Unit 20: Understanding Freshwater and Wetland Management

Unit code: K/601/0079

QCF Level 3: BTEC National

Credit value: 10

Guided learning hours: 60

Aim and purpose

This unit aims to introduce learners to freshwater and wetland management skills and knowledge and how these can be applied in practice. It is designed for learners in centre-based settings looking to progress into the sector or onto further/higher education.

Unit introduction

The Earth provides the system that maintains our air, regulates temperature and provides us with food. Nature provides a large number of `services' that are vital to the human race including clean air and water, fertile soil and nutrients. The `soggy' areas of land we call wetlands and the world's freshwater systems such as rivers and lakes are areas that can filter and clean our water, help to relieve floods and provide a home for numerous animals and plants. Humans often take these systems for granted but they are a valuable resource that should not be underestimated.

Some reports suggest that Scottish peat bogs contain more than 90 percent of the carbon in British soils and forests. As such, wetlands are an important area in storing carbon as organic matter. Freshwater habitats are also vitally important and provide a resource that is used in the industrial, household, agriculture, recreational and environmental sectors. In this unit learners will examine the characteristics that are present in different freshwater habitats, survey areas of freshwater and wetland as well as being able to manage these areas successfully, with the key focus on being environmentally sound and maintaining these areas for future generations.

Learning outcomes

On completion of this unit a learner should:

1 Understand ecological characteristics of lentic freshwater habitats

2 Understand ecological characteristics of lotic freshwater habitats

3 Understand ecological characteristics of wetland habitats

4 Be able to carry out freshwater habitat conservation management activities.

Unit content

1 Understand ecological characteristics of lentic freshwater habitats

Characteristics: physical eg depth, length, width, volume, area, temperature, drawdown zone, turbidity, description of catchment influences, land use, geology; chemical eg pH, dissolved O_2, conductivity, ammonia, nitrates, phosphates, Biochemical Oxygen Demand (BOD); biological eg vegetation, (submerged, floating-leaved, emergent, marginal), aquatic invertebrates, vertebrates (fish, amphibians, reptiles, birds, mammals)

Survey and monitoring: reasons to survey eg site selection (local reserves or SSSIs), impact assessment and mitigation, assessment by local or regional government, species recovery and action plans, management advice, monitoring; methods eg sampling, pond dipping for invertebrates, use of classification keys, use of data logging equipment, National Pond Survey methodology; possible causes of error whilst surveying eg wrong identification; displaying data eg graphs, pie charts.

Habitats, distribution and formation: types eg lakes, ponds, puddles, ephemeral pools, reservoirs, gravel pits, ditches, dykes, canals; conservation value; influence of geology on formation, eg regional differences; glacial landforms eg kettle holes, corries/cwms, flooded valleys; manmade eg dew ponds, flight ponds, cress beds

2 Understand ecological characteristics of lotic freshwater habitats

Characteristics: physical eg water flow (speed, incline, gradient), depth, length, width, volume, area, temperature, turbidity, description of catchment influences, land use, geology; chemical eg pH, dissolved O_2, conductivity, ammonia, nitrates, phosphates, Biochemical Oxygen Demand (BOD); biological eg vegetation, (submerged, floating-leaved, emergent, marginal), aquatic invertebrates, vertebrates (fish, amphibians, reptiles, birds, mammals)

Features and attributes: use as drainage systems eg springs, upland headwaters/tributaries (cold, high O_2 levels, scouring flows, high transport of sediment); mature channels/rivers: attributes eg lowland, reduced flow, erosion, sedimentation and deposition, channel morphology (straight, meandering, braided); In-stream features eg types (meanders, point bars, islands, shoals, pools, riffles, runs, oxbows, backwaters); Riparian zone characteristics (bank features, side channels, root systems, log jams, silt traps, importance of organic inputs, riparian vegetation, buffer zones); floodplain features eg connectivity between floodplain and channel, importance of alluvial deposition and nutrients, importance of flood/drought events, latitudinal and longitudinal complexity, palaeo-landforms (levees, meander scrolls, old oxbows)

Survey and monitoring: physical characteristics eg measuring latitudinal/longitudinal dimensions, depth, cross-section of streambed, temperature, flow; in-stream, riparian and floodplain features; conservation value; classification of rivers using physical characteristics and biotic indices; chemical characteristics (pH, dissolved O_2, conductivity, ammonia, nitrates, phosphates, BOD); biological characteristics (vegetation, aquatic invertebrates, vertebrates, adaptations to riverine existence); health and safety; risk assessment; relevant current legislation and codes of practice; possible causes of error eg wrong identification.

3 Understand ecological characteristics of wetland habitats

Definition: Ramsar criteria; importance of ecotones between terrestrial and aquatic habitats

Survey and monitoring: data collection eg water and air temperature data logging, alkalinity, pH, depth, substrates, vegetation communities, flora and fauna present, invertebrate sampling using kick nets or dip nets; types eg Phase 1/simple National Vegetation Classification (NVC) methodology, use of dip wells in monitoring water levels; conservation value; possible causes of error, eg wrong identification

Habitat;; Alkaline and neutral habitats EG base-rich fens, sedge/reed beds, carr woodland; Acidic habitats EG base-poor fens, valley mires, flushes, blanket bogs, raised bogs; other habitats eg wet grasslands, coastal grazing marsh, water meadows, floodplain grassland, rush pasture

4 Be able to carry out freshwater habitat conservation management activities

Organisations: eg Environment Agency (EA), Scottish Environment Protection Agency (SEPA), Natural England, Scottish Natural Heritage (SNH), Countryside Council for Wales (CCW), Environment and Heritage Service Northern Ireland (EHSNI), Royal Society for the Protection of Birds (RSPB), wildlife trusts

Legislation: relevant current legislation, codes of practice and conventions, eg Environment Act 1995, Water Framework Directive 2000, Habitats and Birds Directives, RAMSAR Convention

Management planning: lentic eg creation and restoration, pond/lake management, landscaping, liners, planting, managing succession; restoration of gravel pits/mineral workings; lotic eg principles of successful river restoration, eg 'best practice', restoring natural features, in-stream and bankside, dredging, desilting, re-profiling, bank protection and enhancement, planting, fencing; wetlands eg grazing (stock types, densities and regimes) water level management (sluices, pipes, drains), engineering (scrapes), planting (reed beds, riparian woodland).

Managing biodiversity: current examples, eg wet grassland management for waders and wildfowl, reed bed management for bittern, river rehabilitation for fish, otter holt construction; management of invasive species, eg signal crayfish, rainbow trout, pumpkinseed, American mink, Himalayan balsam, Japanese knotweed; use of European beaver as management tool

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 safely carry out a survey of the ecological characteristics of a selected lentic freshwater habitat to meet given objectives [TW, SM, EP]	**M1** describe the characteristics of a lentic freshwater habitat	
P2 record and interpret the lentic freshwater data collected [IE]		
P3 safely carry out a survey of the ecological characteristics of a selected lotic freshwater habitat to meet given objectives	**M2** describe the characteristics of a lotic freshwater habitat	**D1** compare data from lentic and lotic freshwater habitats stating the reasons for their similarities and differences
P4 record and interpret the lotic freshwater data collected		
P5 safely carry out a survey of the ecological characteristics of a selected wetland freshwater habitat to meet given objectives, recording and interpreting collected data	**M3** describe the characteristics of a wetland habitat	**D2** evaluate the conservation value of a specified wetland
P6 record and interpret wetland freshwater data collected		
P7 outline possible causes of data collection error		
P8 safely carry out practical management on a freshwater site to meet given specifications	**M4** discuss organisations that manage areas of freshwater and wetland.	**D3** examine current legislation in place to protect freshwater habitats from threats.
P9 describe the use of conservation management techniques		

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:**
P10 recommend improvements to freshwater habitat management. [CT, RL]		

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

Delivery of this unit will involve practical assessments, written assessment, visits to suitable collections, links to work experience placements, site visits and guest expert speakers who may be able to talk about specific locations where freshwater surveying is carried out. Most providers will have access to a body of freshwater though visits to a suitably sized site, which will be a major focus for the surveying section of this unit. Several field visits will be involved to carry out data collection, plus guest speakers and organised visits for practical work such as small invertebrate sampling. Some of the material can however be delivered using a wide range of techniques including lectures, discussions, seminar presentations, supervised practicals and research using the internet and/or library resources. Delivery should stimulate, motivate, educate and enthuse learners.

Any site visits should be checked for suitability and a risk assessment of activities carried out before learners visit the site. Charities that run reserves can often support visits and provide expert guidance on the specific location as well as sometimes being able to create appropriate sessions and practical work. It would be beneficial if learners and site supervisors were made aware of the requirements of this unit before any activities are undertaken so that naturally occurring evidence can be collected at the time. For example, learners may have the opportunity to use data logging equipment and a variety of different probes or kick sampling for small invertebrates and they should to ask for observation records and/or witness statements to be provided as evidence of this. Guidance on the use of observation records and witness statements is provided on the Edexcel website.

Guest speakers would be also be able to provide background information on legal requirements and health and safety considerations when collecting data on different freshwater habitats for example depth, invertebrate sampling. The study of lotic environments should be considered carefully as fast moving water can add extra elements of risk to field visits. Care should be taken over the time of year, water flow speed and whether extra training or specific safety equipment is required in order to sample a specific site. The tutor must ensure that the site chosen for data collection is appropriate to learners' physical abilities.

Some of the techniques can be carried out by setting up a scenario in a laboratory or classroom if suitable equipment is available. Samples can be collected from a variety of sources and analysis completed in the classroom. The data logging equipment and its use could be linked to a series of science-based lectures where, if in a college environment, science specialists may be able to assist.

Whichever delivery methods are used, it is essential that tutors stress the importance of animal welfare, sound environmental management and the need to manage the resource using legal 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: Getting to Know the Local Area (P1, P2, M1) Introduction to assignment.
Research, lectures, guided practical work on lentic freshwater habitats
Assignment 2: Checking for Pollution (P3, P4, M2, D1) Introduction to assignment.
Research, lectures, guided practical work on lentic freshwater habitats
Assignment 3: Working with Other Organisations (P5, P6, P7, M3, D2). Introduction to assignment.
Research, lectures, guided practical work on lentic freshwater habitats
Assignment 4: Getting in the News (P8, P9, P10, M4, D3) Introduction to the assignment.
internet research, library research, guest lectures, demonstrations and guided practical work.
Evaluation of unit.

Assessment

For P1, learners must carry out a survey of the ecological characteristics of a selected lentic freshwater habitat safely to meet given objectives. Learners are expected to survey physical, chemical and biological characteristics. Tutors should identify the habitat and the objectives 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 can be in the form of completed survey documentation, written notes from a field visit, presentation, diary notes or web blog recording information on a site. Alternatively, this could be assessed directly by the tutor during practical activities using witness statements and observation records.

P2 requires learners to record and interpret data on the lentic freshwater habitat studied during P1. This could be through producing graphs to best show data from the survey, presentations using suitable software, production of statistics on species found and their characteristics, comparing data from surveys of similar sites.

P3 could be assessed in a similar way to P1 but this time based around a lotic freshwater habitat.

P4 could be assessed in a similar way to P2 but the data will relate to a lotic freshwater habitat.

P5 is the study of a wetland habitat which again could be assessed as for P1.

P6 can be assessed in a similar way to P2 but the data will relate to a wetland habitat.

P7 requires learners to outline possible causes of error in data collection. Evidence could take the form of a presentation, PowerPoint presentation, annotated poster, leaflet or information booklet.

For P8, learners must carry out practical management on a freshwater site safely to meet given specifications. The availability and accessibility of suitable sites will necessarily dictate the management tasks that can be undertaken. Tutors should identify the habitat and the specifications 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. This 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 and accompanied by appropriate work logs or other relevant learner notes. If assessed during a placement, witness statements should be provided by a suitable representative and verified by the tutor.

For P9, learners need to describe the use of conservation management techniques in a selected freshwater habitat. Tutors should identify the techniques and the habitat 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. Assessment could take the form of an interview with supporting witness statements, annotated diagrams or posters, a presentation, a guidance booklet for example. for the Environment Agency.

For P10, learners must recommend improvements to freshwater habitat management. Evidence could be a report on the site used in P9 including what improvements could be made to the site. Evidence could also be in the form of a presentation or report to the land owner.

M1, M2 and M3 are similar focuses on different freshwater habitats. Learners must describe the characteristics of these habitats. Evidence could come from notes, presentations, observations of practical work with supporting witness statements, photographic evidence with supporting notes, written work, web page, or a booklet for a government agency.

For M4, learners must discuss organisations that manage areas of freshwater and wetland. This could be through a piece of written work, a presentation, a web page or magazine article for a specialist magazine for example the Wildlife Trust.

For D1 learners must compare data from lentic and lotic habitats stating the reasons for the similarities and differences between the two. The comparison can be presented using tables, graphs, charts, pie charts, or other suitable formats and could be presented as a written or oral presentation.

For D2 learners must evaluate the conservation value of a specified wetland. This could be through a question and answer session, blog, web page, video or poster.

For D3, learners should examine a piece of legislation relevant to freshwater habitats. Evidence could take the form of internet research, annotated poster, presentation, web page, a role play of a court case where an area of freshwater has been polluted by a large company who are denying responsibility.

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, M1	Getting to Know the Local Area	You are a qualified ranger for the Wildlife Trust and have recently moved to a new county. Your first job is to familiarise yourself with the lakes and ponds of the local area that you will look after. You are also expected to bring the records for these areas up to date.	Notes, diary, report.
P3, P4, M2, D1	Checking for Pollution	After strange weather the local river has burst its banks and residents are worried that smaller streams and rivers may be polluted. You must survey them and report your findings back to your superiors.	Reports, written work, detailed email.
P5, P6, P7, M3, D2	Working with Other Organisations	The RSPB decides to run a volunteer event at a local wetland reserve and requests help from your charity to provide experts on the day. You will be showing people how to check various levels as well as sample for plants and animals.	Witness statements, diary, observation records.

Criteria covered	Assignment title	Scenario	Assessment method
P8, P9, P10, M4, D3	Getting in the News	The local newspaper and wildlife trust magazine decide they would like to do a piece on the conservation effort in your area. You will be interviewed on things you are doing to help wildlife, conservation projects in your county and whether you think the current laws in place are enough for you to do your job well.	Article, written notes, question and answer session (filmed), filmed interview.

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
Conservation and Improvement of British Habitats	Element EC23.1 Prepare for field surveys Element EC23.2 Collect and record data through field surveys Element EC23.3 Interpret survey data and report on findings
	Understanding Fishery Management

Essential resources

Access to a range of freshwater habitats is essential for learners to experience the environments where lentic, lotic and wetland areas exist. Habitats that support small invertebrates and are relatively safe to work on/in would be preferable.

Equipment required will include normal safety gear for use in laboratories and in the field; a range of dissolved oxygen meters, thermometers and chemical test kits; water sampling equipment; basic water flow measurement equipment; record keeping equipment and a calculator.

Tutors delivering this unit should be experienced in using techniques to sample water and analysing data from a biological survey.

Employer engagement and vocational contexts

Learners would benefit from having access to a working environment. This can achieved by creating links with local businesses or charitable organisations who may even benefit from taking on learners. Local authorities can be a useful source of information as can business education alliances. Charitable organisations can often provide guest speakers to give lectures as well as demonstrations.

Indicative reading for learners

Textbooks

Benstead P, Jose P, Joyce C and Wade P – *European Wet Grassland: Guidelines for Management and Rehabilitation* (RSPB, 1999) ISBN 1901930017

Bronmark C and Hansson L – *The Biology of Lakes and Ponds, 2nd Edition* (Oxford University Press, 2005) ISBN 0198516134

English Nature – *Wildlife and Freshwater: An Agenda for Sustainable Management* (English Nature, 1997) ISBN 1857162609

Friday L – *Wicken Fen: The Making of a Wetland Nature Reserve* (Harley Books, 1997) ISBN 094658933X

Furniss P, Lane A and Tait J – *Water and Wetlands* (Hodder Arnold, 1992) ISBN 0340533684

Giller P and Malmqvist B – *The Biology of Streams and Rivers* (Oxford University Press, 1998) ISBN 0198549776

Holmes N – *Rivers and Wildlife Handbook* (A&C Black, 1994) ISBN 0903138700

Ratcliffe D – *A Nature Conservation Review: The Selection of Biological Sites of National Importance to Nature Conservation in Britain: Site Accounts version 2* (Cambridge University Press, 1977) ISBN 0521214033

Treweek J, Drake M, Mountfield O, Newbold C, Hawke C, Jose P, Self M and Benstead P – *Wet Grassland Guide* (A&C Black, 1997) ISBN 0903138867

White G and Gilbert J – *Habitat Creation Handbook for the Minerals Industry* (A&C Black, 2003) ISBN 1901930378

Williams P J – *Pond Book: A Guide to the Management and Creation of Ponds* (Ponds Conservation Trust, 1999) ISBN 0953797104

Websites

www.ceh.ac.uk	Centre for Ecology and Hydrology
www.defra.gov.uk	Department for Environment, Food and Rural Affairs
www.environment-agency.gov.uk	Environment Agency
www.hse.gov.uk	Health and Safety Executive
www.lantra.co.uk	Sector Skills Council for the Environment and Land-based Industrues
www.pondstrust.org.uk	Pond Conservation
www.ramsar.org	The Ramsar Convention on Wetlands
www.rspb.org	The Royal Society for the Protection of Birds
www.sepa.org.uk	Scottish Environment Protection Agency
www.therrc.co.uk	The River Restoration Centre
www.ukbap.org.uk	UK Biodiversity Action Plan

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	Carrying out internet research and library research questioning experts
Creative thinkers	suggesting improvements to techniques used in the field
Reflective learners	evaluating work completed
Team workers	Carrying out group tasks for analysis
Self-managers	meeting deadlines
Effective participators	completing group tasks.

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	Carrying out research
Creative thinkers	applying techniques studied to the working environment
Reflective learners	suggesting improvements to techniques and sites
Team workers	practising techniques
Self-managers	producing written work on time
Effective participators	participating in team activities.

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	carrying out internet research, writing presentations.
ICT – Find and select information	
Select and use a variety of sources of information independently for a complex task	carrying out internet research on legislation researching water quality at different locations comparing data
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	presenting written work and data.
Bring together information to suit content and purpose	analysing and, displaying data.
Present information in ways that are fit for purpose and audience	carrying out presentations
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	analysing data
Identify the situation or problem and the mathematical methods needed to tackle it	analysing data
Select and apply a range of skills to find solutions	analysing data
Use appropriate checking procedures and evaluate their effectiveness at each stage	checking data
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	analysing data
Draw conclusions and provide mathematical justifications	using formulae

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	producing presentations, video, blogs,
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	reading information as part of internet and library research
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	completing reports, diaries and other assessments.