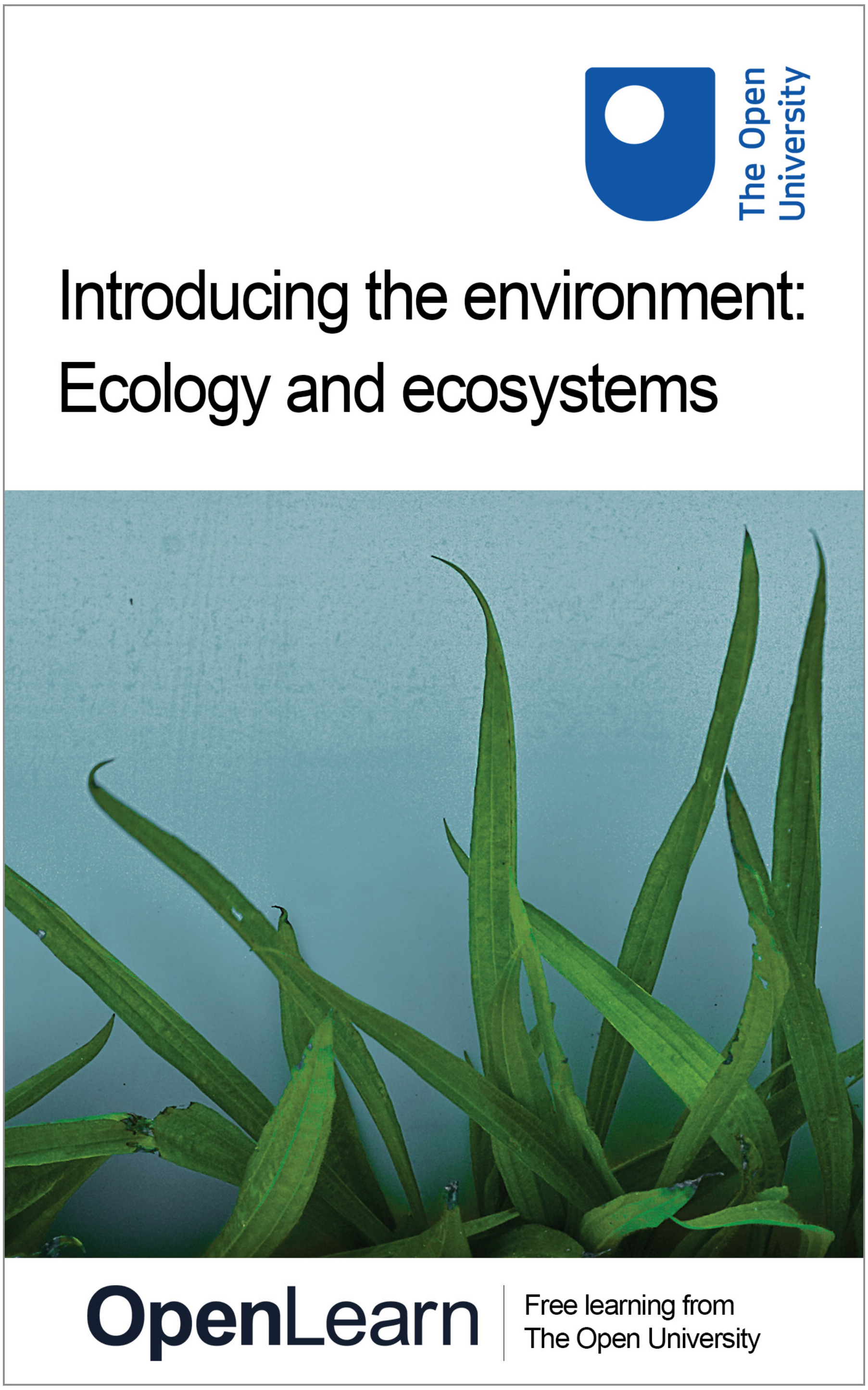
Introducing the environment: ecology and ecosystems


The Open University
Introducing the environment: Ecology and ecosystems
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Introduction

This course starts by looking at ecosystems and at some of the living and non-living components they contain. We will then move on to look at the importance of being able to identify and name the living things in an ecosystem, and examine some of the ways in which we can start to record some of the interactions between them. But we must never forget that we ourselves are members of – and manipulators of – the ecosystems we inhabit. We are a part of the biosphere. We were produced by it; we live within it; and we are beginning to change it in ways we don't yet fully understand. The course will end by introducing the concept of ‘ecological health’, the idea that our growing exploitation of the resources of ecosystems is endangering their ability to support themselves … and us.

This OpenLearn course provides a sample of level 1 study in Environment & Development

Learning Outcomes

After studying this course, you should be able to:

- construct a glossary of scientific terms;
- make notes on what has been read and review these notes.

1 The science of ecology

Let us start by looking at some of the vocabulary involved. To study or understand anything we have to be clear about what the words we use mean. We will need these words to record what we have discovered, and to share our understanding with other people.

This course is primarily concerned with a branch of the study of the natural world known as **ecology**:

> Ecology is the scientific study of the interrelationships between living organisms and the environments in which they live.

Activity 1

0 hour(s) 5 minutes(s)

Words …

Look at the definition of ecology above. As you may already be aware, it is customary in science writing to use words in a precise and careful way. So it is important to be able to recognise and understand important terms when you come across them.

Note any terms in the definition that you feel are especially important to its meaning.

I noted four terms that seemed to be particularly important: ‘scientific’, ‘organisms’, ‘interrelationships’ and ‘environments’.

First and foremost, ecology is a **scientific** way of thinking about the world. This means that it involves a certain way of investigating, studying and writing about a topic.

In this context, an **organism** is a living thing – ourselves and other animals, as well as plants, fungi, bacteria and so on.

These living things interact with each other in various ways and with the non-living components that make up the **environment** in which they live. These non-living components include rocks, soils and water, as well as the atmosphere. (The physical locality, the place, in which an organism lives is known as its **habitat**.)

All these interactions produce a complicated set of **interrelationships**. And these interrelationships can take many forms, as we shall see.

Activity 2

0 hour(s) 5 minutes(s)

… and meanings

It's not enough to just spot important words, although that's a useful skill. The vital thing is to make sure that you understand what they mean.

Look back at the terms identified in Activity 1. Can you explain what each one means?

As you work through the remainder of this course, you will develop your understanding of the terms ‘organism’, ‘environment’, ‘habitat’ and ‘interrelationship’. When you come across one of these terms, stop and think about how it has been used. Does the way the term has been used change, or add anything to, your understanding?

Answer

Organisms:

- wide range of organisms (living things) including animals, plants, fungi, bacteria and so on
- scientific names – underlined if handwritten; Latin; genus and species

Environment:

- physical environment (not living)
- can be seen in terms of ecosystems

Habitat:

- where something lives

Interrelationship:

- many connections even in small rockpool
- for example, food chain, food web

2 Ecosystems

2.1 Where to start?

There is a problem with any attempt to take an ecological approach to the biosphere as a whole. It is so incredibly complicated and diverse that it is difficult to know where to begin. The number of living and non-living components defies description, and the number of possible interactions boggles the mind. There is also the problem of scale. Do we start with weather patterns that cover the whole globe, examine the impact of human settlements on the wildlife of the Gobi desert, or start by investigating the behaviour of ladybirds feeding on greenfly on a rose bush?

One approach to the investigation of anything big and complicated is to break it down into smaller, more manageable parts. We can then study these smaller chunks at a scale and level of detail that suits our purposes. This approach to complexity is called **reductionism**, because it involves reducing complex things to a collection of simpler parts. We can then take what we learn about how things work in the smaller parts and use it to try to understand the system as a whole.

An **ecosystem** (from 'ecological system') is a collection of living things and the environment in which they live. The size and boundaries of an ecosystem, the bits to be studied, and the interactions to be investigated, are all determined by what we want to know. So an ecosystem can be large (a rainforest) or small (a pond) – and large ecosystems can often be broken down into a number of smaller ones. The important thing is that ecosystems are produced by living organisms interacting with each other and the physical environment.

Remember, all ecosystems involve:

- living organisms
- a physical environment (land, water, air)
- a source of energy to make the whole thing work.

For almost all of the Earth's ecosystems the ultimate source of energy is light from the sun.

Activity 3

0 hour(s) 15 minutes(s)

This section has introduced a number of terms and definitions: for example, ecology, ecosystem, organism, environment, habitat. Some, perhaps all, of these words may be new to you. One way to record them for future use is to construct a glossary, in which you jot down important terms and notes about their meanings.

Use a notebook and write down the term and some notes that explain what it means. What you write must mean something to you. Trying to write your own definition, in your own words, will help you to check your understanding. Remember to allow some space so that you can add to, or change, your definitions as you work your way through the course. Think of the glossary as a working document, and don't worry about making it too neat and tidy.

Here are a few glossary entries. They are just examples, and yours may be quite different. The important thing is to think about what the terms mean, and to produce definitions that will remind you of the main points when you return to them.

- Biosphere: the portion of the Earth and its atmosphere that supports life.
- Ecosystem: living things/physical environment/source of energy (e.g. rainforest, pond).
- Reductionism: reducing complex things into a number of smaller parts.

2.2 An example ecosystem: the rockpool

Let's examine the concept of an ecosystem in more detail using an example that is familiar to many people: a rockpool on a British beach (see Figure 1).

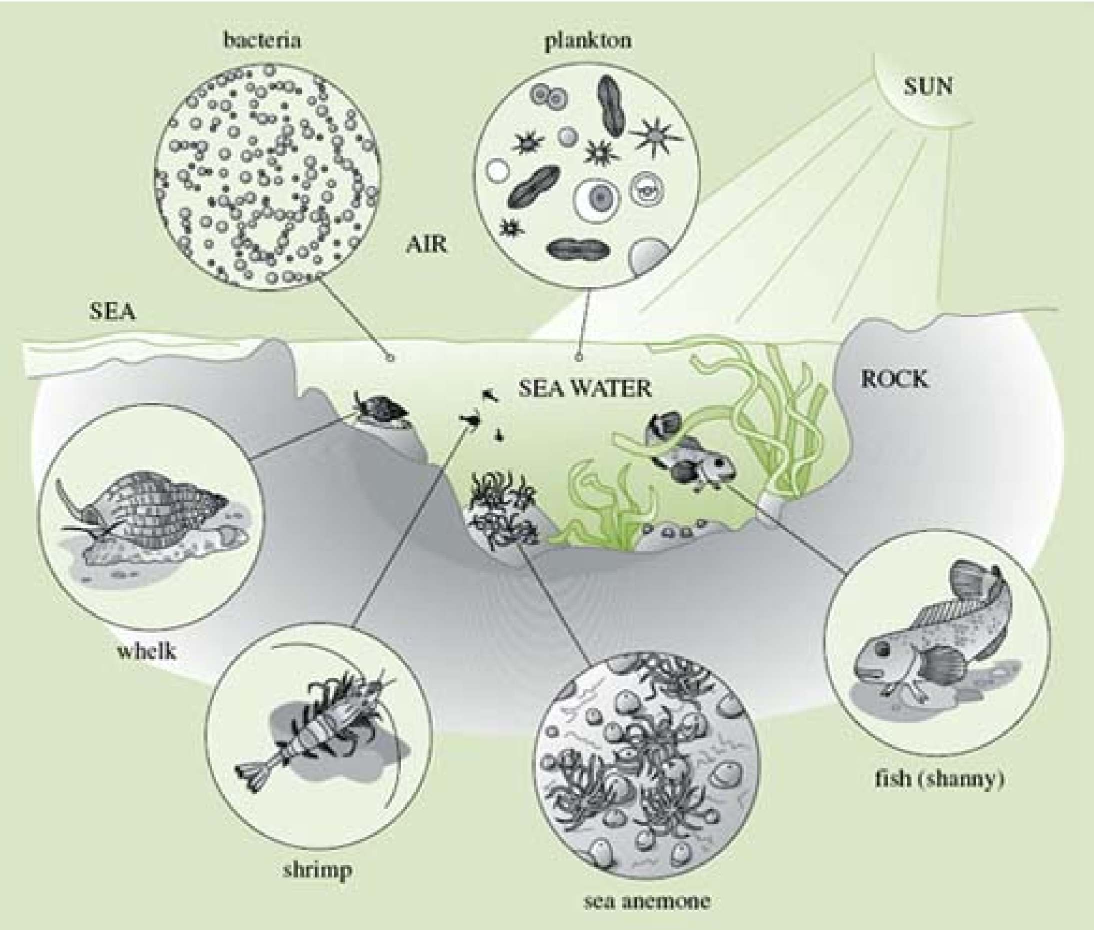

Figure 1 A rockpool

Like all ecosystems, a rockpool is linked to the wider world and to other ecosystems. This link is most apparent in the shape of two tides every day, which change the sea water in the pool and bring in new organisms from the open ocean (as well as allowing others to escape back into the sea). The tides also change the physical characteristics of the pool and its surroundings. When the tide is out, the rockpool is a collection of organisms living together in a fairly clearly defined place. When the tide is in, the pool may become no more than a small depression on the rocky sea bed.

Now let's look at the components of our rockpool ecosystem in more detail. Remember, any ecosystem contains living things, a physical environment and a source of energy.

The most obvious living things will tend to be the largest ones: seaweeds, sea anemones, whelks, shrimps, fish and so on. But this shouldn't blind us to the importance of the organisms we can't see. For example, the water itself is full of tiny plants and animals – called ‘plankton’ – that are food for many of the larger creatures. And the water and rocks contain huge numbers of the simple single-celled organisms called bacteria, and other microscopic forms of life, that play an important part in the working of the ecosystem.

The most obvious components of the physical environment of the pool are the rock that surrounds it, the sea water in it, and the air above it (when the tide is out). But these physical factors are far from fixed. The tides, and the effect of sunlight on the exposed pool, mean that the organisms that live in it must be able to withstand changes and extremes of, for example, temperature or salt content. Some small pools dry up altogether in the summer or ice over in winter when the tide is out.

Almost all of the energy that supports the life in the pool arrives in the form of light from the sun. Some of this energy is captured by seaweeds attached to the rocks and microscopic plants (types of plankton). These plants are eaten by animals, which are eaten by other animals, and so on. But the sun is not the only source of energy involved in the workings of this particular ecosystem: the tides that sweep across the pool twice a day are driven up and down the beach by the gravitational pull of the moon.

Introducing energy

Energy is a concept that is used in many branches of science. In its everyday meaning, you may recognise it as the ‘ability’ to do something; whether that is movement, heating, lighting or providing food or fuel. These correspond to different forms of energy – kinetic (motion), thermal (heat), light, and chemical (food or fuel).

Energy can be converted from one form to another. For example, a plant converts sunlight into chemical energy. The energy from the food we eat (chemical energy) is used to keep us warm (heat energy), to enable us to move (kinetic energy) and to enable us to grow or put on weight (chemical energy in muscle and fat).

Although energy can go through many conversions, there is one rule that appears to apply everywhere in the universe. That is, energy cannot be created or destroyed – in any process, the total amount of energy is always constant.

Activity 4

0 hour(s) 15 minutes(s)

Making notes

This section contains a lot of information. Did you do anything as you read it? Did you simply read the text, or did you make notes?

Read the description of the rockpool again. Try to pick out one or two of the main ideas in each paragraph.

Here's my attempt.

Rockpool ecosystem – links to other ecosystems and wider world.

Ecosystem – living organisms, physical environment, energy.

Living things – plants, animals, plankton, bacteria.

Physical environment – rock, sea water, air, tides.

Energy – sunlight (also tides caused by pull of the moon).

Did you note many of the same points? Is there anything else you'd include? Is there anything you'd leave out? How did you set your notes out? Is there room for you to add extra information later on in your studies?

Remember that it is the observer – you or I – who defines an ecosystem, and selects which organisms or aspects of the environment to study. In much the same way, you have to decide what is important when you make notes.

However big or small our ecosystem, and whichever aspect of the system we choose to study, it is ecology that allows us to investigate how it works – and to wonder at the beauty and strangeness of it all.

2.3 Black smokers

I started with an ecosystem that is familiar and easy to visualise. Most people have seen a rockpool, if only on television. But many ecosystems remain undiscovered, and some of the ones we know about are full of mystery. The purpose of this section is to introduce one that was discovered fairly recently. Don't worry about the details. It's here as another example of how living things, a physical environment and a source of energy can combine to create an ecosystem.

It is probably true to say that we know less about the bottom of the deep sea than we do about the surface of the moon. However, we know that there are ecosystems down there that demonstrate the interaction between living things and extremes of the physical environment. They are unusual in that the main source of energy is not light from the sun but the heat from molten rock.

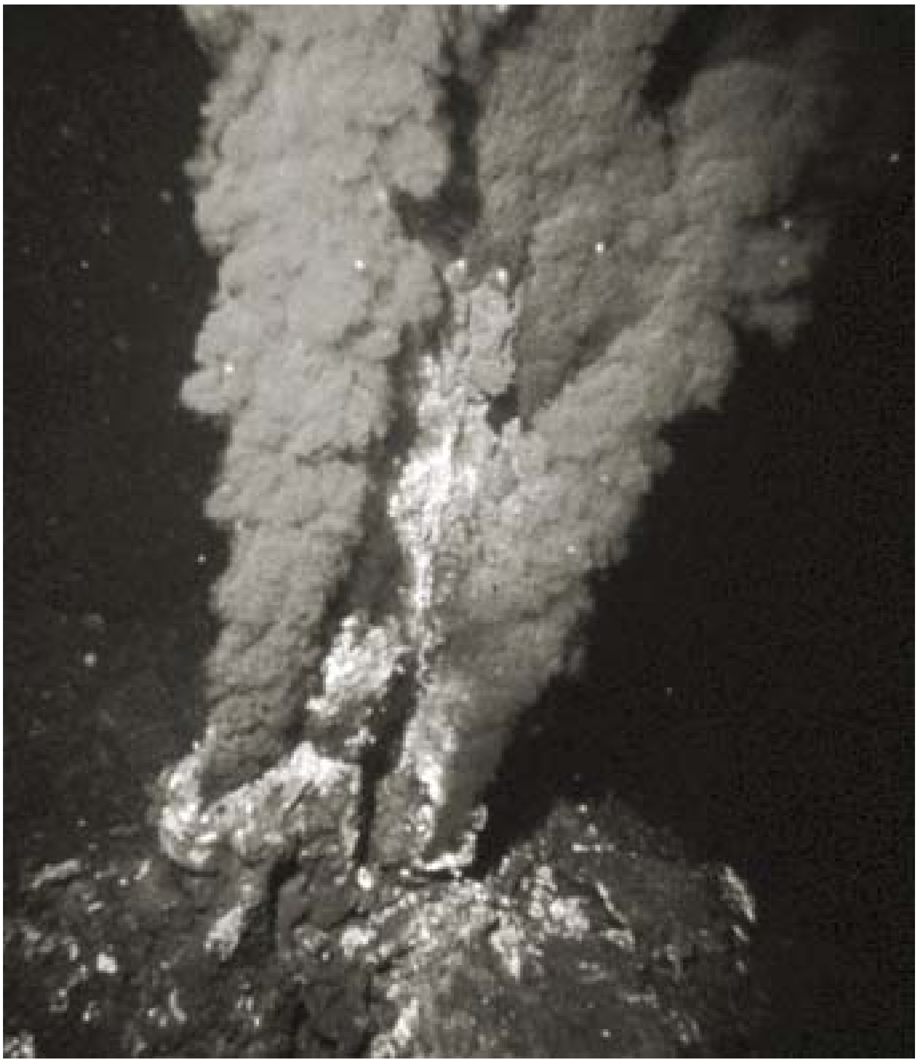

Figure 2 A black smoker

OAR/National Undersea Research Program (NURP)/NOAA

OAR/National Undersea Research Program (NURP)/NOAA

At certain points, sea water penetrates cracks in the ocean floor and comes into contact with the lava produced by active volcanoes. The heated water, full of minerals from the rock, rises rapidly to create plumes of hot water called hydrothermal vents ('hydrothermal' is just science-speak for 'hot water'). The minerals in the super-heated water give it a cloudy appearance, which is why the vents are also known as 'black smokers' (Figure 2). The pressures at these depths mean that water temperatures of 300 °C can be found.

Despite the extremes of temperature and pressure there is life here. Bacteria live around the black smokers at temperatures of up to 110 °C, surviving on minerals and the heat energy in the hot water. Other animals feed on the bacteria and each other: blood-red giant tube worms up to three metres long, limpets, barnacles, prawns, crabs and fish. Most of these organisms are found nowhere else on Earth.

Figure 3 A colony of tube worms close to a black smoker

Photo By Woods Hole Oceanographic Institution

Photo By Woods Hole Oceanographic Institution

3 Making notes

This section develops a useful study skill: making notes. The main scientific story then continues in the next section. Notes can be used for a number of things:

- to develop your own understanding of what you are reading
- to prepare for a specific task, say, a written assignment
- to act as a record for revision.

The first purpose is probably the most important one. After all, it is much easier to write about or revise something that you already understand. Making notes forces you to think about what you are reading and to make sense of it. You have to engage with the text, identify the main points and record them in some way. Good notes pay off in two ways. First, the very process of making and organising your notes improves your understanding of what you have read. Second, your notes will serve as a reminder of the main points long after you have moved on.

The first step is to read the material. Don't worry too much about making notes on the first read through. The important thing is to concentrate on following the line of the argument and making sure that you understand the key points.

Then review the material. Locate the main ideas as well as important points that relate to them. If the book is yours, you can underline or highlight important words or definitions, put a box around important passages, or write notes in the margin.

Alternatively, you can make notes on a separate piece of paper. Remember to leave lots of space so that you can add extra thoughts later on. Learning is a process of changing and developing your understanding. Your notes may take the form of paragraphs, short phrases, bullet points or diagrams (for example, spray diagrams).

The form your notes take will depend on a number of factors:

- the techniques that work best for you
- the nature of what you are reading
- the purpose of your notes
- how much time you have.

Remember that the notes you produce are *your* notes. Experiment to find out what works best for you.

Over time, you will probably develop a range of approaches. So, for example, I tend to use sentences or short paragraphs for material that I find fairly straightforward (see Activity 4). For texts that are more complicated or more difficult to follow I might use a spray diagram. Visual representations often take longer to prepare, but I find the extra investment of time and thought can really help to deepen my understanding. Again, this is a personal preference. Some people find it easier to work with, and to understand, diagrams and pictures. Other people prefer words and lists.

At some point you'll have to give some thought to housekeeping. Where will you keep your notes? In a notebook or a ring binder? I prefer looseleaf notes in a ring binder, as I can add extra pages as necessary, but the choice is up to you. The main thing is to make sure that you can find your notes again when you need them.

Finally, a health warning! Don't put too much time and effort into making notes – and try to avoid writing out the entire text in note form. The trick is to develop an approach that provides the most benefit for the least effort. Always remember that making notes should be a pleasure not a chore. Making notes is an essential part of studying, and if you enjoy the process you'll find you learn a lot more.

4 Identification and naming

Before we can start to investigate how the organisms in an ecosystem interact with the environment we have to be able to give them names. The naming of living things has always had an important practical function, allowing us to understand the natural environment and exploit it more effectively. As soon as something has a name, all sorts of useful information can be attached to the label. Is this plant good to eat or poisonous? Is this animal rare or plentiful? The information can then be passed from one member of a group to another, and from one generation to the next.

Scientists face a similar need. To understand an ecosystem we need to be able to name and list the organisms involved in a precise and accurate way. Naming – like reductionism – is a strategy that allows us to impose some order on the complexity of the natural world.

The science writer Richard Fortey explains the importance of this in his book *Life: An Unauthorised Biography*

> Discrimination and identification have value beyond the obvious separation of edible from poisonous, valuable from worthless, or safe from dangerous. This is a means to gain an appreciation of the richness of the environment and our human place within it. The variety of the world is the product of hundreds of millions of years of evolution, of catastrophes survived, and of ecological expansion. To begin to grasp any of this complexity the first task is to identify and recognise its component parts: for biologists, this means the species of animals and plants, both living and extinct.
>
> (Fortey, 1998, p. 14)

As Richard Fortey notes, the **species** is the fundamental unit of biological diversity. But what is a ‘species’? And how do we distinguish one species from another?

In the field, scientists use two approaches to identify a species. Neither is without its problems.

- Members of the same species normally resemble each other.
- Male and female members of the same species can breed with each other to produce offspring that are also able to reproduce.

The first approach, appearance, is the most obvious one for most of us most of the time. We know that a robin is a robin because it looks like a robin – and the word ‘species’ is derived from the Latin verb *specere* (‘to look at’). But appearances can be deceptive. Males and females of a given species may look different, and many organisms change their appearance as they mature (say, from tadpole to frog or from caterpillar to butterfly).

The second approach is also fairly straightforward in most cases. We take it for granted that our robin can breed with other robins to produce more robins, and that these robins will, in their turn, breed with other robins. But in some circumstances, members of closely related species can and do breed with each other. For example, the horse and the donkey can breed with each other, although the offspring – a mule – is unable to reproduce.

The concept of the species is important to biologists and to our understanding of the working of ecosystems and the biosphere. That's why I've spent some time on it here. The number of species in an ecosystem, or the biosphere as a whole, is an important indicator of its health. Perhaps it is best to think of species as more or less permanent varieties of living things. Many biologists feel that although the definition of a species has its difficulties, in most cases they know one when they see one. The exceptions to the rules are a useful reminder that the complexity of the natural world does not always conform to the categories we attempt to impose on it, and that as a consequence the use of scientific terminology requires judgement and common sense.

Scientific names

Scientists use Latin for the formal names of living things. This means that people from different countries can be sure that they are talking about the same thing. You will come across these scientific names from time to time, so it is useful to know how they work.

Dogs and wolves share a lot of features in common, so they are put together in a **genus** – a grouping of related species – called *Canis*. They don't normally interbreed, so they are different species: for example, *Canis familiaris* (the domestic dog) and *Canis lupus*(the grey wolf). The Latin names of species are given in italics, or underlined if handwritten. The name of the genus starts with an upper-case letter; the name that indicates the species is given a lower-case letter. All human beings are members of the same species: *Homo sapiens*.

As far as I know, only one animal has a common name that is the same as its scientific name: the boa constrictor (*Boa constrictor*).

5 Interrelationships

> It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us.
>
> (Darwin, 1859/1985, p. 459)

So starts the final paragraph of Charles Darwin's famous book *The Origin of Species*. I have included it here because Darwin sets out beautifully, in one sentence, the complexity of the natural world.

First, he introduces us to an ecosystem – ‘an entangled bank’. (I like to think of this as a hedgerow in my home county of Wiltshire. In my mind's eye, I see it on a warm summer's day: a jumbled mix of plants – flowers and trees – with insects crawling through the undergrowth and birds feeding in the branches.)

Darwin notes that this ecosystem consists of different populations of organisms that live together in a particular location or habitat – plants, worms, insects and birds. He also suggests that these organisms are dependent on each other in a number of complicated ways, that is, that they are interrelated. And finally, he writes that these interrelationships are the result of laws – processes – that operate throughout the natural world.

This notion of these interrelationships is so important to the study of the environment that it is worth pausing to examine it in a little more detail.

If a bird in Darwin's hedgerow – say, a robin – eats an earthworm, that's an interaction between the bird and the worm. This interaction has consequences for the bird (a good meal) and rather drastic consequences for the worm (the end of its life). If the worm is to live and play its part in producing another generation of worms, it must avoid being eaten by the robin. But the relationship has implications in both directions. If the bird is to live and help to produce the next generation of robins, it must find and eat a certain number of worms (and other things). This set of interactions produces a link, an interrelationship, between robins and worms.

Of course, the robin and the earthworm will interact with many other living things in many other ways at the same time. The robin will use plant material from the hedgerow to construct its nest, will compete with other robins for territory and mates, and may itself end up as a meal for a sparrowhawk or a cat.

The bird and the worm also depend on, and change, the physical environment of the hedgerow. For example, the bird needs oxygen from the atmosphere and its droppings add chemicals to the soil. The worm extracts nutrients from the soil, and alters its consistency by passing it through its body as it feeds. This makes it easier for the roots of the hedgerow's plants to find the water and the nutrients they need, and so on. It is already easy to see that the interrelationships in our ‘entangled bank’ are more complicated than we might have thought, and that they involve both the living and the non-living components of the ecosystem.

Activity 5

Looking for interrelationships

Look out for examples of interrelationships in the remainder of this course, especially organisms that rely on others for food. Note down any examples.

Answer

Some of the other interrelationships are:

- caterpillars eat oak leaves
- robins eat caterpillars
- sparrowhawks eat robins
- humans eat a wide range of plants and animals.

Some interrelationships, like the ones discussed in this section, are relatively straightforward and easy to spot. Others are far harder to see, and the vast majority remain unknown to science. Yet the answers to so many of our questions about the natural world depend on identifying and analysing these interactions. As we shall see, they explain why some animals are common in a given location and others are rare; why some plants are large and others are small; and why some organisms are found in some habitats but not in others. They also explain many of the distinctive characteristics of the physical environments in which organisms live out their lives.

In the next section, we shall look at how scientists go about identifying, studying and recording some of these interrelationships.

Activity 6

0 hour(s) 10 minutes(s)

Reviewing your notes

It is important to go back and review the notes you have made from time to time. Can you improve them in the light of your new understanding and skills? Is there anything that you'd like to add? (This is why it is important to leave some space in your notes.)

Look back at the notes you made in response to Activity 4. Would you make any changes? Will they meet your needs when you return to them later? Think about what your notes are for.

Making notes is easier if you have a particular goal in mind, for example, a question that you want to answer.

6 Mapping interrelationships

Now we have started to identify the components of an ecosystem, living and non-living, we can start to look at ways of describing some of the interrelationships between them. As we have seen, one very direct form of interrelationship involves living things eating other living things. Everywhere we look, we see an animal making a meal out of a plant or another animal.

So, having reduced the biosphere to a manageable ecosystem, and named the organisms involved, we can move on to another pillar of the scientific approach to the natural world: observation.

If we return to our hedgerow and look closely at an oak tree, we might observe caterpillars eating the leaves. These caterpillars will, in turn, be eaten by the robin, and the robin may find itself unlucky enough to feature on the menu of a sparrowhawk.

We could describe these feeding interrelationships in words, as I have done in the paragraph above, but this is a rather cumbersome way of recording the information.

We could write it out in notes like this:

> an oak leaf is eaten by a caterpillar is eaten by a robin is eaten by a sparrowhawk

Or we could make it even shorter, like this:

> oak leaf → caterpillar → robin → sparrowhawk

When we use a symbol like → it is very important that we are clear about what it means. In this case the symbol → stands for the words ‘is eaten by’. It is important to note the direction of the arrow and to think about what the arrow means.

A diagram like this is called a **food chain**. It is a very useful way of capturing one important aspect of the interrelationships in an ecosystem.

Activity 7

0 hour(s) 10 minutes(s)

Food chains

Using a notepad, rearrange the following organisms from Darwin's hedgerow into food chains.

a. thrush … grass … cat … snail
b. sparrowhawk … oak leaf … robin … ladybird … greenfly
c. rabbit … human being … dandelion
d. grass … fox … snail … hedgehog

Answer

a. grass → snail → thrush → cat
b. oak leaf → greenfly → ladybird → robin → sparrowhawk
c. dandelion → rabbit → human being
d. grass → snail → hedgehog → fox

There are some things to remember about food chains.

First, almost all start with a plant that is eaten by an animal. The chains then vary in length, usually from three to five species. The shortest food chains have just two species: for example, blackberry → human being.

The second thing to note is the presence of human beings, ourselves, in some of the chains. We eat a wide range of plants and animals and occur at the top of a large number of food chains. These chains may involve wild or domesticated plants and animals, but almost all the food in your local supermarket is part of a chain that starts with a plant and ends with you.

The third point to note is that several of our food chains have organisms in common. So, for example, grass and snails are common to lists a and d in Activity 7. This is not surprising, as most animals eat a number of different plants or other animals. If some of the food chains in an ecosystem are combined they form a **food web**, in which each species appears only once. Food webs make it easier to see how the various organisms depend on each other for food. We can combine all the food chains we have produced for Darwin's hedgerow to create the food web shown in Figure 4.

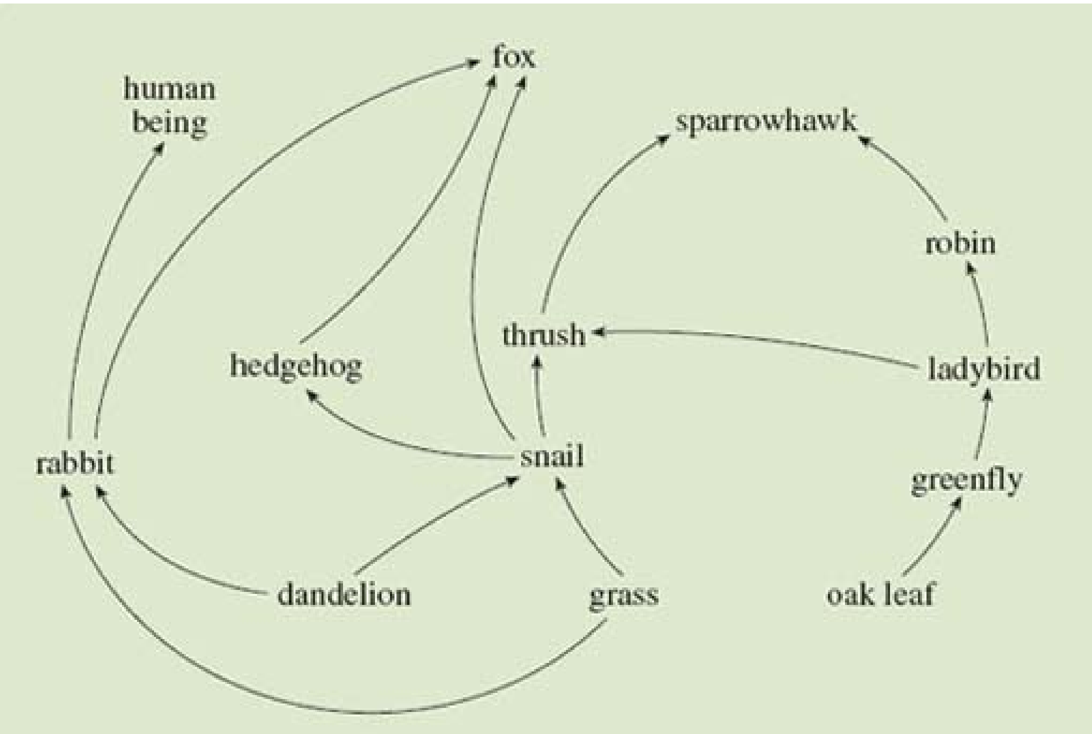

Figure 4 A food web

Activity 8

0 hour(s) 10 minute(s)

Food webs

Can you add an organism and links to Figure 4 that are not included in our food chains? You may find some ideas in Section 5.

My attempt is shown in Figure 5. You may well have come up with a number of different organisms. Food webs can quickly become very complicated: I have added only one organism.

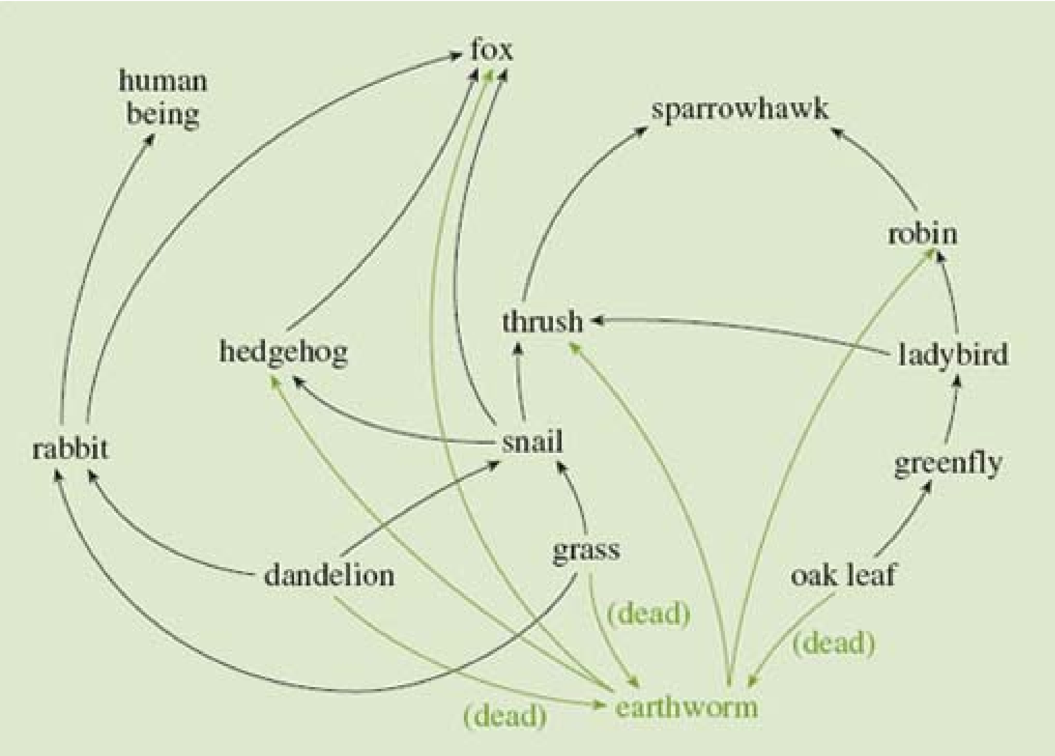

Figure 5 A more complicated food web

7 Ecological health

Does all this matter? Why is it important to divide the biosphere into ecosystems and study the interrelationships they contain?

My first answer would have something to do with the wonder and fascination of nature itself. For me, and for many other people I suspect, what science can tell us about how the biosphere works – about the interrelationships involved – serves to make it more interesting and more beautiful.

There is, however, another pressing reason to study ecosystems. Preserving the ecosystems of the Earth, and their ability to sustain us, is now our responsibility. It is time to put ourselves back into the picture. If asked, we define ourselves in terms of nationality or employment or social class. But we belong to ecosystems as well, and the adaptability of human beings means that we can be found in all sorts of environments from the poles to the equator.

As we have seen, all living things shape – and are shaped by – the physical environments that they inhabit. But no other species has our capacity to alter the world around it, to maximise the exploitation of its resources. And our influence is now global: modern patterns of business, food distribution and the use of natural resources mean that most of us have an indirect influence on ecosystems across the world.

The ways in which we have altered the ecosystems of the world include:

- the use of biological resources, from hunting and fishing to cutting down forests
- the use of physical resources, such as quarrying for rock and diverting water for irrigation systems
- the use of energy resources, including the burning of wood and fossil fuels (coal, oil and gas)
- the creation of artificial ecosystems, such as agricultural land for food production, and towns and cities as places for us to live.

The human population continues to grow and this, combined with the pressure for economic growth and development, will tend to increase our demands on other living things and the physical environment. To manage – or protect – an ecosystem we need to know how the living things it contains depend on each other, and how they depend on the air, soil and water in which they live. In large part, this means understanding the interrelationships involved, and so recognising the consequences of our actions for the ecosystem as a whole.

It is time to introduce a new term into our examination of ecosystems: **ecological health**. This term has become increasingly popular in discussions about the environment, although it is difficult to define or measure with any accuracy. It is possible to identify specific changes to an ecosystem, but any evaluation of its health is a matter of judgement not fact. Who decides whether an ecosystem is healthy? And on what grounds? Is a desert as healthy as a rainforest? Or does ecological health simply depend on a lack of human interference?

The fact that we find it hard to define ecological health doesn't mean that it has no value as a concept. We find it hard to define human health, but we recognise that it is important none the less. We know that some individuals are healthier than others and that certain things – a poor diet, for example – can have a negative effect. Like human health, ecological health is best thought of as a combination of many different things: the diversity, numbers and condition of the living organisms in an ecosystem; the complexity of the food webs involved; and the quality of the air, soil and water that make up the physical environment.

We need to study the health of ecosystems to find out how to protect them. How much change has already taken place? What will be the long-term consequences of our actions? How can we increase an ecosystem's ability both to resist change (**ecological resistance**) and to recover from the changes that have already happened (**ecological resilience**)?

We are the most powerful actors in most ecosystems, yet until recently we have been largely unaware of the ecological consequences of the way we live our lives. A quick glance through the newspapers, however, indicates that we are now becoming increasingly concerned about our collective impact on ecological health, in terms of pollution, climate change and the use of finite biological and physical resources.

Conclusion

You should now understand that:

- Ecology is a scientific approach to the study of the biosphere.
- Ecosystems are created by the interrelationships between living organisms and the physical environments they inhabit (land, water, air). Ecosystems require a source of energy to make them work and for most, although not all, this is light from the sun.
- To study ecosystems we have to start to identify the components involved and the interrelationships between them. We can list the living organisms by identifying the species involved.
- Food chains and food webs are a way of mapping one type of interrelationship between the organisms in an ecosystem.
- Human beings are part of ecosystems, as well as manipulators of ecosystems. As such we are dependent on, as well as responsible for, the ecological health of the ecosystems we inhabit.

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Figure 2: OAR/National Undersea Research Program (NURP)/NOAA;

Figure 3: Photo By Woods Hole Oceanographic Institution.

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