

See What Transpires

Note: The following research idea has not been fully developed into an activity but has been tried in some workshops and classrooms. If you try it, let us know how it went by sending a note to epp@mhub.facstaff.wisc.edu.

Broad Question

How do environmental factors affect plant transpiration rates?

Equipment

- Cobalt chloride paper (available from science supply companies)
- plastic bags
- stop watches
- twist ties
- paper clips

Background

It is thought that, due to intense summer suns, plants on the prairie lose large quantities of water. This water is lost through pores that are generally on the underside of the leaf. This process of water evaporating through the plant's pores is called transpiration. The force of evaporation from the leaf surface is what draws water up from the roots to the top of the plants. In the case of trees, this height can be hundreds of feet--far higher than most pumps can draw.

These pores are also necessary for gas exchange. As a plant photosynthesizes and makes food, it takes in carbon dioxide and excretes oxygen through these pores. The pores can open or close depending on environmental conditions and the needs of the plant. So a plant must find a balance between opening up the pores sufficiently for gas exchange (most necessary when the sun is shining and photosynthesis can occur) but not keeping the pores open when it is too hot and too much water will be lost through evaporation out of the pores (also greatest when the sun is shining). Because of this, transpiration rates make an interesting and complex story.

Activity

You can set up your own experiment based on queries about the relationship of transpiration rates to plant species, plant habitat (dry or wet), water stress adaptations (hairiness, waxy leaves, size, etc.), time of day, season, weather, or some other factor.

To set up the transpiration monitors, apply clear tape to both sides of half of a strip of cobalt chloride paper, paper clip the strip to the leaf, and enclose the

entire leaf inside a plastic bag (closed with a twist-tie). The taped area will remain blue, and the exposed area will turn pink as it is exposed to moisture. Let the paper set until it turns fully pink and record the time necessary for that change. The faster the color changes, the higher the transpiration rate.