Environmental Science & Technology Letters

pubs.acs.org/journal/estlcu

Highlight

Addressing Wildlife Exposure to Radiofrequency Electromagnetic Fields: Time for Action

Jérémy S. P. Froidevaux,* Laura Recuero Virto, Marek Czerwiński, Arno Thielens, and Kirsty J. Park

Cite This: *Environ. Sci. Technol. Lett.* 2024, 11, 3−4

Read Online

ACCESS | Metrics & More | Article Recommendations

ABSTRACT: With the rapid global expansion of mobile communication networks and the introduction of new radiofrequencies, especially above 6 GHz with the emergence of 5G/6G technology, there is an urgent requirement to investigate and tackle the possible effects of radiofrequency electromagnetic field emissions on wildlife. Here, we highlight (i) the pressing need for robust research on this topic, (ii) the inadequacy of existing guidelines from the International Commission for Non-Ionizing Radiation Protection, which solely address human health, and (iii) the lack of attention given to wildlife exposure to radiofrequency electromagnetic field levels when creating and/or restoring wildlife habitats and deploying new radiofrequency electromagnetic field sources. We call for a common worldwide agenda that would prioritize research on wildlife exposure to radiofrequency electromagnetic fields and for an independent international organization to address this issue. Finally, we provide key recommendations aimed at reducing wildlife exposure to radiofrequency electromagnetic fields while awaiting further evidence.

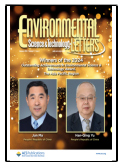
Downloaded via 173.73.27.192 on January 23, 2024 at 20:03:36 (UTC).
See https://pubs.acs.org/sharingguidelines for options on how to legitimately share published articles.

Mobile communication networks have become increasingly pervasive in the environment, in both urban and remote natural areas, leading to unprecedented wildlife exposure to radiofrequency electromagnetic fields (RF-EMFs; 100 kHz to 300 GHz).[1] RF-EMFs have the potential to exert a wide range of biological effects on wildlife,[2] ranging from reduction in bat feeding activity and the alteration of life-history characteristics in insects to morphological abnormalities in plants. Different mechanisms have been proposed that could underlie these effects, including tissue heating and microwave hearing in animals or an increase in the rate of reactive oxygen species metabolism and level of cytosolic calcium in plants. However, these studies cannot be generalized beyond the species and context studied. Moreover, population level effects are largely untested, and knowledge of multistressor effects (e.g., potential additive and synergistic effects of RF-EMF with pesticides and heavy metals) is crucially lacking. Consequently, there is an urgent need for further research to assess the extent of responses of wildlife to RF-EMF exposure.

To date, existing guidelines pertaining to exposure to RF-EMFs from mobile communication emissions, as established by the International Commission for Non-Ionizing Radiation Protection (ICNIRP), exclusively concern human health.[3] However, they are likely to be inadequate in protecting wildlife from RF-induced biological effects because the relationships among RF-EMF exposure, dosage, and outcome are expected to be species-specific; i.e., an RF-EMF exposure that exerts no biological effect in one species could have an effect in another species. In addition, the relationships between RF-EMF exposure and biological effects are unknown for most species. This is particularly true for frequencies above 6 GHz, which is, and will be, increasingly used by the commissioning of 5G and 6G technologies. Furthermore, progress in addressing this potential issue is significantly impeded by the lack of rigorous, high-quality experiments mimicking field-realistic exposure, hampering evidence-based risk assessment.[4] Consequently, the deployment of new sources of RF-EMF is seldom subjected to environmental impact assessments, and the extent of RF-EMF levels is never considered during habitat creation and restoration (Figure 1). For instance, green areas in cities are often established on rooftops with the goal of enhancing urban biodiversity, yet these locations are often near the emitting antennas in areas with high levels of radiation. Additionally, there are no measures in place to shield non-human organisms

Figure 1. (a) Towers with steel structures as a support for nests are increasingly common and set with no control for exposure effects on birds (photo by Andrea Izzotti). (b) Green areas are set up on rooftops that are often near emitting antennas (photo by Sam Aerts).

Received: November 8, 2023
Revised: December 5, 2023
Accepted: December 7, 2023
Published: December 13, 2023



ACS Publications © 2023 American Chemical Society

from relatively high exposures near emitting antennas, while such precautionary measures do exist for humans.

Unlike human exposure to mobile communications emissions, which falls under the mandate of the World Health Organization (WHO), wildlife exposure is not addressed by any supranational institution. We welcome innovations and the development of wireless technologies, but we also urge the international community to mandate an independent international organization such as the United Nations Environmental Programme or the International Union for Conservation of Nature to address wildlife exposure to RF-EMFs. We posit that the controversies around 5G/6G technology partly contribute to the creation of a "fog of distrust" and lead to inaction, which further limits the opportunities to fund research in this area. We therefore call for a common worldwide agenda that would prioritize the needs for research on wildlife exposure to RF-EMFs, similar to the WHO agenda for human exposure.[5]

Pending further evidence, we strongly recommend the implementation of complementary measures aimed at reducing wildlife exposure to RF-EMF, particularly for species of major conservation concern. First, we advocate for strategic spatial planning by aiming the emissions from mobile phone masts away from areas of wildlife conservation significance, such as optimal foraging and nesting sites. Second, emission limitation strategies should be employed, particularly for mobile phone masts that create exposure in these sensitive areas. Third, technical adjustments such as optimizing antenna orientation and installation height and implementing shielding, discouraging, or obstruction mechanisms could further contribute to reducing wildlife exposure to RF-EMF, albeit their effectiveness should first be tested. These measures should ideally be accompanied by a systematic monitoring of wildlife exposure to RF-EMF. Lastly, we suggest integrating an adaptive management approach into these strategies. This approach is adequate to address the uncertainties associated with RF-EMF effects on wildlife by systematically bolstering pertinent knowledge and mitigating risks linked to exposure. This would enable a future in which wireless technologies and wildlife can both flourish.

AUTHOR INFORMATION

Corresponding Author

Jérémy S. P. Froidevaux − *University of Stirling, Biological and Environmental Sciences, Faculty of Natural Sciences, Stirling FK9 4LA, United Kingdom; Centre d'Ecologie et des Sciences de la Conservation (CESCO, UMR 7204), CNRS, MNHN, Sorbonne-Université, 29182 Concarneau/Paris, France; University of Bristol, School of Biological Sciences, Bristol BS8 1TQ, United Kingdom;* orcid.org/0000-0001-6850-4879; Email: jeremy.froidevaux@mnhn.fr

Authors

Laura Recuero Virto − *Research Center, Léonard de Vinci Pôle Universitaire, 92916 Paris, France; La Défense & Economics Departement, École polytechnique, CNRS, IP, 91128 Palaiseau, France*

Marek Czerwiński − *Department of Grassland and Natural Landscape Sciences, Poznań University of Life Sciences, 60-632 Poznań, Poland*

Arno Thielens − *Advanced Science and Research Center, Graduate Center of the City University of New York, New York, New York 10031, United States*

Kirsty J. Park − *University of Stirling, Biological and Environmental Sciences, Faculty of Natural Sciences, Stirling FK9 4LA, United Kingdom*

Complete contact information is available at: https://pubs.acs.org/10.1021/acs.estlett.3c00795

Notes

The authors declare no competing financial interest.

Biography

Jérémy S. P. Froidevaux is a conservation biologist based at the Research Centre for Alpine Ecosystems in Chamonix Mont-Blanc (France). He is a research associate at the French Centre for Ecology and Conservation Sciences. Using emergent technologies, his research primarily focuses on assessing and understanding the mechanisms underlying the impacts of anthropogenic stressors on wildlife at multiple spatial scales. He graduated in 2018 with a Ph.D. in Conservation Biology from the University of Bristol (U.K.). He has held postdoctoral positions at INRAE in Toulouse (France), ISA in Lisboa (Portugal), and MNHN in Paris/Concarneau (France). In 2021, he was awarded a 3-year Leverhulme Trust Early Career Research Fellowship at the University of Stirling (U.K.) to assess the effects of artificial electromagnetic fields on biodiversity, in particular bats and bees.

ACKNOWLEDGMENTS

J.S.P.F. was supported by the Leverhulme Trust through an early career fellowship (award reference ECF-2020-571).

REFERENCES

(1) Bandara, P.; Carpenter, D. O. Planetary electromagnetic pollution: it is time to assess its impact. *Lancet Planetary Health* **2018**, *2*, e512−e514.

(2) Pophof, B.; et al. Biological effects of radiofrequency electromagnetic fields above 100 MHz on fauna and flora: workshop report. *Health Physics* **2023**, *124*, 31.

(3) ICNIRP. Guidelines for limiting exposure to electromagnetic fields (100 kHz to 300 GHz). *Health physics* **2020**, *118*, 483−524.

(4) Vanbergen, A. J.; et al. Risk to pollinators from anthropogenic electro-magnetic radiation (EMR): Evidence and knowledge gaps. *Sci. Total Environ.* **2019**, *695*, No. 133833.

(5) van Deventer, E.; van Rongen, E.; Saunders, R. WHO research agenda for radiofrequency fields. *Bioelectromagnetics* **2011**, *32*, 417−421.