The LBA Project: Nutrient Cycles and Trace Gas Exchange in the Cerrado of Central Brazil

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Co-sponsored by USEPA and the National Aeronautics and Space Administration

A team of U.S. Environmental Protection Agency (U.S. EPA) and Universidade de Brasília (UnB) ecologists is part of the Large Scale Biosphere–Atmosphere Experiment in Amazonia (LBA). The LBA project was created through an international cooperative agreement and includes participants from Brazil, other Amazonian countries, the U.S., and European nations. The LBA participants have conducted research at the atmospheric and soil levels at locations distributed throughout the Amazonian rain forest and the Cerrado (Figure 1). The Cerrado of central Brazil (Figure 2) is one of the largest savannah regions on earth. The "stressors" affecting ecosystems in this region, including deforestation, fire, soil degradation, unwise agricultural practices, climate change, and urbanization, are also experienced in many U.S. ecosystems (Figure 3). Intense agricultural activities, such as land clearing for soybean cultivation and cattle farming, are rapidly changing the Cerrado. U.S. EPA and UnB scientists have been collaborating in central Brazil (Figure 1) to determine how several of these stressors are affecting soil nutrient cycling, decomposition, and the soil–atmosphere exchange of carbon- and nitrogen-containing trace gases. The research is contributing data and scientific understanding for the development of models that describe these stressor–ecosystem interactions.

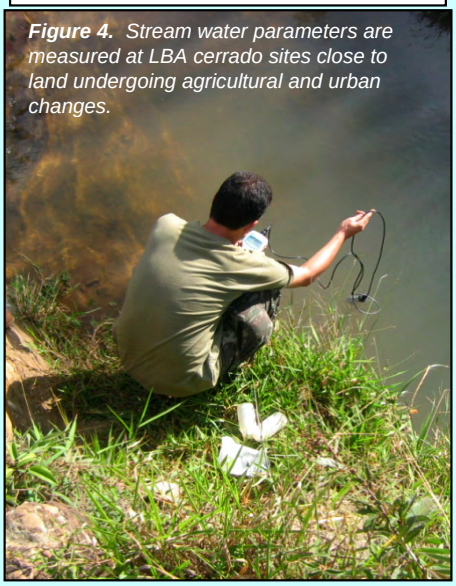

Figure 4. *Stream water parameters are measured at LBA cerrado sites close to land undergoing agricultural and urban changes.*

Figure 1. *Sites included in the Large Scale Biosphere–Atmosphere Experiment in Amazonia (LBA). The EPA-UnB project is located near Brasília, the capital of Brazil.*

Figure 2. Brazilian Cerrado

Figure 3. *The Cerrado is a region of rapid land conversion, where fire is one of the most common tools utilized to clear land for both pasture and crop establishment.*

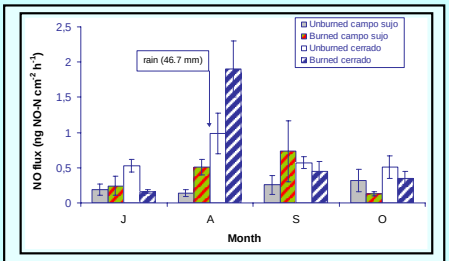

Figure 5. *Wetting produces intense, short-lived pulses of nitric oxide emissions from dry Cerrado soils.*

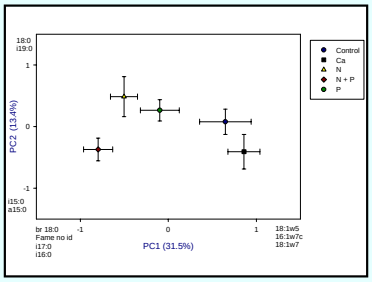

Figure 6. *Effect of different fertilization treatments on lipids that indicate the microbial community structure in Cerrado soils.*

U.S. EPA/UnB researchers have focused on the effects of fire and land use change on (1) soil–atmosphere fluxes of gases that have greenhouse warming potential (carbon dioxide, nitrous oxide) and that affect air quality (carbon monoxide, nitric oxide), (2) stream water quality (Figure 4) and (3) changes in soil microbial community structure. Some of the major results to date indicate that (1) wetting produces intense, short-lived pulses of nitric oxide emissions from dry Cerrado soils, (Figure 5) (2) soil carbon dioxide emissions correlate with soil moisture levels, (3) decomposition of nonliving plant matter at the soil surface is a significant carbon monoxide source, and (4) soil microbial community structure and size are significantly affected by fertilization practices, seasonality, burning regime, and land use (Figure 6). The research has led to development of effective interactions between Brazilian and U.S. EPA scientists providing a springboard for the initiation of actions that protect and remediate the environment in both countries.