When I went home for a free weekend two weeks ago, I noticed how dramatically different the forest around my home was. CalFire had recently cleared out and removed dead oaks and decades of brush growing underneath the coastal redwoods along Kings Mountain Road in Woodside. I live in the hills of Tunitas Creek Canyon in the Santa Cruz Mountains just south of the coastside town of Half Moon Bay surrounded by beautiful, 100-year old coastal redwood trees. As I drive to school and the neighborhoods where many of my friends live, I drive up Tunitas Creek Road and then down Kings Mountain Road, so I know the related forests very well.

CalFire and the forest service remove the underbrush to protect the redwoods which do survive most fires, but not the hottest of wildfires that result from the build up of fuel after years and years of fire suppression. The hills where I live have experienced fires regularly which removes the underbrush, but since people have chosen to live in these forests in the last 100 years, everyone works collectively to prevent and minimize fires. So CalFire's cutting down dead trees and removal of the underbrush has opened up views through the forest previously blocked. Until the rains start and some of the grasses, flowers, ferns and underbrush grows again the forest looks unnaturally barren. Researching this shortly there after, I found that not everyone agrees with this approach to protecting the local forests. I found this excerpt from a local online paper that, "The Sierra Club California stated that clearing trees might create more danger by loosening soil that could lead to mudslides" ("Dead Oaks"). Meanwhile the center [for Biological Diversity] and other environmental groups said focusing on retrofitting and creating defensible space around homes is more effective than thinning forests. Although this latter suggestion seems to emphasize the protection of the homes rather than the coastal redwood trees which survive most fires. These disagreements surprised me, and it made me wonder how else we human's misunderstand nature. How might those misunderstandings be harmful? What would the trees themselves prefer? Do trees communicate with each other? If trees do communicate, what happens when you cut down several trees? Do trees have symbiotic relationships with other member's of their ecosystems? These questions are important to me as I would like to know more about the amazing coastal redwood trees and their forests in which I grew up. I want to expand my understanding of the importance of trees and their communications that we don't see or understand.

Are trees actually thinking? Are they more than we have thought them to be? How do we respectfully live on a planet with all sorts of non-human intelligence without first exploring and understanding other forms of intelligence? Before going into whether or not trees communicate, I first explored the research related to coastal redwood trees, the trees I have grown up exploring, admiring and observing my whole life.

Coastal redwoods are the tallest trees on earth and range from southern Oregon to central California. They can reach heights of nearly 400 feet, which is roughly equivalent to a 37-story skyscraper and are among the oldest living organisms in the world. They have been on the planet for over 240 million years, since the time of dinosaurs (Levine). A typical redwood lives between 500 to 700 years, yet some live for more than 2,000 years – some of these trees were alive during the Roman Empire! The oldest known living redwood clocks is estimated to be 2,200 years old. One of the reasons redwood trees live so long is because of their bark which is like armor and gives the tree physical and chemical protection ("5 Reasons"). Their bark also allows them to withstand low-intensity fires, it contains high levels of toxic tannins to protect the trees from fungus and insect infestations and also makes the wood naturally resistant to rot. They have thick, red, pithy bark which gives the tree both protection and insulation.

Most redwoods grow from sprouts formed around the base of a tree, utilizing the nutrients and root system of a mature tree. When the parent tree dies, a new generation of trees rise, creating a circle of trees that are often called fairy rings (Levine). When the trees grow out of the perimeter of a dead tree trunk (which accounts for about 80% of all living redwoods), the new trees end up being genetic clones of the original (Levine). Some of today's redwoods could be the latest in a 20,000- or 30,000-year line of the same tree reproducing itself over and over and over again.

Regardless, the roots of coastal redwoods intertwine with each other, holding on to each other, greatly increasing their stability (Breyer). In general, trees store carbon dioxide, which makes them an important ally in fighting climate change. According to research, coast redwoods store more CO_2 than any other tree in the world. They hold 2,600 metric tons of carbon per hectare (2.4 acres), more than double the absorption rate of the Pacific Northwest's conifer trees or Australia's eucalyptus forests (Breyer).

Redwoods require a lot of water to survive and during the dry season in the summer, they are able to make their own rain as they capture water from the air from coastal fog which is absorbed by the leaves. The moisture absorbed from the leaves drips down to its roots and all of the other plants below ("5 Reasons"). Fog plays a huge role in the survival of redwood trees and protects them during the summer drought conditions that are common in this area (California). It makes up around 40% of the redwood trees moisture intake. Coastal redwoods are limited to the coastal regions where coastal fog is present throughout the dry summers.

Aside from the pockets of old-growth, most of the coast redwood forests are now young (Breyer). The coastal redwood forest around my home is second growth redwoods as the original old growth redwood were removed during the turn of the prior century as a source of wood and shingles for the local coastside communities, the peninsula and San Francisco. Loggers employed by one of the lumber mills lived in shanties located throughout the forest whose remains can still be found along Tunitas Creek Road. Once felled the huge trees were pulled by oxen to mills located nearby. The resulting boards and shingles were then taken by horse and buggy or trains to nearby markets while some were placed on ships to be taken to San Francisco. Once the accessible old growth trees were removed, the mills went out of business and the forests were left to regenerate themselves. Currently Big Creek Lumber periodically cuts down trees in what is widely recognized as responsible forestry which preserves the unique character of the coastal redwood forests. Clear cutting is no longer practiced in the Santa Cruz Mountains.

An example of how the redwood trees are connected is the existence of "albino redwoods" trees which lack the ability to feed themselves via photosynthesis. Albino redwood trees lack pigmentation in their leave, are white in color and survive by attaching themselves to other redwood trees for nutrition. Recently it was discovered that albino redwoods act as "nature's beautiful toxic waste dumps" ("Ghost Redwoods"). When tested, the green needles from connected redwood trees were found to be at a threshold of heavy metal toxicity while the white leaves of the connected albino redwoods had over double the amount of toxic concentrations. Basically, the white leaves were being used to sequester and remove toxins, saving the green leaves from a toxic demise ("Ghost Redwoods"). So the redwood trees purge toxic metals through albino trees that live off of the roots of healthy redwood trees to stay alive. Albino redwoods are often called the "ghosts of the forest" because of their ghostly hue, they literally cling to life sacrificing themselves for the good of the other trees around them in their endless struggle for existence ("Ghost Redwoods").

These trees can be seen to have mini ecosystems of their own because their large and long lasting lives. As the leaves get older, their dust and litter falls down to lower branches to help create mats of nutrient-rich soil that isn't even on the ground. These ecosystems are called epiphyte communities and can host up to 282 species of plants, fungi, and animals – including new redwood trees – all within a single tree ("5 Reasons"). One old-growth redwood tree boasted 148 resprouted trunks growing from its own limbs. After many years of logging, only about five percent of the old-growth redwood forests remain ("5 Reasons"). A majority of the trees standing today are ones that have recovered. A hundred years ago, the biggest threat to redwood trees was logging and of the original redwood range, about a quarter (625,000 acres) was lost forever (Levine). Since then, we have been able to preserve nearly 200,000 acres in dozens of redwoods parks and help protect redwood forest lands on private properties. Currently, the major threats to redwood trees include climate change, forest fires, and real-estate development.

So what does all of this mean to us? What are we supposed to do with this information?

Humans have been known to misunderstand trees and their communication system, even thinking that trees aren't communicating at all. People have also believed that trees fight for nutrients when in reality they are all helping and sharing with each other.

Humans have come to learn that "trees are far more alert, social, sophisticated—and even intelligent—than we thought" (Diàna). They are considerate when sharing sunlight with each other and have closely connected root systems. For example, when one dies, the other usually dies soon afterward, because they are dependent on each other (Diàna). Some people have started calling it the 'wood-wide web.' All trees that are in a forest that isn't too damaged are connected to each other through underground fungal networks. Trees share water and nutrients through the networks, and also use them to communicate. They send distress signals about drought and disease, for example, or insect attacks, and other trees alter their behavior when they receive these messages (Diàna). Trees link through their root systems, they can communicate through the air by using pheromones and other scent signals, and they can detect scents through their leaves.

There is a symbiotic relationship known as mycorrhiza, stemming from the greek words for fungus and root (National Geographic). The fine, hairlike root tips of trees join together with microscopic fungal filaments to form the basic links of the network, which appear to operate as a symbiotic relationship between trees and fungi, or perhaps an economic exchange (Diàna). As a kind of fee for services, the fungi can consume about 30% of the sugar that trees photosynthesize from sunlight. This sugar is what fuels the fungi, as they scavenge the soil for nitrogen, phosphorus and other mineral nutrients, which are then absorbed and consumed by the trees (Diàna). Mycorrhizae are more effective than tree roots at accumulating water and nutrients, and can store excess nutrients, releasing them to the tree as needed (Norris). Mycorrhizal fungi produce hormones that encourage the production of new root tips, which aids both the tree and the fungi (Norris). Fungi also provides trees with more nutrients than they would be able to take from the soil. Additionally, the fungi can store and later share resources (particularly phosphorus and nitrogen) when the soil becomes depleted, which is important during times of drought or other possible stress ("Mycorrhizae"). This is important for the process of forest succession and also during the early portion of a tree's life, when it is trying to establish itself in the habitat ("Mycorrhizae").

Trees form an underground communication network to exchange water and nutrients, nurture seedlings and sent warning signals if under threat. About one tree can be connected to 47 other trees in a forest. They can actually recover really rapidly. Trees will try to keep other dead trees or tree stumps alive and won't want to abandon their dead. When a tree is cut down, it will send electrical signals like wounded human tissue (Diàna).

Mother trees are the biggest, oldest trees in the forest that also have the most fungal connections. They are a vital defense against many of these threats; when the biggest, oldest trees are cut down in a forest, the survival rate of younger trees is substantially diminished (Diàna). Trees know how much soil is available to them and, as they stretch out their roots, they can differentiate soil from rocks from the roots of other trees or parts of their own bodies. (Noë) Trees work together to to defend themselves against a common threat.

I grew up on Tunitas Creek Road in Half Moon Bay, California. Three miles back from the Pacific Ocean, our house is right next to the start of a large second growth redwood forest. I grew up surrounded by huge redwood trees and their endless branches. I never really thought about trees much or how they are all connected to each other. When I went home for my free weekend I saw all of the work that had been done with removing dead trees on the road for fire hazard issues and it really made me think about how humans impact the natural world around us.

It is important for humans to learn about the importance of trees have and understand how intelligent they truly are. Their communication is real and a lot more significant than we would picture it to be. We need to accept the fact that we are not the only intelligent beings on earth and that both animals and nature are smart, living organisms that have their own way and strategies for survival and that we should not interfere with how they work. We shouldn't cut down trees, especially if they are connected to each other and play a huge role in other trees lives. We also need to help these redwood forests recover and to pay closer attention to their importance and impact they have on the wildlife and nature around them. Humans need to understand how much we impact natural life and not only need to look out for nature but also for our ecosystem.

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