

2017

AP[®]

CollegeBoard

AP Environmental Science

Sample Student Responses and Scoring Commentary

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AP[®] ENVIRONMENTAL SCIENCE

2017 SCORING GUIDELINES

Question 3

Haiti shares a border with the Dominican Republic on the Caribbean island of Hispaniola.

(a) The border between the two countries can be seen using satellite images because of the severe deforestation in Haiti.

(i) **Provide** one reason why deforestation commonly occurs in a less developed country such as Haiti.

(1 point for a correct reason why deforestation commonly occurs in a less developed country.)

- Converting forests into agricultural land, ranchland
- Using trees/charcoal for fuel or source of income
- Protecting forests through regulations is less common than in developed countries
- Harvesting timber for use as building materials
- Using forested land for commercial purposes by corporations/industrialized countries
- Clearing forested land to accommodate growing rural populations (e.g., roads, homes, schools)

(ii) **Describe** one realistic strategy to reduce deforestation in a less developed country.

(1 point for a correct description of a realistic strategy to reduce deforestation in a less developed country.)

- Enact/enforce laws or regulations that restrict cutting of trees
- Encourage sustainable agriculture/forestry programs
- Introduce more efficient cooking methods that reduce use of wood as a fuel source
- Establish programs to promote alternate building materials that reduce the demand for wood
- Develop economic programs to increase individual incomes/decrease reliance on forest conversion
- Reduce population growth resulting in less demand for wood for fuel and income
- Promote ecotourism to protect natural areas and to discourage tree harvesting

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Question 3 (continued)

(b) Deforestation can affect water quality. **Identify** one change that can occur in the water quality of streams within a watershed that has been deforested. **Explain** how deforestation can lead to this change.

(2 points: 1 point for identifying a correct change in water quality and 1 point for correctly explaining the linkage to deforestation. The explanation point cannot be earned without correctly identifying a change in water quality.)

Change in Water Quality	Linkage to Deforestation
Increase in water temperature	Loss of shade; increased solar radiation reaching the stream
Increase in sediment/turbidity	Loss of root structure, leaf litter, canopy leads to increased soil erosion and runoff
Increase in nutrient concentration	Loss of vegetation results in less nutrient uptake and subsequent runoff into stream
Decrease in pH	Loss of root structure allows naturally-occurring acids to run off into streams
Decrease in dissolved oxygen	Loss of shade leads to warmer water, which holds less dissolved oxygen

(c) **Identify** TWO environmental benefits, other than those related to water quality, of maintaining forest ecosystems.

(2 points: 1 point for each correct environmental benefit identified. Only the first two benefits can earn a point.)

- Maintains habitat/biodiversity
- Releases oxygen
- Stores carbon
- Slows climate change/global warming
- Absorbs/reduces/filters air pollutants
- Regulates local temperatures/maintains microclimates and regional climates
- Reduces erosion, thus preserving soil quality/quantity
- Maintains nutrient cycles

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Question 3 (continued)

The table below contains demographic data for Haiti in 1995 and 2015.

DEMOGRAPHIC DATA FOR HAITI

Measure	1995	2015
Fertility rate (number of children per woman)	5.2	2.7
Life expectancy (years)	55	64
Infant mortality (deaths per 1,000)	85	48

(d) **Identify** and **discuss** one factor in a less developed country that could contribute significantly to a change in life expectancy, similar to what occurred in Haiti from 1995 to 2015.

(2 points: 1 point for correctly identifying a factor that increases life expectancy and 1 point for discussing how that factor contributes significantly to this increase. The discussion point may be earned without the identification point.)

Factor	Contribution to Increasing Life Expectancy
Increased access to health care	<ul style="list-style-type: none"> • Fewer deaths from treatable diseases • Prevention of early death by giving vaccines
Improved food quality or quantity	<ul style="list-style-type: none"> • Better health and general wellness resulting in less malnutrition or fewer early deaths • Decrease in food-borne diseases
Increased access to clean water (e.g., sanitation, sewage treatment, drinking water)	<ul style="list-style-type: none"> • Fewer water-borne and communicable diseases
Fewer pregnancies	<ul style="list-style-type: none"> • Fewer children resulting in fewer maternal deaths
Increased health-related education	<ul style="list-style-type: none"> • Better sanitation, less disease transmission

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Question 3 (continued)

(e) **Identify** and **discuss** one economic or cultural factor in a less developed country that could contribute significantly to a change in the fertility rate, similar to what occurred in Haiti from 1995 to 2015.

(2 points: 1 point for correctly identifying one economic or cultural factor that decreases fertility rate and 1 point for discussing how that factor contributes significantly to this decrease. The contribution point may not be earned without earning the factor point.)

Factor	Contribution to significantly decreasing fertility rate
Increased education of women	<ul style="list-style-type: none"> • Fewer children • Later age at first reproduction • Aware of choices for family planning
More economic opportunities for women	<ul style="list-style-type: none"> • Fewer children • Later age at first reproduction • Less dependence on males
Later marriage age for women	<ul style="list-style-type: none"> • Fewer children • Later age at first reproduction
Cultural acceptance of family planning strategies/increased access to family planning	<ul style="list-style-type: none"> • Fewer children • Confidence that children will survive to adulthood
Increased women’s rights/gender equality/empowerment of women	<ul style="list-style-type: none"> • Access to family planning • Choices in reproduction • Financially less dependent on males
Increased industrialization/economic development	<ul style="list-style-type: none"> • Children no longer an asset, but a financial liability
More social programs to support elderly citizens	<ul style="list-style-type: none"> • Children no longer needed to support aging parents

3. Haiti shares a border with the Dominican Republic on the Caribbean island of Hispaniola.
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- (i) **Provide** one reason why deforestation commonly occurs in a less developed country such as Haiti.
- (ii) **Describe** one realistic strategy to reduce deforestation in a less developed country.
- (b) Deforestation can affect water quality. **Identify** one change that can occur in the water quality of streams within a watershed that has been deforested. **Explain** how deforestation can lead to this change.
- (c) **Identify** TWO environmental benefits, other than those related to water quality, of maintaining forest ecosystems.

The table below contains demographic data for Haiti in 1995 and 2015.

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- (e) **Identify** and **discuss** one economic or cultural factor in a less developed country that could contribute significantly to a change in the fertility rate, similar to what occurred in Haiti from 1995 to 2015.

a) i). Deforestation is more common in a less developed country like Haiti because their economy and government isn't yet strong or developed enough to put deforestation regulations in place. This means that there are less consequences to companies that clear-cut forests.

ii). A realistic strategy to reduce deforestation in these less-developed countries is to subsidize companies if they don't clear-cut, but instead cut down trees in a scattered, more sustainable.

manner, this way, the companies can still use lumber, but the trees will grow back in a manner that ensures ecological resilience.

b). The water quality of streams within a watershed that has been deforested can become very nutrient-rich. When an area is deforested, soil erosion increases because of a lack of roots in the soil. The erosion causes more run-off into nearby streams, bringing with it all of the nutrients in the soil, and ~~decreasing~~ causing nutrient content of the water to increase.

c). Maintaining forest ecosystems by not clear-cutting trees is beneficial to ~~the~~ the biodiversity of the ecosystem. If a forest is deforested, many animals will lose their habitats, and will either migrate away or die. Maintaining the ecosystem is equivalent to maintaining these organisms' habitats. Additionally, trees remove CO_2 from the atmosphere during photosynthesis. This process is important because less CO_2 in the atmosphere decreases the effects of global warming by decreasing the greenhouse effect. ~~Not~~ Not deforesting an ~~area~~ area can help decrease

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ADDITIONAL PAGE FOR ANSWERING QUESTION 3

the effects of climate change.

d). An increase in healthcare in a less developed country can greatly increase the life expectancy in that area. When people take better care of their health and have more access to medicines they are able to live longer, and fight disease more effectively.

e). When women achieve more financial success and stability in less developed countries, they don't want to have as many children. Often times they tend to put their career ~~before~~ first, so having a lot of children would interfere with their success. So, as their careers progress, they have less children.

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A) As a less developed country, Haiti likely uses older agricultural techniques that produce lower yields per acre ~~and~~ therefore requiring more land to be devoted to agriculture. If Haiti adopted newer farming practices such as the use of GMOs, that produce ~~the~~ higher crop yields less ~~and~~ land would need to be devoted to agriculture reducing the need for deforestation.

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B) Deforestation can result in erosion of soil and sedimentation of streams because trees that have been cut down once provided stability and structure for the soil. Sediments and ~~the~~ sunlight that used to be blocked by a canopy of trees can severely impact fish populations as well as sedimentation can cause ~~floods~~ buildups that lead to flooding.

C) Forests are a vital carbon sink and producer of oxygen. They help to reduce green house gasses and provide clean air reducing impacts of climate change. Trees in forests provide habitats to important species that may provide a variety of ecosystem services.

D) The adoption of advanced medical techniques and technologies could ~~improve~~ increase the life expectancy as well as ~~the~~ reduction of harmful pollutants.

E) Increased education for women would increase the number of women in the workforce. ~~The~~ More women in the workforce constitutes a lower

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fertility rate. Another possibility is
increased access to contraception.

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- (e) **Identify and discuss** one economic or cultural factor in a less developed country that could contribute significantly to a change in the fertility rate, similar to what occurred in Haiti from 1995 to 2015.

A) One reason deforestation commonly occurs in a less developed country such as Haiti because wood and any other ~~extra~~ thing they get from tree is a vital resource to them. LDC don't have the same tech or resources as a developed country so they use what they have, wood. By cutting down the trees they are able to make homes or use it to cook or building things because it is their resource and it's easy to access for them. One realistic strategy to reduce deforestation in LDC is to send/give them some of our resources or to help them in anyway so that deforestation is no longer needed in that country or lifestyle.

ADDITIONAL PAGE FOR ANSWERING QUESTION 3

b) One change that can occur in the water quality of streams within a watershed that has been deforested is that the water quality will be bad because there are no trees to filter and clean the water and there will be more water because the trees also absorb some water but without it it will flow straight down.

c) Two environmental benefits of maintaining forest ecosystem is that it provides a place for animals to live, it's their habitat and it will increase/keep the biodiversity, ~~there are no things in the forest~~

d) One factor in a LDC that could contribute significantly to a change in life expectancy would be due to better medical care/aid/technology. An increase of medical care/aid/technology create things such as medicine, or vaccines which can help people be healthy thus living longer.

e) One economic or cultural factor in a LDC that ~~could~~ could contribute significantly to a change in fertility rate would be woman getting more education/education opportunities. because as women have more education opportunities they are more willing to get an education, then establishing a career before having children where as someone who doesn't have education opportunities will have kids right away because they don't have an education or career.

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2017 SCORING COMMENTARY

Question 3

Overview

The question was intended to measure students' knowledge of the impacts of deforestation in less developed countries. Students were asked to explain why deforestation commonly occurs in less developed countries and to describe a realistic strategy to reduce deforestation in these areas. These concepts were drawn from IV. Land and Water Use, subtopics A. through D. and III. Populations, subtopics A. Population Biology Concepts and B. Human Populations. Students were then asked to identify one change in stream water quality that can occur in a deforested watershed and to explain how deforestation caused the identified change. These concepts were drawn from I. Earth Systems and Resources, subtopics C. Global Water Resources and Use, and D. Soil and Soil Dynamics of the topic outline. The students were next asked to demonstrate knowledge of additional environmental benefits for maintaining forest ecosystems, not related to water quality. These were drawn from III. The Living World, subtopics A. through E in the topic outline.

In the second part of the question, the stimulus provided demographic data for Haiti for 1995 and 2015 that was used to assess the students' knowledge of factors that could affect life expectancy and fertility rates. Students had to analyze the data in the table and identify and discuss one factor that contributed significantly to the change in life expectancy. The students then had to analyze the data in the table, with respect to fertility rates, and to identify and discuss one cultural or economic factor that could contribute significantly to the change in fertility rate. These concepts were drawn from II. The Living World C. Ecosystem Diversity and III. Population, subtopics A. Population Biology Concepts and B. Human Population.

Sample: 3A

Score: 10

The student earned 2 points in part (a): 1 point for providing the reason for deforestation is that the less developed country's "government ... [doesn't] put deforestation regulations in place" and 1 point for describing that "a realistic strategy to reduce deforestation in ... less developed countries is to subsidize companies if they don't clear-cut, but instead cut down trees in a scattered, more sustainable manner." The student earned 2 points in part (b): 1 point for identifying an increase in the nutrient concentration of streams within a deforested watershed ("streams ... become very nutrient-rich.") and 1 point for linking the change in water quality to deforestation explaining that "soil erosion increases because of a lack of roots in the soil. The erosion causes more run-off into nearby streams, bringing with it all of the nutrients in the soil." The student earned 2 points in part (c): 1 point for identifying that "maintaining forest ecosystems ... is beneficial to the biodiversity of the ecosystem" and 1 point for identifying that forest ecosystems slow climate change as "trees remove CO₂ from the atmosphere during photosynthesis ... [which] decreases the effects of global warming." The student earned 2 points in part (d): 1 point for correctly identifying that life expectancies increase when there is "An increase in healthcare in a less developed country" and 1 point for discussing that "when people take better care of their health and have more access to medicines they are able to live longer, and fight disease more effectively." The student earned 2 points in part (e): 1 point for identifying "When women achieve more financial success and stability" as a factor that increases economic opportunities for women and 1 point for tying the economic opportunities to a decrease in fertility rate by discussing that "Often times they tend to put their career first ... as their careers progress, they have less children."

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2017 SCORING COMMENTARY

Question 3 (continued)

Sample: 3B
Score: 8

The student earned 1 point in (a)(i) for providing that a less developed country requires “more land to be devoted to agriculture,” which results in deforestation. The student earned 1 point in (a)(ii) for describing that if a less developed country “adopted newer farming practices such as the use of GMOs that produce higher crop yields [*sic*] less land would need to be devoted to agriculture reducing the need for deforestation.” The student earned 2 points in part (b): 1 point for indicating that “deforestation can result in ... sedimentation of streams” and 1 point for explaining that “trees ... once provided stability and structure for the soil. Deforestation can result in erosion [*sic*] of soil.” The student earned 2 points in part (c): 1 point for indicating an environmental benefit of maintaining a forest ecosystem is that “forests are a vital carbon sync [*sic*]” and 1 point for indicating that “forests are a ... producer of oxygen.” The student earned 1 point in part (d) for identifying that “the adoption of advanced medical techniques and technologies could increase the life expectancy.” No discussion of the contribution of these advanced medical techniques and technologies was given, so the second point was not earned. The student earned 1 point in part (e) for indicating that “increased education for women” would result in “a lower fertility rate.” The response also indicates that “another possibility is increased access to contraception.” That, however, is the student’s second economic or cultural factor given and not a discussion of how educating women significantly changes the fertility rate. Therefore no discussion point is earned.

Sample: 3C
Score: 6

The student earned 1 point in (a)(i) for providing “wood ... is a vital resource” in a less developed country and “by cutting down the trees they are able to make homes.” No point was earned in (a)(ii) because the strategy to reduce deforestation is too vague. The student earned 1 point in part (c) for indicating that an environmental benefit of maintaining a forest ecosystem is that it “provides a place for animals to live, it’s their habitat.” The student earned 2 points in part (d): 1 point was earned for indicating “an increase of medical care/aid/technology” could contribute significantly to a change in life expectancy in a less developed country and 1 point for discussing that “better medical care/aid/technology creates thing [*sic*] such as medicine, and vaccines which can help people be healthy thus living longer.” The response earned 2 points in part (e). The student earned 1 point for indicating that women “getting more education/education opportunities” is a factor that contributes significantly to a decrease in fertility rates. The student earned an additional point for discussing how “as women have more education opportunities ... establishing a career before having children” will delay them having children and decrease the fertility rate. “Someone who doesn’t have educational opportunities will have kids right away.”