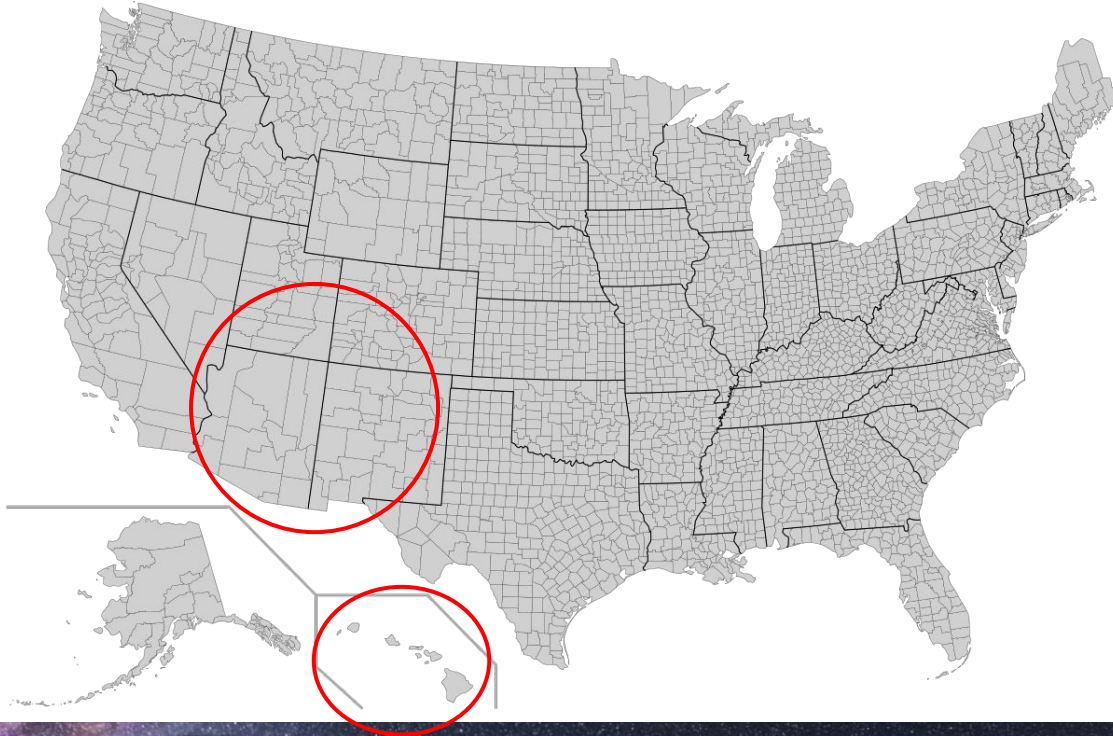


Southwestern USA and Hawaii

Light Pollution Control in the Wild West

Ruskin Hartley
International Dark-Sky Association

Control of Outdoor Lighting in the United States



Regulatory patchwork

- 1 Country
- 50 states
- 3,142 counties
- 19,495 incorporated cities
- 38,779 general purpose governments
- 51,296 special districts

No Federal Law

City: *Flagstaff, Arizona, USA*



[six decades of dark sky protection...](#)

State: *New Mexico Night Sky Protection Act*, 1999

....its purpose is to regulate outdoor night lighting fixtures to preserve and enhance the state's dark sky while promoting safety, conserving energy and preserving the environment for astronomy.

Key Provisions

Shielding

Allows communities to adopt more restrictive controls

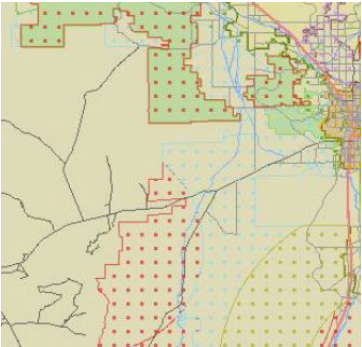
Problem:

Pre-dates the LED revolution.

Allows 70 watt unshielded lights
-> Now, could be 10,000 unshielded lumens

2012 City of Tucson/Pima County Outdoor Lighting Code

Lighting Zones



Astronomical Resource Zones

3.2. Establishment of *Astronomical Resource Zones*. *Critical* and *buffer Astronomical Resource Zones* (ARZ) are established as shown on the *Lighting Zone Map* and generally defined as follows:

Name	Center Location (degrees)		ARZ radius (miles)	
	Latitude	Longitude	critical	buffer
Kitt Peak ARZ	31.9640	-111.6000	15	35
Mount Hopkins ARZ	31.6888	-110.8851	12.5	25
Anderson Mesa ARZ	35.0970	-111.5368	2.5	7
Happy Jack ARZ	34.7443	-111.4225	2.5	7
United States Naval Observatory ARZ	35.1840	-111.7405	2.5	7
Mount Lemmon ARZ	32.4428	-110.7887	15	75
Mount Graham ARZ	32.7014	-109.8891	15	75

Light Output Standards

Land Use and Fixture Shielding	Lighting Zone			Astronomical Resource Zone		Notes
	LZ 1	LZ 2	LZ 3	critical	buffer	
Commercial, Industrial, Multi-family Residential (lumens per net acre)						
total (fully shielded + unshielded)	35,000	70,000	110,000	10,000	20,000	
non-LPS component	35,000	70,000	110,000	1,000	2,000	1
non-amber component	3,500	7,000	11,000	0	0	2
unshielded component	3,500	3,500	3,500	0	0	
Residential (lumens per residence)						
total (fully shielded + unshielded)	20,000	20,000	20,000	10,000	20,000	3
unshielded component	5,000	5,000	5,000	0	5,000	

Shielding

Curfews

- LED signs
- Area lights
- Decorative

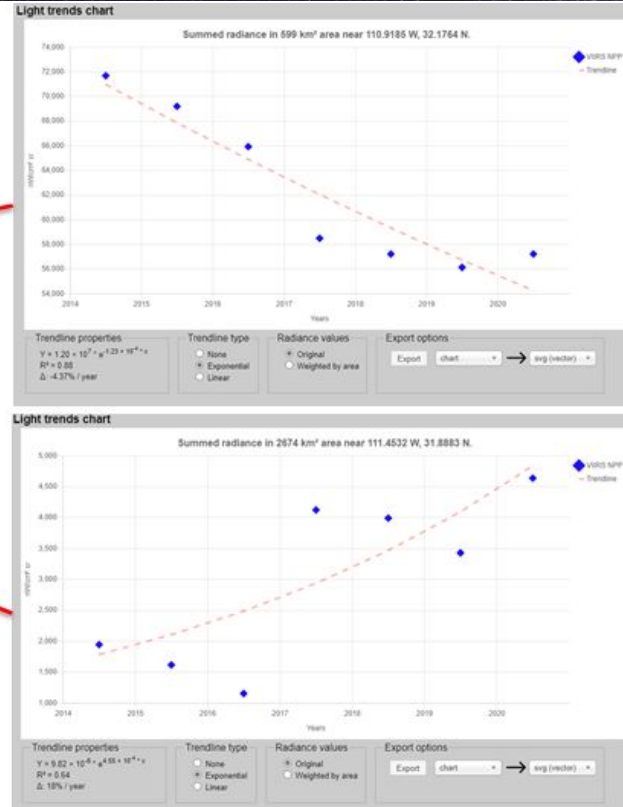
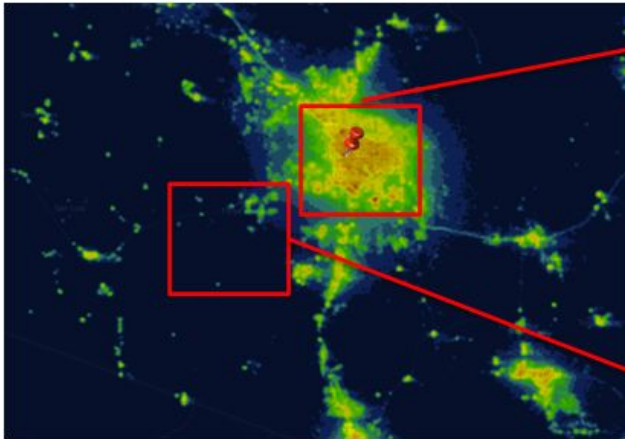
Color

- 3500K

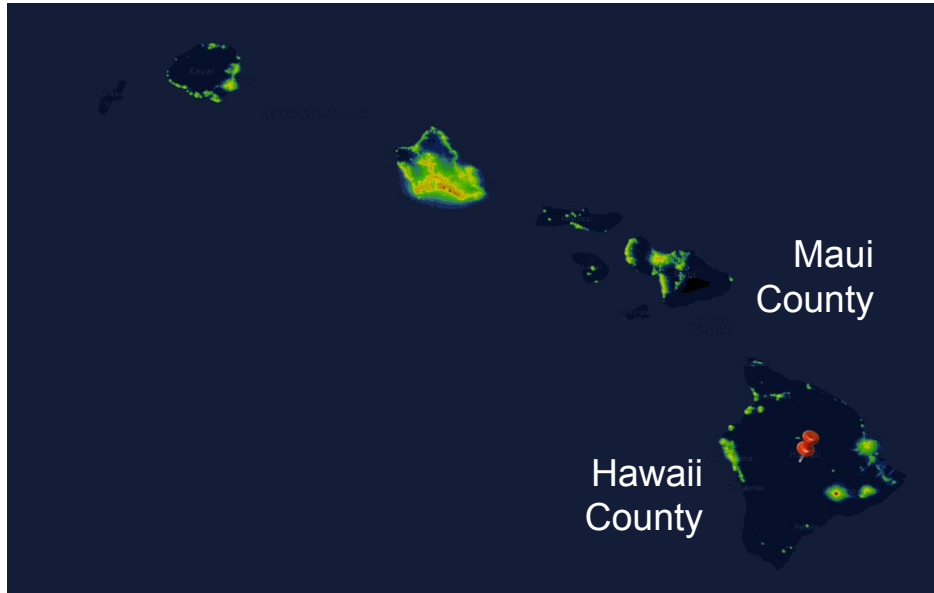
Illumination of Right of ways

- Establishes maximum levels

Tucson - *radiance trends*



State of Hawai'i



The legislature finds that dark night skies hold important cultural, scientific, astronomical, natural, landscape, and tourism related value.

2005: [Coastal Light Pollution Act](#)

- Don't shine light on the shore.

2009: [Relating to Starlight Reserve](#)

- Study proposal

2012: [Hawai'i Night Sky Protection Act](#)

- Applies to state fixtures
- Shielding + 4,000K max

2017: [Relating to Dark Night Skies Protection](#)

- Try again...

Hawai'i Counties

Maui County, 2007 ([20.35](#))

- Shielding
- Usage restrictions

Hawai'i County, 2007 ([14-50](#))

- Shielding
- Usage restrictions
- Spectrum restrictions (<2% blue)



Where color rendering is important

General Illumination

Decorative

Table 14-A		
Lamp Type	Shielding Requirement	Operation Restrictions
Class I		
Low pressure sodium	Fully shielded	None
Low pressure sodium	Partially shielded	Existing fixtures only. New installations as of October 2010 prohibited
Others above 4,050 lumens	Fully shielded	Off from 11:00 p.m. to sunrise*
Others above 4,050 lumens	Fully shielded	Off from 11:00 p.m. to sunrise*
LED fixtures with less than 2% blue light content	Fully shielded	Off at 11:00 p.m. to sunrise*
Class II		
Low pressure sodium		
90 watts or less	None	Existing fixtures only. New installations as of October 2010 prohibited
greater than 90 watts	Partially shielded	Existing fixtures only. New installations as of October 2010 prohibited
Low pressure sodium	Fully shielded	None
LED fixtures with less than 2% blue light content and traffic color compliant	Fully shielded	None
Others above 4,050 lumens		Prohibited
Others below 4,050 lumens		Prohibited
Class III		
Low pressure sodium	Fully shielded	None
Others above 4,050 lumens		Prohibited
Others below 4,050 lumens	Fully shielded	Off from 11:00 p.m. to sunrise*
Neon	None	Off from 11:00 pm to sunrise*

*These lights may remain on after 11:00 p.m. if bona fide business or recreational activities are taking place.

(1988, ord 88-122, sec 3; am 2011, ord 11-18, sec 3; am 2013, ord 13-60, sec 2.)

Challenges, Threats, and Opportunities

Regulatory patchwork

- 50 states
- 19,495 incorporated cities
- 38,779 general purpose governments
- 51,296 special districts

Enforcement

Outdated provisions

- Energy use rather than lumens
- Limited spectral control or outdated limits

Emerging Threats



Digital billboards



Off-grid Lights

Emerging Opportunities

- [International Energy Codes](#)



Moving from Prescriptive to Outcome-based: *City of Tucson, streetlight retrofit*

20,000 roadway luminaires
180M lumens

From: HPS/LPS/LED
To: 3000K LED
with dimming

Lumens:	down 63%
Blue Light:	down 34%
Skyglow:	down 8%
Savings:	\$2.1M per year

Streetlights: 14% of ALAN at zenith





**DARK
& QUIET
SKIES**

Thank you for
your
attention!