



Water

Curriculum Links:

- | | |
|-------------|---|
| • Science | Living things
Environmental awareness and care |
| • Geography | Human environments
Natural environments |
| • SPHE | Myself and the wider world |

Lesson objectives:

To gain a deeper and more detailed understanding of the important phases of the water cycle. To be aware that pollution can damage the countryside and to recognise how the farmer helps prevent this.

Teacher guidelines

It is suggested that teachers ensure that students are familiar with the vocabulary and concepts introduced in the previous modules before starting this lesson.

Keywords and concepts introduced in previous modules:

evaporation condensation precipitation mechanical energy
electrical energy pollution biotic index

Irish farmers live and work in the environment and are very aware that non-renewable sources of energy are becoming scarce. They know that conserving resources is a major world issue and as such they create water and wind energy as much as possible.

Keywords for this lesson:

transpiration lush vegetation biochemical oxygen demand
algae bloom eutrophication

Did you know?

90% of all evaporated water comes from the ocean

The water cycle on the farm

The water cycle is the continuous movement of water on, above and below the earth's surface. It has no beginning or end, however, the sun is the main driver. The sun shines on seas, lakes and rivers. When water is heated, it then changes into water vapour and these tiny droplets of water vapour rise into the air in a process called evaporation. A small amount of moisture is released from trees, plants and grass growing on the farm. This is known as transpiration.

High in the sky, the air is very cold, and as water rises, it cools and condenses, turning the vapour into drops of water. These drops join together to make clouds, via a process called condensation.

When clouds get too heavy, the water drops fall to earth via a process called precipitation. This water can fall as rain, hail, sleet or snow. It then flows along rivers and streams and back into the seas and oceans. When the sun shines, it draws the vapour into the air and the water cycle begins again. In tropical areas, this process might only take a few hours, but on Irish farms, it could take a few days, depending on the time of year.

River management, water quality and the Irish Farmer

In addition to our hedgerows (see The Hedgerow, pg. 26), our waterways, that is rivers, lakes, streams and ponds, are also home to wildlife and vegetation. The farmer works hard to make sure our waterways stay clean. One of the most important jobs the farmer does is to make sure all the animals have enough water to drink. However, the effects of poor river management can have a devastating effect on the river bank and river wildlife. Animals drink from special drinking baths called troughs. In order to prevent animals from entering the waterways to access drinking water, farmers put up fences to secure parts of the farm bordering the banks of rivers. Livestock, especially cattle, can eat lush vegetation that grows around them, this can lead to the wearing away of the river banks causing streams to become shallow and unclean.

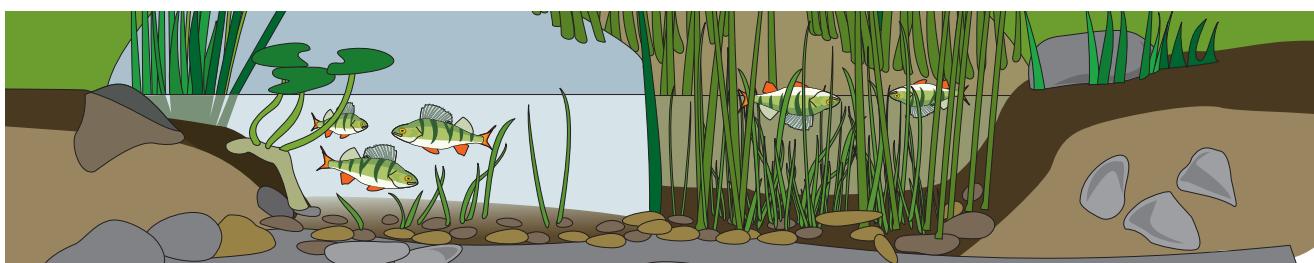
All farmers work very hard with the Department of Agriculture, Food and the Marine and the European Union to keep Irish waterways clean. In doing so, the farmer maintains the food chains and food webs that lie beneath. The farmer must be mindful of when is the right time to spread manure/slurry on fields. In Ireland, farmers are restricted in spreading slurry, farmyard manure and chemical fertilisers over the winter in order to protect ground and surface water, including drinking water. Farmers are also prohibited in spreading slurry at any time of the year when the ground is frozen, water-logged or when heavy rain is forecast to prevent slurry running off into waterways.



Why does the farmer protect the waterways?

Farmers work hard to protect the waterways because if they become polluted, the pollution can have a very damaging effect on the wildlife and vegetation living in water, and on our/animal's health (by drinking polluted water). Dissolved oxygen (DO), which is found in water, is required by plants, fish and other water organisms, to live. However, when water becomes polluted, DO is consumed by bacteria. As a result, oxygen dependent organisms like fish and plants die. This contributes to the organic waste in the water, which is then decomposed by bacteria. A large amount of bacteria then develop in order to break down all these dead species. They use up lots of oxygen, meaning there is not enough left for the fish/plants to live. Oxygen consumed in the decomposition process further robs other organisms of the oxygen they need to survive. Organisms that are more tolerant to lower dissolved oxygen levels may then replace oxygen dependent organisms. This is known as the **Biochemical Oxygen Demand (BOD)**.

As such, BOD is an important water quality parameter. A low BOD is an indicator of good water quality, while a high BOD indicates polluted water. The BOD for drinking water should be nil.



Water pollution

Water mixed with effluent waste and/or chemical fertilisers, especially substances rich in nitrates and phosphates, can cause problems for our rivers and streams. High nutrients in a body of water causes **eutrophication**, accelerating the growth of **algae blooms** and other forms of plant life. This results in the deterioration of water quality (high BOD levels) by reducing the oxygen content and sunlight needed by fish in water, causing the water to turn cloudy and green. This not only ruins the water supply but also has a major effect on food chains, food webs and biodiversity on the farm. In order to avoid this, farmers across the country work hard to maintain and protect waterways.

Pollution can also be measured by looking at the animals living in the river and how they are affected by pollution. To measure the quality of the water we can calculate the **Biotic Index**. Each animal is scored out of ten depending on their level of sensitivity to pollution. A score of ten means the animal is very sensitive to pollution while a score of one means they can live in a polluted river. To determine the Biotic Index for a water sample, you first need to identify what is living in your sample, then add up the scores for the animals found in your sample and divide by the numbers of types of animals found in your sample. The answer should lie between zero (no life at all) and ten (probably a very clean river). In this instance, the higher the score, the less polluted the river.

Suggested activities

- Complete the activity sheet on page 55
- List the different steps the farmer takes to protect waterways
- Test the Biotic Index of two water samples; one from a fresh flowing stream/river and another from a lake/pond. Discuss the food chains and food webs that exist in your samples. Is your sample(s) polluted? If so, can you conclude as to the source of pollution and what actions could be taken to prevent further pollution. Discuss what impact this may have on the surrounding environment.
- Set up a water filter by cutting a plastic bottle in half. Place some coffee filter paper (rolled into a funnel) at the opening of the bottle. Layer some sand at the bottom, fine gravel in the second layer, pebbles above that and large stones at the top. Pour some clean water through and examine. Afterwards, pour some dirty water through (water mixed with soil). Collect, examine and compare the two samples
- Discuss the river management at a local water source near your school. Discuss what might the effects of poor river management be on the river bank and the surrounding river wildlife. What steps could be taken to improve river management (i.e. animal access, coppicing, tree cover, fencing)

Learning outcomes:

At the end of this lesson, students should know how the farmer protects our waterways.

Additional resources:

- www.agriaware.ie



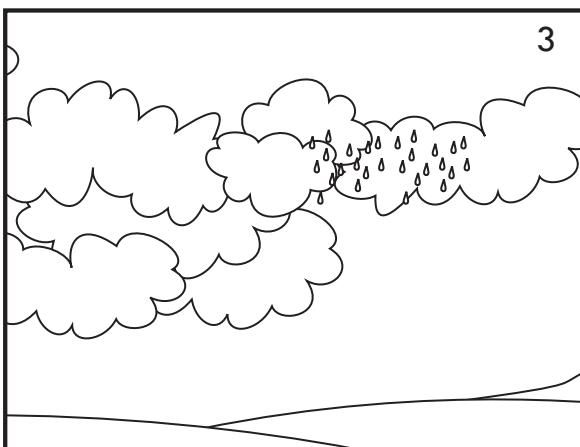
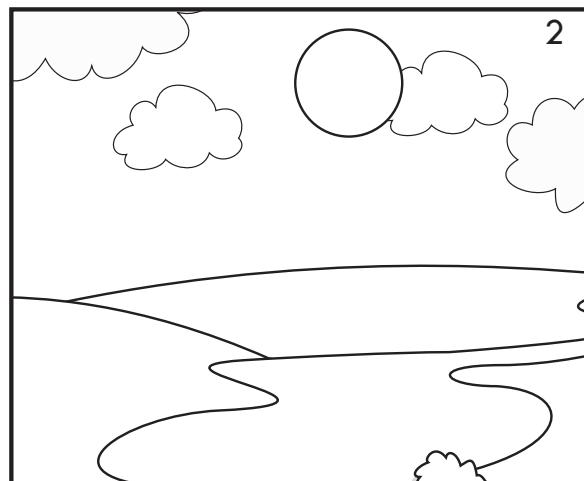
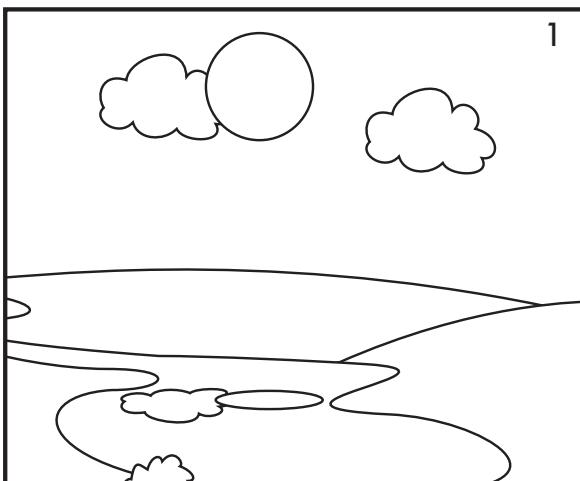
Water

Name: _____

Date: _____

1 The water cycle

Colour and insert arrows into these pictures



2 Dictionary work – Find a definition for

Vegetation _____

Livestock _____

Shallow _____

Abide _____

Transpiration _____

* To be used with teacher guidelines, page 30