Bee FRQ

Practice

Article to Read

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BEETLES BOOM BUT BEES BUST

We share our world with millions of insect species that we tend to overlook in our daily lives. Yet once in a while, some insect species do make the front page — sometimes because their populations are exploding and other times because they seem to be performing a disappearing act. Examples of such species are the mountain pine beetle and the European honeybee.

In the western United States, outbreaks of forest destruction caused by mountain pine beetles have been recorded since the late 1880s. But in the past few decades, mountain pine beetles have been killing mature trees (preferred targets of the beetles) at accelerated rates, and now millions of acres of pine forests have been affected. Fire-suppression policies, the practice of clear-cutting, and lowered winter mortality of beetle larvae have all been implicated in causing the epidemic proportions of the beetles' forest-destroying activities.

While mountain pine beetle populations are booming, European honeybees are in trouble. Many valuable food crops are dependent on pollination by honeybees, yet the number of managed honeybee colonies has dropped significantly since the 1970s due to colony collapse disorder (CCD), which is characterized by the sudden disappearance of all the worker bees in a colony. Recent scientific research suggests that many stress factors of anthropogenic origin are the culprits in CCD. Some farmers are trying to use fewer colonies to pollinate their crops, some are hoping that other natural pollinators (e.g., native wild bees, other insects, bats) will do the job of pollination for them.

Part (a) (i)

(i) Provide one reason why fire-suppression policies lead to increased beetle activity.
(1 point; only the first answer is scored.)

- Suppression leads to increased numbers of trees/more food/denser forests.
- Suppression allows weaker, more vulnerable trees that would have been weeded out by fire survive.
- Suppression leads to less diversity of tree species, so beetles spread more quickly between trees.
- Suppression leads to equal/even-age stands of mature trees, which the beetles prefer.

Part (a) (ii)

(ii) Reduced winter mortality of beetle larvae is likely a consequence of global climate change. Describe TWO ways that the activities of the beetles might enhance climate change.

(2 points; 1 point for each activity. Only the first two answers are scored.)

- Less carbon dioxide is removed by trees (less photosynthesis/primary production/carbon sinks/carbon sequestration).
- Higher levels of dead tree matter release more carbon dioxide through decomposition.
- Burning of forests as a result of infestation (dead trees) releases carbon dioxide.

Note: Carbon dioxide released by beetle respiration is NOT an acceptable answer.

Increased erosion/decreased root systems/increased runoff	• Loss of nutrients for plants. • Loss of root zone for plant stability. • Increased siltation/sedimentation. • Change in stream and river depth leads to changes in plant and animal species. • Changes in water clarity leads to reduced primary productivity. • Mortality of animal and plant species that are buried by sediment.
Less absorption of precipitation by trees	• Increased runoff. • Increased erosion. • Loss of nutrients (leaching or runoff). • Mortality of plant species (waterlogging). • Mortality or migration of animal species. • Decreased local water vapor/drier climate.
Increased flooding	• Loss of nutrients (leaching). • Mortality of plant species (waterlogging). • Mortality or migration of animal species.
Increased soil temperature	• Changes in plant growth. • Changes in soil communities (microbes and invertebrates).
Downed trees or snags	• Increased habitat for species. • Risk of catastrophic fires. • Increased nutrients from tree decomposition.

Part (c)

(2 points; 1 point for each consequence linked to a description. Only the first two answers are scored.)

Economic consequence	Description
• Increased costs/prices	• For food crops. • For beekeepers' services/replacement of hives. • For manual pollination. • For attraction of native pollinators by planting wildflowers/native flowering plants OR providing nesting sites and safe foraging areas. • For better nutrition/medicine for bees.
• Lower revenue/sales	• Because of lower crop yields.
• Loss of jobs	• Because of lower honey production.

(d) Pollinati … **ifferent ecosyste**

Ecosystem service	Benefit
Control of pests with natural predators	• Reduces incidence of disease (vector-borne). • Reduces need for pesticides. • Reduced crop losses.
Waste disposal/treatment	• Decomposition reduces amount of waste. • Recycles nutrients (plant growth). • Detoxification, removal of pollutants.
Filtering/purification of water by soils and plants	• Reduces costs of providing safe drinking water. • Less contamination/fewer waterborne diseases.
Storage and regulation of water supplies (water cycle)	• Reduces costs of creating fresh water (reverse osmosis). • Supports growth of agricultural crops. • Allows transport of goods. • Allows manufacturing of goods. • Water is necessary for survival.
Disposal/dilution of fecal waste	• Reduced incidence of disease. • Reduced cost of sewage treatment.
Cycling of nutrients (such as nitrogen/phosphorus)	• Reduces use of inorganic/synthetic fertilizers. • Recycles nutrients (plant growth).
Release of oxygen by plants (oxygen cycle)	• Necessary for human survival.
Prevention of soil erosion (roots)	• Reduces costs of soil amendment/fertilizer.
Flood control and moderation of the effects of severe storms (storm surges) through absorption of water	• Protection of human lives. • Lower cost for loss of human property.
Lumber/timber	• Building, fuel, paper products. • Provides income for loggers, paper industry. • Difficult or expensive to replace/duplicate (synthetics often use petrochemicals).
Cycling of carbon	• Vital to crop growth. • Helps in moderation of global temperature.
Medicines to treat diseases	• Provides income to harvesters. • Improves quality of human life (e.g., cancer and diabetes drugs).
Genes for resistance to pathogens and crop pests	• Reduces costs of pesticides. • Reduces use of fossil fuels.
Fish, game, fruit, nuts	• Source of food for hunters, gatherers, fishers.
Soil formation, maintenance of soil nutrients	• Reduces costs of fertilizer/soil amendment.