





Electrosmog and species conservation

Alfonso Balmori 

Show more 

 Share  Cite

<https://doi.org/10.1016/j.scitotenv.2014.07.061> 

[Get rights and content](#) 

Highlights

- Studies have shown effects in both animals and plants.
- Two thirds of the studies reported ecological effects.
- There is little research in this area and further research is needed.
- The technology must be safe.
- Controls should be introduced to mitigate the possible effects.

Abstract

Despite the widespread use of wireless telephone networks around the world, authorities and researchers have paid little attention to the potential harmful effects of mobile phone radiation on wildlife. This paper briefly reviews the available scientific information on this topic and recommends further studies and specific lines of research to confirm or refute the experimental results to date. Controls must be introduced and technology rendered safe for the environment, particularly, threatened species.

Introduction

Since the introduction of wireless telecommunication in the 1990s, the roll-out of mobile phone networks has led to a massive increase in environmental exposure to electromagnetic radiation (Levitt and Lai, 2010). The existing standards of public health protection only consider the effects of short-term thermal exposure; however, biological effects resulting from electromagnetic radiation might depend on dosage, including long-term chronic effects, and there is considerable experimental evidence for non-thermal biological effects (Hyland, 2000).

Researchers have also paid little attention to the potential harmful effects of microwaves from mobile phone mast radiation on wildlife. In about two thirds of the reviewed studies ecological effects of RF-EMF were reported, at high as well as at low dosages, linking the hazards with different modes and extents of exposure (Cucurachi et al., 2013). Although the species conservation implications are unclear, current evidence indicates that chronic exposure to electromagnetic radiation, at levels that are found in the environment, may particularly affect the immune, nervous, cardiovascular and reproductive systems (Balmori, 2009). Animals exposed to radiation emissions from nearby antennas may suffer changes in the enzyme activities that disappear when they are moved away from the source (Hässig et al., 2014), and underlying plausible explanations at the cellular level have been proposed in the findings (Pall, 2013).

There are now calls for action from government agencies, both in the U.S. and Europe. In the U.S. the Director of the Office of Environmental Policy and Compliance of the United States Department of the Interior sent a letter (Feb, 2014) to the National Telecommunications and Information Administration in the Department of Commerce which addressed the Interior Department's concern about the negative impact of cell tower radiation on the health of migratory birds and other wildlife. The Interior Department accused the Federal government of employing outdated radiation standards set by the Federal Communications Commission (FCC) (United States Department of the Interior, 2014). The European Environment Agency states: «Independent research into the many unknowns about the biological and ecological effects of RF are urgently needed, given the global exposure of over 5 billion people and many other species, especially those, like bees and some birds whose navigation systems are possibly being affected by such radiations and effects on breeding of wild birds» (European Environment Agency, 2013).

The following are some of the potential effects of anthropogenic electromagnetic radiation on wildlife:

Insects and birds are extremely sensitive to electromagnetic fields. Insects use several senses to forage, detecting visual cues such as colour, shape, etc., but also floral electric fields can be discriminated by bumblebees and this sensory modality may facilitate rapid and dynamic communication between flowers and their pollinators (Clarke et al., 2013). In an electric field of **about 1V/m, the microwaves may have a disastrous impact on a wide range of insects using olfactory and/or visual memory** (i.e., on bees and ants). This experimentally generated

electromagnetic field had a realistic (and even lower) power intensity than those usually encountered by living organisms near phone masts (Cammaerts et al., 2012), and, for this reason, the **insects can be used as bioindicators to reveal biological effects from some wireless apparatus** (Cammaerts and Johansson, 2013). The audiograms and spectrograms revealed that active mobile phone handsets had a dramatic impact on the behaviour of the bees, namely, by inducing the worker piping signal (in natural conditions, worker piping either announces the swarming process of the bee colony or is a signal of a disturbed bee colony) (Favre, 2011). **The migratory birds (*Erithacus rubecula*) are also unable to use their magnetic compass in the presence of urban electromagnetic noise and fully double-blinded tests document a reproducible effect of anthropogenic electromagnetic noise on birds** (Engels et al., 2014).

A possible effect of long-term exposure to low-intensity electromagnetic radiation from mobile phone base stations on the number of house sparrows (*Passer domesticus*) was studied in Belgium and Spain and both studies reached the same conclusion: fewer house sparrows were seen at locations where electric fields were stronger (Everaert and Bauwens, 2007, Balmori and Hallberg, 2007). In large cities, such as London, a huge decline in some house sparrow populations has been found in the last 15–20 years (De Laet and Summers-Smith, 2007), so the possible relationship between this decrease and the proliferation and increase in electromagnetic radiation as one of several factors at play should be thoroughly investigated. In a study looking at factors associated with extirpation of sage-grouse (*Centrocercus* sp.), of the five variables most associated with extirpated and occupied ranges, one was the distance to base stations, and this strong association was an especially interesting result (Wisdom et al., 2011). Bat activity is also significantly reduced in habitats exposed to electromagnetic radiation, which elicit an aversive behavioural response and can be used as a possible method of discouraging bats from approaching wind turbines to prevent fatalities (Nicholls and Racey, 2007, Nicholls and Racey, 2009).

In several research conducted with different animal groups, the exposure to microwave radiations from mobile phone (GSM) base stations caused sperm head abnormalities in mammals, and the radiation from a mobile phone decreased the ovarian development in insects, the amino acid composition changed and the DNA was damaged (Otitoloju et al., 2010, Lu et al., 2010, Panagopoulos, 2012). However, other studies have not found effects on the reproductive capacity of invertebrates exposed to such radiation (Vijver et al., 2013). There are some scientific views that deny any evidence or possibility of effects on human reproduction (Lerchl, 2013), which goes against most of what has been published on this topic (Adams et al., 2014).

In the vicinity of mobile phone base stations, it is possible that microwaves are interfering with the reproduction of birds such as storks and may affect the development and increase the mortality rate of exposed amphibians (Balmori, 2005, Balmori, 2010). For instance, in chicken eggs exposed over the entire incubation period in laboratory, a significantly higher percentage of embryo mortality was observed (Batellier et al., 2008), although other studies have shown lack of adverse effects of this radiation on rat fetuses (Takahashi et al., 2009).

A very limited number of studies have addressed the effects of electromagnetic radiation on plants. The findings of these studies indicate that the effects depend on the plant family, growth stage involved and the radiation characteristics, among other factors (Jayasanka and Asaeda, 2013). High-frequency electromagnetic fields alter the chlorophyll in black locust (*Robinia pseudoacacia*) seedlings and in duckweeds (*Lemna minor*) exposed (Sandu et al., 2005, Jayasanka et al., 2013). In tomato plants (*Lycopersicon esculentum*), which were exposed to low-level (5V/m) electromagnetic fields for a short period (10min), changes were found in the abundance of three specific mRNAs after exposure, strongly suggesting that they were the direct consequence of application of radio-frequency fields (Roux et al., 2007). The similarities of the changes to wound responses suggest that this radiation is perceived by plants as an injurious stimulus and causes them cell stress in the vicinity of radio-frequency irradiating antennas (Monselise et al., 2011). On 18 February, 2011, the first symposium on this topic, "The effect of electromagnetic radiation on trees", which presented results showing disturbing effects on trees, was held in the Netherlands (<http://www.boomaantastingen.nl/> ↗).

Access through your organization

Check access to the full text by signing in through your organization.

Access through **your organization**

Section snippets

Conclusion

At the present time, there are reasonable grounds for believing that microwave radiation constitutes an environmental and health hazard. It is necessary to open specific lines of research to confirm or refute the experimental results cited above, since similar findings were obtained in studies with cattle (Hässig et al., 2014) and humans (Khurana et al., 2010, Dode et al., 2011, Gómez-Perretta et al., 2013), although some governmental reports denied that electromagnetic radiation has adverse ...

Acknowledgements

The author is grateful to J.L. Tellería, D.O. Carpenter, R. Carbonell, S. Wright and two anonymous reviewers for their help and advice. ...

[Recommended articles](#)

References (41)

J.A. Adams *et al.*

[Effect of mobile telephones on sperm quality: a systematic review and meta-analysis](#)

Environ Int (2014)

A. Balmori

[Electromagnetic pollution from phone masts. Effects on wildlife](#)

Pathophysiology (2009)

F. Batellier *et al.*

[Effects of exposing chicken eggs to a cell phone in “call” position over the entire incubation period](#)

Theriogenology (2008)

S. Cucurachi *et al.*

[A review of the ecological effects of radiofrequency electromagnetic fields \(RF-EMF\)](#)

Environ Int (2013)

A.C. Dode *et al.*

[Mortality by neoplasia and cellular telephone base stations in the Belo Horizonte municipality, Minas Gerais state, Brazil](#)

Sci Total Environ (2011)

G.J. Hyland

[Physics and biology of mobile telephony](#)

Lancet (2000)

T. Longcore *et al.*

[Avian mortality at communication towers in the United States and Canada: which species, how many, and where?](#)

Biol Conserv (2013)

H. Lu *et al.*

[Effects of low-intensity microwave radiation on *Tribolium castaneum* physiological and biochemical characteristics and survival](#)

J Insect Physiol (2010)

ARPANSA

[Review of radiofrequency health effects research – Scientific Literature 2000–2012](#)

Technical Report Series No. 164(2014)

A. Balmori

Possible effects of electromagnetic fields from phone masts on a population of white stork (*Ciconia ciconia*)

Electromagn Biol Med (2005)



View more references

Cited by (34)

Electromagnetic radiation as an emerging driver factor for the decline of insects

2021, Science of the Total Environment

Citation Excerpt :

...Although a significant impact on reproductive capacity was not found, probably because the exposure time was too short, the authors warned that more attention should be paid to the possible impacts of EMF radiation on biodiversity because the exposure to an RF-EMF is ubiquitous and is still increasing rapidly over large areas (Vijver et al., 2014). As a result of most of the studies carried out, EMF radiation can be a problem for insects and for their orientation (Balmori, 2006, 2009, 2014 and 2015), and both laboratory and field studies on different invertebrate species have shown this. Bees are highly sensitive to magnetic fields, especially for orientation and navigation, and for this reason, most of such studies have been carried out on bees....

Show abstract

Radiofrequency radiation injures trees around mobile phone base stations

2016, Science of the Total Environment

Citation Excerpt :

...But the waves reflection in the water could also influence. The results presented here lead us to conclude that damage found in the selected trees is caused by electromagnetic radiation from phone masts, as we proposed in previous studies (Balmori, 2004; Waldmann-Selsam, 2007; Waldmann-Selsam and Eger, 2013; Balmori, 2014). Interested parties are able to locate the damaged trees found in this work in Bamberg and Hallstadt with their UTM coordinates....

Show abstract

Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation

2015, Science of the Total Environment

Show abstract

Effects of non-ionizing electromagnetic fields on flora and fauna, part 1. Rising ambient

[EMF levels in the environment ↗](#)

2022, Reviews on Environmental Health

[Exposure of insects to radio-frequency electromagnetic fields from 2 to 120 GHz ↗](#)

2018, Scientific Reports

[Real versus simulated mobile phone exposures in experimental studies ↗](#)

2015, Biomed Research International



[View all citing articles on Scopus ↗](#)

[View full text](#)

Copyright © 2014 Elsevier B.V. All rights reserved.



All content on this site: Copyright © 2025 Elsevier B.V., its licensors, and contributors. All rights are reserved, including those for text and data mining, AI training, and similar technologies. For all open access content, the relevant licensing terms apply.

