

# Teacher **Treesources**

## WATER MOVEMENT IN TREES

Water movement in deciduous trees increases before the leaves and flowers emerge in the early spring. This is the perfect time of year to observe and learn about the processes of water movement in trees. The process of making maple syrup is great way to start students thinking about the structure and function of tree water transport.

- In the lower grades students learn about cycles including life and water cycles.
- In middle school students understand cells carry on specific functions that sustain life.
- In high school students study the details of cellular processes. Molecules enter and leave the cell by the mechanisms of diffusion, osmosis and active transport.

### Background

Maple syrup is usually made from the xylem sap of [sugar maple](#), [red maple](#) or [black maple](#) trees. What we refer to as sap is a mixture of water, minerals and sugars, which are transported throughout the inner parts of a tree. Water is essential for the process of photosynthesis, which takes place in the leaves of a tree. The water and minerals are taken from the soil and absorbed into the tree's roots. In order to reach the leaves, water must travel up a tree through special tubular cells, collectively called the xylem or the [sapwood](#).

Xylem consists of primarily two [different types of cells](#): tracheids and vessel members. Both types of cells serve the purposes of transporting water and providing physical support to the

tree. These tubular xylem cells are [connected](#) to create a continuous column of water that moves from one cell to the next. Water movement in trees is linked to the evaporative process called [transpiration](#). Transpiration draws continuous sugar water (sap) up water columns found in the xylem, which is then released through the leaves into the atmosphere in the form of water vapor. The flow of sap in maple trees that takes place from mid-February to early April cannot be explained entirely by the transpiration process, since maple trees have not yet grown leaves at that time of year. Rather the driving process behind maple sap flow is quite complex. For detailed information on sap flow, read the article [Explaining Sap Flow](#) by the Massachusetts Maple Producers Association.

### Activities

[Role-playing Tree Growth and Function](#) (Grades 3-5) – Students acts out different parts of a tree to learn how trees grow and function.

[SMART Board Activities](#) (Grades 4-6) – SMART Board activities related to water transport in plants.

[Investigating Xylem](#) (Grades 7-12) – Investigate

how water travels up vascular plants using food coloring and various plant cuttings.

[Water Loss through Transpiration](#) (Grades 3-6) – Students calculate how much water a tree can lose through transpiration.

[Maple Syrup Production](#) (Grades K-3) – Students get an opportunity to make maple syrup.

### Resources

#### Web sites:

[Simple Tree Biology](#) (Grades 2-12) – A simple overview of tree structure and function.

[Maple Syrup: A Taste of Nature](#) – (Grades K-5) An easy-to-read overview of maple syrup production.

[Transpiration Lab](#) – (Grades 5-12) An online biology lab about transpiration with quizzes and experiments.

[Transport in Plants](#) – (Grades 6-12) An in-depth explanation of how water and sap is transported in plants with links to helpful diagrams.

[Explaining Sap Flow](#) – (Grades 4-12) An explanation of how sap flows in maples.

#### Video:

[Water Movement in Plants](#) – (Grades 6-12)

[How to Make Maple Syrup](#) – (Grades 4-12)

Children's Literature

[Sugar Snow \(My First Little House\)](#) – (Grades K-4) A cold snap late in winter allows a pioneer girl and her family to enjoy the rich sugar candy made from maple tree sap.

[Sugaring](#) – (Grades K-4) Follow Nora, Gramps and their horses as they collect sap and make maple syrup.

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