Changing Ecosystems

Section 1: Ecosystems

• What are ecosystems?

Ecosystems are self-sustaining systems of living organisms interacting with each other and with the non-living components of the environment. A tropical rainforest can be described as an ecosystem. The living components of an ecosystem are called 'biotic' factors and include all the plants and animals, and the relationships between them. The non-living components, such as the air, soil, rocks and water are the 'abiotic' factors.

• Suggested Film

- What Is An Ecosystem?

Extension Question

Q1. What supplies the energy to ecosystems?

The Sun is the ultimate energy supply for all ecosystems. Plants are able to use the Sun's energy to make food through a process called photosynthesis, and this is why they are known as producers. All other organisms up the food chain depend upon this supply of food, either directly or indirectly.

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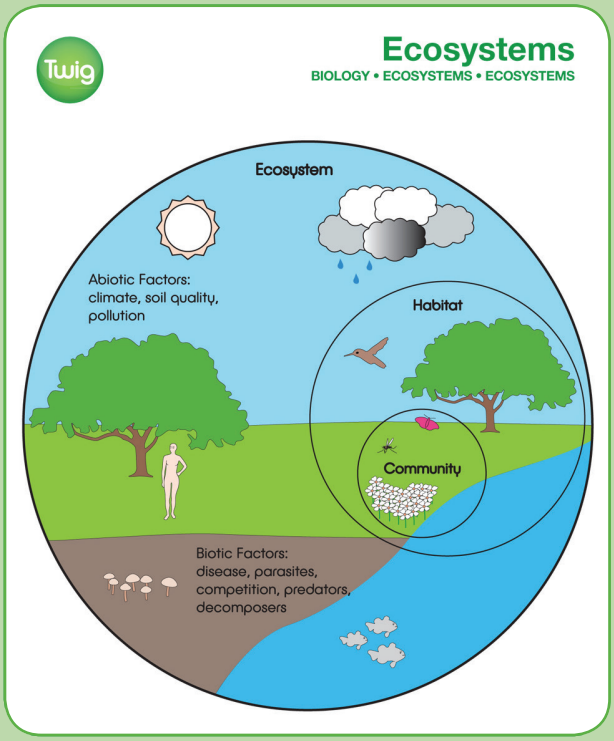

• Can ecosystems change over time?

The removal of any one species can reduce the food source for many other organisms that rely on it

It is not always obvious to see but ecosystems are always changing. Environmental conditions are changing and the populations of organisms within an ecosystem vary from year to year. Often these changes are relatively small and can be reversed, but sometimes ecosystems can change dramatically in response to significant shifts in the biotic and abiotic factors, which determine how the ecosystem functions. For example, the removal of a species due to disease, habitat destruction or predation will affect not only that organism, but also all the other species which rely on it in some way. If that species is a plant at the bottom of a food chain it can affect all species further up the food chain, which ultimately rely upon it for food.

• Suggested Film

- Biotic Factors in Ecosystems

Extension Question

Q2. What is extinction?

Extinction is the term used to describe the complete loss of a species. For example, there are no dinosaurs left on Earth, so we say that the dinosaurs are extinct.

• Can humans affect ecosystems?

The activity of humans has major impacts on ecosystems all over the world. Humans cause habitat destruction, hunt predators, overfish the oceans, cause environmental pollution, and sometimes introduce new species into ecosystems. The introduction of a new species which did not evolve in that ecosystem, can sometimes have a devastating effect, as the new organism is able to occupy a new niche and thereby interact in entirely new ways with other organisms, often outcompeting them and potentially driving them to extinction.

• Suggested Films

- Invading Animals: The Cane Toad

The cane toad now occupies over 1 million square kilometres of land in Australia

Extension Question

Q3. What is a niche?

A niche is the role that an organism has within an ecosystem. It refers to every aspect of an organism's involvement within an ecosystem, both in terms of its physical position and its interactions with other organisms, such as what it feeds on and what feeds on it. Members of the same species occupy the same niche in an ecosystem because they play the same role when they interact with both the biotic and abiotic components.

Section 2: Effects On Ecosystems

• What abiotic factors cause ecosystems to change?

Abiotic factors include all those non-living components of an ecosystem, such as rainfall, temperature and air quality. If abiotic factors shift it will have a massive effect on the make-up and functioning of an ecosystem. For example, if an ecosystem is exposed to a change in its annual rainfall this will be detrimental to some species and perhaps advantageous to others. Over time this could lead to changes in species populations and hence a fundamental shift in the way the ecosystem operates. Some species may become extinct whilst others may evolve over time to the new conditions.

• Suggested Film

- Abiotic Factors in Ecosystems

Extension Question

Q4. What is evolution?

Evolution is the process by which species can change and adapt over time. It is also the process by which new species are formed from pre-existing ones. It involves a change in the frequency of certain genes in a population over time. For example, a population of organisms may change to become better adapted to its conditions, resistant to disease or better camouflaged.

• How might global warming affect ecosystems?

The global climate is always changing and over the past 200 years there has been an increase in average global temperatures. Many believe this is due to increased levels of greenhouse gases, like carbon dioxide and methane, in our atmosphere produced by human activities such as burning fossil fuels. Such a rise in global temperatures has dramatic effects on ecosystems, and rising temperatures affect organisms directly and indirectly. Weather patterns change, sea levels rise and ice caps melt. Habitats can be lost, migration patterns can change, and new diseases can emerge. All these factors, both biotic and abiotic, cause changes in ecosystems driving some species to extinction and allowing others to evolve and exploit new niches.

Human activity, such as waste and pollution, can have dramatic effects on ecosystems

• Suggested Films

- FactPack: Bird Migrations
- FactPack: Amazing Migrations
- Migration: Reproduction
- Migration: Predation
- Migration: Seasons
- Algae

Extension Question

Q5. How does evolution happen?

It is generally accepted that evolution occurs through a process of natural selection. In any population of organisms we can observe differences. For example, some organisms are more resistant to disease, and some are able to withstand drought. If conditions change, say due to global warming, then those that are better adapted to the new conditions are more likely to survive and pass on their genes to the next generation, which in turn may pass them on to their offspring. As a result, over time, a change in the gene frequency of the population can occur and we can say that the population is evolving. Many species seem to be evolving in response to recent global warming.

• What are bio-indicator species?

Because species evolve and are therefore adapted to their environment, we can use the presence of a species to indicate to us what the conditions of the ecosystem are like. Furthermore, if the population of our indicator species changes over time, it suggests that conditions within that ecosystem have shifted. For example, lichens are very sensitive to atmospheric pollution and some species are more tolerant of pollution than others. By recording the population of different lichen species in an area over time, we can use the information to make a judgment about how the atmosphere has changed over time.

Lichens are considered among the oldest living organisms

• Suggested Film

- Lichen: Indicator Species

Extension Question

Q6. What is a lichen?

A lichen is actually two organisms (a fungus and an alga) living mutualistically. The alga can photosynthesise to provide food, and the fungus can absorb water and minerals from the rock surfaces on which the lichen lives. Because of this relationship lichens are often able to live in very inhospitable habitats!

Section 3: Biodiversity

• What is biodiversity?

Biodiversity refers to both the number of organisms and the number of different types of organisms in an ecosystem. Ecosystems that sustain both lots of organisms and lots of different species are said to have high biodiversity. Biodiversity is vital to humans as it provides us with food, materials and medicines. It also has important implications for our atmosphere, soil and water. Furthermore, genetic variations within species can prove to be important in future breeding programmes. As a result it is crucial we maintain this biodiversity.

• Suggested Film

- What Is Biodiversity?

Extension Question

Q7. What ecosystems have very high biodiversity?

Tropical rainforests are regarded as the most biologically diverse on Earth. These rainforests cover only about 6% of the Earth's surface but are home to over half of all the species on the planet. Being close to the equator these ecosystems receive a lot of sunlight every year and so are very productive. Plants grow quickly and this in turn provides a lot of food for other organisms to feed off.

• What is causing biodiversity to decline?

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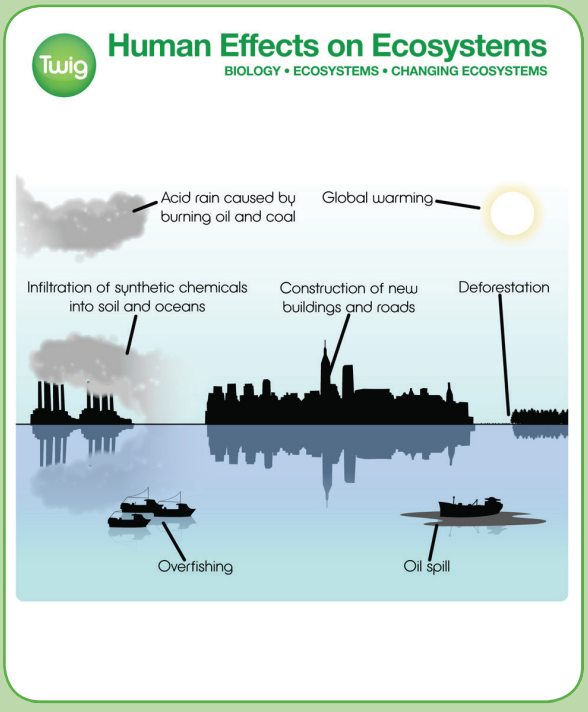

Various factors seem to be causing a rapid loss of biodiversity on Earth at the moment. Some people believe we are living through a period of mass extinction! Habitat destruction caused by human activity and population expansion is probably one of the major causes. Natural habitats are being destroyed to provide materials, farmland, and new spaces for roads and housing. Air and water are being polluted with chemicals, the oceans are being overfished, and the atmosphere is changing, causing global temperatures to increase.

• Suggested Film

- Endangered Species

Overfishing is a huge threat to our oceans' ecosystems

Extension Question

Q8. What is an endangered species?

Endangered species are those species which are at risk of becoming extinct. The International Union for the Conservation of Nature (IUCN) maintains a 'red list' detailing those species at risk of extinction. Species are categorised according to how vulnerable they are.

• Can we prevent loss of biodiversity?

Rare species need to be protected if we are to stop them disappearing forever

Humans can do a lot to reduce loss of biodiversity. They can reduce or stop habitat destruction, they can find new sources of energy, they can minimise pollution and reduce overfishing. They can also introduce bans on hunting, quotas on fishing, and reintroduce species into ecosystems when necessary. Species can be conserved in reserves and zoos, and very rare species can be encouraged to breed in captivity.

• Suggested Film

- Conservation

Extension Question

Q9. What is conservation?

Conservation simply means the process of keeping ecosystems as they are by trying to prevent species and habitats from being lost.