

Citizen Science Programs on Light Pollution Awareness: Where Do We Go with the Data?

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Abstract. Once data from a citizen-science program on light pollution is verified, what research projects, on-line analytical tools and tutorials should be developed, and what ways can results and acknowledgements be provided to the public? These and other questions are explored.

Keywords. Light Pollution, Citizen Science, Public Outreach

The past 7 years have seen several citizen-science light pollution campaigns: GLOBE at Night, UK's Orion Star Count, the Great World Wide Star Count, How Many Stars, the Great Indian Star Count, Brazil's Milky Way Marathon, & the Big Aussie Star Hunt. Most data are taken visually by citizen-scientists of all ages without Moon or cloud cover.

Data has also been taken with various skyglow monitors. The LE, LU and DL models of Unihedron's Sky Quality Meter have >50 stations globally and 1000s of handheld models. The IYA Lightmeter has >30 stations worldwide. The International Dark-Sky Association has 20 Night Sky Brightness Monitor stations, most at major observatories and U.S. national parks. There are also Henk Spoelstras DigiLum devices and STEM Laboratory Inc.'s sky brightness meters.

Until recently, the lack of a common measurement standard has hampered efforts to compare measurements from different locations and to develop long-term databases. Efforts through the Cabauw Lightmeter InterComparison workshop and subsequent public comment period produced a new standard officially adopted at the Protection of the Night Sky Symposium in 2012. See www.darksky.org/night-sky-conservation/248.

In the GLOBE at Night data we find a strong relationship between average estimated naked-eye limiting magnitude (NELM) reported by citizen scientists and approximate skyglow predictors, such as the upward-directed radiance measured by the Defense Meteorological Satellite Program (DMSP), 2010 and the skyglow simulation in "The World Atlas of the Artificial Night Sky Brightness", 2001. Analysis of the GLOBE at Night data over the last 7 years indicates a growing trend for brighter skies worldwide.

Research projects for the public could include comparison of sky brightness over time with population density or with data from satellites. Analyses could be compared with data on health, wildlife and energy. People could take lighting inventories or search for dark sky oases. Understanding the behavior of sky brightness over time is essential for making cases for lighting ordinances to city officials or changing peoples mindsets. As examples, student projects with the GLOBE at Night data have been done on the 'lesser long nosed' bat and on monitoring the sky brightness overnight for several months.

On-line tutorials and analytical tools are needed to help the public render valid analysis. Some tutorials have taken place at in-situ workshops or in on-line forums, video-conferences, teleconferences with Powerpoints and Skype sessions. More effort is needed in getting results and acknowledgements to the public. Efforts to date have seen results published in popular science magazines, social networks, Facebook, Twitter, blogs and through national partners and press releases to local and international media.