

Illumination & Displays

Global campaign to save energy and fight light pollution

Constance E. Walker and Stephen Pompea

A citizen-science campaign is working to improve outdoor lighting and reduce energy costs.

3 November 2010, SPIE Newsroom. DOI: 10.1117/2.1201009.003213



Dark skies are being lost all over the globe, and we are wasting hundreds of millions of dollars worth of energy in the process. In the US and Europe, over half the population cannot see the Milky Way from where they live. Because of light pollution, most urban dwellers also experience the effects of poor-quality lighting. Improper lighting is a concern on many fronts, including safety, energy conservation and cost, human health, and its effect on animals, while it also robs us of the beauty of viewing the night sky.¹⁻³

To address this issue, the National Optical Astronomy Observatory (NOAO) began a collaboration to develop a worldwide light-pollution education and measurement campaign, 'GLOBE at Night.' This program promotes the value of dark skies by encouraging people to observe the prominent constellation Orion over a two-week period each March and compare the number of stars that are visible using their unaided eyes with a series of downloadable online charts. The charts show how Orion would appear in skies ranging from very dark to very bright. Citizen scientists submit the chart that best matches what they see to an online database to help create a map of light-pollution levels worldwide. Many GLOBE at Night citizen scientists also use special meters to measure the night-sky brightness and then post their results online.

GLOBE at Night was developed in 2005 by the NOAO's educational outreach group in Tucson (Arizona) in partnership with Global Learning and Observations to Benefit the Environment (GLOBE) and the Environmental Systems Research Institute Inc. It has grown from a prototype project centered in Arizona and Chile to a global cornerstone program of the recently completed International Year of Astronomy 2009.⁴ Now in its fifth year, the program set a record in 2010 with more than 17,800 measurements of night-sky-brightness levels from people in 86 countries (see Figure 1). Nearly 11,000 measurements came from the US.

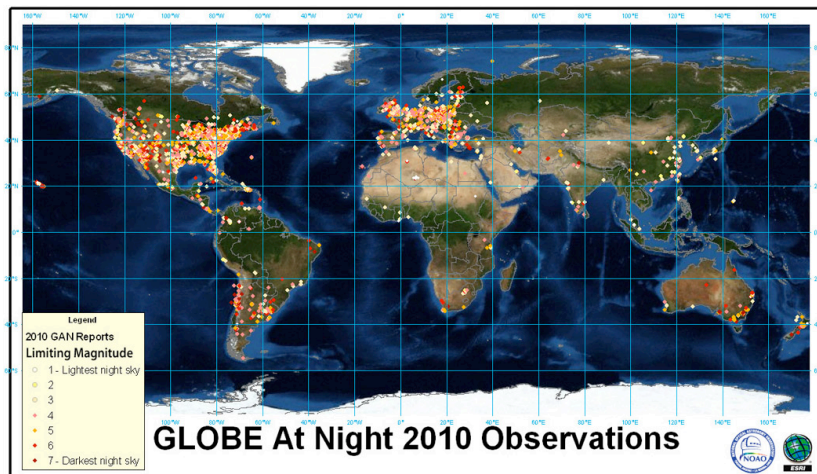


Figure 1. GLOBE at Night measurements worldwide in 2010. Lighter (darker)-colored dots indicate brighter (darker) skies. The limiting magnitude (indicating the faintest stars that can be seen) ranges from 1 (brighter stars) to 7 (fainter stars and, thus, darker skies).

The GLOBE at Night website⁵ clearly explains the value of good lighting practices and how to participate in the program. The website offers background information on key concepts of good and bad lighting. Interactive games and fun quizzes allow participants to check their proficiency on key concepts. Teacher and family guides are available in 14 languages. To help publicize the campaign, the site offers downloadable postcards and flyers in English and Spanish. The reporting page is user-friendly, and the mapping page provides data in various formats.

The program includes activities with which to prepare the public (and especially students) to participate in GLOBE at Night. In particular, the activities introduce children and adults to the effects of light pollution on public health, economic issues, ecological consequences, energy conservation, safety and security, and astronomy.

More than 500 teaching kits, developed by our education group, have been built and distributed at training workshops. Each includes materials for a light-shielding demonstration, a digital sky-quality meter, interactive educational activities, resource DVDs, publicity materials (e.g., postcards, posters, flyers), light-pollution trading cards, and a story book for children, *There Once was a Sky Full of Stars*.⁶

In addition to providing materials and activities before the annual campaign, the program also supplies worldwide measurements of light-pollution levels for use by other projects. With over 50,000 data points from the five annual campaigns so far, the data can be compared over time to look for trends. It can also be correlated with population-density maps or used to search for dark-sky oases or monitor compliance with lighting ordinances. Most recently, it has been compared with telemetry data on the lesser long-nose bat near Tucson to examine whether the bats are preferentially staying in darker areas while traveling between roosts and foraging areas.

Communities are also using their GLOBE at Night data to implement local lighting changes that save energy and make the sky more visible. For example, a school district in Indiana created a 3D model of their measurements using 35,000 Lego® blocks to help visualize light-pollution levels. The students presented their findings to local leaders and were honored for their efforts (see Figure 2).



Figure 2. Elementary and middle-school students collected 3400 GLOBE at Night measurements of their district's night-sky brightness and visualized it by making a map with 35,000 Lego® blocks. Each layer has a different color, with lower layers indicating more light pollution.

Changes in city lighting can ensure that light is directed down, where it is needed, rather than up, where it is wasted. A flyover of a city should reveal no lights shining upwards, other than what is reflected off the ground. By installing proper reflectors on outdoor lighting, the bulb power can be reduced, since light is directed efficiently. Using energy-efficient bulbs and lighting only when needed through curfews or motion sensors are other means of lighting responsibly.

In summary, a citizen-science project like GLOBE at Night provides a good experiential hook that fosters community awareness of real-life issues. It can also encourage people's involvement and motivate them to act on solutions that can positively affect our lives as well as our environment. The program has provided foundational educational activities for schools and informal groups to become familiar with light-pollution issues. It also offers an annual campaign to monitor light pollution worldwide, as well as a means to use the data that is gathered. The next GLOBE at Night campaign will occur twice in 2011, once starting in the third week of February and again in the third week of March, both running for two weeks.

The GLOBE at Night staff will continue to build more of a sense of community at its website.⁵ We are in the midst of creating tutorial videos on Dark Skies Rangers activities. Eventually, we would also like to offer user-friendly analysis

tools for use with the online, downloadable data sets. The goal of our program, to increase awareness of the effects of light pollution so that people take action, is beginning to bear fruit (see Figure 3) and we look forward to supporting other efforts worldwide to save energy and preserve the night.

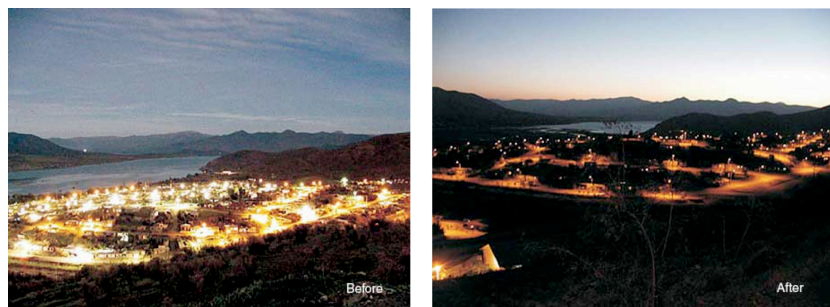


Figure 3. Monte Patria is one of four communities in the Limarí Province of Chile's north-central IV Coquimbo Region. Digital sky-quality meters were delivered before the GLOBE at Night 2009 campaign to measure and access their night-sky brightness. These photographs illustrate the result of lighting changes.

NOAO is operated by the Association of Universities for Research in Astronomy Inc. under a cooperative agreement with the National Science Foundation. GLOBE at Night has been supported by a grant from the National Science Foundation.

Constance E. Walker, Stephen Pompea

National Optical Astronomy Observatory (NOAO)
Tucson, AZ

Connie Walker is an associate scientist. She directs the GLOBE at Night and Dark Skies Rangers programs, chairs the International Dark-Sky Association Education Committee, and was chair of the worldwide Dark Skies Awareness Cornerstone Project for the International Year of Astronomy in 2009.

Stephen Pompea is head of the education and public outreach program at NOAO. He has published extensively in optical physics, stray light, and science education, and was project director of the Hands-On Optics, Galileoscope, and International Year of Astronomy programs.

References:

1. C. E. Walker, S. M. Pompea, D. Isbell, GLOBE at Night 2.0: on the road toward IYA2009, in C. Garmany, M. G. Gibbs, and J. W. Moody (eds.), *Education and Public Outreach—A Changing World: Creating Linkages and Expanding Partnerships*, pp. 389, 2008.
2. C. B. Luginbuhl, C. E. Walker, R. J. Wainscoat, Lighting and astronomy, *Phys. Today* 62, no. 12, pp. 32-38, 2009.
3. C. E. Walker, Our light or starlight?, *Sky Tel.*, pp. 86, 2010.
4. S. M. Pompea, D. Isbell, The International Year of Astronomy 2009: new approaches, novel resources for physics classrooms, *Phys. Teacher*, pp. 428-433, 2009.
5. <http://www.globeatnight.org>. website of GLOBE at Night.
6. C. E. Walker, S. M. Pompea, R. T. Sparks, E. F. C. Dokter, Teaching illumination engineering using light pollution education kits, *Proc. SPIE* 7783, pp. 77830H, 2010. [doi:10.1117/12.862713](https://doi.org/10.1117/12.862713)

[SPIE Professional article on light pollution \(SPIE Member login required\)](#)

Comments: [Submit a comment](#) (requires [sign-on](#)).