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Role of corvids and foxes in predation on artificial nests of the common pheasant (*Phasianus colchicus*) in urban and agricultural environments

Abstract. Given the numerous factors negatively affecting small game populations, including ground-nesting birds, it is important to assess the potential impact of individual predators on the breeding success of these species. The study aimed to determine the predation pressure of corvids (Corvidae) and the red fox (*Vulpes vulpes*) on artificial nests of the common pheasant (*Phasianus colchicus*) in urban and agricultural areas using artificial nest experiments. The study was conducted in urban and agrarian areas from 2024 to 2025. A total of 60 artificial nests were analysed. The nests were located in typical pheasant breeding habitats, such as urban thickets, allotment gardens, field margins, fallow lands, and mid-field woodlots. In urban areas, the main predator responsible for nest destruction was the Eurasian magpie (*Pica pica*), accounting for 72% of destroyed nests. In agricultural landscapes, most nest damage was caused by the red fox (*Vulpes vulpes*), responsible for 66% of cases. The differences in the composition of predator groups between habitats indicate that landscape structure and the degree of human transformation determine both the composition and intensity of predation pressure, and consequently, the level of risk to pheasant nesting success.

Keywords: common pheasant, artificial nest, predator pressure, corvids, red fox

INTRODUCTION

The common pheasant (*Phasianus colchicus*), like other small game species, is exposed to the adverse effects of environmental changes such as agricultural intensification, landscape simplification and the expansion of monocultures [Czyżowski et al. 2017, Ponce et al. 2018, Kamieniarz 2022]. These

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changes reduce the availability of suitable nesting habitats, decrease cover, and increase predation pressure. Such factors can negatively affect reproductive success and, consequently, population size, particularly in ground-nesting bird species. Female pheasants lay their eggs in small ground depressions and incubate them alone for approximately 24–25 days [Bazewicz and Czyżowski 2019]. Ground nests are also threatened by synanthropic predators such as stray and free-roaming cats and dogs [Flis and Rataj 2019], as well as by corvids (Corvidae) such as the Eurasian magpie (*Pica pica*) [Czyżowski et al. 2006, Sage and Aebischer 2017, Capstick et al. 2019]. Nest predation is one of the main factors limiting populations of ground-nesting birds [Pass et al. 2019, Matysioková and Remeš 2024, Palencia and Barroso 2024]. Therefore, monitoring the impact of specific threats, especially predators, is justified. One method used for this purpose involves artificial nest experiments [Krüger et al. 2018]. Although such nests do not perfectly reflect the natural conditions of nesting birds, they help identify potential nest predators and areas at risk [Major and Kendal 1996]. Artificial nests also allow for repeatable observations, although destruction rates may differ from those of natural nests due to differences in egg size, colour, scent, or the absence of incubating birds, which in nature provide camouflage and scent masking [Burke et al. 2004]. Comparing urban and rural sites also helps assess synurbization processes – the adaptation of wildlife to urban environments – which is becoming increasingly widespread [Luniak 2004, Ditchkoff et al. 2006].

This study aimed to assess the predation pressure of corvids (Corvidae) and the red fox (*Vulpes vulpes*) on artificial nests of the common pheasant (*Phasianus colchicus*) in urban and agricultural areas.

MATERIALS AND METHODS

The study was conducted over two breeding seasons (2024–2025). Each year, 15 artificial nests were established in agricultural areas and 15 in urban areas. Each nest consisted of four small brown-shelled chicken eggs and one plasticine egg placed in a ground depression. Nests were randomly distributed, although the selection of sites took into account the presence of concealing vegetation to simulate natural nest locations. The nests were established between late April and early May in areas with known pheasant presence. The study area encompassed the city of Lublin and its surrounding areas, as well as the two rural communes of Mełgiew and Turobin. In urban areas, nests were placed in allotment gardens, a city park, and meadows near the Bystrzyca River. In rural areas, they were located in meadows, fallow lands, and mid-field woodlots. Each study area covered approximately 500 hectares, and the average distance between nests was 400 meters. Each nest was checked four times at weekly intervals. During each inspection, the number of damaged eggs, visible predator tracks, eggshell damage patterns, droppings, scent traces, and direct observations of predators were recorded. Every third nest was randomly selected for video monitoring. The degree of predation was expressed as the percentage of damaged eggs per nest.

Statistical analysis

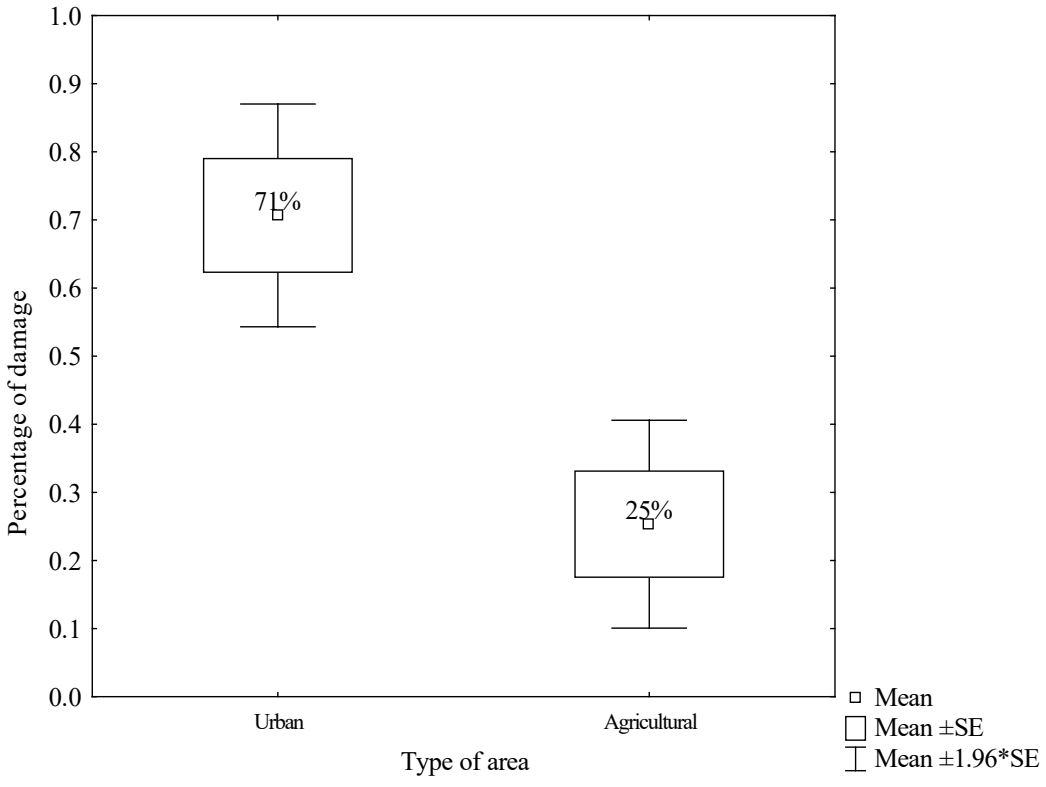
Differences in destruction rates (%) between urban and agricultural sites were tested using the non-parametric Mann–Whitney U test. The influence of environmental and spatial factors on nest destruction (%) was assessed using a linear mixed model (Mixed Model ANOVA) in Statistica 13.1. The dependent variable was the percentage of nest destruction. Fixed effects included nest location and predator species/cause of damage. Covariates included distance from single buildings, villages/compact housing, field–forest boundaries, magpie nests, and the number of magpies observed near nests.

All continuous variables were standardised ($z = (x–\mu)/\sigma$). Nest ID was treated as a random effect. Results were presented as F-values and corresponding p-values.

RESULTS

The analysis of the mean percentage of nest destruction showed that nests located in urban areas were destroyed significantly more often (mean 71%) than those in agricultural areas (mean 25%), as in Figure 1. The difference, assessed using the non-parametric Mann-Whitney U test, was statistically significant. These results are consistent with the mixed-model analysis, which also revealed a significant effect on the destruction rate ($F_{5,18} = 3.07$, $p = 0.036$), as in Table 1. This difference indicates that urban or suburban environments are characterised by higher predation pressure on artificial nests. This effect may result from the higher abundance of synanthropic predators – species well adapted to human presence, such as the Eurasian magpie (*Pica pica*), which are more common near human settlements. These species benefit from the abundance of food and convenient shelter sites near human habitation, which may increase the frequency of their visits to the nest surroundings.

Figure 1. Comparison of destruction rates (%) among artificial nests located in urban and agricultural areas during the study period



U Mann-Whitney test Z = 3.125, p = 0.0018

The mixed-model analysis revealed that the strongest factor influencing the percentage of destroyed nests was proximity to individual buildings – nests located closer to buildings were more likely to be damaged. This may reflect higher predator activity near human settlements or easier access to the nests. The percentage of destroyed artificial nests was significantly related to the distance from individual buildings ($F_{1,18} = 17.57$, $p < 0.001$) and nest location ($F_{5,18} = 3.07$, $p = 0.036$), as in Table 1.

The effect of predator species was close to statistical significance ($F_{2,18} = 2.80$, $p = 0.087$), suggesting that different predator types may have contributed to nest destruction to varying degrees.

Other spatial variables, including distance from villages or compact buildings, distance from field–forest boundaries, distance from magpie nests, and the number of magpies near nests, showed no significant effects ($p > 0.05$).

Table 1. Results of the analysis of variance (ANOVA) for the mixed model with fixed and random effects, analysing the influence of selected environmental components on the percentage of destroyed artificial nests

Variable	Efect	MS	F	p
Distance from individual buildings	covariates	0.422	17.573	0.001*
Distance from the village or compact buildings	covariates	0.007	0.286	0.599
Distance from the field/forest boundary	covariates	0.075	3.112	0.095
Distance from magpie nest	covariates	0.016	0.651	0.430
Number of magpies	covariates	0.030	1.270	0.274
Nest location	fixed	0.074	3.066	0.036*
Cause or predator of the damage	fixed	0.067	2.798	0.087
Nest no.	random	0.024		

*significant for $p \leq 0.05$

Although the mixed model showed only a moderate effect of predator species, some differentiation was observed.

In urban environments, the dominance of corvids, such as the magpie (*Pica pica*), is typical of anthropogenic landscapes (Figure 2). This species is well-adapted to human presence, and its abundance and foraging activity increase in built-up areas. The high proportion of nest destruction caused by corvids in urban environments (72%) suggests that these birds are the primary nest predators in urbanised landscapes. In contrast, the most frequent predator in agricultural landscapes was the red fox (*Vulpes vulpes*, 66%), a typical ground predator of open habitats. Its predominance in rural environments reflects habitat structure and easier access to nests placed close to the ground. The relatively small share of corvids (18%) in agricultural areas suggests that the activity of avian predators there is more scattered and limited by the lower availability of suitable observation points.

Unidentified cases of destruction (16%) in agricultural habitats may have resulted from the absence of clear feeding traces or from predation by other, less common species (e.g. martens or hedgehogs), whose presence was difficult to confirm.

The dominant predator type depended on habitat structure and the degree of anthropogenic influence (Figure 3). In habitats strongly associated with human activity, such as urban parks or allotment gardens, the primary predators were corvids (Corvidae), which are well-adapted to urban environments. Their presence is related to high availability of food resources and convenient observation points (e.g. trees, lamp posts, fences). The high percentage of nest destruction caused by corvids in urban habitats (67–100%) supports their dominant role in nest predation within urban landscapes. In contrast, in more natural or semi-natural habitats such as wastelands and forests, red foxes predominated, accounting for 100% and 75% of nest destruction, respectively. This reflects their preference for areas with denser vegetation and less human presence, where they can move freely and track scents. Meadows and field margins represented transitional habitats – here, both predator groups co-occurred. Corvids predominated on meadows (89%), while on field margins the contribution of different

predators was more balanced, with a high percentage of unidentified cases (46%). This suggests that margins may serve as zones of overlapping activity for both ground and avian predators, whose traces are often difficult to distinguish.

Figure 2. Percentage share of identified nest predators in the compared environments

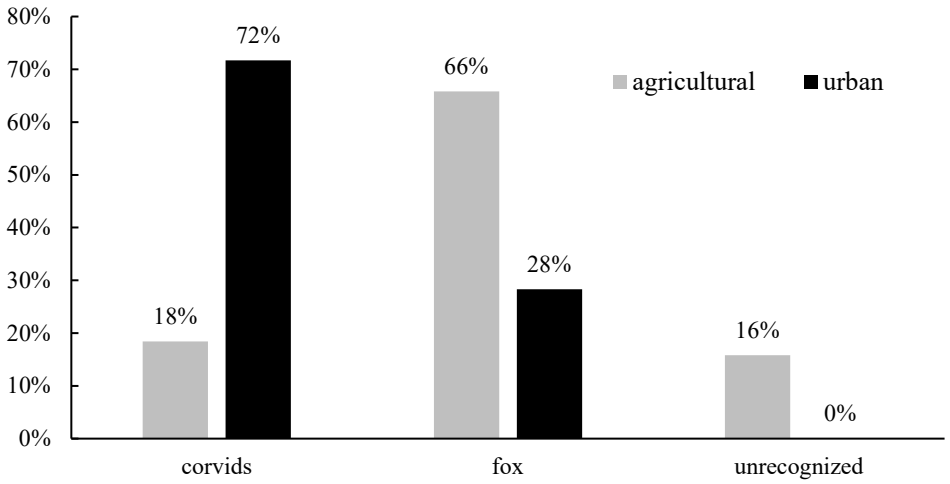
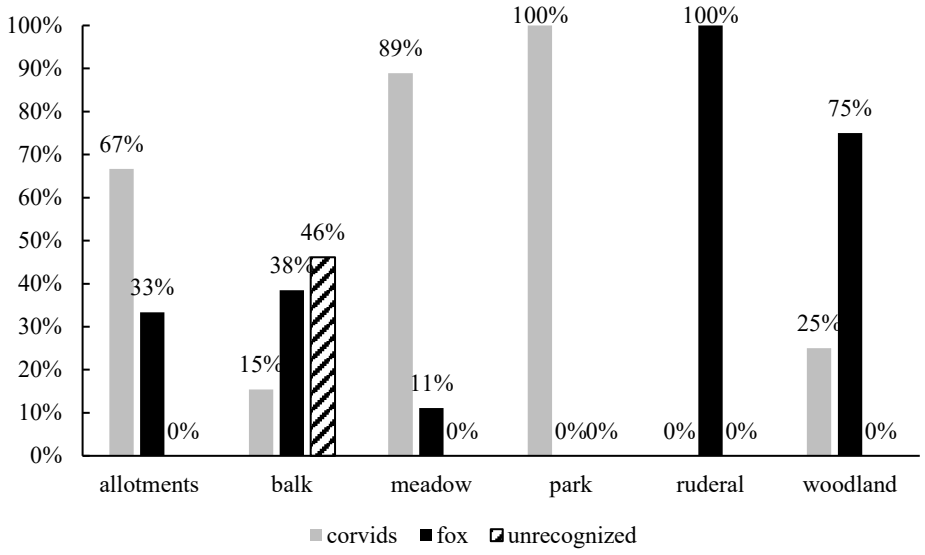


Figure 3. Proportion of predators responsible for nest destruction by habitat type



DISCUSSION

Our study clearly demonstrates significant differences in predation pressure between urban and agricultural habitats. Corvids, especially the Eurasian magpie, were the main nest predators in urban areas, whereas on farm areas the red fox predominated. These results align with previous findings from Poland [Bazewicz and Czyżowski 2019, Czyżowski et al. 2025] as well as other studies [Capstick et al. 2019, Morozov 2022, Jokimäki and Kaisanlahti-Jokimäki 2025]. Pheasants, which often occupy ecotone

zones at habitat edges during the breeding season, are particularly vulnerable to opportunistic predators such as foxes and corvids [Storch et al. 2005, Draycott et al. 2008, Šálek et al. 2010].

The observed habitat-based differences suggest that landscape structure and the degree of urbanisation significantly influence predator composition and predation risk. Synurbization – the adaptation of wild species to urban environments – is now a well-documented ecological process [Luniak 2004, Ditchkoff et al. 2006, Kurucz et al. 2021]. Species such as magpies benefit from abundant food sources and numerous vantage points (trees, lamp posts, fences), which facilitate nest detection [Jokimäki and Kaisanlahti-Jokimäki 2025].

The high destruction rate in urban habitats (mean 71%) confirms the successful adaptation of corvids to urban conditions. Their opportunistic foraging patterns, high intelligence, and problem-solving ability make them effective nest predators [Dupak and Telizhenko 2023]. In contrast, the red fox – a typical terrestrial predator of open areas – was responsible for most nest losses in rural habitats [Baker et al. 2006].

The significant effect of proximity to individual buildings on nest destruction suggests that anthropogenic infrastructure indirectly increases predation pressure by attracting synanthropic predators such as magpies, foxes, and cats [Morozov 2022, Ma et al. 2025]. Although the number and distance of magpie nests were not statistically significant, these variables may not accurately capture foraging intensity, which depends on food availability and vegetation structure [Sage and Aebischer 2017, Capstick et al. 2019].

The differences in predator composition between habitats highlight the need for habitat-specific management strategies to protect pheasant nests. In urban areas, measures limiting corvid access to nesting sites (e.g. vegetation management) may be more effective. In contrast, in rural areas, efforts should focus on controlling terrestrial predator populations, particularly foxes [Benmazouz et al. 2021].

SUMMARY AND CONCLUSIONS

The results indicate that predation pressure on artificial pheasant nests was significantly higher in urban than in agricultural areas. The most important environmental factor influencing nest destruction was proximity to buildings, confirming the role of anthropogenic elements in shaping predator activity. In urban landscapes, corvids – especially the highly synurbized Eurasian magpies (*Pica pica*) – were the dominant predators, whereas in rural areas, the red fox (*Vulpes vulpes*) was the prevailing species. The variation in predator groups between habitats demonstrates that landscape structure and the degree of human modification determine predator composition and intensity, thus influencing the breeding success of the common pheasant. These findings emphasise the importance of considering spatial and urbanisation factors when assessing causes of reproductive failure in ground-nesting bird species.

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