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Perspective

Plant communication: do trees really talk to each other?

Petter Elians*

Department of Biological Sciences, Northern Arizona University, USA

Email: pter@elns.edu

INTRODUCTION

Plants, particularly trees, may seem like quiet, passive organisms, rooted firmly in one place and seemingly unaware of their surroundings. But emerging scientific research over the last few decades has increasingly shown that trees, in fact, have complex ways of communicating with each other. This communication, far from being mere survival strategies, reflects a sophisticated network of interactions that involve sharing resources, warning of danger, and even helping one another in times of need. The idea that trees "talk" to each other has become a fascinating area of study, capturing the public imagination and reshaping our understanding of the plant kingdom (Berendsen RL.,et al 2012)..

One of the most significant discoveries in recent years is the existence of vast underground networks that connect trees and plants in a forest, often referred to as the "Wood Wide Web." These networks are formed by mycorrhizal fungi, which form symbiotic relationships with plant roots. The fungi connect the roots of multiple plants, creating a complex web through which plants can exchange nutrients, water, and even information(Chaerle L.,et al 2001).

Trees in a forest can send chemical signals through these fungal networks. When one tree experiences stress, such as an insect attack or drought, it can release chemical signals into the network that warn nearby trees of the threat. This allows other trees to activate defense mechanisms, such as producing chemicals that deter herbivores or attract predators of the insects that are threatening them. Research has even shown that older trees, sometimes referred to as "mother trees," tend to support the growth of younger or weaker trees in their vicinity by sending nutrients through these fungal networks. This cooperative behavior challenges the long-held view of plants as isolated, competitive organisms and suggests a more interconnected, mutualistic approach to survival (Cook RJ.,et al 2000).

In addition to underground networks, trees also communicate through the air. Many trees release volatile organic compounds (VOCs) into the atmosphere as a way of signaling to other plants. For example, when a tree is attacked by herbivores, it might release certain VOCs that serve as a distress signal. Nearby plants, upon detecting these airborne signals, may ramp up their own defenses in anticipation of a potential attack. This form of communication is particularly evident in tree species like acacia or eucalyptus, which can emit VOCs that serve to warn neighboring trees and deter pests(Flood J.,et al 2010).

The process of chemical signaling is not limited to direct warnings about herbivory. Some studies have suggested that trees can also communicate about environmental conditions, such as a looming drought. When trees sense a decrease in water availability, they may release certain chemicals into the air to signal other trees to adjust their water usage, thus promoting the survival of the forest ecosystem as a whole. This shows that trees are not just passive organisms reacting to environmental factors but are actively engaged in a form of communal management of resources(Ghestem M.,et al 2011).

The communication systems between trees and plants play a vital role in maintaining ecosystem health and stability. In forests, trees often depend on each other for survival, particularly in environments where resources like water and nutrients are scarce. In these ecosystems, trees "talk" to each other to help distribute resources more effectively,

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ensuring that the entire system thrives(Iyer-Pascuzzi AS.,et al 2010).

Furthermore, these communication networks are not just limited to trees within the same species. A study published in *Nature Communications* showed that different tree species in the same forest can exchange information through mycorrhizal networks, sharing nutrients and chemical signals across species boundaries. This highlights the complexity of tree communication, where cooperation and competition can coexist, ensuring a more resilient and balanced ecosystem (Roose T.,et al 2006).

The concept of the "mother tree" is an intriguing one, suggesting that some trees act as central hubs within these communication networks. These older, often larger trees tend to have more extensive mycorrhizal networks and are able to provide nutrients and resources to younger, smaller trees nearby. This support is especially important in the early stages of a tree's life, helping it to establish roots and grow. The "mother tree" hypothesis has been supported by several studies, which have found that the loss of older trees can disrupt these nutrient-sharing networks, leading to declines in the health and diversity of the forest(Ghestem M.,et al 2011)..

Interestingly, research has also suggested that trees are capable of a certain degree of "altruism." Trees will sometimes sacrifice their own resources for the benefit of other trees in their network, especially when these trees are younger or struggling. This finding challenges the idea of natural selection as a purely competitive process and suggests that cooperation can be just as vital to survival as competition in the plant world (Wang E.,et al 2004).

The discovery that trees communicate in these intricate ways has profound implications for how we think about forests and plant life. It challenges our traditional views of trees as solitary, competitive organisms and paints a picture of an interconnected, collaborative community where cooperation plays a key role in survival. Understanding these communication networks could also have practical applications in conservation and forest management. If we can better understand how trees communicate, we might be able to design more effective strategies for preserving forests and combating threats like climate change and deforestation.

Moreover, these findings also raise broader questions about intelligence and consciousness in the natural world. If trees can communicate in such sophisticated ways, it forces us to reconsider the ways in which non-animal organisms interact with their environment. While trees may not have brains or nervous systems, their ability to respond to environmental changes and communicate with one another suggests a form of intelligence that we are only beginning to understand(Zobel RW.,et al 2004).

CONCLUSION

While trees may not talk in the way humans do, their ability to communicate through chemical signals, fungal networks, and even airborne messages is nothing short of remarkable. Far from being isolated organisms, trees are part of a dynamic, interdependent network that sustains the health and vitality of the forest ecosystem. As science continues to uncover the complexities of plant communication, we gain a deeper appreciation for the intelligence of the natural world, one that challenges traditional views and opens up new possibilities for how we engage with and protect the environment.

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