Horse riding in protected areas: And the dung?

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Introduction

Serra do Cipó National Park has undergone a major management challenge which will refine horse riding regulations for visitors of the park. The Brazilian Government recently launched a document entitled Guidelines for visitation in protected areas (Brasil, 2006) which dictates certain rules for recreation ecology activities. However, there are relevant issues related to the introduction of exotic species in protected areas that are inconsistent to the Brazilian law.

The presence of domestic animals in protected areas can cause several environmental impacts including the entry of alien species resulting in biological contamination. Wittenberg and Cock (2001) suggests that the entry of invasive species in protected areas occurs in numerous ways. In many situations, it is not intentional.

Pathogens can be introduced via the clothing and shoes of tourists; seeds infiltrate through equipment, animals and vehicles; and of course wind and water provide a natural means of dispersal. In addition to these various forms of invasive seed dispersal, horses have been highlighted as a means of spread, due to their capacity to transport a large quantity of seed in their feces (Newsome, Smith & Moore, 2008). Amongst the problems relating to the presence of horses in the Serra do Cipó National Park, Ribeiro (2005) reports soil erosion, contamination through feces and social conflict. The invasive alien plant species that have been identified include: braquiária (*Brachiaria decumbens*), braquiarão (*Brachiaria brizantha*), fat-grass (*Melinis minutiflora*), grass jaraguá (*Hyparrhenia rufa*) and grass andropogon (*Andropogon guayanus*).

Methods

This research aimed to investigate whether a relationship exists between the use of horses and biological contamination of exotic grasses by horses' dung, in the Serra do Cipó National Park (Minas Gerais State, Southeast of Brazil). Therefore, we selected two trails of the park which present significant differences in terms of topography and land use history. Farofa trail is mostly used for tourism and Capão trail mainly use for monitoring and fire control.

The method was defined based on the work of Campbell and Gibson (2001) and adapted to local conditions. From each of the tracks, equine dung and soil samples in two seasons: autumn (dry) and summer (rainy), were collected. The samples were divided into two experiments, one installed in situ and another at the Laboratory (Figure1). We have prepared 20 fecal samples from horses brought from each of the two tracks in every season; each sample contained a total volume of 400 ml. These samples were used in an experiment set within the Serra do Cipo National Park.

An employee of the Park was responsible for observation and control of germination. The germinated seeds in the Laboratory were counted and followed during growth. We also conducted an in situ study in order to verify the presence of exotic grasses and native plants in areas served by the two trails.

In this study, four points, which had as reference the center of the trails, were defined for sampling: center, edge, transition and interior. We used a quadrant of 50 cm X 50 cm divided into 25 subdivisions, to count the presence of the exotic grasses and native plants. Statistical analysis was performed using SAS software, version 9.1.3.

Results

The results of this research reveal that there has been an increase in the amount of exotic grasses in the trail *Farofa* when compared with the trail *Capão* ($\chi2 = 136.2003$; $p < 0.0001$). On the trail *Farofa*, significant difference was found for the presence of exotic grasses among the points ($\chi2 = 31.3654$; $p < 0.0001$). The center point was statistically different.

On the trail of *Capão* no difference among the points was assessed for exotic grasses. The native species were found more frequently on the trail of the *Capão* ($\chi2 = 64.0424$; $p < 0.0001$).

There was a statistical difference between the center points on both trails for native species. The results obtained from soil samples that were in the controlled experiment in the laboratory, revealed that there is no difference in germination between the trails. Dung samples, however, identified differences between the tracks ($\chi2 = 7.3657$; $p = 0.0066$), and there is a greater germination in the trail of *Farofa*.

A significant difference in germination between the periods of autumn and summer was found both in the dung samples ($\chi2 = 24.7570$; $p < 0.0001$) and in the soil samples ($\chi2 = 5.0128$; $p = 0.0252$). There was no germination in the experiment installed in situ.

Conclusions

One hypothesis of this research was that the presence of exotic grasses would be greater in the area covered by the trail of Farofa, where the recreational activity of horse hire by visitors is greater. It was possible to diagnose a statistical difference in the presence of exotic grasses in the area covered by this trail.

It has also been noted that there is greater germination of seeds in the faeces originating from the path of Farofa. However, due to the varied use of this region in the past, it is not an absolute certainty that the contamination was caused solely by the presence of these horses.

One reason for the difference in germination of seeds in the soil material and in the feces collected on the trails between the two seasons lies in observing and evaluating plant phenology. In these ecosystems, the exotic grasses have a reproductive period in the autumn – when seeds are released into the environment.

Figure 1. Experiment of germination with fecal material collect ant the park was conducted at the Laboratory and in the field during autumn and summer.

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