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INTRODUCTION

The 8th International Conference on Mycorrhizas (ICOM8) was hosted by the Northern Arizona University in Flagstaff, Arizona, USA, from 3–7 August 2015. Four symposia were held at the conference, the contents of one of which, Mycorrhizas and Global Change, are featured in this Special Issue. Global change widely refers to the effects of human activities on the Earth. The consequences of our activities range from climate change, species invasions, and changes in disturbance regimes, land use, and nutrient cycling to name a few. As with much of the research presented at ICOM8, this symposium took a decidedly belowground perspective to consider some of the effects of global change on mycorrhizas at the population, community, and ecosystem levels. While a single issue can provide only a small snapshot of the myriad of effects global change has on mycorrhizas, we hope readers will get a sense of the research being done to investigate some of the most pressing issues in this field. New tools, approaches, and challenges to restoring ecosystems emerge across the papers in this Special Issue.

To better predict and offset future climate change, Treseder (2016) opens the Special Issue with a call for improving the accuracy with which large-scale models simulate belowground dynamics. In particular, she outlines arguments for including arbuscular-mycorrhizal (AM) fungi in large-scale models to project soil carbon dynamics under climate change, owing to their abundance, roles in carbon cycling, relatively low taxonomic diversity, and availability of data for model development. On a related note, Wahl and Spiegelberger (2016) present a timely review discussing the current knowledge about composition and traits in AM fungal communities and their underlying drivers along altitudinal gradients in mountain ecosystems. They proposed a conceptual framework for testing hypotheses on the functioning of AM fungal–plant interactions along altitudinal gradients, considering current and global change conditions. In turn, Allen et al. (2016) review the changes in AM fungal communities along a gradient of nitrogen (N) deposition in California, and how these changes interact with plants, including the invasive grass *Bromus rubens*. Their evidence shows that not only composition but also AM fungal functioning, change with N deposition. It is proposed that these changes are, at least in part, responsible for the conversion from shrublands to grasslands in this Mediterranean ecosystem.

In addition to the synthetic assessments of Treseder (2016), Wahl and Spiegelberger (2016), and Allen et al. (2016), experimental research is also presented in the Special Issue. These papers in particular highlight new approaches and considerations for how mycorrhizas and soil fungi in general may be affected by processes of global change. Seemingly few now are the experiments considering climate factors in isolation; the combined and interactive effects of temperature and water availability are represented in experiments across organisms and ecosystems. In this issue, Gao et al. (2016) test the combined and interactive effects of these two factors manipulated for 6 years on AM fungal communities of the Inner Mongolian steppe; a semiarid grassland particularly sensitive to climate change and anthropogenic activities. Their findings demonstrate that the AM fungal community responds more strongly to water availability than to warming; a result contrasting with that of Duell et al. (2016), showing that responses of AM fungi to temperature and water availability were more nuanced.

Species invasions are a widespread problem for regions around the world. One of these regions, coastal sage scrub in the western US, is a biodiversity hotspot under threat by land-use changes, shifts in disturbance regimes and, in consequence, vulnerable to plant invasion. Restoration practioners have used AM inoculum as one tool to return AM fungal communities to these degraded habitats. However, as we better understand the complexities of the geographical origin of inoculum and local adaptation between fungi and plants, applying commercial sources of inocula have recently been called into question. Aprahamian et al. (2016) test the effects of native versus exotic sources of AM inocula and found slight detrimental effects of commercial inoculum on native shrubs and forbs, and surprisingly, no evidence that AM inoculation improved restoration success in the coastal sage scrub system. Finally, while most studies emphasize mycorrhizal fungi, invasive plants may also influence communities of dark septate fungi, which are common root endophytes that have poorly studied functions. Gehring et al. (2016) investigated the abundance, species richness, and community composition of dark septate fungi in cheatgrass and sagebrush dominated ecosystems in the western US. Cheatgrass invasion of sagebrush steppe coincided with changes in communities of dark septate fungi, and the next challenge will be to understand the functional consequences of these shifts in fungal communities.

This special issue on mycorrhizas and global change represents a small subset of studies presented at ICOM8. While research on AM fungi is highlighted in this issue, this is not meant to preclude the timely and ecologically relevant research on ectomycorrhizal plants and fungi. Similar processes of global change affect ectomycorrhizal communities. For instance, N deposition causes shifts in ectomycorrhizal fungal community structure (Lilleskov et al. 2002) with linkages to functional traits (Lilleskov et al. 2011). Co-dispersal of ectomycorrhizal trees with their fungal mutualists can lead to plant invasions (Hayward et al. 2015). Although, as researchers, we tend to divide ourselves by those who study AM fungi and those who study EM fungi, progress on understanding mycorrhizas and global change may exist at the intersection of these two camps. Not only do many vegetation types contain both dominant

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forms of mycorrhizas, with climate change terrestrial plant communities are also being reshuffled, often bringing together both mycorrhizal types. Interguild fungal interactions, i.e., those among different trophic groups of fungi may be the next best point of focus to understand and predict the role mycorrhizas play in global change. On this final note, perhaps at ICOM9, Interguild Fungal Interactions and Global Change will be the focus of a subsequent symposium.

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