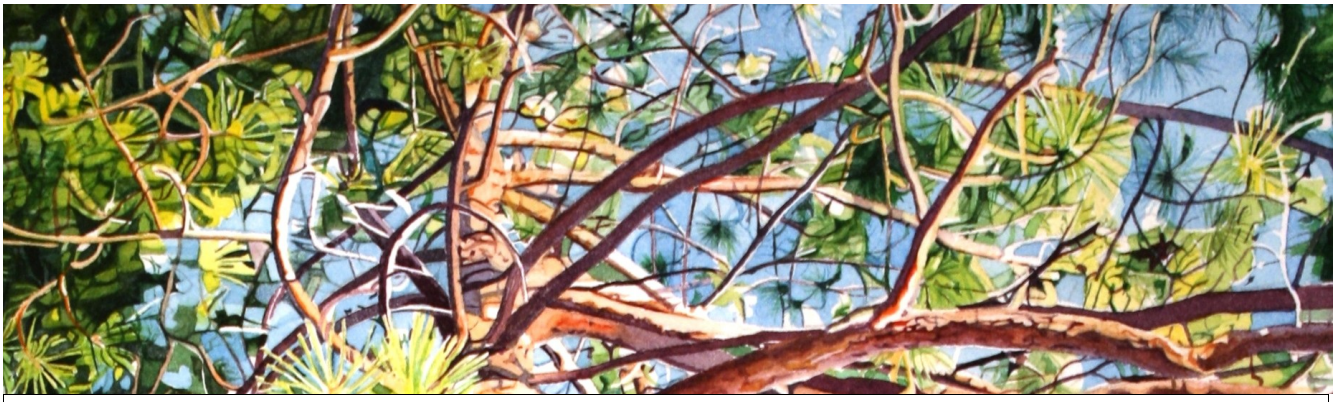
The Wood-Wide Web



Branching Out

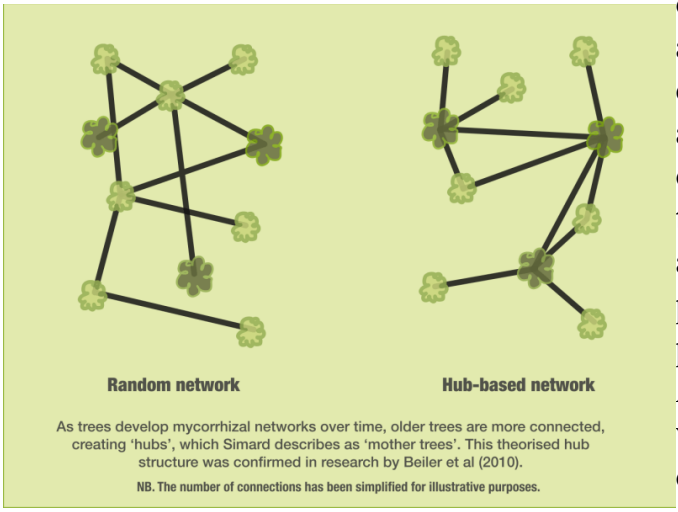
Mushrooms are the fruiting bodies of fungi which we see above ground, but the vast bulk of this organism is a massive 3D network, or giant web, of mycelium underground. The mycelium is made up of long threads or filaments called hyphae that fan out, and it is said there can be 300 miles of these fungi threads under every footstep one would take in any mature forest of the world. Mycelium is the oldest multicellular organism on the planet. Some fossils (found in lava sediments in South Africa) have dated back 2.4 billion years. Theoretically, mycelium can last forever, as long as food is available. Not only are they old, but also huge. There is one mycelial growth on an Oregon mountain that covers thousands of acres. If you have ever knocked or kicked a rotting log and seen the white web-like material, that would be mycelium.

Relationship with Trees and Plants

Here is where things get interesting. This mycelium interacts with trees and plants by growing into their roots. This underground connectivity between the mycelium and the roots is known as the mycorrhizal network. It is said that 90% of the plant's vegetation is connected by these complex webs. Fungi are actually more genetically similar to animals than to plants or bacteria. The relationship is mutually beneficial. Fungi gather nutrients such as phosphorus, nitrogen, calcium, copper, zinc and water from the

soil and provide them to the roots. These fungal networks can increase the "reach" of the plants roots by over 100x. In exchange, trees share up to 1/3 of their carbohydrate (sugar) production with the mycorrhizal network. Fungi cannot produce carbohydrates on their own. This mutually beneficial dependence is called symbiosis.

Things get even more complex. Studies have shown that trees living near one another, transfer water and nutrients to *one another* through these mycorrhizal networks. The older, more established trees in the network are called "mother trees." Their roots go deeper into the soil, which means they have access to even more resources to pass to other trees. The younger saplings require this help when they only have limited access to critical sunlight needed for photosynthesis which leads to carbohydrate production.



As trees develop mycorrhizal networks over time, older trees are more connected, creating 'hubs', which Simard describes as 'mother trees'. This theorised hub structure was confirmed in research by Beiler et al (2010).
NB. The number of connections has been simplified for illustrative purposes.

As an example, one Douglas fir "mother" was found connected to 47 offspring. Not only do these trees communicate within their species, they are found to cooperate with different species nearby if connected by the same mycorrhizal network.

Birch trees have been shown to deliver sugars to shaded Douglas Firs in the summer, and in the fall, the Firs send nutrients to the leafless Birches. Finally, research also shows that trees "talk" to each other by sending chemical signals through mycorrhizal networks. They can send and detect distress signals, and send resources to trees in need.

Importance

Mycorrhizal associations have profoundly impacted the evolution of plant life on Earth ever since the initial adaptation of plant life to land. Without the mycorrhizal network, trees would not exist, neither would humans. In evolutionary biology, mycorrhizal symbiosis has prompted inquiries into the possibility that symbiosis, not competition, is the main driver of evolution.

Several positive effects of mycorrhizal networks on plants have been reported. These include increased establishment success, higher growth rate and survival of seedlings; and the ability to deal with climate change.

Scientists are also studying pesticides derived from fungi as a more natural approach than current more harmful chemicals, for example Roundup.

Threats

Habitat loss, logging, agriculture and urbanization are all threats to the Wood-Wide Web. As stewards of the Huron Woods Carolinian Forest, we can all help by allowing leaves to fall where they may, generating rich soil, and to keep as many native trees as possible in existence. After all, trees are the lungs of the planet.