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RICHNESS AND ABUNDANCE SOIL INVERTEBRATES LIVESTOCK IN AGROFLORESTRY SYSTEMS

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RESUMO
The diversity of edaphic fauna provides expansion in the movement of soil particles and organic cluster formation that will enable the accumulation of organic reserves that provide nutrient release to the local plants. For the assessment of invertebrate abundance and richness of different agricultural systems, the animals were collected in two types of systems, one system silvopastoral (SSP) and a traditional system of monoculture of *Brachiaria decumbens* (SBD). The collected animals were classified into functional groups. In the SSP system there was collectings in points 3 meters from the tree lines and 9 meters of the same trees to see if difference exists between the parameters used in this research. Samples were collected in two comparative stages, one in the dry season (June-September) of 2009 and another in the rainy season (November-February) of 2010. The total richness was of 22 functional groups, from which were found and classified 20 groups on the SSP system and 15 on the traditional system SBD. With the results of diversity in both cases above it will be possible to compare the level of sustainability shown by each agricultural techniques in order to maintain the environment's natural resources.
Palabras claves: Agroforestería, biodiversidad, agricultura, sistemas silvopascícolas

INTRODUÇÃO

The terrestrial biome has a wide variety of habitat through direct relationships with temperature, humidity, altitude, plant composition and other factors that influence the establishment of communities of living things. When an ecosystem is modified for the implementation of agricultural production systems, biotic and abiotic factors are altered due to changes in the landscape, but when the systems have similar structures derived from the original system, existing communities will be better preserved (Barros et. Al., 2003).

Edaphic fauna of invertebrates has key roles in continuing the cycle of energy, in order to conserve the environment. Because they occupy different trophic levels within the food chain, they facilitate the fragmentation of organic compounds from animals and vegetables and they can also feed on possible pests on some crops. The basic activities of the macrofauna present in underground galleries promote the movement of organic fragments, which occurs through ingestion of this fragments or use of them in the construction of nests (WOLTERS, 2000).

The action of this fauna form stable clusters that protect the organic matter from rapid mineralization and minimizes nutrient loss through lixiviation (DECÄENS et al. 2003; LAVELLO & SPAIN, 2001).

Primary production is affected indirectly or directly by these organisms that promote changes in the humidity due to increased porosity of the soil with its galleries, nests

and underground chambers (DECÄENS et al., 2003). Thus the plant species will be positively influenced due to high sustainability in which the soil will be found.
Animals such as earthworms, ants and termites are part of the group known as "ecosystem engineers", their activities lead to the creation of biogenic structures that allow the modification of the soil physical structure (WOLTERS, 2000). When observed the different tasks of these animals, it is possible to realize the importance of the environment and plant cover in order to keep the relationship between the organisms in balance (LIMA, 2007).
In the deployment of cropping systems, it is important to integrate environmental values with economic values, to seek less investment of financial resources for the recovery of productive areas due to loss of fertile soil. It is estimated that the degree of soil degradation of annual crops is 50% and 80% over areas of pasture (KLUTHCOUSKI & AIDAR, 2003). This scenario of low sustainability served as a stimulus for changes in the way of land use, seeking a slower degradation of sites. The expansion of diversity of plant species in productive territory falls in production patterns more conservationist. The silvopastoral system (SSP) is the integrated management of trees, pastures and cattle (MACEDO, 2000) and have been shown as a viable option to prevent degradation of pastures in a few years by handling practices adopted not suited to the site, causing the decline of soil fertility by nitrogen deficiency (YOUNG, 1997). This is given by the fact that some arboreal species add nitrogen and other nutrients to the soil increasing the soil fertility and preventing soil erosion (XAVIER ET. AL., 2002), and providing shade to the animals by giving them a more pleasant environment generating their well-being (MACEDO, 2000). It consists of interactions between livestock production and forest resources, allowing greater vegetation cover and soil accumulation of organic compounds in the environment.
This study aimed to quantify the richness of groups of the invertebrate community on soil under different production systems, as well as use these parameters to evaluate the similarity between the studied agricultural systems.

MATERIALS AND METHODS
The test was conducted at the Campo Experimental of Embrapa Gado de Leite, in Coronel Pacheco, MG, Brazil, where the average monthly rainfall is 60 mm and average temperature of 17 ^{o}C from April to September, and 230 mm and 24 ^{o}C from October to March. The climate is Cwa (mesothermal).
The evaluations were carried out in a pasture in a pre-established ranges of 30m wide, alternating with bands of 10m width composed of four rows of trees, species *Acacia mangium and Eucalyptus grandins* with plantation orientation north-south, in areas of Latosoil Red-Yellow, mountainous topography 30% slope. The fauna of edaphic invertebrates were collected in soil samples (30 x 30 x 20 cm, respectively, width, length and depth) according to methodology described by (ANDERSON, 1993), in accordance with the Tropical Soil Biology and Fertility (TSBF) program for this type of study.
Samples were collected in two seasons, defined as the dry season and rainy season. In the agro forestry SSP samples were taken at two locations along the studied area, with one being three meters of the tree line, the other nine meters of the tree line. In the traditional system of monoculture samples were taken always at the center of the growing grass.
The soil samples were packed in plastic bags until they were analyzed in the laboratory, for the sorting procedure of the macrofauna contained in the soil. With the use of a tray, where the fauna seen with naked eye were collected and stored in bottles and labeled, containing alcohol 70% to preserve the material. Still in the lab, the

contents of the containers were examined under binocular lens. Individuals from each vial were counted and identified in large taxonomic groups.

RESULTS

The group richness found in the studied systems were 22 functional groups of invertebrates, which highlighted the groups Chilopoda, Formicidae, larvae of Coleoptera and Oligochaeta. Among the 22 groups, the silvopastoral system composed of trees and herbaceous forage showed 20 groups representing 90.9% of classified groups. By contrast the system exclusive of foragers, were found 15 of these groups (68.18% of total). However periods of annual rainfall affected the richness of communities in the soil of the different systems Figure 1.

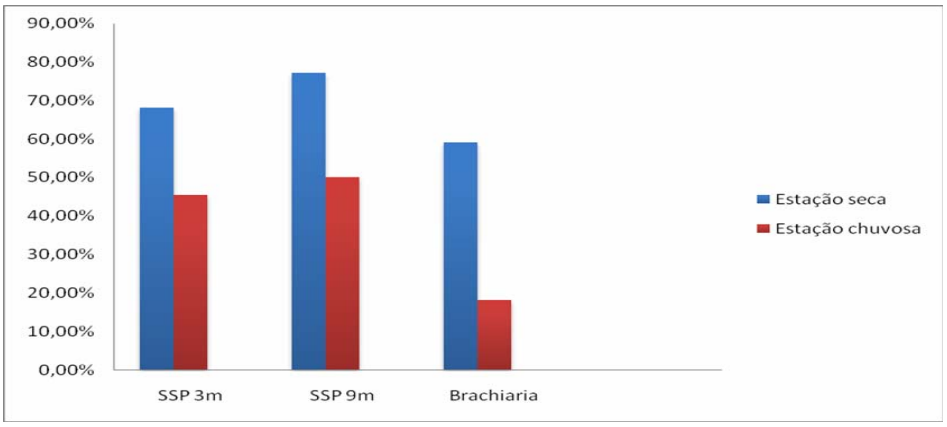

Figure 1 - Graphical representation of the richness of functional groups found in the silvopastoral system 3m from tree line (SSP 3m) silvopastoral system 9m from tree line (SSP 9m) and the monoculture of Brachiaria

As shown above, the traditional system of monoculture showed a smaller percentage of invertebrate groups, indicating that this system has a low range of organic compounds coming from the predominant vegetation, with no amount and quality of resources to support more complex communities. For when the soil is more fertile species of invertebrate macrofauna present there have at their disposal an environment favorable to their reproduction (BROWN et. al., 2004).

In table 1 one can observe the abundance of individuals found in different treatments and analyzed in the two distances within the system integration livestock forest. In the rainy season the abundance was reduced with the exception of the representatives of the order Oligochaeta and individuals in the larval stage of beetles.

Functional Groups	Silvopastoral system				Mono-cropping system of *Brachiaria decumbens*	
	3m away from the strip of trees		9m away from the strip of trees		Center of the pasture	
	Dry season	Rainy season	Dry season	Rainy season	Dry season	Rainy season
Acari	-	-	2	-	-	-
Araneae	14	1	7	-	1	-
Auchenorryncha	1	-	6	-	-	-
Casulo de minhoca	6	8	18	31	31	3
Chilopoda	6	6	6	2	4	-

Coleoptera	24	4	14	-	6	-
Diplopoda	1	-	3	1		-
Diptera					2	-
Enchytraeidae	1	5	10	-	-	3
Entomobryomorpha	-	-	-	1	-	-
Formicidae	269	7	132	20	362	-
Gastropoda	7	2	6	-	-	-
Hymenoptera	-	-	1	-	-	-
Heteroptera					12	-
Isopoda	61	-	5	3	-	-
Isoptera	-	-	24	-	27	-
Larvas Diptera	1	1	-	-	1	-
Larva de Tricoptera	6	-	-	-	-	-
Larvas Coleoptera	5	14	11	16	4	3
Oligochaeta	57	55	98	59	57	14
Poduromorpha	-	-	1	1	1	-
Symphyla	21	-	8	1	8	-
Total Abundance	484	103	352	148	518	23

Table 1 - Abundance of individuals and their functional groups found in the systems

With the monitoring and observation of rainfall rate in the region, it was possible to see that some orders were more abundant in the dry season, for example: Formicidae, Coleoptera, Gastropoda and Symphyla.

CONCLUSION

The interactive system livestock forest had the highest richness of invertebrates in the soil than the monoculture system.

In the rainy season the monoculture system was 18.1% of total wealth found in systems with an abundance of 23 individuals found in the system.

The population with the highest number of representatives was Formicidae, which in the rainy season their number of individuals decreased but remained present in all environments except at planting of *Brachiaria sp*. pure.

The order Oligochaeta remained with stable populations in most treatments, with only a drop in abundance during the rainy season in the planting system of *Brachiaria sp*. pure.

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