Wood You Rather Episode Notes
Go Forth and Science Podcast
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Tall Trees

Stovall, A., Shugart, H., Yang, X. 2019. Tree height explains mortality risk during an intense drought. Nature Communications; 10(4385): 1-6

- The larger the tree the more likely it'll die in a drought
- Because the tree is so big, it has a hard time getting everything it needs to survive in a drought, like water.
    - Trees that were 90 ft or taller were twice as likely to die in a multi-year drought than trees that were less than 45 ft.
- Half of all "mature-forest carbon" is in large trees
    - Changing climate will impact these trees (drought) which will mean more carbon will be released into the atmosphere

National Park Service, Redwood National Park: https://www.nps.gov/redw/learn/nature/about-the-trees.htm

- Hundreds of gallons of water move through a redwood tree every day
- As leaves diffuse the water (transpiration), molecular bonds in the water pull the water up the tree

Human-Tree Connection/Wilderness Therapy

Fernee, C., Mesel, T., Andersen, A.J.W., Gabrielsen, L.E. 2019. Therapy the natural way: a realist exploration of the wilderness therapy treatment process in adolescent mental health care in Norway. Qualitative Health Research; 29(9): 1358-1377.

- Wilderness is restorative, rejuvenating and enlivening, it's not to be conquered, and connectedness happens because outdoor life is simple
- Going outside is empowering, because it means taking steps toward change: emancipation/freedom
- Happier outside than when staying indoors, and anxiety/social discomfort have less of a hold when outside
- "tranquility" and "stillness" of nature allow for reflection, either sitting down or while hiking
- "the deeper into nature one ventures, the greater the… effects may become."

Mycorrhizal Communication

Tedersoo, L., Bahram, M., Zobel, M. 2020. How mycorrhizal associations drive plant population and community biology. Science; 367 (867): 1-9

- Enhance nutrient access and stress tolerance
- Mediate plant interactions with other microbes (like pathogens and mutualists that provide nutrients/vitamins and protection)
- Regulate plant-plant interactions

    - "Extensive mycorrhizal networks physically connect conspecific and heterospecific plant individuals belowground, mediating nutrient transfer and transmission of phytochemical signals."
    - Conspecific = same species
    - Heterospecific = different species
- Some increase diversity by giving certain species a leg up and "suppressing superior competitors", other support "seedling establishment near adult trees" which leads to low diversity.

Simard, S., Beiler, K.J., Bingham, M.A., Deslippe, J.R., Philip, L.J., Teste, F.P. 2012. Mycorrhizal networks: mechanisms, ecology and modelling. Fungal Biology Reviews; 26: 39-60

- Mycorrhizal networks help growth, survival, defense in individual plants
    - Transfer carbon, nutrients, water, and defense signals
- Mycorrhizal plants are "promiscuous", associating with multiple fungal species, and the fungi associate with multiple plant species
    - But: Nonvascular liverworts are very specific about their partners, because they get sugars from "neighboring autotrophic plants"
- These fungi need carbon to survive, but they split their carbon needs among the trees they colonize, and can even pass the carbon on to other trees
- In widespread fungal networks, they can transport water from one part of the landscape to another, and the same goes for nutrients (nitrogen and phosphorus)
- The networks link young trees to "large, old hub trees"
- One single fungus (or a large colony of organisms with all the same genes), can cover hundreds of hectares of soil, and can live to be thousands of years old
    - "it is likely that single genets of EM fungi are influencing forest stand dynamics over large areas and many tree generations"
- Found in forest, woodlands and grasslands

Simard, S. 2018. Mycorrhizal networks facilitate tree communication, learning and memory. Chapter in Memory and Learning in Plants, Springer International Publishing; 192-213

- Plants moved from the ocean to land about 360 million years ago
- Plants put 10-90% of the stuff they make from photosynthesis into the ecosystems at their roots
    - that 90% is in grasslands and tundras, and that 10% is plants in tropical forests
- Mycorrhiza literally means fungus roots
- It's easier to facilitate fungus growth than it is for trees to grow their own roots
    - Can cover more ground area to find patchy resources
    - Without fungi, most trees couldn't survive
- To find resources, they show: "decision making, search and escape movements, and neighbor recognition"
    - "mycorrhizal networks are intimately involved in tree cognition."
    - Human "recognition, that plants have agency and actions, in their capacity to perceive, communicate, remember, learn, and behave, could be transformative for how humans perceive, empathize with, and care for trees and the environment"
- Trees photosynthesize and exchange sugars with fungi
- Darwin even proposed a "root-brain" hypothesis in the 1800's

- Signals can pass between plants in a few hours or days, and they influence plant behavior
    - “Our numerous experiments have found that a multitude of signals—including nitrogen, carbon, water, defense molecules, and kin recognition information—transmit back-and-forth among Douglas-fir trees through ectomycorrhizal networks”
    - Network transmits signals about: rooting depth, height growth, network patterns, photosynthetic rates, nutrient uptake, germination, survival, defense
- Mother trees transfer nutrients to the rest of the ecosystem through the network
    - When predators catch salmon, they take them under the large trees to eat. Nitrogen from the leftovers then feed the mycorrhizae, which then feeds the trees, which then provides more shade for the salmon rivers.