2024

AP® Biology

Sample Student Responses and Scoring Commentary

Inside:

Free-Response Question 4

- ☑ **Scoring Guidelines**
- ☑ **Student Samples**
- ☑ **Scoring Commentary**

Question 4: Conceptual Analysis — 4 points

The common wild oat is native to regions of Europe and Asia but is an invasive species in central California grasslands. In California, the common wild oat has almost completely replaced some species of native bunchgrass. Researchers found that aphids, a type of small insect that often carries plant viruses, have a much higher reproductive rate in grasslands that include the common wild oat than in grasslands composed of only native bunchgrass species. Additionally, the viruses carried by the aphids appear to affect only the native bunchgrasses and not the common wild oat. Native bunchgrasses infected by the virus have much higher death rates than do native bunchgrasses that are not infected.

(a)	**Describe** the change in the resilience of an ecosystem when there is a decrease in the number of species. • (The resilience of the ecosystem) will decrease.	**1 point**
(b)	**Explain** how the addition of the common wild oat affects the number of native bunchgrass plants that can be supported by the California grasslands ecosystem. Accept one of the following: • (The addition of the wild oat) limits the resources available (to the native plants), resulting in a decrease (in the population size). • (The addition of the wild oat) <u>enables the aphid population to increase</u>/<u>increases the exposure to viruses</u>, resulting in a decrease (in the population size of the native bunchgrass).	**1 point**
(c)	Researchers suggest adding ladybugs, predators of aphids, to the California grasslands. **Predict** the effect of adding ladybugs on the abundance of the native bunchgrass population. • (The native bunchgrass population) will increase (in abundance).	**1 point**
(d)	**Justify** your prediction in part (c). • (Adding ladybugs) will decrease the number of aphids, which will cause a decrease in the <u>transmission of</u>/<u>infection by</u> plant viruses.	**1 point**
	Total for question 4	**4 points**

BEGIN Question 4

Begin your response to **QUESTION 4** on this page. Do not skip lines.

A). The ecosystem will have less biodiversity which would lower the resilliance and sustainability of an ecosystem.

B). The number of native bunchgrass plants ~~with decrease~~ that can be supported would decrease due to the wildoat population out-competing them for resources.

C). The abundance of the native bunchgrass population would increase.

D). due to less aphids due to them being consumed by the ladybugs which would result in less native bunchgrass dying due to less transmittance of plant virus by Aphids.

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BEGIN Question 4

Begin your response to **QUESTION 4** on this page. Do not skip lines.

a) When there is a decrease in the number of species, the resilience of an ecosystem decreases.

b) The common wild oat decreases the number of native bunchgrass plants that can be supported by the California grasslands ecosystem.

c) Adding ladybugs will increase the abundance of the native bunchgrass population

d) Adding ladybugs will decrease the number of aphids in the ecosystem since they prey on aphids. Since aphids carry virues that affect the native bunchgrasses, ~~the~~ the decrease in the native aphid population will decrease the number of native bunchgrasses infected, causing the native bunchgrass population to increase.

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BEGIN Question 4

Begin your response to **QUESTION 4** on this page. Do not skip lines.

A) The ecosystem becomes less resilient when there is a decrease in number of species. This is because there is less genetic diversity and more likelyhood that one catastrophic event can wipe out the whole ecosystem, rather than if there were more species, therefore increasing the chance that some species have a trait that could survive a catastrophic event.

B) When common wild oat is added, the number of native bunchgrass plants that can be supported by the California grasslands ecosystem increases. This is because when there is more common wild oat, the aphids, who reproduce better in the common wild oat, will leave the bunchgrass for the common wild oat. When the aphids leave the bunchgrass, so does the viruses increasing the number of surviving plants.

C) Adding lady bugs would increase the

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Additional page for answering Question 4

Continue your response to **QUESTION 4** on this page. Do not skip lines.

abundance of the native bunchgrass population. The ladybugs kill the alphids who are harming the bunchgrass, increasing the abundance of the bunchgrass.

D) The ladybugs kill the alphids who harm the native grass, increasing the abundance of the bunchgrass.

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Question 4

Note: Student samples are quoted verbatim and may contain spelling and grammatical errors.

Overview

Question 4 presented a report about the effects of an invasive species, the common wild oat, on a grassland community in central California. The stimulus of the question explained that aphids, which often carry plant viruses, have higher reproductive rates in grasslands invaded by the common wild oat than in grasslands with only native bunchgrass species and that the viruses appear to negatively affect native bunchgrasses but not affect the invasive species of plant.

Responses to part (a) were expected to describe "the change in resilience of an ecosystem when there is a decrease in the number of species" (Skill 1.A; LO SYI-3.F).

Responses to part (b) were expected to explain "how the addition of the common wild oat" affects the carrying capacity of the ecosystem (Skill 1.C; LOs SYI-1.H and SYI-2.A).

Part (c) described a suggested addition of ladybugs, predators of aphids, to the ecosystem. Responses were expected to predict that the effect of this disruption would be the increased abundance of the native bunchgrass population (Skill 6.E; LOs SYI-1.H and ENE-4-B).

Responses to part (d) were expected to justify the prediction in part (c) by reasoning that ladybug predation on aphids would decrease the abundance of aphids, which would decrease virus transmission to the plants (Skill 6.C; LO SYI-1.H).

Sample: 4A
Score: 4

The response earned 1 point in part (a) for describing "the ecosystem will have less biodiversity...would lower the resilliance." The response earned 1 point in part (b) for explaining that the addition of the wild oat caused a decrease in the number of native bunchgrass plants "due to the wildoat population out-competing them for resources." The response earned 1 point in part (c) for predicting an increase in the abundance of the native bunchgrass population. The response earned 1 point in part (d) for justifying the increase in the native bunchgrass population "due to less aphids" causing "less transmittance of plant virus by Aphids."

Sample: 4B
Score: 3

The response earned 1 point in part (a) for describing a decrease in the resilience of the ecosystem. The response did not earn a point in part (b) because it does not explain how the addition of the common wild oat limits available resources, enables an increase in the aphid population, or increases exposure to the viruses. The response earned 1 point in part (c) for predicting an increase in the abundance of the native bunchgrass population. The response earned 1 point in part (d) for justifying a decrease in the number of aphids "will decrease the number of native bunchgrasses infected."

Question 4 (continued)

Sample: 4C
Score: 2

The response earned 1 point in part (a) for describing that "The ecosystem becomes less resilient." The response did not earn a point in part (b) because it explains that the native bunchgrass population will increase. The response earned 1 point in part (c) for predicting an increase in the abundance of the native bunchgrass population. The response did not earn a point in part (d) because it does not justify the prediction by including a decrease in both the aphid population and the transmission of or infection by plant viruses.