

## BI. 1. 14

Analyze how natural and human caused events can unbalance an ecosystem and describe possible strategies for restoring balance to damaged ecosystems

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**Essential question: How is balance achieved?**

- First concept: **Ecosystem services**.
- **What are the major types of ecosystems?**
- The different types of the ecosystem include:
  - Terrestrial ecosystem.
  - Forest ecosystem.
  - Grassland ecosystem.
  - Desert ecosystem.
  - Tundra ecosystem.
  - Freshwater ecosystem.
  - Marine ecosystem.
- **Ecosystem services** are the benefits to people from nature. These benefits include food, water purification, carbon sequestration, soil stabilization, recreation, cultural values, among others.
- **Ecosystem services**, outputs, conditions, or processes of natural systems that directly or indirectly benefit humans or enhance social welfare. **Ecosystem services** can benefit people in many ways, either directly or as inputs into the production of other goods and services.
- **What is direct value?**
- Direct values include the ways in which biodiversity is used or consumed by man e.g. fishery and forestry products, as well as the ways in which it affects

mankind through its ecological processes e.g. watershed protection or the role of vegetation in the carbon and water cycles.

- **What services do ecosystems provide for humans?**

- Ecosystem services are the benefits people obtain from ecosystems: provisioning services (also known as goods) such as food and water; regulating services such as flood, pest, and disease control; cultural services such as spiritual and recreational benefits; and supporting services, such as nutrient cycling.

- The following services are also known as ecosystem goods:

- Food (including seafood, crops, wild foods, and spices).
- Raw materials (including lumber, skins, fuel wood, organic matter, fodder, and fertilizer).
- Genetic resources (including crop improvement genes, and health care).
- Water purity.
- Biogenic minerals.

- **What is an example of a good or service provided by an ecosystem?**

- Examples of ecological services include purification of air and water, maintenance of biodiversity, decomposition of wastes, soil and vegetation generation and renewal, pollination of crops and natural vegetation, groundwater recharge through wetlands, seed dispersal, greenhouse gas mitigation, and aesthetically .

- **Why is the ecosystem important to humans?**

- Healthy terrestrial ecosystems are vital for human welfare and survival, as they provide us with essential products and benefits. Over 90% of our food

comes from terrestrial ecosystems, which also provide energy, building materials, clothes, medicines, fresh and clean water, and clean air.

- **As a society**, we depend on healthy **ecosystems** to **do** many things; to **purify the air** so we can breathe properly, **sequester carbon** for climate regulation, **cycle nutrients** so we have access to clean drinking water without costly infrastructure, and **pollinate** our crops so we don't go hungry.
- **How do humans impact ecosystem services?**
- Ecosystem services are affected by humans in these three primary ways: by **altering the land habitat**, **modifying the ecosystem structure**, or **changing the biogeochemical cycle**. These variables can have a negative or positive influence on ecosystem services.
- **How does an ecosystem regulate itself?**
- In a balanced condition, ecosystem functioning is self-regulating and self-sustaining. ... This dynamic nature of ecosystem is dependent upon a number of factors including **flow of energy**, **cycling of materials** and **perturbations**, both intrinsic and extrinsic.

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- **Second concept: Management of resources.**
  - **What do you mean by natural resources management?**
  - Natural resource management refers to the management of natural resources such as **land, water, soil, plants, and animals**.
  - **What are the types of resources?**
  - **The Earth's natural resources include air, water, soil, minerals, plants, and animals**. Conservation is the practice of caring for these resources so all living things can benefit from them now and in the future.

- **Environmental resources management** aims to ensure that ecosystem services are protected and maintained for future human generations, and also maintain ecosystem integrity through considering ethical, economic, and scientific (ecological) variables.
  
- **What are resources and its types?**
- These resources, called productive resources, are often classified into three groups: natural resources, human resources, and capital resources. Natural resources (often called land) refer to resources such as coal, water, trees, and land itself. Raw materials used in production come from natural resources.
- **Natural resources** are substances that occur naturally. They can be sorted into two categories: biotic and abiotic. Biotic resources are gathered from the biosphere or may be grown. Abiotic resources are non-living, like minerals and metals.
  
- **Examples of biotic natural resources:**
  - Birds
  - Ferns
  - Flowering plants
  - Fruits
  - Fungi
  - Insects
  - Lichens
  - Mammals
  - Microbes
  - Mosses
  - Natural gas
  - Petroleum
  - Reptiles
  - Shrubs
  - Trees
  - Worms
  
- **Biotic Resources Grown as Crops :**
  - Basil
  - Bay

- Brussels sprouts
- Carrot
- Catnip
- Cauliflower
- Celery
- Cotton
- Corn
- Garlic
- Oat
- Okra
- Parsley
- Peanuts
- Peas
- Rice
- Rye
- Sorghum
- Squash
- Sugarcane
- Sunflower
- Wheat
- Zucchini

- **Biotic Resources in the Ocean :**

- Crustaceans and lobsters
- Fish
- Octopi
- Seaweed and kelp
- Shrimp
- Whales and dolphins

- **Abiotic Natural Resources :**

Here are examples of abiotic natural resources:

- Barites
- Bauxite
- Chromite
- Coal
- Copper
- Diamond
- Gravel
- Gold
- Iron Ore
- Lead
- Marble
- Limestone
- Nickel
- Platinum
- Pumice
- Salt
- Sand
- Silver
- Sulfur
- Talc

- Vanadium
- Zinc

### - **Natural Energy Resources** :

- **Biofuels** - Fuels made from plants and animals.
- **Geothermal energy** - Energy generated from and stored in the earth.
- **Hydroelectric power** - Water drives the turbines that produce electricity either in dams or tides.
- **Natural gas** - This is a fossil fuel.
- **Nuclear energy** - Created by splitting the atom.
- **Solar energy** - The sun's rays heat solar cells that make electricity.
- **Wind power** - The wind turn the turbines that make electricity.

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### - **Third concept: Natural and human – caused disturbances.**

- A natural disturbance is simply a disturbance with a natural cause, such as a fire or flood.
- Different types of **pollution, urbanization, deforestation, and mining** are all examples of human disturbances. **Human disturbances** can have a significant impact on an ecosystem.

### - **What are examples of disturbances in ecology?**

- In ecology, a disturbance is a temporary change in environmental conditions that causes a pronounced change in an ecosystem ... .
- Major ecological disturbances may include **fires, flooding, storms, insect outbreaks.**

### - **How do humans change ecosystems?**

- Humans change ecosystems in many ways, such as **habitat destruction, pollution, introduction of invasive species, and overexploitation of species.** The most common way that **humans damage ecosystems** is by destroying habitat. For example, we **remove trees, change the flow of water, and change grasslands into farms.**
- Humans impact the physical environment in many ways: **overpopulation, burning fossil fuels, and deforestation.** Changes like these have triggered **climate change, soil erosion, poor air quality, and undrinkable water.**
- **What is human disturbance?**
- Human disturbance is a measure of the vulnerability of aquatic resources to a variety of harmful human activities such as: **tree removal, road building, construction near shorelines and stream banks.** Artificial hardening of lakeshores with retaining walls and bulkheads.
- **How is ecosystem change in response to natural disturbances and human activities?**
- Ecosystems are constantly changing in response to natural and human disturbances. As an ecosystem changes, older inhabitants gradually die out and new organisms move in, causing further changes in the community. **This series of predictable changes that occurs in a community over time is called ecological succession.**
- **Are all disturbances bad in an ecosystem explain?**
- **Not every ecosystem disturbance is a disaster.** For example, a low-intensity fire might kill some plant species, but at the same time it might benefit fire-adapted species that can use the additional nutrients released from the dead plants.



- Fourth concept: **Ecosystem disturbance: minor to catastrophic.**
- **Ecological disturbance**, an event or force, of non-biological or biological origin, that brings about mortality to organisms and changes in their spatial patterning in the ecosystems they inhabit. Disturbance plays a significant role in shaping the structure of individual populations and the character of whole ecosystems.



**Ecological disturbance caused by forest fire**

- **Minor disturbances** include localized wind events, droughts, floods, small wild land fires, and disease outbreaks in plant and animal populations. In contrast,
- **Major disturbances** include large-scale wind events (such as tropical cyclones), volcanic eruptions, tsunamis, intense forest fires, epidemics, ocean temperature changes stemming from El Niño events or other climate phenomena, and pollution and land-use conversion caused by humans. The notion of ecological disturbance has deep historical roots in ecological thinking; the first conceptual disturbance-related model in modern ecology



was **ecological succession**, an idea emphasizing the progressive changes in ecosystem structure that follow a disturbance.

- **Characteristics of disturbance and recovery :**

- The ecological impact of a disturbance is dependent on its **intensity and frequency**, on the spatial distribution (or the spatial pattern) and **size** of the disturbed patches, and on the scale (the spatial **extent**) of the disturbance.

These characteristics are further influenced by **the season** in which the disturbance occurs, **the history of the disturbed site**, and **the site's topography**.

- **What causes a disturbance in the environment?**

- **Fires and floods** are examples of natural disturbances that force change upon an ecosystem. Natural disturbances are also caused by **diseases, severe storms, insects, volcanic activity, earthquakes, droughts, and long-term freezing**.

- **What are catastrophic disturbances?**

- Ecologists generally distinguish between relatively small, frequent disturbances and large, infrequent, so-called "catastrophic" disturbances. ... Examples of the large, infrequent disturbances include **volcanic eruptions, hurricanes, and major wildfires**.

- **How do we make sure an ecosystem is balanced?**

- **How to maintain a balanced ecosystem?**

- **Manage Natural Resources** Carefully. A concerted effort to use natural resources in a sustainable manner will help to protect and maintain ecological balance .
- **Protect the water** .
- **Reduce chlorofluorocarbon** .

- Stop open burning.
  - **What is the ability of an ecosystem to recover from disturbance?**
  - In ecology, **resilience** is the capacity of an ecosystem to respond to a disturbance by resisting damage and recovering quickly.
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- Fifth concept: **Ecosystem resilience.**

- **Ecological resilience** was defined as the amount of disturbance that an **ecosystem** could **withstand** without changing self-organized processes and structures (**defined** as alternative stable states).
- **Why is ecosystem resilience important?**
- **Ecological resilience**, also called **ecological robustness**, the ability of an ecosystem to maintain its normal patterns of nutrient cycling and biomass production after being subjected to damage caused by an ecological disturbance.
- **What is an example of ecological resilience?**
- Ecological resilience is the ability of an ecosystem to respond to some kind of disturbance - **a measure of how quickly they recover**. These disturbances can be natural: floods, storms, fire etc. Or they can be human-caused: climate change, deforestation, agriculture, and over-fishing.
- **How is nature resilient?**
- Resilience in Nature is the capacity of a system to absorb disturbance and still retain its basic function, structure, and feedback systems.

- Resilience usually works within limits. If a disturbance is too great, the effect of that impact will overcome the ability of Nature to make corrections.
  - **Which ecosystem is more resilient?**
  - Although **greater diversity** tends to lead to greater system resilience, some ecosystems are **highly resilient even though they are not particularly diverse, such as coastal wetlands.**
  - **What is the difference between resistance and resilience in an ecosystem?**
  - **Resistance** is the ability for an ecosystem to remain unchanged when being subjected to a disturbance or disturbances. ... **Resilience** is the ability and rate of an ecosystem to recover from a disturbance and return to its pre-disturbed state.
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- **Sixth concept: Invasive species.**
- **What is meant by invasive species?**
- **Invasive species** are non-native species that have been introduced by human intervention, outside their natural range and that has the ability to threaten our native wildlife, cause damage to our environment, economy or human health.
- **An invasive species** is any nonnative **species** that disturbs the ecosystems in which it has been introduced. These **species** may harm other living things and the environment and may affect the economy or the health of humans, **Invasive species** can grow and spread quickly.
- **Invasive species are often successful** in their new ecosystems because they can reproduce and grow rapidly or because their **new environment lacks any**

natural predators or pests. As a result, invasive species can threaten native species and disrupt important ecosystem processes.

- **Why are invasive species such a problem?**

- According to the World Conservation Union, invasive alien species are the second most significant threat to biodiversity, after habitat loss. In their new ecosystems, invasive alien species become predators, competitors, parasites, hybridizers, and diseases of our native and domesticated plants and animals.
- Invasive species are harmful to our natural resources (fish, wildlife, plants and overall ecosystem health) because they disrupt natural communities and ecological processes. ... The invasive species can outcompete the native species for food and habitats and sometimes even cause their extinction.

- **What is meant by introduced species?**

- An introduced species (also known as an exotic species) is an organism that is not native to the place or area where it is considered introduced and instead has been accidentally or deliberately transported to the new location by human activity.

- **What is the difference between introduced and invasive species?**

- An introduced species is a non-native species that has one way or another been integrated into the native environment by human or other means. ... An invasive species on the other hand is an introduced organism that has become detrimental to the local environment.

- **What is the most dangerous invasive species?**

- The Cotton Whitefly... .
- The Snakehead Fish... .

- The Asian Longhorned Beetle... .
- The Burmese Python... .
- The Cane Toad... .
- The European/Common Rabbit... .

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- Seventh concept: **Ecosystem resistance.**

- **Ecological resistance** refers to the biotic and abiotic factors in a recipient **ecosystem** that. **Limit** the population growth of an invading species.

- **What is resistance in an ecosystem?**

- **Resistance** - the ability of the ecosystem to continue to function without change when stressed by disturbance.
- **Resilience** - the ability of the ecosystem to recover after disturbance.

- **What is an example of environmental resistance?**

- **Environmental resistance factors** are things that limit the growth of a population. They include **biotic factors** - like predators, disease, competition, and lack of food - as well as **abiotic factors** - like fire, flood, and drought.

- **How do ecosystems respond to disturbances?**

- Different ecosystems respond to disturbances (both natural and anthropogenic) in different ways. **A resistant ecosystem** is one that experiences little change in flows of energy and matter after a disturbance.
- **A resilient ecosystem** is one that returns rapidly to its original state after a disturbance.

- **Resistance** is the ability for an ecosystem to **remain** unchanged when being subjected to a disturbance or disturbances. Some ecosystems are better at resisting change than others, and therefore have high resistance.
- **Resilience** is the ability and rate of an ecosystem to **recover** from a disturbance and return to its pre-disturbed state. Some ecosystems can shift greatly from their previous state and still return to pre-disturbance conditions. The measure for how far an ecosystem can be shifted from its previous state and still return to normal is called **its amplitude**.
- **Both resistance and resilience** are components of determining ecosystem **stability**. Both can also occur at **the community, population, and individual level**. An ecosystem can have high resistance to disturbance, but low resilience, and vice versa.