Tragedy of the Commons Revisited: The High Tech-High Risk Wireless World

Cindy Sage

Sage Associates, Santa Barbara, CA, USA

Abstract: In 1968, Garrett Hardin, an eminent population ecologist from Santa Barbara, CA published an article in Science titled 'Tragedy of the Commons' that was immediately hailed as a landmark piece of thinking. This paper reshaped prevailing views about our place in the ecological network of the planet and was pivotal in defining how pursuit of our individual actions to maximize self-interest will, across populations all doing the same thing, result in diminished and overused environmental resources. Before sustainability was even a buzzword, Hardin created a way of seeing the world that emphasized how individuals must learn to recognize and to act with more in mind than squeezing one more cow onto the common pasture. He gave us new ways to think about how we might better manage our resources in the face of new technologies. He was not a believer in the technological fix. Those lessons are highly relevant today to the unchecked proliferation of wireless radiofrequency signals, thought by many to cause serious health consequences.

Keywords: wireless commons, radiofrequency/microwave radiation, wireless technology

Correspondence: Cindy Sage, Sage Associates, Santa Barbara, CA, USA

INTRODUCTION

In 1968, Garrett Hardin, an eminent population ecologist from Santa Barbara, CA published an article in Science titled *Tragedy of the Commons* that was immediately hailed as a landmark piece of thinking. This paper reshaped prevailing views about our place in the ecological network of the planet and was pivotal in defining how pursuit of our individual actions to maximize self-interest will, across populations all doing the same thing, result in diminished and overused environmental resources.

Hardin focused our attention like never before on three things. Resources are finite. The actions of each of us, acting in our own self-interest, collectively degrade and deplete these resources over the long-term. And, the inevitable result is diminished quality of life. He saw that where individuals seek to maximize their own use of finite resources at the expense of the common good (namely, the commons), doing so is at the expense of everyone's ultimate self-interest.

Before sustainability was even a buzzword, Hardin created a way of seeing the world that emphasized how individuals must learn to recognize and to act with more in mind than squeezing one more cow onto the common pasture. He gave us new ways to think about how we might better manage our resources in the face of new technologies. Hardin was not a believer in the technological fix. Those lessons are highly relevant today.

THE AIR AS COMMONS' AND WIRELESS TECHNOLOGIES

Where wireless is concerned, the new '*commons*' is the air all around us, which is an

essential part of our common heritage. Decades of traditional air pollution control efforts have validated the need to protect this '*commons of the air*' from chemical and particulate contaminants /2/. Today, the new threat is emissions from wireless technologies.

All wireless technologies have an impact on this 'commons', and everyone adds to the burden of radiofrequency and microwave radiation that is transmitted through the air into buildings and into all living things. Wireless transmissions drive electromagnetic energy through our air, into and through virtually all indoor and outdoor living environments. The protective air cushion around our planet holds breathable air, buffers us from space radiation, and supports and sustains life in tandem with the natural electromagnetic signature of the earth itself. We are changing this '*commons of the air'* in major ways. Wireless signals from broadcast and communications technologies are crowding out and overpowering the natural background. The '*commons of the air'* is being altered in unprecedented ways that have enormous consequences for life on earth.

Wireless radiofrequency spectrums (wireless RF) are bought at federal auction, harnessed into products, commercialized by the broadcast and telecom industries—and sold as technological 'must-haves' for a competitive economic future. The byproducts however are invisible toxins that affect all living organisms right down to the genome level /3-4/.

Tremendous financial incentives exist for business to stake a territory in the new wireless world, which drives the commercial proliferation of RF exposures we all must live with. Individuals who buy wireless products contribute their fraction, as well. The overall consequence is that no one is monitoring changes to the commons with respect to cumulative wireless exposures, and no one is defining what the safe carrying capacity might be.

If commercialized and deployed, every new wireless technology layers up more RF exposure for the individual, degrading the quality of life and access to the natural recalibration of circadian cycles that are essential to human health. Wireless RF saturation is extinguishing the natural signals from earth on which we synchronize our circadian rhythms, calibrate our hormone and metabolic cycles, initiate healing, repair DNA damage, and lay down memories during sleep. At some point, the capacity of the 'wireless commons' is exceeded, if measured in human health misery and avoidable societal costs.

The rush to 'buy the airwaves' and to market them for commercial purposes is loading '*the commons of the air*' with unsustainable levels of exposure. We have seen the markets successfully lobby government regulators to allocate even more spectrum, once the existing frequencies are allocated. With no regard to cumulative harm, this reckless stampede for wireless territory has vast implications. Environmental protections afforded to other natural resources under the National Environmental Policy Act have been tossed aside. The cumulative impacts and irretrievable commitments on humans, wildlife, and natural resources have never been assessed. Every student of geology knows that small changes that continue to occur over a long time can result in the carving of a Yosemite Valley by glaciers or the sculpting of a Grand Canyon by rivers. Damage from wireless at current environmental levels to the genome (DNA damage) and to nearly every major tissue and organ system is already being seen in just a few generations at population levels. Consider the irretrievable commitment we are making and irreversible damage that will occur over generations with overuse and misuse of wireless.

Today, we are using up the wireless commons by saturating it with more than 10 billion times as much of this electro-pollutant exposure as was present during human evolution. No living thing on earth has evolved with this burden of radio-frequency/microwave radiation, and we have no biological adaptation to it. To a certain extent we have adaptations to fight the damage done by too

much visible light (sunburn), and to ionizing radiation from natural earth sources (DNA repair systems), but not to microwaves /5-6/.

Our ability to respond to natural environmental signals that are essential for the regulation of life processes and health is diminished. The more the 'commons' is used to deploy new applications of wireless technologies, the greater the human health burden and the less able society is to conserve its important natural properties. Essentially no place is left in societies without RF exposures that dwarf the earth's natural electromagnetic environment.

In the beginning, broadcast industries in radio and television and military radar cast the first layers of artificial wireless radiation around population centers of the world. Later, the development of cell phones created intense but localized RF signals into the head, neck, arms, and hands of the user. Individuals could choose to use them, or not. However, the rollout of these devices also necessitated land-based antenna transmitters throughout every telecom company's service area to make the cell phone system work. Such cell towers or wireless antenna facilities inevitably exposed people nearby to wireless RF signals in their homes, classrooms, playgrounds, and other community spaces. From this point onward, pollution by wireless in '*the commons*' became chronic, involuntary, and mandated by federal law. The expansion of new wireless RF signal for voice and for data transmission has increased exponentially in the last decade, quintupling in urban areas in just a few short years. Virtually no outdoor living space is without cell signal today, and the '*commons of the air'* is saturated with wireless.

Still, one could retreat into the privacy of one's home—one's domicile—where the assumption of private property rights has been held absolute by constitutional protection. With some attenuation of wireless signals afforded by going inside, the possibility of indoor relief from exposure to chronic, artificial wireless signal was still available to most people (at least to those not disproportionately burdened by proximity to a nearby wireless antenna facility or cell tower).

The newest assault on 'the commons' is the deployment of SmartGrid and smart meters by electric utilities. This assault goes far beyond any existing source of electromagnetic or wireless radiation blanket yet found on earth; it is also mandatory. The rollout of SmartGrid is the largest application of wireless technology yet and is poised to inundate every remaining pocket of living space with a pervasive blanket of new wireless, in the name of energy conservation /7/. This last bastion of family privacy and security—the family home—is being threatened by a national program ironically intended as a 'green' solution to reducing home energy consumption by wireless reporting via the electric meter.

Every home that has electricity can soon have their old electric meter replaced by a new wireless meter—euphemistically called smart meters. The purpose is ostensibly for energy conservation. The wireless meter is advertised as giving individuals more choice about when and how much electricity is used in the home. However, the price tag is high. There is no more intensive use of, or alteration of the 'wireless commons' than this unilateral appropriation of the airwaves. Nothing comes close to appropriating more of the available 'resource' of the airwaves—which are already saturated enough to cause health impacts and decreased quality of life.

Wireless smart meter pollution will give us blanket saturation of wireless signals throughout each home and yard. The 'smart meters' emit a very high peak pulsed wireless signal that will permeate every nook and cranny of our living space—the spaces still considered by most people to be sanctuary, a place of renewal and privacy. The pulsed levels of radiofrequency radiation will be higher than living near a cell tower. At close range, smart meters will emit the equivalent of

several cell tower antennas worth of RF radiation in high intensity RF bursts, perhaps inside your kitchen or bedroom, depending on where the meter is located on the outside of your home. Because these SmartGrid systems depend on complete community coverage (namely, RF wireless saturation), the plan also calls for individuals to install additional radio transmitters on each appliance inside the home, creating yet another RF layer with significantly elevated RF emissions. These systems also require complete community-wide-cell antenna relays to get the information from inside your home via a wireless network to the utility. Distributed antenna systems (DAS) or mesh networks can place cell antennas on utility poles throughout neighborhoods everywhere, enabling the wireless transmission system to be completed, meaning that a walk to school, around the block, or to work is blanketed with wireless RF radiation at every turn. The selling of the airwaves for commercial purposes (for communications, for energy and transportation, for security systems, for data transmission) will eventually permeate every part of 'the commons'. No one can opt-out. Surely, this policy is inequitable, will result in lower quality of living for every individual, and should be subject to restraint and planning. The 'commons' is for all to enjoy but is being auctioned off at our peril for wireless technologies over which the public has little influence. The health effects of chronic exposure to wireless RF radiation are substantiated /3-4/, the federal agencies that oversee emissions and health aspects are on record with their concerns /8-9/, and yet the FCC's plans to sell the airwaves continues unabated /10/.

HOW CAN WE FRAME THE ISSUE USING THE LESSONS LEARNED FROM HARDIN'S TREATISE?

Questions about saturating our living world with RF and microwave radiation from new wireless technologies have all the hallmarks of Hardin's old 'commons' and the old lessons still apply.

Who owns the 'commons of the air'? Who should be allowed to pollute it? What are the limits? On what basis should carrying capacity be defined? Who defines the limits? Do these limits conserve the resource for the future? Do they protect public health and welfare, and the health and well-being of other living things on earth? Who bears the burden of proof of safety or of harm? How should the 'new commons' be managed for the greater good? Do we know enough to act responsibly? Who decides? When should limits be placed on utilization?

In Hardin's time, environmental degradation caused by uncontrolled or unanticipated consequences of development were only addressed 'after the fact', often requiring costly litigation and huge societal pressure for change. The rules of the road for free markets changed in the early 1970s with state and federal laws protecting natural resources from unabated plundering. Yet, wireless is largely exempt from environmental protection laws, and indeed, abetted by federal telecommunications and energy laws.

The laws protecting the environment and humans within that environment from 'electromagnetic overload' do not recognize the evidence for human health risks. Precautionary action to protect public health is lacking, which is common for most environmental disease causation /11/. Children are among the least protected /12/.

The existing public safety limits are grossly inadequate and obsolete /3/. Today's limits are based on old thinking that only RF exposures that burn are important. The present regulations do not take into account hundreds of studies showing that non-thermal RF exposures also have bioeffects and adversely affect human health. The regulators rely on outdated and biologically incomplete scientific thinking. Such risks to humans have been chronicled in the scientific literature for more than three decades, but regulatory action is waiting for absolute scientific proof and the political will to enact stricter protections for the public in the face

of strong industry lobbying against change.

Meanwhile, the overburdening of the airwaves —the '*commons of the air*'—goes on unabated with little acknowledgement of the harm it is causing. This hazard is very unlike Hardin's common pasture, where the addition of a few extra cattle can cause visible and undeniable damage to the forage. Wireless RF is invisible to the eye—even though it is not invisible to the body. The body recognizes and reacts to the artificial environmental signals with clear signs of physiological distress, full-blown disease, and in some cases, in death.

New biologically based public exposure limits are necessary and should be key to documented scientific benchmarks for harm plus some safety margin or buffer below these benchmark risk levels.

Environmental laws do not yet protect plants and animals from harm due to 'wireless overload' that is clearly physiologically measurable by laboratory testing. Effects are widely reported about key biologic indicator species—giving concern that wireless exposures contribute to the global biodiversity crisis. Indicators include the disappearance of the house sparrow from the United Kingdom (UK) countryside, collapsing bee colonies in America and Australia, diminished reproduction and deformities in amphibians, malformations of the nervous system (neural tube defects) and heart in chick embryos, decreased reproduction in insects, interrupted wildlife migration, panic reaction and disorientation in mammals, and aversion behavior in bats /13-14/. Another kind of artificial electromagnetic signal (sonar) stupefies and disorients marine mammals without regard to disrupting the communication, feeding, and migration needs of these species.

The primary authority under which the US federal government regulates environmental resources is the Commerce Clause /15. This Clause authorizes Congress to regulate commerce to ensure that the flow of interstate commerce is free from local restraints imposed by various states. The Commerce Clause has been foundational in enacting resource protection legislation, including the Endangered Species Act. In passing the Act, Congress noted the link between economic growth, consumptive development, and endangered and threatened species. Congress found that various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation. Endangered Species Act of 1973, 16 U.S. C. § 1531(a)(1)—perhaps it is time to invoke it with respect to the new wireless commons.

Societies must now define carrying capacity for chronic electromagnetic and wireless exposures. Taking into account the large individual variability to withstand it, new limits must conserve and sustain the '*commons of the air'* so that is sustainable for all—and this includes sensitive populations, the young, the elderly, and those with existing sensitivity. Some countries of the world already have surpassed sustainable wireless exposure levels as demonstrated by significant percentages that have already become electro-sensitive. And, if we are to sustain global crop production that depends on pollination, we need sustainable limits to maintain health populations of pollinating insects, as well as amphibians, avian species and mammals.

The air is global common ground…a shared resource. We cannot sustain unlimited growth of wireless. Our capacity to protect the health and well-being of humans and other living organisms is perilously close to irreversible change for the worse.

Cindy Sage, Sage Associates, Santa Barbara, CA USA
Co-Editor, BioInitiative Report. Research Fellow, Orebro University Hospital, Department of Oncology, Orebro, Sweden.

Sage was an undergraduate student of Garrett Hardin's in 1969, and later a teaching colleague who shared an office with him at UC Santa

Barbara. Hardin and Sage were part of the original founding faculty and teaching staff of the Environmental Studies Program, University of California, Santa Barbara (1970-1981).

REFERENCES

1. Hardin G. Tragedy of the commons. Science 1968; 162(3859):1243-8.
2. California Air Resources Board Appendix III, Part B-Health Effects. Proposed identification of environmental tobacco smoke as a toxic air contaminant, 2005.
3. Sage C, Carpenter DO, eds. BioInitiative Working Group BioInitiative Report: A rationale for a biologically-based public exposure standard for electromagnetic fields (ELF and RF), 2007.
4. Electromagnetic Fields (EMF) Special Issue. Martin Blank, editor. Pathophysiology 2009;16.
5. REFLEX Consortium, Risk evaluation of potential environmental hazards from low energy electro-magnetic field exposure using sensitive in vitro methods. A project funded by the European Union under the 5th Framework Programme. Contract QLK4-CT-1999-01574, 2004. Available from: http://www.verum-foundation. de/reflex.
6. Ruediger HW. Genotoxic effects of radio-frequency electromagnetic fields. Pathophysiology 2009;16:89-102.
7. Sage C. Briefing Letter on smart meters for the collaborative on health and the environment, 2010. Available at: http://www.healthandenvironment.org/wg_emf_news/7803
8. Lotz G. Chief Physical Agents Effects Branch, Division of Biomedical and Behavioral Science, National Institute of Occupational Safety and Health to Richard Tell, Chair, IEEE SCC28 (SC4) Risk Assessment Work Group dated June 17, 1999.
9. National Institutes for Health. National Toxicology Program, 2002. Available at: www.fda.gov.us
10. Richtel M, Stelter B. FCC questioned on its far-reaching plan to expand broadband. New York Times, 3/17/2010 http://www.nytimes.com/2010/03/17/technology/17broadband.html?hpw=&pagewanted=print
11. Grandjean P. Implications of the precautionary principle for primary prevention and research. Annu Rev Public Health 2004;25:199-223.
12. World Health Organization. Children's Health and Environment: A Review of Evidence: A Joint Report from the European Environmental Agency and The World Health Organization, 2002. Available at: http://www.who.int/peh-emf.
13. Balmori A. Electromagnetic pollution from phone masts. Effects on wildlife. Pathophysiology 2009; 16:191-9.
14. Warnke U. Bees, birds and mankind; destroying nature by electrosmog. Effects of wireless communications technologies. Kompetence Initiative for the Protection of Humanity, Environment and Democracy, Published by Prof. Dr. med. Karl Hecht, Dr. med. Markus Kern, Prof. Dr. phil. Karl Richter, and Dr. med. Hans-Christoph Scheiner (Germany). Kempten, 1st ed., November 2007, ISBN: 978-3-00-023124-7. English Edition March 2009.
15. Hudson B. Commerce in the commons: A new concept of environmental and natural resource regulation under the commerce clause. Harvard Environ Law Rev (in press). Available at: http://ssrn.com/abstract=1663838