

# Dark Sky Policy Evaluation Staff Research

UPDATED: 8/10/17

## Studies related to human health

Issue	Title, Author & Summary	Source	Position on Dark Sky Policy
Light pollution effects on human health, environment, and stellar visibility	<u><a href="#">Limiting the impact of light pollution on human health, environment and stellar visibility by Fabio Falchi</a></u> : Residual light pollution is the upward light emission that reflects from the lit surfaces and atmospheric scatter. The environmental impacts of this residual light pollution affect wildlife, human health, and stellar visibility. Researchers analyzed the spectra of common types of lamps for external use and evaluated their emissions relative to the spectral response functions of human-eye photoreceptors. They found that the amount of pollution is strongly dependent on the spectral characteristics of the lamps, with the more environmentally friendly lamps being low-pressure sodium, followed by high-pressure sodium. Most polluting are the lamps with a strong blue emission, like Metal Halide and white LEDs.	<b>PDF Journal of Environmental Management: Limiting Impact of Light Pollution On Human Health, Environment and Stellar Visibility by Falchi</b>	<b>SUPPORT</b>
Lighting Becoming a Public Health Issue	<u><a href="#">Lighting for the human circadian clock: recent research indicates that lighting has become a public health issue by Stephen M. Pauley</a></u> : Studies now indirectly link exposures of shift workers to light at night (LAN) and higher incidences of breast cancer and colorectal cancers. One possible mechanism is melatonin (MLT) suppression by shift worker eye exposures to LAN.	<b>PDF Medical Hypothesis: Lighting for the human circadian clock by Pauley</b>	<b>SUPPORT</b>
Human & Environmental Effects of Light Emitting Diode (LED) Community Lighting	<u><a href="#">Human and Environmental Effects of Light Emitting Diode (LED) Community Lighting</a></u> : This report can be used to assist in advising communities on selecting LED lighting options in order to minimize potentially harmful human health and environmental effects. LED lighting is cost efficient and inherently a directional; it paradoxically can lead to worse glare than conventional lighting. This glare can be greatly minimized by proper lighting design and engineering.	<b>PDF Report of the Council on Science and Public Health: Human and Environmental Effects of Light Emitting Diode LED Community Lighting</b>	<b>SUPPORT</b>
Breast Cancer Risk	<u><a href="#">Light at Night and Breast Cancer Risk Among California Teachers by Susan Hurley</a></u> : There is convincing evidence that circadian disruption mediated by exposure to light at night promotes mammary carcinogenesis in rodents. The role that light at night plays in human breast cancer etiology remains unknown. We evaluated the relationship between estimates of indoor and outdoor light at night and the risk of breast cancer among members of the California Teachers Study.	<b>PDF Epidemiology: Light at Night and Breast Cancer Risk Among California Teachers by Hurley</b>	<b>SUPPORT</b>
Health Impacts of Circadian Disruption	<u><a href="#">Association between light at night, melatonin secretion, sleep deprivation, and the internal clock: Health impacts and mechanisms of circadian disruption By Yvan Touitou</a></u> : Exposing workers to artificial light at night, shift and/or night work decreases the time spent sleeping, and it disrupts the circadian structure, the sleep cycle, social life, and meal times. This results in a perturbation of the	<b>PDF Life Sciences: Association between light at night, melatonin secretion, sleep deprivation, and the internal</b>	<b>SUPPORT</b>

	<p>functioning of the biological clock that is often called “social jet lag” because of the misalignment between the biological clock and social time. In the long run, this rhythm desynchronization is detrimental to health, as underscored by a large number of epidemiological studies, particularly in regard to the risk of breast cancer in women who do shift or night work. It amounts to a bona fide public health issue in <u>light</u> of the very substantial number of individuals involved.</p>	<p><b>clock: Health impacts and mechanisms of circadian disruption by Touitou</b></p>	
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## Studies related to Public Safety

Issue	Title, Author & Summary	Source	Position on Dark Sky Policy
<p><b>The effect of reduced street lighting on road casualties and crime</b></p>	<p><i><u>The effect of reduced street lighting on road casualties and crime in England and Wales: controlled interrupted time series analysis by Rebecca Steinbach:</u></i> <b>Abstract</b> <b>Background</b> Many local authorities in England and Wales have reduced street lighting at night to save money and reduce carbon emissions. There is no evidence to date on whether these reductions impact on public health. Researchers quantified the effect of 4 street lighting adaptation strategies (switch off, part-night lighting, dimming and white light) on casualties and crime in England and Wales. <b>Methods</b> Observational study based on analysis of geographically coded police data on road traffic collisions and crime in 62 local authorities. Conditional Poisson models were used to analyze longitudinal changes in the counts of night-time collisions occurring on affected roads during 2000–2013, and crime within census Middle Super Output Areas during 2010–2013. Effect estimates were adjusted for regional temporal trends in casualties and crime. <b>Results</b> There was no evidence that any street lighting adaptation strategy was associated with a change in collisions at night. There was significant statistical heterogeneity in the effects on crime estimated at police force level. Overall, there was no evidence for an association between the aggregate count of crime and switch off (RR 0.11; 95% CI 0.01 to 2.75) or part-night lighting (RR 0.96; 95% CI 0.86 to 1.06). There was weak evidence for a reduction in the aggregate count of crime and dimming (RR 0.84; 95% CI 0.70 to 1.02) and white light (RR 0.89; 95% CI 0.77 to 1.03). <b>Conclusions</b> This study found little evidence of harmful effects of switch off, part-night lighting, dimming, or changes to white light/LEDs on road collisions or crime in England and Wales.</p>	<p><b>PDF The effect of reduced street lighting on road casualties and crime in England and Wales: controlled interrupted time series analysis by Steinbach</b></p>	<p><b>SUPPORT</b></p>
<p><b>Roadway Lighting &amp; traffic safety</b></p>	<p><i><u>To illuminate or not to illuminate: Roadway lighting as it affects traffic safety at intersections by John D. Bullough:</u></i> This article provides preliminary empirical support for the theoretical links among roadway lighting, visual performance and traffic safety. Models estimate the association between lighting and nighttime and daytime crashes and the resulting night-to-day crash ratios.</p>	<p><b>PDF Accident Analysis and Prevention, To illuminate or not to illuminate: Roadway lighting as it affects traffic safety at intersections by Bullough</b></p>	<p><b>SUPPORT</b></p>

<p><b>Effects of Road Lighting</b></p>	<p><u><i>Effects of road lighting: An analysis based on Dutch accident statistics 1987-2006 by Per Ole Wanvik:</i></u> This study estimates the safety effect of road lighting on accidents in darkness on Dutch roads, using data from an interactive database containing 763,000 injury accidents and 3.3 million property damage accidents covering the period 1987–2006. Conclusions: The safety effects of road lighting on pedestrian, bicycle and moped accidents are significantly larger than the effects on automobile and motorcycle accidents.</p>	<p><b>PDF Accident Analysis and Prevention Effects of Road Lighting: An analysis based on Dutch accident statistics 1987–2006</b></p>	<p><b>SUPPORT</b></p>
<p><b>Light Pollution Not Being Recognized as a Key Environmental Problem Due To Unawareness</b></p>	<p><u><i>Unawareness in Environmental Protection: The Case of Light Pollution From Traffic by Jari Lyytimaki:</i></u> This article focuses on the various ways environmental information can be unintentionally left with insufficient attention or purposefully neglected. Energy-related emissions caused by road traffic in Finland are used as an illustrative example and light pollution caused by artificial lighting is identified as an emerging issue that has gained especially low recognition in the environmental agenda. Four different reasons for this lack of recognition are discussed: recognized unawareness, false awareness, deliberate unawareness and concealed awareness. Paying attention to light pollution is important because implementing measures aimed for reducing light pollution create possibilities for alleviating other social and environmental problems in transport and land use policies.</p>	<p><b>PDF Land Use Policy: Unawareness in Environmental Protection: The Case of Light Pollution From traffic by Lyytimaki</b></p>	<p><b>SUPPORT</b></p>
<p><b>Reducing crime through improved street and alley lighting</b></p>	<p><u><i>The Chicago Alley Lighting Project: Final Evaluation Report by Erica N. Morrow</i></u> In October of 1998, the Mayor’s Office in the City of Chicago and the Department of Streets and Sanitation began a multi-stage plan to reduce crime through improved street and alley lighting. The first part of the plan sought to upgrade and improve the city’s 175,000 streetlights, which illuminate the arterial and residential streets. The second part of the plan involves repairing and upgrading the lighting in and around viaducts and Chicago Transit Authority stations. The final part of the plan has been to boost lighting levels in alleys across the city as a tool for public safety and fighting crime. The intent of the City’s program was to increase feelings of safety and decrease crime in the alleys surrounding Chicago’s residential and arterial streets by increasing the wattage and number of alley lamps. The Illinois Criminal Justice Information Authority was directed by the General Assembly to undertake an evaluation to assess the impact of increased alley lighting on crime. Specifically, this evaluation attempted to measure the effect of increased alley lighting on crime rates in two eight square block areas, with particular emphasis on crimes that were most likely to have occurred in alleys. <b>Conclusion:</b> This evaluation found that reported incidents (offenses) increased between the one-year pre- and one-year post-installation study periods in the experimental area of West Garfield Park where alley lighting was improved. The evaluation also found that the experimental area experienced more notable increases in reported incidents over a six month pre-installation and six-month post-installation study period in comparison to the control area of Englewood, which did not receive the alley lighting improvements. A comparison of reported incidents that occurred during the daytime as compared to nighttime incidents found that generally, nighttime incidents increased during the study periods and reported daytime incidents generally decreased, remained the same, or increased only slightly. While this evaluation could not provide a definitive explanation of these findings, it is likely that some of the observed</p>	<p><b>PDF The Chicago Alley Lighting Project: Final Evaluation Report by Morrow</b></p>	<p><b>SUPPORT</b></p>

	<p>increase in reported incidents is due to increased reporting of crime by residents, who may simply be more aware of offenses taking place due to the improved alley lighting.</p>		
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### **Studies related to Energy, Economics & Astronomy**

Issue	Title, Author & Summary	Source	Position on Dark Sky Policy
<p><b>Economics of global light pollution</b></p>	<p><u><i>The economics of global light pollution by Terrel Gallaway</i></u> : This paper is the first analysis of the economic factors of global light pollution. Light pollution generates significant costs including negative impacts on wildlife, health, astronomy, and wasted energy- which in the U.S. amounts to nearly 7 billion dollars annually. The current paper utilizes unique remote sensing data and economic data from the World Bank to quantify the economic causes of light pollution globally. Fractional logit models show that, similar to other types of pollution, both population and GDP are significant explanatory variables.</p>	<p><b>PDF Ecological Economics: Economics of Global Light Pollution by Gallaway</b></p>	<p><b>SUPPORT</b></p>
<p><b>Economic Impact of Illumination</b></p>	<p><u><i>Illuminated vs. Non-Illuminated Signage – Economic Impact of Illumination by Charles R. Taylor, Villanova University</i></u>: This study reports the results of a nationally representative sample of on premise sign users. Specifically, the study examined the degree to which businesses: 1) light their signs beyond normal business hours; 2) face lighting restrictions on on-premise signs; 3) believe lighted, on-premise signs help them perform key marketing functions; and 4) believe a lighted on-premise sign impacts their bottom line.</p>	<p><b>PDF Illuminated vs. Non-Illuminated Signage – Economic Impact of Illumination by Taylor</b></p>	<p><b>NO POSITION</b></p>
<p><b>Energy and Light Waste</b></p>	<p><u><i>Sustainable Outdoor Lighting for Reducing Energy and Light Waste by Andreas Hanel</i></u>: Sustainable outdoor lighting should consider optimal alignment, the intensity and the color quality of the illumination. These solutions can reduce light pollution and thus waste of energy and will increase human comfort at the same time.</p>	<p><b>PDF 9th International Conference Improving Energy Efficiency in Commercial Buildings and Smart Communities: pg. 202-212 Sustainable Outdoor Lighting for Reducing Energy and Light Waste by Hanel</b></p>	<p><b>SUPPORT</b></p>
<p><b>Issues with Blue-Rich White Outdoor Lighting</b></p>	<p><u><i>Visibility, Environmental, and Astronomical Issues Associated with Blue-Rich White Outdoor Lighting</i></u> This paper summarizes atmospheric, visual, health, and environmental research into spectral effects of lighting at night. The physics describing the interaction of light with the atmosphere shows that the increased blue light emission from white lighting sources will increase visible sky glow and have detrimental effects on astronomical research.</p>	<p><b>PDF International Dark-Sky Association: Visibility, Environmental, and Astronomical Issues Associated with Blue-Rich White Outdoor Lighting</b></p>	<p><b>SUPPORT</b></p>
<p><b>Artificial Night Sky Brightness</b></p>	<p><u><i>The new world atlas of artificial night sky brightness by Fabio Falchi</i></u>: Despite the increasing interest among scientists, light pollution lacks a</p>	<p><b>PDF Science Advances: The new</b></p>	<p><b>SUPPORT</b></p>

	current quantification of its magnitude on a global scale. Now presented is the world atlas of artificial sky luminance, it has been commuted with a light pollution software that uses new high-resolution satellite data and new precision sky brightness measurements. Previously the magnitude of global light pollution is poorly known because measurements were sporadically distributed.	<a href="#">world atlas of Artificial Night Sky Brightness</a>	
<b>Reducing Freeway Illumination for Energy Conservation</b>	<u><i>Safety effects of reducing freeway illumination for energy conservation by Christopher M. Monsere:</i></u> The addition of illumination where none was present is generally believed to have a positive effect on motor vehicle safety; reducing the frequency, as well as the severity of crashes. The operational cost of illumination, however, can make it a candidate for conservation during periods of high energy costs. In response to a forecasted energy shortage, the Oregon Department of Transportation selectively reduced illumination on interstate highways as part of an energy-saving effort. This paper presents the results of a crash-based analysis of the changes in safety performance using an empirical-Bayes observational methodology. The study found an increase in reported crashes where the lineal lighting was reduced both in total crashes and injury.	<b>PDF Accident Analysis and Prevention: Safety effects of reducing freeway illumination for energy conservation</b>	<b>OPPOSE</b>

### ***Studies related to Ecology & Wildlife***

<b>Issue</b>	<b>Title, Author &amp; Summary</b>	<b>Source</b>	<b>Position on Dark Sky Policy</b>
<b>Cloud Coverage amplifying Light Pollution</b>	<u><i>Cloud Coverage Acts as an Amplifier for Ecological Light Pollution in Urban Ecosystems by Christopher C. M Kyba:</i></u> Cloud coverage dramatically amplifies the sky luminance. Changes in ambient nighttime lighting result in behavioral and physiological changes for many nocturnal species.	<b>PDF <a href="#">Cloud Coverage Acts as an Amplifier for Ecological Light Pollution in Urban Ecosystems</a></b>	<b>SUPPORT</b>
<b>Artificial Light Altering Balance of Species Interactions</b>	<u><i>Artificial light pollution: are shifting spectral signatures changing the balance of species interactions? By Thomas W. Davies</i></u> Results suggest that the installation of broader spectrum lighting technologies in artificially lit habitats is likely to improve the ability of animals to detect light reflected from objects in their environment at night, and has the potential to generate greater disparities in this ability between different classes of animal. These improvements in object detection under broad spectrum street lights are likely to affect the execution of visually guided behaviors in animals, altering their normal activity times and spatially extending or fragmenting habitats.	<b>PDF <a href="#">Global Change Biology Artificial light pollution: are shifting spectral signatures changing the balance of species interactions? By Davies</a></b>	<b>SUPPORT</b>

<p><b>Street Lighting Changing the Composition of Invertebrate Communities</b></p>	<p><u><i>Street Lighting Changes the Composition of Invertebrate Communities by Davies:</i></u> Invertebrate community composition is affected by proximity to street lighting independently of the time of day. Five major invertebrate groups contributed to compositional differences, resulting in an increase in the number of predatory and scavenging individuals in brightly lit communities. Results indicate that street lighting changes the environment at higher levels of biological organization than previously recognized, raising the potential that it can alter the structure and function of ecosystems.</p>	<p><b>PDF <i>Biology Letters Community Ecology: Street Lighting Changes the Composition of Invertebrate Communities by Davies</i></b></p>	<p><b>SUPPORT</b></p>
<p><b>Impact of Light Pollution on Protected Areas</b></p>	<p><u><i>Global Assessment of Light Pollution Impact on Protected Areas by Christoph Aubrecht:</i></u> This paper presents a novel global assessment of light pollution impact on protected areas. A set of spatial indicators was developed based on joint analysis of satellite observed nighttime lights as acquired by the U.S. Air Force Defense Meteorological Satellite Program (DMSP) The presented risk assessment underscores the need for accurate and consistent spatial data on a global scale and can help to indicate which protected areas globally and nationally are at greatest risk of human activities.</p>	<p><b>PDF <i>Center for International Earth Science Information Network: Global Assessment of Light Pollution Impact on Protected Areas by Aubrecht</i></b></p>	<p><b>SUPPORT</b></p>
<p><b>Impact of light pollution on nocturnal animals</b></p>	<p><u><i>The influence of Low Intensities of Light Pollution on Bat Communities in a Semi-Natural Context by Aurelie Lacoeyuilhe:</i></u> Artificial lights are suspected to have substantial effects on the ecology of many species, e.g., by producing discontinuities in the territories of nocturnal animals. In this study researchers analyzed the potential influence of the intensity and type of artificial light on bat activity in a semi-natural landscape. Artificial light, even low-intensity light, appeared to be sufficiently strong to disturb certain bat species.</p>	<p><b>PDF <i>Impact of Light Pollution on Nocturnal Animals by Lacoeyuilhe</i></b></p>	<p><b>SUPPORT</b></p>

## Academic Articles

Article Title	Summary	Source
<p><b>Dark Sky Ordinances: How to Separate the Light from the Darkness</b></p>	<p>This article shows that there are many ways to protect the important interests of people who love viewing the beautiful night sky, while also protecting the safety, property, and liberty interests of everyone else.</p>	<p><b>PDF <i>Dark Sky Ordinances: How to Separate the Light from the Darkness</i></b></p>
<p><b>TMCEC Prosecutor Conference: The enforcement of outdoor Municipal Lighting Ordinances in Texas</b></p>	<p>As more municipalities begin to consider the merits of adopting outdoor lighting ordinances, it is important that careful thought be given to the challenges of enforcement. Public education, collaboration, and consensus building are important prerequisites to the passage of a municipal lighting ordinance. However, sustaining such efforts is essential to long term effective enforcement. Regardless of the avenue of enforcement, a municipality should not expect to successfully enforce an</p>	<p><b>PDF <i>Blinded by the Light: The Enforcement of Outdoor Municipal Lighting Ordinances in Texas</i></b></p>

	ordinance that is misunderstood or lacking popular support among residents.	
<b>Department of Energy Street Lighting and Blue Light</b>	An unending succession of news stories generated by the American Medical Association's (AMA) <b>community guidance on street lighting</b> has kept the topic of LED street lighting and its potential effects on health and the environment in the public's mind. As discussion of these issues has become more widespread, so have many misperceptions and mischaracterizations of the technical information, with the difference between what has and hasn't been scientifically established often blurred.	<a href="https://energy.gov/eere/ssl/street-lighting-and-blue-light">https://energy.gov/eere/ssl/street-lighting-and-blue-light</a>
<b>Illuminating the Circadian Clock in Monarch Butterfly Migration</b>	Migratory monarch butterflies use a time-compensated Sun compass to navigate to their overwintering grounds in Mexico. This article reports that constant light, which disrupts circadian clock function at both the behavioral and molecular levels in monarchs, also disrupts the time-compensated component of flight navigation.	<a href="http://science.sciencemag.org/content/300/5623/1303.full">http://science.sciencemag.org/content/300/5623/1303.full</a>
<b>Missing the Dark: Health Effects of Light Pollution</b>	Sleep disorders, decreased melatonin production, significant correlation between outdoor artificial lighting and breast cancer.	<a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2627884/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2627884/</a>
<b>The enforcement of outdoor Municipal Lighting Ordinances in Texas</b>	As more municipalities begin to consider the merits of adopting outdoor lighting ordinances, it is important that careful thought be given to the challenges of enforcement. For the time being, in absence of precedent, Texas cities choosing law enforcement (criminal, civil, or quasi-judicial) are likely to find themselves feeling their way through the dark. Public education, collaboration, and consensus building are important prerequisites to the passage of a municipal lighting ordinance. However, sustaining such efforts is essential to long term effective enforcement. Regardless of the avenue of enforcement, a municipality should not expect to successfully enforce an ordinance that is misunderstood or lacking popular support among residents.	<a href="http://www.tmcec.com/files/6214/2567/8002/00-Turner_BINDER_Blinded_by_the_Light.pdf/">http://www.tmcec.com/files/6214/2567/8002/00-Turner_BINDER_Blinded_by_the_Light.pdf/</a>

<b>Citizen science provides valuable data for monitoring global night sky luminance</b>	The GLOBE at Night citizen science project allows individual observers to quantify skyglow using star maps showing different levels of light pollution.	<a href="http://www.nature.com/articles/srep01835">http://www.nature.com/articles/srep01835</a> <b><u>global night sky luminance</u></b>
<b>The Biological Impacts of Artificial Light at Night</b>	Advocates for the independent funding of research programs experimentally addressing ecological impacts of ALAN. Understanding the effects of both intensity and spectral composition of ALAN.	<b>PDF <i>Philosophical Transactions of the Royal Society B: The Biological Impacts of Artificial Light at Night: The Research Challenge</i> by Gaston</b>
<b>Hiding From The Lights: Artificial Illumination Confounds Commuting Bats</b>	Understanding the impacts of artificial light at night on wildlife is a crucial conservation challenge. Bats being almost exclusively nocturnal animals are ideal subjects for exploring the effects of light pollution.	<b>PDF BATS Bat Conservation International Winter 2010</b>

## News Articles

Title	Summary	Source
<b>Implementation of Sanibel "dark sky" ordinance extended</b>	A new ordinance would require homeowners and businesses to help maintain a dark sky over Sanibel Island by switching to dim lights. The so-called "dark sky ordinance" created in 2000 and set to take effect in January 2015, would require homeowners and businesses to change their lights to full cut-off light fixtures. Those light bulbs cast little to no upward light.	<a href="http://www.nbc-2.com/story/25802817/implementation-of-sanibel-dark-sky-ordinance-extended">http://www.nbc-2.com/story/25802817/implementation-of-sanibel-dark-sky-ordinance-extended</a>
<b>Texas Monthly: Afraid of Losing the Dark</b>	The McDonald Observatory, Celebrating its seventy-fifth anniversary this year, forges ahead with groundbreaking research and crusades to keep the night skies of west Texas Pristine and unadulterated.	<a href="http://www.texasmonthly.com/travel/afraid-of-losing-the-dark/">http://www.texasmonthly.com/travel/afraid-of-losing-the-dark/</a>
<b>Texas Co-Op Power Starstruck: The quest to save West Texas' dark night skies</b>	West Texas and the Big Bend region, where infrequent cloud cover, low humidity, limited air pollution and scant urban sprawl create an astral feast for the eyes.	<a href="http://www.texascoopower.com/texas-stories/nature-outdoors/starstruck">http://www.texascoopower.com/texas-stories/nature-outdoors/starstruck</a>
<b>West Texas Drillers Asked to Cut Light Pollution</b>	The Texas Railroad Commission is asking West Texas oil and gas operators to curb light pollution — particularly around the University of Texas' McDonald Observatory — so astronomers can see the stars at night.	<a href="https://www.texastribune.org/2016/02/17/regulators-ask-west-texas-drillers-protect-dark-sk/">https://www.texastribune.org/2016/02/17/regulators-ask-west-texas-drillers-protect-dark-sk/</a>
<b>Texas Towns Pass Lighting Laws to Protect Star-Gazing</b>	A small but growing number of Texas cities are passing lighting ordinances to keep the night sky dark as the state grows.	<a href="http://www.governing.com/news/local/tt-texas-towns-pass-lighting-laws.html">http://www.governing.com/news/local/tt-texas-towns-pass-lighting-laws.html</a>
<b>The Rivard Report: Seeing the Milky Way in San Antonio: The easiest environmental problem to fix</b>	Documentary filmscreening "The City Dark." "Astronomers and architects don't want to turn the lights off- they want them to be redirected to face downwards." Citizens express concerns over future generations not being able to see the stars.	<a href="http://therivardreport.com/seeing-the-milky-way-in-san-antonio-the-easiest-environmental-problem-to-fix/">http://therivardreport.com/seeing-the-milky-way-in-san-antonio-the-easiest-environmental-problem-to-fix/</a>
<b>Arizona Daily Sun: Images show Flagstaff's dark skies success</b>	Flagstaff began its commitment to dark sky-friendly nearly 60 years ago. It became the world's first international dark sky city in 2001.	<a href="http://azdailysun.com/news/local/images-show-flagstaffs-dark-skies-success/article_b9d0f493-556b-584c-b510-74f3a3006119.html">http://azdailysun.com/news/local/images-show-flagstaffs-dark-skies-success/article_b9d0f493-556b-584c-b510-74f3a3006119.html</a>
<b>The stars at night</b>	A satellite map of light pollution in the United States shows the country split down the middle, with nearly everything to the east full of light and broad swaths of the west still dark. The Interstate 35 corridor forms the boundary between the two; immediately west is the Hill Country. "We call it 'the edge of night,' because you have dark skies that are close to very populated cities."	<a href="http://www.texasmonthly.com/travel/the-stars-at-night/">http://www.texasmonthly.com/travel/the-stars-at-night/</a>
<b>Are your streetlights killing you?</b>	"Not only is blue-rich white LED street lighting five times more disruptive to our sleep cycle than conventional street lighting, according to the report, but recent large surveys have documented that brighter residential nighttime lighting is associated with reduced sleep, impaired daytime functioning and	<a href="http://texashillcountry.com/streetlights-killing/">http://texashillcountry.com/streetlights-killing/</a>

a greater incidence of obesity.” Here’s how we work: sunlight suppresses our body’s production of melatonin, but when it gets dark, melatonin floods our body and helps us get to sleep and stay asleep.

## Military Cities & Counties with Ordinances

City	Summary	Year
<b>Spotsylvania County, Virginia</b>	Near US Army Fort A.P. Hill The purpose of this division is to make provision for outdoor lighting systems and luminaires that are complementary and respectful to business interests, public and property safety and enjoyment, and considerate of interests to maintain flexibility and accommodation of changing lighting technologies over time. The following outdoor lighting regulations are intended to employ night sky friendly principles, whereby reducing impacts of "light pollution", protection of the public welfare by controlling the spillover of light onto adjacent residential properties, and protecting the public safety by preventing glare and/or distraction from outdoor luminaires. To effectuate this, these regulations set standards for the direction of light emitted from certain luminaires, and limit the intensity of light on certain adjacent properties, as provided herein.	2016
<b>Polk County, Florida</b>	Avon Park Air Force Range The Avon Park Air Force Range (APAFR), located in southeast Polk County, is a training facility serving all branches of the military, the National Guard and some civilian organizations, such as the South Florida Community College Law Enforcement Academy. The Military Compatibility Zones (MCZ) overlay is established to ensure that land uses and activities are compatible with the operations of the APAFR, in order to protect the health and safety of residents and to preserve the mission of the Range.	2012
<a href="#"><u>Tucson, AZ</u></a>	Davis-Monthan Air Force Base “The purpose of this code is to preserve the relationship of the residents of the City of Tucson, Arizona and Pima County, Arizona to their unique desert environment through protection of access to the dark night sky. Intended outcomes include continuing support of astronomical activity and minimizing wasted energy, while not compromising the safety, security, and wellbeing of persons engaged in outdoor night time activities. It is the intent of this code to control the obtrusive aspects of excessive and careless outdoor lighting usage while preserving, protecting, and enhancing the lawful nighttime use and enjoyment of any and all property.” <i>City of Tucson</i>	2012
<a href="#"><u>Eagle Mountain, UT</u></a>	One of the first to consider a <a href="#"><u>Dark Sky ordinance in Utah County</u></a> , city council members and the mayor are serious about keeping their Cedar Valley residents in the dark for two reasons: so they can enjoy the brilliance of constellations during the night hours and so Camp Williams soldiers can train in night vision combat and for night flying.	2014

<a href="#">El Paso, Texas</a>	Intent: Excessive and/or careless outdoor lighting can be minimized, while preserving safety, security, and nighttime use and enjoyment of property. These measure will curtail the degradation of the nighttime visual environment by encouraging lighting practices that direct appropriate amounts of lights where and when it is needed, increasing the use of energy-efficient sources, and decrease wastage of light and glare resulting from over lighting and poorly shielded or inappropriately directed lighting fixtures.	2005
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## Texas Cities & Counties with Outdoor Lighting Ordinances

City	Summary	Year
<b>Alpine</b>	The purpose of article VII is to provide safer, more efficient and attractive outdoor lighting; conserve energy; to make alpine community a better place to live and work and more inviting place to visit; to preserve the darkness and clarity of the night sky, mindful of the needs of McDonald Observatory.	2010
<b>Boerne</b>	The City of Boerne recognizes that the regulation of outdoor lighting, which provides consistent outdoor lighting standards and reduces light pollution, is in the best interest of the City.	2008
<b>Dripping Springs</b>	<a href="#">Named The First International Dark Sky Community In Texas</a> it requires the use of appropriate lighting for the space, enhances traffic safety by preventing glare, and prevents light trespass by requiring that the light be kept on the property it's intended to illuminate.	2014
<b>Fredericksburg</b>	The purpose of these rules and regulations are to provide outdoor lighting standards and regulations to assure public safety, promote efficient and more cost effective lighting, enhance the ability to view the night sky and promote a positive City image reflecting order, harmony and pride.	2014
<b>Frisco</b>	The purpose of this subsection is to: (A) Reduce the problems created by improperly designed and installed outdoor lighting; (B) Reduce problems of glare on operators of motor vehicles, pedestrians and land uses; (C) Minimize light trespass; (D) Reduce the energy and financial costs of outdoor lighting by establishing regulations, which limit the area that certain kinds of outdoor lighting fixtures can illuminate; and (E) Preserve the night sky as a natural resource. Refers to outdoor advertising lighting.	2013
<a href="#">Galveston</a>	Purpose is to allow for the reasonable use of outdoor lighting, minimize adverse off-site effects on other properties and habitat areas, improve security through night-time visibility, minimize the cumulative effects of excessive artificial lighting in an urbanized setting that detracts from the enjoyment of the natural darkness and astronomical features of the night sky, and conserve energy.	2015
<b>Helotes</b>	Commercial outdoor lighting, control of glare, outdoor advertising signs.	2009

<a href="#">Horseshoe Bay</a>	As part of the process of applying to become an International Dark Sky Community, local officials undertook a comprehensive evaluation and modernization of the city's outdoor lighting code. In parallel, the city organized a campaign to build public support for lighting practices that help maintain a dark nighttime character as an important element of the quality of life in Horseshoe Bay.	2015
<a href="#">Kendall County</a>	Requires IDA Approved outdoor lighting products for luminaires that minimize glare, reduce light trespass, and do not pollute the night sky within 5 miles around Camp Bullis to protect military nighttime activities.	2009
<a href="#">Lago Vista</a>	Code updates to require all street signs be reflective to accommodate dark skies efforts, expand the existing lighting regulations to further promote dark skies. The Site Development Ordinance currently requires that all roadway, parking lot, walkway, and building floodlights be shielded to allow lighting to project only onto the building or ground.	2015
<b>Llano</b>	Dark night skies are an asset and important element of Llano's appeal as a pleasant community in which to live and that city policy seeks to protect. The purpose of this article is to provide uniform outdoor lighting standards to assure public safety and health, promote efficient and more cost effective lighting, enhance the ability to view the night sky and promote a positive city image reflecting order, harmony and pride, thereby strengthening the economic stability of Llano's business, cultural, historical and residential areas.	2016
<a href="#">Presidio</a>	Passed Outdoor lighting ordinance with full support by the council.	2015
<b>Wimberley</b>	City of Wimberley Comprehensive Outdoor Lighting Ordinance	2001
<b>Webberville</b>	The purpose of this Section is provide for the preservation of night skies, protect property rights by preventing Light Trespass, save energy by eliminating waste, and increase safety by eliminating glare.	2013
<b>Jeff Davis County (Fort Davis)</b>	The Commissioners Court finds that the Director of McDonald Observatory has requested the Court to adopt new orders regulating the installation and use of outdoor lighting in the unincorporated areas of Jeff Davis County. The Commissioners Court finds that the regulations contained in this Order are designed to protect against the use of outdoor lighting in a way that interferes with the scientific astronomical research of the observatory.	2007 ORDER OF THE JEFF DAVIS COUNTY COMMISSIONERS COURT GOVERNING OUTDOOR LIGHTING
<a href="#">Fort Bend County</a>	Outdoor lighting in the unincorporated areas of Fort Bend County. Fort Bend County has adopted regulations intended to prevent over or under lighting relative to ambient lighting conditions.	2006

<b>Brewster County</b>	Requirements on new lighting installations, recreational facilities, outdoor building or landscape illumination, searchlights.	2016
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## Texas Lighting Laws

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- HB 2857 AN ACT relating to regulation of outdoor lighting in certain areas; providing a criminal penalty and for injunctive relief. The bill would require local authorities within 57 miles of the McDonald observatory to institute regulations covering new outdoor lights.
- Tex. Local Government Code §§240.031 *et seq.* In 2007, the Texas Legislature amended an existing law regarding the regulation of outdoor lighting to authorize state counties, at the request of the military, to adopt measures governing the use of outdoor lighting within five miles of a military installation. The provision only applies to counties with at least five military bases and a population of more than 1,000,000 people or adjacent counties located within five miles of a base. County regulations must be designed to protect against interferences with military training activities. Counties may accomplish this goal in a number of ways: (1) require that a permit be obtained before installing certain types of lighting; (2) prohibit the use of particular lighting fixtures; (3) establish requirements for the shielding of outdoor lighting; or (4) regulate the times during which certain types of lighting may be used.
- Texas Health & Safety Code CHAPTER 425. REGULATION OF CERTAIN OUTDOOR LIGHTING. Prohibits the use of state funds to install or replace an outdoor lighting fixture on a roadway unless (1) the fixture is designed to maximize energy conservation and minimize light pollution among others, (2) the fixture emits only as much light as necessary for the intended purpose, (3) a full cutoff fixture is used when the output is more than 1,800 lumens and (4) the purpose of an additional light cannot be achieved by lowering the speed limit, installing reflective markers, etc. Full consideration has been given to energy conservation, reducing glare, minimizing light pollution, and preserving the natural night environment. 2005