

# Unit title: **Ecological Principles and their Application**

Unit code: **D/601/0239**

QCF level: **4**

Credit value: **15**

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## **Aim**

This unit provides learners with an understanding of the delicate balance and interaction of life on our planet and how disruption to this balance threatens the continuing existence of life on Earth. Learners are also able to develop skills in ecological research.

## **Unit abstract**

The unit is designed to give learners an understanding of the fundamental concepts of ecology and how they may be applied in the modern world. By looking at examples of the interaction between biotic and abiotic factors within ecosystems learners will appreciate how a delicate balance is maintained for life within that community and why ecological study is important in monitoring these changes. They will be encouraged to discuss named examples of changes within ecosystems today and the implications of these changes on life within that community.

Learners will study how different species have evolved, adapted and survived in particular environments, as well as how communities change over time. Within this, learners will be encouraged to examine how energy and nutrients flow within ecosystems and why some species fail to survive and become extinct.

Learners will have the opportunity to plan a small-scale ecological research study of their own, and collect, analyse and interpret the ecological information they obtain.

Learners will have opportunities to discuss current social, ethical, moral and environmental issues which impact on survival.

## **Learning outcomes**

### **On successful completion of this unit a learner will:**

- 1 Understand the importance of ecological study
- 2 Understand basic ecological theory
- 3 Be able to conduct ecological research.

## Unit content

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### 1 Understand the importance of ecological study

*Balance of the world's ecosystems:* reasons for maintaining a balance e.g. regulation of atmospheric gases, regulation of climate, nutrient cycling, treatment of pollutants, water supply, pollination, food supply, biological pest control, supplies of fuel and building materials, supplies of medicines, recreation and culture, quality of life for humans

*Important ecological issues:* key issues affecting living organisms e.g. acid rain, global warming, eutrophication, deforestation, biodiversity, human population growth, sustainability, pesticide use, eco-tourism

*Implications of ecological change:* effect of change on ecosystems e.g. global warming, deforestation, human population growth, acid rain, eutrophication, reducing impact of change, maintaining balance in ecosystems

### 2 Understand basic ecological theory

*Evolutionary ecology:* variation in individuals; the diversity of life; natural selection; speciation; adaptation; extinction

*Behavioural ecology:* survival and reproduction ecology e.g. group selection versus individual selection, altruism, life histories, age and sex structures, dispersal, kin selection

*Population ecology:* population growth, abiotic factors, competition, coexistence; predation; herbivory; parasitism

*Community ecology:* characteristics of change e.g. classification of terrestrial and aquatic community types, ecological niches, zonation, succession, biodiversity

*Ecosystems ecology:* primary and secondary production; energy flow; food webs; nutrient cycling

### 3 Be able to conduct ecological research

*Plan an ecological study:* type of study e.g. laboratory experiment, field experiment, correlations, direct observation of behaviour, case studies, modelling

*Techniques:* hypotheses and objectives; planning experiments; sampling and replication e.g. quadrants, transects, abundance scales, mark-release recapture techniques; use and interpretation of statistics

*Data analysis:* types of data collected e.g. nominal, ordinal, interval; non-parametric statistical tests e.g. Spearman rank correlation coefficient, Chi-square, Wilcoxon, Mann-Whitney

## Learning outcomes and assessment criteria

| <b>Learning outcomes</b><br>On successful completion of this unit a learner will: | <b>Assessment criteria for pass</b><br>The learner can:   |
|---|---|
| LO1 Understand the importance of ecological study                                 | 1.1 explain the importance of maintaining a suitable balance to the world's ecosystems for life to exist<br>1.2 review important ecological issues affecting the distribution and abundance of living organisms<br>1.3 discuss the implications of changes to ecological equilibrium and include examples of ecosystems undergoing change   |
| LO2 Understand basic ecological theory  | 2.1 explain the theories behind the evolution and extinction of species and the factors that lead to extinction<br>2.2 discuss the behavioural ecology of three named animals or plants for survival and reproduction<br>2.3 discuss population ecology and the distribution of living organisms using a named animal or plant<br>2.4 review community ecology to demonstrate how communities may change over time<br>2.5 examine models for energy flow and nutrient cycling within ecosystems |
| LO3 Be able to conduct ecological research  | 3.1 plan a small-scale ecological study<br>3.2 carry out a piece of ecological research using appropriate techniques and safe practices<br>3.3 analyse recorded data, draw conclusions and make recommendations.  |

## Guidance

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### Links

This unit has particular links with the following units within this qualification:

- *Unit reference number L/601/0219: Laboratory Techniques for Applied Biology*
- *Unit reference number J/601/0297: Statistics for Experimental Design*
- *Unit reference number Y/601/0238: Environmental Monitoring and Analysis*
- *Unit reference number K/601/0289: Environmental Management and Conservation*
- *Unit reference number A/601/0295: Biodiversity, Conservation and Threats*
- *Unit reference number R/601/0299: Plant Physiology and Environmental Adaptation.*

### Essential requirements

#### Delivery

The unit can focus on the ecology of animals, plants or humans. Learners must gain a general understanding of ecology and then apply that knowledge to important ecological issues.

Learning outcome 1 gives learners an understanding of the interdependence of organisms within ecosystems and the balance between biotic and abiotic factors, which if disturbed can have catastrophic effects on all life within that environment and beyond.

Learning outcome 2 provides a general overview of ecological issues including evolution, adaptation, nutrient cycles and factors influencing distribution of organisms. Learners must start to develop their independent research into the effects of their own workplace on both local and wider ecosystems.

It is important that learners gain some experience of practical ecology. This can be achieved in learning outcome 3 by learners planning their own small ecological study, carrying out a piece of practical research and then analysing the data obtained. The research topic must reflect the learner's main interest. Learners can draw on knowledge gained in other units and also from their own workplace and assess the effect/influence they may be having on the community both locally and generally. A suggested word count for this study would be between 4500 and 5500 words.

#### Assessment

Evidence may be generated using a series of written and practical assignments. For learning outcome 1, learners research a named ecosystem undergoing change, with an emphasis on maintaining a suitable ecological environment. Learners then discuss how the changes taking place could have consequences for life within the system.

For learning outcome 2, the use of named ecosystems will help learners focus their responses and may help them to link tasks together. Desert or arctic ecosystems could serve as suitable examples.

Learning outcome 3 must be assessed through learner projects, where individual or small groups of learners plan, undertake and write up a practical study. Learners must, as individuals or groups, plan, conduct and analyse a relevant piece of ecological research. Learners should be allowed to choose, or be guided towards, issues that are relevant to their interests and vocational background.

If group work is chosen, each learner must provide sufficient evidence to meet the assessment criteria on an individual basis. Practical work must be supported by appropriate tutor observation records or witness statements.

## Resources

Access to basic ecological survey equipment will be necessary. Information can be obtained from books and journals and, in addition, the press may carry articles that emphasise current issues. The internet has a large number of ecological sites, for example [www.whfreeman.com/biology](http://www.whfreeman.com/biology).

Access to statistical packages or spreadsheets will be important for analysing collected data. For up-to-date statistical information (published annually):

- Defra – Sustainable development indicators in your pocket (Defra Publications, 2009) Code PB 13265
- Defra – The environment in your pocket (Defra Publications, 2009) Code PB 13185.

These documents do not have an ISBN as they are published directly by Defra annually.

## Employer engagement and vocational contexts

Learners should be encouraged to apply their research and studies, where possible, to their workplace, looking at the impact of their own organisation both locally and globally. This will allow learners to link the unit theory to practical examples in their everyday working lives. Examples can be as diverse as waste and recycling to emissions, depending on the work setting.