Students often treat the two terms as synonyms. The thing-versus-number contrast and the 'sets' relationship are the targets.

Also acceptable: Accept any plausible pond resource as the example.

- Limiting resource identified as a specific resource (a thing)
- Carrying capacity identified as a number of individuals
- States that the limiting resource determines the carrying capacity

8. Bullfrogs live in thousands of ponds across North America. Explain why 'the bullfrogs in Miller's pond' is a population but 'bullfrogs' by itself is a species, not a population.

Answer: A population is all the members of one species in one area. 'The bullfrogs in Miller's pond' names one species in one place, so it is a population. 'Bullfrogs' alone names the whole species everywhere; it includes thousands of separate populations in different ponds that rarely meet, so it is a species, not a population.

Why: The distinction is the 'one area' part of the definition.

Also acceptable: Accept 'a species can be split into many populations.'

- Population requires one area
- Species spans many areas or populations

Teacher notes

Two accuracy points to hold firm on. First, temperature is a condition, not a resource: the textbook calls a biome's temperature range a 'limited resource,' but organisms do not use temperature up. Rainfall is different: it delivers water, which is a resource. Second, the species definition here says 'offspring that can also reproduce' because some different species can produce infertile hybrids; keep the definition at that level and do not test exceptions. The community level (q3) is standard in biology even though the textbook ladder omits it; students may use either the four-level or five-level ladder later as long as they order it correctly. In q1 the most common disagreements are dead leaves (biotic, because of living origin) and bank space (a resource, because it can be filled up).

Scaffold offered to students: The 'used up?' test and a word bank

For Part A ask two questions in order. (1) Can organisms use it up, so that there is less for others? If no, it is a condition. If yes, it is a resource. (2) Is it alive, or did it come from something alive? If yes, biotic; if no, abiotic. For Part C, the eight words you need are: organism, population, ecosystem, biome, biosphere, competition, limiting resource, carrying capacity. Cross each one out as you use it.

Extension: Your own resources and conditions

Make the same three-column sort for a human being living in a desert city: list at least four biotic resources, four abiotic resources, and three conditions. Then decide which single resource would most likely become the limiting resource for the city's population if the city kept growing, and write a paragraph defending your choice. Finish by explaining how the city's carrying capacity could rise without the resource itself increasing (for example, by using it more efficiently).