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Light Pollution and Climate Change: A Dual Approach to Sustainability

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Abstract:

Light pollution and climate change are two pressing environmental issues that threaten the long-term sustainability of our planet. While these issues are typically addressed as separate concerns, there is a growing recognition of the connections between these challenges, which calls for a combined approach to ensure meaningful progress. This policy paper examines the link between light pollution and climate change, exploring the common causes, impacts, and potential synergies in addressing both. Some of the solutions this paper addresses are energy efficient LED lights and light shields, both of which can help limit excess light pollution while helping to reduce carbon emissions. By tackling these issues together, policymakers can create more impactful strategies for promoting environmental sustainability.

Keywords: Light Pollution, Climate Change, Sustainability, Carbon Emissions, LED Lights, Light Shields

1. Introduction

As humanity faces the ever-escalating challenges of climate change, light pollution emerges as an unexpected, yet impactful, factor in the equation. While these two issues have historically been treated separately, there is a growing recognition of their interconnectedness and the need for an integrated approach to simultaneously address both issues. That is why this paper argues that addressing light pollution and climate change in tandem can create opportunities to more effectively reduce light pollution while advancing global sustainability goals, particularly through the use of light acces- sories, educational campaigns, and international collaboration.

Climate Change and Its Impacts

To begin with, climate change is generally defined as a long-term change in weather patterns and temperatures that has historically been linked to natural phenomena, such as large volcanic eruptions. While this has been the case, more recent climate change has been linked to human activities, particularly the burning of fossil fuels. By burning fossil fuels, humanity has inadvertently trapped enough greenhouse gases in the atmosphere to warm the planet by 1.1 degrees Celsius, or 1.9 degrees Fahrenheit, since pre-industrial times. Although this may not seem like much, even small increases in global temperatures can have outsized impacts on the environment and humanity. That is why scientists around the world urge humanity to limit global warming to no more than 1.5 degrees Celsius by 2100 to avoid the worst impacts of climate change (United Nations, 2020).

If humans continue to rely on fossil fuels, there will be significant consequences for the world economy. It is predicted that even if humanity is able to keep the planet's temperature well below 2 degrees Celsius by 2050, compared to pre-industrial times, the planet will have warmed enough to reduce global GDP by 4 percent—or five trillion USD—compared to today's global GDP. While this is concerning, it pales in comparison to the 18 percent reduction in worldwide GDP, or 20 trillion USD, that could result if humanity blatantly ignores climate change (Marchant, 2021; International Monetary Fund, 2024). Therefore, if humanity does not do anything about climate change, it will significantly reduce worldwide GDP.

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In addition to this loss of global GDP, climate change will also result in more people dying. Currently, the World Health Organization predicts that climate change will cause an additional 250,000 deaths each year between 2030 and 2050 (World Health Organization, 2023). However, this estimate may be on the low end of the spectrum, with some predictions suggesting that the number could reach 500,000 per year when additional impacts of climate change are factored in (Sprinmann et al., 2016). Therefore, millions of people will die in the next 30 years from preventable causes if humanity does not take immediate action on climate change. Addressing light pollution can help mitigate some adverse effects of climate change.

Light Pollution and Its Influence on Climate Change

Light pollution refers to the excessive or inappropriate use of artificial light, particu- larly in urban and suburban areas. Examples of this include streetlights, office lights, car lights, and other lighting sources that not only brighten the night sky, but also the surrounding area (National Geographic, 2024). The reason why this is a problem for climate change is because light sources are commonly powered by energy that produces significant CO2 emissions, such as oil. Therefore, by having excessive, inefficient, or wasted light, it can lead to more CO2 being released into the environment than nec es- sary. However, if the United States were to reduce its light pollution, it would be able to save almost 200 million metric tons of CO2 from being released every year by 2035, which would also save billions of dollars each year for the country (U.S. Department of Energy, 2022). While this is significant, the reduction in CO2 pales in comparison to the roughly 900 million tons of CO2, or 1.67 percent of all greenhouse gasses emitted, that could be prevented each year if energy consumption around the world was cut in half (UNFCCC, 2023; Ritchie et al., 2024). Thus, reducing light pollution can have a considerable effect on climate change.

Light Pollution and Its Influence on Humans

Alongside light pollution being bad for the environment, it is also bad for the health of people. An example of this is how 3- 40 lux of light, which is significantly less than most electronic devices, can cause a reduction in melatonin by 50 to 90 percent, all within an hour (Brown, 2020; Gooley, 2011; Higuchi, 2014; McIntyre, 1989; Obayashi et al., 2021). In turn, this reduction in melatonin, while relatively insignificant for one night, can create an increased risk of diabetes, obesity, high blood pressure, and several forms of cancer if a person were to experience this reduction over multiple years (Blask et al., 2014; Chepesiuk, 2009; Cho et al., 2015; Karska et al., 2024; Mason et al., 2022; Walker et al., 2020). Therefore, light pollution can be a significant risk to the physical health of a person. However, it can also affect the mental health of a person as well.

When someone experiences light pollution over many years, it can lead to a phenomenon called" light pollution anxiety". This form of anxiety, caused by prolonged light exposure, can cause a person to feel constantly exposed and unable to relax. In turn, this anxiety can lead to higher levels of stress, depression, mood disorders, and even suicidal behavior (Karska et al., 2024; Min et al., 2018; Obayashi et al., 2021; Paksarian et al., 2020; Walker et al., 2020). Therefore, light pollution can h ave a major impact on a person's mental and physical health, and that is why policymakers must do something about light pollution.

2. Policy Recommendations

Integrated Lighting and Energy Policies

With light pollution being able to create major impacts for climate change and a per- son's health, policymakers in the United States must develop policies that address light pollution.

Dimmers

An action that the government could potentially take to reduce light pollution and CO2 emissions would be to subsidize physical dimmers. Dimmers are switches that are able to rapidly cut off and restart the flow of energy within a light bulb. B y having this process, a person is not only able to control the brightness of a light, but they are also able to control how much energy the light bulb uses, even if it is not a 1:1 ratio. However, this efficiency can be boosted further by the potential a ddition of triode alternating currents, or TRIAC switches. TRIAC switches are systems that are able to alternate between power and no power within a light bulb hundreds of times a second, resulting in dimmer lights and more energy saved (Smith et al., 2005). Although either of these options would prove beneficial, they are associated with a variety of problems.

While dimmers have the potential to save energy, they do come with a major problem, primarily their high costs. With dimmers requiring several hours of pro- fessional labor to install, it could become expensive for the government to subsidize

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dimmers, especially considering that the dimmer itself also costs money. Therefore, a more effective approach would be to require newly built homes to have dimmers. This allows the government to reduce the energy and CO2 emissions of these new houses while only raising the costs of these homes by a few hundred dollars, which isn't much in the grand scheme of things. Thus, this can be an effective method for the govern- ment to reduce light pollution and CO2 emissions. Another such approach that can be utilized is household sensors.

Household Sensors

Since some individuals may prefer alternatives to dimmers, policymakers should add other technologies to satisfy these new regulations, such as household sensors. These are devices that are able to create an efficient, yet optimal, light level by monitoring and responding to environmental changes within an area. Through this device, people are able to reduce their energy consumption from lighting by an average of 30 to 60 percent, alongside a proportional reduction in light pollution and CO2 emissions (International Energy Agency, 2024; U.S. Department of Energy, 2022). Thus, this can be a cost-effective way for the government to help reduce light pollution, CO2 emissions, and the cost of living at the individual level, especially considering that most of these sensors are priced at a few hundred dollars. However, to effect change at the local level, the government must take another approach.

Sensors on Public Lighting

In order to create change at the local level, the Federal Government of the United States should utilize a stick-and-carrot approach to push cities to use more light accessories in public spaces. One such light accessory that should be included within this approach is sensors. These devices use a variety of methods, such as light levels, temperatures, sound waves, and microwave waves, to detect the movement of people and vehicles within a specified area. Once detected, these devices are able to turn on a light until a person or vehicle has moved out of range, at which point the sensor turns off the light. By implementing this system, cities and communities can reduce their energy use from public lighting by an average of 20-60 percent, with the possibility that this percentage could be higher in areas with little to no traffic (Sadeghian et al., 2024). In addition to this reduction in energy consumption, smart sensors will also be able to reduce the amount of light hitting residential buildings, thereby improving the health of its citizens in the long term. Therefore, this can be an effective method to reduce both light pollution and CO2 emissions. However, other solutions should be considered, as this method is fairly expensive.

Light Shields

Another accessory that can be utilized in the stick-and-carrot approach is light shields. These are barriers placed around a light bulb that direct a bulb's light downward. The reason these are better than regular lights is because unshielded lights can theoretically waste up to sixty percent of their light in non-beneficial directions, such as towards the sky. And so, by using shielded lights, a city can utilize lights that are half as energy intensive while also getting the same amount of brightness as unshielded lights, thereby saving money and energy (International Dark-Sky Association, 2023; Falchi, 2011). Therefore, for these reasons, the government should pursue a stick-and-carrot approach when convincing cities to implement this, and other, light accessories within their area. However, to ensure the maximum effectiveness of these policies, a public awareness campaign should also be created.

Public Awareness

Educational Campaigns on Light Pollution

While creating and implementing policy is a step in the right direction, this step can be reinforced by changing public perceptions about light pollution. One way to achieve this is through comprehensive educational campaigns that target schools, communities, and social media platforms about the dangers of light pollution. For example, public service announcements (PSA) on television could target an older audience, while social media initiatives could leverage influencers and shareable infographics to engage younger audi- ences, thereby helping to raise the awareness of this issue for multi-demographics. The one problem with this is that these campaigns can be somewhat costly, with the cost of these campaigns ranging from a few hundred dollars for a small-scale community work- shop to potentially millions of dollars for a high quality public service announcement campaign. However, the reduction in environmental harms from an increased awareness about light pollution could offset these costs over time, thereby making it a potential option to consider.

Community Initiatives

By prioritizing sustainability in the design of cities, urban planners will be able to reduce energy consumption, CO2

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emissions, and light pollution. One way to do this is by implementing light source regulations. These are policies and guidelines that control the amount, direction, and type of artificial light used at night. An example of how powerful these regulations can be when focused on smart LED lighting is seen in Tucson, AZ. By spending about 11 million dollars, the city was able to convert approximately 19,000 inefficient sodium streetlights to more efficient LED streetlights. Not only did this switch reduce the energy consumption within the city by 70 percent or more, but it also significantly reduced the maintenance costs of these lights, as LED lights last longer than their sodium counterparts. Together, these changes helped save the city more than two million dollars a year, with an expected payback period of about five years (City of Tucson 2016; Citylab Insights and Northeast Group, 2022; International Dark-Sky Association, 2019). In addition to these positive changes, the switch also reduced the number of lumens emitted by the lighting system by about 63 percent, which helps reduces the amount of light pollution impacting people in their daily lives (Citylab Insights and Northeast Group, 2022; International Dark-Sky Association, 2019). Therefore, these changes have been tremendously beneficial for the city and its residents.

International Collaboration

Given the global nature of light pollution and climate change, countries around the world must take action to reduce these issues. With many of the developed countries either having sufficient laws on light pollution, or needing similar laws as the United States, a less talked about idea is having developing countries take steps to reduce these issues. This is especially important considering that these countries are expected to industrialize over the next few decades. And so, in order to create a sustainable culture that reduces CO2 emissions, these countries should embark on a journey to adopt sustainable policies.

One such policy that developing countries can adopt, if they have not already, is mandatory labels on light-related products. These policies, which could be modeled after the United States Energy Star, would require companies to label their products in order to remain on the market. The reason these labels are beneficial is because they provide standardized information on the efficiency of a product, which helps con- sumers make an informed decision about their purchases. Not only does this empower consumers to select cost-effective products that save energy, but it also creates a strong market incentive for companies to develop more efficient products. (International En- ergy Agency, n.d.; Hong, W., Tang, X., & Zhu, X., 2023) Therefore, this law would be a practical step towards sustainability.

In addition to these labels, countries can use Minimum Energy Performance

Standards (MEPS) to enhance the benefits of these labels. MEPS are legally enforceable regulations that require certain products, such as lightbulbs, to meet specific efficiency thresholds in order to remain on the market (Gonzalez-Torres et al., 2023). An example of this is how the United States now mandates that light bulbs must produce the equivalent of 120 lumens per watt in order to stay on the market, which is one of the highest in the world. (Budryk, 2024). However, expecting less developed countries to immediately adopt such high standards would be impractical (International Energy Agency). That's why developing countries should adopt gradual efficiency standards while addressing key barriers to their implementation.

A key barrier preventing developing countries from implementing these stan- dards is the high cost of efficient lighting relative to the income of its citizens. An example of this is how 85 percent of people in Sub-Sahara Africa make less than 5.5 dollars a day, which is not enough for the average person to afford the relatively more expensive LED lighting, while also being able to afford basic necessities like food. (Cas- taneda Aguilar et al., 2019). Therefore, many of these people usually choose cheaper types of lighting, such as incandescent bulbs, to light their homes. However, that is, if they have any electricity at all.

Another problem that countries need to address is the lack of reliable electricity for their citizens. Not only can this be seen around the world, with almost 2.4 billion people not having access to reliable forms of electricity, but it can also be seen in specific areas, such as Sub-Saharan Africa, where only 51.5 percent of the population has ac- cess to electricity. (World Bank, n.d.; Energy Sector Management Assistance Program, 2024). The reason why this is problematic is because not only does it force individuals within these areas to use dirtier forms of lighting, such as kerosene lamps and candles, but it also prevents countries from creating efficiency standards, as there is little point to do so when a large portion of its populace is not able to use lightbulbs in the first place. Therefore, by helping citizens acquire clean electricity, countries and organizations would be able to prevent roughly 25 million tons of CO2 from being released into the atmosphere every year(Energy Sector Management Assistance Program, 2024).

One possible solution to this problem is to provide basic solar lanterns and pan- els to underserved communities. However, even with these solar devices being relatively affordable at a few hundred dollars each, the scale of the problem poses a significant funding barrier, with estimates putting the cost of this program at about 30 billion dollars over a 10-year period to provide electricity to 400 million people. Therefore, given the immense cost of the project, international organizations,

institutions, and governments must step in and collaborate to make this goal a reality. (Energy Sector Management Assistance Program, 2024; Quak, 2018; World Bank, 2020). That is why the World Bank has taken the lead in this effort by providing about 1.3 billion dollars a year to combat this effort, which would equate to about 13 billion dollars by 2035 (En- ergy Sector Management Assistance Program, 2024). But, if this goal is to be achieved, international collaboration is needed; otherwise millions of people will suffer from a lack of lighting and the environmental problems associated with it. This underscores the urgency of coordinated international action.

3. Conclusions

By examining light pollution and climate change as interconnected problems, policy- makers will be able to develop more comprehensive solutions to improve energy efficiency, reduce emissions, and improve public health and well-being.

To effectively address these challenges, people should focus on three key strategies. First, by implementing mandates and subsidies, policymakers can promote the widespread adoption of dimmers, smart sensors, and light shields. Second, by launching educational campaigns at both the local and national levels, individuals can raise awareness about the dangers of light pollution while fostering grassroots support for sustainable practices. Finally, by fostering international collaboration, countries and institutions will be able to help developing countries access clean lighting while setting up the necessary regulatory framework to support a long-term culture of sustainability. Now is the time to take action: advocate for smarter lighting policies, support educational initiatives, and encourage global cooperation to create a brighter, more sustainable future for all.

References:

1. Audubon Society. (n.d.). Lights out Program. Audubon. https://www.audubon.org/our- work/cities-and-towns/lights-out.
2. Blask, D. E., Dauchy, R. T., Dauchy, E. M., Mao, L., Hill, S. M., Greene, M. W., Belancio, V. P., Sauer, L. A., & Davidson, L. (2014). Light exposure at night disrupts host/cancer circadian regulatory dynamics: impact on the Warburg effect, lipid signaling and tumor growth prevention. PloS one, 9 (8), e102776. https://doi.org/10.1371/journal.pone.010277
3. Brown, T. M. (2020). Melanopic illuminance defines the magnitude of human circadian light responses under a wide range of conditions. Journal of Pineal Research, 69 (e12655). https://doi.org/10.1111/jpi.12655
4. Budryk, Z (2024). Here's what new LED lightbulb standards mean for Amer- ican households. The Hill. https://thehill.com/policy/energy-environment/4597982- led-lightbulb-efficiency-rule-savings-american-households/
5. Castaneda Aguilar, R. A., Jolliffe, D. M., Fujs, T., Lakner, C., & Prydz, E. B. (2019). 85% of Africans live on less than $5.50 per day. https://blogs.worldbank.org/en/opendata/85-africans-live-less-550-day
6. Chepesiuk R. (2009). Missing the dark: health effects of light pollution. Envi- ronmental health perspectives, 117 (1), A20–A27. https://doi.org/10.1289/ehp.117-a20
7. Cho, Y., Ryu, S. H., Lee, B. R., Kim, K. H., Lee, E., & Choi, J. (2015). Effects of artificial light at night on human health: A literature review of observational and experimental studies applied to exposure assessment. Chronobiology international, 32 (9), 1294–1310. https://doi.org/10.3109/07420528.2015.1073158.
8. Citylab Insights and Northeast Group. (2022). The benefits of LED and smart street lighting. https://northeast-group.com/wp-content/uploads/2022/01/CityLab-Northeast-Group-the-benefits-of-led-and-smart-street lighting.pdf?form=MG0AV3.
9. City of Tucson. (2016). Investment Grade Audit City of Tucson LED Lighting Conversion Project. https://www.tucsonaz.gov/files/sharedassets/public/v/1/government/departmen and-mobility/documents/01.22.16 cotiga report final.pdf.
10. Energy Sector Management Assistance Program (ESMAP). (2024). Off-grid so- lar market trends report 2024: Outlook. World Bank Group. https://www.esmap.org/Off- GridSolarM arketT rendsReport2024.
11. Falchi, F., Cinzano, P., Elvidge, C. D., Keith, D. M., and Haim, A. (2011). Lim- iting the impact of light pollution on human health, environment, and stellar visibility. Journal of Environmental Management, 92(10), 2714-2722. https://www.sciencedirect.com/science/arti
12. Gonzalez-Torres, M., Bertoldi, P., Castellazzi, L., & Perez-Lombard, L. (2023). Review of EU product energy efficiency policies: What have we achieved in 40 years? Journal of Cleaner Production, 421, 138442. https://doi.org/10.1016/j.jclepro.2023.138442
13. Gooley, J. J., Chamberlain, K., Smith, K. A., Khalsa, S. B., Rajaratnam, S. M., Van Reen, E., Zeitzer, J. M., Czeisler, C. A., & Lockley, S. W. (2011). Exposure to Room Light before Bedtime Suppresses Melatonin Onset and Shortens Melatonin Duration in Humans. The Journal of clinical endocrinology and metabolism, 96 (3), E463–E472. https://doi.org/10.1210/jc.2010-2098
14. Higuchi, S., Nagafuchi, Y., Lee, S.-I., & Harada, T. (2014). Influence of light at night on melatonin suppression in children. The Journal of Clinical Endocrinology & Metabolism, 99 (9), 3298–3303. https://doi.org/10.1210/jc.2014-1629
15. International Dark-Sky Association. (2023). Light pollution wastes energy and money and damages the climate. DarkSky. https://darksky.org/resources/what-is- light-pollution/effects/energy-climate/
16. International Dark-Sky Association. (2019). NIGHTS OVER TUCSON: How the Tucson, Arizona, LED Conversion

Improved the Quality of the Night. DarkSky. https://darksky.org/news/nights-over-tucson/
17. International Energy Agency. (2024). ETP Clean Energy Technology Guide – Data Tools . https://www.iea.org/data-and-statistics/data-tools/etp-clean-energy- technology-guide?layout=trlselectedTechID=3b2f2768
18. International Energy Agency. (n.d.). Lighting. IEA. https://www.iea.org/energy- system/buildings/lighting.
19. International Monetary Fund.World Economic Outlook (October2024)-GDP, current prices. https://www.imf.org/external/datamapper/NGDPD@WEO/OEMDC/AD
20. Karska, J., Kowalski, S., G-ladka, A., & et al. (2024). Artificial light and neurodegeneration: Does light pollution impact the development of Alzheimer's disease? GeroScience, 46(1), 87–97. https://doi.org/10.1007/s11357-023-00932-0.
21. Mason, I. C., Grimaldi, D., Reid, K. J., Warlick, C. D., Malkani, R. G., Abbott, S. M., & Zee, P. C. (2022). Light exposure during sleep impairs cardiometabolic func- tion. Proceedings of the National Academy of Sciences of the United States of America, 119 (12), e2113290119. https://doi.org/10.1073/pnas.2113290119.
22. Marchant, N. (2021). This is how climate change could impact the global econ- omy. World Economic Forum. https://www.weforum.org/agenda/2021/06/impact- climate-change-global-gdp.
23. McIntyre, I. M., Norman, T. R., Burrows, G. D., & Armstrong, S. M. (1989). Human melatonin suppression by light is intensity dependent. Journal of Pineal Re- search, 6(2), 149–156. https://doi.org/10.1111/j.1600-079X.1989.tb00412.x.
24. Min, J., and Min, K. (2018). Outdoor light at night and the prevalence of depressive symptoms and suicidal behaviors: A cross-sectional study in a nationally representative sample of Korean adults. Journal of Affective Disorders, 227, 199–205. https://doi.org/10.1016/j.jad.2017.10.039.
25. National Geographic. (2024). Light pollution. https://education.nationalgeographic.org/resourc pollution/
26. Obayashi, K., Saeki, K., Iwamoto, J., Ikada, Y., & Kurumatani, N. (2013). Exposure to light at night and risk of depression in the elderly. Journal of affective disorders, 151 (1), 331–336. https://doi.org/10.1016/j.jad.2013.06.018
27. Paksarian, D., Rudolph, K. E., Stapp, E. K., Dunster, G. P., He, J., Mennitt, D., Hattar, S., Casey, J. A., James, P., & Merikangas, K. R. (2020). Association of Outdoor Artificial Light at Night With Mental Disorders and Sleep Patterns Among US Adolescents. JAMA psychiatry, 77 (12), 1266–1275. https://doi.org/10.1001/jamapsychiatry.2020.1935.
28. Ritchie, H., Rosado, P, & Roser, M. (2024). Greenhouse gas emissions. Our World in Data. https://ourworldindata.org/greenhouse-gas-emissions
29. Sadeghian, O., Mohammadi-Ivatloo, B., Oshnoei, A., & Aghaei, J. (2024). Un- veiling the potential of renewable energy and battery utilization in real-world public lighting systems: A review. Renewable and Sustainable Energy Reviews, 192, 114241. https://doi.org/10.1016/j.rser.2023.114241
30. Smith, J., Speakes, J., & Rashid, M. H. (2005). An overview of the modern light dimmer: Design, operation, and application. Proceedings of the 37th Annual North American Power Symposium, 2005, 299–303. https://doi.org/10.1109/NAPS.2005.1560542.
31. Springmann, M., Mason-D'Croz, D., Robinson, S., Garnett, T., Godfray, H. C. J., Gollin, D., ... & Scarborough, P. (2016). Global and regional health effects of future food production under climate change: A modelling study. The Lancet, 387 (10031), 1937–1946. https://doi.org/10.1016/S0140-6736(15)01156-3
32. Tawfik, M., El-Maksood, A., Soliman, F., & Abd El-Basit, W. (2023). Design and implementation of electronic illumination control system. Journal of Scientific Research in Science, 40, 72–85. https://doi.org/10.21608/jsrs.2023.331804.
33. Quak, E. J. (2018). The costs and benefits of lighting and electricity ser- vices for off-grid populations in sub-Sahara Africa. Institute of Development Studies. https://assets.publishing.service.gov.uk/media/5af96657ed915d0df4e8cdea/CostsBenefitsOff− GridElectricityLightingSystems.pdf
34. United Nations. (2020). What is climate change? United Nations. https://www.un.org/en/clim is-climate-change
35. UNFCCC. (2023). En.lighten Initiative. https://unfccc.int/climate-action/momentum- for-change/activity-database/momentum-for-change-enlighten-initiative.
36. U.S. Department of Energy. (2022). Solid-State Lighting Research and Devel- opment Opportunities. https://www.energy.gov/sites/default/files/2022-02/2022-ssl- rd-opportunities.pdf
37. Walker, W. H. II, Borniger, J. C., Gaudier-Diaz, M. M., Mel´endez-Ferna´ndez, O. H., Pascoe, J. L., DeVries, A. C., & Nelson, R. J. (2020). Acute exposure to low-level light at night is sufficient to induce neurological changes and depressive-like behavior. Molecular Psychiatry, 25 (5), 1080–1093. https://rdcu.be/d9nU7.
38. World Bank. (n.d.). Access to electricity (% of population) – Sub-Saharan Africa. World Bank Open Data. https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=Z
39. World Bank. (2020). Off-grid solar electricity is key to achieving universal elec- tricity access. The World Bank. https://www.worldbank.org/en/results/2020/11/10/off- grid-solar-electricity-is-key-to-achieving-universal-electricity-access-the-lighting-global-story
40. World Bank Group. (2023). Final consumption expenditure (current US dol- lars). https://data.worldbank.org/indicator/NE.CON.TOTL.CD
41. World Health Organization. (2023). Climate change. https://www.who.int/news- room/fact-sheets/detail/climate-change-and-health

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