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NESTING BEHAVIOUR OF BIRDS ON TRANSMISSION TOWERS AND POWER LINES

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ABSTRACT

Power infrastructure, which includes transmission lines, wires, mobile phone towers, and power towers, is a distinctive anthropogenic structure in terms of material composition, design, and continuity that provides avian animals with artificial habitat for breeding and roosting. The purpose of this study was to determine the variety, quantity, and behavior of birds that use power structures as man-made habitat. Across various species and regions, birds are increasingly utilizing transmission towers as nesting sites, a trend driven by habitat degradation and the availability of these man-made structures as alternative nesting locations Elevated vantage points and reduced threats from ground predators make these towers attractive to certain bird species. However, this behavioral adaptation poses risks both to avian populations and to power infrastructure. As natural habitats such as wetlands, forests, and farmland are rapidly replaced by urban infrastructure—roads, bridges, power lines, and communication towers—the ecological dynamics shift accordingly. While some structures inadvertently support wildlife by providing shelter and breeding spaces, their proliferation raises concerns about long-term environmental impacts.

Keywords: transmissions towers and power lines

INTRODUCTION

Birds are a diverse and highly specialized group of warm-blooded vertebrates belonging to the class Aves, with over 11,000 recognized species distributed worldwide. A distinct set of characteristics distinguishes them from every other group of animals. Francis Willughby and John Ray created the first bird classification in their 1676 book Ornithologeae. (Blem, 1994). In 1758, Carl Linnaeus revised that work to create the current taxonomic classification scheme. According to Linnaean taxonomy, birds belong to the biological class Aves. Aves is classified as an infraclass or, more recently, a subclass or class in the clade Theropoda according to phylogenetic taxonomy.

A key component of birds' reproductive biology, nesting behavior has a direct impact on both survival and the success of reproduction. Due to ecological and evolutionary factors, birds display a remarkable range of nesting methods, including differences in nest layout, site selection, construction materials, and parental care. (Healy et al., 2023) (Perez et al., 2023). In addition to providing a proper microclimate for incubation and development, birds build nests for a variety of reasons, chief among them being the protection of eggs and chicks from predators and environmental threats (Perez et al., 2023). (Healy et al., 2023). A "good" nest's architecture varies greatly depending on the species and reflects adaptations to the local climate, habitat, and life history characteristics. For instance, some species use trees to make open cup nests, while others use cliffs, ground sites, or man-made structures, or they build domed or cavity nests. Utilizing a variety of materials, including twigs, leaves, grasses, feathers, mud, and even man-made objects like wire and plastic, shows both behavioral flexibility and inventiveness.

Across many species and geographical areas, birds have become more accustomed to using transmission towers as nesting sites (Liu & Li, 2024). The availability of these structures as substitute nesting locations and habitat degradation are the main causes of this change. Some bird species are drawn to transmission towers because of their elevated vantage locations and relative safety from ground predators. Nevertheless, this adaptability puts the power infrastructure and the birds at risk. (Ren et al., 2015) Buildings, roads, bridges, power lines, and cell phone towers are among the metropolitan infrastructure that are quickly being replaced. The natural formations, such as marshes, woods, and agricultural areas, every day. These buildings occasionally help wildlife (such as birds and mammals) by offering locations for breeding, roosting, and shelter. (Noreen, 2021).

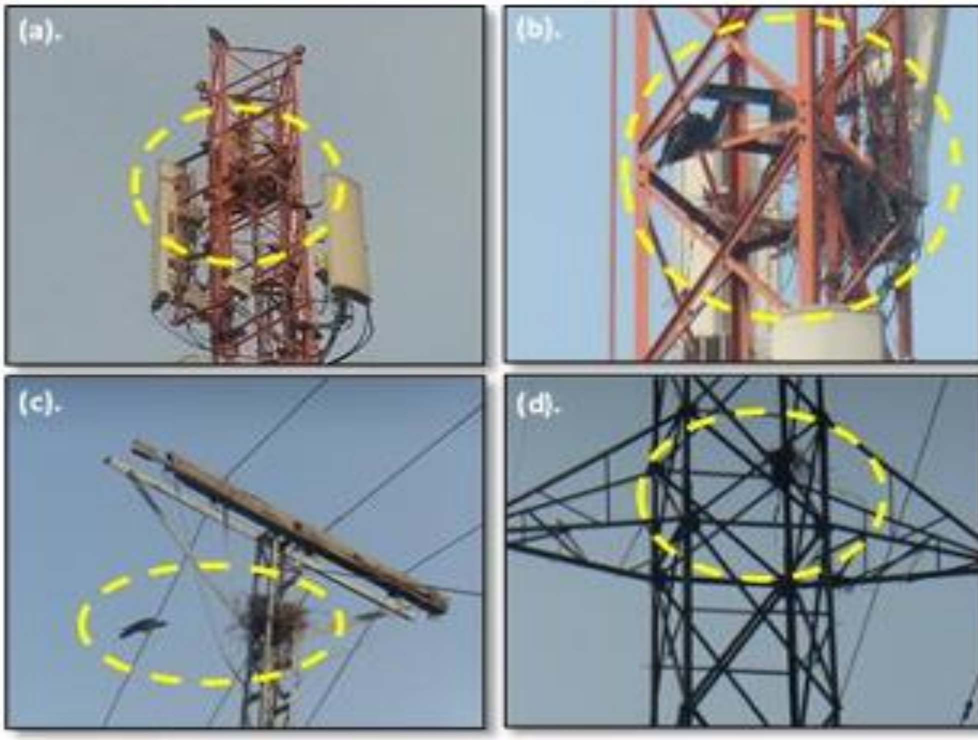

Fig. 1 Mobile phone tower (a & b), transmission line (c) and electricity tower (d) and are being used by local avifauna, as an alternative habitat due to absence of tall trees in the urban area (Noreen, 2021).

ECOLOGICAL BENEFITS ON NESTING ON TOWERS

Bird species can benefit ecologically from nesting on towers and other man-made structures, especially in urban settings. These buildings offer substitute habitats that can improve survival and reproductive success rates, particularly as urbanization reduces natural habitats. Key ecological benefits of nesting atop towers are described in the following sections. Research shows that as compared to conventional natural substrates, birds that nest on man-made structures like rooftops and cellular towers frequently have higher nest success rates. For example, when nesting on artificial platforms, the pale-breasted thrush had a greater daily survival rate and fledgling success (Batisteli et al., 2024). Towers and transmission lines offer elevated, open locations that provide birds with a commanding view of their surroundings, helping them detect and avoid predators. This makes these sites attractive as nesting spots compared to trees or ground locations that may be more accessible to threats. Predation risk may be decreased by elevated nesting locations on transmission wires and towers. These buildings are frequently chosen by raptors and other birds to evade predators on the ground. Because transmission towers are less accessible to predators, Prairie Falcons, for example, have been observed to successfully nest there (Roppe et al., 1989). In regions where there are few natural nesting substrates, like as trees or cliffs, towers and transmission lines offer raised structures that make excellent nesting locations. For instance, in areas without trees, the Eurasian Kestrel has been seen building its nests atop electricity line pylons (Kolnegari et al., 2020). Similarly, over the past three decades, the percentage of White Stork nests on electricity pylons has increased from 1% to 25% (Moreira et al., 2017; Tryjanowski et al., 2009). Tower and transmission line height can create a microclimate that is conducive to bird breeding.

Compared to ground-level nests, elevated locations might provide superior insulation, defense against severe weather, and lower humidity (Reynolds et al., 2019).

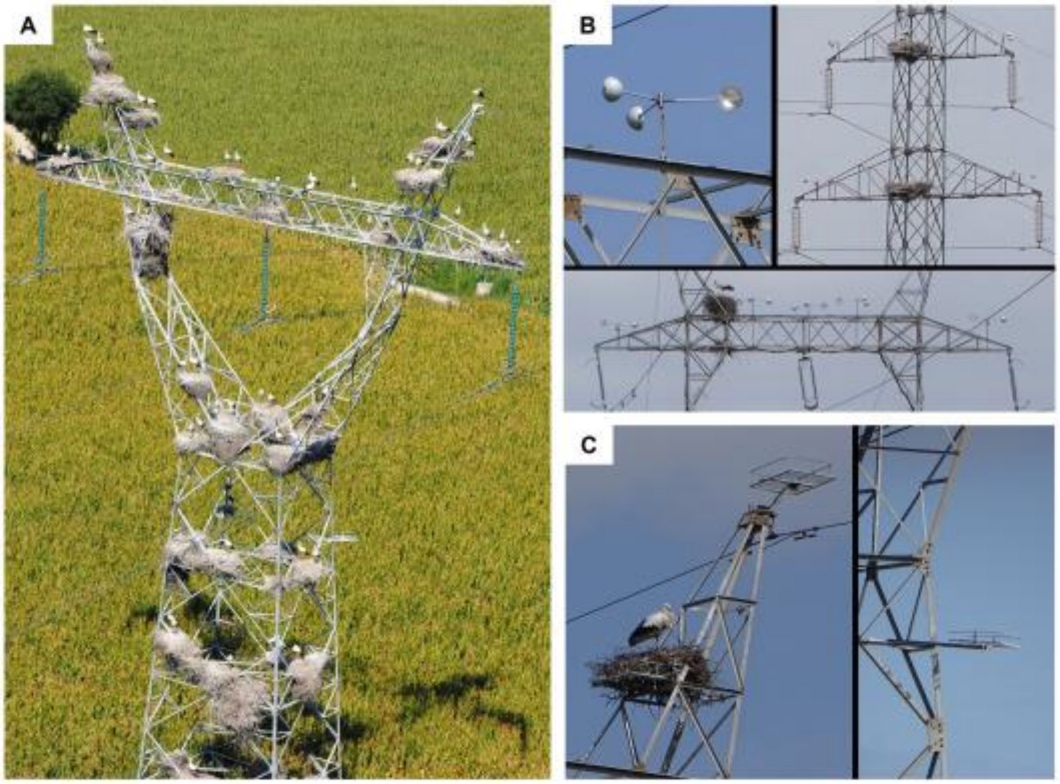

Fig. 2. A: Example of a REN's transmission pylon heavily colonized by nesting white storks (with more than 40 nests); B: The most used anti-perching device by REN, a metallic structure with three-cup configuration that spins horizontally with wind (both in detail and in the context of its installation in two types of pylons, to show their typical position, above insulators); C: Representation of the typical locations were nesting platforms are installed (on the mid-level or on top of the earth-wire support and on the sides of the pylon base). (Moreira et al., 2022).

BEHAVIORAL PATTERNS INFLUENCING NESTING ON TRANSMISSION TOWERS AND POWER LINES

Urbanization and habitat loss are the main causes of the notable change in avian habitat preferences that may be seen in the behavioral patterns affecting nesting on towers and transmission lines. Numerous studies show that, frequently as a result of the lack of natural nesting locations, birds are increasingly using these man-made buildings for nesting. Concerns are raised about how this tendency may affect electric infrastructure and bird populations. The use of towers and transmission lines for nesting is a reflection of the growing adaption of birds to human-modified landscapes. Birds now have more options to use these structures as nesting locations due to urbanization and the growth of electricity infrastructure (Reynolds et al., 2019) (Tomasevic & Marzluff, 2017). Certain bird species are territorial, and towers and transmission lines are desirable for establishing territories due to their prominence and visibility. For instance, these structures are frequently used by raptors as vantage points for nesting and hunting (Steenhof et al., 1993).

SPECIES PREFERENCES OF NESTING ON TRANSMISSION TOWERS AND POWER LINES

A notable change in the use of avian habitat, frequently due to urbanization and habitat loss, can be seen in the nesting choices of different bird species on transmission towers and power lines. Research shows that, with differing degrees of success and difficulty, these man-made buildings are important nesting locations for a number of species. The following sections discuss major studies related to species preferences and nesting practices.

24 bird species from 16 families were found to nest on electricity buildings in Gujranwala, Pakistan; the most common nester on transmission lines and cell phone towers was the Black kite (Noreen, 2022). Similar nesting patterns on power transmission towers have been reported in Kamchatka, while specific species information is lacking (Лобков, 2023). Within ten years of a 500-kV line's completion, 133 pairs of raptors and common ravens had taken up residence along it in southern Idaho and Oregon (Steenhof et al., 1993). In Tamil Nadu, the Baya Weaver has demonstrated a great predilection for building its nests on power and television lines, even though there are natural nesting places nearby. Baya Weavers exhibit flexibility in material sourcing by using fibers from sugarcane leaves to construct their nests. (Pandian, 2024) (Pandian, 2022). Raptors and common ravens have also adapted to nesting on electrical transmission towers, indicating a rapid colonization of these structures due to limited natural nesting options (Steenhof et al., 1993). Common mynas and house crows favor lower electricity towers, whereas black kites typically nest on high structures like transmission lines (Noreen, 2022).

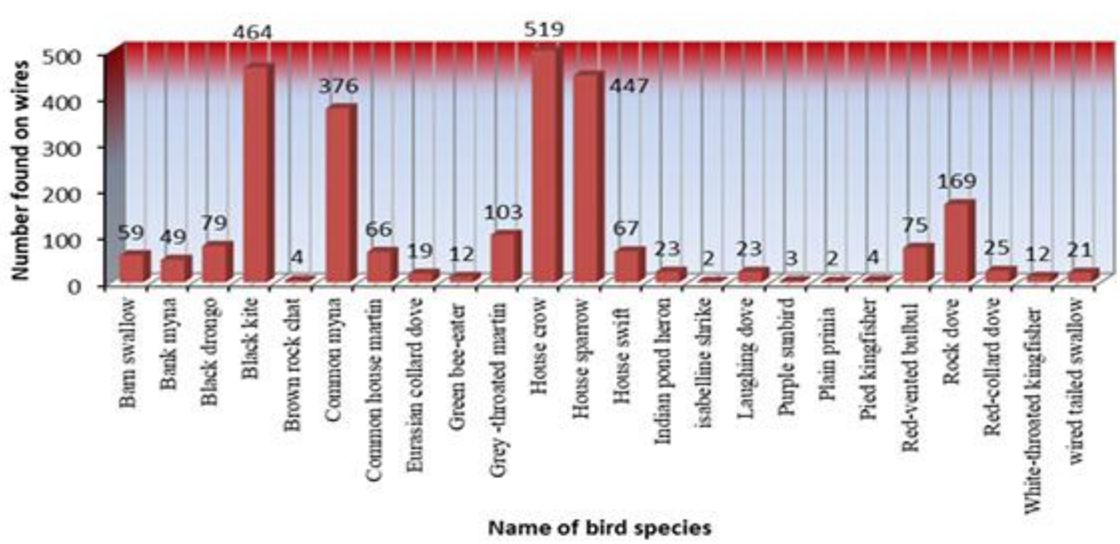

Fig. 3 Total number of avian species found on the power structures (electricity towers, mobile phone towers, wires and transmission lines) (Noreen, 2021)

IMPACTS AND RISKS

Bird nesting on power wires and transmission towers poses serious threats as well as ecological potential. These constructions endanger both electrical infrastructure and bird populations, even though they offer different homes for different bird species. The effects and dangers of this occurrence are described in the sections that follow. Bird-related equipment damage and power outages have significant economic ramifications. Due to the high costs of eagle-related power line failures in South Africa, management techniques have been put in place to lessen these effects while still allowing for eagles (Jenkins et al., 2013). Similar operational and financial challenges have been faced by power providers in Spain as a result of the removal of white stork nests from transmission pylons (Burdett et al., 2022). Bird nests can pose serious risks, such as short circuits that result from bird droppings spanning electrical components and causing power outages. (Durgapersad et al., 2025). In addition, nests may cause insulator flashovers in inclement weather, endangering the dependability and safety of electrical lines (Huo et al., 2023). Power companies may have operational difficulties as a result of nesting birds like the white stork, such as higher maintenance expenses and power disruptions brought on by nest removal.

Environmental factors, such proximity to foraging sites, affect the possibility of nesting on pylons, which might intensify tensions between energy infrastructure management and wildlife protection (Burdett et al., 2022). There is also a chance that birds nesting on electricity cables could get electrocuted. This is especially true for species that construct their nests on grounded constructions like steel crossarms and concrete. While nesting on distribution lines in Iran, passerines, including Eurasian Kestrels, have been electrocuted. Nest box placement reduced the rate of electrocution per nest for Eurasian Kestrels, although the risk is still high (Kolnegari et al., 2020). One of the main causes of death for huge raptors such as vultures and eagles in southern Africa is electrocution. Because birds may come into touch with energized conductors when nesting or roosting, the design of electrical structures frequently makes this risk worse (Ledger & Hobbs, 1999). Fire dangers might also arise from nesting activity. Metal wire, which conducts electricity and can start fires, is frequently incorporated into bird nests. For instance, metal wire is commonly found in Chihuahuan Raven nests atop H-frame transmission facilities in Colorado, raising the possibility of fires and power disruptions (Dwyer & Leiker, 2012).

Worley, D. (2023, July 21). *Mama bird frantically circled overhead as nest burns atop Utah power pole, firefighters say*. Gray News. https://www.wkyt.com/2023/07/21/baby-birds-killed-when-nest-catches-fire-power-pole-authorities-say/.

MIGRATION STRATERGIES

Bird migration tactics vary and are impacted by a number of biological and ecological variables. These tactics, which reflect adaptations to resource availability and environmental conditions, can differ greatly between species and even within populations. Predicting how the ecosystem will react to changes and conservation efforts depend on an understanding of these tactics. These man-made structures, which offer alternate habitats in populated areas, have led to the adaptation of birds to nest on power lines and towers. Habitat destruction and the availability of adequate nesting spots are the main factors driving the transition from natural nesting sites, such trees, to these man-made structures. The complicated link between avian species and human infrastructure is shown by the documentation of this adaptation in a variety of geographical areas. The main reason why birds move from trees to towers and power wires is because of habitat degradation and the fact that these buildings provide other nesting locations. The loss of natural habitats like trees and the growing visibility of power infrastructure, which offers appropriate nesting sites, are the main causes of the change. Numerous bird species are adjusting to anthropogenic surroundings as part of this shift, which is seen in different places. Due to a shortage of alternative nesting substrates, raptors and ravens in southern Idaho and Oregon started building their nests atop transmission line towers, demonstrating a quick adaptation to the artificial structures that were readily available (Steenhof et al., 1993). Birds like the House crow and Black kite are drawn to the continuous and lofty nesting grounds provided by power lines and towers. These buildings offer a foraging vantage point and protection from ground predators. (Noreen, 2022). Despite the possibility of human-wildlife conflict, white storks in southwestern Spain are increasingly using pylons for nesting, particularly close to feeding sites like landfills and water bodies (Burdett et al., 2022).

CONCLUSION

Bird nesting on towers and transmission wires has a variety of negative effects, from equipment damage and power outages to hazards to human and bird safety. However, a combination of perch deterrents, nesting platforms, anti-nesting devices, and design changes can lessen these effects. Power companies can lessen the dangers of bird nesting and aid in bird population conservation by putting these methods into practice. Using anti-nesting devices is one practical way to lessen the effects of bird nesting on electrical lines. To prevent birds from building their nests in dangerous locations, these devices can be mounted atop pylons. To deter Chihuahuan Ravens from nesting, for instance, new nest diverters were installed on H-frame transmission facilities in Colorado. Nesting attempts on treated structures significantly decreased, which was a positive outcome (Dwyer & Leiker, 2012). On appropriate pylons, several power providers have placed nesting platforms in addition to anti-nesting devices. By giving birds a secure location to nest, these platforms lower the possibility of equipment damage and power outages. These platforms, which are intended to reduce the risk of electrocution and structural damage, have been promoted for use by white storks in Spain (Burdett et al., 2022). Perch deterrents, which can be positioned above conductors on nest pylons and other high-risk structures, are a further tactic. By discouraging birds from perching on the structures, these deterrents lower the possibility of malfunctions and electrocution. As part of a comprehensive management plan to decrease eagle-related faults, perch deterrents were placed on power lines in South Africa (Jenkins et al., 2013). An further crucial step in lowering the risk of electrocution is the insulation of hardware and wires. The number of bird electrocutions in Hungary has dramatically decreased when bird-safe crossarms were installed on pylons. The purpose of these crossarms is to keep birds away from electrical lines (Fidlóczky et al., 2014). In certain situations, the dangers of bird nesting can be reduced by altering the design of power line structures. For instance, in order to stop bird droppings from triggering flashovers on composite insulators, researchers in China have created bird-proof baffles. It has been demonstrated that these baffles lessen the electric field strength close to the insulators, lowering the possibility of failures caused by birds (Wang et al., 2024).The number of nests constructed directly on power lines has decreased in Iran as a result of the placement of nest boxes on power poles, reducing the possibility of electrocution and equipment damage. For species like the Eurasian Kestrel, it has also been demonstrated that the use of nest boxes increases the number of successful nests (Kolnegari et al., 2020).

REFRENCES

1. Batisteli, A. F., Sarmento, H., & Pizo, M. A. (2024). Anthropogenic nesting substrates increase parental fitness in a Neotropical songbird, the pale-breasted thrush *Turdus leucomelas*. *Journal of Avian Biology*. https://doi.org/10.1111/jav.03240

2. Blem, C. R. (1994). Handbook of the Birds of the World. Volume 1: Ostrich to Ducks. The Wilson Journal of Ornithology, 106(3), 575.
3. Burdett, E., Muriel, R., Morandini, V., Kolnegari, M., & Ferrer, M. (2022). Power Lines and Birds: Drivers of Conflict-Prone Use of Pylons by Nesting White Storks (Ciconia ciconia). *Diversity*, *14*(11), 984. https://doi.org/10.3390/d14110984
4. Clements, S. J., Loghry, J. P., Linscott, J. A., Ruiz, J., Gunn, J. C., Navedo, J. G., Senner, N. R., Ballard, B. M., & Weegman, M. D. (2025). Migration strategy and constraint in migration behavior vary among shorebird species with different life histories. *Ecosphere*, *16*(1). https://doi.org/10.1002/ecs2.70161
5. Durgapersad, K., Beutel, A., & Mahatho, N. (2025). Literature Review on Mitigation Measures for Bird Electrocutions Occurring Due to Streamers on Transmission Power Lines. *Birds*, *6*(1), 5. https://doi.org/10.3390/birds6010005
6. Dwyer, J. F., & Leiker, D. L. (2012). Managing Nesting by Chihuahuan Ravens on H-Frame Electric Transmission Structures. *Wildlife Society Bulletin*, *36*(2), 336–341. https://doi.org/10.1002/WSB.129
7. Fidlóczky, J., Bagyura, J., Nagy, K., Szitta, T., Haraszthy, L., & Tóth, P. (2014). Bird conservation on electric-power lines in Hungary: Nest boxes for saker falcon and avian protection against electrocutions. Projects' report. *Slovak Raptor Journal*, *8*(2), 87–95. https://doi.org/10.2478/SRJ-2014-0010
8. Hall, L., Latty, C., Warren, J., Takekawa, J., & De La Cruz, S. (n.d.). Contrasting migratory chronology and routes of Lesser Scaup: implications of different migration strategies in a broadly distributed species. *Journal of Field Ornithology*. https://doi.org/10.5751/jfo-00402-950108
9. Healy, S. D., Tello-Ramos, M. C., & Hébert, M. (2023). Bird nest building: visions for the future. *Philosophical Transactions of the Royal Society B Biological Sciences*, *378*(1884). https://doi.org/10.1098/rstb.2022.0157
10. Huo, Y., Fu, Z., Zhang, Y., Li, F., & Liu, C. H. (2023). *The quantitative evaluation framework for non-structural hazards to transmission tower caused by bird nest using large images obtained by unmanned aerial vehicles*. 522–529. https://doi.org/10.1109/PandaFPE57779.2023.10141059
11. Jenkins, A. R., De Goede, K. H., Sebele, L., & Diamond, M. (2013). Brokering a settlement between eagles and industry: sustainable management of large raptors nesting on power infrastructure. *Bird Conservation International*, *23*(2), 232–246.
12. Kolnegari, M., Basiri, A. A., Hazrati, M., & Dwyer, J. F. (2020). Effects of Nest Box Installation on a Distribution Power Line: Increased Eurasian Kestrel Nesting, Reduced Electrocutions, and Reduced Electrical Faults. *Journal of Raptor Research*, *54*(4), 431–439.
13. La Sorte, F. A., Fink, D., Hochachka, W. M., & Kelling, S. (2016). Convergence of broad-scale migration strategies in terrestrial birds. *Proceedings of The Royal Society B: Biological Sciences*, *283*(1823), 20152588. https://doi.org/10.1098/RSPB.2015.2588

14. Ledger, J. A., & Hobbs, J. C. A. (1999). Raptor use and abuse of powerlines in southern Africa. *Journal of Raptor Research*, *33*(1), 49–52. https://www.biodiversitylibrary.org/part/227830
15. Liu, X., & Li, Z. (2024). Urban bird nest building on man-made structures: A review. *Zoological Research: Diversity and Conservation.*, *1*(4), 272–280. https://doi.org/10.24272/j.issn.2097-3772.2024.009
16. Moreira, F., Martins, R. C., Aguilar, F. F., Canhoto, A., Martins, J., Moreira, J., & Bernardino, J. (2022). Long-term management practices successfully reduce bird-related electrical faults in a transmission grid increasingly used by white storks for nesting. *Journal of Environmental Management*, *327*, 116897. https://doi.org/10.1016/j.jenvman.2022.116897
17. Moreira, F., Moreira, F., Encarnação, V., Rosa, G., Gilbert, N. I., Infante, S., Costa, J., D'Amico, M., D'Amico, M., Martins, R. C., Martins, R. C., Catry, I., Catry, I., & Catry, I. (2017). Wired: impacts of increasing power line use by a growing bird population. *Environmental Research Letters*, *12*(2), 024019. https://doi.org/10.1088/1748-9326/AA5C74
18. Noreen, Z. (2021). Trees to towers shift: Power lines emerging as a novel habitat for birds in Gujranwala, Pakistan. *Pure and Applied Biology*, *11*(2). https://doi.org/10.19045/bspab.2022.110063
19. Pandian, M. (2022). Nest colonies of Baya Weaver Ploceus philippinus (Linnaeus, 1766) on overhead power transmission cables in the agricultural landscape of Cuddalore and Villupuram districts (Tamil Nadu) and Puducherry, India. *Journal of Threatened Taxa*, *14*(3), 20721–20732. https://doi.org/10.11609/jott.7748.14.3.20721-20732
20. Pandian, M. (2024). Nesting habits of Baya Weaver Ploceus philippinus (Linnaeus, 1766) on power and television cables in the agricultural landscape of Kallakurichi district, Tamil Nadu, India. *Journal of Threatened Taxa*, *16*(6), 25345–25359. https://doi.org/10.11609/jott.8323.16.6.25345-25359
21. Perez, D. M., Manica, L. T., & Medina, I. (2023). Variation in nest-building behavior in birds: a multi-species approach. *Philosophical Transactions of the Royal Society B Biological Sciences*, *378*(1884). https://doi.org/10.1098/rstb.2022.0145
22. Ren, Q., Luo, S., Du, X., Chen, G., Song, S., & Du, B. (2015). Helper effects in the azure-winged magpie Cyanopica cyana in relation to highly-clumped nesting pattern and high frequency of conspecific nest-raiding. *Journal of Avian Biology*, *47*(4), 449–456. https://doi.org/10.1111/jav.00783
23. Reynolds, S. J., Ibáñez-Álamo, J. D., Ibáñez-Álamo, J. D., Sumasgutner, P., & Mainwaring, M. C. (2019). Urbanization and nest building in birds: A review of threats and opportunities. *Journal of Ornithology*, *160*(3), 841–860. https://doi.org/10.1007/S10336-019-01657-8
24. Roppe, J. A., Siegel, S. M., & Wilder, S. E. (1989). Prairie Falcon Nesting on Transmission Towers. *The Condor*, *91*(3), 711–712. https://doi.org/10.2307/1368123

25. Steenhof, K., Kochert, M. N., & Roppe, J. A. (1993). Nesting by Raptors and Common Ravens on Electrical Transmission Line Towers. *Journal of Wildlife Management*, *57*(2), 271–281. https://doi.org/10.2307/3809424
26. Tomasevic, J. A., & Marzluff, J. M. (2017). Cavity nesting birds along an urban-wildland gradient: is human facilitation structuring the bird community? *Urban Ecosystems*, *20*(2), 435–448. https://doi.org/10.1007/S11252-016-0605-6
27. Tryjanowski, P., Kosicki, J. Z., Kuźniak, S., & Sparks, T. H. (2009). Long-Term Changes and Breeding Success in Relation to Nesting Structures used by the White Stork, Ciconia ciconia. *Annales Zoologici Fennici*, *46*(1), 34–38. https://doi.org/10.5735/086.046.0104
28. Wang, W., Ma, Z., Fan, Y., Ma, J., Liu, K., Wang, Y., & Xu, H. (2024). Analysis and Protection Studies of Bird Droppings Falling on the Electric Field Distribution near the 330 kV Transmission Line V-type Composite Insulators. *IEEE Access*, 1. https://doi.org/10.1109/access.2024.3427120
29. Worley, D. (2023, July 21). *Mama bird frantically circled overhead as nest burns atop Utah power pole, firefighters say*. Gray News. https://www.wkyt.com/2023/07/21/baby-birds-killed-when-nest-catches-fire-power-pole-authorities-say/
30. Лобков, Е. Г. (2023). *Nesting of birds on power transmission towers in kamchatka*. https://doi.org/10.53657/kbpgi041.2023.86.13.029