

Becky Falls Teacher's Notes

GEOGRAPHY

Key Stage 3

Introduction to Becky Falls as an education resource

Facilities

Becky Falls is open from March to November during the year and facilities include toilets, a picnic area, a restaurant selling light refreshments and meals and a gift shop.

There are self-guided colour-coded walks around the site – ask at reception for a map and more details.

In addition there is a small collection of animals including miniature Shetland and Dartmoor ponies, ferrets, chipmunks, sheep, goats, pigs, rabbits, guinea pigs, chickens and some birds of prey.

A fun and informative animal encounter show, featuring boa constrictors, lizards and tarantulas, etc, can be incorporated into your visit by prior arrangement.

What you can see on site

A site of great beauty, visited for hundreds of years by those who appreciate its natural charm, Becky Falls makes an ideal day out for school visits. For younger children it can be used across the curriculum for English, Art, Geography, Science and even Maths!

The Becka Brook flows through ancient woodlands which have been designated as a Site of Special Scientific Interest by English Nature for its characteristic plants and animals. It is particularly noted for its lichen flora. The brook also flows over the spectacular Becky Falls which has inspired artists, poets and writers for centuries including Virginia Woolf, Arthur Quiller-Couch and Rupert Brooke.

Key Stages 1&2, Key Stage 3

Education packs, linked to the National Curriculum, are available for Key Stages 1/2 and 3 for Geography, Science, Art and English as well as BTEC Leisure and Tourism. Packs include teacher's notes and worksheets for the children to use.

How to use the site for Geography KS 3

Two worksheets suitable for children of Keystage 3 are available:

- 1 Classroom activities and experiments
- 2 Fieldwork observations and measurements

The main areas of study are **rivers** including map work, demonstrations, observation and measurements; the **water cycle** including observations and experiments.

Preparing for your visit

What you can see on site

Key features of upper stretches of a river:

- 1 Fast river flow, rapids, waterfall, river bed with large particle sediment, steep banks, steep-sided valley, signs of erosion.
- 2 Erosion, deposition, transportation
- 3 Water cycle – try the transpiration experiment.
- 4 Flooding event (there is a sign below the falls showing the river levels)

Look at pictures of other rivers and waterfalls (Niagra, Victoria, Angel).

Revise how waterfalls form.

Revise river processes, stages of a river and Water Cycle introduce more advanced terminology.

Health and safety

A Risk Assessment is available separately but you are strongly advised to do a pre-visit assessment before you bring your pupils. Please call Becky Falls on 01647 221259 to arrange a free preliminary visit.

Here are some points to remember about this site:

- 1 The rocks can be slippery, especially when wet. – take care and wear sensible footwear.
- 2 The river is deep and fast-flowing in places – especially after heavy rain, avoid entering the water.
- 3 The banks can subside where they are not stabilized by rocks or tree roots.
- 4 A First Aid kit should be carried.
- 5 Mobile phones may not work in the valley.
- 6 Stick to the paths where possible.
- 7 The valley sides are very steep in places.
- 8 Dartmoor has high rainfall – bring waterproofs

Safe routes

There are colour-coded way-marked trails around the site, these are the safest to use as

rails and steps are provided at appropriate places. Stick to the paths where possible.

On the day

Look at the maps (see activity below)

Carry out experiments/demonstrations outlined below (see worksheets for students).

River processes

Classroom experiments/demonstrations

Map activity:

Can you find Dartmoor on the map of Devon?

What features are distinctive about Dartmoor?

Can you find Becky Falls on the OS 1:25,000 map?

What is the grid reference?

What is the altitude of Becky Falls? (look at the contours)

Using the maps and worksheet provided look at:

- 1 the settlements up and downstream from Becky Falls and how they differ, discuss the reasons for differences.
- 2 the change in altitude that gives the fast water flow in the stream
- 3 where the Becka Brook starts and where it joins the River Bovey and then the Teign – look for the river stages from source to sea.
- 4 the catchment area of the River Teign, can you find the watershed between the different catchments?

Activity 1 – carrying capacity

Using a sponge, fill it with water by soaking it in a bowl of water. Weigh the sponge before and after soaking it. Hold up the sponge over the bowl and time how long it takes for the water to stop flowing. Try it with different sized sponges. Can you make the sponge hold more water?

Fact: Bogs are full of mosses – sphagnum moss is really absorbent and it holds onto water, releasing it slowly. This is how rivers get their constant supply of water. Bogs form in uplands like Dartmoor where rainfall is high. Flows are lower in the summer as the bogs are drier. In the winter the bogs cannot hold onto all the water and the water flows rapidly off the land filling the rivers – the rivers overflow – *spate* upstream and *flood* downstream. Look for sphagnum moss during your visit.

Activity 2 – river formation

Using a large tray (1m x 1m minimum) with a mound of gritty/stony sand or garden soil to one side, pour water onto the top of the mound using a hose (you need a constant *slow* flow of water) and watch a river form – fast flowing at the top, cuts deep quickly, then meanders and finally forms a fluvial plain.

Where is the main area of erosion?

Where is the main area of deposition?

Did your 'river' sort out the sediments into different sizes?

Fieldwork

Using the worksheets provided observe, measure and record the river processes on the Becka Brook.

Look at:

- 1 Width of channel
- 2 Load
- 3 River bed
- 4 Banks/signs of erosion
- 5 Areas of deposition
- 6 River profile

Water Cycle

Classroom demonstration and activity

Use Water Cycle worksheet

Make rain:

Take a large jam jar with a lid. Put warm water in the bottom (not steaming) about 3 cm deep. Put the lid on and place some ice cubes on the lid. Watch it rain! Place a dark card behind the jam jar and a bright light shining on one side to make it easier to see.

The warm water is *evaporating* and forming water vapour. Cold air cannot hold as much water as warm air so as the water vapour rises up and reaches the cold lid it *condenses* and form rain.

Explain Water Cycle (students to complete Water Cycle Quiz on worksheet).

Field visit

Fieldwork experiment

Take a clear plastic bag and weigh it. Put it over a tree branch and seal around the neck – leave for 1 hour. (Choose a tree that is in the sun and have large leaves e.g. oak, beech or hazel).

What is inside the bag?

Where did it come from?

Weigh the bag and measure the leaf surface area (use graph paper) to find out how much water was lost per leaf in 1 hour.

Background information for Teachers

About Dartmoor

General

Becky Falls lies within the Dartmoor National Park, one of 13 National Parks, and is protected for its natural beauty. Covering 365 square miles (954 km²) the National Park contains one of the largest and wildest areas of open country in the south of England. It became a National Park in 1951. The highest point is High Willhayes (621 m or 2,039 ft) which is one of 160 tors on Dartmoor. 47% of the moor (48,450 hectares (119,720 acres)) is moorland with the rest being made up of farmland, forestry, woodland, reservoirs and villages.

Unlike National Parks in the USA which are owned by the State, our National Parks are owned by many landowners including public bodies and private individuals. All land on Dartmoor is owned by someone including the open moorland. The main landowners are the National Trust, Forestry Commission, Duchy of Cornwall, Ministry of Defence, South West Water and Dartmoor National Park Authority.

In the UK National Parks are places where people live and work - 33,000 people live on Dartmoor.

Geology

65% of Dartmoor is made up of granite, an igneous rock which was intruded some 295 million years ago. The intense heat and pressure produced by this intrusion altered the rocks immediately around it forming metamorphic rocks and resulted in the mineralisation of tin and copper ore veins as well as arsenic, lead, zinc, tungsten, cobalt, bismuth, antimony, uranium and gold. Many of these minerals have been mined in the past.

Climate

The climate of Dartmoor is different to the rest of Devon due to its high elevation. Rainfall is around 2 m a year! Snow lies for an average of 15-20 days a year on the highest land and average sunshine is 3-4 hours a day.

See Dartmoor Factsheets – General Information, Geology and Landforms, Climate and Weather (available from DNPA or their web site www.dartmoor-npa.gov.uk).

About the site

A Site of Special Scientific Interest and part of the Bovey Valley Woods complex, this site is very species diverse as well as visually attractive. Upland Oak Woodland is the dominant habitat and the trees are cloaked in mosses, ferns and lichens due to the moist clean air here. Granite boulders litter the valley floor. Fallen trees offer deadwood

specialists such as beetles, woodpeckers and various fungi good habitat and the woodland itself attracts birds such as blue tits, great tits, chaffinch, nuthatch and treecreeper. The river is rich in wildlife too with otters, dippers, kingfishers as well as salmon and trout.

About the river

The Becka Brook emerges from a spring just beside the road between Saddle Tor and Hemsworthy Gate (you might like to visit on your way home – SX744761) and flows north to Becky Falls. Within Houndtor Woods, part of the Bovey Valley Woods the Becka Brook joins the River Bovey. The River Bovey is a tributary of the Teign which eventually emerges at Teignmouth on the south Devon Coast.

At Becky Falls the river is a typical upland river demonstrating upper river characteristics, being fast-flowing, narrow, in a steep-sided valley with boulders, rapids and waterfalls. In the winter it goes into spate when rainfall exceeds the capacity of the water-holding bogs to retain the water. During the rest of the year the water is slowly released and maintains a constant flow.

The river here has a sandy, gravelly or rocky bed depending on whether it is flowing fast or passing through a deep slow-moving pool. Signs of erosion, transportation and deposition can be observed.

About the waterfall

Waterfalls form when a hard rock overlies a softer rock. The harder rock doesn't erode away and the softer rocks downstream erode faster, undercutting the harder rock forming a steep cliff where a waterfall forms. Waterfalls can form when the hard rock is horizontal, vertical or dips upstream.

Here at Becky Falls the harder rock is (granite) and the softer rock is a metamorphic rock formed when sedimentary rocks (sandstones and slates) came into contact with the very hot molten granite and changed into another (metamorphic) rock, softer than granite.

About the Teign Catchment

The River Teign arises on Dartmoor at a height of 520m above sea level and flows in a southeasterly direction towards the Teign Estuary and sea. The Catchment of the River Teign covers an area of 550 km². The principal sub catchments are the Rivers Lemon and Bovey and the Aller Brook. The River Teign flows through a diversity of landscapes and habitats, from the open moorland of Dartmoor through steep sided valleys extensively covered with ancient woodland, across improved pastureland and to the south through broad valleys meeting its floodplain and finally the Estuary.

The Teign Estuary is approximately 9km in length and less than 1 km wide at its widest point, and is one of South Devon's most valuable assets. The mouth of the estuary is marked by a permanent spit, The Point, on the north bank at Teignmouth extending southwest, and the red cliffs at Shaldon to the south.

The principal industries within the Teign Catchment are agriculture, the ball clay industry, tourism and the fishing industry including the Teign Estuary shellfishery. The Teign Estuary is a bass nursery and is very important for migratory fish. The shellfishery has the potential to produce up to 1,000 tonnes of shellfish.

Other sources of information

Dartmoor Factsheets: www.dartmoor-npa.gov.uk

Rivers: <http://library.thinkquest.org/Co110238/Lessons/outline.htm>

Other information for Teachers

River Cycle

- 1 *Head* – water comes out of the earth from a spring or a bog.
- 2 *Upper* – water flows rapidly down a steep slope in a steep-sided valley, there are rapids and waterfalls. River is small – often called a stream or brook. The river bed is made up of large grains of gravel or stones. There is active erosion.
- 3 *Middle* – water flows more slowly and often meanders, sediment on the bed is finer, other streams have joined to make a river. Deposition occurs on the inside of the bends and erosion on the outside.
- 4 *Lower* – water flows very slowly, land is flat, river takes up a wide flood plain and meets the sea. Deposition takes place.

River Erosion

Corrasion

Otherwise known as abrasion, is the grinding of rock fragments carried by the river against the bed and banks of the river. This action both widens and deepens the channel. The power of the grinding is especially powerful in floods when large fragments of rock are carried along the river bed eroding the bed and the banks.

Attrition

Attrition is the knocking of rock fragments in the water against one another. The fragments are broken into smaller pieces and become smoother along the process.

Solution

Solution, also known as corrosion, is the process by which river water reacts chemically with soluble minerals in the rocks and dissolves them.

For example, when a river stream flows over an area of limestone (calcium carbonate), it erodes the limestone by reacting chemically with it and dissolves it.

Hydraulic Action

Hydraulic action is the breaking down of rocks and dragging them away from the bed and banks by the force of the running water itself. When water from a fast moving stream enters cracks in a rock, the force breaks up the force into pieces

Water Cycle

Precipitation, evaporation, and transpiration are all part of **the water cycle**, a complex process that not only gives us water to drink, fish to eat, but also weather patterns that help grow our crops.

Water is an integral part of life on this planet. It is an odorless, tasteless, substance that covers more than three-quarters of the Earth's surface. Most of the water on Earth, 97% to be exact, is salt water found in the oceans. We can not drink salt water or use it for crops because of the salt content. We can remove salt from ocean water, but the process is very expensive.

Only about 3% of Earth's water is fresh. Two percent of the Earth's water (about 66% of all fresh water) is in solid form, found in ice caps and glaciers. Because it is frozen and so far away, the fresh water in ice caps is not available for use by people or plants. That leaves about 1% of all the Earth's water in a form useable to humans and land animals. This fresh water is found in lakes, rivers, streams, ponds, and in the ground. (A small amount of water is found as vapor in the atmosphere.)

Water is constantly being cycled between the atmosphere, the ocean and land. This cycling is a very important process that helps sustain life on Earth.

Through the process of **evaporation** and **transpiration**, water moves into the atmosphere. Water vapor then joins with dust particles to create clouds. Eventually, water returns to Earth as **precipitation** in the form of rain, snow, sleet, and hail. The water fills streams and rivers, and eventually flows back into the oceans where evaporation starts the process anew.

All clouds contain water vapor. You rarely ever see clouds in the desert because there is very little water to evaporate and form clouds. Coastal regions can receive a lot of rain because they pull up moisture from the surrounding sea.

Cloud size is influenced by many complex factors, some of which we still do not understand very well. These include: heat, seasons, mountain ranges, bodies of water, volcanic eruptions, and even global warming. Dartmoor has a particularly high rainfall due to its altitude. Land east of Becky Falls is in the 'rainshadow' of Dartmoor and is drier than the western side which is prone to the prevailing south-westerly winds and rain.

Scientific Concepts in the Water Cycle

There are **six** important processes that make up the water cycle. These are:

Evaporation

Evaporation is the process where a liquid, in this case water, changes from its liquid state to a gaseous state. Liquid water becomes water vapour. Although lower air pressure helps promote evaporation, temperature is the primary factor. For example, all of the water in a pot left on a table will eventually evaporate. It may take several weeks. But, if that same pot of water is put on a stove and brought to a boiling temperature, the water will evaporate more quickly.

During the water cycle some of the water in the oceans and freshwater bodies, such as lakes and rivers, is warmed by the sun and evaporates. During the process of evaporation, impurities in the water are left behind. As a result, the water that goes into the atmosphere is cleaner than it was on Earth.

Condensation

Condensation is the opposite of evaporation. Condensation occurs when a gas is changed into a liquid. Condensation occurs when the temperature of the vapor decreases.

When the water droplets formed from condensation are very small, they remain suspended in the atmosphere. These millions of droplets of suspended water form clouds in the sky or fog at ground level. Water condenses into droplets only when there are small dust particles present around which the droplet can form.

Precipitation

When the temperature and atmospheric pressure are right, the small droplets of water in clouds form larger droplets and precipitation occurs. The raindrops fall to Earth. As a result of evaporation, condensation and precipitation, water travels from the surface of the Earth, into the atmosphere, and returns to Earth again.

Surface Runoff

Much of the water that returns to Earth as precipitation runs off the surface of the land, and flows down hill into streams, rivers, ponds and lakes. Small streams flow into larger streams, then into rivers, and eventually the water flows into the ocean. Surface runoff is an important part of the water cycle because, through surface runoff, much of the water returns again to the oceans, where a great deal of evaporation occurs.

Infiltration

Infiltration is an important process where rain water soaks into the ground, through the soil and underlying rock layers. Some of this water ultimately returns to the surface at springs or in low spots downhill. Some of the water remains underground and is called groundwater.

As the water infiltrates through the soil and rock layers, many of the impurities in the water are filtered out. This filtering process helps clean the water.

Transpiration

One final process is important in the water cycle. As plants absorb water from the soil, the water moves from the roots through the stems to the leaves. Once the water reaches the leaves, some of it evaporates from the leaves, adding to the amount of water vapor in the air. This process of evaporation through plant leaves is called transpiration. In large forests, an enormous amount of water will transpire through leaves. In the winter, when the leaves have fallen, transpiration rates are much lower.