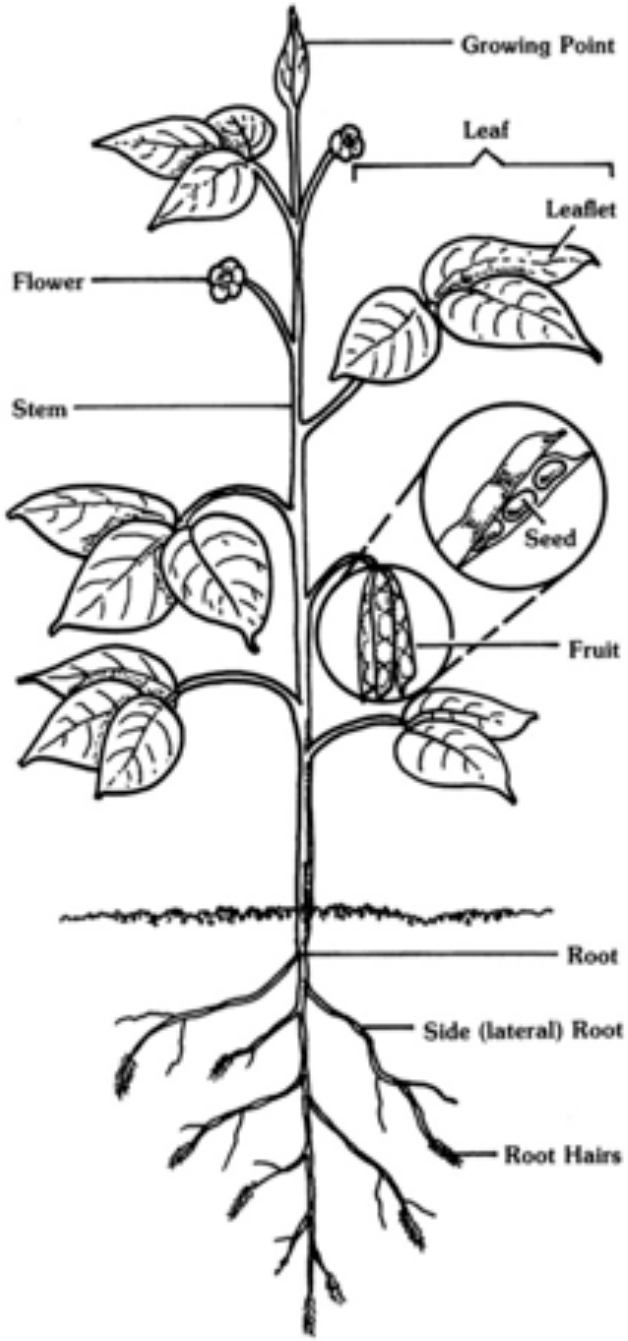
Roots!



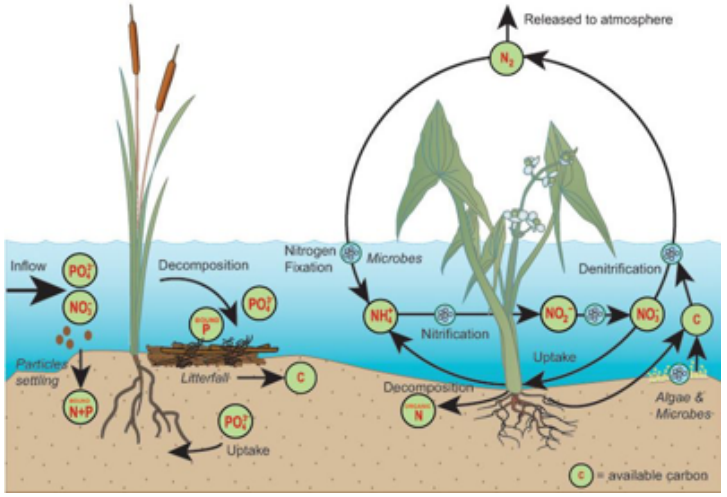
www.melissarooneywriting.com

Here's a great Intro YouTube Video!
Here's another one.

More online Resources and Lesson Plans (elementary):
Plant Parts
Food Sense: Root Vegetables
Roots Station Lab
Food Storage in Roots
Stems versus Roots
Root Systems, Structures, and Functions
Taproots and Trees
The Hidden World of Roots
Why Desert Plants need Long Roots

Why do Plants need Roots?

1) Anchor the Plant – why would this be good for the plant?
2) Draw in nutrients and water from the soil
3) Stabilize the soil and prevent erosion – why is this good for the plant?



A simplified illustration of the nitrogen and phosphorus cycles in a wetland (modified from Kadlec and Knight (1996), "Treatment Wetlands"; images from IAN, University of Maryland).

Roots Experiment!

Here's a YouTube Video of an easy experiment demonstrating how roots absorb water.

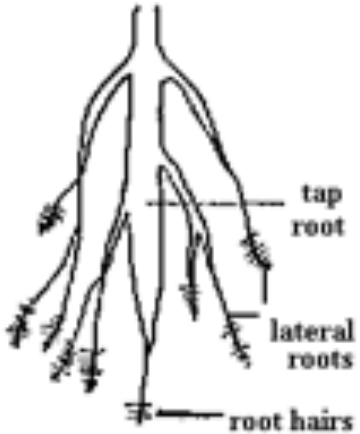
Do you see a problem with this experiment? (Hint: it has to do with the *control* test tube- the one without a plant in it.)

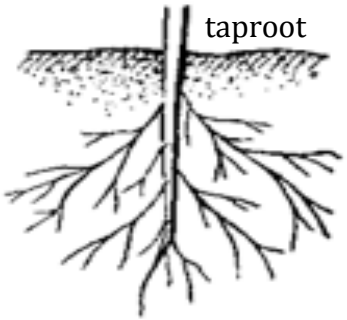
How can you correct for this problem?

Want to try your amended experiment and see if the results turn out differently? If you don't have test tubes, what could you use instead (must have a narrow neck for water-level

Plants have Two Types of Root Systems:

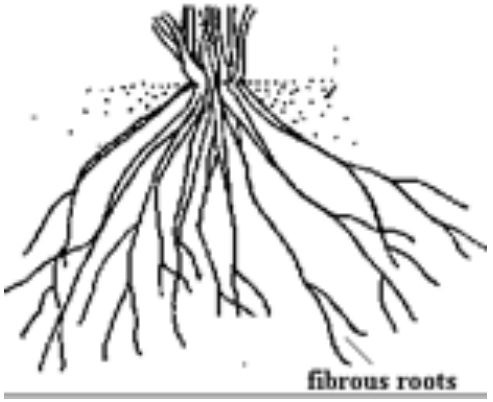
1. Taproot system:

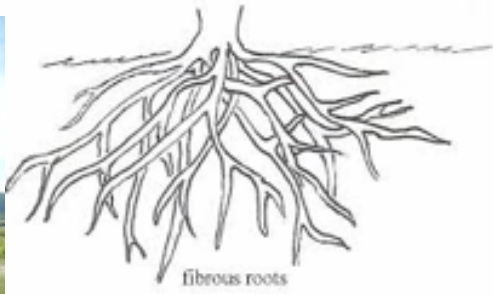




25-year-old Oak Tree

2. Fibrous Root system

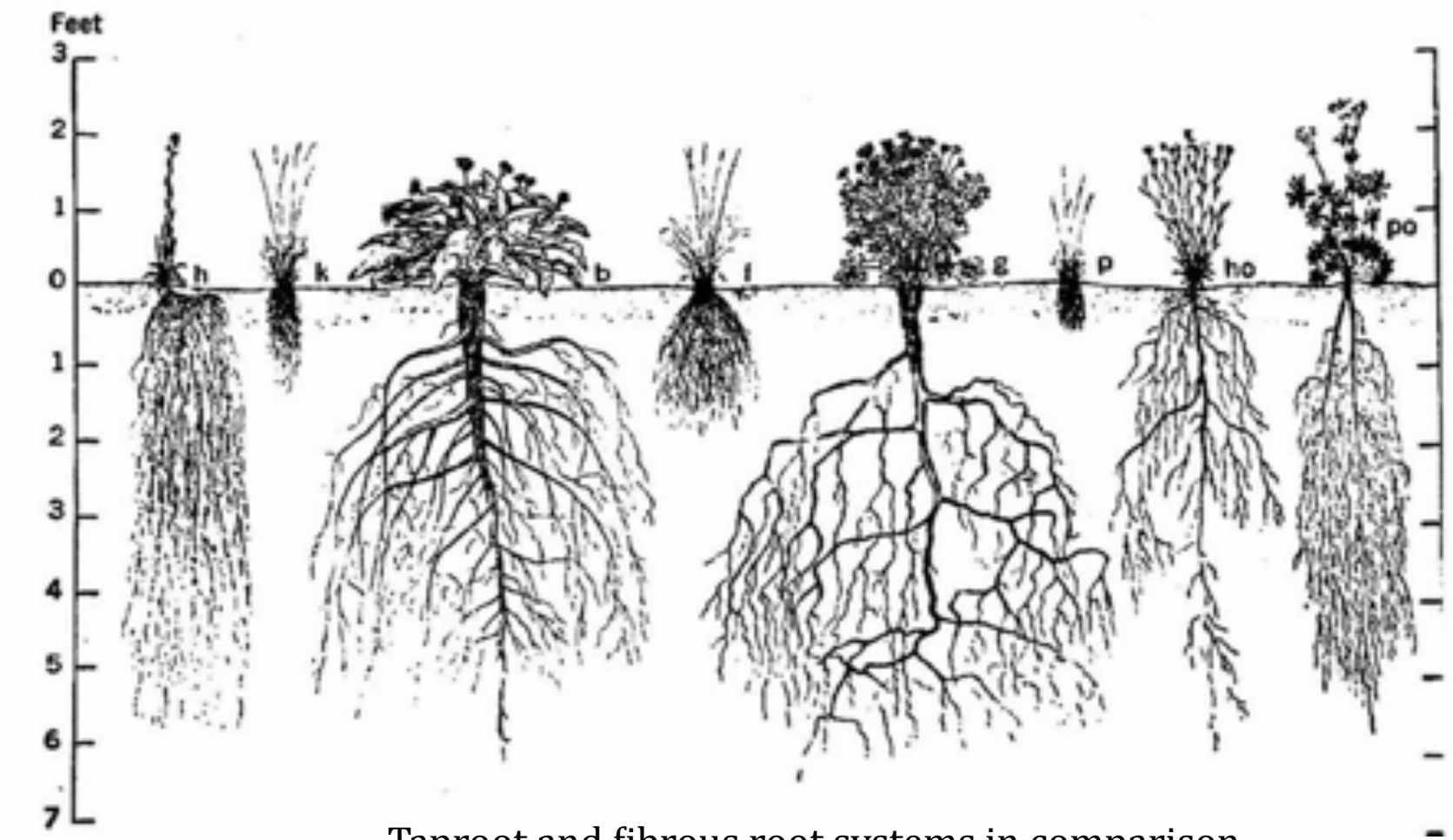




Some trees (like walnuts, pecans and many oaks and pines are anchored by a deep, vertical taproot, but most fruit trees and a lot of shade trees have a fibrous root system. In a fibrous root system, horizontal roots radiate out of the trunk. Vertical roots (called "sinker roots") grow along these horizontal roots them (with different spacing for different plant species) and extend downward so that the whole root-system acts like a tripod to hold up the heavy, above-ground part of the tree.

Which Root System do you think is better?

It depends on the plant

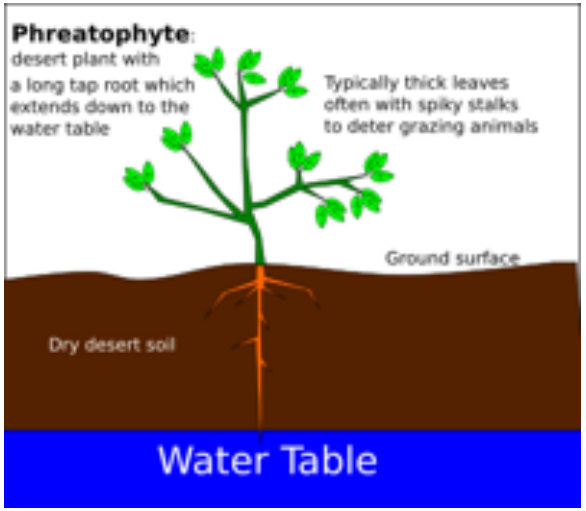


Taproot and fibrous root systems in comparison
~ University of Sydney (Australia) Plants Resources

… and the environment.

Fibrous root systems allow grasses like these to grow along beaches and in other sandy environments where a taproot may have a hard time getting a good hold.

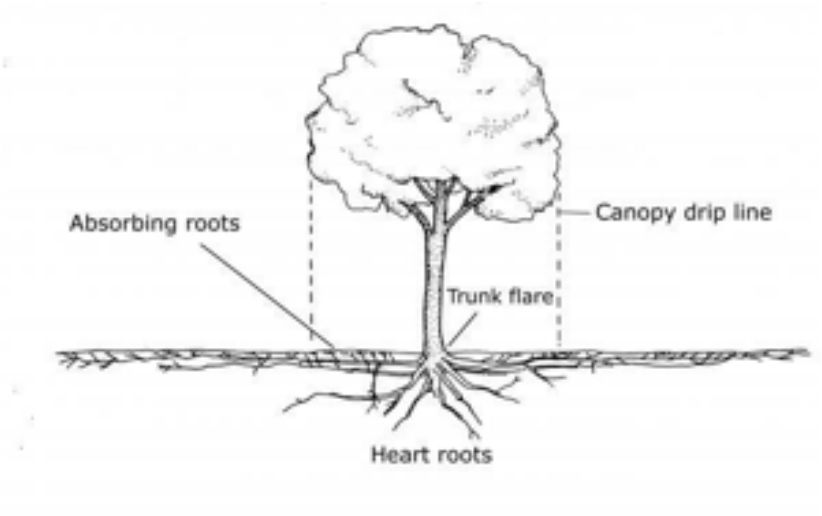
… Whereas plants with taproots tend to be very drought tolerant, because their roots can reach the water table far below the surface of the soil.

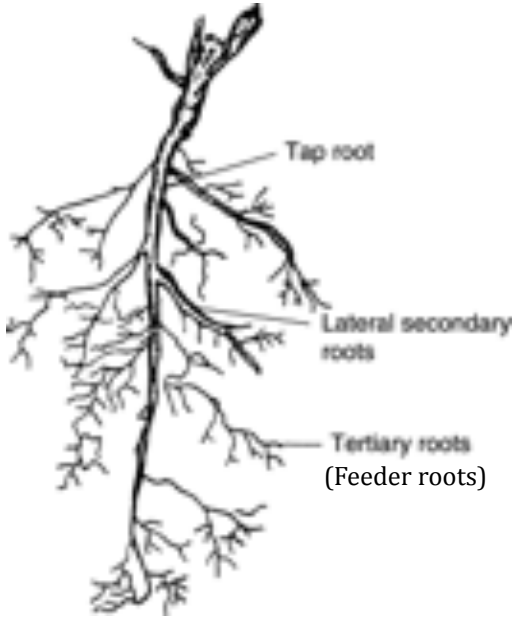


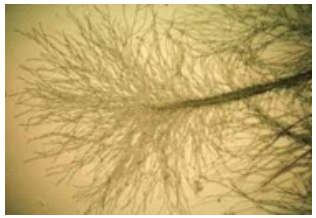
A Closer Look at Roots:

With many plants, we see the larger “woody” roots that provide stability and store water and carbohydrates, but the smaller *feeder* roots (or rootlets) that grow out of these make up most of a tree’s root system and do most of the work. In fact, feeder roots can extend beyond the canopy (branch reach) of a tree!

Feeder roots are incredibly efficient at absorbing surface water and minerals, and they often have tiny hairs that make them even better.

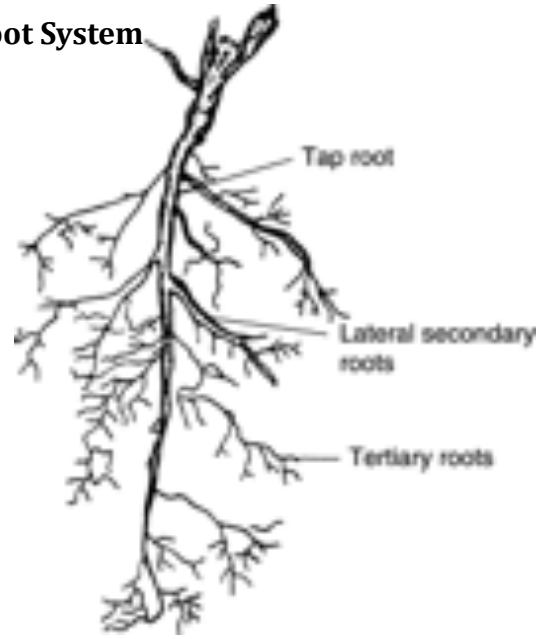


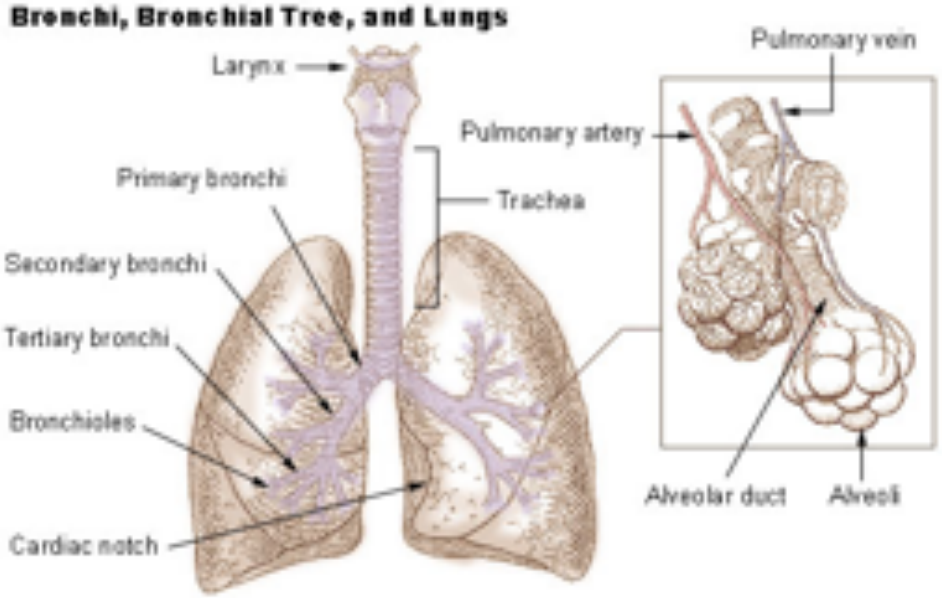




Tiny root "hairs" as small as 0.2 mm in diameter help trees absorb water and nutrients. Image courtesy gibneyCE.com

Tree Root System

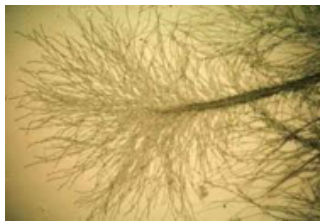




It's easy to visually compare tree roots with the system of air tubes (called bronchi) in your lungs. Efficiency has driven both to develop the way they have, and their parts are named in a similar fashion. But plant roots suck up nutrients in water, not in air, which makes roots more like straws than bronchi.

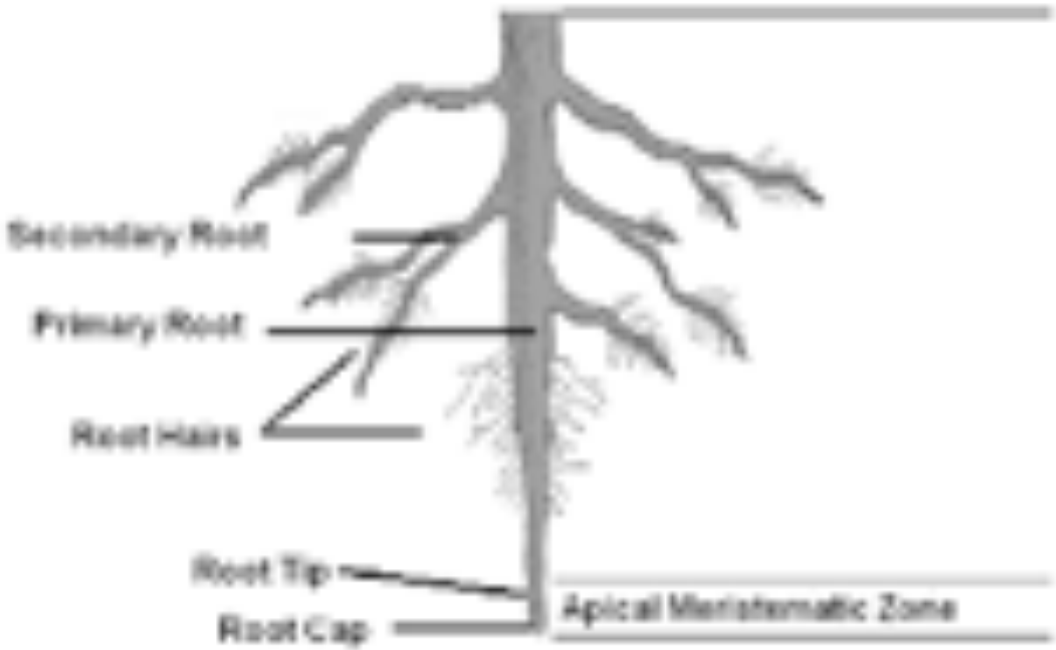
The feeder roots are smaller (sometimes very tiny) straws that connect to larger straws (secondary roots or the taproot), which connect to and feed the entire above-ground plant is fed.

The hairs on the feeder roots are even tinier straws, and it's amazing they don't get clogged.



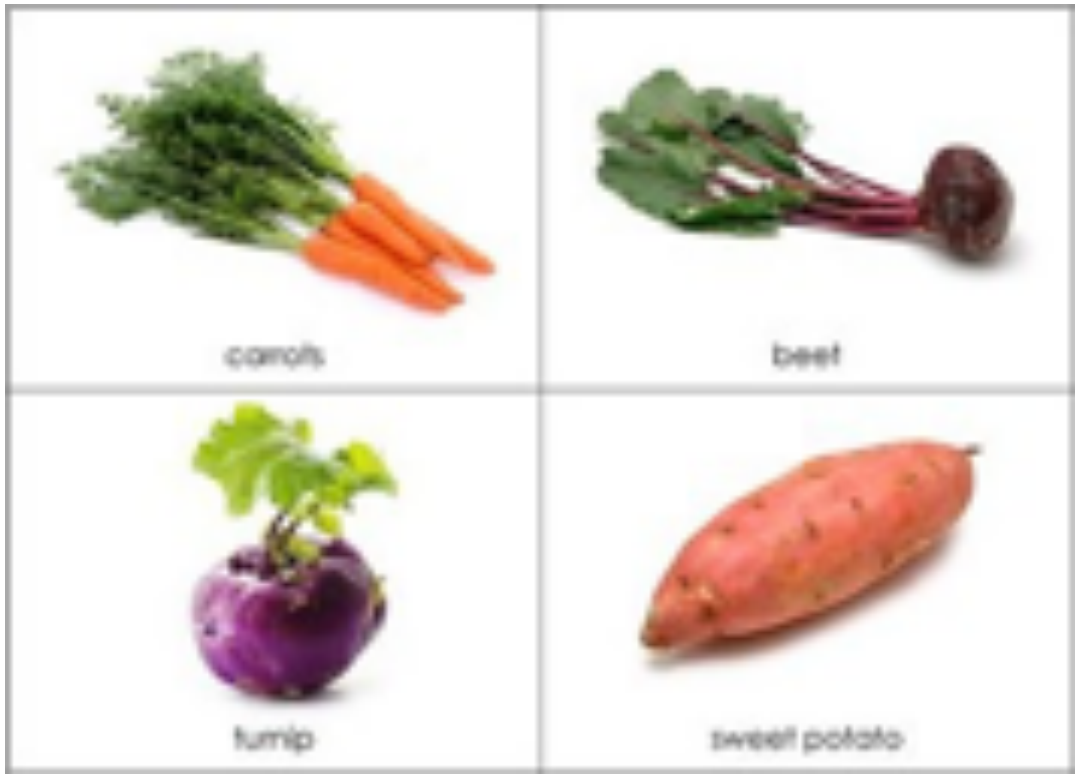
So…

All the way down to their tiny root hairs, ROOTS act like straws as they absorb water and minerals from the soil. But unlike straws, roots can store extra food for future use. Because of this food-storage capacity, many roots are full of nutrients, starches and sugars, providing animals with food (including us humans).



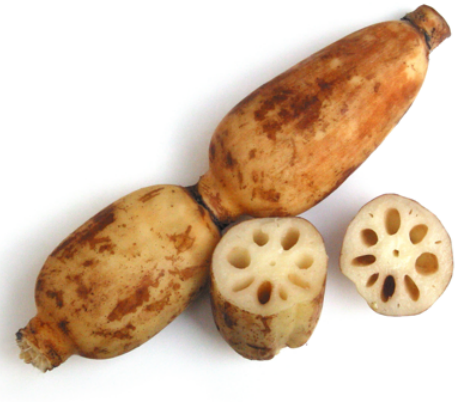
Can you name some of the roots that we eat?

Hint: A lot of them are *tap roots.*



Yams, beets, parsnips, turnips, rutabagas, carrots, yuca, kohlrabi, **onions**, garlic, celery **root** (or celeriac), horseradish, daikon, turmeric, jicama, Jerusalem artichokes, radishes, ginger …

Weirdest (and Coolest) Roots We Eat?
Some might say "Lotus Roots".



Why Eat Lotus Root?

High in Vitamin C – good for skin

Helps produce collagen, which

Protects skin against free radicals and UV rays

Helps reduce hyperpigmentation (dark spots on skin/ cancer)

Boosts immunity (makes body stronger to fight diseases/injuries

High in Copper – like beef liver, sunflower seeds and cashews

Promotes energy levels, strengthens bones, supports metabolism and improves brain function

High in Iron – supports energy levels

Iron is required to transport oxygen throughout your body (in your blood)

High in Fiber – good for digestive system and weight management

Fiber relieves constipation and reduces hunger, decreases blood pressure and cholesterol levels

High in Potassium

In combination with minerals like magnesium and calcium, potassium prevents the buildup of fluids in our cells, lowering blood pressure and reducing cardiovascular issues like heart disease and stroke.

But lotus roots aren't roots.
They're *RHIZOMES!*
(A lot of 'roots' are)

A *rhizome* is subterranean (underground) plant *stem* that contains *nodes* from which roots grow downward and shoots (stems that grow leaves and/or flowers) grow upward.

Rhizomes may also be called rootstalks or creeping rootstalks, because they grow horizontally (left and right instead of up and down).

Plants with rhizomes can become invasive (take over) very quickly, so care must be taken when planting to make sure they don't overtake native plants.

http://www.louistheplantgeek.com/

Although the lotus is native to Asia and flourishes in a wide range of climates from **India** to China, lotuses are grown in water gardens throughout the world for their beauty: The *Sarah P. Duke Gardens* in North Carolina have a large water garden that contains both lotus and water lily plants.

Also rhizomes:

tumeric

ginger

bamboo

Incidentally…

Differences between Lotus and Water Lily

- Water Lily (Nymphaea species): leaves and flowers **both** float on the water's surface.
-
- Lotus (Nelumbo species): leaves and flowers are *emergent*, or grow above the water's surface.
-

[One Exception: *tropical* water lilies leaves float on the surface just like hardy lilies but their flowers rise above the surface of the water about 6-8 inches.]

* Both have lily pads

Water lilies have multiple edible parts. Young leaves and unopened flower buds can be boiled and eaten as a vegetable. The seeds are high in protein, oil, and starch and can be popped, baked/roasted, or mashed into flour. The tubers (from the species *N tubersa*), which look like potatoes, can also be eaten.

For more on differences between Lotus and Water Lily plants, check out this **YouTube Video**.

And HERE's a *short* YouTube video about the spiritual meaning of the Lotus.
More Resources related to Lotus, Water Lily, and other rhizome-containing plants:

Lotus Roots
Another Oddity of Lotus Roots
Why Eat Lotus Roots
Culinary Uses of Lotus Roots
What is a Rhizome?
Harvesting and Dividing Lotus Rhizomes
Water Lilies versus Lotus Plants
Symbolism and Meaning of the Lotus Flower

For the active part of this lesson…

We played Name that Root! using root vegetables in my kitchen (I stocked the ones I know we'll use), then cut up some roots (potatoes), tossed them in olive oil and salt & pepper, and put them in the oven for 25 minutes at 400F (flip at the 10-minute mark). While we waited for our home fries to cook, we watered our potted and in-ground plants from our lesson yesterday, then pulled up weeds by the roots in the garden and yard, taking note whether they had taproots or fibrous roots.

When our potatoes were done, we ate them outside with ketchup, ranch dressing, and Texas Pete (and a teenager brother), while we re-watched the 'best' video from today and searched for more on YouTube.

Suggested reading: Armadilly Chili by Helen Kettemen

Check back for our next lesson:

x

What do plants do for *us*?
Give us Food and Oxygen
Filter Our Air and Water
Stabilize Our Land (Prevent Erosion)

Links to view in preparation:
Streambank Stabilization 1
Streambank and Shoreline Stabilization
Prevent Soil Erosion (WikiHow)
https://www.youtube.com/watch?v=IYxfz1PSfZ0

www.melissarooneywriting.com

Thanks for supporting these free lesson plans by checking out my website, scheduling me for a hands-on educational workshop, and/or purchasing one of my children's books.