

# Sustaining Ecosystems

## Knowledge checklist

Key ideas	How secure is my knowledge?		
<p><b>Why are natural ecosystems important?</b></p> <ul style="list-style-type: none"> <li>• Understand the concept of an ecosystem as being the interdependence of climate, soil, water, plants and animals.</li> <li>• Outline the global distribution of polar regions, coral reefs, grasslands, temperate forests, tropical forests and hot deserts.</li> <li>• Overview of the climate, flora and fauna within these ecosystems.</li> </ul>			
<p><b>Why should tropical rainforests matter to us?</b></p> <ul style="list-style-type: none"> <li>• The distinctive characteristics of a tropical rainforest ecosystem, including the climate, nutrient cycle, soil profile and water cycle.</li> <li>• The interdependence of climate, soil, water, plants, animals and human activity in tropical rainforests.</li> <li>• Explore the value of tropical rainforests through the study of their goods and services.</li> <li>• Human impacts in the tropical rainforest from activities such as logging, mineral extraction, agriculture and tourism.</li> <li>• A case study to illustrate attempts to sustainably manage an area of tropical rainforest such as ecotourism, community programmes, biosphere reserves and sustainable forestry, at a local or regional scale.</li> </ul>			
<p><b>Is there more to polar environments than ice?</b></p> <ul style="list-style-type: none"> <li>• Outline the distinctive characteristics of Antarctica and the Arctic, including climate, features of the land and sea, flora and fauna.</li> <li>• The interdependence of climate, soil, water, plants, animals and human activity in either the Antarctic or the Arctic polar region.</li> <li>• Explore a range of impacts of human activity on either the Antarctic or the Arctic ecosystems, such as scientific research, indigenous people, tourism, fishing, whaling and mineral exploitation.</li> <li>• A case study to examine one small-scale example of sustainable management in either the Antarctic or the Arctic such as sustainable tourism, conservation and whaling.</li> <li>• A case study to examine one global example of sustainable management in either the Antarctic or the Arctic by investigating global actions such as Earth Summits or the Antarctic Treaty.</li> </ul>			

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## Ecosystems:

### Key words

- Producer
- Consumer
- Decomposer
- Recycling
- Food chain
- Food web
- Nutrient cycle

### Definition

- An ecosystem is a community of plants and animals living together in a habitat. The lives of the plants and animals are closely linked to each other and the climate and soil of the area that they live in.
- Exist on a range of scales – small scale (e.g. pond) to larger scale (a lake or woodland). The largest ecosystems are called biomes exist on a global scale (e.g. tropical rainforest).

### Small scale ecosystems

- Ecosystems can be small-scale, covering a small area (such as a pond) or large-scale covering a large area (such as a tropical rainforest).
- The world is divided up into ten major ecosystems. These large-scale ecosystems are called biomes.

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### Freshwater pond

- A freshwater pond is a small ecosystem for plants and animals
- The amount of light, water and oxygen will vary across the pond
- Plants like reeds grow
- Ducks and small insects will live on the surface
- In deeper parts of the pond there will be fish

### Local vs global

- Change can be local changes to habitat such as hedgerow removal or global such as climate change

### Hedgerow removal

- Removing hedgerows to make bigger fields destroys habitats and changes local balance
- This can affect the nutrient cycle

### Agriculture

- Human activities such as farming can be harmful
- Fertilisers can enter the pond causing eutrophication, nitrate increase which leads to algae growing, less oxygen and this may kill plants and animals
- Ponds may also be drained for farming

### Climate change

- In some areas the climate is changing too quickly for animals to adapt'

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- Seasons are also changing affecting animals and plants

### Natural change

- Some change will be natural and unavoidable
- Extreme weather like drought can have a big impact leading plants and animals to die

### Ecosystem restoration

- In some areas ponds will be restored
- This occurs through de-silting, redefinition of the lake and creation of new watersides to attract birds, waterfowl and ultimately create new habitats
- This can lead to the ecosystems becoming healthy again

### Global ecosystems:

#### Key words

- Biome
- Tundra
- Polar
- Desert
- Savanna

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## Tropical rainforests:

### Key words

- Tropical
- Deforestation
- Acre

### Facts

- The tropical rainforests are known as the lungs of the world. They provide over 20% of the world's oxygen.
- 25% of the ingredients in today's cancer-fighting drugs come from organisms found **only** in the rainforest.
- 50% of the Earth's plant and animal species live in tropical rainforests.
- An area of tropical rainforest the size of a football pitch is lost every second.
- Tropical rainforests used to cover 14% of the Earth's surface. Now they only cover 2%.
- At current rate of deforestation all the world's tropical rainforests will have disappeared in 40 years time.
- At least 80% of MEDCs diet originated in the tropical rainforest.
- One acre of tropical rainforest can contain over 750 different species of tree.

### What are rainforests like?

- Why do you think it's called a rainforest?
- It's called a rainforest due to the amount of rainfall it gets each year.
- Rainforests have an annual rainfall of at least 100 inches (254cm) and often much more!

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- Rainforests are very dense, warm and wet forests.

#### There are 4 layers to a rainforest

- **Emergent Layer** - very sunny because it is the very top. Only the tallest trees reach this level.

**Who lives here?** birds, butterflies and small monkeys live with big snakes and bugs.

- **Canopy Layer** - much of the rain is stopped by the thick foliage. Most trees in the forest grow to this height. There are plants that grow in the canopy layer. Their roots don't reach the ground. These are called air plants.

**Who lives here?** birds, monkeys, frogs, and snakes as well as lizards, snakes and many insects.

- **Understory Layer** - many vines, dense vegetation, not much light.

**Who lives here?** birds, butterflies, frogs and snakes

- **Forest Floor** - dark, damp, full of fallen leaves, twigs and dead plants. The forest floor is dark because the trees above stopping the sunlight from entering the forest. It is estimated that only 2% of the sunlight actually reaches the floor.

**Who lives here?** jaguars in South America, gorillas and leopards in Africa and tapirs and tigers and elephants in Asia.

#### Nutrient Cycles

- Soil in the rainforest quickly loses its fertility when the trees are cut down
- The nutrient cycle is the circulation of the abiotic and biotic parts of the ecosystem
- All plants need nutrients to grow
- The nutrient cycle in TRFs is rapid

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- They have a large biomass store
  - A small litter store
  - Large growth transfer
  - Large weathering input
  - Large leaching output

### Food chains

- Food chains show which organisms eat other organisms

Grass -> Rabbit -> Fox

- The arrows show the transfer of energy from one organism to the next.
- **Producers** - organisms which can make their own energy from carbon dioxide and water using sunlight for energy (plants)
- **Primary consumer** - organisms which eat producers (herbivores)
- **Secondary consumers** - organisms which eat primary consumers (carnivores)
- **Tertiary consumers** - organisms which eat secondary consumers (carnivores)
- Each level of a food chain is known as a trophic level
- Food chains always start with a producer. Producers are always on the first trophic level.

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### The value of rainforests:

- Each level of a food chain is known as a trophic level
- Food chains always start with a producer. Producers are always on the first trophic level.

### Key words

- Deforestation
- Logging
- Habitat
- Unsustainable

### Malaysia

- Malaysia is in South East Asia
- It's largely made up of tropical rainforests (70%)
- Deforestation is destroying animal habitats – such as the Orangutan – which literally means 'people of the forest'
- Deforestation is occurring to make people money!

### Habitat building

- Replanting trees is known as reforestation and is possible in some areas
- Vegetation will regrow if it is allowed to
- Although diversity will be poor at first some species will return

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- Some areas can be made sustainable e.g. low level harvesting and low intensity logging

### Help from home

- We can all help to save the rainforest in a small way:
  - Only use **paper** that comes from sustainable trees
  - Only eat locally sourced **beef**. Much of the farming in Amazon is for cattle farming
  - **Recycle**. Especially wood, paper and rubber, all of which may come from the rainforest
  - Buy products that are **rainforest friendly** – these products support the rainforest

### Ecotourism

- This is promoting people to visit the rainforests but in a sustainable way
- Things you can do include:
  - Stay in local hotels rather than chains like Hilton
  - Use companies that employ local people and don't destroy the environment
  - Support wildlife sanctuaries

### Protect areas

- Some areas may be protected because they are an **ecological hotspot** e.g. they have lots of rare plants and animals
- This will mean that these areas cannot be destroyed by law

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- The Brazilian government have made some areas **reserves** similar to national parks in the UK

### **The human impact on rainforests:**

#### The facts

- Trees and soil in rainforests absorb and store carbon
- It is estimated up to 20% of carbon dioxide in the world that contributing to climate change comes from the rainforests
- This is mainly because of burning areas of rainforest to clear them and the loss of carbon absorption from cutting them down

#### Climate change vs Global warming

- The altering of the Earth's climate used to be called global warming however, it is now accepted that not all areas of the world will become warmer
- People now refer to this change as **climate change**

#### What is the greenhouse effect?

The greenhouse effect is the way the earth traps the sun's heat.

Without the greenhouse effect the world would be about 30°C colder and humans and animals would not be able to live.

#### Climate change

- The enhanced greenhouse effect is leading to a change in Earth's climate known as 'climate change'. Scientists have evidence that shows that the atmosphere is getting warmer.

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### Rainforests and climate change

- It is now estimated that 20% of carbon dioxide in the atmosphere is as a result of rainforest deforestation. This is because of burning the wood and the loss of trees to absorb carbon

### Soil erosion

- Soil takes thousands of years to form and can be destroyed in just hours
- Taking away trees and plants stops the soil from being bind together

### Loss of biodiversity

- Deforestation kills plants and animals, reducing biodiversity
- Parts of the Peninsular Malaysia are being heavily deforested
- This areas has over 600 animal species
- It is home to 75% of Malaysia's trees
- Many plants are thought to have undiscovered medicinal qualities

### Economy

- Profit is the main reason for deforestation, however it is a short term gain

### Sustainable management of TRFs:

#### What does 'sustainable mean'?

- **Sustainability** is about allowing us to meet our needs today without affecting the chances of people in the future to meet their own needs.
- Human actions can be seen as **sustainable** or **unsustainable**

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How do humans impact the planet?

- Using cars to make short journeys rather than walking
- Leaving the lights on all day
- Having a short shower instead of a bath
- Burying all our waste in a landfill site
- Using wind power to generate all our electricity

**Ecotourism:**

What does sustainable tourism mean?

- Sustainable tourism is a process which meets the needs of present tourists and host communities while protecting and enhancing the needs of future generations.

Tourism is a very important industry, particularly for LEDCs.

- However, as we learnt last week when we looked at Thailand, the people that rely on tourism are not always treated fairly.
- Look back at your information sheet on Thailand...how were the local people treated (disadvantages)

**Polar Regions:**

Hot and cold environment facts

- Almost 1/3 of the world is considered to be arid or semi-arid
- The coldest place on earth is Antarctica
- The hottest place on earth is Death Valley, California

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## Summary

- Both the Antarctic and Arctic tundra are examples of fragile environments.
- Plants, fish and animals grow slowly because of the cold – some species of lichen grow 2mm per year so cannot sustain heavy grazing. Likewise a careless human footfall can destroy a hundred years' worth of growth.
- Only 2 species of flowering plant are found in the Antarctic due to the acidity of the soils. This makes colonisation difficult.

## Opportunities for development in Svalbard:

### Facts

- Norwegian archipelago
- 60% of islands covered in glaciers
- Population 2,640
- About a quarter of the population work in mining
- Temperatures range from summer highs of 6°C to winters lows of -16°C

### Mining

#### Rich coal reserves

- Mining coal is controversial because of the greenhouse gases it releases
- Coal mining is vital to the Svalbard economy
- It is the number 1 economic activity
- More than 300 people are employed in mines

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- In recent years the industry has been in decline as global coal prices drop

### Energy developments

- Energy on Svalbard is mainly produced by burning coal
- Longyearbyen power station is Norway's only coal powered station
- Some believe it should be closed down and energy made by renewable sources
- Like Iceland, Svalbard has many geothermal energy opportunities

### Fishing

- The cold waters of the Barents Sea are some of the richest fishing waters in the world
- There are over 150 species of fish here, including cod
- The waters need to be protected to control important breeding and nursery grounds
- The Barents Sea is jointly controlled by Russia and Norway

### Tourism

- Tourism has been increasing in recent years as people seek more extreme experiences
- In 2017, 70,000 people visited Longyearbyen, 30,000 of which were cruise passengers
- The harbour at Longyearbyen has been increased to cope with increasing cruise ship numbers
- Tourism provides around 300 jobs

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- In the natural environment you can see Polar bears and the Northern Lights

### Cold environments under threat:

#### Tundras

- Tundra's are fragile environments as they will take a long time to recover if damaged by human activity
- Even standing on the ground in a tundra could leave your footprint there for 10 years
- Vegetation in tundra's takes a long time to establish and grow
- They are delicate ecosystems

#### Off road vehicles

- Off road driving is a popular tourist activity
- People drive off road to go hunting and fishing
- Walking is also popular with tourists
- Most off road driving takes place in the summer
- Warm weather makes the soil soggy
- Deep tracks can harm the tundra over a large area
- It can take many years, even decades, to recover

#### Oil polluted river

- Trees and wildlife killed
- Risk of fire in the river

- High level of pollution
- Habitats destroyed in a way they may never recover from
- Oil can enter the river via pipes, factories and tanker spills

### Oil extraction

- Oil Spills –

From tankers or pipelines can lead to direct fatality of organisms, bioaccumulation of toxins in the food chain leading to birth defects, and long term ecological damage.

Cold temperatures mean bacterial breakdown of pollutants is slow.

### Exxon Valdez Disaster, 1989

- Super-tanker hit Bligh reef in Prince William Sound, Alaska.
- 40 million litres of oil spilled into the ocean.
- Killed 250,000 birds and fish.
- Massive long-lasting environmental damage.
- Exxon paid \$9 billion in clean up costs and \$1 billion in compensation (only after being made to by the US Supreme Court).

### Fishing

- Food chains –

e.g. Krill fishing is depleting food supplies for whales and penguins in Southern Ocean.

- Overfishing –

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can deplete a whole population beyond recovery. Patagonian Toothfish is currently a concern in Antarctica.

### Tourism

- Cruise ships increase pollution (from ships and tourists).
- Tourists and tourist developments –

disrupt wildlife, damage habitats and reduce biodiversity.

### What are the economic reasons for people living in cold environments?

- Often rich reserves of oil, gas and other precious minerals such as diamonds.
- Oil and gas in very high demand
- Countries keen to exploit these resources
- To support this exploitation roads and supply bases are built across the tundra
- Hundreds of workers need homes

### Economic importance of mining in Alaska

- Mineral extraction is Alaska's second largest export commodity – zinc, lead, gold, silver, copper.
- Worth \$3.4 billion in 2013.
- State government received \$150 million in fees in 2013.
- Mining industry paid \$144 million to Alaska Native Corporations in 2013.

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Negative impacts of mining at Red Dog

- Fugitive dust – elevated levels of lead and zinc in the mosses either side of the 52 mile transport road. Mosses are food for Caribou and Caribou are food for the Inupiaq people.
- Historical oil spills at the port.
- Solid waste and acidic wastewater issues – there have been releases into the environment.
- Active water treatment from waste heaps and waste ponds will be needed forever to ensure acid discharges into downstream water courses does not happen.
- Impact on Caribou migration routes.
- **Predominantly environmental.**

Positive impacts of mining at Red Dog

- Employs 475 people
- Half the employees are Inupiaq shareholders – heavy ownership by local community.

Mining is responsible for buying goods and services in the area – supports businesses

TECO is sole taxpayer in this region - \$230 million dollars per year.

- Royalty payments to local villages – largest source of income in the area – sustaining Inupiaq way of life.
- **Predominantly economic.**

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Is this sustainable?

- Sustainable Development:
- A method of progress that meets the needs of today without compromising the ability of future generations to meet their own needs.

**Managing cold environments**

How can we reduce the threats?

- Cold environments need to be sustainably managed
- This can be achieved using technology, action from governments and the work of conservation groups

Trans-Alaskan pipe line

- In 1969 oil was discovered in Prudhoe Bay in Northern Alaska
- Winter sea ice meant the oil could not be transported by sea. The trans-Alaskan pipeline was therefore built
- Opened in 1975, it transports the oil 1300km from Prudhoe to the port of Valdez

Action from the government

The US government has constantly worked to protect the area since oil was found

- The National Environmental Policy Act ensure that the oil companies must respect the rights of native people
- The Western Arctic Reserve act protects 9 million hectares of wilderness
- The National Oceanic and Atmospheric Administration protects the marine life

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International agreements

- In 1959 the Antarctic treaty was signed by countries with territorial claims to the Antarctic
- It protects the environment and prevents economic development in the region

Conservation groups

- Groups like the WWF (world wildlife fund) protect environments like the Arctic
- They provide scientific information, expertise and resources
- In Canada the WWF helps manage critical ecosystems, protect endangered species works with oil companies and Inuit communities to build a sustainable future

PREVIEW