

# UNIT SIX

## MAJOR GLOBAL ENVIRONMENTAL CHANGES

### Introduction to Environmental Challenges

Human activities have significantly impacted the planet's ecology, leading to persistent and emerging environmental changes. Key issues include environmental degradation, poverty, habitat fragmentation, resource over exploitation, and unsustainable development. This section will help you understand these changes and their implications for sustainability.

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#### 6.1.1 Habitat Destruction

**Habitat** refers to the physical environment necessary for a species to survive and reproduce. Human activities have significantly altered landscapes, causing habitat loss and biodiversity decline. The main methods of habitat modification are:

- **Perforation:** Creating gaps in habitats.
- **Dissection:** Cutting through habitats, like roads.
- **Fragmentation:** Breaking larger habitats into smaller pieces.
- **Shrinkage:** Reducing the size of habitats.
- **Attrition:** Gradual loss of habitat area.

Natural events, such as floods and volcanic eruptions, also contribute to habitat destruction. Invasive species, introduced by humans, can further threaten native species by out competing them for resources.

#### Impact on Species:

- Access to habitat affects distribution, survival, and reproduction.
- Habitat degradation can cause long-term population declines.
- **Extinction Debt:** The delay between habitat change and species extinction.

#### Management:

- Habitat restoration involves management, protection, and reconstruction efforts.

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### 6.1.2 Agricultural Intensification

**Agricultural Intensification** involves increasing productivity by using more inputs such as seeds, fertilizers, and machinery. This approach was part of the Green Revolution aimed at boosting food production but has had several negative effects:

- **Loss of Biodiversity:** Reliance on a few high-yield crop varieties reduces genetic diversity.
- **Soil Quality:** Synthetic fertilizers degrade soil health and cause water pollution.
- **Pesticide Hazards:** Pesticides can contaminate soil and water, leading to health issues.
- **Soil Salinization:** Excessive irrigation can lead to soil toxicity.
- **Increased Pests and Disease:** Monocropping can lead to pest and disease outbreaks.
- **Soil Compaction:** Heavy machinery can compact soil, affecting its health.

#### Sustainable Practices:

- Improved fertilizer and water use efficiency.
- Integrated soil and pest management.
- Agroforestry for additional ecosystem services.

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### 6.1.3 Overexploitation of Resources

**Overexploitation** occurs when natural resources are used at a rate faster than their regeneration. This includes:

- **Overfishing:** Depleting fish stocks beyond sustainable levels.
- **Overgrazing:** Grazing land beyond its capacity.
- **Over-logging:** Harvesting timber faster than forests can regenerate.
- **Over-drafting:** Extracting groundwater faster than it can be replenished.

#### Consequences:

- Resource depletion.
- Economic and ecological impacts.
- Increased reliance on alternative resources like minerals and oil.

### Mitigation:

- Promote recycling and sustainable practices.
  - Shift to renewable energy sources like solar and wind power.
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## 6.1.4 Invasive Alien Species

**Invasive Alien Species** are non-native species that disrupt ecosystems. They can be terrestrial or aquatic and often outcompete native species for resources.

### Causes of Expansion:

- Climate change can enhance survival and spread of invasive species.
- Disturbances like floods can facilitate their establishment.

### Types:

- **Terrestrial Invasive Species:** Plants and animals that invade land habitats. Examples include the mayapple and purple loosestrife.
- **Aquatic Invasive Species:** Plants that invade water bodies, such as water hyacinth and mangroves.

### Impact:

- Disrupt ecosystems.
- Affect native species and biodiversity.
- Alter water quality and availability.

### Management:

- Control and prevent spread of invasive species.
- Restoration of affected habitats.

By understanding these concepts, you can better grasp the complexities of environmental challenges and the importance of sustainable practices for preserving our planet.

## Ecological Classification of Invasive Plants

**Invasive plants** are classified based on their population behavior through four distinct phases:

1. **Introduction:** This phase occurs when invasive plants arrive at a new location outside their natural range and begin to establish populations. These plants may start to spread and become more common in the new area.
2. **Naturalization:** In this phase, the introduced species forms self-sustaining populations. They spread widely and integrate into the local flora. The ability of the species to thrive depends on abiotic factors like temperature, pH, salinity, and nutrient availability.
3. **Colonization:** Here, the invasive plants from the founding population reproduce and form a self-sustaining colony. These plants grow rapidly and compete effectively for resources.
4. **Dispersal:** The final phase involves the spread of the species to new locations. Dispersal is influenced by factors such as the plant's ability to move, dispersal mechanisms, and the connectivity of habitats. The rate of spread can be affected by factors like nutrient availability and human activities.

The graph illustrating the relationship between invasive species spreading and management costs shows that prevention is more cost-effective than controlling established invasions. Early intervention can be less expensive and more effective than dealing with widespread infestations.

### Impacts of Invasive Plants:

- **Biodiversity Loss:** Invasive plants are major drivers of biodiversity loss and species extinction. They can outcompete native plants, leading to habitat and food shortages for native insects, birds, and other wildlife.
  - **Disruption of Ecological Processes:** They disrupt natural processes such as plant community succession and plant-animal interactions, including pollination and seed dispersal.
  - **Human Health:** Some invasive plants can also pose risks to human health.
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## Poverty and the Environment

**Poverty-Environment Nexus:** The relationship between poverty and environmental degradation is often described as a “vicious cycle” where poverty leads people to overuse and degrade resources, which in turn exacerbates poverty. This cycle is influenced by geographic, economic, and social factors and requires a balanced approach to environmental preservation and poverty reduction.

**Poverty and Land Degradation:** Land degradation, which includes soil and water degradation, affects ecosystems and contributes to climate change. Poor agricultural practices and overexploitation of resources by impoverished communities exacerbate land degradation. Management options include:

- **Soil Management:** Techniques to manage soil runoff, pH, salinization, and compaction.
- **Vegetation Management:** Preventing overgrazing, improving cropland management, and maintaining tree cover.
- **Water Management:** Preventing over-extraction and managing flooding.
- **Integrated Options:** Addressing biodiversity loss, pollution, and other factors.

**Poverty and Deforestation:** Deforestation is driven by both poor and rich individuals. The impacts of deforestation vary depending on the motives behind it and its effects on forest goods and services. Strategies to balance forest preservation with poverty reduction include:

1. **Strengthening Forest Rights:** Empowering marginalized groups and promoting sustainable forestry.
2. **Integrating Forests into Economic Strategies:** Improving governance and encouraging investments in forest products.
3. **Protecting Environmental Values:** Establishing protected areas and promoting international environmental services.

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## Environmental Degradation

### Types of Environmental Degradation:

- **Soil Degradation:** Results from poor farming practices and excessive use of chemicals.
- **Water Degradation:** Caused by pollution from waste and industrial activities.

- **Atmospheric Degradation:** Includes air pollution and ozone layer depletion.
- **Other Pollutions:** Noise and light pollution.

#### **Causes of Environmental Degradation:**

- **Land Disturbance:** Damage to land due to human activities.
- **Pollution:** Contamination of air, water, and soil.
- **Overpopulation:** Increased demand for resources leads to overuse and pollution.
- **Landfills:** Waste disposal leading to soil and water contamination.
- **Deforestation:** Loss of forests affecting soil fertility and contributing to flooding.

#### **Effects of Environmental Degradation:**

- **Human Health:** Air pollution can lead to respiratory issues.
- **Biodiversity Loss:** Degradation causes loss of species.
- **Ozone Layer Depletion:** Reduces protection from harmful UV rays.
- **Atmospheric Changes:** Disrupts natural processes like the water cycle.
- **Scarcity of Resources:** Leads to shortages of arable land, water, and food crops.
- **Food Shortages:** Contributes to long-term food scarcity and famine.

### **6.3.2 Sustainable Development as a solution to Environment Degradation**

**Environmental Degradation:** Environmental degradation is a critical challenge in sustainable development. It refers to the deterioration of the environment through processes such as deforestation, pollution, and habitat destruction. Effective environmental protection strategies include:

- **Stopping Deforestation:** Preventing the loss of forests which are crucial for biodiversity and climate regulation.
- **Government Regulation:** Implementing policies and laws to control pollution and manage natural resources.
- **Controlling Illegal Dumping:** Preventing the improper disposal of waste that contaminates land and water.
- **Recycling and Reducing Waste:** Minimizing waste through recycling and reducing consumption of single-use items.
- **Avoiding Plastic Waste:** Reducing the use of plastics that contribute to pollution and environmental harm.
- **Environmental Education:** Raising awareness about environmental issues and encouraging responsible behavior.

**Adapting for Sustainability:** Adapting to environmental changes is essential for sustainability. This involves:

- **Self-Reliance and Flexibility:** Communities in variable environments often rely on diverse and flexible methods to manage resources.
- **Diverse Crop Varieties and Systems:** Using a variety of crops and cropping systems to enhance resilience and productivity.
- **Integrated Management:** Combining crop and livestock management for more efficient and sustainable agricultural practices.

Sustainable development principles focus on:

- **Conserving Vitality and Diversity:** Protecting the earth's ecosystems and species.
- **Improving Quality of Life:** Enhancing human well-being while maintaining environmental health.
- **Reducing Resource Depletion:** Minimizing the use of non-renewable resources.
- **Encouraging Eco-Friendly Behavior:** Promoting practices that are beneficial to the environment.

**Persistent Environmental Changes:** These changes include:

- **Habitat Loss:** Alteration of landscapes through human activities and natural processes, leading to reduced biodiversity.
- **Agricultural Intensification:** Increased farming activities causing carbon stock reductions, soil nutrient loss, and decreased ecosystem variety.
- **Spread of Invasive Species:** The proliferation of non-native species due to climate change and other factors, affecting ecosystems on land and water.

In **less developed countries**, poverty exacerbates environmental degradation as impoverished communities overuse natural resources, worsening their situation and environmental conditions. Addressing this issue requires balancing environmental preservation with poverty reduction to achieve long-term sustainability.

**Key Points for Sustainable Development:**

1. **Preserve Earth's Vitality:** Maintain ecological balance and biodiversity.
2. **Promote Human Well-Being:** Ensure that development efforts improve the quality of life.
3. **Limit Resource Depletion:** Use resources responsibly and sustainably.

4. **Encourage Eco-Friendly Practices:** Adopt behaviors that protect and sustain the environment.

Understanding and addressing these issues are crucial for achieving sustainable development and ensuring a healthy environment for future generations.