

2013 AP® ENVIRONMENTAL SCIENCE FREE-RESPONSE QUESTIONS

4. Biological diversity, or biodiversity, has become a topic of great concern among conservationists. Biodiversity is often used by scientists and policy makers to help determine the health of ecosystems.
- (a) **Describe** TWO characteristics shared by ecosystems that have high biodiversity.
 - (b) **Identify** TWO specific human activities that result in a loss of biodiversity, and **explain** how each activity lowers biodiversity.
 - (c) For each human activity you discussed in (b), **propose** a practical strategy (other than simply banning the activity) to reduce the loss of biodiversity.
 - (d) **Describe** ONE naturally occurring factor that could lead to a loss of biodiversity.
 - (e) **Describe** TWO ecological benefits that greater biodiversity provides.

STOP

END OF EXAM

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Question 4

(a) Describe TWO characteristics shared by ecosystems that have high biodiversity.

(2 points: 1 point for each description of a characteristic)

- Large number of different species
- Large number of individuals of different species
- Complex food webs
- Greater genetic diversity
- Variety of ecological roles / niches
- Abundant resources

(b) Identify TWO specific human activities that result in a loss of biodiversity and explain how each activity lowers biodiversity.

(4 points: 1 point for each activity and 1 point for each correctly linked explanation)

Activity	Explanation
Clearing land for construction/homes/roads	<ul style="list-style-type: none">• Reduces habitat for many species• Results in habitat fragmentation
Logging/clear cutting/deforestation	<ul style="list-style-type: none">• Reduces habitat for many species• Results in habitat fragmentation
Agriculture: <ul style="list-style-type: none">• Monoculture• GMOs• Clearing forests to create pastureland• Pesticide use	<ul style="list-style-type: none">• Eliminates native species; decreases genetic variation• Reduces habitat for many species• Eliminates native species and beneficial organisms
Overfishing/hunting (overhunting)/poaching	<ul style="list-style-type: none">• Reduces keystone species• Reduces top predators• Depletes endangered species
Water contamination by: <ul style="list-style-type: none">• Excess fertilizer• Runoff from feedlots• Runoff from construction• Untreated sewage	<ul style="list-style-type: none">• Overloads sediments and nutrients• Decreases dissolved oxygen (only certain species can survive)
Burning of fossil fuels	<u>Climate change</u> <ul style="list-style-type: none">• Death of coral reefs• Loss of reef habitat• Increases sea level with resulting loss of coastal habitat <u>Acid rain</u> <ul style="list-style-type: none">• Increases acidity of freshwater systems (only certain species can survive)
Introduction of invasive species	<ul style="list-style-type: none">• Displaces native species
Dams/hydroelectric plants	<ul style="list-style-type: none">• Fragments habitat
Surface mining	<ul style="list-style-type: none">• Destroys habitat

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Question 4 (continued)

(c) For each human activity you discussed in (b), propose a practical strategy (other than simply banning the activity) to reduce the loss of biodiversity.

(2 points: 1 point for each reasonable solution correctly linked to the activity or explanation in part b)

Activity (or explanation) from part (b)	Solution
Clearing land for construction/homes/roads	<ul style="list-style-type: none"> • Cluster development • Smart Growth planning • Develop urban boundaries • Habitat-conservation areas
Logging/clear cutting/deforestation	<ul style="list-style-type: none"> • Replant trees • Selective cutting
Agriculture: <ul style="list-style-type: none"> • Monoculture • GMOs • Clearing forests to create pastureland • Pesticide use 	<ul style="list-style-type: none"> • Encourage polyculture, agroforestry, intercropping • Require GMO crops to be sterile • Create wildlife/habitat corridors • Grow shade-tolerant crops • Implement IPM techniques, biological pest controls
Overfishing/hunting (overhunting)/poaching	<ul style="list-style-type: none"> • Regulate activities and/or establish quotas • Enforce existing laws (ESA) • Ban trade (CITES)
Water contamination by: <ul style="list-style-type: none"> • Excess fertilizer • Runoff from feedlots • Runoff from construction • Untreated sewage 	<ul style="list-style-type: none"> • Regulate non-point sources of water pollution (e.g., buffer zones, swales, containment ponds, storm water treatment areas) • Secondary or tertiary treatment
Burn fossil fuels	<u>Climate change</u> <ul style="list-style-type: none"> • Implement the Kyoto Protocol • Carbon sequestration • Carbon cap-and-trade • Carbon tax • Switch to renewable energy sources <u>Acid rain</u> <ul style="list-style-type: none"> • Require scrubbers on coal burning power plants • Switch to renewable energy sources
Introduction of invasive species	<ul style="list-style-type: none"> • Checkpoints for agricultural inspections • Tighter enforcement on import of horticultural or exotic species • Education regarding strategies to prevent invasives
Dams/hydroelectric plants	<ul style="list-style-type: none"> • Steps to allow fish migration
Surface mining	<ul style="list-style-type: none"> • Enforce Surface Mining and Reclamation Act

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Question 4 (continued)

(d) Describe ONE naturally occurring factor that could lead to a loss of biodiversity.

(1 point)

- Particulates from asteroids/volcanoes can alter the atmosphere (e.g., block sunlight, resulting in cooler temperatures and reduced photosynthesis)
- Widespread wildfires can wipe out small populations
- Natural, long-term climate change can result in warmer or cooler temperatures
- Hurricanes/tsunamis can wipe out coastal nursery/estuary areas
- Droughts (e.g., food source may be lost; populations may be unable to adapt to drier conditions)
- Mutation/evolution may lead to new diseases/predators

(e) Describe TWO ecological benefits that greater biodiversity provides.

(2 points: 1 point for each ecological benefit)

- Pollination (by insects and other organisms)
- Water/air filtration by intact ecosystems
- Stability/survivability of ecosystems
- Control of pest species
- More source material for evolution
- Soil microorganisms can contribute to nutrient recycling, leading to higher primary productivity