

* Review

Artificial Lighting and Public Health

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Summarized Work

BARGHINI, Alessandro. **Antes que os Vaga-Lumes Desapareçam ou Influência da Iluminação Artificial sobre o Ambiente.** (Before Fireflies Disappear or the Influence of Artificial Lighting on the Environment) São Paulo, Editora ANNABLUME; FAPESP, 2010. 192 p. ISBN:978-85-391-0057-6.

While peoples are challenged regarding the role they play in destroying the planet, a very relevant aspect has deserved little attention in the discussions, be it in scientific environments, be it in public policies debates: the impact of artificial lighting on the environment and on public health. The book by Professor Barghini partly fills this gap.

The purpose of the author is to make clear the attraction by insects for night lights and its consequences for public health in the attraction of disease carriers. Through a wide theoretical and methodological repertoire developed along the chapters, the author tracks evidence about the role played by light in the transmission of disease, such as Chagas disease and malaria. Light performs this role through two distinct mechanisms: attracting vectors to an anthropic influence region and, another one subtler, changing the circadian cycle of certain species, increasing the foraging period and facilitating the haematophilic relations with man and the likelihood of infections.

Little is known about the harmful effects of artificial night lighting on different organisms, on circadian cycles and on the balance of ecosystems in general. In academia, the problem of artificial lighting and its consequences for ecology and public health is dealt with in a shallow manner. There is a single recorded conference, in 2002, in Los Angeles, USA (*Ecological Consequences of Artificial Night Lighting*) that produced one of the few publications that are international references on the subject (RICH & LONGCORE, 2005). The book summarized here stimulates more in-depth discussion and study about the theme, as well as attention to public lighting policies.

Reading the work is easy and pleasant, at the same time being well-organized, plentiful of information and useful content. Barghini makes a wide and careful bibliographic revision about the theme. He mentions writers, philosophers and scientists of natural sciences, always bringing up interesting, instigating reflections. Maybe this ease stems from his unorthodox formation, since he graduated in political sciences and developed work in the field of anthropology. His professional life was dedicated to the practice of energy planning in several countries, which gave him unique experiences and world views. He resumed his studies 37 years after graduating, with a master's dissertation in ecology and, in 2008, he finished his doctorate thesis in the USP Ecology Department. The book presented here is a synthesis of it.

The book is organized in ten chapters. In the first two, the author contextualizes the problem and provides the reader with the basics about the essential principles of natural light and their central relationship with the existence of life on Earth.

In the incursion about the physical and biological bases related to light, the author describes the characteristics of the solar spectrum as it advances on the troposphere and its transformation until it reaches the terrestrial surface. Barghini characterizes light phenomena that are essential to the energy demand necessary for the existence of life on land. He remembers that life is the self-organization of matter, which happens in thermodynamic conditions of non-equilibrium ensured by the energy flow within a narrow energetic limit. The author revises the concepts of the life window for electromagnetic radiation, in which only in wavelengths between 280 and 1400 nanometers is a photobiological response obtained, ensuring the photosynthetic fixation of chlorophyll and the vision of all beings on the planet.

Chapter three contains an in-depth analysis of artificial radiation and its dissipation. The emission power of models of lamps commercialized today, types of glass used and its ability to filter ultra-violet radiation are analyzed by the author. He also points out the existence of three types of lamps: incandescent, discharge and LEDs (*light emitting diodes*), and discusses the physical characteristics of these different types regarding the emission of UV radiation and efficiency, relating its effects in attracting insects. It is highlighted, for instance, that lamps with metallic vapors and fluorescent lamps emit white radiation to the perception of the human eye and are strongly aggressive to the environment due to the UV emission. Even

though technical, reading is facilitated by the writing style of the author, which is concise and precise in explanations.

The reading of chapter fourth, which discusses artificial lighting, is also pleasant. Enriched with historical passages of humanity that drove it to the extensive and abundant offer of artificial lighting in the last 50 years, the recent aspect of this growing phenomenon after the middle of the 19th Century is evident. Barghini traces a history of technology along the evolution of humanity, since the discovery of fire, and it is curious to notice that humanity spent most of its history in the dark, between sunset and sunrise! In face of this fact, the author recovers the concept of scotoscopic vision, in which the human eye accommodates and has greater efficiency during the night (page 61). However, urban centers began having more lighting points and the eye takes around half an hour to accommodate. The needs for lighting became bigger. Technology evolved to more efficient lamps, with higher color temperature, exactly in the area of scotoscopic vision and also in the region where the visual sensitivity of insects is higher (p. 67), increasing the possibility of attraction. In man, this affects the melanopsin receptors and, thus, the circadian cycles.

Fascinating is the incursion in the evolutionary process, in chapter five, where the author analyzes the sensations, that allow the organism to see the external world, both in its structural and in its functional characteristics. In chapter six, Barghini integrates evolutionary biology with physiology, where he dissects the human and insect visions. He also describes the discrimination of varied wavelengths and cerebral processing, which ensures the discrimination of colors.

In chapter seven, the author goes deeper into the issue in the context of health when he raises the concern with the "reduction or increase in insects that may cause deep changes to the trophic network, with possible consequences regarding the diffusion of diseases emerging in wilderness areas modern lighting has yet to reach" (p. 115). Barghini sums up some of the impacts of lighting on the transmission of diseases, which may occur due to changes to the habits of vectors or of populations, and suggests strategies to minimize them. The author discusses the interpretation mistakes of the phenomenon along the history of public health, exemplifying with Chagas disease. He also points out lighting as an important variable also in the transmission of malaria and in the attraction of phlebotominae, which leads him to rethink the urbanization of leishmaniosis, which has been observed. However, he understands that "lighting is another element of attraction of insects, and its influence can and should be controlled" (p. 123). The book makes it clear that there is a need for more research focusing on the issue.

In chapter eight, Barghini brings his original contribution to the theme, mentioning his field experiments, integrating the knowledge presented along the work with his valuable results. His goal was to verify if artificial lighting would be capable of drawing disease-transmitting insects. Thus, he tested the hypothesis of attraction of insects by ultra-violet radiation. His results are very relevant: it was verified that, upon reducing the emission to the spectra visible for insects, but not for humans, the impacts of artificial lighting in the attraction of the entomological fauna are minimized. From that, Barghini proposes technical solutions for lighting engineering and practical suggestions, such as the use of UV radiation filters for luminaries.

Chapter nine is particularly interesting for calling the attention to the importance of the biological clock, although the author has focused too much on the importance of light in the attraction and repulsion of species, particularly insects. Then he describes the effects of artificial lighting in the working of plants, animals and humans, interfering in the physiology of living things. Plants have their flowering periods changed, when photo-periods are disturbed. In the case of humans, the periods of light and dark affects receptors that stimulate the production of melatonin. It is a known fact that people present depression when they move to regions where days are too short. On the other hand, it is considered that prolonged

exposition to artificial lighting may produce insomnia. However, the effect of changes in the exposition to light cycles in different animal species is still too little studied, including in humans.

The last chapter has as its title a Japanese saying: "the darkest place is under the lighthouse". The author explores the double meaning of this sentence to conclude the book and drive us to the reflection that "excess lighting obfuscates sight and makes us see less" (p. 147), exactly in a world in which a large part of people does not know what night vision is, and where it's already nearly impossible for astronomers to observe the Milky Way, due to the excess of artificial lighting. The metaphoric sense regards the focus on the detail, which precludes the vision of the whole, applying this concept to the epidemiological understanding, when laboratory experiments do not reproduce the "complexity of interactions between vectors and hosts of diseases" (p. 147). Thus one of the great merits of his studies, since the experiments of the author were made on field.

The theoretical contribution of the author is reinforced by the pragmatic direction, providing in the "appendix, an abstract of the main project measures to minimize the impact of artificial lighting on the environment"(p.157).

In the entire world, urban lighting is intensified in an attempt to face the growing public safety issues. Among other interesting considerations, the author mentions the issue of safety as a decisive factor for the increase in artificial lighting, although he considers this arguable. In Brazil, rural areas get the benefit of electrical powering projects, as a policy to bring comfort, safety and well-being to people of peripheral areas and of the backwoods. However, the waste of energy with lighting in desert ways, through pastures and fields is notorious, whereas millions of Brazilians remain in the dark. Barghini has a vehemently contrary position to the excesses committed against the planet regarding artificial lighting. Attention is brought to the "conspicuous consumption" and it is considered to be the "cursed part" of contemporary technological societies. It is understood that the control of the light flux and of its intensity may be a first step to make the need for public lighting compatible with the environment, since the bigger the contrast of luminaries, the bigger the impact on the environment and on humans. Aiming the luminous beam where it is very necessary is proposed, diminishing the luminous pollution and the harmful effects of it on plants and animals. The modulation of the spectra of luminaries is proposed, as well as the use of selective wavelength filters, resulting in a reduction of the attraction of insects. The elaboration of more rigorous norms is also defended, so that, besides human comfort, effects on the environment are considered. Finally, the author revisits the concept of sustainability, understanding it fundamentally as the reduction in conspicuous consumption.

In concluding the reading of the book by Professor Barghini, the reflection in place is that the impacts of artificial lighting to the environment and to public health are not present in the plan for expanding the system. Neither is the population informed about it. These variables are not taken into account in the urban projects.

Small grammar or orthography mistakes do not compromise the work; they would just deserve a more detailed revision in the next edition, also contemplating bibliographic references, since some works cited do not appear listed. The title is inappropriate, long, confusing and does not translate the essence of the book, poetic though it may be.

Considering the differentiated formation of the author, the work presented drives us to reflect on the difficult practice of interdisciplinarity, almost always frustrating, frequently directed to the undesired reductionism. In this case, it happened within a same individual, capable of transiting between different fields of knowledge, entwining natural sciences, health and social sciences to produce extremely interesting results in the analysis of complex problems.

The book reveals profound knowledge and analysis capability by the author. It is a must for all interested in a better relationship between technology and its effects for the environment and for public health. It is really desirable that the work is an inspiration for legislators and managers and that it is a starting point for deeper studies and public policies dealing with this theme.

Reference

RICH, C.; LONGCORE, T. **Ecological consequences of artificial night lighting**. Washington DC: Island Press, 2005.