

Microbial communities in Cerrado soils under native vegetation subjected to prescribed fire and under pasture

Laura Tillmann Viana⁽¹⁾, Mercedes Maria da Cunha Bustamante⁽¹⁾, Marirosa Molina⁽²⁾, Alexandre de Siqueira Pinto⁽¹⁾, Keith Kisselle⁽³⁾, Richard Zepp⁽²⁾ and Roger A. Burke⁽²⁾

⁽¹⁾Universidade de Brasília, Departamento de Ecologia, Campus Universitário Darcy Ribeiro, ICC Sul, CEP 70919-970 Brasília, DF, Brazil. E-mail: laura.viana@ana.gov.br, mercedes@unb.br, alexandresp@unb.br ⁽²⁾United States Environmental Protection Agency, 960 College Station Road, Athens, Georgia 30605-2700 USA. E-mail: molina.marirosa@epamail.epa.gov, zepp.richard@epamail.epa.gov, burke.roger@epamail.epa.gov ⁽³⁾Austin College, Department of Biology and Environmental Studies, 900 N Grand Avenue, suite 61610, Sherman, TX 75090 USA. E-mail: kkisselle@austincollege.edu

Abstract – The objective of this work was to evaluate the effects of fire regimes and vegetation cover on the structure and dynamics of soil microbial communities, through phospholipid fatty acid (PLFA) analysis. Comparisons were made between native areas with different woody covers ("cerrado stricto sensu" and "campo sujo"), under different fire regimes, and a 20-year-old active palisadegrass pasture in the Central Plateau of Brazil. Microbial biomass was higher in the native plots than in the pasture, and the highest monthly values were observed during the rainy season in the native plots. No significant differences were observed between fire regimes or between communities from the two native vegetation types. However, the principal component (PC) analysis separated the microbial communities by vegetation cover (native x pasture) and season (wet x dry), accounting for 45.8% (PC1 and PC3) and 25.6% (PC2 and PC3), respectively, of the total PLFA variability. Changes in land cover and seasonal rainfall in Cerrado ecosystems have significant effects on the total density of soil microorganisms and on the abundance of microbial groups, especially Gram-negative and Gram-positive bacteria.

Index terms: land use, microbial diversity, PLFA, savannas, seasonality.

Comunidades microbianas de solos de Cerrado sob vegetação nativa sujeita a queimadas prescritas e sob pastagem

Resumo – O objetivo deste trabalho foi avaliar os efeitos de regimes de queima e cobertura vegetal sobre a dinâmica e a estrutura de comunidades microbianas do solo, por meio da análise de perfis de ácidos graxos de fosfolípidos (PLFA). Compararam-se áreas nativas com diferentes coberturas vegetais (cerrado stricto sensu e campo sujo), sob diferentes regimes de queima e uma pastagem de capim-braquiária de 20 anos, no Planalto Central do Brasil. A biomassa microbiana foi maior nas parcelas com vegetação nativa que na pastagem, e os maiores valores mensais foram observados durante a estação chuvosa nas parcelas nativas. Apesar de não terem sido observadas diferenças significativas como consequência das queimadas ou entre as vegetações nativas, a análise de componentes principais separou as comunidades microbianas pela cobertura vegetal (nativa x pastagem) e pela sazonalidade (chuvosa x seca), tendo explicado 45,8 e 25,6%, respectivamente, da variabilidade de PLFA total. Mudanças na cobertura do solo e a sazonalidade na precipitação têm efeito significativo sobre a densidade total e a abundância de grupos de microrganismos do solo no Cerrado, especialmente bactérias Gram-negativas e Gram-positivas.

Termos para indexação: uso da terra, diversidade microbiana, PLFA, savanas, sazonalidade.

Introduction

Savannas of Central Plateau of Brazil, locally known as Cerrado, comprise the second largest biome of South America with an area of approximately two million square kilometers. The Cerrado is characterized by high plant diversity and different vegetation types forming a density gradient of woody species.

The Cerrado is one of the 34 biodiversity hotspots in the world, i.e., areas with high biodiversity and

accelerated loss of habitats (Mittermeier et al., 2005). Rapid conversion of native Cerrado areas to agriculture has been occurring since 1960 with the establishment of the Brazilian Federal District and the construction of Brasília. By 2002, approximately 39.5% of the Cerrado was already converted primarily into pastures (26.5%), and cropland (10.5%), (Sano et al., 2008).

Fire is commonly used as a management practice during the dry season to promote fresh grass re-growth in pastures, clearing of areas for cultivation and