

THE DARK SIDE OF THE LIGHT: RACHEL CARSON, LIGHT POLLUTION, AND A CASE FOR FEDERAL REGULATION

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ABSTRACT: This comment explores the negative effects of light pollution and considers whether current levels of artificial light at night (LAN) warrant federal control by the Environmental Protection Agency (EPA). This study first identifies the negative effects of light pollution on human health and the environment, treatment of which aligns with the mission statement of the EPA. Light pollution comprises both a private and a public nuisance. Next, this comment assesses the effectiveness of the common law approach, local government, state government, and federal control over light pollution in this context to determine which form of governance is most effective. Then, EPA involvement through federal and state implemented plans, as well as federal regulation of manufacturing is investigated. Last, this comment considers the necessity of private action through an emerging legal reform called new governance, which emphasizes public-private approaches. The negative effects of light pollution on human health and the environment could eventually lead the EPA to assert control over the regulation of light pollution, but under the current presidential administration this is highly unlikely. The predicted lack of government action leads me to call for nongovernment organizations (NGOs) to step in and take action to privately regulate light pollution and mitigate its negative effects through certification regimes, insurance premium incentives, and corporate social responsibility until government exerts regulatory control.

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“THERE WAS ONCE a town in the heart of America where all life seemed to live in harmony with its surroundings.”¹ At night, the townspeople lay in the midst of an illuminated sea, reciting ancient constellate stories of eagles, lions, and hunters.² The people relied on the interstellar patterns for telling time, navigating featureless lands, planting crops, and forming ideology.³ Under the ageless stars, silent hunters preyed effortlessly on voles and children slept peacefully. So it had been since long before the land was settled. Then a strange

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1. RACHEL CARSON, *SILENT SPRING* 3 (Penguin Classics 2012) (1962). This introduction follows the style, ideas, and text found in the first chapter of Rachel Carson's *Silent Spring* very closely. In this instance, imitation of *Silent Spring* is used to commemorate and revive the Carsonian tone that brought about the modern environmental movement.

2. See Julia Ackendorf, *How Did Ancient People Use the Stars and Planets?*, *SCIENCING* (Apr. 24, 2017), <http://sciencing.com/did-people-use-stars-planets-8675019.html>.

3. See *id.*

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glow crept over the area and everything began to change: birds swarmed in circles, owls blundered in the bright sunlight, and people restlessly tossed and turned in their beds.⁴ The glowing blight grew brighter, up into the sky and out across the land like an uncontrollable flame swallowing everything in its path. Suddenly, the night was gone.

“THERE WAS A STRANGE STILLNESS. The birds, for example—where had they gone? Many people still spoke of them, puzzled and disturbed.”⁵ Bird baths in parks were deserted and feeders remained untouched. Spirited daybreaks became ambiguous sunrises lacking cheerful voices.⁶ Peaceful twilights became ceaseless sunsets, hustling and bustling with insufferable headlights. Near the town’s coast, misdirected sea turtles hiked up the shoreline to lay their eggs in foreign soil. Upon exiting their shells, sea-turtle hatchlings doom themselves for failure, running aimlessly on the beach until devoured by predators.⁷ Increasingly and inexplicably, sleep deprived men and women breathe their last breaths.⁸

“THIS TOWN DOES NOT ACTUALLY EXIST, but it might easily have a thousand counterparts in America or elsewhere in the world.”⁹ While it would be difficult to find a single city or suburb currently facing all of the issues described above, every consequence described here is occurring in this moment as a result of excessive light. To echo Carson, the dark side of light “has crept upon us, almost unnoticed, and this imagined tragedy may easily become a stark reality.”¹⁰

Similar to Rachel Carson’s cry against the excessive use of pesticides, this comment warns of the dangers of light pollution and explores possible methods of regulating excessive light going forward. This comment is not intended to discourage the use of artificial light entirely—such a proposition would be highly irrational and unsuccessful. However, the complicated matter calls for balance. While federal control seems like a long shot, private-sector pressure through certification regimes, insurance premium incentives, and corporate social responsibility are viable options.

4. CARSON, *supra* note 1, at 4.

5. *Id.* (emphasis added).

6. *Id.*

7. Sharon Guynup, *Light Pollution Taking Toll on Wildlife, Eco-Groups Say*, NAT’L GEOGRAPHIC NEWS (Apr. 17, 2013), http://news.nationalgeographic.com/news/2003/04/0417_030417_tvlightpollution_2.html.

8. See Angela Spivey, *Light at Night and Breast Cancer Risk Worldwide*, 118 ENVTL. HEALTH PERSP. A525, A525 (2010).

9. CARSON, *supra* note 1, at 4 (emphasis added).

10. Carson stated, “A grim spectre has crept upon us almost unnoticed, and this imagined tragedy may easily become a stark reality we all shall know.” *Id.* at 5.

I. LIGHT POLLUTION

Throughout history, light has played an integral role in mankind's way of life, shaping ideology and providing a means for basic survival.¹¹ Many religions focus on light as fundamentally good.¹² The first chapter of *The Bible* states: "God said, Let there be light: and there was light. And God saw the light, that *it was* good: and God divided the light from the darkness. And God called the light Day, and the darkness he called Night."¹³ In its primitive days, mankind's source of light was primarily the moon, the stars, and the sun.¹⁴ This evolved with the artificial creation of light through fire and torches, oil lamps and candles, and finally gas lamps, lightbulbs, and streetlamps.¹⁵

Within the last one hundred years, our grandparents and great grandparents could look out their bedroom windows and witness the Milky Way arching beautifully across the night sky.¹⁶ There was no need for bright streetlights; the stars and the moon provided the right amount for them to see where they were going.¹⁷ Regrettably, they have become witnesses of urban sprawl's massacre of the night sky.¹⁸

Many sources have attempted to define "light pollution"; for example, one source defines it "as excessive, misdirected, or obtrusive artificial (usually outdoor) light"¹⁹ while another presents it as the problem created when light is "inefficient, overly bright, poorly targeted, [and] improperly shielded."²⁰ In a classic dark sky, more than 2,500 stars are visible to the naked eye.²¹ In contrast, fewer than a dozen are visible from a typical city.²² The inconvenient truth is that the stars are not fading away, but the Earth is becoming immensely brighter.²³ Unfortunately, light pollution is not only an obstacle to astronomy,

11. Marissa Rosenberg et al., *Astronomy in Everyday Life*, INT'L ASTRONOMICAL UNION, http://www.iau.org/public/themes/astronomy_in_everyday_life/ (last visited Sept. 7, 2017).

12. See Cathy Lynn Grossman, *A Beacon of Hope: The Importance of Light in Religion*, USA TODAY (Dec. 23, 2011, 10:19 AM), <http://usatoday30.usatoday.com/news/health/wellness/story/2011-12-27/A-beacon-of-hope-The-importance-of-light-in-religion/52188010/1>.

13. *Genesis* 1:3–5 (King James).

14. See Bob Trembley, *History of Light Pollution*, CATHOLIC ASTRONOMER (Mar. 17, 2015), <http://www.vofoundation.org/blog/history-of-light-pollution/>.

15. See *id.*

16. See Ethan Siegel, *The Milky Way: Invisible to Most of Us, but Accessible to All*, FORBES (June 14, 2016, 11:35 AM), <http://www.forbes.com/sites/startswithabang/2016/06/14/the-milky-way-invisible-to-most-of-us-but-accessible-to-all/#52c625632ead>.

17. See Dave Clark, *Walking at Night with No Hand-Held Light: Some Observations*, RAMBLINGS BUSH PHILOSOPHER: INT'L SEC. (Oct. 17, 2016), <http://ramblingsdc.net/WalkingAtNight.html>.

18. Siegel, *supra* note 16.

19. *What is Light Pollution?*, GLOBE NIGHT, <https://www.globeatnight.org/light-pollution.php> (last visited Sept. 7, 2017).

20. *Light Pollution*, INT'L DARK-SKY ASS'N, <http://darksky.org/light-pollution/> (last visited Sept. 7, 2017).

21. *Light Pollution*, NAT'L GEOGRAPHIC KIDS, <http://kids.nationalgeographic.com/explore/space/light-pollution/#light-pollution-city-lights.jpg> (last visited Sept. 7, 2017).

22. *Id.*

23. David Owen, *The Dark Side*, NEW YORKER (Aug. 20, 2007), <http://www.newyorker.com/magazine/2007/08/20/the-dark-side-2>.

but a severe detriment to human health, the economy, plant and animal life, and mankind's already dulled connection with the environment.²⁴

The war on light pollution is fought at many different levels, but the most effective means to fight harmful light is through the legal system.²⁵ The modern environmental movement and wave of environmental legislation were sparked by Rachel Carson's book *Silent Spring* in June 1962.²⁶ Before *Silent Spring*, the issue of overusing pesticides was similar to the current issue of light pollution—it was unnoticed and unexposed.²⁷ One year after Carson's publication, the United States Secretary of the Interior, Stewart Udall, issued a "call to arms" on the fight against environmental pollution.²⁸ Over the next several years, Congress passed the Clean Air Act of 1963, the Water Quality Act of 1965, the Motor Vehicle Air Pollution Control Act of 1965, the Endangered Species Act of 1966, and the National Environmental Policy Act of 1970, all of which gave the government more control over the direct regulation of the environment.²⁹

Without this wave of environmental legislation during the sixties and seventies, municipalities, companies, and individuals would have little incentive to live and operate responsibly within the natural world.³⁰ Without the passing of the Clean Air Act in 1963, there would have been no incentive for automobile manufacturers to invest in developing technologies to reduce air pollutants. On the other hand, incentives for a billboard owner to lower the wattage of his lighting fixtures are virtually nonexistent when other billboards apply the highest wattage available. There is an economic incentive for the billboard owner to install even brighter lights to match or even outperform the competition. Similarly, a suburb has little incentive to invest money in preserving dark skies if the metropolitan city or neighboring suburbs do nothing to preserve dark skies because their efforts will be thwarted by the city's skyglow and go unnoticed. As John Spacey states, this "competition between governments, regions, cities or companies to reduce standards, quality or protections" is often referred to as "race to the bottom," and is one of the primary reasons that big government must act to solve the increasingly dangerous threats light pollution poses.³¹

24. *Light Pollution Hurts the Environment, Hides the Night Sky*, DEP'T PHYSICS, FLA. ATLANTIC UNIV., <http://physics.fau.edu/observatory/lightpol.html> [https://perma.cc/BQ8F-DPZ9] (last visited Sept. 7, 2017).

25. See generally Barry A.J. Clark, *A Rationale for the Mandatory Limitation of Outdoor Lighting* (May 4, 2006), http://www.darksksociety.org/handouts/2006_crime_clark.doc [https://perma.cc/VTP9-GRDG] (discussing international legislative responses to increases in outdoor lighting and its adverse consequences, and recommending such legislation in Australia).

26. *The Modern Environmental Movement*, PBS: AM. EXPERIENCE, <http://www.pbs.org/wgbh/americanexperience/features/earth-days-modern-environmental-movement/> [https://perma.cc/JGQ6-TW9V] (last visited Sept. 7, 2017).

27. See Rachel Carson, CHEMICAL HERITAGE FOUND., <https://www.chemheritage.org/historical-profile/rachel-carson> [https://perma.cc/7N8L-HDGX] (last updated Dec. 1, 2015).

28. *The Modern Environmental Movement*, supra note 26.

29. *Id.*

30. John Spacey, *What Is a Race to the Bottom?*, SIMPLICABLE (June 25, 2016), <http://implicable.com/new/race-to-the-bottom> [https://perma.cc/79BG-WYX8].

31. *Id.*

Unfortunately, living in a world with countless ecological threats forces environmentalists to pick and choose their battles. Matters that do not become a priority are sometimes referred to as “soft” issues.³² Sadly, most modern environmentalists view light pollution and artificial light at night (LAN) either as a “soft” issue or not an issue at all.³³

Like *Silent Spring*'s exposure of the overuse of pesticides in the 1960's, light pollution calls for a *Carsonian* awakening. Government action is necessary if the undefined harms of light pollution are to be foiled. Light pollution consumes and devastates the earth's resources, defiles the air, disconnects the world from the night sky, and adversely affects the health of animals and humans.³⁴ Drawing on Carson's influence raises a question, “What has already silenced the voices of [the night] in countless towns in America?”³⁵ The answer to this question is clear: light pollution. Unless legal systems at the local, state, and federal levels act in a timely manner, the damage caused by light pollution will unquestionably swell and become a much greater threat to human health and the environment.

A. Light Pollution and Its Negative Effects on Human Thinking

In David Abram's ecological book, *The Spell of the Sensuous*, he analyzes the relationship between man and the natural world.³⁶ He writes, “[t]here is an intimate reciprocity to the senses. . . . The senses, that is, are the primary way that the earth has of informing our thoughts and of guiding our actions.”³⁷ Abram claims that only through our “direct, sensory interactions” with the natural world can we truly learn from and understand it.³⁸ For thousands of years, the most advanced civilizations have developed this intimate reciprocity with the stars, peering into the enigmatic sky for spiritual elation and communal strength.³⁹ Disappointingly, lights have become so bright many people will never see the night sky as it once was.⁴⁰ In 1994, an earthquake in California knocked out all power to the city of Los Angeles and many terrified residents called 911 to report seeing a “giant, silvery cloud” looming over the city.⁴¹ What

32. Owen, *supra* note 23.

33. *Id.*

34. Marina Murphy, *Revealing the Dark Side of Light: Artificial Light*, CHEMISTRY & INDUS., Oct. 2, 2000, at 627.

35. Carson wrote, “What has already silenced the voices of spring in countless towns in America?” CARSON, *supra* note 1, at 5 (emphasis added).

36. See generally DAVID ABRAM, *SPELL OF THE SENSUOUS* (1996).

37. *Id.* at 268.

38. *Id.*

39. Hasan Chowdhury, *Light Pollution: As We Lose Sight of the Stars, We Lose a Sense of Ourselves*, NEWSTATSMAN (Sept. 7, 2016), <http://www.newstatesman.com/2016/09/light-pollution-we-lose-sight-stars-we-lose-sense-ourselves> [<https://perma.cc/UF3J-G7A7>].

40. Brady Dennis, *Thanks to Light Pollution, the Milky Way Is Now Hidden from a Third of Humanity*, WASH. POST (June 10, 2016), https://www.washingtonpost.com/news/energy-environment/wp/2016/06/10/light-pollution-keeps-much-of-humanity-from-seeing-the-night-sky/?utm_term=.b858f61d2129 [<https://perma.cc/7Y43-MAJB>] (last updated Dec. 1, 2015).

41. Ron Chepesiuk, *Missing the Dark: Health Effects of Light Pollution*, 117 ENVTL. HEALTH PERSP. A20, A21 (2009) (describing the Los Angeles night sky during a blackout).

the urbanites were actually witnessing—for the first time—was the Milky Way.⁴²

Nearly four out of every five people on the planet now live under light-polluted skies and more than one-third of humanity can no longer see the Milky Way, the galaxy we live in.⁴³ This disconnection from the stars characterizes more than mankind's general stellar ignorance; it is the Freudian-ego of mankind, manifested by general disinterest in the environment, others, and anything not ourselves.⁴⁴ Therefore, the chance to see true night skies could be the "age-old solution" to bring us back to our ancestral roots of living a more peaceful and cooperative existence, so giving relief to "a world stifled with political anxieties and economic inequality, torn in regions by oppressive regimes."⁴⁵

B. Light Pollution: Astronomical Definitions

The three primary forms of light pollution are *glare*, *light trespass*, and *skyglow*.⁴⁶ We have experienced all three of these forms, but perhaps the most temporary, annoying, and destructive problem is glare. Glare refers to misdirected light that beams directly into one's eyes.⁴⁷ For example, glare causes loss of contrast in the eyes, which can blind you temporarily and lead to unsafe driving conditions.⁴⁸ When glare creates a nuisance by entering a person's property, it is referred to as light trespass.⁴⁹ Light trespass can be especially harmful to human health when misdirected light enters into a bedroom window, disrupting the sleep cycles of persons trying to rest.⁵⁰ Skyglow is the term light pollution most properly denotes, referring to "the glow effect that can be seen over populated areas."⁵¹ Skyglow is produced when light that is "either emitted directly upward by luminaires or reflected from the ground is scattered by dust and gas molecules in the atmosphere, producing a luminous background."⁵² The brightened sky reduces the visibility of the stars.⁵³ Studies show that night time suburban skies are "5 to 10 times brighter" than the sky's natural state and metropolitan skies may be "25 to 50 times brighter" than a true night sky.⁵⁴

42. *Id.* (discussing that the strange cloud Los Angeles residents witnessed during a large power outage was actually the Milky Way).

43. Dennis, *supra* note 40.

44. This article shows still frames from photographer Sriram Murali's time-lapse short film and evidences mankind's increasing separation from the Universe. Michael Zhang, *This is How Light Pollution Affects How We See the Night Sky*, PETAPIXEL (Aug. 15, 2016), <http://petapixel.com/2016/08/15/light-pollution-affects-see-night-sky/>.

45. Chowdhury, *supra* note 39.

46. *What Is Light Pollution?*, *supra* note 19.

47. *See id.*

48. *Id.*

49. *Id.*

50. *See id.*

51. *Id.*

52. Michele W. McColgan, *Light Pollution*, LIGHTING ANSWERS, Mar. 2003, at 1, 3, <http://www.lrc.rpi.edu/programs/nlpip/lightinganswers/pdf/print/LightPollution.pdf> (revised Feb. 2007).

53. *Id.*

54. *Id.*

C. Light Pollution and Human Health

Research on light pollution and how it affects human health is still considered a new field.⁵⁵ Humans have evolved into cyclical creatures over the past several millennia, regulated by light and dark.⁵⁶ Within the last century, humans have thrown ourselves off this evolutionary groove by exponentially brightening the planet. Studies suggest that “[s]leeping, waking, digestion, secretion of adrenalin, body temperature, blood pressure, pulse and many other important aspects of body functions and human behavior” follow the 24-hour cycle known as circadian rhythm.⁵⁷ Temporary disorientation of the circadian rhythm by glare and light trespass will usually lead to “feelings of fatigue and disorientation.”⁵⁸ While short term disruption might be a nuisance, long term disruption of the circadian rhythm can lead to severe health and safety problems.⁵⁹

The most theorized association between disruption of the human biological clock and human health complications is the interference in the systematic production of the hormone melatonin.⁶⁰ Specifically, there is a part of the human brain called the suprachiasmatic nucleus (SCN), which controls the body’s circadian rhythm through the production of melatonin.⁶¹ When your eyes signal to the SCN that it is getting darker, the SCN begins producing melatonin to help your body prepare for sleep.⁶² In other words, the level of melatonin that is produced by your body is directly correlated with how much exposure to light you have had. Beyond healthy sleep patterns, numerous studies show correlations between reduced melatonin levels, as a result of a disrupted circadian rhythm, and mood disorders, age-associated diseases, and even cancer.⁶³ In essence, the more light exposure one gets, the more likely that person is to develop cancer.⁶⁴

55. Timothy Berthaume, *Light Pollution: A Case for Federal Regulation 21* (July 11, 2007) (unpublished M.S. thesis, Rochester Institute of Technology) (on file with RIT Scholarworks, Rochester Institute of Technology).

56. *Id.*

57. *Rotational Shiftwork: OSH Answers*, CANADIAN CTR. FOR OCCUPATIONAL HEALTH & SAFETY, <https://www.ccohs.ca/oshanswers/ergonomics/shiftwrk.html> (last updated Nov. 9, 2010).

58. *See id.*

59. Soc’y for Neuroscience, *Disruption of Circadian Rhythms Affects Both Brain and Body, Mouse Study Finds*, SCI. DAILY (Oct. 28, 2009), <https://www.sciencedaily.com/releases/2009/10/091026225744.htm>.

60. *See* Chepesiuk, *supra* note 41, at A26; *Human Health*, INT’L DARK-SKY ASS’N, <http://darksky.org/light-pollution/human-health/> (last visited Sept. 8, 2017); *see also* *How Light Pollution Is Ruining Your Health*, MERCOLA (Nov. 20, 2008), <http://articles.mercola.com/sites/articles/archive/2008/11/20/how-light-pollution-is-ruining-your-health.aspx>; *Light Pollution Links to Breast, Prostate Cancers by Stopping Melatonin*, DEP’T PHYSICS, FLA. ATLANTIC UNIV., <http://physics.fau.edu/observatory/lightpol-melatonin.html> (last visited Sept. 8, 2017).

61. Robert Y. Moore, *Suprachiasmatic Nucleus in Sleep–Wake Regulation*, 8 SLEEP MED. S27, S32 (2007).

62. *Id.* at 31–32.

63. *See* Rüdiger Hardeland, *Neurobiology, Pathophysiology, and Treatment of Melatonin Deficiency and Dysfunction*, 2012 SCI. WORLD J. 1, 2 (May 2012).

64. *How Light Affects Human Melatonin Levels*, *supra* note 60.

According to a 2007 study by Itai Kloog that compared satellite images of Israel to cancer registries, women who live in areas with large amounts of light pollution are more likely to contract breast cancer than women who live in areas where true rhythmic darkness exists.⁶⁵ While admitting that LAN is not “the only . . . major risk factor for cancer,” Kloog still affirms that the study regarding light pollution reveals “a clear and strong correlation that should be taken into consideration.”⁶⁶ This study, along with the many others, suggests that mankind needs to be thinking about light pollution more seriously moving forward than it has in the last half century.

On a similar note, a study by Vanderbilt University revealed that “constant artificial light exposure in neonatal intensive care units could impair the developing circadian rhythm of premature babies.”⁶⁷ In the study, the researchers exposed newborn mice to artificial light for several weeks.⁶⁸ Consequentially, the mice were unable to establish a regular activity cycle.⁶⁹ After the study was completed, the research revealed that “excessive artificial light exposure early in life might contribute to an increased risk of depression and other mood disorders in humans.”⁷⁰ In light of the vast research, light pollution is surely an immediate and escalating health concern for our illuminated world.⁷¹

D. Economic Effect of Light Pollution

The International Dark-Sky Association (IDA), one of the leading organizations on dark-sky research, “estimates that one-third of all lighting in the United States is wasted, at an annual cost of 30 million barrels of oil and 8.2 million tons of coal.”⁷² By itself, skyglow in the United States comes to an estimated 3 billion dollars per year.⁷³ Given the massive amount of economic waste, control seems like the obvious solution. However, for industries that are fixated on economic growth, environmental considerations for light pollution can be threatening because of the high price tag on energy efficient lights, new lighting shields, and the fear of decreased productivity with lower usage.⁷⁴

65. See Itai Kloog et al., *Light at Night Co-Distributes with Incident Breast but Not Lung Cancer in the Female Population of Israel*, 25 CHRONOBIOLOGY INT'L 65, 77–78 (2008).

66. Rick Weiss, *Lights at Night Are Linked to Breast Cancer*, WASH. POST (Feb. 20, 2008), http://www.washingtonpost.com/wp-dyn/content/article/2008/02/19/AR2008021902398_pf.html [<https://perma.cc/UC96-PNTJ>].

67. Chepesiuk, *supra* note 41, at A25 (discussing Hidenobu Ohta et al., *Constant Light Disrupts the Developing Mouse Biological Clock*, 60 PEDIATRICS RES. 304 (2006))

68. *Id.*

69. *Id.*

70. *Id.*

71. See *id.* at A21–22.

72. *Light Pollution Hurts Our Economy and Our Resources*, DEP'T OF PHYSICS, FLA. ATLANTIC UNIV., <http://physics.fau.edu/observatory/lightpol-econ.html> [<https://perma.cc/L7NV-2K63>] (last visited Sept. 8, 2017).

73. *Light Pollution Wastes Energy and Money*, INT'L DARK-SKY ASS'N, <http://darksky.org/light-pollution/energy-waste/> [<https://perma.cc/43TX-ZBXW>] (last visited Sept. 8, 2017).

74. See *A Darker Future for All: The Battle Against Light Pollution*, PBS: HOW WE GOT TO NOW (Aug. 12, 2015, 5:17 AM), <http://www.pbs.org/how-we-got-to-now/blogs/howwegottonext/a-darker-future-for-all-the-battle-against-light-pollution/> [<https://perma.cc/SC9P-T49B>].

On the surface, fixing light pollution seems cheap and simple: shut off the lights. In reality, solving the problem is extremely complex.⁷⁵ Industries might consider who they will pay to take the time to make the changes, how expensive the changes will be, how work will continue with new or no lights, and so forth. However, Dr. Terrell Gallaway notes that it is important to remember that “the primary benefit of an economic system is not money but happiness. . . . [and] generating this happiness does not always require producing and consuming commodities.”⁷⁶ Furthermore, he states that “[r]educing light pollution isn’t just about reducing healthcare and energy costs,” but about “making people better off without squandering a bunch of our scarce resources.”⁷⁷ Ultimately, it is imperative to recognize that investments in healthier and more efficient lighting practices will set mankind up for a happier and economically favorable future.

E. Light Pollution and Biota

An extensive and increasing number of studies on the ecological effects of artificial LAN are emerging within the scientific community.⁷⁸ But still, leading dark-sky enthusiasts have voiced the concern that, as a whole, “professional conservationists have yet to recognize the implications of the dramatic transformation of the nighttime environment by ever-increasing artificial lights, except for a few well-known situations that leave dead bodies on the ground.”⁷⁹ While some of the effects may appear to be insignificant, in the symbiotic and interconnected ecological web of the world, every slight modification is critical.⁸⁰ Travis Longcore and Catherine Rich of The Urban Wildlands Group, USA distinguish three general types of impacts that LAN has on wildlife: “direct mortality, altered reproductive behaviors, and disrupted interactions between species.”⁸¹

Direct mortality is conceivably the most obvious environmental impact of light pollution because carcasses and withered plants are observable everywhere.

75. See Berthaume, *supra* note 55, at 58.

76. *A Darker Future for All: The Battle Against Light Pollution*, *supra* note 74 (quoting Dr. Terrell Gallaway, Missouri State University).

77. *Id.* (quoting Dr. Terrell Gallaway, Missouri State University).

78. See, e.g., Joelle Gehring et al., *Communication Towers, Lights, and Birds: Successful Methods of Reducing the Frequency of Avian Collisions*, 19 *ECOLOGICAL APPLICATIONS* 505 (2009); Robert W. McFarlane, *Disorientation of Loggerhead Hatchlings by Artificial Road Lighting*, 1963 *COPEIA* 153 (1963); Michael Salmon, *Protecting Sea Turtles from Artificial Night Lighting at Florida’s Oceanic Beaches*, in *ECOLOGICAL CONSEQUENCES OF ARTIFICIAL NIGHT LIGHTING* 141–68 (Catherine Rich & Travis Longcore eds., 2006); H. Yurk & A.W. Trites, *Experimental Attempts to Reduce Predation by Harbor Seals on Out-Migrating Juvenile Salmonids*, 129 *TRANSACTIONS AM. FISHERIES SOC’Y* 1360 (2000).

79. Catherine Rich & Travis Longcore, *Introduction to ECOLOGICAL CONSEQUENCES OF ARTIFICIAL NIGHT LIGHTING*, *supra* note 78, at 1.

80. See Chepesiuk, *supra* note 41, at A22, A24 (explaining laboratory studies that reveal devastating effects of light pollution on turtles, birds, frogs, etc.).

81. Travis Longcore & Catherine Rich, *Lights Out! For Nature* in *STARLIGHT: A COMMON HERITAGE* 185–92 (Cipriano Marín & Jafar Jafari eds., 2007)

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Each year, about 10,000 migratory birds crash into massive, glowing skyscrapers in New York City.⁸² Across North America, the number of fowl deaths by collision amounts to nearly a billion.⁸³ Insects attracted to outdoor lamps persistently fly into the flaming bulbs, eventually burning themselves to death.⁸⁴ Ecologists have found that “[s]ea turtle hatchlings attracted to coastal streetlights end up desiccated, crushed under foot and wheel, or killed by predators.”⁸⁵ Trees subjected to artificial LAN germinate and grow more rapidly, thereby become rotting stubs because artificial LAN “prevent[s] trees from developing dormancy that allows them to survive the rigors of winter weather.”⁸⁶ Lastly, animals that have adapted through the millennia to escape predators suddenly find themselves exposed: disoriented fish swim in circles until hunted easily, natural evasion instincts are confused, and light visually exposes animals to predators that would otherwise be unable to see them.⁸⁷

If an insect, plant, or animal is not directly killed by light pollution, there is a good chance that its behavior will be affected.⁸⁸ The feeding behavior of bats, for example, is altered by artificial light because of a decreased feeding time and a decreased number of insects in dark sky.⁸⁹ Bat conservationists have discovered that lights can “interfere with navigation of bats during nocturnal migrations or commuting flights.”⁹⁰ For nocturnal mammals like bats, excess light makes foraging for food a near impossible task, which forces them to starve or forage in distant locations away from their homes.⁹¹

In many cases, the altered behaviors are more immediately threatening to the survival of a species because they are associated with reproduction.⁹² In one study, French scientists confirmed that light pollution can override the natural reproductive cycle of some animals, making them sexually active out of season.⁹³ In this study on seasonal estrus and daily rhythms of mouse lemurs, Thomas LeTallec, Marc Théry, and Martine Perret recorded the following:

Mammals use variations in the length of day to anticipate environmental changes and time their reproduction. Light pollution, which affects day length

82. Chepesiuk, *supra* note 41, at A22, A24; *IDA Light Pollution and Wildlife Brochure*, INT’L DARK-SKY ASS’N (2008), <https://www.globeatnight.org/dsr/dsee/IDA%20Resources/IDA%20Light%20Pollution%20Brochures/IDA%20Light%20Pollution%20and%20Wildlife%20Brochure.pdf>.

83. *Id.* at A24.

84. Longcore & Rich, *supra* note 81, at 186.

85. Rich & Longcore, *supra* note 79.

86. William R. Chaney, *Does Night Lighting Harm Trees?*, PURDUE EXTENSION 3 (June 2002), <https://www.extension.purdue.edu/extmedia/fnr/fnr-faq-17.pdf>.

87. *IDA Light Pollution and Wildlife Brochure*, *supra* note 82; *Light Pollution Effects on Wildlife and Ecosystems*, INT’L DARK-SKY ASS’N, <http://darksky.org/light-pollution/wildlife/> (last visited June 14, 2017).

88. Longcore & Rich, *supra* note 81, at 187.

89. Jens Rydell, *Bats and Their Insect Prey at Streetlights*, in *ECOLOGICAL CONSEQUENCES OF ARTIFICIAL NIGHT LIGHTING*, *supra* note 78, at 43, 44; Chepesiuk, *supra* note 41, at A24; *IDA Light Pollution and Wildlife Brochure*, *supra* note 82.

90. Rydell, *supra* note 89.

91. *IDA Light Pollution and Wildlife Brochure*, *supra* note 82.

92. Longcore & Rich, *supra* note 81, at 187.

93. Thomas LeTallec et al., *Effects of Light Pollution on Seasonal Estrus and Daily Rhythms in a Nocturnal Primate*, 96 J. MAMMALOGY 438, 442–43 (2015).

perception, could lead to changes in biological functions. . . . This study demonstrates that light pollution can affect daily rhythms and the timing of seasonal estrus in a primate and suggests that functional changes in the circadian system may underlie the adverse effects of light pollution that are observed in wildlife.⁹⁴

This study provides even more proof that the haze from skyglow extends beyond the borders of urban cities and suburbs, devastating the behavior of countless plants and animals. Like mouse lemurs, the reproductive behaviors of wildlife such as other mammals, amphibians, reptiles, birds, and insects are negatively affected by light pollution.⁹⁵ While some may argue that the negative effects of light pollution may not be as immediately severe as other environmental and human health concerns, light is gaining momentum as one of the most dangerous kinds of pollution.⁹⁶ The message conveyed by the human health, environmental, and economic concerns is simple and straightforward: our planet needs the night.

Astronomers have gathered that mankind's "positive perceptions of light mean[s] that we struggle to see it as a pollution" which is discouraging.⁹⁷ First, humans are generally under the misconception that the more illuminated our environment becomes, the safer we are from crime, road accidents, and the unknown. In reality, studies show that the relationship between these dangers and the night is complex and not as threatening as one would expect.⁹⁸ Additionally, light pollution is not visibly dirty.⁹⁹ Unlike polluted water or billowing smoke stacks, light pollution has no smell, taste, or sound.

Moreover, it is harder to understand excess and misdirected light as pollution because it is hardly regulated at the local, state, or federal level. Under the Clean Air Act, the Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) to protect public health and welfare and to regulate emissions of hazardous air pollutants.¹⁰⁰ Our designation of pollution comes from the policy and regulations that we put up with. For most of us, this means checking the CO₂ emissions of our car every one or two years. For others, it could mean monitoring emissions at a smoke stack or manufacturing automobiles that operate in a way that is sustainable. Because the government makes and enforces these strict regulations, the public generally accepts that these problems exist. However, when the government does not recognize a problem, it is much less likely that it will be accepted.

94. *Id.* at 438.

95. *IDA Light Pollution and Wildlife Brochure*, *supra* note 82.

96. *See, e.g., Light Pollution—Does Anyone Care?*, PHYSICS.ORG, <http://www.physics.org/featuredetail.asp?id=58>; Berthaume, *supra* note 55 **Error! Bookmark not defined.**, at 4.

97. *Light Pollution—Does Anyone Care?*, *supra* note 96.

98. *Id.*

99. *Id.*

100. *Summary of the Clean Air Act*, U.S. ENVTL. PROTECTION AGENCY, <https://www.epa.gov/laws-regulations/summary-clean-air-act> (last visited Sept. 8, 2017).

Lawmakers, attorneys, and dark-sky advocates have attempted to control light pollution through common law resolution in courts and government regulation by creating municipal laws, state laws, and designated dark-sky preserves.¹⁰¹ Some lighting research and policy experts have concluded that “existing institutional frameworks and instruments are inadequate to deal with most of the conflicting concerns over lighting today.”¹⁰² Like the modern environmental movement that led to a wave of legislation in the 1960s and 1970s, the movement against light pollution is gaining more momentum and it must lead to increased consideration by lawmakers at all levels of government if it is to continue. The question is: who should regulate what, how should it be regulated, and to what end? The remainder of this comment will contemplate the effectiveness of various common law, local, state, and federal governance approaches to tackling light pollution. Governance at every level is necessary to solve the problem, and there is little doubt that some means are more effective than others.

II. APPROACHES TO LIGHT POLLUTION

A. Common Law Approach to Light Pollution

Before the phrases “light trespass” and “light pollution” existed, it was not uncommon for petitioners to bring forth nuisance complaints based on obtrusive light.¹⁰³ The two different nuisance claims, private and public, are related to “the unreasonable and substantial invasion of the interests of others” and enjoyment of their land.¹⁰⁴ Private nuisance “involves interference with a property-owner’s use and enjoyment of land,” and a finding by the court that such nuisance exists leads the injured party to recover damages or injunctive relief.¹⁰⁵ Commonly, environmental nuisance claims arise from “noise pollution, dust, smoke, vibrations and odors.”¹⁰⁶ Even though private nuisance and trespass cases centered on light pollution have been around for nearly a century, few cases have demonstrated plaintiffs declaring light as the exclusive nuisance factor.¹⁰⁷

101. See, e.g., Kate Galbraith, *Progress in Fight to Keep Night Skies Dark*, N.Y. TIMES, (Oct. 17, 2012), <http://www.nytimes.com/2012/10/18/business/energy-environment/progress-in-fight-to-keep-night-skies-dark.html?mcubz=1>; *Lighting Ordinances*, INT’L DARK-SKY ASS’N, <http://www.darksky.org/lighting/lighting-ordinances/>.

102. Dietrich Henckel & Timothy Moss, *Towards a Brighter Future? Conclusions for Lighting Research and Policy*, in URBAN LIGHTING, LIGHT POLLUTION AND SOCIETY 299, 300 (Josiane Meier et al. eds., 2015).

103. Kristen Ploetz, Note, *Light Pollution in the United States: An Overview of the Inadequacies of the Common Law and State and Local Regulation*, 36 NEW ENG. L. REV. 985, 1003 (2002) (describing the history of light pollution based complaints in the common law, state, and local regulation).

104. Kenneth S. Boger, *Common Law of Public Nuisance in State Environmental Litigation*, 4 B.C. ENVTL. AFF. L. REV. 367, 368 (1975) (describing traditional approaches of private and public nuisance cases in environmental law).

105. *Id.*

106. Ploetz, *supra* note 103, at 1005.

107. *Id.* at 1005–06.

In *Shelburne, Inc. v. Crossane Corp.*, the owner of Shelburne hotel brought a nuisance claim against an adjacent property owner for erecting a brightly lit billboard, measuring 66 feet high and 72 feet long, that emitted light into the hotel's rooms.¹⁰⁸ The excess light from the billboard disturbed guests and inevitably lowered the value of the hotel rooms.¹⁰⁹ While the court struggled to classify the obtrusive light as a legal nuisance initially, eventually it did decide that it was a nuisance and granted *Shelburne* relief.¹¹⁰

When private nuisance cases like *Shelburne* are tried, sympathetic courts could decide to grant damages or injunctive relief to the plaintiff, but doing so becomes impossible when the skyglow from thousands of lights enter into bedroom windows and cause the same problems. While *Shelburne* deals with one source of light nuisance, the common dwelling deals with streetlights, neighborhood lights, commercial buildings, billboards, and so forth. The countless number of petitioners creates standing complications that make it difficult to bring a lawsuit.¹¹¹ Furthermore, private nuisance cases are not likely to be brought when individuals do not recognize light pollution as an interference with their enjoyment of their land.

In the private nuisance case *Madison v. Ducktown Sulphur, Copper & Iron Co.*, the defendant's copper mining operations caused significant nuisance to several residents.¹¹² The plaintiffs sought an injunction to stop the mine from creating large plumes of smoke that spread across the countryside and destroyed their timber and crops.¹¹³ The court was reluctant to grant the injunction because the offending mines had such great economic value compared to the small tracts of land.¹¹⁴ Similarly, even though a court might recognize light as a nuisance, it is unlikely that it will grant an injunction against a defendant when argued on a private level.

In contrast to private nuisance, scholars have differentiated public nuisance as involving "interference with public interests generally, and not solely with the interests of a few individuals. The cause of action for public nuisance rests primarily with the state."¹¹⁵ Such cases are brought for "public safety, public morals, public peace, and public welfare."¹¹⁶ In this pursuit, legal experts state that "to prevail, a plaintiff must show that the defendant's conduct constitutes

108. *Shelburne, Inc. v. Crossane Corp.*, 122 A. 749, 749 (N.J. Ch. 1923).

109. *Id.* at 750.

110. *Id.* at 750–51.

111. Courts generally will not find there is a nuisance claim unless the property invasion does more societal harm than good. Based on this harm-benefit analysis, most courts find the common light invasion caused by urban building reasonable and insufficient for such a claim, because of buildings' significant social usefulness. See Dean N. Alterman, Comment, *Reflected Sunlight Is a Nuisance*, 18 ENVTL. L. 321, 323 (1988).

112. *Madison v. Ducktown Sulphur, Copper & Iron Co.*, 83 S.W. 658, 659 (Tenn. 1904).

113. *Id.*

114. *Id.* at 666–67.

115. Boger, *supra* note 104.

116. *Id.*

Lystrup

substantial and unreasonable interference with the public or with public property.”¹¹⁷

On the other hand, in one of the most prominent and traditional public nuisance cases, *State of Georgia v. Tennessee Copper Co.*, the U.S. Supreme Court found that the state of Georgia should be awarded adequate relief against the sulphurous fumes released by some of Tennessee’s copper smelting plants that destroyed plant life on the Georgia side of the border.¹¹⁸ Besides the parties involved, the facts are almost identical to *Madison v. Ducktown*. While private nuisance claims, especially those related to light pollution, are less effective, public nuisance claims carry much more weight.

In theory, public nuisance claims could be effective in controlling light pollution because light crosses state lines in the same way as large plumes of smoke, and they affect entire populations across borders. The lights from Las Vegas, for example, can be seen from the South Rim of the Grand Canyon in Arizona, Death Valley in California, and parts of Southern Utah.¹¹⁹ In the Eastern United States, state boundaries are much closer together and light pollution from a single city like New York can spread across multiple state lines. Unfortunately, given the relatively recent discovery of light pollution as harmful to human health and the environment, it is unlikely that light pollution will be accepted by attorneys general or district attorneys to advance public nuisance claims.¹²⁰ Given the insufficient number of cases tried and inconsistent results of court holdings, the common law does not seem adequate to deal with the task of limiting light pollution.¹²¹

A. State and Local Governance

In the United States, at least 18 states have laws in place to reduce light pollution sometimes known as “dark skies” legislation.¹²² By doing so, these states have “promote[d] energy conservation, public safety, aesthetic interests, and astronomical research capabilities.”¹²³ While the passage of these laws indicates that there is a growing public awareness for the dangers of light pollution, it is not enough to counter the growing challenge. Some of the earliest dark skies

117. Ploetz, *supra* note 103, at 1011 (quoting John L. Giesser, Comment, *The National Park Service and External Development: Addressing Park Boundary-Area Threats Through Public Nuisance*, 20 B.C. ENVTL. AFF. L. REV. 761, 776 (1993)).

118. See *Georgia v. Tenn. Copper Co.*, 237 U.S. 474, 476–77 (1915).

119. Alicia Chang, *Death Valley Works to Preserve Night Sky*, NBC NEWS (Dec. 26, 2008, 12:58 PM), http://www.nbcnews.com/id/28390772/ns/technology_and_science-space/t/death-valley-works-preserve-night-sky/.

120. See Ploetz, *supra* note 103, at 1012.

121. *Id.*; see, e.g., *Shepler v. Kansas Milling Co.*, 278 P. 757 (Kan. 1929) (addressing plaintiff’s nuisance claim regarding reflected sunlight from defendant’s grain storage tanks); *Amphitheaters, Inc. v. Portland Meadows*, 198 P.2d 847 (Or. 1948) (addressing plaintiff theatre owner’s claim of trespass where light created by defendant’s track interfered with the theater’s outdoor screen).

122. *States Shut Out Light Pollution*, NCSL (May 23, 2016), <http://www.ncsl.org/research/environment-and-natural-resources/states-shut-out-light-pollution.aspx>.

123. *Id.*

legislation in the United States came out of Arizona in 1986, requiring all outdoor lighting fixtures to be fully or partially shielded.¹²⁴ While this is a good start, exemptions to the legislation include lights used in construction, incandescent fixtures less than 150 watts, and emergency lights.¹²⁵ Furthermore, street-light fixtures are completely exempt from obeying the law if the shielding is not available from the manufacturer.¹²⁶ Most of these state laws allow for similar exemptions.¹²⁷ Unfortunately, the manufacturers will continue to make cost effective lighting fixtures that do not have shields, and construction will continue to use a great amount of light.

Some states like New Hampshire pass laws that “encourage” municipalities to “adopt ordinances and regulations to conserve energy and minimize light pollution.”¹²⁸ The majority of legislation for reducing light pollution exists at the county and municipal levels.¹²⁹ When States do not do enough to prevent excess light, municipalities that care about the issue “adopt[] light pollution regulations as part of their zoning codes.”¹³⁰ In southeastern Florida, this has certainly been the case as a county model lighting ordinance encouraged local governments to develop policies to protect ocean life, especially sea turtles.¹³¹ These local policies have led coastal counties to turning off unnecessary lights, redirecting light to areas only where it is intended, eliminating all upward-directed light, and incorporating only the latest light management technology into new construction sights.¹³² These counties have succeeded in reducing the unintended impacts of light, while still using light for everyday matters.¹³³

While local governance is essential to minimizing light pollution, municipalities often lack incentive to create and enforce legislation when it is not being equally enforced in neighboring suburbs or counties. This creates a race to the bottom scheme for many municipalities and consequentially, the night sky becomes increasingly polluted with light due to lack of or minimal preventative legislation. Moreover, some counties will strictly enforce and some will not enforce at all. Also, with private properties contributing immensely to the glowing night sky, enforcement becomes even more difficult. Regardless of the chosen enforcement avenue of the legislation, whether criminal or civil, law enforcement faces numerous challenges in imposing increased dark skies legislation at the state and local level.¹³⁴

124. ARIZ. REV. STAT. ANN. § 49-1102 (2017).

125. *Id.*

126. *Id.*

127. *States Shut Out Light Pollution*, *supra* note 122.

128. *Id.*

129. Ploetz, *supra* note 103, at 1017–18.

130. *States Shut Out Light Pollution*, *supra* note 122.

131. Salmon, *supra* note 78.

132. *See id.* at 160–65.

133. *See id.*

134. *See id.* at 150, 165.

B. Federal Governance

Considering the common law, local regulation, and state regulation's failure to adequately confront the intensifying problem of light pollution, there is a need for prompt federal legislation. In 1972, the federal government created the Noise Control Act after it found

that inadequately controlled noise presents a growing danger to the health and welfare of the Nation's population, particularly in urban areas; . . . and that, while primary responsibility for control of noise rests with State and local governments, Federal action is essential to deal with major noise sources in commerce control of which require national uniformity of treatment.¹³⁵

Even though this act was almost entirely defunded in the 1980s, it has never been rescinded by Congress and remains in effect today.¹³⁶ In announcing his decision to sign the bill that authorized the EPA to set noise emission standards for a variety of sources, President Richard Nixon explained:

While a number of municipal governments have moved to control the rising levels of noise in our country—particularly in major urban centers—many of the most significant sources of noise move in interstate commerce and can be effectively regulated only at the Federal level. The new act will enable the Environmental Protection Agency to set limits on the amount of noise permitted both from trucks, buses, and railroad trains operating in interstate commerce and from a variety of newly manufactured products such as jackhammers and compressors, automobiles, motorcycles, snowmobiles, motors and engines.¹³⁷

By looking at the justifications for federal regulation of noise, the potential for federal regulation of light pollution is foreseeable. Noise pollution is characteristically intangible and vague, as is light; therefore, it is not the center of the public's attention. President Nixon mentioned that noise moves in interstate commerce, as does light. Furthermore, municipal governments have attempted to control the rising levels and have failed repeatedly.¹³⁸

The EPA states that its mission is to “protect human health and the environment—air, water, and land,” all of which are affected by the devastating effects of light pollution.¹³⁹ From the studies and data cited above, a strong argument can be made that artificial LAN impacts both elements of the EPA's mission, human health and the environment, in the air, water, and on land. In 2007, a student researcher interviewed Clark Reed, a member from the Climate Protection Partnership Division of the EPA.¹⁴⁰ Reed spoke regarding the EPA's

135. 42 U.S.C. § 4901 (1972).

136. *EPA History: Noise and the Noise Control Act*, U.S. ENVTL. PROTECTION AGENCY, <https://www.epa.gov/history/epa-history-noise-and-noise-control-act> (last visited Sept. 9, 2017).

137. *Noise Control Act of 1972*, BALLOTPEdia, https://ballotpedia.org/Noise_Control_Act_of_1972 (last visited Sept. 9, 2017).

138. See, e.g., J. Scott Feierabend, *The Value of Dark Skies—About Environmentally Friendly Lighting*, 54 ENVTL. IMPACT LIGHTING 80, 80 (2016).

139. *Introduction: Environmental Enforcement and Compliance*, U.S. ENVTL. PROTECTION AGENCY, <https://www3.epa.gov/region9/enforcement/intro.html> (last updated Mar. 7, 2017).

140. Berthume, *supra* note 55, at 49.

thoughts on regulating light pollution and expressed that he did not feel that the EPA mandate encompassed light at that point in time.¹⁴¹ He said:

Let me comment first on the term “light pollution.” To me that’s a creative term to describe glare. And just speaking loosely, pollution to the EPA defines something that is chronically or acutely toxic to plant and animal life. And yes, you know glare is annoying. Glare can be inefficient, wasteful. Glare can even be dangerous on the highway, but excess light in and of itself does not contaminate the air, the soil or the water. Glare simply does not fit into the classic definition of pollution as we see it here at EPA. As you are well aware EPA gets its regulatory authority from Congress which passes laws like the clean air act [sic]...and the clean air act [sic] states EPA shall regulate air pollutants that in the agencies judgment cause or contribute to air pollution which maybe anticipated to endanger public health or welfare. The agency has judged that there are basically 6 classic criterion pollutants to address: sulfur dioxide, nitrous oxides, carbon monoxide, ozone, particulate matter and lead. Actually just today the Supreme Court ruled in case you hadn’t already heard we have to reconsider regulating carbon dioxide. So, excess light is not on that list.¹⁴²

Reed’s interview demonstrates the difficulties of leaving environmental concerns to an agency appointed by the executive branch of the United States government.¹⁴³ Less than a year after this interview was given, the Obama Administration took the White House and assertiveness within the EPA changed dramatically.¹⁴⁴ In December 2015, under the progressive second term of the Obama administration, an interview with astrophysicist Neil deGrasse Tyson and EPA administrator Gina McCarthy reflected an entirely different outlook on the issue.¹⁴⁵ When asked about the EPA’s thoughts on light pollution, McCarthy responded by explaining that light pollution is “in our portfolio, and we’re thinking about it and there are steps we can take.”¹⁴⁶

However, newly elected, President Trump’s disinterest in the environment through his selection of an EPA leader who denies climate change and his withdrawal from the Paris Climate Agreement sparks little hope for environmentalists and dark-sky enthusiasts.¹⁴⁷ With the political flip-flopping that inevitably occurs under each new executive administration, especially as it pertains to the

141. *Id.*

142. *Id.*

143. Christopher D. Ahlers, *Presidential Authority Over EPA Rulemaking Under the Clean Air Act*, 44 ENVTL. L. 31, 55–56 (2014).

144. *See id.*

145. Daniel Chaitin, *EPA Chief: Light Pollution ‘in Our Portfolio’*, WASH. EXAMINER (Dec. 30, 2015, 1:05 PM), <http://www.washingtonexaminer.com/epa-chief-hints-light-pollution-may-beher-next-target/article/2579307>.

146. *Id.*

147. *See* Coral Davenport & Eric Lipton, *Trump Picks Scott Pruitt, Climate Change Denialist, to Lead E.P.A.*, N.Y. TIMES (Dec. 7, 2016), <http://www.nytimes.com/2016/12/07/us/politics/scott-pruitt-epa-trump.html>; *see also* Kevin Liptak, *Cohn: Trump Still Planning to Withdraw from Paris Climate Accord*, CNN (Sept. 18, 2017), <http://www.cnn.com/2017/09/18/politics/gary-cohn-climate-paris-trump/index.html>.

environment, it is likely that the EPA's assertiveness in tackling environmental concerns will fade away, at least for a while.¹⁴⁸

While it is not foreseeable within the next four or eight years under a Trump administration, the EPA will likely accept the dangers of light pollution in the future as scientists reinforce studies unearthing the dangerous environmental and human health consequences of artificial LAN. A strong case for federal regulation over light is within reach, but unfortunately it is not happening despite the EPA's mission of "protect[ing] human health and the environment."¹⁴⁹

Even though the federal government has not and likely will not take any steps toward regulation of artificial LAN under the current administration, there are a few methods the EPA could use in their approach to the problem in the future. The first method would be for the EPA to approach light pollution following the CAA implementation of NAAQS.¹⁵⁰ In order to regulate light pollution in such a manner, the government must first find that light is a pollutant under the CAA.¹⁵¹ In setting national light pollution standards, the EPA would designate "areas as meeting (attainment) or not meeting (nonattainment) the [set] standard."¹⁵² Then, the EPA would require each state "to develop a general plan to attain and maintain" the light pollution standards, including the creation of a "specific plan to attain the standards set for each area designated nonattainment."¹⁵³ In meeting these standards, each state could tackle the problem of light pollution in its own way, preventing the federal government from getting too involved with unfamiliar locations and markets.¹⁵⁴ If a state repeatedly failed to meet the light pollution standards, the federal government could take complete control over the problem, reaching attainment as they see fit.¹⁵⁵

While working with the states in developing and implementing distinct plans seems to be a more cooperative approach to tackling light pollution, it will likely be inefficient and costly.¹⁵⁶ Light pollution differs from the six criteria air pollutants (ground-level ozone, particulate matter, carbon monoxide, lead, sulfur dioxide, and nitrogen dioxide) regulated by NAAQS because regulation of the six common air pollutants is "immensely complex due to highly variable emissions, wind, and weather affecting the inherently dynamic atmospheric

148. *See id.*

149. *Introduction: Environmental Enforcement and Compliance*, *supra* note 139.

150. *NAAQS Implementation Process*, U.S. ENVTL. PROTECTION AGENCY, <https://www.epa.gov/criteria-air-pollutants/naqs-implementation-process> (last updated Feb. 13, 2017).

151. *See Introduction: Environmental Enforcement and Compliance*, *supra* note 139. Because the CAA defined the six pollutants that the EPA must regulate with NAAQS, Congress would need to amend the CAA to include light pollution as a criteria air pollutant. *See Criteria Air Pollutants*, U.S. ENVTL. PROTECTION AGENCY, <https://www.epa.gov/criteria-air-pollutants> (last updated Aug. 28, 2017).

152. *NAAQS Implementation Process*, *supra* note 150.

153. *Id.*

154. *See id.*

155. *See Introduction: Environmental Enforcement and Compliance*, *supra* note 139 (describing the EPA's work with state, local and tribal agencies to ensure compliance with environmental regulations).

156. *See William Yeatman, CDPHE's Regional Haze State Implementation Plan: At Least \$100 Million Too Expensive*, INDEP. INST. (Jan. 11, 2011), <https://www.i2i.org/cdphe-regional-haze-state-implementation-plan-at-least-100-million-too-expensive/>.

chemistry involved.”¹⁵⁷ Light, while still complex and difficult to control, can be controlled by the flip of a switch; however, state implemented plans (SIP) are often expensive and time consuming. For instance, a report published by the Regulatory Assistance Project has stated that “a nonattainment state’s SIP filings typically span thousands of pages reflecting federal obligations, adopted regulations, modeling, data sets, assumptions, public comments, and so on.”¹⁵⁸ Ultimately, the use of state implemented plans could be helpful in protecting human health and the environment, but this approach will undoubtedly come at great economic cost.

Perhaps the most efficient method for the federal government to take in tackling the issue is controlling the problem from the top—where lights and lighting structures are manufactured. For instance, Arizona statute § 49-1102 exempts streetlights from obeying light pollution laws if shielding is not available from the manufacturer.¹⁵⁹ While government implementation of statutes is a good idea, creating these kinds of loopholes nullifies the purpose of the statute, making it easier and cheaper for manufacturers to continue producing the same products that fuel the problem. If the federal government cannot control the importing and manufacturing of lights and fixtures that are harmful to human health and the environment, then “cost effective” products will continue to be constructed and light pollution will continue to destroy the night. Until the federal government takes control from the top, scientists and dark-sky enthusiasts must work “bottom-up” in applying pressure to lawmakers, regulators, and especially manufacturers through a legal reform model called new governance.

D. New Governance

Scholars have described new governance as an emerging “legal reform emphasizing the role of non-state actors in influencing behavior against a backdrop of the state.”¹⁶⁰ Some professionals distinguish new governance from traditional and hierarchal regulatory approaches because rather than governing from the top through a traditional regime, new governance instead “aspires . . . to be more open-textured, participatory, bottom-up, consensus-oriented, contextual, flexible, integrative, and pragmatic.”¹⁶¹ Others have held that new governance “aims to create a participatory, cooperative, and collaborative form of governance that responds to failures of both markets and regulators, and which is both effective and legitimate.”¹⁶² In stalemated debates where traditional government

157. KENNETH A. COLBURN ET AL., STATE IMPLEMENTATION PLANS: WHAT ARE THEY AND WHY DO THEY MATTER? 13 (2012).

158. *Id.* at 12.

159. ARIZ. REV. STAT. ANN. § 49-1102 (2017).

160. *E.g.*, Karen Bradshaw Schulz, *New Governance and Industry Culture*, 88 NOTRE DAME L. REV. 2515, 2515 (2013).

161. Bradley C. Karkkainen, “*New Governance*” in *Legal Thought and in the World: Some Splitting as Antidote to Overzealous Lumping*, 89 MINN. L. REV. 471, 474 (2004).

162. Tamara C. Belinfanti, *Shareholder Cultivation and New Governance*, 38 DEL. J. CORP. L. 789, 802 (2014).

regulations fail to provide relief, new governance brings alternative and intervening nonstate regulation to promote welfare.¹⁶³ A nongovernmental organization (NGO) is defined as a “citizen-based group that functions independently of government.”¹⁶⁴ Examples of prominent NGO’s include Wikimedia Foundation, Sierra Club, and World Wildlife Fund, to name a few. NGOs apply pressure to manufacturers, regulators, and lawmakers through certification regimes, insurance premium incentives, and corporate social responsibility, to name a few. In almost every new governance issue, there is strength in numbers.¹⁶⁵ The more businesses, organizations, and individuals involved, the more persuasive an NGO coalition can be.

Leading academics have stated that “[c]orporate social responsibility describes industries and companies attempting to contribute to the resolution of societal problems although they are not legally required to do so.”¹⁶⁶ Though not exclusive to corporations, corporations’ large amount of financial resources make them well equipped to address social problems.¹⁶⁷ The IDA is an excellent example of corporate social responsibility. The IDA has been saluted by many as “the recognized authority on light pollution and . . . the leading organization combating light pollution worldwide.”¹⁶⁸ The organization reaches out to individuals, businesses, and municipalities all over the world to help cities pass dark sky lighting ordinances.¹⁶⁹ The IDA now has certified nearly five dozen “Dark Sky Places” throughout the world.¹⁷⁰ Unsurprisingly, the IDA relies on businesses and individuals for support and is primarily funded by membership donations, corporate sponsorships, and grants.¹⁷¹ In 2015, total donations totaled \$549,408, which the IDA used predominantly for outreach and programs to educate communities and lawmakers on the dangers of artificial LAN.¹⁷² While donations to the IDA’s cause provide enough money to help keep unneeded light out of the skies in various locations around the country,¹⁷³ this kind of small scale sponsorship is not enough to keep up with population growth and booming

163. Orly Lobel, *New Governance as Regulatory Governance*, in OXFORD HANDBOOK OF GOVERNANCE 65, 65 (David Levi-Faur ed. 2012).

164. Jean Folger, *What Is an NGO (Non-Governmental Organization)?*, INVESTOPEDIA, <http://www.investopedia.com/ask/answers/13/what-is-non-government-organization.asp> (last visited Sept. 25, 2017).

165. See, e.g., CONNIE CHAPLAN & DAVID HARRISON, HOW A COALITION OF IMMIGRATION GROUPS IS ADVOCATING FOR BROAD SOCIAL AND POLITICAL CHANGE: POWER IN DIVERSITY NEW YORK IMMIGRATION COALITION (NYIC) 3–4 (2009), <http://wagner.nyu.edu/files/leadership/Teaching NoteNYIC.pdf>.

166. Bradshaw Schulz, *supra* note 160, at 2520 (citing VIRGINIA HAUFLE, A PUBLIC ROLE FOR THE PRIVATE SECTOR 31, 53, 81 (2001)).

167. *Id.* at 2521.

168. *About IDA*, INT’L DARK-SKY ASS’N, <http://darksky.org/about/> (last visited Sept. 9, 2017).

169. *Success Stories*, INT’L DARK-SKY ASS’N, <http://darksky.org/about/success-stories/> (last visited Sept. 9, 2017).

170. *Id.*

171. *Funding*, INT’L DARK-SKY ASS’N, <http://darksky.org/about/funding/> (last visited Sept. 9, 2017).

172. *Id.*

173. Karen Mason, *Preserving the Dark*, PULP (Aug. 3, 2015), <http://pueblopulp.com/preserving-the-dark-westcliffe-silver-cliff-wet-mountains-light-pollution>.

suburban sprawl.¹⁷⁴ Even though social responsibility is an integral part of many of the largest corporations in the world,¹⁷⁵ it would seem light pollution is not high on their priority list based on the relatively low financial contributions listed by the IDA. For organizations like the IDA to form more persuasive coalitions, they must educate corporations and help them understand why they are stakeholders injured by excess light.

Another successful approach of new governance involves insurance companies regulating environmental problems by issuing discounted premiums for responsible action. Auto insurance companies do this to incentivize good driving,¹⁷⁶ homeowner's insurance companies do this to encourage the maintenance of safety standards,¹⁷⁷ and some health insurance companies do the same to encourage a healthy lifestyle.¹⁷⁸ For example, low pressure sodium (LPS) light bulbs are some of the "most energy efficient light[s] available [and] [are] favored by professional astronomers."¹⁷⁹ Regulation through insurance premium incentives for responsible behavior works because people generally prioritize money over their own health and well-being.¹⁸⁰ Sadly, being socially responsible usually becomes feasible for people only after receiving economic benefits.

Consumer incentives through NGO pressure and financial incentives, such as discounted insurance premiums, often meet strong resistance by manufacturers. For example, while the efficient LPS bulb saves money, many lighting manufacturers refuse to make LPS and even campaign against its production.¹⁸¹ Currently, the process of making LPS bulbs is expensive and LPS lighting fixtures are not readily available.¹⁸² Manufacturers are not interested in losing money, but insurance companies could incentivize the manufacturing of LPS bulbs and fixtures by providing less expensive premiums for manufacturers who produce LPS bulbs and fixtures. Similarly, such incentives could apply to municipalities, homeowners, and automobile manufacturers that choose to use LPS street lighting instead of traditional lighting.

Conceivably, one of the most common ways of creating market incentives based on good behavior is through certification regimes. In an article on new

174. See Joel Kotkin, *So Much for the Death of Sprawl: America's Exurbs Are Booming*, FORBES (Nov. 3, 2015, 2:55 PM), <http://www.forbes.com/sites/joelkotkin/2015/11/03/so-much-for-the-death-of-sprawl-americas-exurbs-are-booming/#6a5b44e0495a>.

175. See Devin Thorpe, *Why CSR? The Benefits of Corporate Social Responsibility Will Move You to Act*, FORBES (May 18, 2013, 5:04 PM), <http://www.forbes.com/sites/devinthorpe/2013/05/18/why-csr-the-benefits-of-corporate-social-responsibility-will-move-you-to-act/#653ee1a25e1c>.

176. See *No One Rewards Safe Drivers Better than Allstate*, ALLSTATE, <https://www.allstate.com/auto-insurance/safe-driver-rewards.aspx> (last visited June 14, 2017).

177. See *Roofing Materials—Discounts*, STATE FARM, <https://www.statefarm.com/insurance/home-and-property/homeowners/discounts/roofing-materials> (last visited June 14, 2017).

178. Katie Thomas, *Companies Get Strict on Health of Workers*, N.Y. TIMES (Mar. 25, 2013), <http://www.nytimes.com/2013/03/26/business/companies-offer-workers-more-incentives-for-health-changes.html>.

179. BOB MIZON, LIGHT POLLUTION: RESPONSES AND REMEDIES 245 (2012).

180. See Lindsay Holmes, *Americans Are More Stressed About Money than Anything Else—and It's Taking A Toll on Their Health*, HUFFINGTON POST (Feb. 4, 2015, 1:09 PM), http://www.huffingtonpost.com/2015/02/04/2015-stress-in-america-su_n_6613744.html.

181. *Id.*

182. *Id.*

governance, Karen Bradshaw describes sustainability certifications as “voluntary, primarily private regulatory regime[s] that incentivize[] firms to conduct their operations in accordance with what the certification identifies as socially desirable standards.”¹⁸³ In creating certifications, industries try to appeal more to consumers by forming collectives to discuss criteria that reflect social welfare.¹⁸⁴ When the firms have agreed on the requirements, a logo is designed and placed on the product to reflect the company’s dedication to a good cause.¹⁸⁵ Labels exist for “Dolphin-safe” tuna, organic produce, gluten free foods, cage-free eggs, and high quality timber to name a few.¹⁸⁶ Theoretically, Bradshaw notes that “consumers [will] express preferences towards certain kinds of manufacturing processes or ingredients by purchasing certified products, relying upon the certifiers’ assurance that products bearing that logo have been produced in accordance with the organizing bodies’ guidelines.”¹⁸⁷

For light pollution, IDA’s “Dark Sky Places” certification helps communities and municipalities “enhance the visibility of designated locations and foster increased tourism and local economic activity.”¹⁸⁸ While the IDA’s certification process is a large step in the right direction, it mostly appeals to astronomers and ecotourism based cities, rather than the typical business and individual. The IDA, or any other NGO with enthusiasm for dark skies, could widen its audience by developing certifications that represent manufacturing processes. For example, manufacturers selling LPS and other low-intensity bulbs could use an appealing certification and logo to convey social responsibility to consumers. Even though the lights and fixtures will be more expensive at first, businesses and individuals will be more inclined to purchase the certified LPS bulbs in order to be environmentally responsible.

In theory, dark-sky certifications could be the quickest way for NGOs to govern light pollution. Unfortunately, unsupported, false, and irrelevant certifications within the same market may bury the effectiveness of these true certifications; this is known as information flooding.¹⁸⁹ After issuing certifications for LPS bulbs, manufacturers of light-emitting diode (LED) bulbs or other competing regimes could obscure consumer preference by falsely issuing certifications related to the same cause. As a result, confused consumers could lose trust in the certification regimes and revert back to making socially irresponsible choices.¹⁹⁰

183. Bradshaw Schulz, *supra* note 160, at 2517.

184. *Id.* at 2526.

185. *Id.*

186. *Id.*

187. *Id.* at 2526–27.

188. *International Dark Sky Places*, INT’L DARK-SKY ASS’N, <http://darksky.org/idsp/> (last visited Sept. 27, 2017).

189. See Karen Bradshaw Schulz, *Information Flooding*, 48 IND. L. REV. 755, 756 (2013).

190. *Id.* at 772.

This comment begins by assessing the serious risks posed by increased amounts of light pollution to the environment and human health. While the negative effects of light pollution are continually being unearthed by scientists, the rapid discovery of negative effects suggests that they are merely scratching the surface.¹⁹¹ Nonetheless, the studies proving light pollution's negative effects on the environment are already overwhelming and the studies revealing excessive light's devastating effects on human health are fresh, but disquieting. The darker side of light "has crept upon us almost unnoticed," and a Carsonian "tragedy may easily become a stark reality" if federal control of light pollution is not asserted in the future.¹⁹²

In theory, a common law approach to light pollution could prove effective in controlling light pollution because it crosses state lines and it threatens environmental and human health in large populations. Unfortunately, claims brought by citizens and populations are not likely to be accepted given the relatively recent discovery of light pollution as harmful.¹⁹³ Moreover, the number of cases actually tried are scarce and the holdings are unpredictable.¹⁹⁴ Realistically, the common law approach will never, on its own, be able to solve the problem of excess light.

While local and state governance is essential to minimizing light pollution, municipalities often lack incentive to create and enforce legislation when it is not being enforced equally in neighboring suburbs, counties, or states. This creates a shaken race to the bottom scheme where companies compete to be bigger and brighter. Because of its ability to establish uniformity among local and state governments, federal action is arguably the most effective way to govern light pollution. However, under a Trump administration, it is unlikely that such control will be asserted.

Until federal action is taken, new governance through certification regimes, insurance premium incentives, and corporate social responsibility is necessary to control the maturing problem. For this emerging legal reform to work properly, it is critical that scientists and dark-sky enthusiasts raise awareness of the issue in order to involve more stakeholders to form stronger coalitions. As scientists continue to expose the negative effects on human health and eventually become certain of its danger, the dark sky movement will gain popularity and populations will once again reconnect themselves with the night sky. However, until awareness is raised worldwide, it is doubtful that anything will change on a large enough scale to make a real difference for human health and the environment.

191. See *Light Pollution Impacts Animals and Environment*, INT'L DARK-SKY ASS'N, <http://physics.fau.edu/observatory/lightpol-environ.html> (last visited Sept. 9, 2017).

192. CARSON, *supra* note 1, at 5.

193. Ploetz, *supra* note 103, at 1012.

194. See *supra* note 121 and accompanying text.

Lystrup



WE STAND NOW where two roads diverge. But unlike the roads in Robert Frost's familiar poem, they are not equally fair. The road we have long been traveling is deceptively easy, a smooth super-highway on which we progress with great speed, but at its end lies disaster. The other fork of the road—the one 'less traveled by'—offers our last, our only chance to reach a destination that assures the preservation of our earth.¹⁹⁵

195. CARSON, *supra* note 1, at 255 (emphasis added).