

# Punto de Vista

## BEYOND BIRDS' CONSERVATION: ENGAGING COMMUNITIES FOR THE CONSERVATION OF URBAN GREEN SPACES

MÁS ALLÁ DE LA CONSERVACIÓN DE LAS AVES: INVOLUCRANDO A LAS COMUNIDADES PARA LA CONSERVACIÓN DE LOS ESPACIOS VERDES URBANOS

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**ABSTRACT.**- Urban green spaces are important for bird conservation functioning not only as a buffer against the impacts of human actions on their surroundings, but also bringing benefits to humans, such as the improvement of climatic conditions and a more intimate contact with nature. In this point of view, we describe, in three sections, how ornithological research in a peri-urban vegetation patch in a tropical metropolis culminated in an environmental protection movement. This vegetation patch consists of a mosaic of typical phytophysiognomies from the transition zone between two biodiversity hotspots: Cerrado and Atlantic Forest. Even though its vegetation presents characteristics that indicate high degradation, the region still harbors 108 bird species (threatened and endemic species included), suggesting that notwithstanding the adverse impacts, the area presents characteristics of resilience to shelter the local biodiversity. Given these findings, we discuss the potential of this urban green space for scientific research, environmental education, and birdwatching. We highlight the possibility of influencing community engagement in the conservation of the area, whether for the preservation of charismatic species or for leisure and educational activities. By bridging the gap between academia and society we can assist in the conservation of urban green spaces, especially in a region that presents high social environmental vulnerability.

**KEYWORDS.**- *urban ecology; environmental education; social environmental; citizen participation*

**RESUMEN.**- Los espacios verdes urbanos son importantes para la conservación de las aves, representan un amortiguador de los impactos de las acciones humanas en su entorno, pero también benefician a los humanos a través de la mejora de las condiciones climáticas y un contacto más íntimo con la naturaleza. Desde este punto de vista, describimos, en tres secciones, cómo la investigación ornitológica en un parche de vegetación peri urbano en una metrópolis tropical culminó en un movimiento de protección ambiental. Este parche de vegetación consiste en un mosaico de fitofisionomías típicas de la zona de transición entre dos hotspots de biodiversidad: Cerrado y Mata Atlántica. Si bien su vegetación presenta características que indican una alta degradación, la región aún alberga 108 especies de aves (incluidas especies amenazadas y endémicas), lo que sugiere que, a pesar de los impactos adversos, el área presenta características de resiliencia para albergar la biodiversidad local. Dados estos hallazgos, discutimos el potencial de este espacio verde urbano para la investigación científica, la educación ambiental y la observación de aves. Destacamos la posibilidad de incidir en el compromiso de la co-

munidad en la conservación del área, ya sea para la preservación de especies carismáticas o para actividades lúdicas y educativas. Al cerrar la brecha entre la academia y la sociedad, podemos ayudar en la conservación de los espacios verdes urbanos, especialmente en una región que presenta una alta vulnerabilidad ambiental social.

**PALABRAS CLAVE.**- *ecología urbana, educación ambiental, participación ciudadana, socioambiental*

## INTRODUCTION

Urban green spaces have been identified as fundamental for biodiversity conservation as they represent heterogeneous environments modulated by human management (Kowarik and von der Lippe 2018), and provide habitat for several species, including threatened ones (Ives et al. 2016, Luna et al. 2018). At the same time, green spaces and the natural heritage, in general, are public properties that are fundamental for human quality of life due to their role in the maintenance of public health and climatic stability through the realization of ecosystem services (McDonald et al. 2013). There is a close relationship between the existence of green spaces and human well-being, especially due to the associated ecosystem services (such as pollution absorption and attenuation of climatic conditions), which brings even more importance to the preservation, maintenance, and restoration of these areas (Tratalos et al. 2007, McDonald et al. 2013).

In the context of urban development, areas in the vicinity of the city, such as peri-urban vegetation patches, can be strategic from ecological and biodiversity conservation perspectives, since their location can form a continuum of vegetation with rural areas, in addition to presenting lower human population density (Fournier et al. 2020). This proximity could facilitate the movement of organisms into and out of the urban matrix (Bhakti et al. 2021) and serving as a shelter for a larger pool of species compared to the central regions of the city (Escobar-Ibáñez et al. 2020). However, from an urbanistic perspective, peri-urban regions may represent areas with higher rates of illegal settlements and unplanned urban growth (Aguilar 2008), resulting in environmental degradation, either through the pollution of water courses or the reduction of native vegetation (Yankson and Gough 2013).

Due to their important ecological role in cities, there is a growing interest to understand the characteristics of urban green spaces that can maximize their positive influences on the integrity of urban ecosystems (Zipperer and Pickett 2012), and the necessary actions to reduce the negative human impacts caused by urban growth. Since urban ecology also considers the human dimensions into biodiversity research, it is possible to adopt interdisciplinary approaches (such

as architecture, urbanism, and sociology) to explore, besides the influences of urban green spaces on biodiversity and human quality of life, how people may be engaged in their preservation. Interdisciplinarity is important, especially in human dominated ecosystems, because the value of landscapes, forests, water resources, and the flora and fauna are not easily measured (Eriksson et al. 2018). Their importance goes far beyond their exploitation as resources, reaching the affective side of those who know and live near to or within them (Silva et al. 2022). Furthermore, by assessing the community engagement in urban environmental issues, it is possible to evaluate how different actors (local community, academy, economic sectors) may influence the formulation of public policies (Pena et al. 2017a).

In this point of view, divided into three sections, we describe how ornithological research enhanced community engagement for the preservation of a peri-urban vegetation patch in a tropical metropolis (locally known as the Izidora Forest). The academic activities in the area culminated into an environmental protection movement formed by actors from different sectors of society (academics, neighborhood associations, environmental activists and educators). First, we present the Izidora Forest, the vegetation patch that we hope can be protected through the creation of a new urban green space. Then, in section two, we describe the results of the bird survey we conducted in Casa de Francisco, a religious institution that has been supporting scientific research and developing environmental educational activities within the boundaries of the Izidora Forest. Finally, in section three, we address the relationships between academic research, decision-makers, and communities, and how the combination of these three actors can influence the search for the protection of urban green spaces.

### Section 1: The Izidora Forest

The Izidora Forest is a peri-urban vegetation patch located in the northern portion of Belo Horizonte, Minas Gerais state capital, Southeastern Brazil. The area comprehends a complex ecological system, formed by a mosaic of grassland and forest patches and several water courses with different levels of conservation,

in addition to peripheral human settlements ranging from traditional communities, religious institutions, and irregular occupations (Senra 2018). The area represents the last non-occupied portion of the municipality's territory, and it is located nearby the state administrative district. Thus, in addition to the great socio-environmental relevance, there is an intense real estate speculation in the region, increasing environmental degradation and threatening the local biodiversity (Horta et al. 2018, Bhakti et al. 2020).

The Izidora Forest is not classified as a protected area (e.g., parks or reserves) according to the municipal government (Belo Horizonte 2019). However, according with the Belo Horizonte macro-zoning, the area is called the Izidora Special Attention Area (originally "Área de Diretrizes Especiais", ADE Izidora) with 935 ha (Fig. 1). An ADE is a public policy instrument determined by the Belo Horizonte Municipal Master Plan that aims to delimit a region that needs stricter rules regarding proposals for human occupation (Belo Horizonte 2019). The ADE Izidora contains two main classes of micro-zoning (named zoning). The first is related to relevant areas for potential environmental protection (which is subdivided into three levels of protection - Fig. 1). These zones do not represent parks or other types of protected areas but indicate that human occupations should be sustainable and reduce their impacts on the local native vegetation and water resources. The second class of this micro-zoning describes regions with high social vulnerability, i.e., mostly areas irregularly occupied that have social problems such as lack of public sanitation and risk of landslides (Fig. 1). This classification is important because the northern region of Belo Horizonte has one of the lowest Human Development Indexes - IDHM (PBH 2018) in the municipality. Thus, the macro-zoning can assist in the definition of public policies that may bring social justice in association with high environmental quality.

The environmental relevance attributed to the Izidora Forest area is due to the large area of continuous native vegetation in addition to the presence of several watercourses and springs with different levels of conservation. The combination of vegetation and the presence of water is already recognized by the municipality as important for the city's climate, with the Izidora Forest being included in a climate vulnerability study for 2030 (SMMA 2014). The high vegetation amount of the area contributes to a more balanced atmospheric moisture and temperature, reduces the intensity of floods (providing soil absorption of rainwater), and prevents landslides in the region and its surroundings

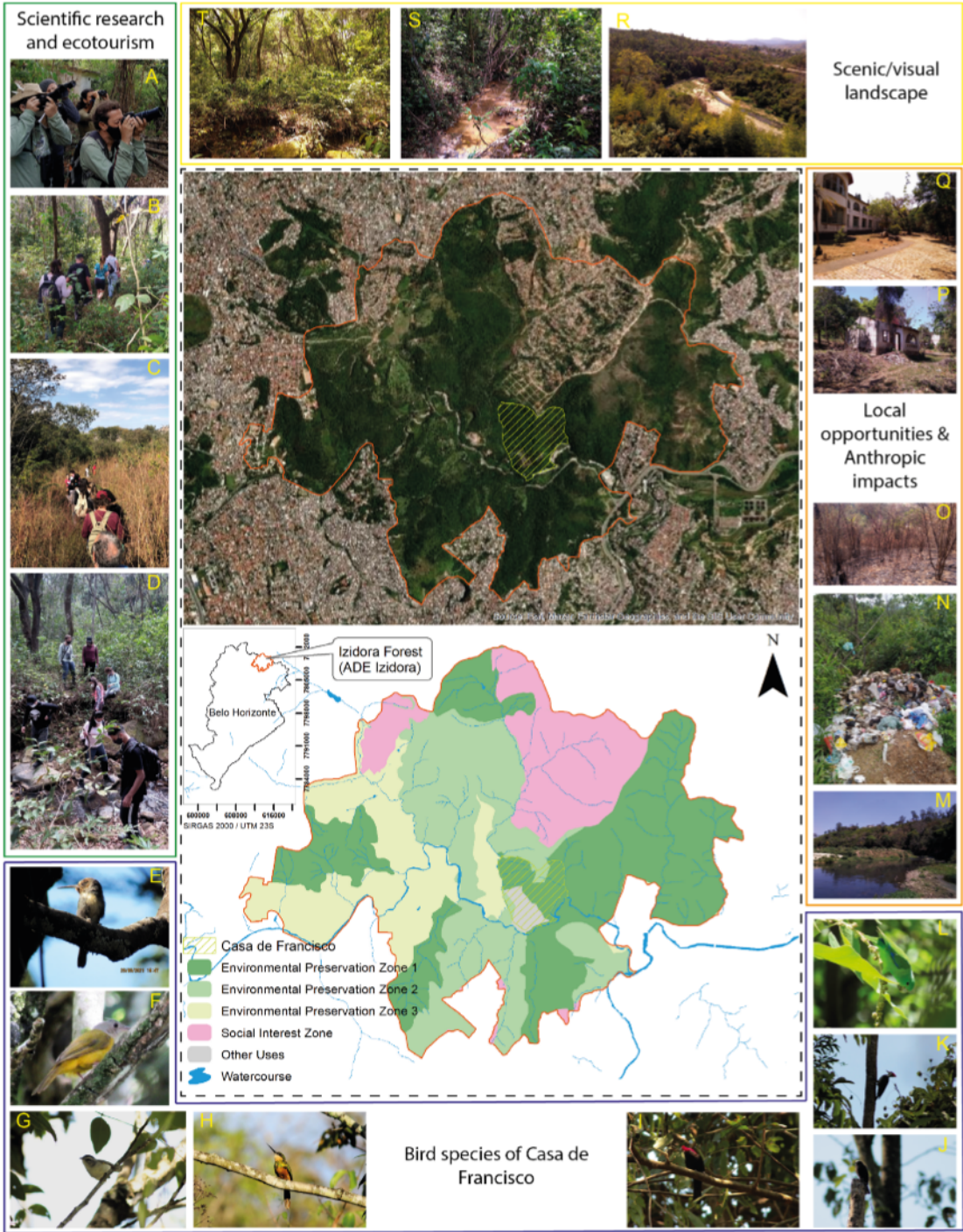
(Depietri et al. 2012). Although its environmental importance is recognized, the absence of formal protected areas in Izidora Forest prevents conservation measures from being implemented, such as an adequate structure for visitation, action plans for the protection of species, and monitoring of several anthropogenic impacts such as illegal logging, garbage disposal, and fire outbreaks (Luck 2007) (Fig. 1).

## Section 2: The birds of Casa de Francisco

Casa de Francisco for Integral Ecology (hereafter Casa de Francisco) was founded in 2020 as an environmental education unit located in the interior of Izidora Forest and belonging to the local archdiocese. The Casa de Francisco is an area of approximately 30 ha that was used as a hospital for the treatment of tuberculosis during the first decades of the 20th century and later as a nursing home, being unused for almost 10 years (Senra 2018). Today the Casa de Francisco works as an environmental education center and is legally inserted within the ADE Izidora.

Among the groups of organisms most associated with studies on the effects of urbanization on biodiversity, birds stand out as good bioindicators (Morelli et al. 2021). Based on ornithological research developed in cities, it is highlighted the importance of urban green spaces for birds' conservation, ranging from parks and large remnants of native vegetation, to more urbanized habitats such as squares, vacant lots, and wooded streets (Pena et al. 2017b, 2023, Villaseñor et al. 2020). We conducted a survey for the avifauna of Casa de Francisco between October 2020 and September 2021. Bird surveys consisted of regular visits, and in each of them, we used a different trail to cover a larger tract of forest. Casa de Francisco has several trails that connect the administrative buildings to the forested areas and to two nearby streams. We used the trails in an exploratory way, together with point counts for observation with binoculars and photography. We also recorded the vocalization of the birds we found. Fieldwork was always done in the morning (between 6 am and 10 am).

We recorded a total of 108 bird species only in the Casa de Francisco forest patch (Table 1), which represents 85.71% (126) of all species ever recorded in the entire Izidora Forest area during previous studies (Bhakti et al. 2020). Among the observed species, one is endemic to the Cerrado and four to the Atlantic Forest biomes (Table 1). We also recorded the Three-toed Jacamar (*Jacamaralcyon tridactyla*), which is considered Vulnerable by the International Union



**Figure 1.** Infographic of the Casa de Francisco region, municipality of Belo Horizonte, state of Minas Gerais, Brazil. In the center is delimited the Izidora Special Attention Area (ADE Izidora) - or Izidora Forest, being above the satellite image with the location of Casa de Francisco and below the Izidora Forest land cover with the macrozoning according to the Belo Horizonte Municipal Master Plan. Side images counterclockwise - Scientific research and ecotourism: (A) birdwatching, (B-D) ecotourism Trails; bird species of Casa de Francisco: (E) *Jacamaralcyon tridactyla*, (F) *Eucometis penicillata*, (G) *Basileuterus culicivorus*, (H) *Galbula ruficauda*, (I) *Antilophia galeata*, (J) *Colonia colonus*, (K) *Dryocopus lineatus*, (L) *Forpus xanthopterygius*; local opportunities & anthropic impacts: (M) water pollution, (N) illegal dumping, (O) wildfires results, (P-Q) physical structure of Casa de Francisco as an opportunity for restoration and ecological use; and scenic/visual landscape (R-T). Credits: ML (A); CH (E, F, L); TB (G-K, M-T); and Izidora Park Movement collection (B-D).

for Conservation of Nature and is the only globally threatened species registered in the whole Izidora Forest (BirdLife International 2020). Other species, such as the Gray-headed Kite (*Leptodon cayanensis*) and the Gray-headed Tanager (*Eucometis penicillata*) are considered rare in urban landscapes to their specificity to some habitat features, such as the availability of larger tracks of natural vegetation (Beninde et al. 2015, Cannedoli et al. 2018). In the Casa de Francisco area, we also recorded species associated with other specific habitat features, such as aquatic species (e.g., Green Ibis - *Mesembrinibis cayennensis*).

The Casa de Francisco, probably due to its location in a peri-urban vegetation patch comprised by a mosaic of phytophysiognomies typical of the ecotone between the Cerrado and the Atlantic Forest, is inhabited by a large diversity of species from both biomes - including endemic species (Silva 1995, Vale et al. 2018) (Table 1). The importance of the Casa de Francisco for the occurrence and maintenance of bird species in Belo Horizonte and its surroundings is remarkable, despite its small size and the environmental degradation of the area. Although not all the species described here are classified under a threatened status, all of them require some habitat features

for their occurrence in an urbanized area. Thus, Casa de Francisco is able to provide a high heterogeneity of environments, harboring a high proportion of the bird diversity that inhabits the whole Izidora Forest. Through the knowledge about which species occur in the region, their ecology, and natural histories, it is possible to determine public policies and actions to allow them to occupy the area in the long long-term, such as the preservation of both grassland and forest patches, reducing the fast occupation of the Cerrado vegetation in Izidora Forest (Bhakti et al. 2020). Such actions would benefit not only the bird community, but also other animal groups that need different habitat types to thrive in a region that borders one of the largest Brazilian urban landscapes. By preserving the Izidora Forest and its biodiversity, the area would be able to provide several ecosystem services not only for the surrounding communities, but for the whole city, such as pollution control, the protection of water bodies, and be a new focus for sustainable economic activities, such as ecotourism and birdwatching. Thus, Casa de Francisco, due its high ecological quality, despite degradation, has been a source of encouragement and engagement for different environmental protection movements of the Izidora Forest's surrounding communities.

**Table 1.** List of bird species recorded at Casa de Francisco between October 2020 and September 2021. Below are shown the species' scientific names and English names, also species endemic to the Cerrado vegetation are marked as CE, and those endemic to the Atlantic Forest vegetation are marked as AF. Birds species classification follows the Brazilian Ornithological Records Committee (Pacheco et al. 2021).

Taxon	English Name	Endemism
TINAMIFORMES		
Tinamidae		
<i>Crypturellus parvirostris</i>	Small-billed Tinamou	
ANSERIFORMES		
Anatidae		
<i>Cairina moschata</i>	Muscovy Duck	
<i>Amazonetta brasiliensis</i>	Brazilian Teal	
GALLIFORMES		
Cracidae		
<i>Penelope superciliaris</i>	Rusty-margined Guan	
COLUMBIFORMES		
Columbidae		
<i>Columbina talpacoti</i>	Ruddy Ground-Dove	
<i>Patagioenas picazuro</i>	Picazuro Pigeon	
<i>Leptotila verreauxi</i>	White-tipped Dove	
<i>Leptotila rufaxilla</i>	Gray-fronted Dove	



Taxon	English Name	Endemism
CUCULIFORMES		
Cuculidae		
<i>Piaya cayana</i>	Squirrel Cuckoo	
<i>Crotophaga ani</i>	Smooth-billed Ani	
<i>Guira guira</i>	Guira Cuckoo	
APODIFORMES		
Trochilidae		
<i>Phaethornis pretrei</i>	Planalto Hermit	
<i>Eupetomena macroura</i>	Swallow-tailed Hummingbird	
<i>Colibri serrirostris</i>	White-vented Violetear	
<i>Chlorostilbon lucidus</i>	Glittering-bellied Emerald	
<i>Chionomesa lactea</i>	Sapphire-spangled Emerald	
GRUIFORMES		
Rallidae		
<i>Aramides cajaneus</i>	Gray-necked Wood-Rail	
CHARADRIIFORMES		
Charadriidae		
<i>Vanellus chilensis</i>	Southern Lapwing	
PELECANIFORMES		
Ardeidae		
<i>Ardea alba</i>	Great Egret	
Threskiornithidae		
<i>Mesembrinibis cayennensis</i>	Green Ibis	
<i>Phimosus infuscatus</i>	Bare-faced Ibis	
CATHARTIFORMES		
Cathartidae		
<i>Coragyps atratus</i>	Black Vulture	
ACCIPITRIFORMES		
Accipitridae		
<i>Leptodon cayanensis</i>	Gray-headed Kite	
<i>Rupornis magnirostris</i>	Roadside Hawk	
<i>Buteo brachyurus</i>	Short-tailed Hawk	
STRIGIFORMES		
Strigidae		
<i>Megascops choliba</i>	Tropical Screech-Owl	
<i>Glaucidium brasilianum</i>	Ferruginous Pygmy-Owl	

Taxon	English Name	Endemism
<b>CORACIIFORMES</b>		
<b>Alcedinidae</b>		
<i>Chloroceryle amazona</i>	Amazon Kingfisher	
<b>GALBULIFORMES</b>		
<b>Galbulidae</b>		
<i>Jacamaralcyon tridactyla</i>	Three-toed Jacamar	AF
<i>Galbula ruficauda</i>	Rufous-tailed Jacamar	
<b>PICIFORMES</b>		
<b>Ramphastidae</b>		
<i>Ramphastos toco</i>	Toco Toucan	
<b>Picidae</b>		
<i>Picumnus cirratus</i>	White-barred Piculet	
<i>Melanerpes candidus</i>	White Woodpecker	
<i>Veniliornis passerinus</i>	Little Woodpecker	
<i>Colaptes melanochloros</i>	Green-barred Woodpecker	
<i>Dryocopus lineatus</i>	Lineated Woodpecker	
<b>CARIAMIFORMES</b>		
<b>Cariamidae</b>		
<i>Cariama cristata</i>	Red-legged Seriema	
<b>FALCONIFORMES</b>		
<b>Falconidae</b>		
<i>Caracara plancus</i>	Southern Caracara	
<i>Milvago chimachima</i>	Yellow-headed Caracara	
<i>Herpetotheres cachinnans</i>	Laughing Falcon	
<b>PSITTACIFORMES</b>		
<b>Psittacidae</b>		
<i>Psittacara leucophthalmus</i>	White-eyed Parakeet	
<i>Forpus xanthopterygius</i>	Blue-winged Parrotlet	
<i>Brotogeris chiriri</i>	Yellow-chevroned Parakeet	
<i>Pionus maximiliani</i>	Scaly-headed Parrot	
<i>Amazona aestiva</i>	Turquoise-fronted Parrot	
<b>PASSERIFORMES</b>		
<b>Thamnophilidae</b>		
<i>Dysithamnus mentalis</i>	Plain Antvireo	
<i>Herpsilochmus atricapillus</i>	Black-capped Antwren	
<i>Thamnophilus caeruleus</i>	Variable Antshrike	
<i>Taraba major</i>	Great Antshrike	

Taxon	English Name	Endemism
<b>Furnariidae</b>		
<i>Furnarius figulus</i>	Wing-banded Hornero	
<i>Furnarius rufus</i>	Rufous Hornero	
<i>Phacellodomus rufifrons</i>	Rufous-fronted Thornbird	
<i>Synallaxis frontalis</i>	Sooty-fronted Spinetail	
<i>Synallaxis spixi</i>	Spix's Spinetail	
<b>Pipridae</b>		
<i>Ilicura militaris</i>	Pin-tailed Manakin	AF
<i>Antilophia galeata</i>	Helmeted Manakin	CE
<b>Tityridae</b>		
<i>Pachyrhamphus polychopterus</i>	White-winged Becard	
<b>Rhynchocyclidae</b>		
<i>Tolmomyias sulphureus</i>	Yellow-olive Flycatcher	
<i>Todirostrum poliocephalum</i>	Gray-headed Tody-Flycatcher	
<i>Todirostrum cinereum</i>	Common Tody-Flycatcher	
<b>Tyrannidae</b>		
<i>Camptostoma obsoletum</i>	Southern Beardless-Tyrannulet	
<i>Elaenia flavogaster</i>	Yellow-bellied Elaenia	
<i>Phyllomyias fasciatus</i>	Planalto Tyrannulet	
<i>Serpophaga subcristata</i>	White-crested Tyrannulet	
<i>Myiarchus ferox</i>	Short-crested Flycatcher	
<i>Pitangus sulphuratus</i>	Great Kiskadee	
<i>Myiodynastes maculatus</i>	Streaked Flycatcher	
<i>Megarynchus pitangua</i>	Boat-billed Flycatcher	
<i>Myiozetetes similis</i>	Social Flycatcher	
<i>Tyrannus melancholicus</i>	Tropical Kingbird	
<i>Empidonomus varius</i>	Variegated Flycatcher	
<i>Colonia colonus</i>	Long-tailed Tyrant	
<i>Fluvicola nengeta</i>	Masked Water-Tyrant	
<i>Cnemotriccus fuscatus</i>	Fuscous Flycatcher	
<i>Lathrotriccus eulerti</i>	Euler's Flycatcher	
<b>Vireonidae</b>		
<i>Cyclarhis gujanensis</i>	Rufous-browed Peppershrike	
<i>Hylophilus amaurocephalus</i>	Gray-eyed Greenlet	
<i>Vireo chivi</i>	Chivi Vireo	
<b>Hirundinidae</b>		
<i>Pygochelidon cyanoleuca</i>	Blue-and-white Swallow	
<i>Stelgidopteryx ruficollis</i>	Southern Rough-winged Swallow	



Taxon	English Name	Endemism
<b>Troglodytidae</b>		
<i>Troglodytes musculus</i>	Southern House Wren	
<b>Poliophtilidae</b>		
<i>Poliophtila duminicola</i>	Masked Gnatcatcher	
<b>Turdidae</b>		
<i>Turdus leucomelas</i>	Pale-breasted Thrush	
<i>Turdus rufigiventris</i>	Rufous-bellied Thrush	
<i>Turdus amaurochalinus</i>	Creamy-bellied Thrush	
<b>Estrildidae</b>		
<i>Estrilda astrild</i>	Common Waxbill	
<b>Fringillidae</b>		
<i>Euphonia chlorotica</i>	Purple-throated Euphonia	
<b>Passerellidae</b>		
<i>Arremon flavirostris</i>	Saffron-billed Sparrow	
<b>Icteridae</b>		
<i>Psarocolius decumanus</i>	Crested Oropendola	
<b>Parulidae</b>		
<i>Geothlypis aequinoctialis</i>	Masked Yellowthroat	
<i>Basileuterus culicivorus</i>	Golden-crowned Warbler	
<i>Myiothlypis flaveola</i>	Flavescent Warbler	
<b>Cardinalidae</b>		
<i>Cyanoloxia brissonii</i>	Ultramarine Grosbeak	
<b>Thraupidae</b>		
<i>Thraupis sayaca</i>	Sayaca Tanager	
<i>Thraupis palmarum</i>	Palm Tanager	
<i>Stelpnia cayana</i>	Burnished-buff Tanager	
<i>Nemosia pileata</i>	Hooded Tanager	
<i>Conirostrum speciosum</i>	Chestnut-vented Conebill	
<i>Sicalis flaveola</i>	Saffron Finch	
<i>Hemithraupis ruficapilla</i>	Rufous-headed Tanager	AF
<i>Volatinia jacarina</i>	Blue-black Grassquit	
<i>Eucometis penicillata</i>	Gray-headed Tanager	
<i>Coryphospingus pileatus</i>	Pileated Finch	
<i>Tachyphonus coronatus</i>	Ruby-crowned Tanager	AF
<i>Tersina viridis</i>	Swallow Tanager	
<i>Coereba flaveola</i>	Bananaquit	
<i>Sporophila nigricollis</i>	Yellow-bellied Seedeater	
<i>Sporophila caerulea</i>	Double-collared Seedeater	

### Section 3: Strengthening ties between academic research and society

Here, we present how communities that live in the surroundings of Casa de Francisco got engaged in the preservation of the whole Izidora Forest area during our research on the local bird diversity. We also describe difficulties we faced during the process of community engagement, since we expected to turn the results of the bird survey into environmental education actions and conservation basis for the whole Izidora Forest.

Due to the locally endangered species we found in the area, the Three-toed Jacamar, we started a working group with members of the Ornithology Laboratory of the Federal University of Minas Gerais and the Casa de Francisco with the aim of evaluating the possibilities of legally enhancing the protection of the area with the help of different stakeholders: neighborhood associations, environmental organizations, schools, companies, religious institutions, and traditional communities. We invited representatives to a meeting that led to the creation of an environmental protection group called Parque Izidora Movement (PIM). The PIM, whose symbol is the Three-toed Jacamar perched in the shoulder of a quilombola woman, aims to seek the creation of a protected area in the region of Izidora Forest. Due to the high bird species diversity and easy accessibility for all sorts of people, the Izidora Forest and the Casa de Francisco can be considered with high potential for environmental education activities, ecotourism, and birdwatching. The latter has already proved to be a hobby that is friendly to beginners, has a low ecological impact, and helps conservation projects (Castillo-Aguilar and Roa-Angulo 2021). Attracting visitors to the region would provide visibility to the environmental movement and demands of the local populations.

Since 2020, several meetings and events have been held at the Izidora Forest, such as tracks through local walking trails and seminars, with the goal of making the surrounding communities aware of the importance of protecting this vegetation patch, and taking this message to the Belo Horizonte municipal government. The core of the PIM is based on an idea widespread in urbanism theories (Jacobs 2011), which highlights the importance of occupying a space to create an identity and thus increasing its value for the local communities and consequently their engagement in its protection. This involvement of the surrounding communities is an important step towards the creation of new protected areas, especially when they are supported by scientific research (Constan-

tino 2020). PIM's involvement also occurred in other spheres, interacting with other environmental and social movements that operate in the region with complementary goals. Different groups emerged to fight and demand a more sustainable development of the region due to the presence of critical social environmental issues in the Izidora Forest area. The group "Deixe o onça beber água limpa" (or "Let the Jaguar River drink clean water") is a collective of residents who are interested in the ecological cause and in an urban development plan that considers the needs of local communities. Another example is the "Quilombo das Mangueiras" nearby Casa de Francisco, a traditional black community that occupied the Izidora Forest area at the end of the XIX century (CBH Velhas 2021), and is also essential for protecting social interests in the region as their movement has been focused on solving severe social problems, such as the lack of public sanitation and urban infrastructure and protecting the local human heritage.

Even if the local community desires to create a green space, it is the public administration that has the function of managing and/or creating urban green spaces through elected representatives. Although they do not always have access to scientific data, they should work in collaboration with researchers to obtain adequate information about the urban ecosystem (Parris et al. 2018). As members of PIM, we participated in several meetings with representatives from the municipality (mainly from the Secretary of Environment), adding technical knowledge regarding the importance of preserving the Izidora Forest area for the urban biodiversity (with focus on the bird community) and for the human population. Despite the positive feedback, our meetings still did not result in any action from Belo Horizonte municipality for the creation of an urban green space or conservation unit in the Izidora Forest. PIM also approached city council representatives to expose the importance of creating a green space in the Izidora Forest. We also received positive feedback from some of the aldermen we met, but a bill to create a new law is a long process that needs the approval of several city council members and sectors of the society. The main issue regarding actions from stakeholders is that they are elected or appointed every four years, which hinders the continuity of actions such as the creation of green space in a region that is under high social and economic pressure.

For the sustainable use and conservation of the water resources in the Izidora Forest region, a collaboration between the local communities and the mu-

nicipal government is of paramount importance. The fast and disorderly urban population growth in the Izidora Forest area already culminated in the destruction or degradation of the riparian vegetation (Bhakti et al. 2020), which may have led to the contamination of streams by domestic sewage. More studies, especially regarding other taxa and the physical environment of Izidora Forest, are still needed to properly measure the degree of degradation of the whole area and to give support to the creation of a green space. For future urban interventions of the Izidora Forest, we hope our research in Casa de Francisco to assist in reducing the social and ecological vulnerabilities and the lack of public infrastructure by bringing education, attention, resources, and closure to the problems associated with the area while conserving the important ecosystem services provided by this remnant of native vegetation, which still harbors diverse fauna and flora.

As researchers, we aim to reduce the gap between scientific knowledge and public action, and we understand that it is a process that requires interacting with a variety of stakeholders. Thus, we would like to highlight some general difficulties that researchers may face when taking their work outside the academic environment:

As researchers, one of our main difficulties is translating information for a broader and diverse audience. Scientific knowledge can be useful during interactions with schools and the local community, but it is not easily understandable by the general public, due to its specific and sometimes complicated vocabulary and technicalities (Pedretti 1999). Thus, PIM has been promoting lectures during the events and maintaining social media profiles to talk about birds, their characteristics and ecological roles in urban green spaces, and the importance of the conservation of the native vegetation in the Izidora Forest in accessible vocabulary and using photos and figures (such as land cover maps of the Izidora Forest) as supporting material.

It is necessary to understand that the pace and expectations are different for each social sector involved (Cunha et al. 2017). In academia it takes time – often years – to develop and conclude research (conducting fieldwork, analyzing data, writing reports, and publishing papers). Therefore, within the scale of government cycles (four years in the case of the three executive spheres in Brazil – municipal, state, and federal) it is difficult to provide consistent results and to give feedback to a community that sometimes needs fast information to help in the fight for the protection of a green space. In the same way, decision-makers work

under regulatory legislation and a political agenda that often changes after each four-year cycle. Our research team have been using the available knowledge we have about the Izidora Forest (such as the presence of endangered and endemic species and the land cover maps that show the loss of natural habitats) as the basis to demonstrate for decision makers the need of a more sustainable development of the area. Nevertheless, long-term basic scientific research in the area is key to produce a base line of knowledge sufficient to help fighting for the conservation of the Izidora Forest (and hopefully we will be able to enhance the local academic engagement by disseminating our experience in this highly important urban vegetation patch through a scientific publication).

The Casa de Francisco, acting as a headquarters, has the potential to unite its surrounding communities to engage and fight for the protection of the natural and human heritage of the whole Izidora Forest. Furthermore, the academic research developed in the region can provide technical support for the creation of public policies for sustainable urban development. We expect that the combination of the social movements, the environmental education activities, and the academic research in the region, would represent the first steps towards the sustainable urban development of the Izidora Forest as a whole. Hopefully, future generations will be able to live in a neighborhood – and in a city – that managed to preserve a vegetation patch of almost 1000 hectares, inhabited by animal and plant species typical of two of the most biodiverse terrestrial biomes of the planet, the Atlantic Forest and the Cerrado.

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