

Wood Wide Web “Healthy roots, healthy trees”

By

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Many recent studies show that “trees do talk to each other” through a vast network of the root systems. This is what is called “**Wood - Wide Web.**” This happens mostly due to a fungus and bacteria symbiotic mycorrhizal relationship and interaction with the tree root system through sharing water and nutrients. Beside many other functions this vast mycorrhizal networks are extremely important for tree health during the times of danger and stress. Studies show that certain species of fungi can facilitate tree resilience against certain environmental stressors such as predators, toxins, and pathogenic microbes that invade an ecosystem. These stress signals received through root system by not affected trees will facilitate the releasing volatile hormones or chemicals to discourage predators or pathogenic bugs.

Soil and Tree Roots

All plant life in the forest originates from the thin layer of minerals, organic matter, water and air that we all commonly call soil. Tree roots are very opportunistic as they will grow wherever and whenever there is available oxygen, water, nutrients and warm environment. Soil surface is the place where most of these preferable environments are and that is why the majority of tree roots are in the upper 45 to 60 cm (soil 18"-24") of soil. To understand how roots function, it is important to understand the relationship between above ground tree growth and roots as well as proper balancing between these two. If a portion of roots die, a certain amount of leaves and branches will die too and vice versa.

The fine roots are the place where the production of essential nitrogen and mineral nutrients happens. They are transported together with water throughout wood tissue. There are many studies that show the surface area of roots are several times larger than the surface area of leaves. Good example is native aspen tree in Alberta. The distance of roots from the main trunk can be as twice as the height of the tree itself (e.g. 80 feet aspen can produce the roots 160 feet from the main trunk)

Overall tree roots systems provide several key functions including: anchor portion of the trees above ground, store essential food reserves and transport water and minerals from the soil to the rest of the trees. Root damage will disrupt these key functions and together with pest or environmental issues such as drought, salt, frost and mechanical damages, will contribute to decline and the mortality of whole tree.

Causes of tree root injuries and problems

There are many ways to damage and destroy a root system, which ultimately lead to the decline and death of trees above ground. Once a tree is established, anything that changes the soil condition or the oxygen and water supply can be extremely detrimental for tree growth and survival. Some of the main causes of root injuries and declines are:

- Compaction - this is the most common and damaging cause for root decline
- Mechanical damages - using various equipment to disc, dig and trench with purpose of physical cutting of the roots from the main tree
- Chemical damages - using various improper herbicides, salt for de-icing and other chemicals
- Watering and fertilization- over and under watering and improper fertilization will lead to root damage
- Pests - there are several pests (insects and diseases) that are able to damage and kill the root system

- Improper tree selection and planting - choosing trees that are not adaptable to existing soil conditions will lead to root decline and speed up mortality

These causes are very common on a farm as well as urban/town settings but the severity of impact is quite different. Trees in urban/town settings are exposed to more severe impacts of these causes and the lifespan on the trees are overall less than in farm or natural settings.

Compaction is caused when the soil particles squeeze air and moisture out of the pore spaces. It may occur during new house and road development, construction, livestock grazing, timber harvesting, recreation and hosts of other activities. Compaction in farm settings is less common than in urban settings where it is one of the biggest killers of urban trees. In urban settings, the use of heavy clay subsoils instead of topsoil is causing compaction. Sandy soils compact the least, while clays and loams are the most susceptible. Moist soils are more likely to compact than dry or frozen soils.

Mechanical damages are caused by severing fine feed and major roots. Mature trees contain 4 to 7 major roots with thousands of medium, small and fine feeder roots. Cutting one major root just a few feet away from the trunk can reduce up to 25 % of root system. Mechanical damage to the surface of the roots is the main entry point for many fungal diseases of trees.

Chemical damages are very common causes both in farm and urban/town settings. On farm settings, constant crop spraying near trees, where tree root system absorb chemicals can weaken or kill them in a long run. Salt de-icing and herbicide use are very detrimental to the roots survival.

Watering and fertilizing - over or underwater or fertilizing can damage roots. Too much water will fill the soil air pockets and drown roots. Under watering will cause improper root development nor allow root ability to absorb nutrients. Over fertilizing will “burn” root while under fertilizing will not allow roots to take necessary minerals for trees to grow.

Pests- There are variety of pests that can damage roots. Majority of root pests are related to fungal diseases with few exceptions (insects). Fungal diseases can damage roots in two ways- one: they attack small/fine feeder roots, another type of fungal disease that can attack large roots resulting in root rots.

Improper tree species selection and planting - it is very common to see trees planted in the soil that are not preferable to that tree species. Choosing sandy and dry soil loving species such as pine and planting them in a water logged or swampy area will not allow roots to be established or thrive in these environments. Many root injuries happen due to improper planting or damaged during the planting.

Symptoms

It is sometimes very hard to identify root problems as they are associated with other symptoms that cause trees to decline. Proper identification of root injury of causes and symptoms are crucial for the determination of tree decline or mortality. There are several symptoms to identify root problems including:

- Leaves - yellow, small and chlorotic foliage. Leaves are tufted and scorch looking
- Branch dieback - portion of small or large branch entirely dead
- Bark - fungal fruiting bodies (mushroom or conks) on bark or under the bark
- Mechanical root damages - it sometimes takes years to identify the cause of decline and mortality of trees
- Dead vegetation due to chemical damages
- Roots are black or brown vs white or light colour(indication of health of roots)
- Changes in soil slopes
- Past constructions and activities in soil

Recommendations for healthy roots- healthy trees

- Avoid practices that cause root damages - e.g. compaction, mechanical, chemical, watering damages etc.
- Use tilling to break up heavy compacted soil prior to tree planting
- Add some soil amendments if the top soil is poor or removed
- Apply 2 to 4 inch thick mulch layer to protect soil
- Improve drainage by ensuring ditches and culvert are kept clear to allow free flow of water
- Perform soil testing to determine nutrient deficiency and availability
- Consider the tree species suitability for different soil types
- Avoid any weed control - especially disking and spraying once tree were established
- Avoid spraying or using chemicals on nearby trees
- Provide adequate watering and fertilizing based on tests, not on guessing
- Avoid grade changes and use directional drilling to avoid root damages
- Avoid planting trees near sewage lines, sidewalks and house foundations
- Perform proper tree planting to avoid too deep or shallow planting by looking into changes in colour between trunk and roots. It should be a visible root flare after tree is planted
- In an urban/town area - use alternative sidewalk designs and materials
- Keep leaves on the ground (do not rake leaves) in the fall as this is source of minerals, micro nutrient and organic material to roots
- Keep leaves in fall as they will act as mulch to protect roots from deep freezing

Conclusion

Knowing and understanding where tree roots are located, what they require to grow and how they interact and the cause and symptoms are crucial to overall survival and thriving of trees. Protect the tree roots - you will have long lasting healthy trees

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