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Editorial

Fungal Diversity

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Fungi play key roles at two levels of ecological organization: in communities, fungi are symbionts of plants and animals, while in ecosystems, fungi are decomposers that recycle nutrients to other organisms. Connections occur between the community and ecosystem levels, however, as some symbioses result in nutrient acquisition to increase primary productivity. Moreover, at the community level, the outcome of fungal symbioses can range along a spectrum from parasitic to mutualistic for the host. Parasites can decrease primary productivity, and thus influence ecosystem processes. Kingdom Fungi offers a journey up the ladder from micro to macro to global.

As fungi interact with diverse hosts and substrates, Kingdom Fungi encompass high levels of diversity, with recent estimates that range from 2.2 to 3.8 million species on the planet [1]. A large part of this diversity relates to plant symbioses and to decomposition. The study of microfungi as symbionts and decomposers has benefitted from recent advances in sequencing from environmental samples. High-throughput sequencing has allowed the refinement of fungal diversity estimates, but the majority of fungal taxa that are identified as unique sequences remains unidentified [1]. Still, broad community patterns are helpful for understanding the influence of environmental or host changes on fungal communities.

In this Special Issue, the authors described trends in fungal diversity in various environments and using different techniques. All of the articles dealt with fungi and their relation to plants and soil, and most of the contributions touched on how human disturbance or restoration actions influence fungi. The contributions differed in the techniques used to describe fungal communities, with two culture-independent studies and three culture-dependent studies. Culture-independent studies are useful for in-depth descriptions of fungal diversity patterns and of cryptic diversity from non-culturable organisms. Culture-dependent studies can be used to estimate fungal abundance and diversity, describe taxonomy, and provide strains for tests of ecological function.

Both of the culture-independent studies in this Special Issue took place in coastal wetlands. Schroeder et al. [2] studied the fungal communities associated with the roots and soil of an invasive plant species, *Phragmites australis*, with comparisons to native species. Their study highlights the prevalence of pathogens accumulating in the tissues of invasive species. Almeida et al. [3] studied the soil fungal diversity on restored tree islands in the Florida Everglades. The tree islands are surrounded by grassy wetlands and serve as habitat for many plants and animals. Their study took place 15 years after restoration actions created the islands, and they found that fungal communities differed with respect to restoration techniques.

The culture-dependent studies in this issue were associated with agricultural and tropical systems. Ortega Fors et al. [4] described strains of dark septate endophytes in several varieties of sugar cane. They established that it was common to observe dark septate endophytes in the roots of sugar cane and identified at least five fungal species. Barney et al. [5] investigated how the use of glyphosate and copper-based herbicides has influenced communities of yeasts in the Appalachian region of USA. This work showed how anthropogenic activity has reduced biodiversity

and has resulted in artificial selection of non-target organisms like yeast. Finally, Tellez et al. [6] presented patterns on endophytic fungi in epiphytes of tropical forests. Their study related foliar endophyte communities to the physiological and physical traits of epiphyte leaves. Together, these five studies increase our understanding of fungal diversity and will aid in outlining the challenges involved in fungal conservation.

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