

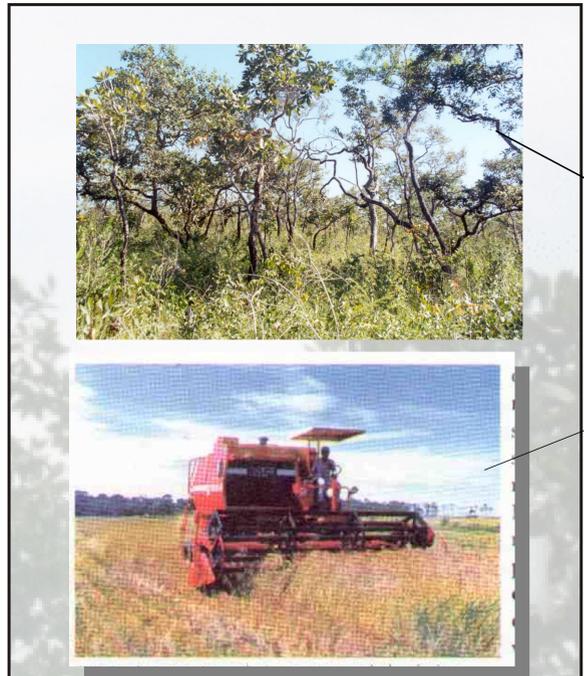
Effects of Land Use Changes on the Functioning of Soils and Watersheds of Central Brazil Savannas: Impacts On Nutrient And Carbon Cycles And Trace Gas Exchange - Team ID # ND-07

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Abstract

This project is examining the effects of land use change on soil and watershed functioning in the central Brazilian Cerrado. Emphasis is on nutrient and carbon cycles and trace gas exchange. Our native study sites continue to include native cerrado stricto sensu and campo sujo and will expand to include gallery forests. Added converted Cerrado sites include croplands and recently converted pastures. We are quantifying rates of carbon and nutrient cycling and characterizing soil organic matter (SOM) and litter quality at both native and converted sites. We are studying the influence of fertilization and management practices (tillage, no-tillage and cover crops) on the carbon balance in pastures and cropland. These experiments include measurements of different SOM fractions, litter quality, N cycling, and P fractions. To provide data and relationships needed for regional trace gas models we are measuring trace gas fluxes (CO₂, CH₄, CO, N₂O, and NO) and relevant ancillary data, including changes in soil temperature, moisture, and incident solar radiation. To assess land use changes on gallery forests and aquatic systems, we are investigating nutrient cycling in selected gallery forest buffers and streams that drain watersheds dominated by natural vegetation, agriculture, and urban lands. The goal of the watershed research is to develop predictive models that relate the landscape metrics, determined by analysis of spatial land cover databases, to the various chemical and physical parameters.



Scientific Objectives:

We plan to assess the effects of land use change in the Cerrado on:

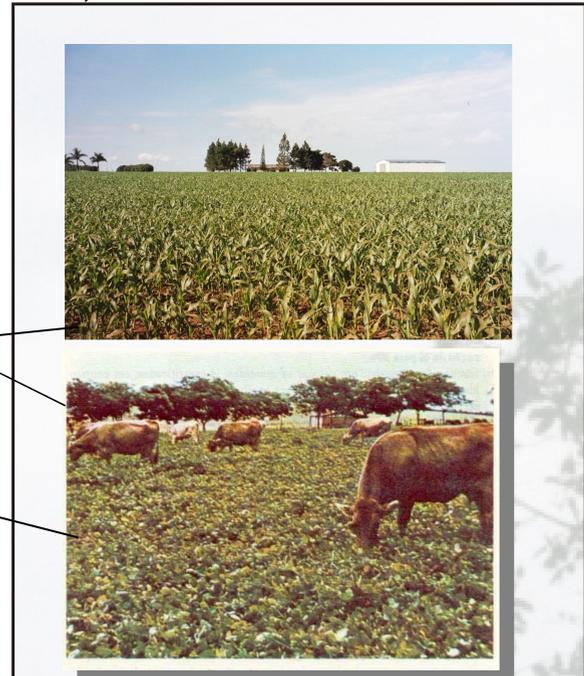
- 1) The stocks and cycling rates of nutrients and carbon
- 2) Soil-atmosphere fluxes of trace carbon and nitrogen gases (CO₂, CH₄, CO, N₂O, and NO) and related ancillary data;
- 3) The composition and quantity of nutrients and organic matter entering small streams via gallery forests.



Research sites

Our native study sites will continue to include native cerrado stricto sensu and campo sujo and will expand to include gallery forests. Added converted Cerrado sites will include croplands and recently converted pastures. Sites include (see above map):

- The research and ecological reserve operated by the Instituto Brasileiro de Geografia e Estatística (IBGE) (www.recor.ibge.br) and located 35 km south of Brasília D.F (15° 56' S, 47° 51' W)
- Pasture sites located at the Fazenda Rio de Janeiro (15° 14' S, 47° 42' W) northwest of Brasília
- Croplands located at Fazenda Dom Bosco located near Cristalina in Goiás about 100 km S of Brasília



Approaches:

The following research activities will be pursued to accomplish the objectives:

- Soil trace gas exchange and related ancillary data (ambient and soil temperatures, gravimetric and volumetric soil water content, solar irradiance, microbial biomass) for six sites (six chambers per site), two native cerrado, two crop sites, two pasture sites with 2 intense data sets (4 measurement sets on weekly basis) per year and monthly measurements in intervening months.
- SOM and litter characterization at the six sites
- Nutrient pools/flux characterization and microbial biomass for the same sites and frequency included in trace gas research
- Stream chemistry from a single location in each of six watersheds and along two transects of samplers moving from the stream to three different adjacent land use classes

Key Past Results

- Net N mineralization rates lower than the rates found for tropical rain forests.
- Soil N gas fluxes were generally low stimulated by exposure to fire and/or light and moisture addition.
- Soil CO₂ fluxes exhibited a positive correlation with soil moisture.
- Soil CO fluxes highest during the late dry season and stimulated by light exposure.
- Season and vegetation had the most significant effects on microbial community structure. Fire was less important factor.

Integration and Synthesis:

- Active participation in various scientific meetings sponsored by LBA
- Communicated research results to other LBA participants and broad scientific community via journal articles, oral/poster presentations, and LBA-DIS data sets
- Leadership roles in LBA training and Brasília site management activities
- Interactions with other LBA research teams and with other scientific groups outside of LBA that are working in the Cerrado such as continuing our close working relationship with ND-02, especially in our studies of stream water chemistry in Cerrado watersheds; increasing interactions with remote sensing team (LC-19) working in Cerrado region to help with site selection and with scaling-up; continued interactions with other LBA teams involved in trace gas work; new formal relationship with EMBRAPA-Cerrado
- Acquisition of scientific data that will be useful to integrative modeling such as trace gas and ancillary data measurements for the development and calibration of algorithms and models that are being used to integrate trace gas fluxes over space and time in the Cerrado