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## AGRICULTURE AND BIODIVERSITY GENERATION OF WILD FAUNA IN ORGANIC CANE PLANTS

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**Abstract:** Studies on the role of agricultural areas in the conservation of wild fauna are still quite scarce. The managements used in these systems exert a differentiated discrimination on the composition and structure of the faunal stands. Today, with the new agricultural techniques such as direct planting, organic agriculture, biological pest control, there is an expansion of the possibilities of gaining wild species and increasing biodiversity. This research project was developed by the EMBRAPA Territorial team and collaborating researchers specializing in wild fauna and aimed to detect and characterize the biodiversity of vertebrates in a delimited territory. The study area comprises a set of farms with 7,868 hectares under organic cultivation and ecological management, located in the region of Ribeirão Preto, SP. Almost three decades ago, Usina São Francisco initiated processes of ecological restoration of the surrounding environments of the sugarcane plantation areas in an organic production system, in addition to the preservation of the remnants. The significant increase in biodiversity over the years was the result of the spatial emergence of the flora and the complexity of the vegetation restored in the Permanent Protection Areas. Campaigns for data collection and fauna monitoring were carried out throughout the year and over the years, the results confirmed the effectiveness of the methods used. A total of 341 species of wild vertebrates were recorded and identified in the set of ten sampled environments (27 amphibians, 25 reptiles, 246 birds and 43 mammals), of which 49 of the species are considered or are under some risk or threat of extinction in the state of São Paulo. The methodological itinerary adopted to assess faunal biodiversity allowed achieving the research objectives and proved to be fully adequate. The results obtained so far indicate

that cultivation in organic systems, associated with ecological management, has increased faunal biodiversity.

**Keywords :** Organic agriculture, wild fauna, endangered species.

## INTRODUCTION

The conservation of fauna biodiversity contributes to the maintenance of vegetation, as it is certain that animals are seed dispersers, pollinators, etc. (BRASIL, 1967; SMA-SP, 2010 a). The simple occurrence of wild vertebrate species in agricultural areas, until now, has been studied in a very incipient way. Little attention has been paid to the effective role of agroecosystems in conserving wildlife biodiversity of wild vertebrates (Beca et al., 2017). The type of management used in these systems can be more or less discriminating about the composition and structure of the faunal stands of the macrofauna. EMBRAPA Territorial researchers, collaborators and specialists in wild fauna have developed research aimed at understanding how production systems can present greater or lesser sustainability to populations of wild vertebrates. A study has been monitoring for over a decade the evolution of terrestrial vertebrate biodiversity in organic sugarcane production systems in the region of Ribeirão Preto, SP. The study area encompasses a set of farms with 7,868 hectares with organic cultivation and ecological management of the adjacent environments. About 80% are represented by sugarcane crops (Miranda & Miranda, 2004; Miranda, 2010; Miranda et al., 2011 (a, b); Miranda et al., 2012 (a, b, c) ; Ariedi Junior, 2013; Miranda & Ariedi Junior, 2013 (a, b)) and the rest occupied by more natural environments.

## GOALS

The objectives of this work were multiple, they aimed to develop, test, adapt and

confirm the effectiveness of a methodological itinerary for evaluating the biodiversity of wild vertebrates in a delimited territory, using satellite images to identify, qualify and spatialize the faunal habitats. As well as analyzing the quality of the faunal richness of wild vertebrates existing in a property cultivated with organic sugarcane and in the different adjacent environments throughout the management of this territory, which is under ecological management. Special attention was paid to the occurrence of wild vertebrate species considered at risk or threatened with extinction in the state of São Paulo.

## **MATERIAL AND METHODS**

The study area comprises agricultural areas 100% certified for organic production, preserved and restored natural environments associated with Usina São Francisco, according to the mapping and mapping of land use and occupation. The set of farms is located in the Pardo and Mogi-Guaçu river basins, tributaries of the Paraná River (Miranda & Miranda, 2004). The faunal groups were sampled through combinations of non-harmful scientific methods (no capture, marking and collection) based on specialized literature, widely used and used in wild fauna studies. The methods used in the study over the years were Visual and Auditory Search; Visual and Auditory Record; Search with Vehicle; Occasional Encounters and Photo Traps. The combined methods were used in the areas that cut and surround all ten environments available to wild fauna present in the agricultural areas of Usina São Francisco and surroundings, throughout the day, in the morning, twilight and night periods. The sampling effort was dimensioned to include the 10 faunal habitats available to the fauna, but not necessarily distributed in the same number of surveys,

but also because of those environments in which some previous evidence of the occurrence of endangered wild mammal species was detected. The interpretation of satellite images made it possible to identify ten habitats for the fauna: organic sugarcane plantations, exotic forests, floodplains with herbaceous plants, floodplains with riparian forests, restored native forests, mixed forests in regeneration, native forests, drainage ditches, forests in spontaneous regeneration, in spontaneous regeneration. Once observed and/or captured, the individuals were recorded and identified at the lowest possible taxonomic level (species), then released, photographed and recorded (vocalizations) when possible, for registration and necessary subsequent identification through comparisons in databases. . All and any type of record, direct and/or indirect, was marked as a face-to-face record of the species. The cycle of seasonal variations, mainly humidity and temperature, was considered concomitantly with possible fluctuations in the composition of stands, in terms of biological activity and migratory behavior of certain species in all the strata sampled. All data collection surveys for the inventory and monitoring of species in the field were carried out following defined criteria and methodological itineraries and using the previously prepared form, in regular campaigns between the years 2002 to 2013, in the 10 environments (habitats) mapped and available to wild fauna in agricultural areas, in the associated preserved and restored natural environments belonging to Usina São Francisco (Miranda & Miranda, 2004; Miranda & Ariedi Junior, 2013 b).

## **RESULTS AND DISCUSSION**

As a result of maintaining the regularity of the sampling effort, between 2002 and 2016, 341 species of wild vertebrates were recorded

and identified in the set of ten environments shown in satellite images and duly sampled (27 amphibians, 25 reptiles, 246 birds and 43 mammals), of which 49 of the species are considered or are under some risk or threat of extinction in the state of São Paulo, according to State Decree n° 56.031 (SMA-SP, 2010 b). Examples of these threatened species are the anhuma (*Anhima cornuta*), the harpy eagle (*Busarellus nigricollis*), the maguari (*Ciconia maguari*) and the gray suiriri (*Suiriri suiriri*); the cauré (*Falco ruficularis*), the long-billed weevil (*Herpsilochmus longirostris*), the tuiuiú (*Jabiru mycteria*), the collared tanager (*Schistoclamys melanopis*), the cricket (*Synallaxis hypospodia*) and the little star black (*Synallaxis scutata*); the maned wolf (*Chrysocyon brachyurus*), the ocelot (*Leopardus pardalis*), the bush deer (*Mazama americana*), the giant anteater (*Myrmecophaga tridactyla*) and the puma (*Puma concolor*), among others. The total

wealth value can be considered very high. The accumulated richness curve illustrates a strong deceleration in the gain of new species from 1400 surveys (figure 1). In organic sugarcane fields alone, approximately one hundred species of wild vertebrates were recorded. This fact is due to the fact that they are harvested without burning, with raw cane, without the use of agrochemicals, among other factors related to organic cultivation and the ecological management of other environments, such as Permanent Preservation Areas, Forest Remains, Forests in Spontaneous Regeneration, etc. In addition, after harvesting, a plant biomass of approximately 20 tons of dry matter per hectare/year remains on the ground, which will be decomposed by the soil biota. These decomposers form the base of a pyramid or food web and considerably expand the supply of prey from the ecological food niche for various vertebrates.

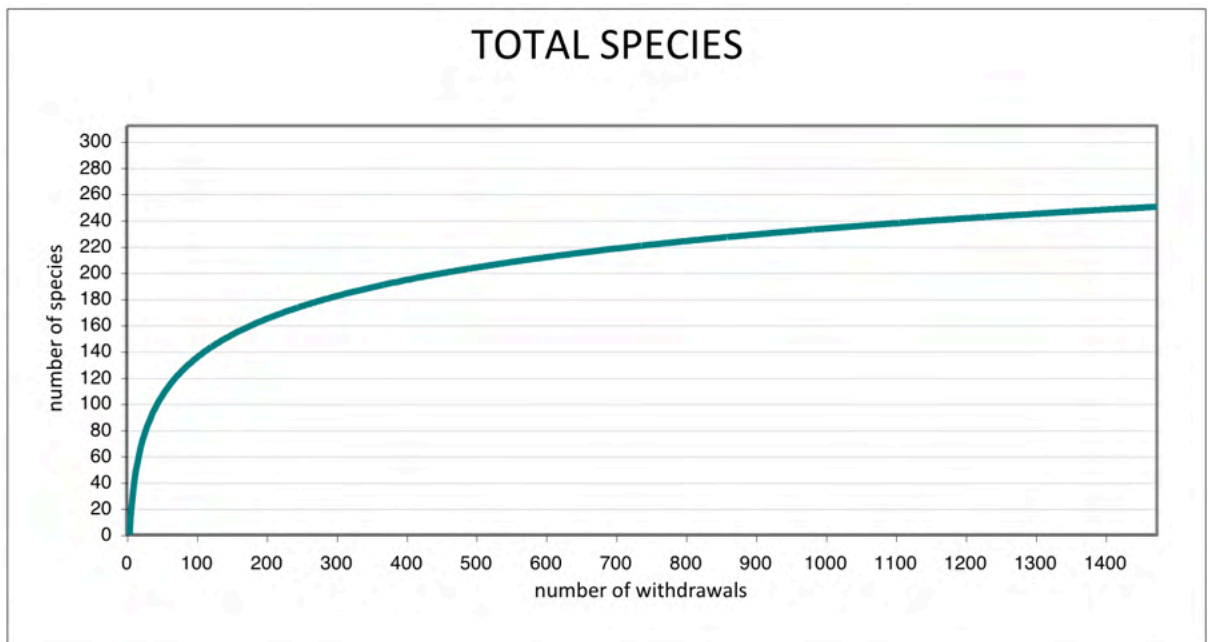


Figure 1: Accumulated richness curve expressing the number of species detected as a function of the total number of surveys carried out.

## CONCLUSIONS

The processes initiated more than two decades ago by Usina São Francisco for ecological restoration, Permanent Protection Areas and other environments surrounding the sugarcane plantation areas were fundamental for the expansion of specific richness. The significant increase in biodiversity over the years was the result of the spatial emergence of the flora and the complexity of the vegetation restored in the Permanent Protection Areas. They are located along water courses, in native forest remnants or implanted in order to connect different types of natural environments. The methodological itinerary adopted to assess faunal biodiversity allowed achieving the research objectives and proved to be fully adequate for studies in a delimited territory. The use of images for mapping the different habitats offered to wild vertebrate fauna favored the stratified sampling strategy and allowed the detection of greater specific richness in the sampled universe. The results obtained by maintaining the regularity of the sampling effort, in which data collection campaigns and fauna monitoring were carried out throughout the year and over the years, confirmed the effectiveness of the methods used and the very high specific richness, 341 species of wild vertebrates, in the type of sugarcane production system studied. Migratory and resident species could be detected and identified during the variations of dynamic environmental conditions throughout the year. Among the cataloged species, 49 are under some risk or threat of extinction in the state of São Paulo and are strong ecological indicators of the quality of natural resources. offered in this agricultural system pattern, in terms of existing ecological niches. It is safe to say that the expansion of wildlife biodiversity occurs through greater spatial and temporal stability

of environments and the predictability in the growing supply of available natural resources, such as food, shelter and reproduction conditions. The results indicate increasingly harmonious and conciliatory interactions between the conservation of wild fauna and the production systems implemented. Maintaining the regularity and continuity of this study has allowed us to understand how to reconcile faunal biodiversity with agricultural activities without loss of production and productivity. Annually, new species are added by natural processes to the animal community and many of them will find possibilities of permanent implantation. The maintenance of organic practices and the organization of the harvest proper to Usina São Francisco are also fundamental for the conservation of biodiversity. Currently, about 20% of the sugarcane fields are being formed annually (plant-cane) and are not harvested; they play an important role as a refuge for fauna during the harvest period. It can be said that farming areas are perceived by the fauna as an extension of their ecological niches for feeding, reproduction and refuge, in addition to serving as corridors for displacement in this mosaic of environments. The results obtained show, in a detailed way, the importance of spatial and temporal stability of land use and cover for the preservation and maintenance of micro, meso and macrofauna biodiversity. And it effectively demonstrates the evolution of wild fauna biodiversity in organically cultivated sugarcane fields with ecological management. The trend between agriculture and wildlife indicates that more interactive relationships should occur and are characterizing the contribution of agricultural systems to conservationist public policies. It is clear that vertebrate stands are being incorporated as an integral part of the production process.

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