Geophysical Research Abstracts
Vol. 17, EGU2015-3947-2, 2015
EGU General Assembly 2015

Recovery of microbial community structure and functioning after wildfire in semi-arid environments: optimising methods for monitoring and assessment

Miriam Muñoz-Rojas (1,2), Dylan Martini (1,2), Todd Erickson (1,2), David Merritt (2), Kingsley Dixon (1,2)

(1) The University of Western Australia, School of Plant Biology, Crawley, 6009, WA (miriam.munozrojas@bgpa.wa.gov.au), (2) Kings Park and Botanic Garden, Kings Park, Perth 6005, WA

Introduction
In semi-arid areas such as northern Western Australia, wildfires are a natural part of the environment and many ecosystems in these landscapes have evolved and developed a strong relationship with fire. Soil microbial communities play a crucial role in ecosystem processes by regulating the cycling of nutrients via decomposition, mineralization, and immobilization processes. Thus, the structure (e.g. soil microbial biomass) and functioning (e.g. soil microbial activity) of microbial communities, as well as their changes after ecosystem disturbance, can be useful indicators of soil quality and health recovery. In this research, we assess the impacts of fire on soil microbial communities and their recovery in a biodiverse semi-arid environment of Western Australia (Pilbara region). New methods for determining soil microbial respiration as an indicator of microbial activity and soil health are also tested.

Methodology
Soil samples were collected from 10 similar ecosystems in the Pilbara with analogous native vegetation, but differing levels of post-fire disturbance (i.e. 3 months, 1 year, 5, 7 and 14 years after wildfire). Soil microbial activity was measured with the Solvita test which determines soil microbial respiration rate based on the measurement of the CO_2 burst of a dry soil after it is moistened. Soils were dried and re-wetted and a CO_2 probe was inserted before incubation at constant conditions of 25°C during 24 h. Measurements were taken with a digital mini spectrometer. Microbial (bacteria and fungi) biomass and community composition were measured by phospholipid fatty acid analysis (PLFA).

Results
Immediately after the fire (i.e. 3 months), soil microbial activity and microbial biomass are similar to 14 years 'undisturbed' levels (53.18±3.68 ppm CO_2-CO and 14.07±0.65 mg kg-1, respectively). However, after the first year post-fire, with larger plant productivity, microbial biomass and microbial activity increase rapidly, peaking after 5-7 years post fire (70.70±8.94 ppm CO_2-CO and 21.67±2.62 mg kg-1, respectively). Microbial activity measured with the Solvita test was significantly correlated (R Pearson > 0.7; P < 0.001) with microbial parameters analysed with PLFA such as microbial biomass, bacteria biomass or mycorrhizhal fungi. This method has proven to be reliable, fast and easy to interpret for assessment of soil microbial activity in the recovery of soil quality during the recovery after fire.

Keywords
Pilbara region, biodiverse ecosystems, microbial biomass, microbial respiration, Solvita test, CO_2 burst.