# TAKE IT AND LEAVE IT: EXPLORING RIVER PROCESSES

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**The movement of material carried by rivers creates an ever-changing landscape. Here, Anna and Ben suggest how pupils can explore this process to deepen their understanding of rivers.**

Rivers are the veins of our living breathing Earth, draining water from land to oceans or lakes. On a map of the British Isles you can see the indented 'smiles' on our coastline, these mark major estuaries and the location of our major cities. Used for recreation, tourism and settlement (inflating both property values – notice all the developments along our waterways – and home insurance), rivers are part of a living landscape that farmers and town planners need to understand and manage.

All our water that is not stored or evaporated will flow to a local stream or river, connecting to arterial rivers and into the sea. Anything that ends up in our streams and rivers – natural rocks and sediment, but also plastics and pollution – will follow the same flowing route.

Rivers transport this material along their course, producing a range of erosional and depositional landforms on the way. To understand how river features are created, pupils first need to get to grips with how rivers erode, transport and deposit material of different sizes within their flow.

## Exploring erosion

Ask pupils to think about what they might see in their nearest river – rocks, stones, pebbles, gravel, mud, rubbish, etc. Can they identify those materials that occur naturally? How do such materials find their way into a river? The answer is, by the process of erosion. There are four main causes of erosion in rivers:

1. When the force of the river water crashes against the banks and breaks the rock with its strength and weight, this is known as hydraulic action. Pupils can try this in the school grounds by placing wood or plastic cubes together to form a wall and throwing a bucket of water at them with force.
2. When the materials carried by the river grind against the river bed or banks, and wear away the surface, this is known as abrasion. Pupils can try out this process by first looking closely at the surface of a nail file or sandpaper to see the abrasive grains, then rubbing it on a fingernail or piece of wood and seeing the height reduced and the dust created.
3. When the materials carried by the river collide with each other and break into smaller pieces, this is known as attrition. Pupils can try this by placing sugar cubes into a jar or plastic bottle and shaking it vigorously to see how the pieces break against each other.
4. When the water dissolves the surface of softer rock in the banks or bed of a river, this is known as solution. Pupils can try this by watching what happens to the surface of a sugar cube when they pour water over it continuously.

## Exploring force

Pupils can experiment using paper straws. First, they blow through the straw hard enough to move a small amount of sand; next they see how much harder they need to blow to move a small pile of gravel, then to move small stones (Figure 1).

**Figure 1: Exploring force using straws to try and move sand, gravel and stones. Photo © Anna Grandfield.**

This activity demonstrates how additional force or energy is required to move (or transport) larger objects.

Next, use three jam jars to show the difference in movement within the water of the three grades of material. Fill the jars half-full with water and add sand to the first, gravel to the second, and a stone or two to the third. Swirl the sand water first, watching how the grains lift up from the bottom of the jar and mix with the water. This form of transportation is known as suspension. Swirl the gravel water next, watching how the small pieces lift a little, move and bounce against and off each other. This form of transportation is known as saltation. Swirl the stone water last, watching how the stones roll around the bottom of the jar. This form of transportation is known as traction.

## Exploring settling

Now swirl all three jars until the water begins to transport the contents around, place the jars back on the desk and observe what happens as the movement of the water slows down. The stones will stop moving first; even though the water is not yet still, it has lost the force necessary to transport through traction. The gravel will stop moving next, as the force of the water lessens further and it loses the force necessary to transport through saltation. The sand will settle last, as the water loses all force, sand is released slowly and drifts down to settle on the bottom of the jar. This dropping of transported material is deposition. The river deposits its contents along the way wherever it loses the necessary force to transport materials further. As the pupils observe, ask questions such as:

- What do you think…?
- What is happening…?
- Why do you think…?
- Why might…?

Using this experience of transportation and deposition, pupils can explore how the shape of a river affects where deposition occurs. Ask pupils to shape a river channel using air-drying clay. Their river should be thinner at the start and wider at the end, with at least two different types of bends along its course (Figure 2).



**Figure 2: Modelling a river (a) will reinforce understanding of river courses and features (b). Photo © Anna Grandfield.**

Pupils draw a plan of their model river and hypothesise where the water might lose the force to transport material. They mark these places on their plans and note the reasons for their hypothesis. Pupils can carry out this work in small groups to enable them to discuss their ideas.

Once dry, the model rivers need to be held at a gentle angle to represent the slope of the river's course down to the sea or lake, with a tray beneath in order to collect the water and debris at the end. The pupils sprinkle a very small amount of biodegradable glitter at the top of their river, then gently trickle water into the top of their river course. As the water makes its way down the river's course, it will carry and leave deposits of the glitter wherever the water loses sufficient force to transport it further.

On examination of the deposits on their model rivers pupils should see that where a river goes around a bend, the force is lost on the inside of the bend and not on the outside. Pupils can compare their glitter deposit locations with those they marked on their plans.

You could exemplify this difference in speed around bends in the school grounds. Small groups of pupils link arms to form a straight line and walk round in a full circle, counting the number of steps taken by each pupil. The pupil on the outside of the circle will take many more steps and have to walk a lot faster to keep up than the pupil at the centre of the circle.

To consolidate further, show a selection of photos of different river courses and have pupils annotate areas of deposition (such as river beaches) and areas of erosion (such as river cliffs).

To test how transported material is deposited in flood conditions, pupils can re-use their model rivers, this time pouring so much water into their river that it overflows. As the water gradually drains away, deposition will be visible on the land beside the river, and will indicate how far the floodwater reached (Figure 3). This can lead to discussion about how the nutrient-rich river deposits make floodplains attractive sites for farming, despite the danger of further flooding. Pupils can first discuss, then try out different modelling of what possible solutions might be. These will include raising river banks to contain the water, straightening the river, moving houses further back from the river or knowing where the flooding is likely to extend to and not building any closer.

These activities provide pupils with a secure knowledge of erosion, transportation and deposition and will enable them to move on to learn how rivers produce the landforms we see around us. It will also prepare pupils for later work on glacial processes.

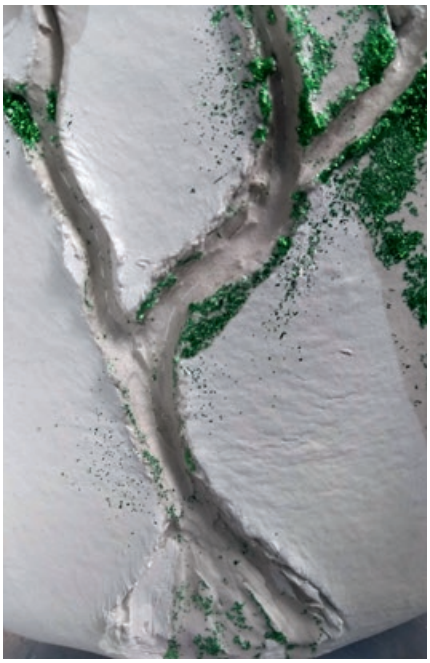

**Figure 3: Using a greater amount of glitter and more water will create floodplains on the pupils' rivers. Photo © Anna Grandfield.**



## WEB RESOURCES

Download a messy maps and models river activity idea: *www.geography.org.uk/pg*


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