

# DP IB Environmental Systems & Societies (ESS): HL



## 3.3 Conservation & Regeneration

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Your notes

## Preserving Biodiversity

# Preserving Biodiversity

- There are many reasons for maintaining and preserving biodiversity, including:
  - Aesthetic reasons
  - Ecological reasons
  - Economic reasons
  - Ethical reasons
  - Social reasons

## Aesthetic reasons

- Humans find great joy and pleasure in the beauty of nature
  - It provides inspiration for human creativity, including photography, poetry, music and art
  - There is a strong argument for preserving biodiversity because of its aesthetic benefits

## Ecological reasons

- Species and habitats contribute to vital ecological **processes** and **services**
  - E.g. pollination, water purification, climate regulation and maintaining soil fertility
- Biodiversity has a major effect on the **stability** and **resilience** of an ecosystem
  - A more diverse ecosystem is better able to recover from disturbances and adapt to environmental changes or threats
- For example, if the temperature of a species-rich lake rises due to global warming:
  - Some species of fish in the ecosystem are unable to cope with the change while others can or may be able to adapt
  - The fish that are able to cope or adapt will survive, reproduce and keep contributing to the ecosystem, allowing the ecosystem to continue to function
- Within communities, there are **keystone species** that have a larger impact on the ecosystem than others
  - When these species are lost there are **knock-on effects**
  - Bush elephants in the African savannah are a keystone species

- They graze in a very extreme way, knocking over and eating several species of tree
- This destruction of vegetation actually helps to maintain the ecosystem by preventing any one plant species from dominating, creating habitats for other species and increasing biodiversity
- Elephant dung also provides a habitat for many important fungi and insect species
- In cases where elephants have been illegally poached for their ivory and their numbers greatly reduced, ecologists have observed major negative impacts on the savannah ecosystem



Your notes

## Economic reasons

- **Ecotourism** is a major source of income for many countries
  - Natural areas attract tourists, generating **revenue** for local economies and providing **jobs**
    - E.g. many tourists travel to and spend money in National parks so they can see wildlife
- **Natural capital:**
  - Natural ecosystems provide resources like timber, fish and clean water
  - Maintaining these resources supports long-term economic prosperity
- **Genetic resources:**
  - Wild species are sources of genes for **crop improvement, medicine, and biotechnology**
  - Preserving this genetic diversity could be essential for future innovations and food security
- Many of the **medicines** used today have originated from plants, fungi and bacteria
  - For example, the cancer-fighting drug paclitaxel is sourced from Pacific and Himalayan Yew Trees
    - The Himalayan Yew has declined in numbers due to over-harvesting for fuel and medicine
  - Due to the large number of drugs that have already been sourced from nature it is reasonable to assume that there are many other drugs still to be found in nature that could be used in the future



Your notes



*The pacific yew tree is a source of anti-cancer drugs (Jason Hollinger, Wikimedia Commons, CC BY 4.0 DEED)*



Your notes

## Ethical reasons

- Many people believe that species and habitats have **intrinsic value** (i.e. they have inherent worth, independent of their usefulness to humans)
- Many believe that humans have a **moral obligation** to prevent the loss of biodiversity that results from human activities
  - Humans share the planet with millions of other species and many people hold the view that they have **no right** to cause the extinction of other species
  - As humans are the most intelligent, dominant and powerful species on the planet, many believe that it is our **responsibility** to protect and value all organisms on Earth
  - Many believe that is also our ethical obligation to preserve nature for **future generations**

## Social reasons

- Many people enjoy spending time in the natural environment
  - There are many activities that people can do together in nature, e.g. birdwatching, walking, climbing
  - Access to natural spaces improves **mental** and **physical health**
  - Such environments may be lost if their biodiversity is not conserved, resulting in the loss of the social benefits that they can bring



Your notes



*Many people enjoy spending time in the natural environment doing activities such as bird watching*



### Examiner Tips and Tricks

Make sure you are clear on how aesthetic, ecological, economic, ethical, and social justifications for preserving biodiversity **differ** from each other, as well as how they **interrelate**.

For your exams, be ready to provide a few examples for each type of justification.



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## Conservation Strategies

# Conservation Strategies

- Conservation strategies are methods used to protect and preserve biodiversity
  - These strategies can be divided into:
    - Species-based** conservation
    - Habitat-based** conservation
    - Mixed** approaches

## Species-based conservation

- Species-based conservation focuses on protecting individual species, especially those that are endangered
- This often involves **ex situ** strategies
  - This means conservation actions are taken **outside the natural habitat** of the species

## Ex situ strategies

- Botanic gardens:**
  - Botanic gardens are specially designed areas where a wide variety of plants are grown for scientific, educational and ornamental purposes
  - Botanic gardens cultivate and maintain plant species outside their natural habitats
  - They provide a safe environment for endangered plants and facilitate research and education.
    - For example, Kew Gardens in London holds over 30 000 different plant species.
- Zoos:**
  - Zoos keep and breed animals in captivity, often focusing on endangered species
  - They play a role in **education**, **research** and **breeding programmes** to reintroduce species into the wild
    - Captive breeding** is the process of breeding animals in controlled environments, such as zoos, aquariums, or wildlife sanctuaries
    - These programmes are often used to help **restore populations** of endangered species that have declined in the wild



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- For example, the San Diego Zoo in the United States runs breeding programmes for species like the California Condor
- Zoos also play a role in conservation by **raising public awareness** and funding other conservation efforts
- **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES):**
  - CITES is an international agreement that aims to ensure that international trade in wild animals and plants does not threaten their survival
  - It regulates and monitors the trade of endangered species through a licensing system
    - For example, CITES has helped to protect many species, including elephants, rhinos and tigers
- **Seed banks:**
  - Seed banks are places where seeds of different plant species are stored to **preserve genetic diversity**
  - They act as a backup against the loss of plants in their natural habitats
    - For example, the Svalbard Global Seed Vault in Norway holds seeds from all around the world

## Habitat-based conservation

- Habitat-based conservation focuses on protecting and restoring habitats to support the species that live there
- This often involves *in situ* strategies
  - This means conservation actions are taken **within the natural habitat** of the species

## In situ measures

- **National parks:**
  - National parks protect large areas of natural habitat, preserving the ecosystems and species within them
  - They also provide opportunities for **research, tourism** and **education**
    - For example, Yellowstone National Park in the USA protects a variety of ecosystems and species, including grizzly bears and wolves
- **Reserves and sanctuaries:**
  - Wildlife reserves and sanctuaries are areas set aside for the protection of particular species and their habitats
  - They often involve community participation and sustainable use of resources



- For example, the Maasai Mara National Reserve in Kenya protects a range of species including lions, elephants and wildebeest

## Mixed conservation approach

- A mixed conservation approach **combines** species-based and habitat-based strategies
- This approach often focuses on **flagship** or **keystone species** to justify the conservation of **entire ecosystems**

## Flagship species



*The mountain gorilla is an example of a flagship species (photo by Paula Robinson on Unsplash)*

- Flagship species are **charismatic** species that are well-known and popular with the public, such as elephants, pandas or tigers
- They can be used as symbols for conservation efforts and can help to raise **awareness** and **support** for conservation efforts



Your notes

- By protecting charismatic species, their habitats and other species in the same ecosystem may also be protected
  - An example of a flagship species is the mountain gorilla (*Gorilla beringei beringei*)
  - These primates are found in the Virunga Mountains, which span Rwanda, Uganda, and the Democratic Republic of Congo
  - The mountain gorilla population has faced threats from habitat destruction, poaching, and human conflict
  - By focusing on the conservation of mountain gorillas and their habitat, conservation organisations have been able to protect not only this species but also the many other plants and animals that share their ecosystem

## Keystone species



Your notes



Your notes



*Sea otters are a keystone species (photo by mana5280 on Unsplash)*

- Keystone species are species that have a **disproportionate effect** on the **structure** and **function** of their ecosystem.
- Their removal can cause **significant changes** in the ecosystem, including the loss of other species
- By protecting keystone species, the integrity of the ecosystem can be maintained, which can in turn benefit other species in the ecosystem

- For example, the sea otter is a keystone species in the kelp forest ecosystem in the Pacific Northwest of the United States
- It feeds on sea urchins
- This helps to control the population of sea urchins, which are herbivores that can significantly damage the kelp forests



Your notes



## Case Study

### Chengdu Research Base of Giant Panda Breeding

- The Chengdu Research Base of Giant Panda Breeding in China is a good example of a mixed conservation approach, combining species-based and habitat-based strategies to protect the giant panda

#### Objectives and strategies:

- **Captive breeding:** running a breeding program to increase the giant panda population.
- **Habitat restoration:** restoring and expanding bamboo forests, the natural habitat of giant pandas
- **Public education and awareness:** educating the public through tours, programs and exhibits to generate support for conservation
- **Research and collaboration:** conducting research on panda biology and collaborating with international organisations

#### Facilities:

- **Breeding centres:** areas for breeding and raising panda cubs
- **Veterinary hospital:** provides medical care for pandas
- **Enclosures and habitats:** naturalistic spaces for pandas to live and play
- **Research laboratories:** equipped for scientific research on panda conservation

#### Achievements:

- **Increased panda population:** successful breeding programs have raised the number of giant pandas
- **Genetic diversity:** genetic diversity have been maintained through careful breeding
- **Habitat protection:** has played a key role in restoring and protecting panda habitats
- **Wider ecosystem and species conservation:** by focusing on this flagship species, the base has also helped to protect the broader ecosystem and other species within it



## Examiner Tips and Tricks

Make sure you know the definitions of the terms **ex situ** and **in situ** in the context of conservation strategies.

Be prepared to give examples of both the types of strategies.



Your notes

## Convention on Biological Diversity

- The Convention on Biological Diversity (CBD) is a **United Nations treaty** aimed at promoting **sustainable development** and **conserving biodiversity**
  - It was signed at the Earth Summit in Rio de Janeiro in Brazil in 1992



## Convention on Biological Diversity

- **Objectives:**
  - The conservation of biodiversity by use of a variety of different conservation methods
  - The sustainable use of biological resources
  - Identify and protect marine areas beyond national jurisdictions
- **Nagoya Protocol:**
  - The CBD also includes the Nagoya Protocol, which is the part that ensures fair sharing of benefits arising from the use of **genetic resources**
- The countries that signed the convention agreed to:
  - Design and implement national strategies for the conservation and sustainable use of biodiversity
  - Organise international cooperation and further international meetings



Your notes

## Habitat Management & Designing Protected Areas

### Habitat Management

- Habitat conservation strategies aim to protect species by preserving and managing their natural environments
  - This may involve the **protection of wild areas** or **active management**
- These strategies are crucial for maintaining biodiversity and ensuring the survival of various species

### Protection of wild areas

- Protecting wild areas involves:
  - Setting aside land that is left in its **natural state**
  - Ensuring this land remains **free from significant human interference**
- This helps to maintain the habitat necessary for the survival of many species, allowing ecosystems to **function naturally**
  - For example, large areas of the Amazon Rainforest are protected to preserve the rich biodiversity found there

### Active management

- Active management refers to human intervention to **maintain** or **restore habitats** to a desired condition
- Methods include:
  - **Controlled burning**: this can be used to manage grasslands and forests, promoting the growth of desired plant species
  - **Reforestation**: planting trees to restore deforested areas
  - **Invasive species control**: removing non-native species that threaten local biodiversity



#### Case Study

##### Active management in the Norfolk Broads, UK

- **Location**: Norfolk, England
- **Habitat type**: wetlands, including rivers, broads (shallow lakes), fens and marshes



Your notes

- **Biodiversity:** the Norfolk Broads are home to a wide variety of wildlife, including some rare and endangered species of plants, birds and insects
  - E.g. bitterns, marsh harriers and swallowtail butterflies
- **Active management practices:**
  - **Water level control:** ensuring the water levels remain suitable for the wetland plants and animals
    - Sluices and pumps are used to manage water levels, preventing areas from becoming too dry or too flooded
  - **Reed cutting:** preventing the wetlands from becoming overgrown and maintaining open water areas
    - These open water areas are essential for certain species
  - **Wildlife monitoring:** regular surveys to monitor species populations
    - Removal of non-native species that could dominate and alter the ecosystem
- **Surrounding land use:** mainly agricultural land, which requires careful management to prevent pollution (e.g. via nutrient runoff) and ensure sustainable water use



## Case Study

### Ecosanctuary with pest-exclusion fencing: Zealandia, New Zealand

- **Location:** Wellington, New Zealand
- **Habitat type:** forest and scrubland
- **Conservation strategies:**
  - **Pest-exclusion fencing:** a predator-proof fence encircles the sanctuary to keep out invasive species like rats, stoats and possums
    - These are major threats to New Zealand's native species
  - **Reintroduction of native species:** species such as the little spotted kiwi and tuatara have been reintroduced to the area
    - These reintroduction efforts have helped boost populations of species that had declined drastically due to predation by invasive species
- **Surrounding land use:** the sanctuary is located near urban areas but is isolated by the fence, creating a safe habitat for native wildlife

# Factors in Conservation Area Design

## Surrounding Land Use

- **Agricultural Areas:** Risk of pollution and habitat fragmentation.
- **Urban Areas:** Higher risk of human disturbance and invasive species but can provide education and recreation opportunities.



Your notes

## Distance from Urban Centres

- **Close Proximity:** Easier for public access and educational purposes but higher pressure from human activities.
- **Remote Locations:** Reduced human disturbance but harder to manage and access.

## Factors in Conservation Area Design

- Effective conservation of biodiversity in conservation areas depends on:
  - A detailed understanding of the **biology** of the **target species**
  - The **size** and **shape** of the conservation area
- These factors help ensure that the ecosystem or habitat:
  - Meets the needs of the species
  - Maintains ecological processes

## Biology of target species

- **Habitat requirements:** understanding what specific conditions the species needs to thrive, such as food, water, shelter and breeding sites
- **Home range:** knowing the area size that individual animals or groups need to roam and find resources
- **Life cycle:** understanding the different life stages of the species and their varying habitat requirements
- **Threats:** identifying natural and human threats to the species, such as predation, disease, habitat destruction and climate change

## Size and shape of conservation areas

- Factors that need to be considered when designing protected areas include:
  - Size
  - Shape
  - Edge effects
  - Corridors



- Proximity to potential human influence

### Protected Area Design Factors



Your notes

Criteria for designing protected area	Explanation
<b>Size</b>	<p>Larger areas can support <b>more species</b>, have <b>larger populations</b> and provide a <b>greater range of habitats</b></p> <p>The size should be large enough to maintain viable populations of target species</p>
<b>Shape</b>	<p>The shape of a protected area can affect its biodiversity by influencing the distribution of habitats and the <b>movement of organisms</b></p> <p>A complex shape can <b>increase edge effects</b>, while a simple shape may not provide enough habitat variety</p> <p>Irregular shapes that follow natural features like rivers and ridges can provide <b>better connectivity</b> and help ecological processes</p>
<b>Edge effects</b>	<p>Edge effects refer to the <b>changes</b> that occur at the <b>boundary</b> between two different habitats or land-use types, e.g. at the boundary of a protected area</p> <p>Protected areas with high edge-to-area ratios can have negative effects on biodiversity due to increased exposure to <b>human disturbances</b>, <b>invasive species</b> and <b>variable microclimates</b></p> <p>Minimising edge effects can be achieved by creating protected areas with <b>simple shapes</b> or using <b>buffer zones</b> around the edges</p>
<b>Corridors</b>	<p>Corridors are narrow strips of land that <b>connect</b> otherwise <b>isolated areas</b> of habitat</p> <p>They can facilitate the movement of organisms and allow for gene flow between populations</p> <p>Corridors can also provide <b>additional habitat</b> and <b>increase the effective size</b> of a protected area</p> <p>The effectiveness of corridors depends on their width, length and the surrounding land use</p>
<b>Proximity to potential human</b>	<p>Human activities can have negative impacts on biodiversity</p>

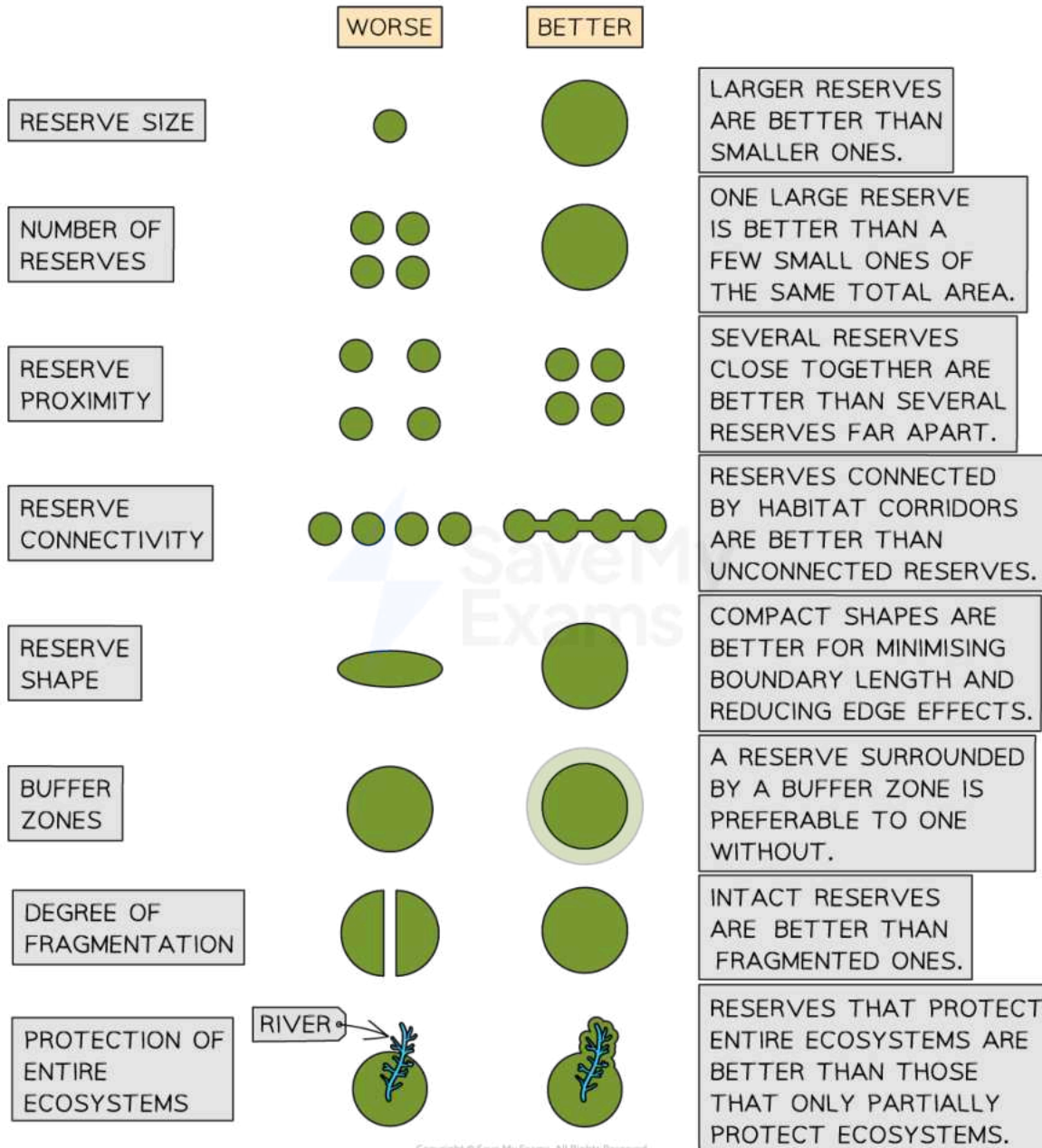


Your notes

**influence**

Protected areas that are close to human settlements or infrastructure may be subject to **habitat destruction, pollution** and **hunting**

It is important to balance the need for accessibility and the potential for human impact when designing protected areas



*There are many factors to consider when designing protected areas in order to make them more effective for the conservation of habitats and species*



Your notes

## Surrounding land use

- **Agricultural land:** risk of pollution (e.g. via nutrient runoff), habitat fragmentation and human-wildlife conflicts
- **Urban areas:** higher risk of human disturbance and spread of invasive species, but can provide education and recreational opportunities
- **Industrial areas:** potential pollution and habitat destruction

## Distance from urban centres

- **Close proximity:** easier access for management and public education, but higher human pressure and disturbance
- **Remote locations:** less human disturbance, better preservation of natural states, but harder for conservation workers to access and manage



### Case Study

#### UNESCO Biosphere Reserve: The Great Barrier Reef, Australia

- **Location:** northeast coast of Australia
- **Biodiversity:** over 1 500 species of fish, 411 types of hard coral and various marine mammals, birds and reptiles
- **International conservation importance:** internationally recognised for its biodiversity and as a critical habitat for many endangered species

#### Conservation zoning

- **Core area:**
  - Pristine coral reefs with minimal to no human activity allowed
  - Critical for the protection of the most vulnerable species
- **Buffer zones:**
  - Areas surrounding the core where limited and regulated activities are allowed
  - E.g. sustainable fishing and sustainable tourism
- **Transition zones:**
  - Outer areas where sustainable resource use and human activities are encouraged
  - Conservation occurs alongside economic activities

#### Human impacts and management strategies

- **Climate change:**

- Coral bleaching is due to rising sea temperatures
- Strategies include monitoring and researching resilient coral species
- **Pollution:**
  - Runoff from agriculture causes nutrient loading
  - Management includes reducing agricultural runoff through better farming practices
- **Overfishing:**
  - Regulations on fishing practices
  - Quotas to ensure sustainable fish populations
- **Tourism:**
  - Managing tourist numbers and activities to reduce impact on the reef



Your notes



### Examiner Tips and Tricks

Make sure you have a clear understanding of edge effects and how they can be affected by the size and shape of a protected area, or by the presence of a buffer zone.

Some protected areas use a core/buffer/transition zone model to ensure edge effects are minimised and the most important or vulnerable species are protected.



Your notes

## Rewilding

# Rewilding

- **Human activities** such as deforestation and overharvesting of resources can **disrupt, damage** and **destabilise ecosystems**
- Conservation efforts at the ecosystem level aim to restore ecosystem stability by **restoring natural ecosystem processes**
  - These processes may include:
    - Predator-prey relationships
    - Seed dispersal
    - Nutrient cycling
- This type of ecosystem restoration project is also known as **rewilding**
- Restoration strategies may involve:
  1. **Species reintroduction**
    - Reintroduction of apex predators will reduce herbivore populations and allow the restoration of habitat vegetation
    - This may boost the diversity of plant species
    - This, in turn, **enhances total biodiversity**
      - For example, wolves were reintroduced to Yellowstone National Park, USA
      - The wolves help to control deer populations
      - This has allowed certain types of vegetation to recover
    - Reintroducing keystone species can improve the structure of an ecosystem
      - For example, beavers have been reintroduced to parts of the UK
      - Beavers build dams
      - These dams create large wetland areas that support diverse wildlife
  2. **Improving habitat connectivity**
    - This involves connecting **fragmented** habitats to allow free movement of species

- Creating **wildlife corridors**, such as hedgerows on farmland, connects small pockets of habitat
- This allows wildlife to roam over larger areas, **increasing the resources available**
- This allows larger population sizes to establish

### 3. Stopping agriculture

- Allowing land previously used for farming to return to its **natural state**
  - For example, the **Knepp Estate** in England has been rewilded
  - This former farmland now supports wild ponies, pigs and longhorn cattle
  - These species **promote biodiversity** by disturbing soils, dispersing seeds and grazing on vegetation, so no single plant species dominates

### 4. Limiting human influence

- This may involve **preventing the harvesting of resources**, e.g. by logging or fishing
- **Ecological management techniques**, e.g. controlled grazing or burning, may be used to restore a habitat
- The aim is to minimise direct human management and let ecosystems self-regulate as much as possible



Your notes



## Case Study

### Restoration of Hinewai Reserve, New Zealand

- Location: Banks Peninsula, New Zealand
- Hinewai Reserve was once farmland but is now privately owned, with the aim of **restoring the natural ecosystem** of the area
- Some initial human intervention was involved, e.g. the **removal of non-native species**
- The area is now managed with **minimal human intervention** to allow native **communities** to be restored by **succession**
- Human activities are limited in the area, though the public can enjoy walking in the Reserve
- Successes:
  - Rapid regrowth of native bush
  - Increase in native bird populations
  - Effective control of invasive species



Your notes



*Hinewai Reserve in New Zealand is considered to be an example of successful rewilding (CC BY-SA 4.0, via Wikimedia Commons)*



### Examiner Tips and Tricks

Make sure you understand and can define key terms like **rewilding**, **apex predators**, **keystone species**, and **habitat connectivity**. You should also learn one or two examples of successful rewilding projects

## Biodiversity Planetary Boundary



Your notes

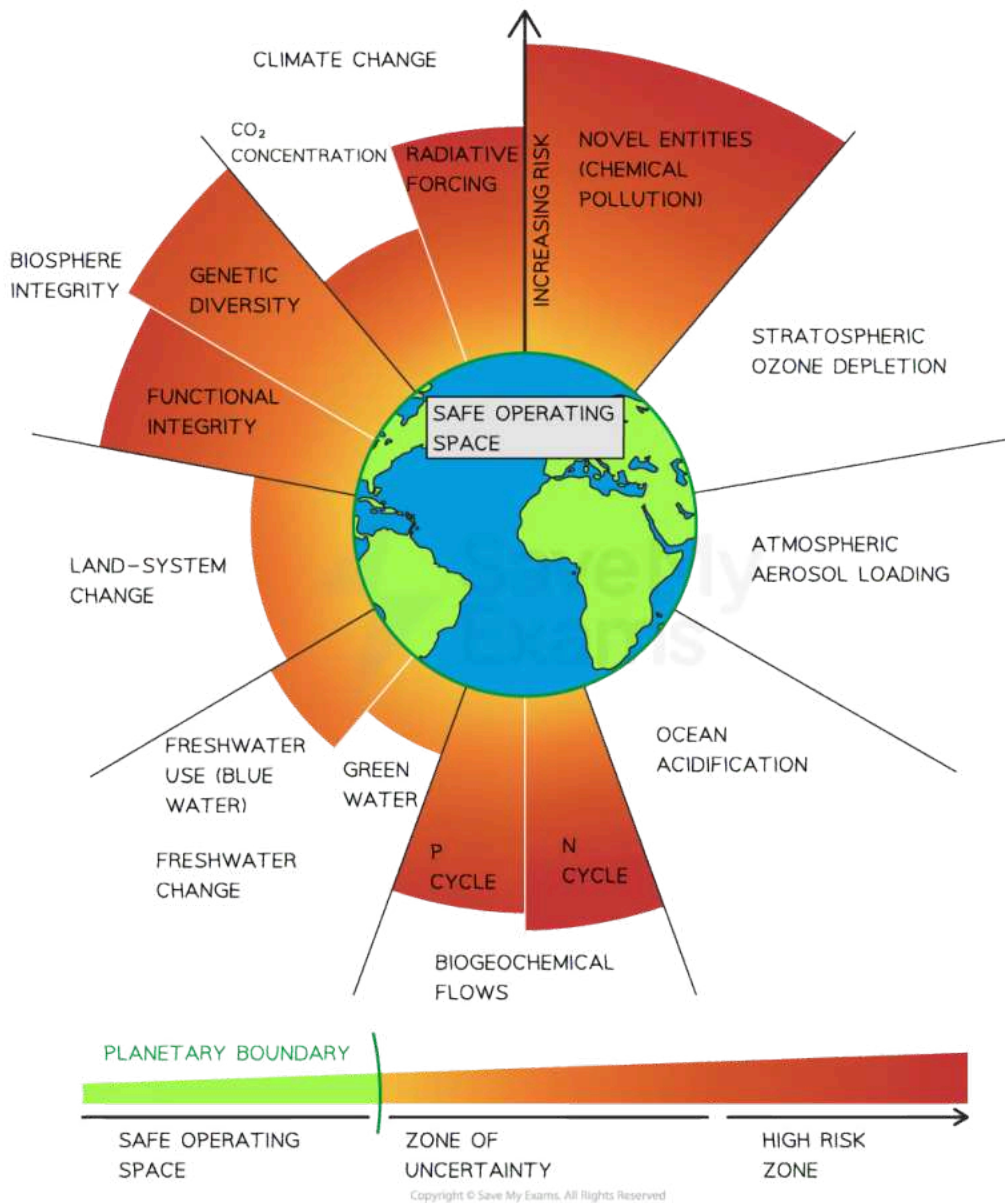
# Biodiversity Planetary Boundary

- The planetary boundaries model outlines nine critical processes and systems that have regulated the stability and resilience of the Earth system during the Holocene epoch
  - The model identifies the level of human disturbance on certain fundamental **ecological processes** and systems
  - It aims to highlight where action is needed in order to avoid **abrupt** and **irreversible changes**





Your notes



**Planetary Boundaries Model—the biodiversity boundary is often referred to as biosphere integrity**

- The biodiversity planetary boundary refers to the **limits** within which humanity can **safely operate** to maintain the Earth's biodiversity
  - The boundary is often referred to as biosphere integrity
  - Protecting biosphere integrity means preventing the loss of **species** (and therefore **genetic diversity**) and the loss of **ecosystem functioning**

- This is important as biodiversity loss can have significant negative impacts on human life and the planet's health

## Current state of the biodiversity planetary boundary

- Biodiversity loss is occurring at an **alarming rate** due to human activities such as deforestation, pollution and overfishing, as well as human-induced climate change
  - Scientists estimate that we have **already crossed** the biodiversity planetary boundary
  - This means the current rate of species extinction is **higher** than the **safe limit**
- **Conservation** and **ecosystem regeneration** measures can be used to reverse this decline in biodiversity
  - The aim is to move back towards a safe operating space for humanity within the biodiversity planetary boundary
- In order for this to be achieved, these measures will need to be implemented at all levels, including:
  1. **Individual behaviours**, e.g.
    - Reduce, reuse, recycle
    - Sustainable consumption
  2. **Collective actions**, e.g.
    - Local conservation projects, such as tree planting or habitat restoration,
    - Increase understanding of biodiversity issues within communities through workshops and educational programmes
  3. **National measures**, e.g.
    - Establish national parks and wildlife reserves
    - Enforce laws that prevent illegal logging, poaching and trade in endangered species
    - Providing financial incentives for businesses and farmers to adopt environmentally friendly practices
  4. **International efforts**, e.g.
    - Participate in international treaties and agreements, such as the Convention on Biological Diversity (CBD)
    - Contribute to international funds that support biodiversity projects in developing countries
    - Sharing scientific knowledge and technologies across borders to enhance conservation efforts



Your notes



Your notes

## Conservation Perspectives

# Conservation Perspectives

## Impact of environmental perspectives and value systems

- Environmental perspectives and **value systems influence** the choice of conservation strategies
  - Ecocentric perspectives:**
    - Focus on the intrinsic value of biodiversity
    - Prioritise **low-intervention in situ** strategies
    - This refers to conservation strategies that involve **minimal human interference** and are implemented **within** the natural habitats or ecosystems where species live
    - Example: setting aside large areas of land as wilderness reserves or national parks, such as the Cairngorms National Park in Scotland (UK)
  - Anthropocentric/technocentric perspectives:**
    - Focus on the **economic** and **societal value** of biodiversity
    - Encourage scientific interventions, zoos, gene banks and ecotourism
    - Example: conservation breeding programme for European bison at the Highland Wildlife Park in Scotland (UK)

## Factors influencing conservation success

- The success of conservation and regeneration measures depends on:
  - Community support:**
    - Engaging local communities in conservation efforts
    - Getting volunteers to help complete projects
    - Example: Snowdonia National Park Authority has a successful partnership with local farmers in Wales (UK) to manage and conserve the upland landscapes of Snowdonia National Park (known as Eryri)
  - Adequate funding:**
    - Securing financial resources for conservation projects
    - Example: the National Lottery Heritage Fund supports biodiversity conservation projects across the UK



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- **Education and awareness:**
  - Raising public awareness about conservation issues
  - Example: millions of people watched the BBC's Blue Planet II documentary series, which highlighted the effects of plastic pollution on marine ecosystems
- **Appropriate legislation:**
  - Implementing laws and regulations to protect biodiversity
  - Example: the Wildlife and Countryside Act 1981 in the UK provides legal protection to endangered species and habitats
- **Scientific research:**
  - Informing conservation decisions through scientific knowledge.
  - Example: the British Trust for Ornithology (BTO) conducts extensive research on bird populations to guide conservation efforts

## Environmental justice considerations

- It is also important to consider issues of environmental justice in conservation efforts
- Conservation efforts should try to ensure that different social groups receive a **fair share** of conservation **benefits** and **burdens**
  - For example, the Marine Conservation Zones (MCZs) in the UK are established to protect marine habitats and species while also considering the livelihoods of local communities
  - Stakeholders, including fishermen, conservationists and local residents, are involved in the decision-making process to balance ecological protection with economic and social needs
  - This collaborative approach helps ensure that the benefits of conservation, such as improved fish stocks and healthier ecosystems, are shared among different social groups
  - At the same time, the potential burdens to certain groups, like restrictions on fishing, are fairly managed



### Examiner Tips and Tricks

Remember that the success of most conservation efforts depends on a combination of the factors outlined above, including community engagement, funding, education, legislation, and scientific research.

Be prepared to evaluate conservation strategies from these different viewpoints, as well as consider whether environmental justice is also being taken into account.



Your notes



Your notes

## Conservation Organisations (HL)

# Conservation Organisations

## International, governmental and non-governmental organisations

- Environmental intergovernmental organisations (IGOs) and non-governmental organisations (NGOs) are organisations that focus on promoting **environmental protection** and **conservation efforts** around the world

### IGOs



- Environmental IGOs are intergovernmental bodies established by states with the aim of promoting environmental protection and conservation efforts on a global scale
  - These organisations are usually composed of **member states** and operate within the framework of **international law**
- Examples include:
  - United Nations Environment Programme (UNEP)**
    - The UNEP is a leading global environmental authority that provides leadership and encourages partnerships in caring for the environment
  - Intergovernmental Panel on Climate Change (IPCC)**
    - The IPCC is a scientific body under the United Nations that assesses the science related to climate change, its impacts, and potential future risks
  - World Conservation Monitoring Centre (WCMC)**
    - The WCMC provides information services on the conservation and sustainable use of species and ecosystems, and supports others in the development of their own information

management systems

## NGOs



Your notes

**GREENPEACE**



The Nature Conservancy 

- Environmental NGOs are non-profit organisations that are **independent of any government** and focus on promoting environmental protection and conservation efforts
  - These organisations work to **raise awareness, lobby governments and businesses**, and often carry out practical projects **in the field** (i.e. at the local level) to protect the environment
- Examples include:
  - Greenpeace**
    - Greenpeace is an international environmental organisation that campaigns on various environmental issues such as climate change, deforestation, overfishing, and nuclear power
  - World Wild Fund for Nature (WWF)**
    - WWF is an international conservation organisation that aims to conserve nature and reduce the most pressing threats to the diversity of life on Earth
  - The Nature Conservancy (TNC)**
    - TNC is a non-profit environmental organisation that works to protect ecologically important lands and waters for nature and people
    - TNC's work spans across 70 countries and all 50 states in the United States

## Comparing Environmental IGOs and NGOs

- IGOs and NGOs both play an important role in conserving and restoring ecosystems and biodiversity
  - IGOs such as the United Nations (UN) and its various specialised agencies, such as the United Nations Environment Programme (UNEP) and the Food and Agriculture Organisation (FAO), have a global reach and can influence conservation efforts on a large scale

- NGOs, on the other hand, are often more focused on specific issues and are able to respond quickly to emerging threats to biodiversity
- The **effectiveness** of IGOs and NGOs in conservation and restoration efforts can vary due to a number of factors, including:
  - Use of media
  - Speed of response
  - Diplomatic constraints
  - Financial resources
  - Political influence
  - Enforceability



Your notes

### Comparing IGOs and NGOs

Factor	Environmental IGOs	Environmental NGOs
Use of media	IGOs often have a larger traditional media presence (e.g. the news, TV & radio and press releases) due to their size and resources. They can use the media to disseminate information and raise awareness about environmental issues, e.g. by reading written statements.	NGOs are often more successful in using media to promote their causes, as they are more nimble and able to respond quickly to emerging issues. They often rely heavily on social and digital media to disseminate information and raise awareness about environmental issues. They may use traditional media less frequently due to limited resources.
Speed of response	IGOs may be slower to respond to environmental issues due to bureaucratic processes and decision-making. However, they often have the resources and capacity to launch large-scale responses once decisions are made.	NGOs can respond quickly to environmental issues due to their flexible structures and ability to mobilise resources quickly. However, their response may be limited in scale and scope.
Diplomatic constraints	IGOs may be constrained by diplomatic considerations, particularly when dealing with issues that involve multiple countries or political sensitivities.	NGOs are generally not constrained by diplomatic considerations and may be more able to take controversial or unpopular positions on environmental issues.





Your notes

Financial resources	IGOs often have greater financial resources than NGOs due to contributions from member countries and other sources.	NGOs often rely on donations and fundraising for their financial resources, which can be more limited.
Political influence	IGOs may have greater political influence due to the involvement of member countries and their ability to make decisions and set policies at an international level.	NGOs may have less political influence than IGOs, but they can often mobilise public opinion and pressure decision-makers to take action.
Enforceability	IGOs can develop and enforce international laws and agreements, but enforcement can be limited by the willingness of member countries to comply.	NGOs do not have the authority to enforce laws or agreements but can advocate for their implementation and monitor compliance.



Your notes

## Rewilding & Habitat Restoration (HL)

# Rewilding & Habitat Restoration

## What is rewilding?

- Rewilding is a conservation method that involves:
  - Allowing habitats to return to their natural state
  - Reintroducing species that were previously driven out or became extinct in that area
  - Allowing ecosystems to self-regulate
  - Promoting natural processes such as predation, grazing, and habitat regeneration
  - Minimal human management

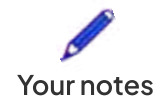
## What is habitat restoration?

- Habitat restoration aims to:
  - Repair and regenerate damaged ecosystems, often through human intervention and control
  - Bring back lost biodiversity and restore ecosystem functions
  - Use strategies such as replanting native species, removing invasive species, or rehabilitating degraded landscapes (e.g. polluted rivers or deforested areas)

## Positive feedback loops in rewilding and habitat restoration

- **Positive feedback loops** refer to a process where the results of an action amplify that action over time
  - In conservation, some positive feedback loops can lead to enhanced ecosystem recovery
- Rewilding and habitat restoration can trigger positive feedback loops that:
  - **Enhance biodiversity:** For example, when predators are reintroduced (e.g. wolves in Yellowstone National Park), they control herbivore populations, allowing vegetation to recover and creating valuable habitats for other species
  - **Promote ecosystem equilibrium:** The recovery of ecosystems through natural processes leads to healthier, more balanced ecosystems where species interact naturally
- Examples of positive feedback:
  - **Increased growth and biomass:** As vegetation recovers, it supports herbivores and pollinators, which in turn feed predators

- This sustains the ecosystem
- **Enhanced reproduction and survival:** A restored habitat can increase the survival rates of species, which then leads to more reproduction
- This further stabilises food webs



## Benefits and limitations of rewilding

### Benefits of rewilding

- **Restores biodiversity:** Rewilding brings back species that play important roles in ecosystems, leading to healthier environments
- **Improves ecosystem services:** Rewilded areas can provide important services (that are also beneficial to human societies) like carbon sequestration, flood prevention, and water purification
- **Promotes sustainable ecotourism:** Rewilded areas often become destinations for wildlife enthusiasts, providing economic opportunities to local communities

### Limitations of rewilding

- **Land-use conflict:** There is often competition between using land for **food production** and allocating it for rewilding, especially in countries where land is scarce and farming is vital for the economy
  - Balancing agriculture with conservation can be difficult, especially in densely populated or economically poor regions
- **Unintended consequences:** Sometimes reintroduced species may cause unforeseen effects on local ecosystems or human populations
  - For example, reintroduced predators may pose risks to livestock
- **Economic growth vs. conservation:** In some regions, governments prioritise economic activities (e.g., mining, logging) over conservation
  - This can stop large-scale rewilding projects from being undertaken

## Examples of rewilding projects

### Knepp Estate, England

- Knepp Estate is one of the most well-known rewilding projects in the UK, located in West Sussex
- Formerly an intensively farmed estate, Knepp turned to rewilding in 2001 when the land proved unproductive for conventional agriculture
- Instead of farming, the estate focused on allowing nature to take over, encouraging natural processes such as free-roaming grazing
- **Benefits:**



Your notes

- **Increased biodiversity:** The introduction of grazing animals like longhorn cattle, Tamworth pigs, and Exmoor ponies has transformed the landscape
  - This has led to the return of rare species like **nightingales**, **turtle doves**, and **purple emperor butterflies**
- **Natural ecosystem regeneration:** With less human intervention, the land has regenerated naturally, increasing the variety of habitats, including wetlands, scrublands, and woodlands
- **Carbon sequestration:** The increase in natural vegetation, especially woodlands, has helped sequester more carbon, contributing to climate change mitigation
- **Limitations:**
  - **Land-use conflict:** Some have questioned the rewilding approach in Knepp, particularly the decision to move away from farming
    - Given the pressure to use land for food production, this raises debates about balancing agriculture and conservation in the UK
  - **Economic viability:** Although the project has seen biodiversity benefits, it depends on ecotourism and government grants for financial sustainability
    - This raises questions about its long-term economic viability without external support

## Affric Highlands, Scotland

- The Affric Highlands project is one of Scotland's largest rewilding efforts, aiming to restore natural habitats across 500,000 acres
- It focuses on:
  - Reviving native forests and peatlands, important carbon sinks
  - Bringing back wildlife that was once common in the region
- **Benefits:**
  - **Restoration of native species:** Efforts are being made to reintroduce species like red squirrels, wildcats, and potentially lynx
    - These species play important roles in the ecosystem
  - **Ecosystem services:** Restoring peatlands and forests not only improves biodiversity but also provides important ecosystem services such as water purification, flood regulation, and carbon storage
  - **Cultural revival:** Local communities, especially in the Highlands, benefit from increased tourism and ecotourism opportunities
- **Limitations:**

- **Rewilding vs. rural development:** Some local communities are concerned that large-scale rewilding could impact agricultural activities or rural development
- **Reintroduction challenges:** Reintroducing top predators like the lynx faces opposition from farmers concerned about livestock predation

## Oostvaardersplassen, Netherlands

- Oostvaardersplassen is a unique rewilding project in the Netherlands, situated on reclaimed land that was originally planned for industrial development
- Instead, it became a nature reserve where large herbivores such as red deer, Konik horses, and Heck cattle were introduced to allow natural grazing to shape the landscape
- **Benefits:**
  - **Landscape restoration:** The introduction of these large grazers helped create a mosaic of habitats, including grasslands, wetlands, and scrub
    - This has allowed for the growth of various plant species and the return of birds like white-tailed eagles and spoonbills
  - **Natural processes:** The project demonstrated how rewilding could mimic natural processes without active human management
- **Limitations:**
  - **Harsh winters:** The reserve has faced criticism for its hands-off approach, particularly during harsh winters when many herbivores starved due to lack of food
    - This has led to debates about whether human intervention is needed in these extreme circumstances
  - **Management dilemmas:** The lack of predators to naturally control herbivore populations has resulted in overgrazing and population booms
    - This has raised questions about whether the ecosystem can remain self-sustaining

## Gorongosa National Park, Mozambique

- Early in the 2000s, Gorongosa National Park underwent a significant restoration effort after suffering decades of civil war
- Many species were driven to local extinction due to hunting and habitat destruction
- Since the restoration project began, efforts have been made to restore biodiversity and rebuild local ecosystems
- **Benefits:**



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- **Restocking of key species:** Iconic species like elephants, lions, hippos, and buffalo were reintroduced, helping to restore the park's ecosystem dynamics
  - This has created a more balanced food web and restored natural predator-prey interactions
- **Community involvement:** The park restoration has also brought significant benefits to local communities through job creation, ecotourism, and education programmes
  - The park is now seen as a symbol of Mozambique's recovery
- **Biodiversity recovery:** Gorongosa is becoming a biodiversity hotspot again
  - Research has shown an increase in both animal and plant species
- **Limitations:**
  - **Human-wildlife conflict:** As large predators and herbivores are reintroduced, there is potential for conflict with local communities, particularly farmers
    - Managing this balance is an ongoing challenge
  - **Funding dependency:** Long-term success depends on sustained funding and continued collaboration between government agencies, NGOs, and international partners to support both conservation work and local livelihoods



Your notes



Your notes

## Assessing Conservation Success (HL)

# Assessing Conservation Success

- Assessing the success of conservation or regeneration efforts ensures that the strategies used are **effectively protecting biodiversity** and achieving their goals
- Conservation measures must be **regularly evaluated** to determine their impact on the environment and local communities
- Success can be measured at different levels, including:
  - How well the project achieves its goals
  - Its acceptance by local communities
  - Whether it was the most effective method for conserving nature

## Evaluating claims of conservation success

- Conservation efforts are often **claimed** to protect biodiversity and restore ecosystems
- These claims must be **critically assessed**
  - For example, some projects may have positive environmental impacts but could **harm local communities** by limiting their access to natural resources
  - Other projects might benefit both the environment and communities, creating a balance between biodiversity conservation and human well-being

## Three levels of evaluating conservation success

### 1. Did the measures succeed as planned?

- This level assesses whether the specific goals of the conservation project were achieved
- Did the project meet its targets, such as increasing species population, improving habitat quality, or restoring ecosystems?
- For example, replanting forests may be a goal, but was the reforestation successful in creating a sustainable habitat for wildlife?

### 2. Was the project well-received by the impacted communities?

- This level assesses how local people perceive and are affected by the project
- Were local communities involved in decision-making?
- Did they benefit economically, socially, or culturally from the project?

- Projects that involve community participation and provide benefits like employment or improved ecosystem services are more likely to be sustainable

### 3. Was this the best way to conserve nature?

- This level assesses whether the chosen conservation strategy was the most effective approach
- Could other methods have been more successful or less damaging to local people or the environment?
- Evaluating alternative methods ensures that future conservation projects can learn from past successes or failures



Your notes



## Case Study

### Wangari Maathai's Green Belt Movement in Kenya

- The Green Belt Movement, founded by **Wangari Maathai** in 1977, is an environmental organisation based in Kenya
- Its primary goal is to combat deforestation, restore degraded landscapes, and promote sustainable development

#### 1. Did the measures succeed as planned?

- The Green Belt Movement has helped to combat deforestation, restore degraded land, and improve environmental awareness
- It has been successful in planting millions of trees, reducing soil erosion, and improving water availability
- The movement has helped restore forest cover and biodiversity in many parts of Kenya

#### 2. Was the project well-received by the communities?

- Local communities, particularly women, were empowered through the project
  - It provided them with training, income, and a **sense of ownership over their environment**
- The project promoted grassroots participation, with community members actively involved in tree planting and environmental protection.
- Although there were challenges, including opposition from political leaders at times, overall, the project was widely supported by local communities

#### 3. Was this the best way to conserve nature?

- The project's approach of engaging local communities in tree planting and environmental education was highly effective in conserving nature and promoting sustainable land use
- Alternative methods, like large-scale industrial reforestation, might not have provided the same **social benefits** or been as **cost-effective**



- The Green Belt Movement's emphasis on community-driven conservation was key to its **long-term success**



Your notes

## Other examples of conservation success

- **Willie Smits' Rainforest Restoration in Kalimantan and Sulawesi:**
  - This project focused on reforestation and creating sustainable livelihoods for local communities by using agroforestry techniques
- **Steve Elliot and FORRU-CMU's Forest Restoration in Southeast Asia:**
  - This project worked on restoring degraded tropical forests, with an emphasis on research and community engagement



### Examiner Tips and Tricks

Remember to consider how the local community is involved in conservation projects, as this can be an important point in both the success and sustainability of the efforts.



Your notes

## Ecotourism (HL)

# Ecotourism

## What is ecotourism?

- Ecotourism refers to responsible travel to natural areas that:
  - Conserves the environment
  - Sustains the well-being of local communities
  - Involves education
- It focuses on minimising environmental impact while supporting conservation efforts and improving the livelihoods of people in those areas
- However, 'ecotourism' is sometimes used as a **marketing tool**, where tourism companies claim to be environmentally friendly but don't fully commit to sustainable practices
  - This can result in minimal positive impact on conservation efforts while still causing environmental damage and disrupting local communities
  - In many cases, ecotourism **falls short of its goals**, with profits being prioritised over genuine environmental stewardship
  - As a result, it may lead to overexploitation of natural resources and wildlife disturbance, acting more as '**greenwashing**' than true sustainable tourism

## Benefits of ecotourism

- **Increased income for local communities:** Ecotourism can provide alternative livelihoods by creating jobs in hospitality, guiding, and transportation
- **Funding for conservation:** Income from ecotourism can help protect endangered species, restore habitats, and fund protected areas
- **Promotion of biodiversity:** Protecting areas for ecotourism can help preserve critical ecosystems and increase species richness
- **Education and awareness:** Visitors can learn about biodiversity, environmental challenges, and conservation efforts, raising global awareness of ecological issues

## Negative impacts of ecotourism

- **Environmental degradation:** Increased tourism can lead to soil erosion, habitat destruction, and pollution from litter, transport, or improper waste disposal



Your notes

- **Disturbance to wildlife:** Tourists may unintentionally disturb animal behaviour, such as nesting or feeding patterns, leading to stress on species
- **Overcrowding and infrastructure pressure:** High numbers of visitors can strain local infrastructure
- **Cultural and social impacts:** The influx of tourists can sometimes lead to a loss of traditional lifestyles or commodification of indigenous cultures



## Case Study

### Ecotourism in the Maasai Mara, Kenya

- The Maasai Mara National Reserve is one of Africa's most famous wildlife reserves
- It attracts thousands of tourists every year
- It is located in southwest Kenya and is known for its **vast savannah landscapes** and the **annual Great Migration** of wildebeest and zebras
- The reserve is home to some of the most iconic wildlife species, including **lions, elephants, cheetahs, and black rhinos**
- This biodiversity makes it a popular ecotourism destination, with tourists visiting to witness the wildlife and support conservation efforts

#### Benefits of ecotourism in the Maasai Mara

1. **Economic benefits for local communities:** The Maasai people, who have lived in the area for centuries, benefit from jobs as guides, lodge staff, and through the sale of traditional handicrafts
  - A portion of tourism revenue is also used for community development projects, such as building schools and healthcare centres
2. **Wildlife conservation:** Revenue generated from park entrance fees and tourism helps fund critical conservation efforts, including **anti-poaching patrols** and the protection of endangered species like the black rhino
  - This financial support ensures that the ecosystem remains intact and wildlife populations are better monitored and protected
3. **Cultural preservation:** Ecotourism can also promote the **preservation of Maasai culture**, as tourists often show interest in learning about local traditions, dances, and crafts
  - This can encourage the continuation of traditional practices and the sharing of cultural knowledge with people from all over the world

#### Negative impacts of ecotourism in the Maasai Mara

1. **Overcrowding and environmental degradation:** During peak tourist seasons, large numbers of vehicles and tourists can overwhelm the delicate ecosystem
  - Tourists may trample vegetation, disturb animals, and cause soil erosion
  - Overcrowding can also disrupt the migration routes of key species like wildebeest

2. **Conflict with local livelihoods:** The expansion of tourism infrastructure (e.g., hotels, roads, and campsites) can lead to the displacement of Maasai communities from their traditional grazing lands

- As land is increasingly reserved for wildlife and tourism, there is less space for the Maasai to practice traditional livestock grazing
- This leads to tensions between conservation goals and local livelihoods

3. **Pollution and waste:** The rise in tourism also increases pollution, particularly waste from lodges, camps, and vehicles

- Without proper waste management systems, this pollution can contaminate water sources and harm local wildlife
- In some cases, irresponsible tourist behaviour (such as littering) can damage the environment or endanger wildlife



Your notes