
AP[®] Environmental Science

Sample Student Responses and Scoring Commentary Set 2

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Free-Response Question 2

- Scoring Guidelines**
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Question 2: Analyze an Environmental Problem and Propose a Solution**10 points**

(a) (i) Based on the data in the graph, **identify** the habitat type with the greatest number of lizards. **1 point**

- Clearings, Gardens

(ii) Based on the data in the graph, **describe** the relationship between the lizard numbers observed on islands with and without mongoose populations. **1 point**

Accept one of the following:

- Lizard populations are smaller on islands where mongooses are present than on mongoose-free islands.
- Lizard populations are larger on mongoose-free islands than on islands where mongooses are present.
- The relationship between lizard number counted and mongoose population is an inverse relationship.

Total for part (a) 2 points

(b) Based on the theory of island biogeography, **describe** the characteristics of an island with the greatest species diversity. **1 point**

- A large island that is located near the mainland will contain the greatest species diversity.

Total for part (b) 1 point

(c) (i) **Describe** one environmental problem caused by invasive animal species. **1 point**

Accept one of the following:

- Invasive species outcompete native species for resources, causing food web disruptions/trophic cascades/habitat loss.
- Invasive species outcompete/prey on native organisms, decreasing biodiversity/reducing population size of native species.

(ii) Invasive species are often pests. **Make a claim** that proposes one way to control pest species. **1 point**

Accept one of the following:

- Introduce biological controls, like natural predators of the species, to reduce the number of pests.
- Use chemical controls, such as pesticides, to kill off pests.
- Use manual/mechanical methods to remove plant species.
- Trap/hunt animal species and kill/remove them from the area.

(iii) Justify the solution proposed in (c)(ii) by providing an additional benefit of the solution. **1 point**

Accept one of the following:

Solution proposed in (c)(ii)	Justification of solution with additional benefit
Introduce biological controls like natural predators of the species to reduce the number of pests	<ul style="list-style-type: none"> Method least likely to harm other species because the pest species can be specifically targeted Harmful synthetic chemicals are not introduced into the environment
Use chemical controls, such as pesticides, to kill off pests	<ul style="list-style-type: none"> Quick/efficient method to reduce/eliminate pest species
Use manual/mechanical methods to remove plant species	<ul style="list-style-type: none"> Method least likely to harm other species because the pest species can be specifically targeted Harmful synthetic chemicals are not introduced into the environment Financial gain from selling killed pest organisms
Trap/hunt animal species and kill/remove them from the area	<ul style="list-style-type: none"> Method least likely to harm other species because the pest species can be specifically targeted Harmful synthetic chemicals are not introduced into the environment Financial gain from selling killed pest organisms

Total for part (c) 3 points

(d) (i) Identify a provisioning ecosystem service provided by primary forests. **1 point**

Accept one of the following:

- Timber/lumber/wood
- Medicine
- Food

-
- (ii) Based on the data in the graph, **explain** how replacing primary forests with sugarcane fields may have affected the number of lizards counted on the mongoose-free Pacific islands. **1 point**

Accept one of the following:

- The cleared land is preferred habitat for the lizards, which led to increased numbers of lizards in the sugar cane fields compared to the forests.
- The cleared land has fewer predators, which led to increased numbers of lizards counted in the sugar cane fields compared to the forests.
- The cleared land has more food for the lizards, which led to increased numbers of lizards in the sugar cane fields compared to the forests.

-
- (iii) The long-term use of monocultures in commercial sugarcane farming is one cause of the ecological damage. **Describe** one problem associated with monocultures. **1 point**

Accept one of the following:

- Decreased genetic diversity of monoculture species
- Decreased species diversity
- Increased susceptibility of monoculture to disease/pests
- Depletion of nutrients from soil
- Increased use of irrigation water/fertilizer/pesticide

Total for part (d) 3 points

-
- (e) **Describe** an advantage of crop rotation using legumes on soil fertility. **1 point**

Accept one of the following:

- Improved nitrogen fixation in the soil
- Less nitrogen-based fertilizers required

Total for part (e) 1 point

Total for question 2 10 points

Important: Completely fill in the circle that corresponds to the question you are answering on this page.

Question 1

Question 2

Question 3



Begin your response to each question at the top of a new page. Do not skip lines.

2(a)(i) The habitat type with the greatest number of lizards are clearings, gardens.

(ii) The relationship between the lizards numbers ~~and~~ on islands with and without mongoose populations is that the lizard ~~populations~~ ^{numbers} tend to be greater on islands without mongoose populations and ~~and~~ ^{lizard numbers} tend to be less on islands with a mongoose population.

~~(b)~~ (b) Based on the theory of island biogeography the island with the greatest species diversity is an island closer to mainland and larger in size. An island closer to mainland is more easily accessible to different kinds of species and the larger it is in size the ~~more~~ ^{greater} variety of species that it can host.

(c)(i) One environmental problem caused by invasive animal species is that they can outcompete native species leading to extinction. An invasive animal species may prey on the same food source that a specialist native species relies on, if the invasive species is able to outcompete the native species this may cause the extinction of the native species due to lack of resources.

(ii) One way to control a pest species is through integrated pest management (IPM). Integrated pest management is used typically to control pests through methods like introducing a predator to the pest, since the predator consumes the pest the population of the pest reduces thereby controlling the pest species.

Important: Completely fill in the circle that corresponds to the question you are answering on this page.

Question 1

Question 2

Question 3



Begin your response to each question at the top of a new page. Do not skip lines.

(iii) An additional benefit of the ~~soil~~ ^{Integrated Pest} management is improving soil

(d)(i) A provisioning ecosystem service provided by primary forests is wood.

(ii) Replacing the primary forests with sugarcane fields may have ~~affected~~ ^{increased} the number of lizards counted on the mongoose-free Pacific Islands. The primary forests were likely not an ideal habitat type for the lizards and replacing them with sugarcane fields may have been more ideal habitat so the lizard population was able to increase.

(iii) One problem associated with monoculture ~~is pests.~~ ^{pests cause migration} ~~is that crops need to be fertilized with different materials in order to grow.~~ ~~is that crops need to be fertilized with different materials in order to grow.~~ Since practicing monoculture ~~reduces species diversity~~ it makes crops more prone to pests because they tend to depend on one species making the pests more prevalent in a monoculture.

(e) An advantage of crop rotation using legumes on soil fertility is that it creates more organic material. The organic material produced by different crops helps soil fertility because it is more nutrient rich as it contains different types of crops

Important: Completely fill in the circle that corresponds to the question you are answering on this page.

Question 1

Question 2

Question 3



Begin your response to each question at the top of a new page. Do not skip lines.

- a) i) Clearings and gardens were the habitats with the most lizards, counted.
- ii) When mongoose are present, the lizard populations still fluctuate based on habitat but are overall reduced compared to islands without the mongoose.
- b) A large island, close to the mainland with ample precipitation and rich soil will have the highest species diversity.
- c) i) An invasive animal species may fill the same niche as a native species, compete with it, and replace the native species throwing the ~~native~~ relationships the native species had out of balance, causing small scale ecosystem shear.
- ii) To control an invasive pest species, pesticides could be used to reduce their population.
- iii) An additional benefit to the use of pesticides is the reduction of other pest species as well.
- d) i) Primary forests provide natural erosion protection, with their roots holding the soil in place.
- ii) By replacing the lizard's natural primary forest habitats with sugarcane fields it reduces their population by removing their protective cover of the forest as well as their natural reproductive locations.
- iii) Monocultures attract vast populations of ^{one species of} ~~specific~~ pests, which desimates natural insect diversity.
- e) Crop rotation, of legumes, would more evenly utilize the soil's nutrients as the variety of legumes would each ^{need} ~~use~~ the nutrients in ~~of~~

Page 4

Use a pen with black or dark blue ink only. Do NOT write your name. Do NOT write outside the box.

● **Important:** Completely fill in the circle that corresponds to the question you are answering on this page.

Question 1

Question 2

Question 3



Begin your response to each question at the top of a new page. Do not skip lines.

c continued.) slightly differing concentrations,

Important: Completely fill in the circle that corresponds to the question you are answering on this page.

Question 1



Question 2



Question 3



Begin your response to each question at the top of a new page. Do not skip lines.

a)

i) clearings, gardens

ii) As the number of mongoose populations rise, lizard populations increase as well. When mongoose ~~are~~ are not present, lizard populations decline.

b) Mongoose-present islands have the greatest species diversity. This means, there is more of a variety of species and there is balance in the ecosystem.

c) i) Invasive species are harmful to the ecosystem and can decline a species population which puts the food chain off balance.

ii) Pesticides help control invasive species ~~from~~ ^{and keeps} ~~the~~ ^{animal} food chain in check.

iii) When the food chain has balance, then the ecosystem's biodiversity will flourish.

d)

i) timber

ii) the lizard population would decrease

iii) Monocultures ~~lessen~~ ^{plant} the amount of biodiversity.

e) Crop rotation helps decrease the amount of soil erosion and with legumes, the soil fertility will increase.

Question 2

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

Overview

This question focused on the broad categories of competitive relationships, biodiversity, and agricultural practices. In part (a) students were asked to analyze graphical data to identify and describe patterns in interspecies relationships [Practice 5 Data Analysis and Topic 1.1 Introduction to Ecosystems].

In part (b) the prompt specifically asked for a species diversity description using the theory of biogeography [Topic 2.3 Island Biogeography, Topic 2.1 Introduction to Biodiversity].

Part (c) focused on the impact of invasive animal species and asked students to propose a solution to control pest species [Practice 7 Environmental Solutions and Topic 2.1 Introduction to Biodiversity, Topic 3.5 Population Growth and Resource Availability, Topic 9.8 Invasive Species, Topic 5.6 Pest Control Methods, and Topic 5.14 Integrated Pest Management].

In parts (d) and (e) students were asked to identify a forest provisioning ecosystem service [Practice 1 Concept Explanation and Topic 2.2 Ecosystem Services]. The next focus was on anthropogenic habitat disruption (conversion to agriculture), the impact of this disruption on species, and conservation-minded agricultural practices [Topic 2.1 Introduction to Biodiversity, Topic 4.3 Soil Composition and Properties, Topic 5.4 Impacts of Agricultural Practices, Topic 5.15 Sustainable Agricultural, and Topic 1.5 The Nitrogen Cycle].

Sample: 2A

Score: 8

One point was earned in part (a)(i) for identifying “clearings, gardens” as the habitat type with the greatest number of lizards. One point was earned in part (a)(ii) for describing the relationship as “the lizard numbers tend to be greater on islands without mongoose populations.” One point was earned in part (b) for describing, “Based on the theory of island biogeography the island with the greatest species diversity is an island closer to mainland and larger in size.” One point was earned in part (c)(i) for describing “invasive animal species ... can outcompete native species leading to extinction.” One point was earned in part (c)(ii) for making the claim “introducing a predator to the pest, since the predator consumes the pest the population of the pest reduces” as one way to control pest species. No point was earned in part (c)(iii). One point was earned in part (d)(i) for identifying “wood” as a provisioning ecosystem service provided by primary forests. One point was earned in part (d)(ii) for explaining, “Replacing the primary forests with sugarcane fields may have increased the number of lizards counted ... sugarcane fields may have been more ideal habitat so the lizard population was able to increase.” One point was earned in part (d)(iii) for describing “one problem associated with monoculture is ... it makes crops more prone to pests.” No point was earned in part (e).

Question 2 (continued)

Sample: 2B

Score: 5

One point was earned in part (a)(i) for identifying “Clearings and gardens” as the habitat type with the greatest number of lizards. One point was earned in part (a)(ii) for describing the relationship as “When mongoose are present, the lizard populations ... are overall reduced.” One point was earned in part (b) for describing “A large island, close to the mainland” as the characteristics of an island with the greatest species diversity, based on the theory of island biogeography. No point was earned in part (c)(i). The response does not describe the environmental problem caused by invasive animal species. One point was earned in part (c)(ii) for making the claim that “pesticides could be used to reduce their population” of an invasive pest species. No point was earned in part (c)(iii). No point was earned in part (d)(i). No point was earned in part (d)(ii). One point was earned in part (d)(iii) for describing, “Monocultures ... desimates natural insect diversity.” No point was earned in part (e).

Sample: 2C

Score: 3

One point was earned in part (a)(i) for identifying “clearings, gardens” as the habitat type with the greatest number of lizards. No point was earned in part (a)(ii). No point was earned in part (b). No point was earned in part (c)(i). No point was earned in part (c)(ii). The response makes a claim that does not include the impact on the pest species. No point was earned in part (c)(iii). One point was earned in part (d)(i) for identifying “timber” as a provisioning ecosystem service provided by primary forests. No point was earned in part (d)(ii). One point was earned in part (d)(iii) for describing, “Monocultures lessen the amount of plant biodiversity.” No point was earned in part (e).