Forests and Water

LESSON PLAN

INVESTIGATE FORESTS

Experiment 1: Investigating Transpiration in Trees

Aim:

To introduce students to the important role trees and forests play in the Water Cycle.

Curriculum Links:

Living Things
Environmental awareness and care

Global Goals/SDG Links:

Goal 3 – Good Health & Wellbeing
Goal 6 – Clean Water & Sanitation
Goal 11 – Sustainable Cities and Communities
Goal 13 – Climate Action
Goal 14 – Life below water
Goal 15 – Life on Land

Skills:

Research; Observing; Recording;

Background Information:

This Lesson Plan introduces teachers/facilitators to the connection between Forests & Water.

Support Sheet 1 will equip you with an understanding of how trees and water interact, with some age appropriate facts to share with your students.

The Student Activity Sheets will help explore the role and value of forests for the Earth's water systems. They aim to help students understand the pathway of water in a tree and the role that trees and forest ecosystems play in water redistribution systems.

This also relates to their role as defense against flooding, soil erosion and extreme weather events.

Equipment:

- ✓ Experiment 1: Student Activity Sheet per group
- ✓ Experiment 1: Answers
- ✓ Clipboards/Pencils
- ✓ Tablet/Camera to record work
- ✓ Tree Swatches for Identification
- ✓ Printed transpiration diagram
- ✓ Plastic bags: preferably zip-lock (you may need to use string to secure it)

Methodology:

1. Explain to student that trees, like all plants, take in water through their roots and loose water through their leaves. When plants lose water, we say they transpire.

> **Transpiration is the loss of water from a leaf through tiny holes on the underside of the leaf called stomata**

2. Explain to students that they are going to investigate transpiration by placing plastic bags over leaves on trees as in the picture below:

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3. Divide the class into groups and get them to place plastic bags on the leaves of various trees/plants as outlined in the Student Activity Sheet.

4. Leave the bags in place for at least 30 minutes. If the day is not very sunny, they will have to be left for longer.

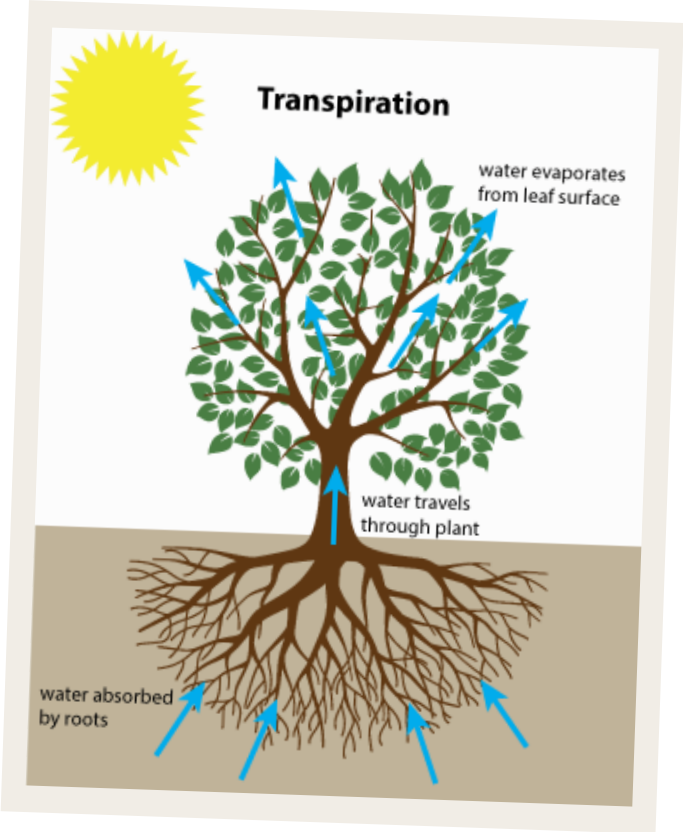
5. While waiting for a result, you can move onto **Experiment 2 or carry out some basic Tree Identification and Physiology.** Introduce students to some trees in the school grounds. You could investigate the species of trees in the school grounds (use the tree swatch) and revise the parts of the tree with students i.e. roots, trunk, branches, buds, leaves, flowers (keep it age appropriate).

6. Using the transpiration diagram, discuss how trees take in water and how it moves through the tree.

> **Explain that water moves into the tree through the roots and travels up through narrow tubes called xylem just like a straw. 95% of the water leaves through holes on the underside of the leaves called stomata as the tree transpires.**

7. Ask the students to see if they can see these holes with their naked eye? If you have hand lenses per group, they can explore them closely and are more likely to see them.

DIAGRAM:
TRANSPIRATION IN TREES



> **Of the 5% that is retained in the leaf, some is used to make food with carbon dioxide & water and some is stored in the body of the tree.**

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8. Record results in Activity Sheet. Ask the groups to compare results with each other. Are some results different from others? Why would this difference occur?

9. Discuss the factors that drive transpiration and cause water to be sucked up from the roots. The same conditions which dry clothes on a line speed up transpiration i.e. sunlight, heat and wind

Useful Links:

LEAF Theme – Forests & Water:
https://leafireland.org/themes/forests-water/

Green-Schools Water Theme:
https://greenschoolsireland.org/resources/theme_category/water/

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SUPPORT SHEET

INVESTIGATE FORESTS

Experiment 1: To investigate transpiration in plants:

Transpiration is the loss of water from the leaves of trees/plants through the stomata. To see how much water a plant loses through its leaves, cover the leaves with a plastic bag as shown in the picture. Leave the bag in place for an hour. After an hour, investigate any changes.

Different types of leaves lose different amounts of water. You can compare the water loss from deciduous broadleaved trees, (like ash, sycamore, apple, birch or beech) with coniferous trees (like pine, spruce or larch). You can also compare with trees/plants with waxy leaves (like holly or ivy).

Type of Leaf	Species of Tree	Volume of water in bag *	Why do you think the tree lost this much water?
Broadleaved in sunny area	e.g. Oak		
Coniferous in sunny area	e.g. Pine		
Waxy in sunny area	e.g. Holly		
Plant in shaded area	Any species		
Branch with leaves removed in sunny area	Any species		

*** You can measure the volume of water with a small syringe, with a teaspoon or write an estimation such as - none, little, a good bit or a lot**

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SUPPORT SHEET

INVESTIGATE FORESTS

1. What is transpiration?

2. S _ _ _ _ _ _ are tiny pores on the underside of leaves, which allow water to transpire from the leaf. They also allow gases to enter and exit.

3. Name 3 factors which speed up transpiration _ _e _ _t S _ _ _ _ _ _ _ _ _ _ _ _ _d

4. Why do coniferous trees have needle like leaves?

5. Why do some plants have waxy leaves?

6. Do deciduous plants transpire in the winter? What evidence have you for this?

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Answers

Experiment 1: To investigate transpiration in trees

Type of Leaf	Species of Tree	Volume of water in bag	Why do you think the tree lost this much water?
Broadleaved in sunny area	*e.g. Oak*	A lot	**The leaves are big. Broadleaves generally grow best in places with lots of water.**
Coniferous in sunny area	*e.g. Pine*	A little	**Conifers have small needle like leaves to prevent water loss. They can grow in places with little available water.**
Waxy in sunny area	*e.g. Holly*	A little	**Holly keeps it leaves in winter. Since their leaves are protected with a waxy coat the wind cannot dry them out. Ivy often grows in shady conditions under trees, where there is little water available. Their waxy leaves help them to retain as much water as possible.**
Plant in shaded area	*Any species*	A little or none	**The main causes of transpiration are heat, sunlight & wind. Shaded plants are not exposed to sun & wind.**
Branch with leaves removed in sunny area	*Any species*	None	**Plants mainly lose water through the stomata in the leaves. These are pore holes and can be seen if you look closely on the underleaf or with a handlens**

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SUPPORT SHEET

INVESTIGATE FORESTS

1. What is transpiration?

Transpiration is the loss of water from the leaves of a plant into the air.

2. STOMATA **are tiny pores on the underside of leaves, which allow water to transpire from the leaf. They also allow gases to enter and exit.**

3. Name 3 factors which speed up transpiration HEAT SUNLIGHT WIND

4. Why do coniferous trees have needle like leaves?

They often grow where there is not a lot of water. Having needle like leaves stops them losing too much water by transpiration. This is known as an adaptation to environmental conditions.

5. Why do some plants have waxy leaves?

Having waxy leaves stops them losing too much water by transpiration. This is an adaptation to growing conditions.

6. Do deciduous plants transpire in the winter? What evidence have you for this?

Deciduous plants don't transpire in winter as they lose their leaves and plants transpire through their leaves.

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