Geophysical Research Abstracts
Vol. 17, EGU2015-3961-1, 2015
EGU General Assembly 2015

Seasonal dynamics of soil CO_2 efflux in biodiverse semi-arid ecosystems of Western Australia

Miriam Muñoz-Rojas (1,2), Wolfgang Lewandrowski (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 recent years, soil respiration (Rs) has been a major research focus given the increase in atmospheric CO_2 emissions and the large contribution of CO_2 fluxes from soils. Rs is the second largest carbon flux in terrestrial ecosystems and globally accounts for 98 ± 12 CO_2-C yr-1 or ten times that produced by fossil fuel combustion. In addition to its importance in the global carbon cycle, Rs is a key indicator of ecosystem state and functioning. Despite the global importance of this process, there is still limited knowledge of its and responses to abiotic and biotic processes, particularly in arid and semi-arid areas. In this research we investigated the seasonal variations and controlling factors of Rs for different vegetation types in biodiverse ecosystems of the Pilbara region (Western Australia). This region, with a semi-arid climate and two main seasons (wet–summer and dry-winter), is an ancient landscape with diverse geology and high levels of regional endemism.

Methods
This research was conducted in seven study sites across the Pilbara region with similar native soils and analogous ecosystems representative of the area. A permanent plot was defined at each site which included three of the most representative and dominant vegetation cover types of the Pilbara ecosystems: trees (Corymbia spp.), shrubs (Acacia spp.), grasses (Triodia spp.), and bare soil. Soil sampling and field measurements were carried out in February 2014 (wet-summer season) and July 2014 (dry-winter season). Rs was measured with a portable soil CO_2 flux chamber attached to a Li-Cor 6400 and, simultaneously, both temperature and soil moisture were determined.

Results
Soil CO_2 efflux ranged from 0.57 μmol m-2 s^{-1} to 1.96 μmol m-2 s^{-1} in the dry-winter season and from 1.57 μmol m-2 s^{-1} to 3.91 μmol m-2 s^{-1} in the wet-summer season. Higher Rs rates were found in the wet-summer season in all vegetation types and below Corymbia spp. in both periods. Rs differed significantly between vegetation types (F=18.9, P<0.001) and seasons (F=59.6, P<0.001) and differences among vegetation types were larger in the dry-winter season (CV= 40.0- 116.0%) compared to the wet-summer season (CV= 41.5-50.0%). Rs was poorly correlated with soil moisture (R Spearman= 0.13, P>0.1), but significant relationships (P <0.001) were found with soil temperature, air temperature, organic carbon and nitrogen (R Spearman values 0.36, 0.35, 0.32 and 0.41 respectively). Our results highlight the importance of the vegetation type and environmental factors as well as the seasonal patterns for the estimation of CO_2 efflux in semi-arid ecosystems.

Keywords
Soil respiration, Pilbara region, soil carbon, automated soil respiration chambers, carbon cycle.