



▲ Figure 19 Sunlight supplies energy to a forest ecosystem and nutrients are recycled

### Activity

#### Cave ecosystems

Organisms have been found living in total darkness in caves, including eyeless fish. Discuss whether ecosystems in dark caves are sustainable.

Figure 20 shows a small ecosystem with photosynthesizing plants near artificial lighting in a cave that is open to visitors in Cheddar Gorge. Discuss whether this is more or less sustainable than ecosystems in dark caves.



▲ Figure 20

Nutrients can be recycled indefinitely and if this is done there should not be a lack of the chemical elements on which life is based. The waste products of one species are usually exploited as a resource by another species. For example, ammonium ions released by decomposers are absorbed and used for an energy source by *Nitrosomonas* bacteria in the soil. Ammonium is potentially toxic but because of the action of these bacteria it does not accumulate.

Energy cannot be recycled, so sustainability depends on continued energy supply to ecosystems. Most energy is supplied to ecosystems as light from the sun. The importance of this supply can be illustrated by the consequences of the eruption of Mount Tambora in 1815. Dust in the atmosphere reduced the intensity of sunlight for some months afterwards, causing crop failures globally and deaths due to starvation. This was only a temporary phenomenon, however, and energy supplies to ecosystems in the form of sunlight will continue for billions of years.



### Mesocosms

#### Setting up sealed mesocosms to try to establish sustainability. (Practical 5)

Mesocosms are small experimental areas that are set up as ecological experiments. Fenced-off enclosures in grassland or forest could be used as terrestrial mesocosms; tanks set up in the laboratory can be used as aquatic mesocosms. Ecological experiments can be done in replicate mesocosms, to find out the effects of varying one or more conditions. For example, tanks could be set up with and without fish, to investigate the effects of fish on aquatic ecosystems.

Another possible use of mesocosms is to test what types of ecosystems are sustainable. This involves sealing up a community of organisms together with air and soil or water inside a container.

You should consider these questions before setting up either aquatic or terrestrial mesocosms:

- Large glass jars are ideal but transparent plastic containers could also be used. Should the sides of the container be transparent or opaque?
- Which of these groups of organisms must be included to make up a sustainable community: autotrophs, consumers, saprotrophs and detritivores?
- How can we ensure that the oxygen supply is sufficient for all the organisms in the mesocosm as once it is sealed, no more oxygen will be able to enter.
- How can we prevent any organisms suffering as a result of being placed in the mesocosm?