For Peat’s Sake

Investigating and understanding the importance of peat and wetlands.



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This project is aimed at students studying at post 16 level, e.g. A Level Environmental Science, A Level Biology, A Level Geography, BTEC Environmental Sustainability and more.

Aims:

* To carry out practical fieldwork to survey, wildlife, water quality and peat soil properties in the Broads National Park.
* Raise awareness of the importance of peatlands on climate, biodiversity, water quality and flood risk mitigation.
* Understand sustainability issues facing peatlands within the Broads, the UK and globally.

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# Introduction to Peat

The Broads is one of Europe’s most important wetlands for nature conservation. Its rich mosaic of habitats comprises of saltmarshes, intertidal mudflats, shallow lakes, fens (wet grassland, dominated by reeds, rushes and sedge, on peat-rich soil), drained marshland, wet woodland, relict estuary and coastal dunes.

# What are peatlands?

Peat is a type of soil comprised of plant remains, which are compressed in waterlogged conditions over long periods of time. The waterlogged conditions prevent plant material from fully decomposing and ‘peat’ soil is formed by the partially decayed material, which builds up slowly.

Peatlands are areas of land and habitat, supporting a naturally-accumulated layer of peat.

# Why are peatlands important?

## Carbon storage

Peatlands are some of the most carbon-rich ecosystems on Earth. The carbon-rich peatland ecosystems such as those in the Broads provide multiple benefits to the environment, including a net cooling effect on climate, reduction of flood risk, and supporting biodiversity. Healthy peatlands can reduce flood risk by slowing the flow of water from the uplands, and by providing floodplain storage in the lowlands.

Around 40% of the total mass of peat soil is carbon, whereas regular topsoil only contains up to 3% of carbon. In Broads peatland there is an estimated 12,000,000 - 14,000,000 tons of carbon.

Interesting fact: Peatlands only cover 3% of the earth’s land surface but hold twice as much carbon as all the world’s forests combined.

## Biodiversity

Fens are a type of wet grassland found in peatlands, dominated by reeds, rushes and sedge.

Fens are the richest habitats in the Broads for biodiversity, hosting so much rare flora and fauna that they are protected by international law. There are around 1700 hectares of wildlife-rich fen in the Broads - that's the largest expanse in lowland Britain.

They are incredibly rich in species because they have peat beds underlying them, which act to fertilise the plant communities in the Broads. Many of these plants wouldn’t be present in the Broads without the peat. Due to the unique flora and fauna they support, and their global rarity, they have sometimes been referred to as the ‘rainforests’ of the UK. Species include:

**Bladderwort** – A aquatic carnivorous plant with tiny underwater bladders used trap and digest crustaceans and insects.

**Fen Raft spider** – a very rare spider found in the Broads, the largest spider in the UK.

**Swallowtail** – a large butterfly only found in the Broads.

**Norfolk hawker dragonfly** – likes clean water – especially with lots of water soldier. Sea water kills both the dragonfly larvae and the plants it prefers to live amongst.

**Fen Orchid** – a rare plant of pools on fen peat. Its decline is directly due to falling water tables.

**Cranes** – once common, then hunted to extinction in the UK, a small population in the Broads is now slowly increasing and spreading across East Anglia.

**Bitterns** – a reedbed specialist, and the rarest bird in the UK during the 1980s, now increasing in number due to specially managed reedbeds. The male bittern’s booming call is one of the loudest and lowest of any bird.

**Marsh Harriers** – once down to a single breeding pair in the UK, they are now a common sight above wetlands throughout the Broads and across the country.

**Water Voles** – seriously threatened by habitat loss and predation by American Mink.

Issues: Around 80% of UK peatland has been negatively affected by human activities, such as land drainage for agriculture and peat digging.

As peat is exposed to the air its carbon content oxidises forming CO2 which escapes into the atmosphere. If the peatlands of the Broads were to oxidise completely they would create approximately 44,000,000 tonnes of CO2!

While the Broads stores vast amounts of carbon, locked up in its wet fen and peatlands, nearly a quarter of its deep peat soils are drained for agriculture, which releases greenhouse gases. In fact, around one million tonnes of carbon have been lost from the Broads in the past 40 years.

## Water storage

Peatlands store a vast amount of water, acting like large sponges they absorb water and release it slowly helping to reduce flooding risk in surrounding areas. They also filter pollution from the water leading to cleaner water courses for wildlife and humans.

Issues: If peatland is drained and becomes drier its carbon mass slowly oxides becoming CO2 in the atmosphere, this loss of mass means the peatland physically shrinks losing altitude which in turn makes it more at risk of flooding. Drained peatland can drop by 1cm every year!

Interesting fact: Drained agricultural peatlands can emit over 40 tonnes of CO2 per hectare per year. Globally, 10% of all human caused CO2 emissions are from drainage, extraction, burning, cultivation or destruction of peatlands.

# Restoring peatlands

Peatland restoration will play an increasingly important role in reducing greenhouse gas emissions from agricultural land.

Re-wetting. By pumping out less water the water table can be brought back close to the surface of the soil stopping that peat from turning into CO2. Every 10 centimetres of reduction in water table depth could reduce the net warming impact of CO2 and CH4 emissions by the equivalent of at least three tonnes of CO2 per hectare per year.

There are a number of ways that this can and is being done. One solution is turning agricultural peatlands back into natural fen – re-wilding, and allowing nature to rebuild peat through natural processes, providing new habitat for rare and endangered species found in our wonderful wetlands. Protecting the existing carbon stores and removing more CO2 from the atmosphere as peat builds.

Or, continuing to farm but in new ways. Paludiculture is the name given to farming wetland crops on wet peat, reducing the rate at which peat decomposes, protecting the carbon locked away below the surface. This could be traditional crops like Reed for thatching or new crops such as Reedmace which can be used to make building materials, insulation, fuel, and clothing, or new food crops such as Floating Sweet Grass.

Or, paying landowners and communities to protect peatlands, directly through grants or through carbon credits used to put a monetary value on the carbon locked away in the peat.

## Carbon Fact list

If all the carbon in 1m3 of Peat oxidises it could release up to 385kg of CO2, the equivalent emissions of driving a 50mpg petrol car 1770miles, the distance from Norwich to London via John O Groats and Land’s End, or driving from Norwich to Greece if you prefer.

The Broads contains over 44,000,000 tonnes of CO2 locked away in peat, that’s the equivalent CO2 emissions of driving a petrol car 180 million miles, that’s from Norwich to the Sun and back.

Peat is made in Broads wetlands very slowly, building up only 2.7mm per year.

The Broads have areas of peat 10m deep, this may have started forming almost 4000 years ago, not long after Stonehenge was built.

Drained peat disappears as CO2 into the air, losing 1cm of peat per year. So it is at increasing risk of flooding the longer it is drained.

# Investigating peat

When peat forms in very wet conditions it accumulates faster, and is less decomposed, than in drier places. So, climate scientists can use peat as an indicator of climatic change. Because peat is made up of unrotted plant material, it is possible to take a vertical core of it and look at the plant remains within its layers (and the layers of other kinds of soil) to work out what has been growing around the site over many centuries, and how wet the area has been at different times. Fig.1 (peat Auger)

**References**  
[Peatland factsheet.pdf (ceh.ac.uk)](https://www.ceh.ac.uk/sites/default/files/Peatland%20factsheet.pdf)

## Experiments

Here are 6 field experiments which give you first hand data relating to the topics covered in the background information section of this document.

### 1. Peat depth

**Apparatus and Materials**

* Peat auger
* Lengths of white guttering (numbered)
* Measuring tape
* Camera

**Method**

1. Take a record of your location (as precisely as possible).
2. Drill the auger 1m into the ground.
3. Remove it and scoop the first metre of peat out onto the first piece of white guttering.
4. Connect an extra rod and drill it back down the same hole.
5. Remove it and scoop out the second metre of peat onto the second piece of white guttering.
6. Keep repeating this until you can’t go any further (You will either hit the bottom or run out of rods for the auger.) Use a measuring tape to measure how deep the peat was. Record this.
7. Take careful photographs of the whole length.

### 2. Vegetation survey

**Apparatus and Materials**

1. 0.5x0.5m 25square Gridded Quadrat
2. Random number tables
3. Plant identification sheet
4. Recording sheet

**Method**

1. Lay out a 10m tape measure from the peat coring site and another at a right angle to it.
2. Use the random number chart to choose two numbers – close your eyes and point at the table – this is your random number.
3. One team member walks along the first tape measure to the distance of your first random number, another team member walks along the second tape measure the distance of the second random number. They then walk in straight lines until they meet. This is your random sampling point (see supporting diagrams).
4. Place the quadrat with one corner lying over the point your coordinates have brought you to. Use your pencil to point to the bottom left-hand corner of each of the 25 little squares. Record the plant that your pencil touches (see supporting diagrams). You would record just the one plant the pencil touches.
5. Record them on the field record sheet.
6. Record presence in your quadrat for the other plant species that occur in the quadrat but are not touched with the point sample e.g. 0P, meaning Zero recordings but present in the quadrat.
7. Estimate the percentage of bare ground (if any) within the 10x10m area.

### 3. Soil Temperature and Air Temperature

Use the pH meter/thermometer to measure soil temperature.

Record these results:

1. Soil pH – see separate sheet (purple)
2. Soil Moisture (in the field)

**Apparatus and Materials**

1. Measuring cylinder (500ml)
2. Funnel for the above
3. Resealable polythene bags (must be watertight)

**Method 1**

1. Finger test, subjective scale 1 (bone dry) – 5 (soaking wet).

**Method 2**

1. Take a loose handful of peat and squeeze as much water as possible from it into a measuring cylinder. Record it on your field record sheet. Repeat three times. (What are the limitations of this method?)
2. Take a reasonable sample of new peat about 500 ml (about 3 double handfuls), seal it in a plastic bag/container and take it back to school for the soil moisture test. Some of the same sample can be used for the organic content measurement.
3. Soil Moisture (back at school)
4. Soil Carbon Content (back at school)
5. Measure nitrates and phosphates with Palintest® kit.

### 4. Nitrates

**Apparatus and materials**

1. Nitrate Palintest® kit

**Method**

1. Fill test block tube to the mark.
2. Add one Nitrate No 1 tablet, cap tube and shake to disintegrate the tablet.
3. Add one Nitrate No 2 tablet, cap tube and shake vigorously for exactly one minute.
4. Leave to stand for 5 minutes (without disturbing it).
5. Take the test reading and record results.

### 5. Phosphates

**Apparatus and materials**

1. Test tube
2. Phosphate HR Palintest® kit

**Method**

1. Fill test tube to 10 ml mark.
2. Add one Phosphate HR tablet, crush and dissolve.
3. Leave to stand for 10 minutes.
4. Take the test reading and record the result.

### 6. Measure nitrates and phosphates

**Apparatus and materials**

1. Nitrate and phosphate testing strips, colour chart

**Method**

1. Dip the testing strip into the water and remove.
2. Wait the amount of time specified on the testing strip instructions.
3. Once the time has elapsed compare the colour of the testing strip against the colour chart to find the nearest match.
4. Record findings.

### Follow up

We would also like you to tell us how you got on at school helping to raise other people's understanding of the importance of peat. So, take lots of pictures and record your thoughts while you enjoy your day out on the beautiful wetland landscape near your school.

Thank you for helping us with this project.