



Fungi in the Forest – JDSF Biologist Robert Douglas takes a deep dive into fungi and how important they are to the forest ecosystem

Types of fungi and how they work

Fungi comprises a diverse kingdom of organisms that provide numerous ecological services and are key players in decomposition and nutrient cycling in ecosystems across JDSF. Fungi are carbon-limited and heterotrophic, meaning they must acquire energy and nutrients from other organisms or dead organic material in the environment. One common type of fungi found at JDSF is saprotrophic fungi. These fungi secrete enzymes on substrates such as dead organic material (e.g. leaves and/or wood) to digest cellulose and other compounds, then absorb the breakdown products to support growth and reproduction. Because this mode of nutrition involves extracellular digestion (a process in which organisms feed by secreting enzymes through the cell membrane onto the food. The enzymes break the food into molecules small enough to be taken pass through the cell membrane into the cell) in the environment, the process is ecologically important because it makes simple compounds such as carbohydrates and minerals available to other organisms in the soil. Mycorrhizal fungi – also populus and important in the JDSF - also function to protect plant roots from soil pathogens.

Although some fungi acquire carbon by being pathogenic (cause disease) to plants, other fungi, and even animals, many form mutualistic relationships with plants known as mycorrhizas--meaning “fungus (myco) root (rhiza).” This latter mutualism, also known as the mycorrhizal symbiosis, takes on several forms and is critical to the survival of most plant species, and hence, forests and even ecosystems. The evolution of the mycorrhizal symbiosis is thought to have facilitated the colonization of terrestrial environments by the earliest plants over 400 million years ago.

Mycorrhizae are formed where the fungus establishes a distinct cellular interface with the roots of its plant host. This interface is the junction where the fungus provides minerals and water to the plant host in exchange for carbohydrates produced by the plant via photosynthesis. The fungus has filamentous



Figure 1 Boletus edulis var grandedulis: a choice edible ectomycorrhizal fungal species associated with Bishop and shore pine in our area.

vegetative structures known as hyphae, which collectively form a fine, root-like branching structure called a mycelium that permeates the soil. The mycelium is a vegetative structure that can grow throughout the soil and functionally extend the surface area of the plant host's root system to access nutrients and water. Fungi produce spores for asexual and sexual reproduction; and some groups of fungi produce conspicuous spore-bearing structures, or fruiting bodies (e.g. mushrooms, truffles, etc.), triggered by a suite of environmental cues (light, temperature, moisture).



Figure 2 Amanita calyptroderma—an ectomycorrhizal associate frequently found fruiting in tanoak.

How does fungi work and live at JDSF

The coast redwood ecosystem is host to a diversity of fungi, both saprotrophic and mycorrhizal. Coast redwood forms arbuscular mycorrhizas (AM), which are the most widespread and evolutionarily old mycorrhizal symbiosis associated with approximately 74% of plant species. Most fungal species forming AM do not produce conspicuous fruiting bodies. In contrast, tree species that co-occur with coast redwood, such as Douglas-fir, grand fir, western hemlock, tanoak, and chinquapin, form ectomycorrhizas (symbiotic relationship between fungal symbiont and plant root) which are associated with approximately 2% of all plant species, primarily woody tree species. Many fungi in this group produce mushrooms or other large fruiting bodies many of which are choice edible species sought after by mushroom hunters on JDSF.



Figure 3 Galerina marginate group—a deadly poisonous saprotrophic fungus.

Maintaining a diversity of tree species across the forest, and in sufficient quantities and spacing post-harvest, ensures that fungi exist in the soil to support forest regeneration and ecosystem resilience.

Learn more about the JDSF Mushroom Gathering Permit [HERE](#)