Give Your Trees a Breath of Fresh Air

Backyard Wisdom - March/ April 2018

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photo credits: Gilbert A Smith and Lesley Bruce Smith

Give your trees a breath of fresh air? Normally we think the other way around, that trees give us a breath of fresh air, and they do. Without trees we would soon choke on our Carbon Dioxide (CO_2) and die from lack of Oxygen (O_2). Thank you trees! But did you know that **tree roots breathe just like we do, *"in with the O_2 and out with the CO_2"*?** Now you can amaze your friends with this myth busting fact. Try it out on your most knowledgable gardening friends. You'll be surprised by how few people, even landscapers, know this.

It's obvious when you think about it…every living thing breathes. Tree branches, trunks, and don't forget, tree roots **all** respire as part of normal metabolic processes. We are raised on the misconception, however, that trees breathe Carbon Dioxide. That's not really true. It's an anthropomorphism that misleads us, with disastrous consequences for our trees. Yes, during the day when the sun is out, the chlorophyll in green plants does convert CO_2, H_2O and sun energy into O_2 and sugar energy (carbohydrates). This is what we call *photosynthesis*, but here's the tricky part. When plants are photosynthesizing during the day and even at night, when they are not, they are doing what all living things are do, *respiring* or what we call breathing (using O_2 and giving off CO_2).

Tree roots are close to the surface as illustrated here by this fallen 80' Red Oak whose roots form a pancake. They stay near the air so they can breathe.

Hah! Now that we've gotten that out of the way, *how do tree roots breathe?* The whole tree: branch, stem and roots have specialized groups of cells called *lenticels* which open the normally impermeable bark and allow O_2 to enter and CO_2 to exit. The *lenticels* are attached to *ray cells* that penetrate deep into the wood. That's easy enough to understand on tree trunks but how do the roots get air? This is the crux of the matter: so listen carefully! ***In forested uncompacted soil at least 50% of the volume of the soil is made up of air spaces.*** Those air spaces are connected through ant tunnels, worm holes and fissures in the soil to the air at the surface. So actually, the soil breathes too.

Have you ever walked in a forest in the spring right after having walked on a lawn? If you have, you should notice that your feet sink into the lovely cushion of forest soils but not into the lawn. Trees are always expanding their roots. If it is into the forest soil or a forest like mulched bed they are breathing a deep

breath of fresh air. If it is into the soil under a lawn, they cannot expand as well, because there are not as many air pockets and the grass roots are in competition, so tree roots have trouble breathing.

The Morton Arboretum did research on mulching trees out to their branch spread. They measured the volume of roots on several species of trees with grass growing under their branches. Then they removed the grass and installed mulch out to the branch spread. After a few months they measured again and found that the volume of roots in the non grassy mulched areas doubled! This should be a clue to us who care for trees, our trees in the lawn are trying to survive with ***half of their normal amount of roots***.

These Poplar tree roots are gasping for air

You might ask: If tree roots need to breathe, how do they do it when they grow deep into the soil? In our Illinois wet, clay soil, tree roots do not survive ***deeply*** in the soil. In fact, the Morton Arboretum also did tests and found that **90% of all tree roots are located in the upper 1'-2' of soil.** One of the main reasons for the predominance of roots at the soil surface is *because they need to breathe*. **Tree roots do not grow deeply into the soil.** So why do we care about air spaces in the soil? Here are some common causes of tree mortality, which we see ALL the time due to misunderstandings about how trees grow.

1) **Cars or trucks parked under shade trees** compact the soil crushing all of the air pockets and choking the tree to death.
2) **Construction which brings heavy clay,** with NO AIR pockets to the surface. When the construction is finished we plant our trees into this soil. In order to survive the trees must grow their roots at or above the soil surface so they can breathe. *Whenever we see tree roots above the soil surface we know that the tree is gasping for air.* Usually these roots are seen as a problem for the grass, so tree roots

Construction damaged soil, with the heavy clay that has NO air spaces making it very difficult for any new plants to thrive or old ones to survive.

are cut or soil and sod planted to cover them. It is amazing that trees survive construction at all, a hundred year old Oak can be killed with as little as an inch of clay fill over the roots.

3) **Over fertilizing a tree that is struggling due to insufficient healthy roots**. When trees are struggling we often think fertilizing sounds like a good thing ***but it is the worst thing we can do.*** Fertilizers stimulate added top growth which the poor air starved roots cannot support.
4) **We water our trees twice a week with a sprinkling system so they get enough water along with our grass and flowers.** Watering is good, right? According to the University of Illinois if the trees, or lawn is watered more often than once a week the air pockets are filled with water, drowning roots, which actually dehydrates the trees and grass more and more. Notice that this applies to lawns as well as trees. Notice also that all of your neighbors are watering lawns and trees twice a week in an attempt to save their landscape. *More lawns and trees die from overwatering than from under watering.* Note: This is not the case east of Lake Michigan where the soil is sandy and has lots more air pockets and is faster draining soil than Illinois.
5) **Planting trees too deep in the soil.** We spend hundreds of dollars planting a new tree and yet it is often planted with the root crown below the soil surface so that it looks like a telephone pole. In the forest all of the tree trunks have a healthy tree taper or root flare out into the soil. **When the tree looks like a telephone pole (according to the National Nursery Association) your tree is gasping for breath, it has been planted too deeply.**

So how do we avoid these common tree problems and **give our trees a breath of fresh air?** It's really as easy as breathing:

1) Do not park vehicles under trees.
2) Remove clay soil or plant above it in new home construction. (See ***Arborsmith™ Tree Preservation Abstract***)
3) Soil sample before fertilizing to determine if it is helpful or hurtful. (See ***Arborsmith™ Fertilizing Abstract***)
4) Water lawns and trees no more often than once a week. (See ***Arborsmith™ Watering Abstract***)
5) Plant trees so you can see the soft taper of the root flare at the surface. (See ***Arborsmith™ Planting Abstract***)
6) Segregate your tree and shrub plantings from your lawn areas and mulch the planting beds like they do at the Chicago Botanic Garden, The Morton Arboretum and as Arborsmith recommends. (See ***Arborsmith™ Mulching Abstract***)