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Society and nature: the reconfiguration of the urban landscape of Maringá – PR and the overpopulation of pigeons (Columbides)

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Abstract

The aim of this paper is twofold: i) to discuss the urban landscape of Maringá–PR, Brazil, through the changes that have been occurring between nature and society in regards to pigeons overpopulation; ii) to comprehend how the overpopulation of pigeons impacts in an environmental imbalance, creating possible zoonosis areas. Thus, we created a map to show the notified pigeon presence from 2001 to 2012 utilizing geoprocessing tools. Subsequently, we applied a spatial statistic technique, and fieldwork was conducted to analyze the study area. As a result, we identified two critical areas with centrality that highlight pigeons' presence. These areas are possible spaces of contamination due to the overpopulation of birds where human action was present. Therefore, these spaces need specific intervention, such as environmental reeducation for society and nature to live in harmony.

Keywords

Society-Nature, Anthropogenic changes, Urban Space, Zoonosis

Introduction

Humans are old guests of various points on the surface of the Earth who adapted, in each place, to the surrounding environment, creating a constant and cumulative relationship with nature through a collection of techniques (Ortega & Gasset, 1963), habits, uses, and customs that allowed them to use

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the available natural resources, transforming the nature around them and, consequently, themselves, remaining inserted in the dialectical relationship generated by the work performed in the production of the geographic space (Santos 2012).

It is in this interactional relationship between humans and nature that geographic space is created, where humans inhabit, produce, and, lastly, consume, in the simple act of existing and living, given that "there is no production of space that takes place without work. To live, for humans, is to produce space" [...] "the life process is a process of geographic space creation" (Santos, 1988, p. 88).

Geographic space is managed and organized by forces that characterize its constitution, creating ways to perceive and analyze different aspects. In this sense, it should be stressed the importance of using geographic analysis categories and their interlocution to understand the reality of the research, given that the geographic reading of the space allows a more accurate understanding of the investigated phenomena (Miyazaqui 2008).

In this reading of the geographic space, an approach that understands the spatial phenomena through the landscape is necessary. According to Milton Santos (1988), the landscape is everything within reach of our eyes, of the perceptual, visible, and sensorially perceived, so to highlight the importance of its criticality and reading.

The landscapes must be understood as the materialization of different moments and movements that are intrinsic to their plasticity, with this being "the result of the dynamic, thus unstable, combination of physical, biological, and anthropic elements that, reacting dialectically with each other, render the landscape a unique and inseparable set in perpetual evolution" (Bertrand, 2004, p. 141), which, as such, is managed by the "hands of humans" under the passing of time in the society-nature interaction.

We underscore the historical nature that a landscape has, expressed in the records, processes, accumulations, superpositions, in the palimpsest that is generated, and, lastly, in the narrative that it holds in its constitution. In short, it is about the materialized and visible results of the interactions that took place in the space, which "express heritages that represent the successive forms of the localized relationships between humans and nature [...], gathering past and present objects in a cross-sectional construction" (Santos, 2012, p. 103).

Hence, as the object of interest of the research, the landscape may be understood as the result of the interactions between elements of natural and human origin, organized dynamically over time (Maximiano 2004), in a continuous reconfiguration of the spaces.

It is in cities and their intricate relationships that the spatial reconfiguration intensifies and make themselves present in various social, political, and economic dynamics, which establish implications represented by their fixed and flows, more vehemently observed in their central areas, given that they are "*a living set of social institutions and crossing of flows of a real city*" (Villaça, 1998, p. 238).

From the viewpoint of economic activities, every city is a spatial perspective of a central locality, of a higher or lower level, if its centrality and number of offered goods and services are taken into account (Souza 2010). Villaça (1998) described the existence of several centers where the issue of centrality is implicit, given that every center, to a greater or lesser extent, holds distinct functions and importance in the roles of a city, altering its fixed and flows. Centrality denotes the socioeconomic dynamics of urbanization, as well as their repercussions (Júnior Santos 2010) in the urban space.

In contemporary cities, pigeon overpopulation has been a public health problem. Hence, this work aims to discuss the urban landscape of Maringá, PR, Brazil, from the human alterations and the consequent pigeon overpopulation, and to understand how this phenomenon causes an imbalance in the environment,

favoring the circulation of pathogens and the possible presence of zoonoses. We seek to discuss how human action leads this population to increase and how this turns into a serious problem, causing diseases and possibly leading individuals to death.

For such, the notifications of complaints about the presence of pigeons (columbids) were mapped, and the highest concentrations of such birds were identified through geoprocessing and the application of spatial statistics.

Resulting from the methodology, areas critical to the presence of pigeons were found, spaces of possible contamination due to the excessive population of these birds. In such areas, centrality stands out, i.e., the pigeon population has concentrated in the places where human action is present, so such spaces need specific interventions so society and nature may coexist more harmoniously.

Beyond this introduction, this paper is divided into four additional sections. In the first section, the pigeon overpopulation and the risk to human health are problematized, and disease cases are sought in the literature. The second presents the methodology, a dialogue between the theory and practical work of this investigation. The third and fourth sections outline the results and include the discussion and final considerations, respectively.

Society and nature: the overpopulation of species Columba livia and Zenaida auriculata

Human action in space is one of the ways that most contributes to the change in the environment. The alterations promoted in the environment culminate in different scenarios that create new life dynamics, food sources, and shelter for the bird populations, leading specific species to adapt and coexist with humans in urban landscapes (Mendonça-Lima Fontana 2000).

Each bird species has common characteristics but also preserves singularities; hence, specific birds adapt better to distinct environments, establishing different adaptation relationships (MT. Crepaldi 2014). However, these animals may generally represent health risks, considering the zoonoses and the contamination of environments and food from their excrements (Schuller 2004).

Birds from the Columbiformes order and Columbidae family, specifically the species Columba livia and Zenaida auriculata, found in great abundance in urban areas, represent public health risks. However, we stress that the diseases associated with columbids are generally of low prevalence relative to other transmitted diseases; moreover, they have subclinical diagnoses, hampering the obtainment of information on them (Brasil 2010).

Among the several diseases of possible contamination through avian species, three stand out: cryptococcosis (torulosis or European blastomycosis), histoplasmosis, and ornithosis (or psittacosis). Cryptococcosis is caused by a fungus (Cryptococcus neoformans) found in the feces of the animals that remains resistant for several months. The disease has no direct contamination from animals to humans or from one individual to another (Cotin et al., 2011); it occurs through contact with the fungus present in the excrements. The disease may also affect dogs and cats and presents differential diagnoses regarding human contamination, such as tuberculosis, meningitis, meningoencephalitis, lymphomas, histoplasmosis, and sarcoidosis (Brasil 2010).

Histoplasmosis is also caused by a fungus (Histoplasma capsulatum) found in terrains with high organic matter content, primarily in soils with large deposits of bird feces. The disease is systemic and asymptomatic, with the infection being caused by the inhalation of the fungus, possibly prolonging

until the lethal phase or even manifesting itself according to the hosts and their immunological capacities (Brasil 2010).

Ornithosis is a bacterial disease (Chlamydia psittaci) of acute and infectious nature, resulting in different symptomatic characteristics such as coughing, fever, prostration, and shivering. Birds are the main reservoirs of the bacteria, and contamination occurs from the inhalation of the dust of dried bird feces present in the environment (Brasil 2010).

Cryptococcosis merits prominence among the described diseases due to its magnitude and high incidence rates (Brasil 2010). Corrêa . (1999) described nineteen cases of children who developed the disease in Belém, PA, Brazil. In this group, five deaths were notified due to the infection. In another study, Pantoja . (2009) reported a case of the disease in an immunosuppressed patient resident of Abaetetuba, PA, Brazil. They stressed that the patient presented neurological crises and pulmonary difficulties that culminated in a subcutaneous eruption.

Filíu . (2002) underscored the occurrence of the disease in the Central-West Region of Brazil, in Campo Grande, MS, highlighting that, from October 1994 to February 1998, 23 cases of cryptococcal meningoencephalitis were recorded in the city.

Research in newspapers connected to Folha de Londrina described the occurrence of cases of diseases related to the birds, locations near the municipality of Maringá, PR. It should be noted that one 47-year-old victim, a resident of Londrina, PR, died due to an infection with meningitis that resulted in the loss of consciousness and, ultimately, in respiratory capacity insufficiency (Folha de Londrina, 2013). Also, recently in Santos, SP, two people died due to cryptococcosis (Castro, 2019).

Through the information and data obtained from the Laboratory of Medical Mycology, a service that integrates the Laboratory of Teaching and Research in Clinical Analyses (LEPAC, from the Portuguese Laboratório de Ensino e Pesquisa em Análises Clínicas) of the State University of Maringá, seventeen fungi of the Cryptococcus genus were analyzed and detected in the blood and cerebrospinal fluid samples of patients admitted to the Regional University Hospital, assuming possible potential contamination and public health risk in the city of Maringá. Studies have also demonstrated the presence of Cryptococcus yeast in pigeon excrements in the city (Ribas . 2011).

Regarding histoplasmosis and ornithosis, no signs of hospitalization in 2013 were found after consulting the DATASUS Information System in the Control and Auditing Management of the Municipal Department of Health of Maringá. Hence, it is important to stress that the diseases described are not of compulsory notification to the Information System on Notifiable Diseases (SINAN, from the Portuguese Sistema de Informação de Agravos de Notificação) of the Brazilian Ministry of Health, which directly contributes to the non-obtainment of data related to morbimortality in the city.

The lack of data regarding hospitalizations in this field stems from the conduction of clinical examinations, which may assume a secondary nature. Commonly, the etiological agent is not identified in the primary diagnosis procedure, consequently hampering the information in the Hospital Authorizations report.

Hence, a need for more coherence relative to the importance of notifying cases of the investigated diseases is noted, given that they may cause substantial damage to health and have various diagnoses, many without resorting to the etiological agent that originates the infectious diseases caused by pigeons, the vectors for the agents.

Materials and Methods

Maringá is a municipality in the state of Paraná located at latitudes 23°15' and 23° 34' south and longitudes 51° 50' and 52° 06' west (Figure 01). It is 425 km from the state capital, Curitiba (IBGE, 2017). The municipality is located in the northwestern region of Paraná and is inserted within the area colonized by the Companhia de Terras do Norte do Paraná, which later gave place to the Companhia Melhoramentos Norte do Paraná.

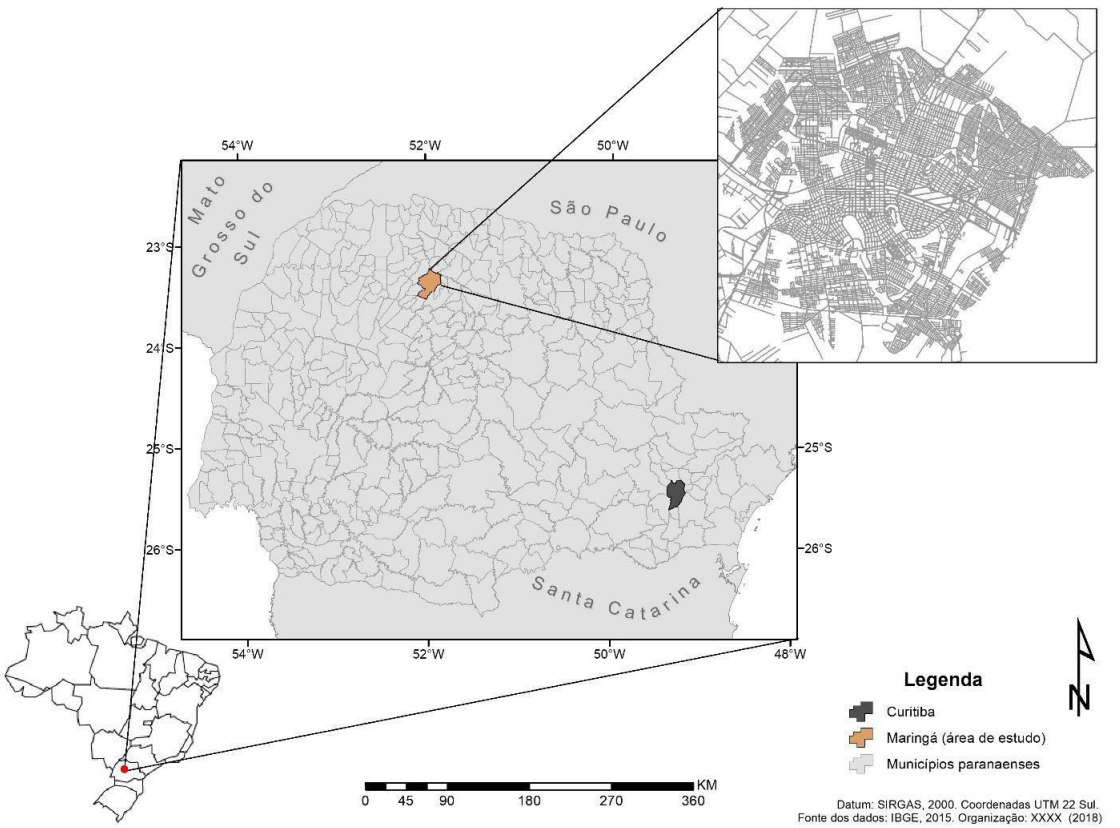

Figure 1. Study area

Source: Organized by the authors (2021)

The notifications of the presence of pigeons that characterize overpopulation, a public health problem, were surveyed. The data are from the Management of Zoonoses of the Department of Health of the municipality of Maringá, PR, regarding the notifications for complaints from 2001 to 2012.

Google Maps (Google©) was used to georeference the locations of the notifications with the address geocoding tool. The data were then mapped in ArcMap in the ArcGIS 10.2.2 Geographic Information System (ESRI, Redlands, CA, USA).

After the geographic coordinates were identified, a spatial statistics technique was applied: the Kernel intensity estimator (Bailey Gatrell 1995), as per Equation 1, where d_i is the distance between point s and the event observed in s_i and τ is the width of the band centered on s. At a zero distance, the weight is $3/\pi\tau^2$, and it decreases and softens at a distance of τ (Gatrell . 1996).

$$\hat{\lambda}_{\tau}(s) = \sum_{d_i \leq \tau} \frac{3}{\pi\tau^2} \left(1 - \frac{d_i^2}{\tau^2}\right)^2 \quad [1]$$

The radius was defined as 1000 m according to the length of displacement and flight of the birds, aiming to identify the locations with a more significant concentration of notifications, i.e., the places where the pigeon population was considered a problem. The methodological procedures are highlighted in Figure 02.

Figure 02:

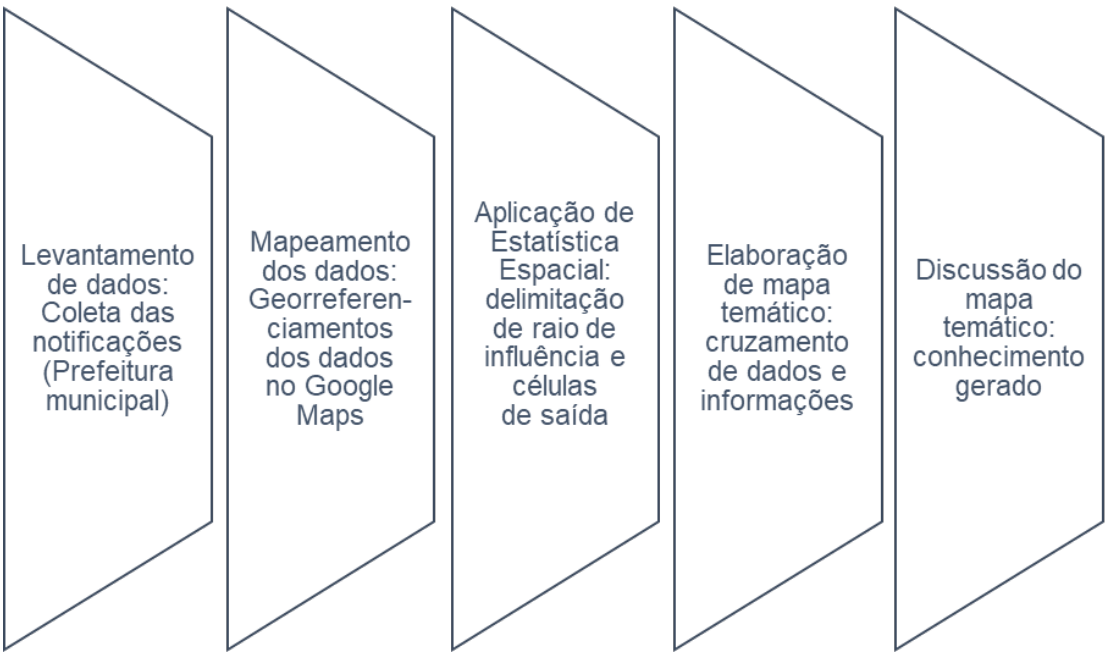

Figure 2. Description of the methodological procedures

Source: Organized by the authors (2021)

After mapping the notified complaints, two field trips were made, aiming to establish a set of possibilities that explained the spatial configuration of the critical areas. On the field, observations and analyses were carried out at the locations with high concentrations of notifications to substantiate the results and discussions of the mapping.

Results and Discussions

Through the mapping generated (Figure 03), two areas with high concentrations of complaints of the presence of pigeons, the focus of this investigation, were identified. This first approximation with the identification of the problem elicited the obtainment of singular characteristics in the highlighted areas.

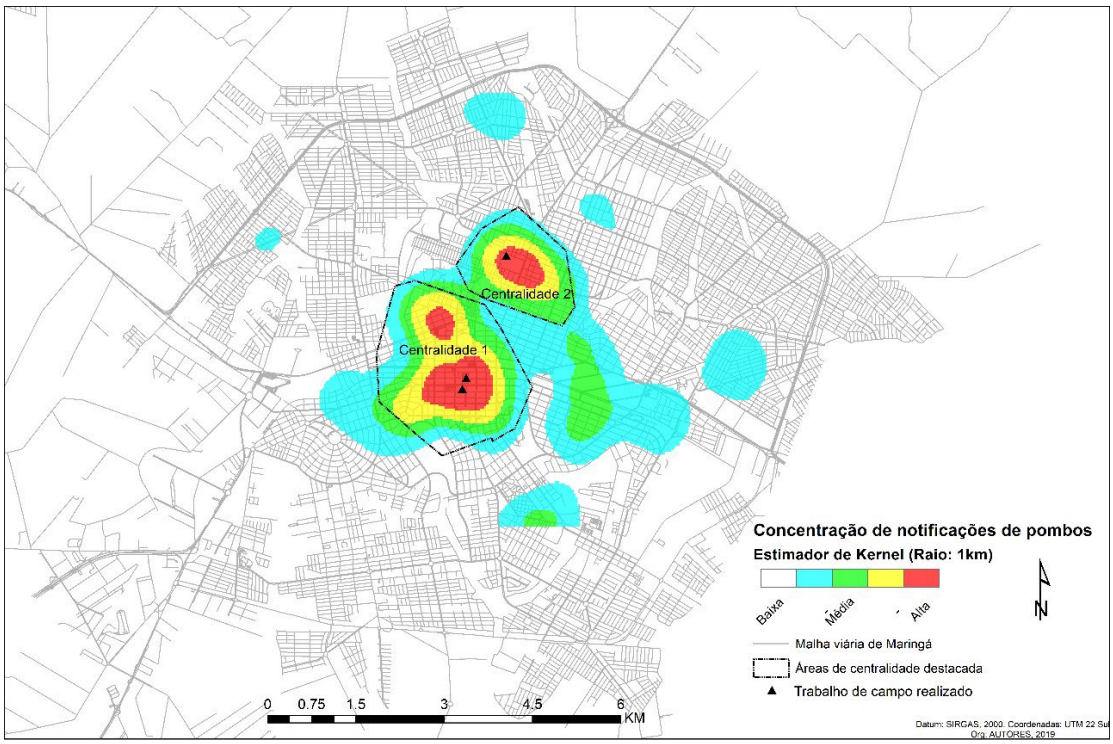

Figure 3. Concentration of the notifications of complaints of pigeons from 2001 to 2012
Source: Organized by the authors (2021)

The centrality process was observed as a landscape modifier. Therefore, once the landscape is modified by human action, changes to the urban spaces are noticed and, consequently, to the original landscape (Dickman 1987).

One of the striking characteristics of cities is the presence of parks and public squares, guaranteeing the leisure of the population. If, on the one hand, such spaces may propitiate healthy habits regarding the quality of life and mental health of people, guaranteeing access of the population to public spaces of leisure, on the other hand, a relational analysis among the possible concentration of pigeons, the circulation of people, and the creation of degraded environments conducive to the presence of zoonosis is valid.

The significant flow of individuals and their daily activities in areas without awareness/sensitization propitiated by environmental education may generate solid waste such as food leftovers (or even induced

feeding) or other sources of organic matter that serves to attract avian species to feed and nest on marquees and trees, facilitating their permanence and reproduction. Certain birds have the feeding habit characterized by grain consumption but may significantly take advantage of food leftovers and waste found in public places such as parks and squares (M. Crepaldi Ferreira 2018; MT. Crepaldi . 2018; Faria . 2010).

This may occur in any area with centrality, given that there is a circulation of people and possible residues stemming from everyday practices. Hence, the responsibility of the population, with environmental reeducation measures, is a decisive factor for increasing the frequency of the birds or controlling the problem. When fed, the animals create habits of commonly returning to the places at their time of feeding and then flying to their nests elsewhere (M. Crepaldi Ferreira 2018; MT. Crepaldi . 2018).

Due to the set of characteristics of this scenario, the centrality of the demarcated locations in Maringá, PR, is made evident through the intense circulation of people, who corroborate the transformation of the dynamic of this landscape, creating habitats for the permanence of pigeons in these areas.

In the fieldwork, the presence of avian species (Figure 04-A) and accumulation of waste (Figure 04-B) was observed and recorded, conditioned by the permanence of these animals, generating a concentration in the areas where there is available food resulting from human activities.

Figure 04 was registered in fieldwork in the central areas of Maringá, PR, the core area of the city center (Figure 3, centrality 1). Figure 04-A was recorded at the intersection of Avenida Brasil with Travessa Guilherme de Almeida, and Figure 04-B at Praça Raposo Tavares, both with prominent centrality – with an intense populational flow permeated by economic activities and services concentrated in this area.

This region has commercial, health, food, and education services, shopping malls, squares, economic circuits, etc. These elements may be understood as fixed and flows (immaterial and material) that must not be "considered in isolation but rather as a single frame in which the story takes place" (Santos, 2012, p. 63), organizing the space and its centralities.

Another element that may contribute to the concentration of avian species is the presence of vegetation in places where environmental management may be neglected. For example, riparian forests in watercourses, leisure parks, agricultural cultivation areas, among others – fractioned in different formats and proportions, with frequently altered plant extracts resulting from human action (Dickman 1987), serving as a shelter and providing conditions for the maintenance and permanence of synanthropic animals such as pigeons.

These elements were observed in a university area, identified as having marked centrality (Figure 3, centrality 2). If added to the food courts, the production of solid waste, and the populational flow, wooded spaces potentialize the presence and permanence of pigeons in this area, contributing to the occurrence of possible zoonoses (Figure 05).

Given this scenario, the landscapes over time stand out: i) the natural environment of the balance of the birds in the trophic chain; ii) the environment changed by humans where there is a pigeon overpopulation; iii) the balanced environment in which society and nature may coexist more harmoniously.

In the first condition figures Maringá, PR, in its colonization period and later years, when humans lived in the city yet the bird population size was not yet a problem given there was a natural functioning

Figure 4. Field registration: A) presence of avian species; B) bird waste

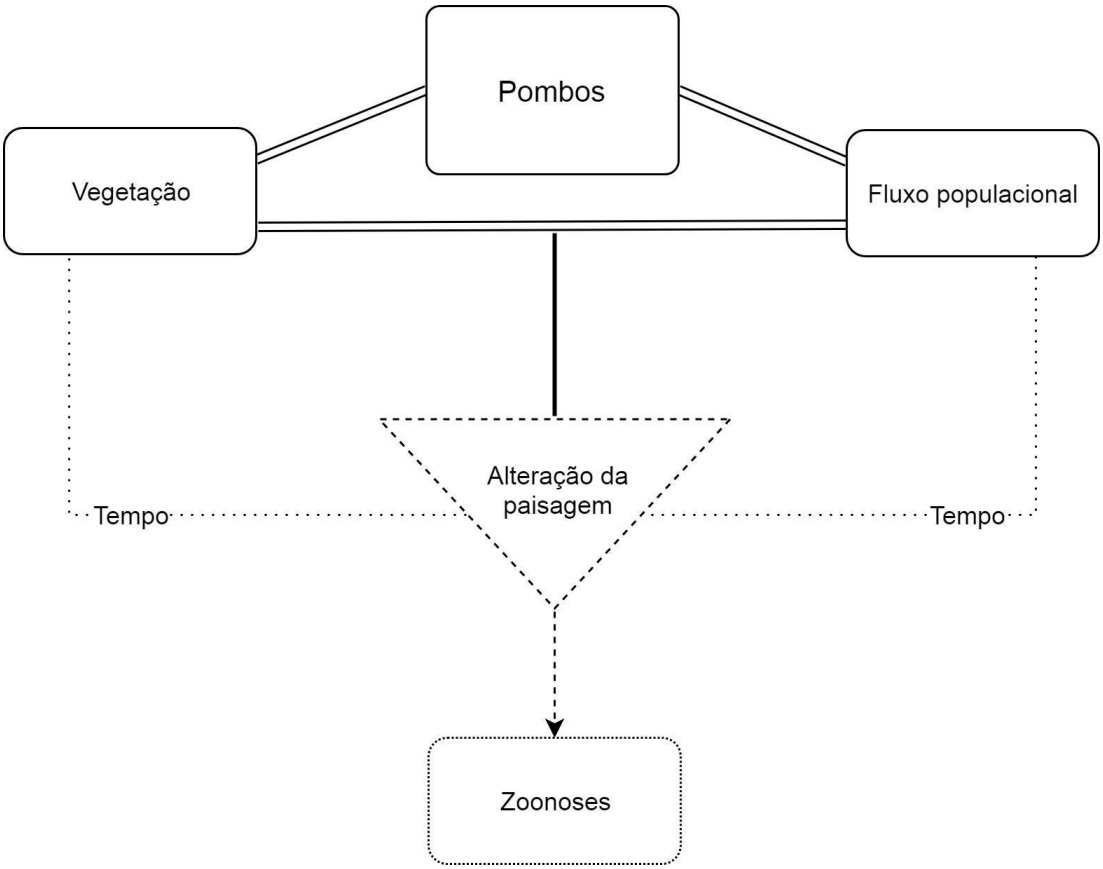

Figure 5. Interactional relationship of elements in the landscape change

of their habitat adapting to the urban environment. In the second condition, humans change the spaces where they live consubstantially. In some locations, people domesticate the birds and feed them, causing the overpopulation problem in areas with the presence of vegetation, an environment conducive to the proliferation of pigeons. The third condition is that discussed in this paper, the one idealized. A balance is expected in which the bird population may live more harmoniously with humans.

Hence, given the two centralities identified through the mapping and the records produced on the field, a relational interaction of dynamics between society and nature is noticed, sometimes in disharmony, that transform the urban landscape. Such interaction occurs in a tenuous realization that depends on factors that constitute the process, referring to the possibility of a potential unbalance of the environment and the risk of the emergence of zoonoses.

Final Considerations

From the concept of landscape, the implications resulting from the interactions between nature and society were highlighted through a geographic reading, so it was possible to understand the changes present in the urban landscape of Maringá, PR.

Given the results identified, the pigeon overpopulation has been considered a problem that incurs possible public health issues, given they implicate a potential unbalance between society and nature. In this sense, it is worth stressing that the avian species do not constitute the unbalance itself; instead, human actions transform the environment of such species and, hence, their habits.

Given this, the need for a reflection on the disagreements in the urban environment between the elements that constitute the landscape is considered. Hence, the following is asked: How to guarantee the harmony between avian species and people in the urban space?

It is understood that environmental education may guarantee sensitization and awareness, propitiating a liberating education (Freire 1987) in which subjects become aware of the importance of their actions in the environment in which they are inserted. Environmental education is at the core of the response since, despite the existence of information on the subject, it has not been communicated effectively, which sometimes precludes the access, understanding, and apprehension by the population of the knowledge and the form of acting according to the situation, in addition to the relationship with the existing institutions, among the public and private powers and non-governmental organizations.

Hence, environmental education would allow thinking of birds as members of the landscape, being influenced by the reorganization movement of society. Therefore, it is necessary to rethink the actions and interactions among the set formed by the public power and the population (instances such as neighborhood associations, schools, etc.) aiming at building solutions that are not palliative but constitute a basal framework for the transformation of the epidemiological landscape related to pigeons.

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