

***1029 LIGHT POLLUTION IN CENTRAL AND SOUTHERN ARIZONA: A RUNAWAY PROBLEM WITH AN ACHIEVABLE SOLUTION**

Two-thirds of Americans cannot see the Milky Way when they look up at the night sky.¹ For the past forty years, the City of Tucson and Pima County have beaten these odds, enacting Dark Sky Ordinances that maintain the conditions necessary to support a thriving astronomy research industry. Unfortunately, lax laws in Maricopa County are allowing light pollution from the Phoenix area to spill south, threatening to undo decades of careful planning. This Comment explores light pollution in Arizona, compares the respective lawmaking approaches of Tucson and Phoenix, and makes recommendations to address this growing problem.

INTRODUCTION TO LIGHT POLLUTION

Since the advent of artificial illumination, humans have inadvertently brightened more space than they intended. Throughout the centuries, we have “lit up the night as if it were an unoccupied country, when nothing could be further from the truth.”² The phenomenon of light falling where it is neither wanted nor needed is known as light pollution.³ An unshielded light bulb produces excess illumination, and light spills into the sky and onto surrounding properties.⁴ It is estimated that the United States alone projects over \$4.5 billion worth of excess light into the sky every year.⁵

While outdoor lighting is essential for businesses and residences alike, light pollution adversely affects the astronomy community. Arizona is home to eighteen telescopes and ***1030** optic research facilities,⁶ which brought \$252.8 million into the state in 2006.⁷ However, the cosmos is less visible now than it was several decades ago.⁸ It is not that the stars are dimmer; “rather, the Earth has become vastly brighter,”⁹ so that celestial objects are more difficult to see. The atmosphere is now less transparent and more reflective, with the stars looking washed-out as a result of sky glow.¹⁰

Arizona’s efforts in combatting light pollution began in the 1970s, when astronomers working at the Kitt Peak National Observatory¹¹ noticed a decrease in astronomical visibility of the night sky.¹² This observation corresponded with the growth of the Tucson metropolitan area and its sky glow.¹³ Astronomers and academics persuaded local city and county officials to enact ordinances governing the brightness and intensity of external lighting.¹⁴ As a result of these efforts, the visibility of the sky in southern Arizona has held steady at 1970 levels.¹⁵ However, new state legislative actions such as permissions for electronic light-up billboards threaten to reverse this progress.¹⁶ In the coming decades, Arizona’s skies--and the lucrative astronomy industry that depends on them--are in danger because of the rapid and unchecked growth of the Phoenix area.¹⁷

***1031 I. TUCSON’S NUANCED SOLUTION**

For more than three decades, a confluence of astronomers, legislators, and nonprofit groups such as the International Dark-Sky Association¹⁸ has helped shape Tucson’s light pollution laws so as to minimize pollution without inhibiting growth.

In order to keep the sky around Kitt Peak as dark as possible, the Tucson City Council has worked to set guidelines and maximum limits for the lumens¹⁹ per acre available to local businesses.²⁰

As a result of decades of hearings and studies, Tucson's 2012 Outdoor Lighting Code now spans seventeen pages of definitions, regulations, and charts.²¹ It features strict guidelines on maximum light brightness as well as hours of operation and light shielding requirements. The code limits the "brightness of exterior fixtures and requires most of them to be of a type ... known as 'full cutoff' or 'fully shielded,'" meaning that fixtures must cast light only downward, as opposed to upwards or horizontally.²² The Tucson ordinance caps the total light output from unshielded lights at 11,000 lumens per acre of residential development,²³ with all lights turned off by 11pm every night.²⁴ The revised 2012 code also sets color temperature guidelines for both general lighting and signs, as it creates a more proactive approach to combating wasted light. The National Optical Astronomy Observatory directly credits these ordinances with suppressing sky glow and keeping the sky dark for research.²⁵

II. PHOENIX'S QUICK FIX

In most large cities across the world, light pollution means that the "sky looks as though it has been emptied of stars," and Phoenix is no exception.²⁶ Maricopa County has experienced exponential population growth in the last several decades, and its residential *1032 building has kept pace.²⁷ The county's main zoning ordinance devotes just four pages to outdoor lighting regulations and compliance.²⁸ In the last several years, the legislature has weakened even these laws to allow larger and brighter lights, including illuminated digital billboards on the sides of freeways.²⁹

The Maricopa County outdoor lighting code is most notable for the topics that it does not discuss. The ordinance makes no mention of residential versus commercial zoning, or lumen limits per acre of development.³⁰ Also missing are distinctions between color temperatures, angle of mounted light fixtures, and new LED technology.³¹ The county ordinance sets only general guidelines,³² without any concrete mention of maximum illumination standards. The code recommends that certain lights should always be partially or fully shielded to prevent light trespass, while creating statutory exemptions.³³ For instance, billboards with bottom-mounted, upward-facing lights are immune from the Outdoor Light Control Provisions so long as the lights are turned off between midnight and sunrise.³⁴ The last two years have brought some judicial³⁵ and gubernatorial³⁶ pushback on these lax standards as electronic billboard operators apply for permits to build along state highways, but very little is being done on the residential front. As the Phoenix area and its suburbs continue expanding southward, light pollution from Maricopa County will begin affecting the observatories that Pima County and Tucson have worked so hard to protect.

*1033 III. REGULATORY RECOMMENDATIONS

If policymakers in Arizona want the state's observatories to continue operating in the coming decades, Maricopa County's ordinances must mirror those of Tucson and Pima County. Earlier this year, Governor Jan Brewer exerted some pushback on overbroad legislation regulating electronic billboards, but one veto is not enough. Unchecked light pollution will impede the function of telescopes and advanced spectroscopy research in Arizona and deprive the state of much-needed revenue. Furthermore, new advances in LED technologies mean that today's policies will have lasting effects on millions of outdoor light sources across the state as they are retrofitted with new energy efficient bulbs. Tucson's comprehensive approach to lighting regulation illustrates how businesses, nonprofit organizations, and city officials can work together to effect meaningful change and curtail pollution. New legislation that offers actionable solutions, such as lower caps on permitted lighting emissions from parking lots and businesses, can allow the Phoenix area to grow and develop without harming Arizona's skies--just as Tucson has done since the 1970s.

Footnotes

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- ¹ Interview with W. Scott Kardel, Managing Dir., Int'l Dark-Sky Ass'n, in Tucson, Ariz. (Oct. 19, 2012).
- ² Verlyn Klinkenborg, *Our Vanishing Night*, NAT'L GEOGRAPHIC, Nov. 2008, at 102, 104.
- ³ Glossary of Basic Terms, INT'L DARK-SKY ASS'N, [http:// www.darksky.org/education/98-glossary-of-basic-terms](http://www.darksky.org/education/98-glossary-of-basic-terms) (last visited Oct. 20, 2012).
- ⁴ Kristen M. 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, 990 (2002).
- ⁵ Marina Murphy, *Revealing the Dark Side of Light*, 2000 CHEMISTRY & INDUS. 627.
- ⁶ *Telescopes*, DEP'T OF ASTRONOMY & STEWARD OBSERVATORY, UNIV. OF ARIZ., <https://www.as.arizona.edu/research/telescopes.html> (last visited Oct. 30, 2012).
- ⁷ VERA PAVLAKOVICH-KOCHI ET AL., ASTRONOMY, PLANETARY AND SPACE SCIENCES RESEARCH IN ARIZONA: AN ECONOMIC AND TAX REVENUE IMPACT STUDY 2-4 (2007).
- ⁸ *Light Pollution*, NAT'L OPTICAL ASTRONOMY OBSERVATORY, [http:// www.noao.edu/education/gsm/tp](http://www.noao.edu/education/gsm/tp) (last visited Oct. 20, 2012).
- ⁹ David Owen, *The Dark Side: Making War on Light Pollution*, THE NEW YORKER, Aug. 20, 2007, 28.
- ¹⁰ "Sky glow increases the brightness of the dark areas of the sky, which reduces the contrast of stars or other celestial objects against the dark sky background." *What Is Sky Glow?*, LIGHTING RESEARCH CTR., RENSSELAER POLYTECHNIC INST., [http:// www.lrc.rpi.edu/programs/nlpip/lightinganswers/lightpollution/skyGlow.asp](http://www.lrc.rpi.edu/programs/nlpip/lightinganswers/lightpollution/skyGlow.asp) (last modified Feb. 2007).
- ¹¹ Light Pollution, *supra* note 8.
- ¹² Owen, *supra* note 9, at 32.
- ¹³ *Id.*
- ¹⁴ *Id.* at 31, *see also* Interview with W. Scott Kardel, *supra* note 1.
- ¹⁵ Press Release, Nat'l Optical Astronomy Observatory, Kitt Peak Night Sky is Still Dark (Sept. 21, 2010), *available at* [http:// www.noao.edu/news/2010/pr1003.php](http://www.noao.edu/news/2010/pr1003.php).
- ¹⁶ Mike Sunnucks, *Brewer Signs Bill Allowing Electronic Billboards on Phoenix Freeways, Possibly by Arizona Cardinals*, PHX. BUS. J. (May 10, 2012, 3:06 PM), <http://www.bizjournals.com/phoenix/news/2012/05/10/brewer-signs-bill-allowing-electronic.html>.
- ¹⁷ Jason Koebler, *10 Metro Areas With the Largest Population Growth*, U.S. NEWS & WORLD REP. (Apr. 6, 2011) [http:// www.usnews.com/news/articles/2011/04/06/10-metro-areas-with-the-largest-population-growth](http://www.usnews.com/news/articles/2011/04/06/10-metro-areas-with-the-largest-population-growth).

- 18 *See About IDA*, INT’L DARK-SKY ASS’N, <http://www.darksky.org/about-ida> (last visited Oct. 20, 2012).
- 19 A lumen is the measure of the quantity of visible light emitted by a source. This is different than a candela, which is the measure of the intensity or power emitted by a light source in a particular direction. *Definition of: Lumen*, P.C. MAG, http://www.pcmag.com/encyclopedia_term/0,1237,t=lumen&i=46391,00.asp (last visited Nov. 18, 2012).
- 20 Tom Beal, *Kitt Peak Remains in Dark, Shows Effectiveness of Local Lighting Laws*, ARIZ. DAILY STAR (Sept. 16, 2010, 12:00 AM), http://azstarnet.com/news/local/kitt-peak-remains-in-dark-shows-effectiveness-of-local-lighting/article_b1fb01f4-c064-5247-a9e9-48abdef02b75.html.
- 21 Tucson, Ariz., Ordinance 10,963 (Feb. 7, 2012) (adopting 2012 City of Tucson/Pima County Outdoor Lighting Code). *See also Pima County Approves Changes to Lighting Ordinance*, KVOA.COM (Mar. 13, 2012, 6:12 PM) <http://www.kvoa.com/news/pima-county-approves-changes-to-lighting-ordinance/>.
- 22 Owen, *supra* note 9, at 32.
- 23 Tucson, Ariz., Ordinance 10,963, at 12.
- 24 *Id.* at 13.
- 25 Press Release, *supra* note 15.
- 26 Klinkenborg, *supra*, note 2.
- 27 Press Release, U.S. Census Bureau, Arizona’s Maricopa Leads Counties in Population Growth Since Census 2000 (Mar. 22, 2007), *available at* <http://www.census.gov/newsroom/releases/archives/population/cb07-42.html>.
- 28 MARICOPA CTY., ARIZ., ZONING ORDINANCE § 1112 (2012).
- 29 Sunnucks, *supra* note 16.
- 30 MARICOPA CTY., ARIZ., ZONING ORDINANCE § 1112.
- 31 Interview with W. Scott Kardel, *supra* note 1. As Kardel explained, It is now easier to create more light than ever before. Because LEDs are more efficient in the blue portion of the spectrum, there is the potential for increased harm. This is also an economic push on this as LEDs save energy, but blue light can do more damage to the night sky. The Pima County ordinance addresses [different] types of lighting (more lumens are allowed for astronomically friendly sources), but [there are no] limits in the central part of the state. One of the consequences of this [is that] when streetlights are converted [to LED,] they will be in use for decades. This conversion will likely be coming for most cities in the near future.
- 32 MARICOPA CTY., ARIZ., ZONING ORDINANCE § 1112,
- 33 *Id.*

³⁴ *Id.* § 1112.7.1.

³⁵ *Scenic Ariz. v. City of Phx. Bd. of Adjustment*, 268 P.3d 370 (Ariz. Ct. App. 2011).

³⁶ Letter from Janice K. Brewer, Governor, Ariz., to Andy Tobin, Speaker of the House, Ariz. House of Representatives, (Mar. 28, 2012), *available at* http://azgovernor.gov/dms/upload/PR_032812_HB2757VetoLetter.pdf (explaining veto of House Bill 2757).