Unit title: Plant Physiology and Environmental Adaptation

Unit code: **R/601/0299**

QCF level: **5**

Credit value: **15**

Aim

This unit provides learners with an understanding of plants and their habitats and the environmental issues which can affect their survival. Learners also develop skills in assessing the use of plants in environmental restoration.

Unit abstract

This unit enables learners to explore the main areas of plant anatomy and their functions. This knowledge can then be used to look at how xerophytic and hydrophytic plant species have become adapted to their particular habitats. Following on from this, learners will use the information to understand how plants can be used in habitat formation, restoration, maintenance and regeneration.

The underlying science is studied along with its application in conservation projects locally and nationally.

The role of genetics is considered from the point of view of genetic manipulation and its usefulness to society. This includes the interbreeding of genetically modified and natural species and the effect this could have on the natural population.

Visits to centres engaged in conservation and site visits form an essential part of this unit.

It is envisaged that learners will have the opportunity to gain practical experience in maintaining and monitoring sites and working with interested groups, be they farmers, ecologists or conservationists.

Learning outcomes

On successful completion of this unit a learner will:

1 Understand plant anatomy in relation to physiological processes

2 Understand plant adaptation to extreme habitat type

3 Be able to investigate the use of plants in the environmental restoration of industrial and waste land

4 Understand the use of plant types in local re-vegetation and habitat maintenance sites.

Unit content

1 Understand plant anatomy in relation to physiological processes

Root type and structure: cell types and cellular arrangements; function of cell types in relation to the structure; water and mineral uptake and pathways followed; soil-plant-water relations

Stem structure: cell types and cellular arrangements; functions of cell types in relation to structure; specific mechanisms of transportation

Leaf structure: cellular arrangements in relation to functional capacity in terms of optimising photosynthesis; leaf morphology

Identification of the range and variation of plant anatomical arrangements: algae eg chlorophyta, phaeophyta, euglenophyta; bryophyta eg mosses; pteridophyta eg ferns; spermatophyta eg gymnosperms, angiosperms

2 Understand plant adaptation to extreme habitat type

Xerophytic: adaptation eg comparative anatomy and physiology of the root, stem and leaf structures; changes that result in physiological pathways

Hydrophytic: adaptation eg comparative anatomy and physiology of the root, stem and leaf structures; changes that result in physiological pathways

Plant classification: overview of plant species; the wide variety of life cycles and habitat dwellings eg in relation to their use in habitat restoration and maintenance

3 Be able to investigate the use of plants in the environmental restoration of industrial and waste land

Plants adapted to different habitats: types of habitat eg nutrient rich water, acid/alkaline soil, polluted soil, atmospheric pollution, dry conditions

Development of communities and ecosystems: assessment eg using local areas of interest, site assessment inclusions (soil sampling, toxicology, drainage), factors affecting the choice of typical soil and native plant species, community/public use of site post restoration, maintenance requirements

Typical plant species: classification eg indigenous to the area, typical of the habitat type, plant interrelations and long-term survival for biodiversity establishment

Local agenda 21: worldwide origins; local groups; aims and objectives; implementation in the UK; effects of agenda 21

4 **Understand the use of plant types in local re-vegetation and habitat maintenance sites**

Characteristics for plant type selection: ability to survive environmental factors eg drainage, weathering, general climatic fluctuations, soil characteristics, surrounding foliage type; theoretical interpretations of different maintenance techniques for different site types eg Sites of Special Scientific Interest (SSSI), natural re-vegetation site, low maintenance techniques

Current technology: application eg use of plant species for rectifying sites of toxicity, harmful run off

Farm conservation and biodiversity: policies of alternative site use, the interaction of standard farm practices with habitat creation and maintenance eg hedgerows, aquatic areas, SSSI corners; incentives available to farmers to create and maintain such sites within their farm lands; personnel skills and educational aspects for dealing with introduction of ideas; the use of farm sites in local authority research

Plant genetics and habitats: the theoretical interpretation of genetically modified species and their usefulness in society; the interrelationship of natural and modified species; the effect on the natural population of plant species in terms of interbreeding and species dominance; public opinion on genetically modified plants

Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	**Assessment criteria for pass** The learner can:
LO1 Understand plant anatomy in relation to physiological processes	1.1 explain the functions of root type and structure 1.2 discuss stem structure in relation to functions 1.3 explain the functions of leaf form and structure 1.4 identify the major anatomical arrangements in a range of plant groups
LO2 Understand plant adaptation to extreme habitat type	2.1 discuss xerophytic adaptation to habitat compared to the mesophytic plant form 2.2 explain hydrophytic adaptation to habitat in comparison with the mesophytic plant form 2.3 explain how to identify plants using binomial classification keys
LO3 Be able to investigate the use of plants in the environmental restoration of industrial and waste land	3.1 assess the adaptations shown by plants to different habitats 3.2 discuss how a site is assessed to encourage the development of animal and plant species for long-term biodiversity survival 3.3 carry out a survey of typical plant species indigenous to a local area 3.4 explain the effects of Local Agenda 21
LO4 Understand the use of plant types in local re-vegetation and habitat maintenance sites	4.1 explain the plant characteristics which need to be taken into account when selecting for planting in a variety of sites 4.2 discuss how current technology is used to combat the effect of a damaged site 4.3 assess the role of farm conservation and management in enhancing indigenous biodiversity 4.4 assess the role of plant genetics in habitat construction or destruction.

Guidance

Links

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

- *Unit reference number T/601/0215: Cell Biology*
- *Unit reference number J/601/0218: Physiology of Cellular Systems in Animals*
- *Unit reference number D/6010239: Ecological Principles and their Application*
- *Unit reference number A/601/0295: Biodiversity, Conservation and Threats.*

Essential requirements

Delivery

This unit is designed to enable learners to examine practical evidence wherever possible. Centres are encouraged to develop links with local environmental centres, agencies, conservation groups, councils and research centres. Delivery of the unit must be based on learner interaction and participation in practical techniques.

Learning outcome 1 is best delivered using practical laboratory work supported by theoretical input. Learners must be taught to interpret the plant structures seen and practical exercises can be used to reinforce the learning process. The use of visual material is recommended as an aid to learning, for example when learners are looking at plant types such as algae, gymnosperms.

The use of visual texts and actual species is expected in delivery of learning outcome 2. Visits to sites where plants can be seen or the use of video material can prepare learners for future fieldwork. Learners must be familiar with the use of classification keys for the naming of specific examples. Learners must be able to classify to genus, species level. Emphasis is on the use of the keys and the relevance to fieldwork.

Where possible, learners should conduct their own literature searches to investigate current techniques being used within local establishments, providing evidence for learning outcome 3. Again, practical work at local sites is essential to make learner research relevant to real situations.

This also applies to learning outcome 4, where site visits and practical discussions, along with some theoretical delivery help to make theory and practical investigations vocationally relevant.

Health and safety protocols must be followed closely when delivering this unit.

Assessment

Learners must be able to demonstrate a clear understanding of the major physiological processes that occur in plants and relate their structure and adaptation to the habitat type. Through understanding these concepts learners will be able to interpret the use of plants in habitat formation and maintenance. The unit is also designed to enable learners to come into contact with many common species, so improving the identification of species as a secondary skill.

Resources

Current plant and environmental journals, papers and magazines are essential for current techniques and research, as are plant identification guides.

Some specialist lectures would enhance more detailed aspects of the unit. University department websites are a useful source of information and they often publish their research and results or a summary of them. Likewise local authority websites, under conservation or ecology, often contain a section on their work which covers aspects of this unit and often refers to agenda 21.

The ability to transport learners to local sites to carry out survey work and habitat assessments is needed.

Employer engagement and vocational contexts

Visits to centres engaged in conservation and site visits are essential parts of this unit. Contact with employers is vital if learners are to use such facilities.

Visits to laboratories at a local university to see the structures visible using electron microscopes etc would be valuable. Local farmers and conservation groups welcome interested groups, especially if they can join in with some activities.

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