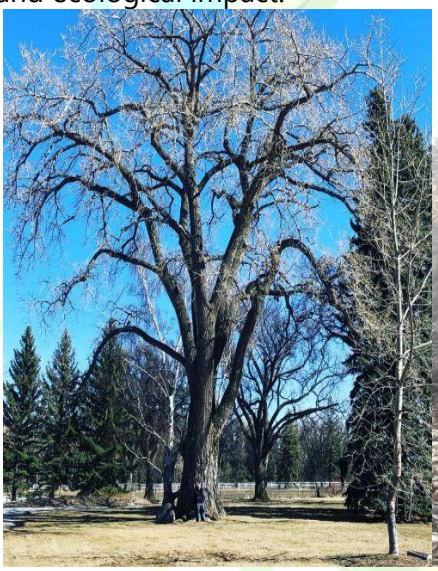
ATTS Group

Poplars underground connections

By Toso Bozic

Poplars is common name in Alberta which includes native trembling aspen (white poplar), balsam poplar (black poplar), Plaines cottonwood as well as wide range of clonal varieties that are belonging to the genus Populus. In fact, some of the largest living organisms on Earth are poplar clones. One famous example is the Pando clone (*Pando in Latin mean " I spread")* in Utah Fish Lake National Forest which consists of thousands of individual trees connected by a single root system and is estimated to be over 80,000 years old.

If you've ever wondered how poplar trees spread and thrive in such diverse environments—from prairie deserts and mountain ranges to the edges of the northern tundra—the answer lies in their remarkable root system, which allows them to adapt to these harsh conditions. They thrive in a variety of environments in various soil conditions from, farm fields, sand dunes, heavy disturb sites, riverbanks to harsh conditions in urban areas. One of the most fascinating aspects of poplars is their extensive underground root system, which allows them to form interconnected networks. These underground connections contribute to their survival, resilience, and ecological impact.




Pictures: Plains cottonwood -the Fairfield Poplar (L), roots and root biomass of black poplar (R)

The root system of poplars

Poplars are well known for their rapid growth and adaptability. Beneath the surface, poplars are connected by an extensive root system. Poplars have a vigorous and widespread root system that plays a crucial role in their growth and survival. Poplars have extensive and aggressive root systems that can spread far beyond the tree canopy. Unlike some trees that develop deep taproots, poplars primarily grow lateral roots that spread horizontally. These roots can extend over vast distances, often intertwining with those of neighboring trees.

Their root system consists of two primary components including taproots which in young poplars initially develop a central taproot that anchors them firmly into the soil. However, as the tree matures, the taproot often becomes less dominant. Vast majority of poplar roots are lateral roots which trees rely heavily on. Lateral roots which grow horizontally and spread far beyond the tree's canopy. These roots are responsible for water and nutrient absorption, stabilization, and forming connections with other trees.

Clonal connection, root suckering and root grafting

Poplars are considered clonal trees, meaning they can reproduce asexually through root suckering. One of the most remarkable ways poplars connect underground is through a process called **root suckering**. Root suckering occurs when new shoots, known as suckers, emerge from the lateral roots of a parent tree. These suckers grow into genetically identical trees, forming a clonal colony. Over time, a single poplar tree can give rise to an extensive grove of interconnected trees.

Mechanism of root suckering works that certain cells in the lateral roots of poplars remain meristematic, meaning they retain the ability to divide and produce new shoots. Environmental factors such as sunlight exposure, soil conditions, and mechanical disturbances can trigger the formation of suckers. Since suckers originate from the same parent tree, they share identical genetic material. This allows the entire stand of trees to function as a single organism, effectively expanding the reach of a single tree over large areas.

Another way poplars are connected underground is through **root grafting**, a phenomenon where roots of neighboring trees physically fuse. Root grafting can occur between genetically identical trees (clones) or even between different poplar individuals of the same species.

Formation of root grafts occurs when two poplar roots come into contact, they may grow together through a natural process called secondary growth. Over time, vascular tissues (xylem and phloem) from both trees merge, establishing a direct exchange of water, nutrients, and even chemical signals.

Poplars are also capable of clonal reproduction, a process where new trees are produced from the roots of a parent tree. This results in a group of genetically identical trees, known as a **"clone."** Clonal reproduction is common in poplar species such as the trembling aspen (Populus tremuloides). These clonal networks have significant ecological and evolutionary advantages. They allow poplars to rapidly colonize new areas, outcompeting other plant species. Additionally, clonal reproduction ensures the persistence of advantageous genetic traits, contributing to the long-term survival of the species.

Underground communication - Mycorrhizal Networks

In addition to direct root connections, poplars also form associations with **mycorrhizal fungi**, connect with other trees through a symbiotic relationship. Mycorrhizal fungi form symbiotic relationships with poplar roots, creating an extensive underground fungal network, often

referred to as the **"wood wide web."** This "mycorrhizal networks" acts as an underground highway for resources nutrients and information. The fungi colonize the tree's roots, extending their own network of hyphae (thread-like structures) into the soil. The fungal mycelium connects multiple trees, allowing the transfer of water, nutrients, and signaling compounds. Through these mycorrhizal networks, poplars can also send chemical signals to warn neighboring trees of pest attacks or environmental stress. This communication enhances the collective resilience of the tree community.

Significance of underground connections

The underground connections of poplar trees have significant ecological and practical implications. In natural ecosystems, their ability to form extensive root networks helps prevent soil erosion, stabilize riverbanks, and support biodiversity. Animals, insects, and fungi rely on poplar forests for habitat and sustenance.

In human environments, however, the aggressive root systems of poplars can sometimes cause problems. Their roots can invade underground infrastructure system and interfere with agricultural crops. The interconnected root system of poplars provides several ecological and economic benefits:

- **Forest Regeneration:** Clonal growth through root suckering ensures rapid forest regeneration, especially after disturbances such as wildfires, floods, or logging. It is economically viable options for forest managers to reforest aspen forest.
- **Soil Stabilization:** Their extensive root system prevents soil erosion, particularly in riparian zones where poplars are commonly found.
- **Wildlife Habitat:** The interconnected trees create dense stands that offer shelter and food for various wildlife species.
- **Carbon Sequestration:** By maintaining a vast underground root network, poplars play a significant role in carbon storage, helping to mitigate climate change.

Poplars are more than just fast-growing trees—they are highly interconnected organisms that thrive through underground connections. Whether through clonal reproduction, mycorrhizal networks, root grafting, or chemical signaling, these trees form resilient and cooperative communities beneath the soil. Understanding how poplars connect underground provides insight into their remarkable adaptability and the intricate web of life that exists beneath our feet.

For more information:

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