Title

Ecological Sensing in a Southern California Forest: Integrating Environmental Abiotic and Biotic Measurements to Understand Ecosystem Function.

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Ecological Sensing in a Southern California Forest: integrating environmental abiotic and biotic measurements to understand ecosystem function

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Integrating spatial and temporal variation in abiotic and biotic measurements:

Automated Minirhizotron Images and Environmental Variables

• Which are the factors associated with root and fungal growth? How do roots and mycorrhizal fungi influence aboveground processes?

• Continuous measurements of soil temperature, moisture and CO_2 coupled with analysis of minirhizotron images, sap flow measurements, and leaf phenology is helping to these questions.

• Differences in fungal diversity in fungal diversity in space and time could influence aboveground processes such as transpiration and soil respiration.

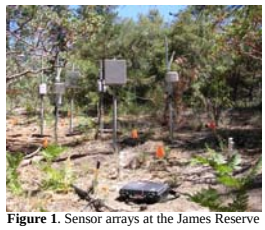

Figure 1. Sensor arrays at the James Reserve measuring aboveground and belowground variables

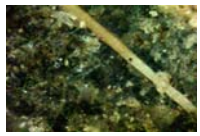

Figure 2. Arbuscular mycorrhizal fungi

Figure 3. Ectomycorrhizal fungi

Mycorrhizal Fungal Diversity

• Mycorrhizae, the symbiotic association between fungi and plant roots, are important in understanding ecosystem functioning because they participate in nutrient, carbon, and water dynamics.

• There is a need to better understand the temporal and spatial variation in mycorrhizae diversity.

• Combining AMR images, morphological and molecular identification is an alternative solution to track spatial and temporal changes in mycorrhizal diversity.

Roots and Mycorrhizal Fungi: who are they and how do they affect ecosystem processes

Abiotic Measurements

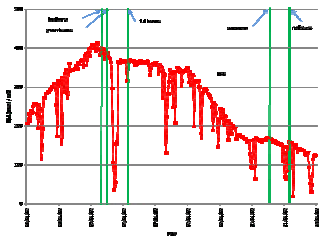

Figure 4. Mean daily photosynthetic active radiation (PAR) at the James Reserve during the 2008 growing season.

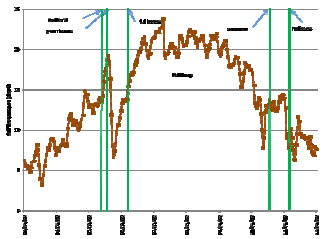

Figure 5. Mean daily soil temperature at the James Reserve during the 2008 growing season.

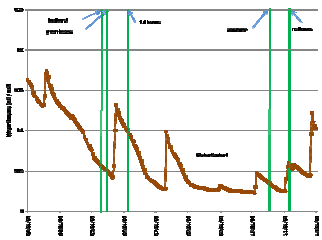

Figure 6. Mean daily soil water content at the James Reserve during the 2008 growing season.

New Images from the Automated Minirhizotron

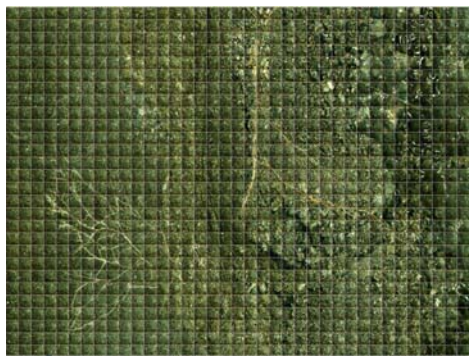

Figure 7. Mosaic of fine roots and fungal hyphae using the new automated minirhizotron. This image was constructed by stitching together 1036 images from a single minirhizotron tube.

Figure 8. Phylogenetic tree of a subset of Ascomycota fungi found at the James Reserve. This tree was obtained by the neighbor joining method and was based on alignments from the 5.8s and the large subunit of the ribosomal internal transcribed spacer (ITS) region.

Figure 9. Phylogenetic tree of a subset of Basidiomycota fungi found at the James Reserve. This tree was obtained by the neighbor joining method and was based on alignments from the 5.8s and the large subunit of the ribosomal internal transcribed spacer (ITS) region.

Biotic Measurements

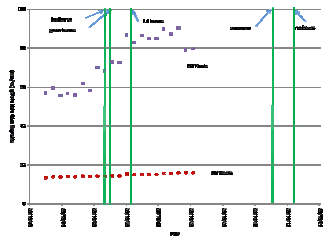

Figure 10. Standing crop root length of ectomycorrhizal root (blue circles) and arbuscular mycorrhizal roots (red circles) during the 2008 growing season.

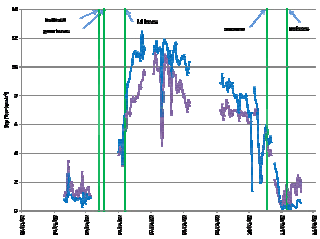

Figure 11. Mean daily sample flow rates for two Oak trees at the James Reserve during the during the 2008 growing season.

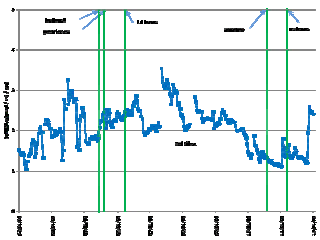

Figure 12. Mean daily CO_2 efflux from the soil surface during the 2008 growing season.