Paper 3: Forests under Threat

KO8/9

Taiga forest biome

The climate of the taiga biome is highly seasonal and extreme. The winters are long and very cold; the summers are warm and wet but very short.

Worked example

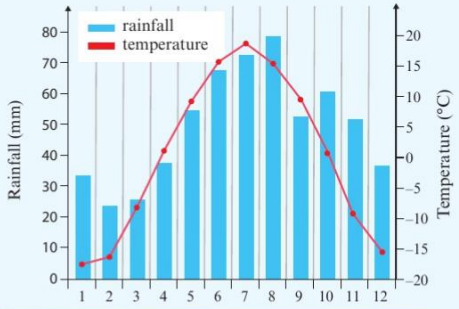
Study the climate graph opposite. Identify **three** ways in which the climate of the taiga is different from the equatorial climate of the rainforest biome. **(3 marks)**

In the tropical rainforest the temperature does not change much all year (variation of around 2°C). In the taiga the temperature is very variable: freezing cold winters and mild summers.

The taiga is much drier than the tropical rainforest. While some rainforests receive 2000 mm of rain a year, some taiga locations have only 450 mm a year.

The taiga has long, extremely cold winters when plants cannot grow. The tropical rainforest is above 20°C all year, so plants grow constantly.

Taiga climate graph



Remember that biotic and abiotic components interrelate in all ecosystems. Abiotic includes climate, soil and water. Biotic includes plants, animals and humans.

Taiga plants

Taiga plants have to deal with very low temperatures, a very short growing season and low-nutrient soils. Their adaptations include:

- **Needle-shaped** leaves: taiga trees do not drop their leaves. This is to maximise photosynthesis throughout the year. To reduce water loss the leaves are needle-shaped and waxy.
- **Cone-shaped**: many taiga trees have downwards facing branches to shed heavy snow.
- Few species – a **simple ecosystem structure**: few plants can deal with taiga extremes. **Coniferous** trees dominate, plus lichens and mosses. Trees grow close together to reduce wind damage.

Taiga animals

In the short taiga summer, huge numbers of insects attract many bird species. Most of the birds then **migrate** south for warmer winters.

The taiga supports some large mammals: both herbivores and carnivores.

- The moose (called an elk in Europe) is an example of a large taiga herbivore. It is one of the few animals that can eat pine needles.
- The brown bear is an example of a large taiga carnivore/omnivore. Bears build up fat layers in summer for hibernation in winter dens.

Non-migrating animal species often have coats or feathers that turn white in winter for camouflage and extra warmth.

Now try this

Study the photo of the moose on this page, which is licking salt off a road. Explain two negative impacts road building could have on the taiga biome. **(4 marks)**

Threats to the Taiga: LEEPH

Logging for softwood (housing, furniture, matches)
Exploitation of fossil fuels (extraction of gas and oil)#
e.g. Tar sand is earth containing a thick, black oil, which can be processed into fossil fuels, e.g. petrol, tar sands are found underneath taiga forests, e.g. in Canada. This can cause large scale deforestation.
Exploitation of minerals (iron ore, gold, copper and silver)
Pulp and paper production
HEP (dams to create hydroelectricity)

Loss of biodiversity is also caused by…

Acid Rain - Sulphur dioxide and nitrogen oxides dissolve in water in the atmosphere. Acids are deposited via precipitation.
Fires – Climate change is leading to warmer, drier conditions leading to wildfires.
Pests – e.g. Spruce Bark Beetles attack Spruce trees.
Disease – More diseases survive in warmer climates.

Conservation of the Taiga:

Creation of Wilderness Areas – Human activity is banned / Can be hard to police
Creation of National Parks – Logging & mining are not permitted / sometimes don't consider the needs of indigenous people.
Sustainable Forestry – Selective logging / some countries struggle to enforce the restrictions e.g. in Russia.
Some people think the taiga forests should be protected. Other people think that the forest and its natural resources should be exploited. You need to know reasons for each e.g. Carbon store, extinction, indigenous people / resources/industry/wealth

Rainforest layers

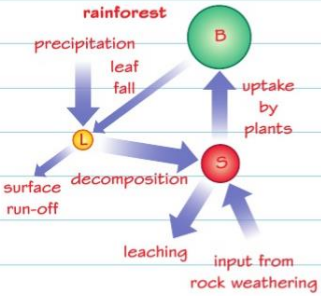
The tropical rainforest has five main layers: herb layer, shrub layer (including young trees), under-canopy, main canopy and emergent layer. Different plants and animals are adapted to each layer.

Productivity and biodiversity

The tropical rainforest has very high biodiversity and very high productivity. The taiga has much lower biodiversity and much lower productivity.

Rainforest nutrient cycle

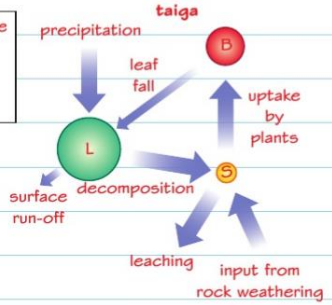
- Plants grow all year in huge numbers.
- Dead matter drops to the forest floor and decomposes quickly in the warm, wet conditions.
- Fast-growing plants take up the nutrients very quickly.
- The constant precipitation leaches nutrients down through the deep rainforest soil.



Taiga nutrient cycle

- Plants can only grow in the short summer: 3–5 months.
- Litter accumulates because decomposition only happens in summer.
- Soils are thin, low in nutrients and acidic.
- Plants grow very slowly due to short growing season and low-nutrient soil.

L=Litter store
B=Biomass store
S=Soil

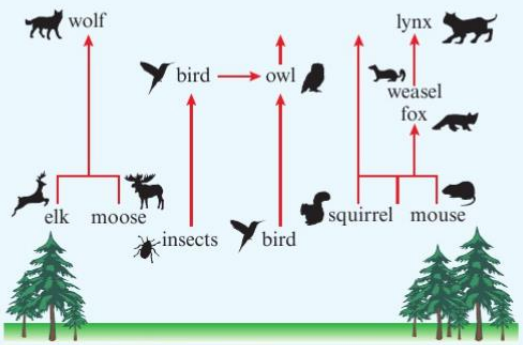


Worked example

Study the food web shown opposite. Explain why a taiga food web is much less complex than a food web for a tropical rainforest. **(4 marks)**

Biodiversity is much higher in tropical rainforests than in the taiga because the equatorial climate supports year-round plant growth. In the taiga, nutrient supply is much lower and can support far fewer plant and animal species: low biodiversity. In the taiga, the extreme winters mean that plant and animal species have to be specialised to survive. This means fewer species overall. In the rainforest there are many ecological niches, encouraging very high biodiversity.

A taiga food web from North America



Make sure you understand the difference between biodiversity (the number of species) and productivity (a measure of the biomass the ecosystem can support).

Now try this

Using the nutrient cycle diagrams on this page to help you, explain **one** reason why most tree species in both the tropical rainforest and the taiga forest have shallow roots. **(2 marks)**

Threats to the tropical rainforests CLUMPH – Direct Threats

Cattle ranching / subsistence farming

Logging for fuel wood and furniture

Urbanisation for housing

Mining for resources and minerals e.g. gold, copper and iron ore

Hydroelectric power production – Building dams floods large areas

Loss of biodiversity is also caused by… Indirect threats
Climate change can cause the temperature to increase and precipitation decrease, which leads to drought.
Droughts lead to ecosystem stress as plants and animals are adapted to moist conditions so many species die. Drought can also lead to forest fires which destroy large areas of forest.

Conservation of the tropical rainforest:

The rate of deforestation varies from place to place. Deforestation is rising in Borneo and Nigeria due to poverty, population growth, foreign debt and economic development (building roads).

However, in Costa Rica and Brazil the government has invested in eco-tourism and pays landowners to reforest areas. Some companies are named and shamed for their deforestation and many have pledge to zero-deforestation. Monitoring systems e.g. Global Forest Watch (GFW) provides satellite data to track forest loss. This means authorities can act quickly to stop illegal logging.

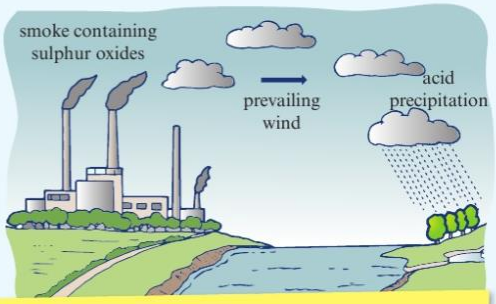
For levels 4+ PRACTICE writing out your responses to exam questions.

Worked example

With reference to the diagram opposite, explain how acid precipitation threatens the taiga biome. **(4 marks)**

When power plants and factories burn coal or oil the smoke contains pollutants such as sulphur dioxide, CO_2 and nitrogen oxides that react with water vapour in the clouds and fall to the surface as acid precipitation. When prevailing winds carry pollution from industrial areas to taiga areas, the acid precipitation damages taiga trees and makes them less resistant to pests and diseases and less able to recover from forest fires.

Acid precipitation



Do use Resource Booklet sources to answer questions – but avoid just repeating the information they provide.

Biodiversity at risk

Global warming as a result of industrial development also threatens the taiga.

- Animals like the Siberian tiger have heavy fur coats and high levels of body fat, making them heat intolerant.
- Warmer winter temperatures will allow new diseases and pests to spread to the taiga. Taiga animals and plants will not have resistance to these, so species could die out.
- Forest fires in Russia's taiga are 30–50 per cent more common than they were 20 years ago, which correlates with global warming. Taiga species are not adapted to frequent fires; new trees need many years to grow.

Now try this

In the UK, 78 per cent of the paper we used gets recycled. Recycling paper generates 70 per cent less CO_2 than making new paper. Explain **two** ways in which recycling paper helps reduce the impact of human activity on the taiga biome. **(4 marks)**

Protecting the rainforest

Global actions to protect the tropical rainforest have advantages and disadvantages.

CITES

- **CITES** stands for the Convention on International Trade in Endangered Species of Wild Fauna and Flora.
- CITES currently protects 35 000 different species. Countries that sign up to CITES agree to stop exports or imports of endangered species.

REDD

- **REDD** stands for Reducing Emissions from Deforestation and Forest Degradation.
- REDD supports schemes that reduce the rate of deforestation.
- The United Nations monitors the schemes by the use of remote sensing and visits.

Advantages of CITES

- CITES has a huge international influence: 181 countries have signed up to it.

Disadvantages of CITES

- It is very difficult to check that all the countries are enforcing the CITES rules. For example, in 2014, over 1000 rhinos were killed by poachers in South Africa.

Advantages of REDD

- Because REDD is backed by the United Nations, very large sums of money are available for REDD projects. A REDD scheme in Brazil is backed by a US$1 billion fund.

Disadvantages of REDD

- It is not clear what REDD means by 'forest'. Some palm tree plantations received REDD funding, even though these damage rainforest.

Successful sustainable management has to make sure that forest conservation gives local populations real economic benefits.

What is sustainability?

Sustainability is the ability to keep something going at the same rate or level. There are several key ideas when considering this as a geographer. These are, that it:

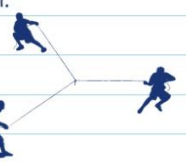
- keeps going without using up natural resources
- doesn't require lots of money to keep it going
- meets the needs of people now and in the future without having a negative effect.

Sustainable biosphere management

- Ensures the ecosystem can recover quickly from any use.
- Prevents damage to the environment/ecosystem.
- Helps local people to benefit from their environment/ecosystem.
- Helps local people to understand why this management benefits them.

Possible tensions

1. **Economic** – individuals and communities often want to make as much money as possible, and may use the resources in the biosphere to do this. This provides tensions as it may damage or even destroy the environment in the long term.
2. **Social** – to be socially sustainable something must not benefit one group/individual at the expense of another, including future generations. It also means consulting people on an equal basis. If everyone is to benefit, this may put the environment at risk. There are also economic tensions as some businesses may flourish at the expense of others.
3. **Environmental** – being environmentally sustainable means not harming natural resources so they cannot regenerate or continue in the long term. This can conflict with making money and improving living standards for all.



Now try this

Explain **one** way in which sustainable forest management can be difficult to achieve. **(2 marks)**

For levels 4+ Read, highlight, make notes and create a revision card for the rainforest and taiga forest