Unit 37: Understand the Principles and Identify the Signs of Pests and Diseases of Trees

Unit code: K/600/9921

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

Aim and purpose

This unit aims to provide learners with an understanding of pests and diseases of trees and how these can be put into practice. This unit is primarily aimed at learners within a centre-based setting looking to progress into the sector or to further education and training.

Unit introduction

Professional arboriculturists and foresters are commonly asked to assess and manage the growth and development of trees in a variety of situations. The predominant aim is to produce healthy trees that meet owner objectives. To do this effectively, it is important to understand the appearance and characteristics of 'normal' tree growth and what is required for this to occur. Disease can then be identified as a deviation from normal tree growth expected in a particular situation.

It is of paramount importance that learners have a basic understanding of the abiotic and biotic pathogens that affect tree growth and which they are likely to encounter in their professional career. Successful management of trees is only possible with the skill to identify pathogens and ability to understand their significance. Learners will develop a broad perspective of plant pathology and study the range of common biotic and abiotic pathogens that cause disease. The signs and symptoms of common biotic and abiotic pathogens will be described and the life cycles of biotic pathogens examined. In addition, learners will evaluate appropriate monitoring, prevention and control measures for common biotic pathogens. Although this unit looks at both common biotic and abiotic pathogens, there is an emphasis on those biotic pathogens considered to have a significant impact on amenity and forestry trees.

Learning outcomes

On completion of this unit a learner should:

1 Understand the principles of pathology and the common causes of disease

2 Be able to identify the signs and symptoms of common biotic and abiotic pathogens

3 Understand common biotic pathogens

4 Understand monitoring, prevention and control measures of common biotic pathogens.

Unit content

1 Understand the principles of pathology and the common causes of disease

Principles of pathology: basic requirements for the healthy growth of trees; identification and recognition of signs and symptoms associated with unhealthy or structurally unsound trees; treatment; prevention; cure; how pathogens affect tree growth and development

Causes of disease: differences between abiotic and biotic pathogens; abiotic pathogens eg lightning, sun scorch, frost, drought, poor soil aeration, nutrient deficiencies, air pollution, road salt, herbicides; biotic pathogens eg bacteria, fungi, vertebrate pests, invertebrate pests

2 Be able to identify the signs and symptoms of common biotic and abiotic pathogens

Identification of biotic pathogens: insect pests (Hemiptera, Hymenoptera, Lepidoptera, Coleoptera); mammalian pests (rabbits, grey squirrels and deer); fungal pathogens (Ascomycetes eg Nectria spp; Basidiomycetes, eg rusts, Armillaria spp, Meripilus giganteus, Ganoderma spp, Laetiporus sulphurous; Oomycetes eg Phytophthora spp); bacterial pathogens eg Xanthomonas populi; rot types; invasion strategies; signs and symptoms eg colour changes of leaves, defoliation, browsing, bark stripping, fruitifications, dieback, premature senescence, shoot distortion; use of identification keys; effects; consequences of misidentification

Identification of abiotic pathogens: lightning, sun scorch, frost, drought, waterlogging, poor soil aeration, nutrient deficiencies, air pollution, road salt, herbicides; signs and symptoms eg fissures, bark cracking, leaf loss, shoot distortion, dieback, colour changes of leaves, stunted growth, effects, consequences of misidentification

3 Understand common biotic pathogens

Characteristics: life cycle; reproduction methods and rates; breeding seasons; behavioural characteristics; growth and development; social structure; preferred habitat; food supply and preferences; natural population controls eg diseases, parasites and natural mortality; mode of movement eg insect vectors, wind, spores, territory; significance of life cycle (to tree disease or damage identification)

4 Understand monitoring, prevention and control measures of common biotic pathogens

Monitoring measures: access arrangements; tree condition; surveys eg faeces, damage, timing and frequency; tree inspection; trapping eg live capture, pheromone; decay detection equipment; reporting procedures; environmental implications; current relevant legislation; health and safety

Prevention measures: methods used to promote healthy growth eg irrigation and feeding; repellents; physical barriers eg fencing, tree shelters; breeding for natural resistance; species selection; environmental implications

Control and management measures: predators; bacteria; disease; lifespan; shooting and culling; approved traps; pesticides eg fumigation and poisons; pruning; sanitation felling; environmental implications

Legal considerations: current wildlife protection and management legislation eg Pests Act 1954, Plant Health Act 1967, Wildlife and Countryside Act 1981; current pesticide legislation eg Food and Environment Protection Act 1985, role of Pesticides Safety Directorate, Approved Code of Practice for Using Plant Protection Products; current health and safety legislation eg Health and Safety at Work Act

1974, Control of Substances Hazardous to Health Regulations 2002; insurance requirements

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P1 summarise the principles of pathology	**M1** explain the relationship between the identification, treatment, prevention and management of ill health in trees	**D1** assess common biotic and abiotic pathogens in given scenarios accurately, recommending valid management options
P2 identify the consequences of pests and diseases for trees [IE]		
P3 review the common causes of tree diseases [IE]		
P4 describe the signs and symptoms of common biotic pathogens	**M2** describe the impact of common biotic and abiotic pathogens on tree health	
P5 describe the signs and symptoms of common abiotic pathogens		
P6 diagnose pathogen damage to trees [IE]		

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P7 discuss the life cycles of common invertebrate, vertebrate, fungal and bacterial pathogens	**M3** examine strategies used by given pathogens to spread	**D2** discuss the significance of the life cycle of pathogens for identifying the cause of disease or damage to trees in a given scenario.
P8 explain the significance of the life cycle for correctly identifying pathogens		
P9 describe host and pathogen relationships		
P10 evaluate appropriate monitoring measures associated with common biotic pathogens [IE]	**M4** explain legal and environmental considerations of monitoring, prevention and control measures.	
P11 evaluate appropriate prevention measures associated with common biotic pathogens [IE]		
P12 evaluate appropriate control measures associated with common biotic pathogens [IE]		
P13 produce a suitable plan to manage specified biotic pathogens [CT]		
P14 outline the legal and environmental considerations associated with control of common biotic pathogens.		

PLTS: This summary references where applicable in the pass criteria, in the square brackets, the elements of the personal, learning and thinking skills. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

Tutors delivering this unit have opportunities to use a wide range of techniques. Lectures, discussions, seminar presentations, site visits, supervised fieldwork, internet and/or library-based research and the use of personal and/or industrial experience would all be suitable.

It would be beneficial to make learners on work placements and their supervisors aware of the requirements of this unit before any work-related activities are undertaken, so that naturally occurring evidence can be collected at the time. For example, learners may have the opportunity to inspect unhealthy or structurally unsound trees and they should ask for observation records and/or witness statements to be provided as evidence of this.

Visiting expert speakers could add to the relevance of the subject for learners. For example, an arboricultural officer or consultant, a forest manager, a tree pathologist or researcher or pest control contractor could talk about their work, the situations they face and the methods they use.

Whichever delivery methods are used, it is essential that tutors stress the importance of health and safety, and the need to monitor, prevent and control pathogens using legal methods with consideration given to environmental implications.

Health and safety issues relating to learners visiting any diseased trees or undertaking any practical work with any items of equipment must be stressed and reinforced regularly, and risk assessments must be undertaken before all practical activities. Adequate PPE must be provided wherever appropriate and used following the production and implementation of suitable risk assessments.

Due to the seasonal nature of many pathogens, learners could be given the opportunity to study diseased or structurally unsound trees and pathogens throughout the year, with particular regard to the timing when signs and symptoms may be found most easily. Emphasis should be given to local or regional pathogens and/or those vocationally significant to learners.

Learners are not expected to use pesticides or traps during delivery and assessment for this learning outcome, but should be exposed to other, alternative management options which are commonly used. Dummy products, simulations or demonstrations should be used to illustrate appropriate methods.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan gives an **indication of the volume of learning it would take the average learner** to achieve the learning outcomes. It is **indicative and is one way of achieving the credit value**.

Learning time should address all learning (including assessment) relevant to the learning outcomes, regardless of where, when and how the learning has taken place.

Topic and suggested assignments/activities and/assessment
Introduction and overview of the unit.
Assignment 1: Pest and Disease Report (P1, P2, P3, P6, P14, M1, M4, D1) Tutor introduces assignment.
Introduction to the principles of pathology.
Overview of the causes of disease.
Assignment 2: Pest and Disease Logbook (P4, P5, P7, P8, P9, D2) Tutor introduce assignment.
Introduction to plant healthcare programmes.
Top rotting and heart-rotting fungi.
Laboratory session.
Personal study.
Pathogenic fungi.
Fungal colonisation.
Laboratory session.
Personal study.
Decay fungi.
Laboratory session.
Personal study.
Rusts and other fungal diseases.
Laboratory session.
Personal study.
Defoliaters, sap-suckers and galls.
Laboratory session.
Individual support.
Personal study.
Mammalian pests.
Bacterial damage.
Laboratory session.
Personal study.
Individual support.
Abiotic damage.
Pesticide legislation.
Personal study.
Assignment 3: Biotic Pathogens (P10, P11, P12, P13, M2, M3) Tutor ntroduces assignment.
Field diagnosis.
Individual support.
Unit review.

Assessment

P1 requires learners to summarise the principles of pathology. Learners should explain the general requirements of trees and how pathogens affect tree growth. This will link to several criteria, including P2, P3 and M1, with evidence being in the form of a report.

For P2, learners need to identify the consequences of pests and diseases for trees. This could be in terms of specific trees or general symptoms of unhealthy trees. This links with P1, with evidence being in the same format.

P3 requires learners to review common causes of tree diseases. Learners should explore both biotic and abiotic pathogens. Tutors should identify the causes of disease or agree them through discussion with learners. Where possible, to ensure assessment is fair, the size and complexity of the tasks should be the same for all learners. Evidence could be in the same form as for P1 and P2: as a report or through a presentation or poster.

For P4, learners must describe the signs and symptoms of common biotic pathogens. Tutors should identify the pathogens, which must be relevant to the appropriate industry for learners and locally or regionally significant. Where possible, to ensure assessment is fair, the size and complexity of the tasks should be the same for all learners. As a minimum, learners should provide evidence covering the pathogen groups listed in the unit content.

Due to the seasonal nature of many pathogens, assessment should be planned carefully in relation to when they can be found most easily. Evidence may link directly to work being undertaken for P5.

For P5, learners must identify the signs and symptoms of common abiotic pathogens. Tutors should identify the pathogens, which must be relevant to the appropriate industry for learners and locally or regionally significant. Where possible, to ensure assessment is fair, the size and complexity of the tasks should be the same for all learners. Evidence may link directly to work being undertaken for P4.

P6 requires learners to diagnose pathogen damage to trees. Due to the seasonal nature of many pathogens, assessment should be planned carefully in relation to when they can be found most easily. Evidence may link directly to work being undertaken for P2 or could be assessed directly by the tutor during practical activities. If this format is used, then suitable evidence from guided activities would be observation records completed by learners and the tutor.

For P7, learners must discuss the life cycles of invertebrate, vertebrate, fungal and bacterial pathogens. Tutors should identify the pathogens or agree them through discussion with learners. As a minimum, learners should provide evidence covering the pathogen groups listed in the unit content. This can be linked directly to work being undertaken for P4 and evidence may be in the same format.

P8 requires learners to explain the significance of the life cycle of pathogens in identifying the cause of disease or damage. Evidence may link directly to work being undertaken for P4, P5 and P7 and could be in the same format as for P4.

For P9, learners are required to describe host and pathogen relationships. Evidence may link directly to work being undertaken for P4, P5, P7 and P8 and may be in the same format as for P4.

P10, P11 and P12 require learners to evaluate the monitoring, prevention and control measures for common biotic pathogens. Tutors should identify the pathogens or agree them through discussion with learners. As a minimum, learners should provide evidence covering the pathogen groups listed in the unit content. This can be linked directly to work being undertaken for P4. Evidence may be in the same format as for P4 or take the form of a short written test.

P13 requires learners to produce a suitable plan to manage specified biotic pathogens. Tutors should identify the pathogens or agree them through discussion with learners. This can be linked directly to work being undertaken for P4 or P10, P11 and P12 and evidence could be in the same format as that suggested for P4 or P10, P11 and P12.

For P14, learners are required to outline the legal and environmental considerations associated with the control of common biotic pathogens. Tutors should identify the pathogens or agree them through discussion with learners. This could be linked to P1, P2, P3 and M4, with the evidence in the same format as that for P1.

For M1, learners must explain the relationship between the identification, treatment, prevention and management of tree ill health. Tutors may identify an industrial context in discussion with learners. Evidence can link directly to work being undertaken for P1 and be in the same format as for P1.

M2 requires learners to describe the impact of common biotic and abiotic pathogens on tree health. Tutors should identify the pathogens relevant to the appropriate industry for learners and which are locally or regionally significant. As a minimum, learners should provide evidence covering the pathogen groups listed in the unit content. This could be based on a visual examination or short written tests and could involve the use of identification keys and other aids.

Due to the seasonal nature of many pathogens, assessment should be planned carefully in relation to when they can be found most easily. Learners could give verbal answers to tutors based on samples, photographs or drawings of pathogens or the damage they cause.

M3 requires learners to explain the strategies used by given invertebrate, vertebrate, fungal and bacterial pathogens to spread. Tutors should identify the pathogens or agree them through discussion with learners. As a minimum, learners should provide evidence covering the pathogen groups listed in the unit content. This can be linked directly to M2 and evidence may be in the same format as for M2.

For M4, learners are required to explain the legal and environmental considerations associated with the monitoring, prevention and control of pathogens. Tutors should identify the pathogens or agree them through discussion with learners. This could be linked to P12 with the evidence in the same format.

For D1, learners are required to assess common biotic and abiotic pathogens in given scenarios accurately, recommending valid management options. Tutors should identify the pathogens or agree them through discussion with learners. This can be linked directly to work being undertaken for P6 and evidence may be in the same format.

D2 requires learners to discuss the significance of the life cycle of pathogens in identifying the cause of disease or damage in a given scenario. Tutors should identify the pathogens or agree them through discussion with learners. This can be linked directly to work being undertaken for P7 and evidence may be in the same format.

Programme of suggested assignments

The following table shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, P3, P6, P14, M1, M4, D1	Pest and Disease Report	For four trees, create a report detailing the main pests and/or diseases present on each tree. Advise on appropriate prevention and control treatments for each problem, linking them to legal and environmental considerations. Describe the observed symptoms and implications of the pest/disease. Set measurement parameters for monitoring damage. Explain how the life cycle of the pest/disease affects its spread and distribution.	Report.

Criteria covered	Assignment title	Scenario	Assessment method
P4, P5, P7, P8, P9, D2	Pest and Disease Lab Book	Create a lab book of10 specimens covering a range of both biotic and abiotic pests and diseases. Describe their biology, life cycles, spread, principles of diagnosis, secondary symptoms caused, and relationship with the host.	Lab book.
P10, P11, P12, P13, M2, M3	Biotic Pathogens	Undertake a written test answering questions relating to the monitoring, prevention and control measures of biotic pathogens, management of biotic pathogens, the effects of pathogens and strategies used by pathogens to spread.	Test.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Land-based sector suite. This unit has particular links with:

Level 2	Level 3
Introduction to Practical Forestry Skills	CU80 Plan and manage the control of pests, diseases and disorders
Understanding Ecology of Trees, Woods and Forests	Understand and Carry Out Identification, Planting and Care of Trees
	Undertaking Woodland Habitat Management

Essential resources

Learners will need access to laboratory facilities with binocular microscopes, hand lenses, a projection microscope, and access to supplies of diseased, damaged and decayed material, and samples of pathogens including photographs. Learners will need access to practical examples and to be able to study trees affected by disease in order to complete this unit. Learners should have the opportunity to observe a wide range of biotic pathogens associated with unhealthy and unsound trees, as well as diseased trees in situ.

Access to the internet and a library with multiple copies of specialist texts is also essential and access to the *Tree Doctor* CD ROM, or similar diagnostic tools, would be beneficial.

Employer engagement and vocational contexts

This unit focuses on developing skills that will be of value to learners within the working environment. Centres are encouraged to create and develop links with tree professionals in the local area and other specialists in this field. This could be through guest lectures or site visits. Links with industry will ensure that learners appreciate the importance of the skills they have developed in this unit and their value within the industry.

Indicative reading for learners

Textbooks

Agrios N – *Plant Pathology, 5th Edition* (London Academic Press, 2005) ISBN 9780120445653

Alford D – *A Colour Atlas of Pests of Ornamental Trees, Shrubs and Flowers* (Manson, 1995) ISBN 9781874545347

Bevan D – *Forest Insects* (Stationery Office Books, 1987) ISBN 9780117102002

Butin H – *Tree Diseases and Disorders* (Oxford University Press, 1995) ISBN 9780198549321

Dent D – *Insect Pest Management, 2nd Edition* (CAB International, 2000) ISBN 9780851993409

Gregory S and Redfern D – *Diseases and Disorders of Forest Trees: A Guide to Identifying Causes of Ill-health in Woods and Plantations* (The Stationery Office Books, 1998) ISBN 9780117103382

Hibberd B – *Forestry Practice* (The Stationery Office Books, 1991) ISBN 9780117102811

Lonsdale D – *Principles of Tree Hazard Assessment and Management* (The Stationery Office Books, 1999) ISBN 9780117533554

Peace T – *Pathology of Trees and Shrubs, 2nd Edition* (Trollius Publications, 2001) ISBN 9780953971817

Pirone P T, Harfman J R and Sall M A – *Pirone's Tree Maintenance, 7th Edition* (Oxford University Press, 2000) ISBN 9780195119916

Prior R – *Trees and Deer: How to Cope with Deer in Forest, Field and Garden* (Swan Hill Press, 1994) ISBN 9781853104329

Schwarze F, Engels J, Mattheck C and Linnard W – *Fungal Strategies of Wood Decay in Trees* (Springer-Verlag, 2000) ISBN 9783540672050

Strouts R and Winter T (eds) – *Diagnosis of Ill-Health in Trees, 2nd Edition* (The Stationery Office Books, 2000) ISBN 9780117535459

Weber K and Mattheck C – *Manual of Wood Decay in Trees* (Arboricultural Association, 2003) ISBN 9780900978357

Journals

Arboricultural Journal

Forestry Journal

Quarterly Journal of Forestry

Other publications

Arboricultural Association newsletter

Websites

www.defra.gov.uk	Department for Environment, Food and Rural Affairs
www.forestry.gov.uk	Forestry Commission
www.hse.gov.uk	Health and Safety Executive
www.pesticides.gov.uk	Chemicals Regulations Directorate
www.treehelp.info	The Tree Advice Trust

Delivery of personal, learning and thinking skills (PLTS)

The following table identifies the PLTS opportunities that have been included within the assessment criteria of this unit:

Skill	When learners are ...
Independent enquirers	identifying unhealthy trees reviewing common causes of tree diseases diagnosing pathogen damage to trees evaluating appropriate monitoring, prevention and control measures associated with pathogens
Creative thinkers	planning suitable management of biotic pathogens.

Although PLTS opportunities are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Independent enquirers	assessing common pathogens in given scenarios
Creative thinkers	recommending prevention, treatment and cures for pathogens.

Functional Skills – Level 2

Skill	When learners are ...
ICT – Use ICT systems	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	producing a report on pests and diseases affecting given trees
Manage information storage to enable efficient retrieval	producing a report on pests and diseases affecting given trees
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	identifying the signs and symptoms of given pathogens
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	identifying the signs and symptoms of given pathogens
ICT – Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: • text and tables • images • numbers • records	producing a report on pests and diseases affecting given trees
Bring together information to suit content and purpose	producing a report on pests and diseases affecting given trees
Present information in ways that are fit for purpose and audience	producing a report on pests and diseases affecting given trees
Evaluate the selection and use of ICT tools and facilities used to present information	producing a report on pests and diseases affecting given trees
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	advising on prevention and control measures for pests and diseases affecting given trees
Identify the situation or problem and the mathematical methods needed to tackle it	advising on prevention and control measures for pests and diseases affecting given trees
Select and apply a range of skills to find solutions	advising on prevention and control measures for pests and diseases affecting given trees
Use appropriate checking procedures and evaluate their effectiveness at each stage	advising on prevention and control measures for pests and diseases affecting given trees
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	advising on prevention and control measures for pests and diseases affecting given trees

Skill	When learners are ...
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	explaining the legal and environmental considerations associated with the control of common biotic pathogens
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	diagnosing pathogen damage to trees
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	producing a report on pests and diseases affecting given trees.