
AP[®] Environmental Science

Sample Student Responses and Scoring Commentary

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AP[®] ENVIRONMENTAL SCIENCE

2019 SCORING GUIDELINES

Question 1

(a) Use the maps provided to answer the following questions.

(i) **Identify** the preferred nesting habitat for piping plovers.

(1 point for the correct identification of a preferred nesting habitat for piping plovers)

- Unvegetated sand
- Sandy areas/open sandy beaches
- Washovers

(ii) **Describe** the change in the number of piping plover nests in Assateague Island between 1999 and 2009.

(1 point for the correct description of the change in the number of piping plover nests)

- The number of nests decreased by almost half (43%).
- The number of nests decreased from 44 to 25.
- There were 19 more nests in 1999 than in 2009.

(iii) **Describe** one likely reason for the change in the number of piping plover nests between 1999 and 2009.

(1 point for the correct description of a likely reason for the change in the number of piping plover nests)

- The preferred habitat was reduced because of a decrease in unvegetated sandy areas.
- The preferred habitat was reduced because of an increase in the amount of vegetation/revegetation.

(b) Coastal species are affected by more than just natural events.

(i) Special beach restrictions can help piping plovers during nesting season. **Describe** one restriction that could reasonably be implemented to help prevent the destruction of plover nests by human actions.

(1 point for the correct description of a restriction that could reasonably be implemented to help prevent the destruction of plover nests by human activity)

- Post warning signs/fencing/barrier tape/boardwalks around the nesting area.
- Place wire enclosures/other barriers over active nests.
- Limit specified recreational activity on beaches with plover nests (prohibit kite flying, fireworks, etc.).
- Implement motor vehicle restrictions (limit times, size of vehicles, raking, etc.).
- Require pets to remain indoors or on leashes.

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Question 1 (continued)

- (ii) In addition to providing habitat for piping plovers, barrier islands (and closely related landforms) are important for other reasons. **Explain** one way that these features help to preserve and protect the environment in coastal regions.

(1 point for the correct explanation of one way that features of barrier islands help to preserve and protect the environment in coastal regions)

- They block/buffer the wind and/or waves, which mitigate beach erosion.
- They reduce storm surge, which protect the interior coastline from flooding.
- They block/buffer the waves and create wetland ecosystems/pools, which serve as habitat for a variety of species (fish, turtles, migratory birds, etc.).
- They trap sediments/pollutants in wetland habitats/marsh grasses, which filter the water.

- (iii) **Identify** one human action that directly threatens coastal habitats and **describe** one impact on species, other than the piping plover, that use the habitat.

(2 points; 1 point for the correct identification of a human action that directly threatens coastal habitats and 1 point for the correct description of the impact of human activity on species that use the habitat)

Identify one human action that directly threatens coastal habitats	Describe one impact on species that use the habitat
Tourism/Recreation	<ul style="list-style-type: none"> • Beachgoers accidentally step on or crush nests of species on the beach. • Unleashed pets on beaches may cause stress and/or disrupt nesting, survival, etc. of coastal species. • Vehicles on beach can disrupt nesting, survival, etc. of coastal species habitat. • Beachgoers leave food/garbage that attracts predators/harbors pathogens of coastal species. • Sunscreen washes off and can be toxic to coral or other coastal marine organisms.
Coastal Development	<ul style="list-style-type: none"> • Development (commercial, residential, recreational) can lead to the loss of suitable habitats of coastal species. • Development near beach may increase noise pollution or light pollution, which disrupts nesting/migration/survival of coastal species. • Development near beach may provide food/garbage that attracts predators/harbors pathogens of coastal species.
Littering/Solid Waste Disposal	<ul style="list-style-type: none"> • Coastal species get tangled up in trash (plastic) on the beach or in coastal water. • Coastal species ingest trash, which fills or blocks respiratory/digestive tract.
Offshore Oil Drilling	<ul style="list-style-type: none"> • Spilled oil coats coastal marine organisms, impacting survival. • Spilled oil can be toxic if ingested by coastal marine species.
Commercial Fishing	<ul style="list-style-type: none"> • Dredging or trawling can destroy coral/habitat for bottom-dwelling organisms. • Overharvesting can dramatically decrease coastal populations of fish or shellfish. • Coastal species can unintentionally get trapped in fishing gear.

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Question 1 (continued)

(c) **Identify** one economic impact on coastal communities that has resulted from rising sea levels.

(1 point for the correct identification of one economic impact on coastal communities that has resulted from rising sea levels)

- Decrease of tourist revenue
- Decrease of property value
- Increase in damage to property, land, or infrastructure requiring repair or replacement
- Increase in insurance costs
- Loss of agricultural land or aquaculture operations resulting in financial loss
- Loss of fish nurseries in wetland areas leading to less revenue for commercial fisheries
- Increase in jobs in infrastructure/construction to repair damaged structures and properties
- Increase in costs associated with preventative measures (building sea walls, raising building, etc.)

(d) **Describe** TWO methods that may be used locally to protect coastal communities from rising sea levels.

(2 points; 1 point for each correct description and method that may be used locally to protect coastal communities from rising sea levels)

- Raise structures to reduce or prevent water damage.
- Move/build structures back from the beach (setbacks) to reduce or prevent water damage.
- Install pumps to reduce flooding.
- Build structures, such as sea walls, to protect area from wave action/storm surge/flooding/erosion.
- Plant vegetation along appropriate shoreline to decrease erosion.
- Replenish sand to address problems from erosion or to increase width of beach.
- Build jetties/groins to act as a barrier from waves.

- (a) Use the maps provided to answer the following questions.
- Identify** the preferred nesting habitat for piping plovers. *unvegetated sand*
 - Describe** the change in the number of piping plover nests on Assateague Island between 1999 and 2009.
 - Describe** one likely reason for the change in the number of piping plover nests between 1999 and 2009.
- (b) Coastal species are affected by more than just natural events.
- Special beach restrictions can help piping plovers during nesting season. **Describe** one restriction that could reasonably be implemented to help prevent the destruction of plover nests by human actions.
 - In addition to providing habitat for piping plovers, barrier islands (and closely related landforms) are important for other reasons. **Explain** one way that these features help to preserve and protect the environment in coastal regions.
 - Identify** one human action that directly threatens coastal habitats and **describe** one impact on species, other than the piping plover, that use the habitat.

Approximately 40% of the United States population resides in coastal areas, such as areas near Assateague Island, where sea level rise and shoreline erosion is occurring.

- (c) **Identify** one economic impact on coastal communities that has resulted from rising sea levels.
- (d) **Describe** TWO methods that may be used locally to protect coastal communities from rising sea levels.

a) i) Unvegetated sand is the preferred nesting habitat for piping plovers.
 ii) The number of piping plover nests has dramatically decreased (almost halved) between 1999 and 2009.
 iii) A reason for the decrease in plover nests could be that the amount of vegetated (sparsely & densely) sand has increased while the amount of unvegetated sand, where plovers make their nests, has decreased, possibly due to a decrease in washovers.

b) i) A beach restriction that would help plovers could be signs and ~~boards~~ caution tape put up around nesting grounds to keep beachgoers from trampling the nests.
 ii) Barrier islands catch the brunt of strong storms & hurricanes before they get to the coast, preventing coastal beach erosion and mangrove destruction, which helps preserve coastal ecosystems.

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 - Describe** the change in the number of piping plover nests on Assateague Island between 1999 and 2009.
 - Describe** one likely reason for the change in the number of piping plover nests between 1999 and 2009.
- (b) Coastal species are affected by more than just natural events.
- Special beach restrictions can help piping plovers during nesting season. **Describe** one restriction that could reasonably be implemented to help prevent the destruction of plover nests by human actions.
 - In addition to providing habitat for piping plovers, barrier islands (and closely related landforms) are important for other reasons. **Explain** one way that these features help to preserve and protect the environment in coastal regions.
 - Identify** one human action that directly threatens coastal habitats and **describe** one impact on species, other than the piping plover, that use the habitat.
- Approximately 40% of the United States population resides in coastal areas, such as areas near Assateague Island, where sea level rise and shoreline erosion is occurring.
- Identify** one economic impact on coastal communities that has resulted from rising sea levels.
 - Describe** TWO methods that may be used locally to protect coastal communities from rising sea levels.

i)
a) Piping plovers prefer to nest on open sandy beaches with unvegetated sand between sparsely vegetated sand dunes.

ii) Between 1999 and 2009, the number of piping plover nests on Assateague Island decreased.

iii) One reason for the decrease in piping plover nests is human activity disturbing and fragmenting piping plover habitats. Such activity can include tourism; a large mass of people on beaches during busy summer seasons can trample the sand where the birds live, displacing or killing them.

b) ⁱ⁾ ~~The~~ The destruction of plover nests can be avoided through creating sectioned off areas of the beach where piping plovers nest. Putting a fence or rope around a plover nesting area where humans cannot make contact with it can help to avoid human interference with the nest.

ADDITIONAL PAGE FOR ANSWERING QUESTION 1

ii) Barrier islands are critical in protecting the mainland from storms. Barrier islands ^{help to} block storm surge from adjacent mainland. As a result erosion of the coastline is less likely to occur, thus helping to preserve the habitats of wildlife native to the coastline.

iii) ~~Over~~ ^{commercial} fishing is a human action that devastates coastal habitats. Methods such as bottom trawling scrape the ocean floor in search of massive schools of fish. This action destroys large amounts of coral ^{reefs} that it damages and consequently destroys other habitats that the other ocean organisms have made of the coral.

see page 1.

c). An economic impact that coastal communities have had to face due to increased sea levels is the high cost of repairing and rebuilding homes and infrastructure as a result of coastal flooding.

d). one method to protect ^{coastal} communities from rising sea levels is to erect walls between the coastline and ~~the populated~~ ^{roads} the areas populated by humans. This will help to counteract ~~the~~ ^{and lessen} the impact of coastal flooding by preventing the surge of water into streets and human populated areas. Another method of protecting coastal communities from rising

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ADDITIONAL PAGE FOR ANSWERING QUESTION 1

sea levelists constructing new homes on stilts. By raising the height of houses above sea level, there will be less of a likelihood that they will be impacted by coastal flooding and increased volume of storm surge.

→ b) (i) ^{action}, one human ~~activity~~ that devastates coastal habitats is tourism, specifically through building hotels and other types of infrastructure. Erecting these buildings eliminates the breeding grounds for many species ^{who live along coastlines} including sea turtles. This forces the turtles to find new nesting sites, and their movement can be further ^{anthropogenic sources of} disrupted through light (street lamps), which can ultimately cause them to die through ~~the~~ ways such as getting smacked by cars.

GO ON TO THE NEXT PAGE.

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 - Describe** one likely reason for the change in the number of piping plover nests between 1999 and 2009.
- (b) Coastal species are affected by more than just natural events.
- Special beach restrictions can help piping plovers during nesting season. **Describe** one restriction that could reasonably be implemented to help prevent the destruction of plover nests by human actions.
 - In addition to providing habitat for piping plovers, barrier islands (and closely related landforms) are important for other reasons. **Explain** one way that these features help to preserve and protect the environment in coastal regions.
 - Identify** one human action that directly threatens coastal habitats and **describe** one impact on species, other than the piping plover, that use the habitat.

Approximately 40% of the United States population resides in coastal areas, such as areas near Assateague Island, where sea level rise and shoreline erosion is occurring.

- Identify** one economic impact on coastal communities that has resulted from rising sea levels.
- Describe** TWO methods that may be used locally to protect coastal communities from rising sea levels.

a) i) sandy beaches with sparsely
between sparsely vegetated dunes.
ii) The number of nests between
1999 and 2009 decreased
iii) one likely reason is the
development of more sand dunes
and more densely vegetated dunes.
b) i) To prevent destruction
of nests beaches containing them
could be barred to human use.
ii) Barrier islands are important
because they provide a natural
buffer to storms that
protect the mainland

ADDITIONAL PAGE FOR ANSWERING QUESTION 1

iii) Coastal development by humans leads to habitat destruction to many sea birds and small coast animals.

c) Rising sea levels damage ~~water~~ ~~water~~ property or buildings that then need to be repaired or moved. Both options come at great cost to communities

D) Sea walls or buildings on stilts can help protect communities from rising sea levels and flooding.

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2019 SCORING COMMENTARY

Question 1

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

Overview

The intent of this question was for students to evaluate a diagram of the nesting sites of a species of migratory shorebirds, the piping plover, on Assateague Island, Virginia, and to describe issues impacting coastal species and coastal communities.

In the first part of the question, the stimulus provided a map of Assateague Island, Virginia, with various habitats and the distribution of piping plover nests in 1999 and in 2009. Students were asked to read the information about plovers provided and to use the maps to answer questions related to changes in nesting habitats over time. These concepts were drawn from the following sections of the topic outline: II. The Living World, A. Ecosystem Structure and D. Natural Ecosystem Change.

The next part of the question evaluated student understanding of human actions that could impact nesting coastal species. Students were asked to explain a way that features of barrier islands help preserve and protect the environment in coastal regions. They were asked to identify and describe a human action that directly threatens coastal habitats and an impact on species that use the habitat.

Students were then asked to identify an economic impact of rising sea levels and to describe two different methods that could be used locally to protect coastal communities from rising sea levels. These concepts were drawn from the following section of the topic outline: VII. Global Change, B. Global Warming and C. Loss of Biodiversity.

Sample: 1A

Score: 10

The response earned 3 points in part (a): 1 point in (a)(i) for identifying “unvegetated sand” as the preferred habitat for the piping plovers; 1 point in (a)(ii) for describing that the number of nests is “almost halved”; and 1 point in (a)(iii) for describing that “the amount of vegetated ... sand has increased while ... where plovers make their nests, has decreased” as a likely reason for the change in the number of piping plover nests. The response earned 4 points in part (b): 1 point in (b)(i) for describing a restriction to help prevent the destruction of plover nests as “signs ... put up around nesting grounds”; 1 point in (b)(ii) for correctly describing that barrier islands absorb energy from storms and hurricanes, preventing beach erosion; 1 point in (b)(iii) for identifying “disposal of plastic” as one human action that directly threatens coastal habitats; and an additional 1 point in (b)(iii) for describing the effect of the ingestion of plastic on the digestive tract of sea gulls. The response earned 1 point in part (c) for identifying that rising sea levels in coastal communities can “flood coastal agricultural areas, which ruins the crop & causes financial loss” as an economic impact. The response earned 2 points in part (d): 1 point for describing how dikes reduce or prevent flooding and 1 point for correctly describing that beach replenishment can increase the width of the beach.

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Question 1 (continued)

Sample: 1B**Score: 8**

The response earned in part (a)(i) for identifying “open sandy beaches” as the preferred habitat for the piping plovers; no points were earned in part (a)(ii) because the description does not include the magnitude of the change in the number of nests. The response earned 4 points in part (b): 1 point in (b)(i) for describing a restriction to help prevent the destruction of plover nests by human actions as “a fence or rope around a plover nesting area”; 1 point in (b)(ii) for correctly describing that barrier islands block the effects of storms and prevent erosion; 1 point in (b)(iii) for identifying “tourism” as a human action that directly threatens coastal habitats; and 1 additional point for describing that there is a loss of breeding habitat along coastlines for sea turtles because of coastal development. The response earned 1 point in part (c) for identifying an economic impact on coastal communities that has resulted from rising sea levels as a “high cost of repairing ... homes.” The response earned 2 points in part (d): 1 point for describing the use of walls along the coastline to prevent flooding and 1 point for describing “constructing new homes on stilts” and “less ... impacted by coastal flooding” as methods that may be used locally to protect coastal communities from rising sea levels.

Sample: 1C**Score: 6**

The response earned 1 point in part (a)(i) for identifying “sandy beaches” as the preferred habitat for the piping plovers. No point was earned for part (a)(ii) because the description does not include the magnitude of the change in the number of nests, and no point was earned in (a)(iii) because the description of an increase in densely vegetated sand dunes is not linked to habitat loss. The response earned no point in part (b)(i) because “beaches containing them could be barred to human use” is vague and does not describe the actual restriction being implemented. The response earned no point in part (b)(ii) because “protect the mainland” is vague. The response earned 1 point in part (b)(iii) for identifying “coastal development” as a human action that directly threatens coastal habitats and 1 point for describing that the direct impact of coastal development is “habitat destruction to many sea birds.” The response earned 1 point in part (c) for identifying an economic impact as the cost associated with damage to buildings that then need to be repaired. The response earned 2 points in part (d): 1 point for describing “[s]ea walls” that “protect communities from ... flooding” and 1 point for describing that “building on stilts” would “protect communities from ... flooding.”