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ORIGINAL PAPER

Identifying management guidelines to control the invasive House Sparrow (*Passer domesticus*) within natural protected areas through the estimation of local colonization and extinction probabilities

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Abstract Invasive species hinder the conservation objectives of natural protected areas, particularly of those found within or nearby urban settlements. Identifying the habitat and landscape traits that determine the establishment and persistence of populations is essential for implementing effective management plans to control invasive species. We employed multi-season occupancy models to identify the habitat and landscape traits that determined the local colonization and extinction probabilities of an invasive bird (House Sparrow—*Passer domesticus*), in order to provide recommendations for controlling its population within a natural protected area immersed in Mexico City. We selected traits that exhibited management potential to provide feasible recommendations for controlling the species. We observed that increasing values of shrub cover, tree cover, and distance to developed areas discouraged the sparrow from invading new sites of the reserve. Simultaneously, greater distances to developed areas promoted the extinction of the species across invaded sites. These effects might be related to resource availability, foraging preferences of the species, predatory exposure, and competition. Preserving tree and shrub cover as a natural barrier for dissuading species arrival represents a key management objective for its control in the reserve. Greater management efforts must be focused at those sites of the reserve that are closer to developed areas, given that the latter may function as source habitats for the House Sparrow. Our approach for identifying management actions that impact the population dynamics of an invasive species might provide crucial results to control this type of populations. Such a strategy could be replicated for other species and natural protected areas to enhance the conservation value of reserves and provide alternatives when dealing with invasive species.

Keywords Imperfect detectability · Mexico City · Multi-season models · Occupancy dynamics · Occurrence modeling · Urban reserve

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Introduction

Natural protected areas have received major attention in an attempt to preserve natural resources and ecosystems services. In fact, they have become one of the main tools for conserving biodiversity worldwide (Lovejoy 2006; Kareiva and Marvier 2012). Still, natural protected areas face a myriad of challenges that limit their conservation objectives, mainly within tropical countries (Llorente-Bousquets and Ocegueda 2008; Laurance 2013). For example, their functionality may be severely constrained by a lack of budget, staff limitations, poaching, and vandalism (James et al. 1999; Danielsen et al. 2003; West et al. 2006; DeFries et al. 2007). Beyond such socio-economic factors, there are several biological agents that might hinder the success of natural protected areas, including the detrimental effects of invasive species (Foxcroft et al. 2013). Invasive species represent a particular challenge for natural protected areas because they have the potential to alter the abiotic components of habitats, displace endangered species, disrupt mutualistic processes, modify the cycles of ecosystems, and are often difficult to control (Bednarczuk et al. 2010; Foxcroft et al. 2013; Schulze et al. 2018).

The location of natural protected areas is not restricted to remote regions of the globe. In fact, many of them can be found within or nearby urban settlements (Watts and Larivière 2004; Ramp et al. 2006; Konvicka and Kadlec 2011). In such cases, their relevance is not solely associated with the biodiversity that they harbour, but also with the social, recreational, and educational services that they provide to city dwellers (Kadlec et al. 2008; Borgström et al. 2012). However, human-associated disturbances are more intense in urban landscapes (Sukopp and Starfinger 1999). Invasive species are often more abundant within and nearby cities (McKinney 2002, 2006), and their effective control can be hampered by both social and biological circumstances. For example, programs controlling invasive species might face social obstacles if such strategy is rejected by people (Bardsley and Edwards-Jones 2006), even if these organisms have negative impacts on the local environment. Finally, direct removal of invasive species could be expensive, logistically arduous, and ultimately ineffective (Bednarczuk et al. 2010). Therefore, indirect measures to control invasive species should be preferred.

From a biological perspective, controlling invasive species is not a straightforward task, given that their initial establishment is difficult to detect, and they reproduce and spread rapidly (Stohlgren and Schnase 2006). As a result, control activities should be focused on the mechanisms that determine the establishment and persistence of their populations (Lenda et al. 2010; MacKenzie et al. 2018). Hence, habitat management that may impact both the colonization and extinction processes of a population is fundamental to control invasive species (Bogich and Shea 2008). Colonization and extinction probabilities can be assessed through a metapopulation approach, in which colonization represents a shift of sites from unoccupied to occupied status, whereas extinction depicts a shift in the opposite direction (Hanski and Gilpin 1991; MacKenzie et al. 2003). However, from a management perspective, estimating colonization and extinction probabilities of an invasive species alone would be insufficient to determine the necessary actions to control its population. Thus, identifying the specific landscape and habitat traits that affect the occurrence dynamics of an invasive species, as well as vulnerable sites to invasion, is essential for the implementation of effective management plans to control the local distribution of their populations (MacKenzie et al. 2018).

Robust analytical approaches must be used to address the mechanisms that determine invasion, not only to obtain reliable management recommendations, but also to implement cost-effective control measures (MacKenzie 2005). This is important because natural protected areas might operate with a low budget and few staff members, mainly within tropical countries (James et al. 1999; Danielsen et al. 2003; DeFries et al. 2007). Multi-season occupancy models represent a robust analytical tool for assessing occupancy dynamics, while accounting for environmental covariates (MacKenzie et al. 2003). These models rely on metapopulation theory to identify those habitat traits that determine the colonization and extinction probabilities of a given population (Hanski and Gilpin 1991). Moreover, multi-season occupancy models account for imperfect detection, which is essential to obtain reliable estimations, and be able to use them as the basis for wildlife management recommendations (MacKenzie 2005; Royle et al. 2005; Archaux et al. 2012).

In this study, we employed multi-season occupancy models to identify the landscape and habitat traits that determined the colonization and extinction probabilities of an invasive bird species, in order to provide feasible recommendations for controlling its population within a natural protected area. We selected the House Sparrow (*Passer domesticus*) as a target species, given that it is common throughout the area and might outcompete the local resident species (MacGregor-Fors et al. 2010; Ortega-Álvarez and MacGregor-Fors 2010; Ramírez-Cruz et al. 2019; García-Arroyo et al. 2020). We performed our study within a natural protected area (i.e., Reserva Ecológica del Pedregal de San Ángel; referred to as "ecological reserve" hereafter) that is located within Mexico City, central Mexico. We measured one landscape trait and several habitat features that have been suggested to determine the presence and density of the species, to identify which of them impacted the species' occupancy dynamics. We focused on selecting habitat traits that exhibited management potential by local authorities to provide feasible recommendations for controlling the invasive species. We expected that tree cover and litter might foster colonization probabilities of the species, given that previous studies have shown that such traits provide roosting and feeding resources for the species, respectively (Siriwardena et al. 2002; Chamberlain et al. 2007; Skórka et al. 2009; Kanaujia et al. 2014). Also, we predicted higher colonization probabilities of the House Sparrow at those sites of the reserve closer to developed areas, given that the latter may function as source habitats for its population. Finally, we suspected that shrub cover and both tree and shrub species richness might increase the extinction probability of the invasive species, given that such vegetation traits usually reduce habitat quality for the species across the region (Anderson 2006; Ortega-Álvarez and Macgregor-Fors 2011; Ramírez-Cruz et al. 2018). Our study considered temporal variation of the occupancy of the House Sparrow, and evaluated those mechanisms that determine its occurrence, which might enhance the efficiency of management activities to control its population. This approach could serve as an example to determine occupancy dynamics of invasive species within natural protected areas, in order to identify and promote management recommendations for controlling invasive species in areas of high conservation and social concern.

Methods

Study site

The Reserva Ecológica del Pedregal de San Ángel is in southern Mexico City. It has an area of 237 ha. The dominant vegetation is xerophytic scrubland that established after the eruption of the Xitle volcano (Siebe 2009). This ecological reserve is located within the campus of the Universidad Nacional Autónoma de México and is divided in two distinct conservation area types: 171 ha distributed between three highly restricted core areas and 66 ha among 13 buffer areas with limited access. The reserve areas are surrounded by 730 ha of urban landscape that include unprotected scrubland, green urban areas, parking lots, roads, and buildings (Zambrano et al. 2016). Climate is temperate subhumid with rains from June to October. Mean temperature is 15.6 °C (Zambrano et al. 2016).

Sampling

We set a total of 100 point count stations throughout the study site. The location of these stations was selected randomly, but a minimum distance of 150 m was kept between each of them to gather independent data. Count stations were visited between five and seven occasions per survey season during the months of May, September, and January from 2015 to 2018, which corresponded to the spring, fall, and winter respectively. We performed surveys for a total of nine seasons (i.e., spring 2015, 2016, 2017; fall 2015, 2016, 2017; winter 2016, 2017, 2018). This allowed us to account for intra-annual variability in our estimations. At each station, observations were carried out during a 15 min interval in which all detected House Sparrows within a 20 m radius from the center point were recorded. Groups of three to five observers worked between sunrise and noon, and between 5 p.m. and sunset to cover the periods of peak activity of the species. At each point count station, the observers measured five habitat traits that exhibited management potential by local authorities for controlling the invasive species, including tree and shrub cover, the percentage of litter, and tree and shrub species richness (Table 1). Observers visually estimated the percentage of each cover type by assigning them a score from 1 to 10 separately. To determine the tree and shrub covers, as well as the amount of litter within

Table 1 Landscape and habitat traits measured at each point count station to evaluate their effect on the colonization and extinction probabilities of the House Sparrow. Mean values and standard deviations (SD) for each of the nine survey seasons (S) are specified

Habitat trait	S1	S2	S3	S4	S5	S6	S7	S8	S9
Tree cover (%)									
Mean	20.53	20.03	21.85	22.61	23.89	26.39	25.96	24.80	24.54
SD	11.97	12.52	14.26	13.76	13.82	14.69	14.14	13.99	14.29
Shrub cover (%)									
Mean	27.82	28.94	27.07	28.09	26.19	27.5	28.44	26.67	26.89
SD	23.16	23.12	23.78	25.35	23.25	24.39	25.53	24.55	26.63
Litter (%)									
Mean	9.14	2.73	4.23	3.48	1.72	2.64	2.64	2.64	2.64
SD	14.02	4.98	7.05	5.59	3.33	4.63	4.63	4.63	4.63
Tree species richness									
Mean	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64
SD	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
Tree + shrub species richness									
Mean	15.94	15.94	15.94	15.94	15.94	15.94	15.94	15.94	15.94
SD	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04
Distance to developed areas (m)									
Mean	36.04	36.04	36.04	36.04	36.04	36.04	36.04	36.04	36.04
SD	56.47	56.47	56.47	56.47	56.47	56.47	56.47	56.47	56.47

the 20 m radius from each observation site, the scores recorded by each observer were multiplied by 10, and then compared to reach a consensus and adjust extreme estimates (Klimeš 2003). The number of tree and shrub species at each station was also registered by observers. Measurement of all habitat traits was performed for each survey season. Finally, we considered the distance to developed areas as a landscape trait that might influence the population dynamic of the House Sparrow. Distance to developed areas was measured by using a Global Information System (GIS), and represented the linear length from the center of the point count station to the nearest urban infrastructure, including trails, parking lots, buildings, and lawns (Table 1).

Data analyses

We evaluated the influence of landscape and habitat traits on the colonization/extinction probabilities of the House Sparrow within the ecological reserve by using 3-year data analyzed with single-species, multi-season occupancy models (MacKenzie et al. 2003). All nine surveyed seasons were included in the modeling process. We modeled: (a) the probability of occupancy for the first season (ψ_1) as a reference level for denoting differences among parameters in all seasons; (b) colonization probability (γ), representing the probability than an unoccupied site i at time t becomes occupied at $t + 1$; (c) local extinction probability (ε), which represents the probability that an occupied site i at time t becomes unoccupied at $t + 1$; and (d) detection probability (p) for the species, with the R package "unmarked" (Fiske and Chandler 2011). We used distance to developed areas, tree cover, shrub cover, litter, tree species richness, and tree + shrub species richness as covariates for modelling ψ_1, γ, and, ε, whereas only tree and shrub cover were employed as covariates to model p. Before model fitting, we standardized habitat traits to a mean of zero and variance of one. We used the R package "MuMIn" (Barton 2016) to construct the candidate model sets, which included additive models. We omitted interactions among variables to avoid overparameterization and to facilitate interpretation of the results. We performed model selection based on the second-order Akaike's Information Criterion for small sample sizes (Burnham and Anderson 2002). In order to reduce the total number of competing models and minimize the effect of uninformative parameters (Arnold 2010), we used a four-stage modelling approach for the estimation of parameters. First, we modeled p through a candidate set of models that included the effect of tree and shrub cover, as well as an intercept-only model that did not consider the effects of covariates on the estimated parameter. Second, we used the p model with the lowest ΔAICc value to construct a candidate model set to examine ψ_1. In this set of models, we also included an intercept-only model, and we used the landscape and the five habitat traits for modelling ψ_1. Third, we used the ψ_1 model with the lowest ΔAICc value as a basis for examining a candidate set of γ models, including again an intercept-only model and using the landscape and the five habitat traits for modelling γ. Finally, we used the γ model with the lowest ΔAICc value for modeling ε with a candidate model set that contained an intercept-only model and models that considered the effect of the landscape and habitat traits on ε. We predicted the effect of the landscape and the habitat traits on the colonization and extinction probabilities of the House Sparrow by using the model-averaged estimates of all the model coefficients derived from the last stage of our modelling approach (i.e., ε modelling). We considered that the habitat traits influenced ψ_1, γ, ε, and p when the 95% confidence intervals of their averaged beta coefficients did not include zero.

Results

Single-species, multi-season occupancy models (Table 3) revealed that shrub and tree cover had a negative effect on House Sparrow detectability, whereas distance to developed areas and shrub cover had a negative effect on its occupancy probability for the first year (Tables 2, 3). We found that shrub cover, tree cover, and distance to developed areas influenced the probability of colonization of the House Sparrow within the ecological reserve (Fig. 1). Increasing values of shrub cover, tree cover, and distance to developed areas resulted in a reduction of the colonization probability of the species. When shrub and tree cover were absent from a site located in a developed area, the colonization probability of the House Sparrow reached its highest value (0.6, 95% CI = 0.4–0.7; 0.6, 95% CI = 0.4–0.7; and 0.5, 95% CI = 0.4–0.6, respectively; Fig. 1a,b,c). However, high values of shrub (70%) and tree cover (50%), coupled with a distance > 200 m from developed areas, reduced the colonization probability of the species below 0.3 (95% CI = 0.1–0.4), 0.2 (95% CI = 0.1–0.4), and 0.2 (95% CI = 0.1–0.3), respectively (Fig. 1a–c).

Our modelling results also suggested that distance to developed areas impacted the extinction probabilities of the House Sparrow across the study site (Fig. 2). However, in this case, distance to developed areas was positively related with the extinction probability of the species. According to our predictions, sites located in developed areas promoted a low extinction probability for the House Sparrow (0.1, 95% CI = 0.08–0.15; Fig. 2). In contrast, the extinction probability of the species increased with greater distances to developed areas, in such a way that distances > 50 m to developed areas led to extinction probabilities higher than 0.5 (95% CI = 0.4–0.6; Fig. 2). The metapopulation of the House Sparrow might be close to an equilibrium within the studied preserve at 41 m to developed areas, because at this particular distance extinction was equal to colonization probability (Online Resource 1).

Discussion

Distance to developed areas was a key landscape trait for the House Sparrow, as it impacted both mechanisms determining the occupancy dynamics of the invasive species. In particular, sites of the reserve proximate to developed areas were more susceptible to be colonized by the species, whereas distant sites from developed areas suffered less from the invasion of the species given that its probability of extinction was higher in such sites. In this sense, developed areas might be functioning as source habitats for the House Sparrow, whereas distant sites immersed in the reserve might represent sink habitats for the species (Pulliam 1988). Colonization probabilities were also affected by shrub and tree cover in such a way that increasing values of these habitat traits discouraged the sparrow from invading new areas of the ecological reserve. These effects might be related to different ecological processes that operate at the same time on its population. For instance, large surfaces of shrub and tree cover might: (a) decrease the area of the preferred feeding stratum of the species, given that the House Sparrow usually forages in open spaces at ground level (Anderson 2006; Rajashekar and Venkatesha 2008); (b) diminish the availability of food resources, as the species largely feeds on cereals, weed seeds, and food

Table 2 Model-averaged coefficients and standard errors for each analyzed landscape and habitat trait. Traits were considered to influence parameters when the 95% confidence intervals $\psi_1$of their averaged beta coefficients did not include zero (*)

Parameter	Trait	Coefficient	Standard error
ψ_1	Intercept	4.39	0.94
ψ_1	Distance to developed areas*	− 0.06	0.01
ψ_1	Litter	− 0.04	0.02
ψ_1	Shrub cover*	− 0.03	0.01
γ	Intercept	1.43	0.49
γ	Distance to developed areas*	− 0.008	0.002
γ	Shrub cover*	− 0.01	0.007
γ	Tree cover*	− 0.03	0.01
ε	Intercept	− 2.57	0.47
ε	Distance to developed areas*	0.03	0.008
ε	Tree species richness	− 0.09	0.1
ε	Tree + shrub species richness	0.06	0.05
ε	Shrub cover	0.01	0.01
ε	Tree cover	0.001	0.006
ε	Litter	0.001	0.008
p	Intercept	1.35	0.10
p	Shrub cover*	− 0.02	0.002
p	Tree cover*	− 0.02	0.003

Parameters are: occupancy probability for the first year (ψ_1), colonization probability (γ), extinction probability (ε), and probability of detection (p)

Table 3 Best-supported models (ΔAICc < 2) that resulted for fitting single-species, multi-season occupancy models to the detection histories of the House Sparrow

Models	K	AICc	ΔAICc	AICc weights
Detection probability (p)				
$\psi_1\{.\}\ \gamma\{.\}\ \varepsilon\{.\}\ p\{SC + TC\}$*	6	5239.88	0	0.99
Occupancy (ψ_1)				
$\psi_1\{D + L + SC\}\ \gamma\{.\}\ \varepsilon\{.\}\ p\{SC + TC\}$ *	9	5183.35	0	0.20
$\psi_1\{D + SC\}\ \gamma\{.\}\ \varepsilon\{.\}\ p\{SC + TC\}$	8	5184.81	1.45	0.10
$\psi_1\{D + L\}\ \gamma\{.\}\ \varepsilon\{.\}\ p\{SC + TC\}$	8	5185.22	1.86	0.08
Colonization (γ)				
$\psi_1\{D + L + SC\}\ \gamma\{SC + D + TC\}\ \varepsilon\{.\}\ p\{SC + TC\}$ *	12	5155.01	0	0.38
$\psi_1\{D + L + SC\}\ \gamma\{SC + D + TC + TSSR\}\ \varepsilon\{.\}\ p\{SC + TC\}$	13	5156.70	1.68	0.16
Extinction (ε)				
$\psi_1\{D + L + SC\}\ \gamma\{SC + D + TC\}\ \varepsilon\{D + TSR + TSSR\}\ p\{SC + TC\}$	15	5081.63	0	0.19
$\psi_1\{D + L + SC\}\ \gamma\{SC + D + TC\}\ \varepsilon\{D + SC + TSR + TSSR\}\ p\{SC + TC\}$	16	5082.16	0.52	0.14
$\psi_1\{D + L + SC\}\ \gamma\{SC + D + TC\}\ \varepsilon\{D + SC\}\ p\{SC + TC\}$	14	5082.27	0.93	0.12
$\psi_1\{D + L + SC\}\ \gamma\{SC + D + TC\}\ \varepsilon\{D + SC + TSSR\}\ p\{SC + TC\}$	15	5083.48	1.84	0.07

We followed a four-stage modelling approach for the estimation of parameters. We used the model with the lowest ΔAICc value from a previous stage (*) to construct the candidate model set of the subsequent modelling stage. Occupancy probability for the first season (ψ_1), colonization probability (γ), and extinction probability (ε) were modeled as a function of distance to developed areas (D), tree cover (TC), shrub cover (SC), litter (L), tree species richness (TSR), and tree + shrub species richness (TSSR). Detection probability (p) was modeled as a function of TC and SC. We show the number of parameters in the models (K), Akaike's Information Criterion adjusted for small sample sizes (AICc), difference in AICc with respect to the top model (ΔAICc), and AICc weights. Models with ΔAICc > 2 are not shown

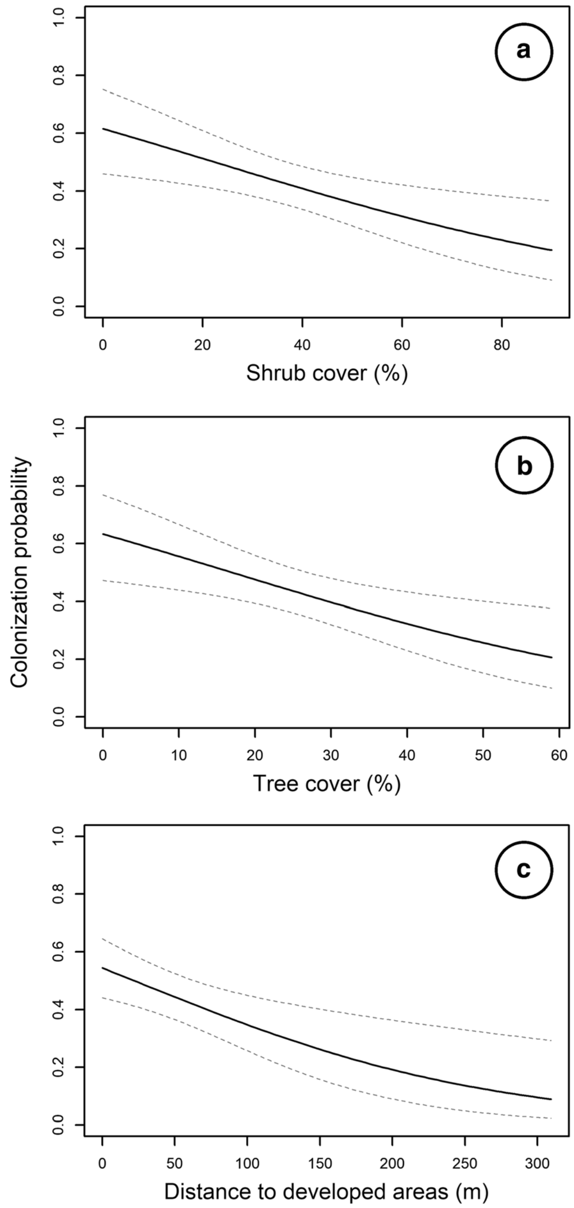

Fig. 1 Predicted relationships between **a** shrub cover, **b** tree cover, and **c** distance to developed areas and colonization probabilities of the House Sparrow within the ecological reserve. Dotted lines represent confidence intervals (95%) of the estimations

spills (Gavett and Wakeley 1986; Rajashekar and Venkatesha 2008; Skórka et al. 2009; Pärn et al. 2012); (c) reduce the field of view, compromising the detection of predators and increasing predation risk (e.g., domestic and feral cats; Woods et al. 2003; Whittingham and Evans 2004; Anderson 2006;

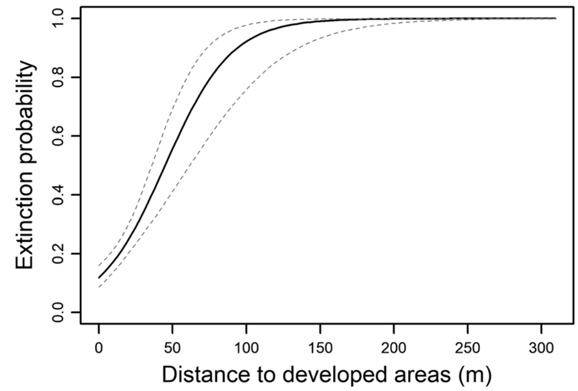

Fig. 2 Predicted relationships between distance to developed areas and extinction probabilities of the House Sparrow within the ecological reserve. Dotted lines represent confidence intervals (95%) of the estimations

Dandapat et al. 2010); and (d) increase competition with native shrubland birds (Ramírez-Cruz et al. 2019).

Following our results, management activities could be implemented for reducing habitat quality for the House Sparrow and controlling its population within the ecological reserve. From a landscape perspective, management efforts should be prioritized and intensified in those sites of the reserve that are more proximate to developed areas, given that they are more susceptible to the invasion of the House Sparrow. For site management, preserving native tree and shrub species, such as *Pittocaulon praecox*, *Buddleja cordata*, *Eysenhardtia polystachya*, and *Dodonaea viscosa*, might prove useful as a natural barrier for dissuading the arrival of the species to new sites. Furthermore, previous studies suggest that fostering poor-quality habitats for the species might limit its breeding success and reduce its dispersal (Pärn et al. 2012). Simultaneously, managing shrubs might exert positive effects on the local avifauna, as regional studies have shown that increasing shrub cover might benefit resident species (Ortega-Álvarez and MacGregor-Fors 2009; Ramírez-Cruz et al. 2019). In contrast to this effect, reducing the House Sparrow's preferred habitat within the ecological reserve might diminish its negative impact on the native bird communities (MacGregor-Fors et al. 2010; Ortega-Álvarez and MacGregor-Fors 2010; García-Arroyo et al. 2020). Monitoring the outcomes of management activities should be performed, including the assessment of the effects of tree and shrub cover manipulation on the density of the House Sparrow. Moreover, complementary activities for controlling the species should not be discarded. For example, nest removal from built areas located within and nearby the reserve might be promoted for aiding habitat management measures. The involvement of the local human population might also be fundamental for controlling the House Sparrow by avoiding feeding the species and enhancing waste management (Siriwardena et al. 2002; Chamberlain et al. 2007). Finally, identifying and managing the habitat traits that influence other demographic parameters of the species (e.g., mortality, density, fecundity) might aid regulating the population of the invasive species.

We found that vegetation traits, such as tree and shrub cover, could be managed for controlling occupancy dynamics of the House Sparrow within the area. Still, we acknowledge that other unmeasured habitat traits might affect the occupancy dynamics of the species. In this sense, the availability of urban infrastructure (e.g., light poles, walls) and buildings could be important, given that the House Sparrow heavily depends on them as nesting sites (Kalinoski 1975; Indykiewicz 1991; Cordero 1993; Kanaujia et al. 2014). Given that the House Sparrow exhibits outstanding behavioral plasticity (Anderson 2006; Bednarczuk et al. 2010), site-specific assessments must be performed to identify the landscape and the habitat traits affecting the occupancy dynamics of the species in other natural protected areas. Furthermore, future studies could benefit from evaluating the habitat use of the House Sparrow when they are not active, to compare them with periods of time in which they are more active and provide robust management guidelines for this species.

Through this study, we provided a cost-effective approach within relatively quick time frames for identifying feasible and practical habitat management actions to control an invasive species within a natural protected area. Proposed guidelines were focused on identifying susceptible sites to invasion (i.e., sites proximate to developed areas) and managing habitat characteristics (i.e., tree and shrub cover) that impact the processes determining the establishment and persistence of the invasive species (Bogich and Shea 2008; Lenda et al. 2010). Moreover, recommended actions do not include direct methods for removing the species (e.g., trapping, shooting), which might be useful for ameliorating costs and avoiding social repudiation. Multi-season occupancy modeling was useful for identifying landscape and habitat selection traits of the invasive species and defining management strategies for controlling its population. Our approach might be replicated for different species and other natural protected areas, to enhance the conservation value of reserves and provide more alternatives when dealing with invasive species.

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Authors' contribution All authors contributed to the study conception and design. Material preparation and data collection were performed by GAR-C; analyses were performed by RO-A. The first draft of the manuscript was written by both authors. Both authors read and approved the final manuscript.

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Declarations

Conflict of interest The authors declare no conflict of interest.

Consent for publication The publication of this study has been approved by all authors.

Data availability Datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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