

8 ECOSYSTEMS

8.1 Vocabulary

synonyms • nouns from verbs • paraphrasing

A Discuss the following questions.

- 1 What is meant by the term *ecosystem*?
- 2 What roles in an ecosystem do the items in box a have?

B Study the four pictures on the opposite page. Discuss your answers to Exercise A.

C Look up each noun in box b in a dictionary.

- 1 Is it countable, uncountable or both?
- 2 What is its ecological meaning?
- 3 Is there a good synonym?
- 4 What useful grammatical information can you find?

D Study the two lists of verbs in box c.

- 1 Match the verbs with similar meanings.
- 2 Make nouns from the verbs if possible.

E Look at the Hadford University handout on the right.

- 1 How does the writer restate each section heading in the paragraph?
- 2 Find synonyms for the blue words and phrases. Use a dictionary if necessary.
- 3 Rewrite each sentence to make paraphrases of the texts. Use:
 - synonyms you have found yourself
 - synonyms from Exercise C
 - the nouns you made in Exercise D
 - passives where possible
 - any other words that are necessary

Example:

Energy passes through a sequence of organisms, each feeding on an animal or plant from the preceding food level.

→ *Energy is passed through a series of animals and/or plants, each of which consumes organisms from the previous food level.*

a animals plants rainfall
sunlight worms

b carnivore component
ecosystem extinction herbivore
organism population
sample waste

c	1	2
appreciate	eat	show
exist	form	(be) composed (of)
indicate	intersect	converge
mean	mean	signify
		occur
		understand
		consume



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Feeding relationships in ecosystems

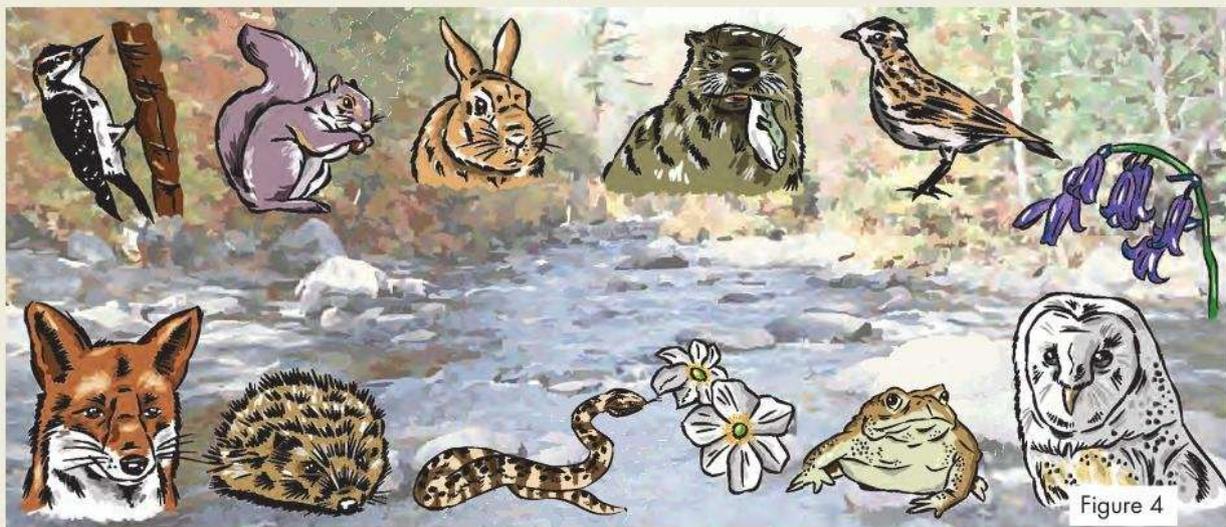
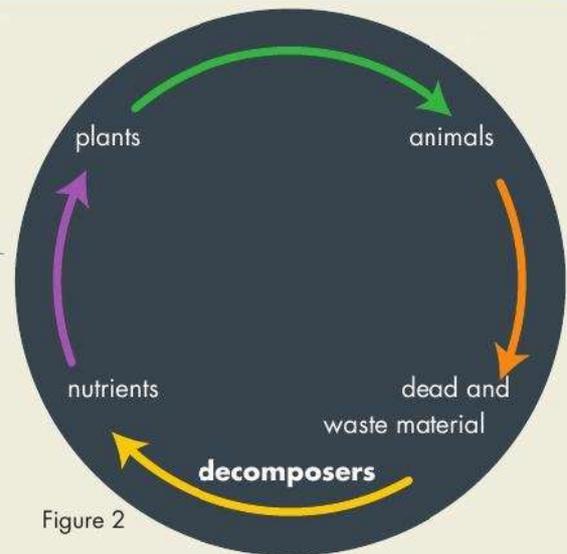
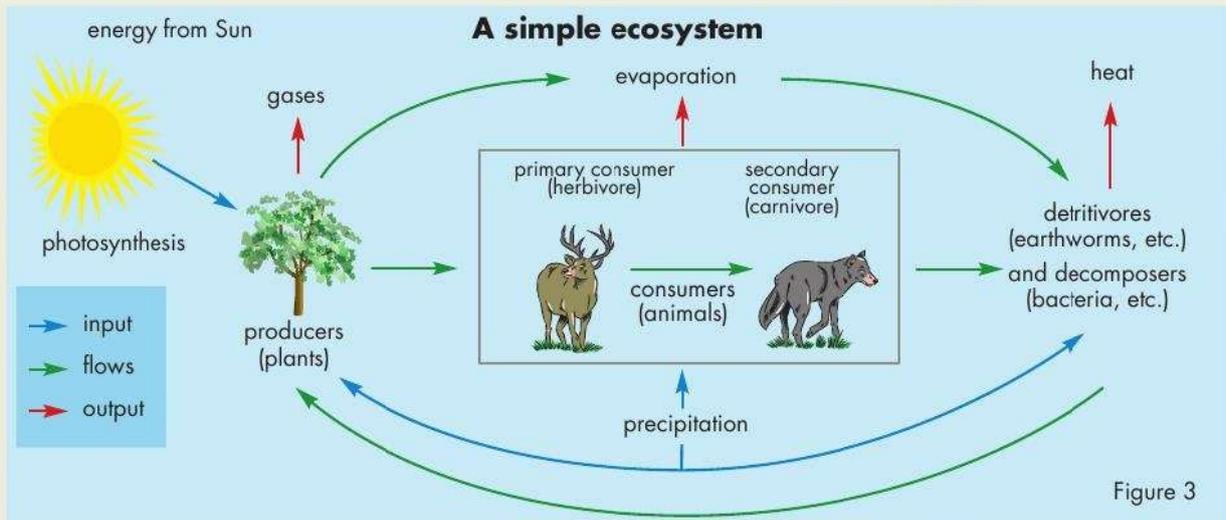
A Food chains

Energy passes through a **sequence** of organisms, each feeding on an animal or plant from the **preceding** food level. However, in rare instances, other types of food chain may **exist**. **For example**, some **large** carnivores may cross levels, eating a wide variety of animals and plants. One example of this is the North American grizzly bear, which **regularly** crosses feeding levels.

B Food webs

Food chains within an **ecological system** are almost always **interconnected** and **form** a network of relationships. Recent research has led to a greater understanding of the complexity of feeding relationships in ecosystems. We now understand that the eradication of one small beetle may have unforeseen **consequences** in other parts of the food web.

The biosphere and ecosystems



8.2 Reading

essay types • complex sentences with passives • definitions

A Look at the animals and plants on the first slide on the right.

- 1 Refer back to Figure 3 on page 63. Classify each animal or plant on the slide as one of the following:
 - producer
 - primary consumer
 - secondary consumer
- 2 What could go wrong with this food web if the ladybird population died out?

B Look at the four essay types on the second slide on the right.

- 1 What should the writer do in each type?
- 2 Match each essay type with one of the questions below the slide (A–D).
- 3 What topics should be covered in each essay question?

C Read the title of the text on the opposite page and the first sentence of each paragraph.

- 1 What will the text be about?
- 2 Choose one of the essay questions in Exercise B. Write four research questions which will help you to find information for your essay.

D Read the text.

- 1 Using *your own words*, make notes from the text on information for your essay question.
- 2 Work with another person who has chosen the same essay question as you. Compare your notes.

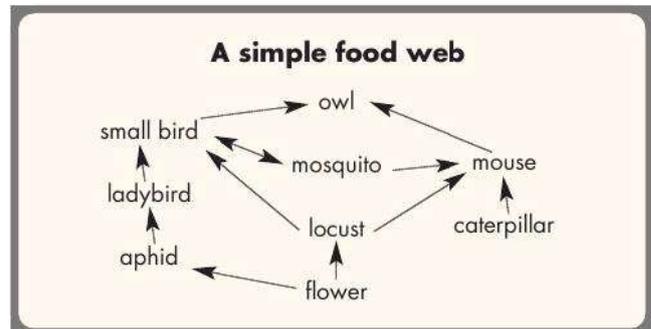
E Study the highlighted sentences in the text.

- 1 Underline all the subjects and their verbs.
- 2 Which is the main subject and verb for each sentence?

F Study the table on the right.

- 1 Match each word or phrase with its meaning.
- 2 Underline the words or phrases in the text which the writer uses to give the definitions.

See *Skills bank*



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There are four main essay types in environmental science:

- descriptive
- analytical
- comparison
- argument

A Compare and contrast the key processes by which producers and consumers obtain energy in ecosystems.

B 'Life is extremely rare on the fringes of the biosphere.' To what extent do you agree with this statement?

C Explain why the biosphere is considered to be a 'closed system'.

D What are the features of the Earth's biosphere which make it unique? Cite relevant examples where appropriate.

Word/phrase	Meaning
1 biosphere	complex molecules such as sugar or starch which provide the body with energy
2 microorganisms	a system that has no inputs from outside
3 closed system	the animal and plant life of a particular region
4 carbohydrates	dead organic material
5 biota	extremely small living things that cannot be seen by the naked eye
6 detritus	the part of the Earth's environment where life exists

The biosphere and ecosystems: our planet's life support system

One key aspect of ecology is the study of the Earth's biological systems and the interactions that occur within them. The largest system is the biosphere, which can be described as the intersection of air, water and land, where life exists. Life only exists because it can draw components from these three elements. For example, plants can only thrive because they capture CO₂ from the atmosphere which is then converted into food molecules. The biosphere refers to the planet as a whole. However, when we look at the interaction of different populations of organisms which live together in a particular location, and the way they interact with the physical environment, we are describing another biological system which is known as an ecosystem.

There are two fundamental characteristics of the Earth's biosphere we should consider. Firstly, the biosphere is actually a very thin zone of life. Within this zone, the majority of life occurs in an even narrower band of tolerance which begins at around 200 metres below the ocean's surface and ends at around 6,000 metres above sea level. Beyond this zone, life becomes sparse. However, every year we are making new discoveries of life forms in areas which had been considered to be devoid of life. For example, scientists have found microorganisms, living things which are too small to be seen without a microscope, in deep Antarctic ice core samples which had been thought to be sterile. Furthermore, research focusing on deep sea volcanic vents has shown that numerous species, including giant tube worms, clams and shrimp, can survive in extremely high water temperatures and pressures.

Another characteristic of the biosphere is that it is a closed system. In other words, the biosphere receives virtually no material from outside. Apart from the occasional meteorite, the only meaningful input is sunlight, which is vital to almost all life forms on our planet. Therefore, all the materials that are essential for life must be recycled within the biosphere. For example, the CO₂ you exhale today may be used by a sunflower during photosynthesis next month in southern France. This CO₂ is incorporated into carbohydrates (food

molecules) produced by the sunflower and stored as seed. The seeds are then consumed by birds and the carbohydrates are broken down again into their constituent parts during cellular energy production. The cycle is completed when the CO₂ is released back into the atmosphere.

Within each ecosystem, the biota (that is, the flora and fauna of a particular location) can be classified into three basic types. The first type are all the green plants we see around us. These are known as producers. They convert water and CO₂ into carbohydrates and release oxygen as a waste product. This process is important because, along with minerals, carbohydrates allow plants to produce the organic compounds they need to survive.

The second type of organism is known as the consumer, and within this grouping we find three basic types. The first type are called primary consumers. They are herbivores that obtain their energy in the form of complex organic molecules by feeding on the producers. Organisms that feed on this group are known as secondary consumers, and those that feed on secondary consumers are described as tertiary consumers. Both secondary and tertiary consumers are also known as carnivores. Therefore we see that, within an ecosystem, a food chain exists where there is a transfer of energy starting with the producer and finishing with the tertiary consumer. To illustrate this, imagine a snail feeding on a leaf. The snail is caught and consumed by a blackbird, and the blackbird is then eaten by a cat. Parasites are a further type of consumer. They can be either plants or animals that live in or on another organism. Often they can be harmful to the 'host' but they commonly do not kill it; rather they coexist with the host.

The final types of organisms found in an ecosystem are the detritivores and the decomposers. Detritivores such as earthworms feed on detritus, or dead plant and animal material. Decomposers such as bacteria and fungi consume dead organisms and their waste products. Both play crucial roles in the ecosystem because they break down organic matter and release nutrients back into the environment.

8.3 Extending skills

passives in dependent clauses • essay plans

A Find the words in the box in the text in Lesson 8.2.

- 1 What part of speech is each word?
- 2 Think of another word which could be used in place of the word in the text. Use your dictionary if necessary.

particular location
characteristic consider material
essential exhale describe

B Study sentences A–D.

- 1 Identify the dependent clause.
- 2 Copy the table under the sentences and write the parts of each dependent clause in the table.
- 3 Rewrite the sentence using an active construction.

Example:

A *There are a number of factors which environmental scientists have to consider.*

C Read the essay plans and extracts on the opposite page.

- 1 Match each plan with an essay title in Lesson 8.2.
- 2 Which essay is each extract from?
- 3 Which part of the plan is each extract from?

A There are a number of factors which have to be considered by environmental scientists.

B Ecologists have known for a long time that ecosystems are adversely affected by human activity.

C Ecosystems have 'food chains' through which energy is transferred from producers to consumers.

D Today, it is clear that the biosphere is being damaged by carbon emissions.

D Work with a partner.

- 1 Write another paragraph for one of the plans.
- 2 Exchange paragraphs with another pair. Can they identify where it comes from?

Subject	Verb	By whom/what
(factors) which	have to be considered	by environmental scientists

8.4 Extending skills

writing complex sentences • writing essay plans • writing essays

A Make complete sentences from these notes. Add words as necessary.

A biosphere – air, land and water – intersect – life exists

C nowadays – science of ecology – focus – biosphere – some describe – 'skin of life' on Earth

E three unique features – biosphere – first – narrow – dimensions

B second characteristic – biosphere – closed system – components – recycled

D in conclusion – biosphere – complex and unique – no biosphere, no life

F third feature – biosphere – supports life – provide organisms – components – gases, water, minerals

B The sentences in Exercise A are topic sentences for paragraphs in essay D in Lesson 8.2. Put them in the best order for the essay. What is the main topic for each paragraph?

C Look at the essay question on the opposite page.

- 1 What kind of essay is this?
- 2 Do some research and make a plan.
- 3 Write the essay.

See *Skills bank*

Essay plans

A

- 1 Introduction: importance of biosphere, esp. in context of life; aims of essay
- 2 Define biosphere
- 3 List scientific factors for the biosphere being a closed system (e.g., lack of inputs, recycling of components, etc.)
- 4 Case study of how 'recycling system' functions, e.g., carbon
- 5 Conclusion: our biosphere is a closed system because the only external input is sunlight; the rest is recycled

B

- 1 Introduction: importance of producers and consumers in ecosystems; give essay aims
- 2 Definition of producers and consumers in the context of ecosystems
- 3 How producers obtain energy; photosynthesis; waste product (O_2)
- 4 How consumers obtain energy, including (i) primary consumers, (ii) secondary consumers, (iii) tertiary consumers
- 5 Conclusion: producers and consumers form a food chain where energy is transferred from one organism to another

Essay extracts

1

Within the complex structures of an ecosystem, where organisms constantly interact with each other, one of the key relationships is the transfer of energy between producers and consumers. In this essay I will look at the differences between the two by analyzing how they obtain energy and the relationship that exists between them in the food chain. In addition, I will outline the three basic types of consumer that occur in this category.

2

It is clear that the biosphere is a closed system which has only one significant input, namely solar energy. Components such as water, atmospheric gases and minerals are constantly recycled within the biosphere rather than being added to from an outside source. This can be illustrated by examining the way CO_2 moves around the biosphere. At the initial stage, CO_2 is exhaled by a primary, secondary or tertiary consumer. The CO_2 may then be captured by a green plant to be used when it produces food molecules during photosynthesis. These food molecules are then stored as seeds. The process is finished when the seeds are eaten by a primary consumer and the CO_2 is released back into the environment as a waste product of cellular energy production.

Essay question

Write a description of an ecosystem which you are familiar with and look at how human activity is affecting it. The essay should first describe some of the different populations of organisms which live together and how they interact. Secondly, it should analyze the effects of human activity on the ecosystem, in the context of pollution, loss of habitat, hunting and farming.

Vocabulary bank

Understanding new words: using definitions

You will often find new words in academic texts. Sometimes you will not be able to understand the text unless you look the word up in a dictionary, but often a technical term will be defined or explained immediately or later in the text.

Look for these indicators:

<i>is or are</i>	<i>Ecosystems are ...</i>
brackets	<i>... carbon sinks (CO₂-absorbing forests)</i>
<i>or</i>	<i>Detritivores such as earthworms feed on detritus, or dead plant and animal material.</i>
<i>which</i>	<i>... acid rain, which is a type of precipitation containing harmful chemicals.</i>
a comma or a dash (–) immediately after the word or phrase	<i>... detritivores, soil-based organisms decomposers – bacteria and fungi that break down waste ...</i>
phrases such as <i>that is, in other words,</i>	<i>The biota (that is, the flora and fauna of a particular location) can be classified into three basic types.</i>

Remember!

When you write assignments, you may want to define words yourself. Learn to use the methods above to give variety to your written work.

Understanding direction verbs in essay titles

Special verbs called direction verbs are used in essay titles. Each direction verb indicates a type of essay. You must understand the meaning of these words so you can choose the correct writing plan.

Kind of essay	Direction verbs
Descriptive	<i>State ... Say ... Outline ... Describe ... Summarize ... What is/are ...?</i>
Analytical	<i>Analyze ... Explain ... Comment on ... Examine ... Give reasons for ... Why ...? How ...?</i>
Comparison/evaluation	<i>Compare (and contrast) ... Distinguish between ... Evaluate ... What are the advantages and/or disadvantages of ...?</i>
Argument	<i>Discuss ... Consider ... (Critically) evaluate ... To what extent ...? How far ...?</i>

Skills bank

Choosing the correct writing plan

When you are given a written assignment, you must decide on the best writing plan before you begin to write the outline. Use key words in the essay title to help you choose – see *Vocabulary bank*.

Type of essay – content	Possible structure
<p>Descriptive writing List the most important points of something: e.g., in a narrative, a list of key events in chronological order; a description of key ideas in a theory or from an article you have read. Summarize points in a logical order. Example: <i>What are the key features of an ecosystem?</i></p>	<ul style="list-style-type: none"> • introduction • point/event 1 • point/event 2 • point/event 3 • conclusion
<p>Analytical writing List the important points which in your opinion explain the situation. Justify your opinion in each case. Look behind the facts at the how and why, not just what/who/when. Look for and question accepted ideas and assumptions. Example: <i>Explain the rise of global temperatures in recent decades.</i></p>	<ul style="list-style-type: none"> • introduction • definitions • most important point: example/evidence/reason 1 example/evidence/reason 2 etc. • next point: example/evidence/reason 3 example/evidence/reason 4 etc. • conclusion
<p>Comparison/evaluation Decide on and define the aspects to compare two subjects. You may use these aspects as the basis for paragraphing. Evaluate which aspect(s) is/are better or preferable and give reasons/criteria for your judgment. Example: <i>Compare woodland and grassland ecosystems in the American north-west.</i></p>	<ul style="list-style-type: none"> • introduction • state and define aspects <i>Either:</i> <ul style="list-style-type: none"> • aspect 1: subject A v. B • aspect 2: subject A v. B <i>Or:</i> <ul style="list-style-type: none"> • subject A: aspect 1, 2, etc. etc. • conclusion/evaluation
<p>Argument writing Analyse and/or evaluate, then give your opinion in a thesis statement at the beginning or the end. Show awareness of difficulties and disagreements by mentioning counter-arguments. Support your opinion with evidence. Example: <i>'Recycling strategies are causing more harm than good.'</i> <i>Discuss with reference to two or three examples in the European Union.</i></p>	<ul style="list-style-type: none"> • introduction: statement of issue • thesis statement giving opinion • define terms • point 1: explain + evidence • point 2: explain + evidence etc. • conclusion: implications, etc. <p><i>Alternatively:</i></p> <ul style="list-style-type: none"> • introduction: statement of issue • define terms • for: point 1, 2, etc. • against: point 1, 2, etc. • conclusion: statement of opinion