Wireless Devices & Wildlife

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The effects of EMR from wireless devices on wildlife
Excerpts and Resources from *An Electronic Silent Spring*
The radiofrequency (RF) signals that cellular antennas, mobile devices and "smart" utility meters require to function are now ubiquitously and continuously emitted.

How do these signals affect wildlife?

Scientists report that RF fields emitted by cellular antennas alone potentially cause the decline of animal populations, reduction of some species' useful territory, and deterioration of plant health. Some species may experience reduction of their natural defenses, problems in reproduction and aversive behavioral responses. (1)
Here are summaries of studies about the effects of RF signals on trees, insects and birds:

Trees

In a 2010 paper published in the International Journal of Forestry Research, researcher Katie Haggerty explained that the Earth's natural radiofrequency environment has remained about the same within the lifespan of modern trees. "Before 1800," Haggerty wrote, "the major components of this environment were broadband radio noise from space (galactic noise), from lightning (atmospheric noise), and a smaller RF component from the sun. (2) …Plants may have evolved" to use these environmental signals, along with visible light in order to regulate their periodic functions. Therefore, they may be sensitive to man-made RF fields. "The background of RF pollution," Haggerty continued, "is now many times stronger than the naturally occurring RF environment. From the perspective of evolutionary time, the change can be considered sudden and dramatic. (3,4) …Growth rates of plants (5) and fungi (6) can be increased or decreased by RF exposure. Exposure to RF signals can induce plants to produce more meristems, (7) affect root cell structure, (8,9) and induce stress response…causing biochemical changes."(10)
Ms. Haggerty went on to describe her study of the influence of RF signals on trembling aspen seedlings. Seedlings that were shielded in a Faraday cage (a metal container that prevents RF radiation from entering) thrived. Seedlings that were exposed to RF signals showed necrotic lesions and abnormal coloring in their leaves. (11)

According to British biologist Dr. Andrew Goldsworthy, "Trees are now dying mysteriously from a variety of diseases in urban areas all over Europe. They also show abnormal photoperiodic responses. Many have cancer-like growths under the bark (phloem nodules). The bark may also split so that the underlying tissues become infected. All of these can be explained as a result of exposure to weak RF fields from

mobile phones, their base stations, Wi-Fi and similar sources of weak non-ionizing radiation." (12)

Other scientists have found that trees in areas with high Wi-Fi activity suffer from bleeding fissures in their bark, the death of parts of leaves, and abnormal growth. In 2010, in the Netherlands, 70% of urban ash trees suffered from radiation sickness, including a "lead-like shine" on their leaves, indicating the leaves' oncoming death. In 2005, only 10% of ash trees suffered radiation sickness. (13)

Ants

Perhaps the first study to demonstrate that insects have an electrical sense came out in 1992. Biologist William MacKay and his colleagues showed that several kinds of ants were attracted to electrical fields. Indeed, ants can damage equipment that produces "attractive" electrical fields. (14)

In 2013, Belgian biologist Marie-Claire Cammaerts and Swedish neuroscientist Olle Johansson exposed ants to common wireless devices. The scientists placed a mobile phone under a tray, then placed ants on the tray. When the phone was off or on standby-mode, the ants' angular speed increased. Within two to three seconds of the scientists' turning the phone on (able to receive or send calls), the ants' angular speed increased and their linear speed decreased.

Exposed to a smartphone, the linear speed of "fresh" ants decreased; their angular speed increased. The ants' speed changed similarly but more strongly when exposed to a DECT (cordless landline) phone. They had difficulty moving their legs and did not move toward their nest or their food site as usual. The ants were exposed to each of these two phones for three minutes, and took two to four hours to resume their normal behavior.

When Cammaerts and Johansson put a mobile phone on standby mode under the ants' nest, the ants left their nest immediately, taking their eggs, larvae and nymphs with them. They relocated far from the phone. Once the phone was removed, the ants returned to their original location.

After thirty minutes of exposure to a Wi-Fi router, the ants' speed changed again, as did their foraging behavior. It took them six to eight hours to resume normal foraging. Several ants never recovered and were found dead a few days later.

When the scientists placed an ACER Aspire 2920 about twenty-five centimeters away, the insects appeared disturbed as soon as the computer was switched on. When the PC was switched on with its Wi-Fi function de-activated, the ants appeared undisturbed.

The researchers concluded that ants can be used as bio-indicators to reveal the biological effects of RF signals from some wireless devices. They also advised users to de-activate the Wi-Fi function of their PCs. (15)

Bees

Bees also have an electrical sense. Bees are positively charged, and flowers are negatively charged. These charges help pollen stick to bees' hair while they pollenate. In 2012, biologist Dominic Clarke and his colleagues showed that bees use their electrical sense to determine whether or not a flower has recently been visited by another bee–and is therefore worth visiting. (16,17)
In *Bees, Birds and Mankind: Effects of Wireless Communication Technologies* (Kentum, 2009), German scientist Ulrich Warnke states, "Bees and other insects, just as birds, use the Earth's magnetic field and high frequency electromagnetic energy such as light. They accomplish orientation and navigation by means of free radicals as well as a simultaneously reacting magnetite conglomerate. Technically produced electromagnetic oscillations in the MHz range and magnetic impulses in the low frequency range persistently disturb the natural orientation and navigation mechanisms created by evolution."
In his book, Warnke quotes Ferdinand Ruzicka, a scientist and beekeeper who reported, in 2003, after several transmitters (cellular antennas) were erected in the immediate vicinity of his hives: "I observed a pronounced restlessness in my bee colonies (initially about forty) and a greatly increased urge to swarm. As a frame-hive beekeeper, I use a so-called high floor. The bees did not build their combs in the manner prescribed by the frames, but in random fashion. In the summer, bee colonies collapsed without obvious cause. In the winter, I observed that the bees went foraging despite snow and temperatures below zero, and they died of cold next to the hive. Colonies that exhibited this behavior collapsed, even though they were strong, healthy colonies with active queens before winter. They were provided with adequate additional food and the available pollen was more than adequate in autumn."

Ruzicka then organized a survey of beekeepers through the magazine Der Bienen Vater. All twenty of the beekeepers who replied to his questionnaire had a transmitter within 300 meters of their beehives. Compared to the bees' behavior before and after the transmitters were in operation, 37.5% observed increased aggression from their bees.

25% found that their bees had a greater tendency to swarm.

65% reported that their colonies were inexplicably collapsing since the transmitters became operational.

Warnke says that monocultures, pesticides, the Varroa mite, migratory beekeeping, dressed seed, severe winters, and genetically modified seeds could also explain the bee colonies' collapse. However, none of these convincingly explains "the fairly sudden

and country-spanning appearance two to three years ago of the dying bees phenomenon. Should the bees simply be too weak or ill, they should also die in or near the hive. But no ill bees were found in research into this phenomenon."

In May, 2009, The U.S. Fish and Wildlife Service urged Congress to investigate the potential relationship between wireless devices and bee colony collapse. (18)

Frogs

In 2010, Spanish biologist Alfonso Balmori published his study of a common frog habitat 140 meters from a cellular antenna. The experiment lasted two months, from the egg phase until an advanced phase of tadpole. Balmori placed some of the frogs inside a Faraday cage. These shielded frogs had a mortality of 4.2%. The unshielded frogs – exposed to the antenna's RF fields–had a mortality of 90%. Balmori concluded that "this research may have huge implications for the natural world, which is now exposed to high microwave radiation levels from a multitude of phone masts." (19)

Bird collisions with telecom equipment

Albert Manville, PhD, wildlife biologist with the Division of Migratory Bird Management, U.S. Fish and Wildlife Service (USFWS), estimates that up to 6.8 million birds die per year in collisions with communications antennas or their guy-support wires in North America. The impacts of cellular antenna radiation on migratory birds in North America, especially those nesting close to these structures, remain suspect and unknown.

In January 2012, Dr. Manville wrote: *Recent studies from Europe raise troubling concerns about the effects of radiation from cellular communication antennas, especially on resident, breeding migratory birds. These apparent effects include feather deformities, weight loss, weakness, reduced survivorship and death, especially to those birds and their offspring nesting adjacent to cellular antennas. Where Before-After, Control-Impact (BACI) studies were performed during some of the European research, no effects to resident birds were detected prior to construction and operation of cellular communication antennas. Some laboratory studies in the U.S. have documented lethal effects of extremely low levels of radiation to chicken embryos in the frequencies of cellular telephones, (20) but research to better address cause and effect to wild birds in North America has yet to be conducted. To date, only anecdotal reports from instances in North America have been brought to the attention of authorities at the USFWS.*

If we are to better understand the cumulative effects of human infrastructure on migratory birds–including communication technologies, research needs to be conducted to specifically address how radiation is affecting migratory birds and what resultant lethal and injurious effects are occurring. The explosive growth of hand-held technologies raises further concerns since potential impacts may grow.

The unpermitted killing or injury of a migratory bird, is called a "take" under the Migratory Bird Treaty Act (MBTA). The USFWS does not permit the 'incidental or accidental take' of any of the 1007 migratory bird species protected under MBTA. Therefore, studies need to be undertaken to determine how much 'take' is occurring as a result of radiation, and what steps can be undertaken to "avoid or minimize" future "take." The USFWS continues to suggest to the FCC the need for these North American

studies based alone on cumulative effects that must be addressed under National Environmental Policy Act review. The studies need to better tease out how and at what level "takes" are occurring, then determine what conservation measures can be adopted to "avoid or minimize" future "take." Because of the controversial nature of this issue, any studies and outcomes need to be seamless and fully transparent.

The white stork

During the Springs of 2002, 2003 and 2004, biologist Alfonso Balmori monitored the reproduction of the white stork, a vulnerable bird species that usually lives in urban areas. White stork couples build their nests in pinnacles and other very high places that are now exposed to man-made microwaves. Balmori studied white stork nests within 200 meters of antennas and nests located more than 300 meters from antennas. He found that 40% of the nests within 200 meters of antennas had no chicks, while only 3.3% of nests further than 300 meters of antennas had no chicks. Also, near antennas, white stork couples frequently fought for sticks, their sticks fell to the ground while they tried to build nests, the nests did not get built and hatched white stork chicks frequently died. (21)

Common citizens have also observed changes in birds when technologies that emit EMR are deployed. After transmitting water meters were installed in Renton, Washington in December, 2012, a retired civil engineer who had spent thirty dollars per month on birdseed for years noticed that the feeders in his yard no longer emptied. His neighbors also noticed that immediately after the transmitting water meters were installed, the birds that had frequented their yard (beside a greenbelt) disappeared. (22)

Birds, bees and magnetically-sensitive cryptochromes

Why would RF signals disturb birds and bees? Here's an answer from biologist Andrew Goldsworthy, PhD: To navigate and also to control their immune systems, birds and bees use magnetically-sensitive substances called cryptochromes. These are pigments found in virtually all animals, plants and many bacteria. Cryptochromes absorb blue-green and ultra-violet light and use this energy to drive photochemical reactions where light energy is converted to chemical energy. Cryptochromes measure light to control and reset animals' and plants' biological clocks. Some animals also use cryptochromes to sense the direction of the Earth's magnetic field.

Unfortunately, cryptochromes are badly impaired by man-made oscillating fields that are orders of magnitude weaker than the Earth's steady magnetic field. Such impairment can disrupt insects' and animals' solar and magnetic navigational abilities. It can account for colony collapse disorder in bees, the loss of some migratory birds and butterflies, and immune system weakening in many more organisms.

An array of cryptochrome molecules oriented in different directions can be found in the compound eye of an insect, or in the retina of a vertebrate's eye. This cryptochrome found in the eyes is quite distinct from the regular visual pigments (rhodopsins) that are used in normal vision. However, the combination of these pigments gives the animal the potential to "see" the direction of the magnetic field, possibly as an extra color superimposed on its normal field of vision.

Robins can navigate in the Earth's magnetic field if they receive light from wavelengths absorbed by cryptochrome. (23) However, exposure to man-made frequencies between 0.1 and 10MHz at field strengths as little as 0.085 mT (about 500 times weaker than the Earth's magnetic field) made the birds completely unable to respond to the Earth's field. Frequencies used by mobile devices, including cell phones, DECT cordless landline phones and Wi-Fi, can blot out "magnetic vision." Even lower field strengths are likely to disturb magnetic navigation, since radiation that is too weak to blot out magnetic vision totally may still be strong enough to distort a bird's perception of the Earth's field, causing the bird or insect to fly in the wrong direction.

The sheer number of wireless devices gives birds continuously conflicting navigational data – as if they're constantly bombarded by flashing disco lights. We should not be surprised that birds would leave such areas. Likewise, scientists who put DECT cordless phone base stations next to their beehives found that their bees behaved abnormally and were less likely to return to the hive. (24) (Beekeepers are thereby well advised not to carry their mobile phones when visiting their hives.)

Birds, bees and many other animals can also navigate by the sun's position. To do this, they must have an internal clock that adjusts to the sun's changing position throughout the day. Cryptochrome makes this clock sensitive to magnetic fields. A 300 mT steady field can alter the clock's speed or even stop it altogether. (25) Given that sensing light and magnetic fields by cryptochrome uses the same basic mechanics as the internal clock, it's likely that weak alternating fields would also disrupt a clock's normal functions. As a consequence, weak, man-made electromagnetic fields would render animals unable to adjust accurately to the sun's changing position. This leaves the animal unable to use either magnetic or solar navigation. If there were no landmarks to guide it, the animal would be completely lost. This could explain colony collapse disorder, when bees do not return to their hives.

Circadian (daily) metabolic rhythms, which occur in virtually all higher organisms, keep us in sync with the Earth's twenty-four hour rotation on its axis. Circadian rhythms are also driven by cryptochrome-containing internal clocks. They enable the organism to anticipate the coming of dawn and dusk, and they modify its metabolism to be ready for the new conditions. Circadian rhythms control the production of melatonin (a sleep hormone); at night, they divert metabolic resources to repair and immune system strengthening.

Losing or even weakening of the circadian rhythm – due to a failure of the internal clock's exposure to man-made electromagnetic fields–would have serious consequences. In humans, this would result in tiredness during the day, poor sleep at night, and reduced production of melatonin. All of these effects have been reported in people exposed to continuous, weak, electromagnetic radiation from DECT phone base stations, Wi-Fi routers and cellular antennas.

Also, any weakening of the circadian rhythms' amplitudes means that processes controlled by them will never function at maximum power. The immune system may never be able to summon the massive power that is sometimes required to overcome pathogens or destroy developing cancer cells before they get out of control. In part, this could explain epidemiologists' findings that people living near cellular antennas have an

increased cancer risk. It could also explain bee colonies' continuing decreased health and ability to resist pathogens.

Bill Bruno, PhD biophysicist, retired from the Los Alamos National Lab: *Biology is very sophisticated in its ability to make use of electromagnetic fields. Cryptochromes are just one example. Despite centuries of discoveries in biology and advances in medicine, there is so much we don't know. For example, why do our brains, sinuses and other tissues have magnetic magnetite particles?*

Our bones and collagen are piezoelectric: in an electric field, they expand and contract. What are the implications of that? And what about recent experiments that show that DNA is a semiconductor, and that melanin, including neuromelanin in the brain, is a conductor?

Endnotes

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