

## BEES, WIRELESS & EMFS

### Pollinators at Risk

The biodiversity of insects is threatened worldwide. Mounting scientific research indicates that wireless technology and other non-ionizing electromagnetic fields (EMFs) act as a harmful stressor to insects.

### An Environmental Pollutant

Cell towers and 4G/5G network antennas emit radiofrequency (RF) radiation and high voltage powerlines emit extremely low frequency (ELF). Both are types of EMF which scientists consider a new type of environmental pollution impacting wildlife.

Ambient levels of these EMFs are increasing in wildlife habitat due to the large-scale proliferation of cell towers, 5G “small” cell towers and electrical equipment in national parks, farmland and ecologically sensitive areas.

### Experts Call For Protection

Hundreds of independent scientists are calling for protective policies to reduce environmental EMF exposure due to the growing scientific evidence linking exposure to a range of harmful biological effects.

### Defending Pollinators

Government accountability is needed. Outdated EMF regulations were not designed to protect honeybees or wildlife. Environmental agencies should update regulations and EMF mitigation measures are needed in order to safeguard pollinators, especially in ecologically sensitive areas.



**“Electromagnetic radiation should be considered seriously as a complementary driver for the dramatic decline in insects, acting in synergy with agricultural intensification, pesticides, invasive species and climate change.”**

– Alfonso Balmori (Wildlife Biologist) in “Electromagnetic radiation as an emerging driver factor for the decline of insects” published in *Science of the Total Environment* (2021)

**“There is enough evidence to indicate we may be damaging non-human species at ecosystem and biosphere levels across all taxa from rising background levels of anthropogenic non-ionizing electromagnetic fields (EMF) from 0 Hz to 300 GHz.”**

– Levitt et al. in “Low-level EMF effects on wildlife and plants” published in *Frontiers in Public Health* (2023)

### SCIENTIFIC RESEARCH: IMPACTS TO BEES EXPOSED TO EMFS

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- 1 Colony Strength
  - 2 Immune System
  - 3 Behavior
  - 4 Homing Ability (ability to come home)
  - 5 Physiology
  - 5 Reproduction & Fertility
  - 6 Queen Bee Egg Laying
  - 7 Orientation

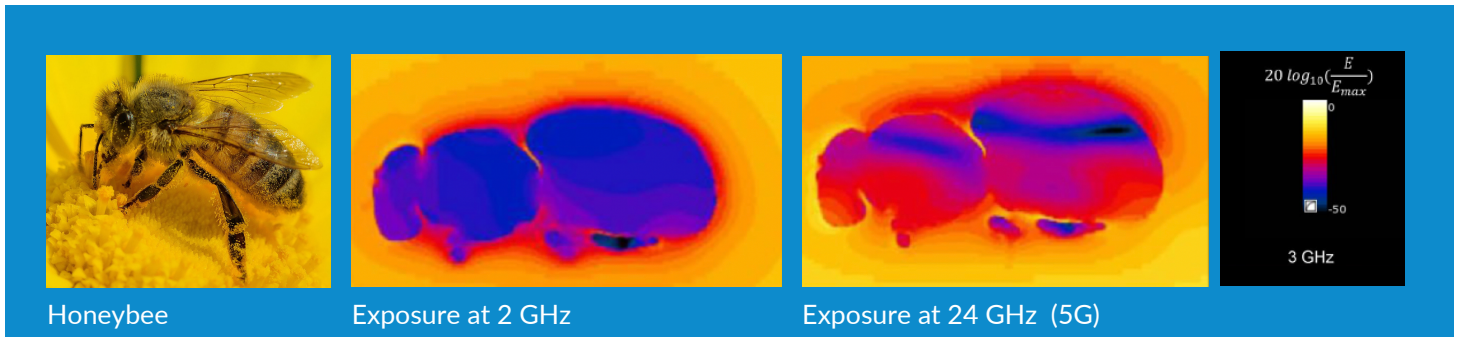
Studies have also found decreased diversity and abundance of insects in areas with higher RF radiation due to the cell tower emissions.

RF = radiofrequency

EMF = non-ionizing electromagnetic fields including RF and ELF

## BEES AND INSECTS ARE UNIQUELY VULNERABLE

### Research Finds Higher Exposures into Insects From 5G's Higher Wireless Frequencies Even When the Power Remains The Same



Lighter colors represent higher exposures. Images are from wireless frequency exposure simulations in the published study “Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz” published in *Scientific Reports* by Thielens et al. (2018).

#### Higher Frequency = Higher Exposures to Insects

New technologies such as 5G will run on higher frequencies from 24 to 40 GHz. Published studies have found that exposure to the higher frequencies of 5G and new networks will result in significantly higher RF absorption into the bodies of bees and insects. The higher frequency EMF waves resonate with the smaller size of the insect to increase exposures, even when the power levels are the same.

#### A Regulatory Gap

Despite research reviews finding the majority of studies show effects to insects, environmental agencies have no research evaluation, EMF monitoring, wildlife impact surveillance, or risk-assessment process in place to ensure current or future wireless radiation and EMF levels are safe for pollinators and wildlife.

#### Impacts To Habitat

Numerous studies have found effects to plants from non-ionizing EMF, including adverse biochemical changes and direct damage to tree canopy. The impacts to both the physical health of the insect as well as their habitat add to the numerous environmental stressors faced by bees and pollinators.



**“Our study provides conclusive evidence of detrimental impacts of EMF on honeybee’s pollination behavior, leading to negative effects on plant community.”**

– Molina-Montenegro et al. in the study “Electromagnetic fields disrupt the pollination service by honeybees” published in *Science Advances* (2023)

# FACTSHEET: POLLINATORS, CELL TOWERS & POWERLINES

## RESEARCH ON INSECTS, WIRELESS AND EMFS

### Research Reviews

Balmori A. (2021) [Electromagnetic radiation as an emerging driver factor for the decline of insects](#). *Science of the Total Environment*

Cucurachi, S., Tamis, W. L. M., Vijver, M. G., Peijnenburg, W. J. G. M., Bolte, J. F. B., & de Snoo, G. R. (2013). [A review of the ecological effects of radiofrequency electromagnetic fields \(RF-EMF\)](#). *Environment International*

Levitt, B. B., Lai, H. C., & Manville, A. M. (2022). [Effects of non-ionizing electromagnetic fields on flora and fauna, Part 2 impacts: How species interact with natural and man-made EMF](#). *Reviews on Environmental Health*

Levitt, B. B., Lai, H. C., & Manville, A. M. (2022a). [Effects of non-ionizing electromagnetic fields on flora and fauna, part 1. Rising ambient EMF levels in the environment](#). *Reviews on Environmental Health*, 37(1), 81–122.

Levitt, B. B., Lai, H. C., & Manville, A. M. (2021). [Effects of non-ionizing electromagnetic fields on flora and fauna, Part 3. Exposure standards, public policy, laws, and future directions](#). *Reviews on Environmental Health*.

Thill A, Cammaerts MC, Balmori A. (2023) [Biological effects of electromagnetic fields on insects: a systematic review and meta-analysis](#). *Rev Environ Health*. Nov 23

### Approaches and Recommendations

Jérémy S. P. Froidevaux, Laura Recuero Virto, Marek Czerwiński, Arno Thielens, and Kirsty J. Park [Addressing Wildlife Exposure to Radiofrequency Electromagnetic Fields: Time for Action](#) *Environmental Science & Technology Letters*

Levitt BB, Lai HC and Manville AM II (2022) [Low-level EMF effects on wildlife and plants: What research tells us about an ecosystem approach](#). *Front. Public Health*

### A Selection of Studies

A. Lázaro, A. Chroni, T. Tscheulin, J. Devalez, C. Matsoukas, & T. Petanidou. (2016). [Electromagnetic radiation of mobile telecommunication antennas affects the abundance and composition of wild pollinators](#). *Journal of Insect Conservation*

Adelaja, O. J., Ande, A. T., Abdulraheem, G. D., Oluwakorode, I. A., Oladipo, O. A., & Oluwajobi, A. O. (2021). [Distribution, diversity and abundance of some insects around a telecommunication mast in Ilorin, Kwara State, Nigeria](#). *Bulletin of the National Research Centre*

Borre, E. D., Joseph, W., Aminzadeh, R., Müller, P., Boone, M. N., Josipovic, I., Hashemizadeh, S., Kuster, N., Kühn, S., & Thielens, A. (2021). [Radio-frequency exposure of the yellow fever mosquito \(A. aegypti\) from 2 to 240 GHz](#). *PLOS Computational Biology*

Favre, D. (2011). [Mobile phone-induced honeybee worker piping](#). *Apidologie*

Lopatina, N. G., Zachepilo, T. G., Kamyshev, N. G., Dyuzhikova, N. A., & Serov, I. N. (2019). [Effect of Non-Ionizing Electromagnetic Radiation on Behavior of the Honeybee, Apis mellifera L. \(Hymenoptera, Apidae\)](#). *Entomological Review*

Lupi, D., Palamara Mesiano, M., Adani, A., Benocci, R., Giacchini, R., Parenti, P., Zambon, G., Lavazza, A., Boniotti, M. B., Bassi, S., Colombo, M., & Tremolada, P. (2021a). [Combined Effects of Pesticides and Electromagnetic-Fields on Honeybees: Multi-Stress Exposure](#). *Insects*

Molina-Montenegro MA, Acuña-Rodríguez IS, Ballesteros GI, Baldelomar M, Torres-Díaz C, Broitman BR, Vázquez DP. (2023) [Electromagnetic fields disrupt the pollination service by honeybees](#). *Sci Adv*.

Santhosh Kumar, S. (2018). [Colony Collapse Disorder \(CCD\) in Honey Bees Caused by EMF Radiation](#). *Bioinformation*

Sivani, S, and D. Sudarsanam. (2012): ["Impacts of radio-frequency electromagnetic field \(RF-EMF\) from cell phone towers and wireless devices on biosystem and ecosystem-a review."](#) *Biology and Medicine* 4, no. 4 202-216.

Thielens, A., Bell, D., Mortimore, D. B., Greco, M. K., Martens, L., & Joseph, W. (2018). [Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz](#). *Scientific Reports*

Thielens A, Greco MK, Verloock L, Martens L, Joseph W. (2020) [Radio-Frequency Electromagnetic Field Exposure of Western Honey Bees](#). *Scientific Reports*

V. Jeladze, A. Thielens, T. Nozadze, G. Korkotadze, B. Partsvania and R. Zaridze, (2023) ["Estimation of the Specific Absorption Rate for a Honey bee Exposed to Radiofrequency Electromagnetic Fields from 2.5 to 100 GHz,"](#) *IEEE XXVIII International Seminar/Workshop on Direct and Inverse Problems of Electromagnetic and Acoustic Wave Theory (DIPED)*, Tbilisi, Georgia

Wyszkowska J, Maliszewska J, Gas P. [Metabolic and Developmental Changes in Insects as Stress-Related Response to Electromagnetic Field Exposure](#). *Applied Sciences*

Wyszkowska J, Kobak J, Aonuma H. (2023). [Electromagnetic field exposure affects the calling song, phonotaxis, and level of biogenic amines in crickets](#). *Environ Sci Pollut Res Int*.