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The Journal of Dark Sky Studies is a biannual, international, trans-disciplinary journal focusing on the impacts of artificial light at night and the value and preservation of the natural night. We publish peer-reviewed scholarly research, news, and creative works from students, community scientists, advocates, and authors in all fields of science, technology, design, arts, and the humanities.

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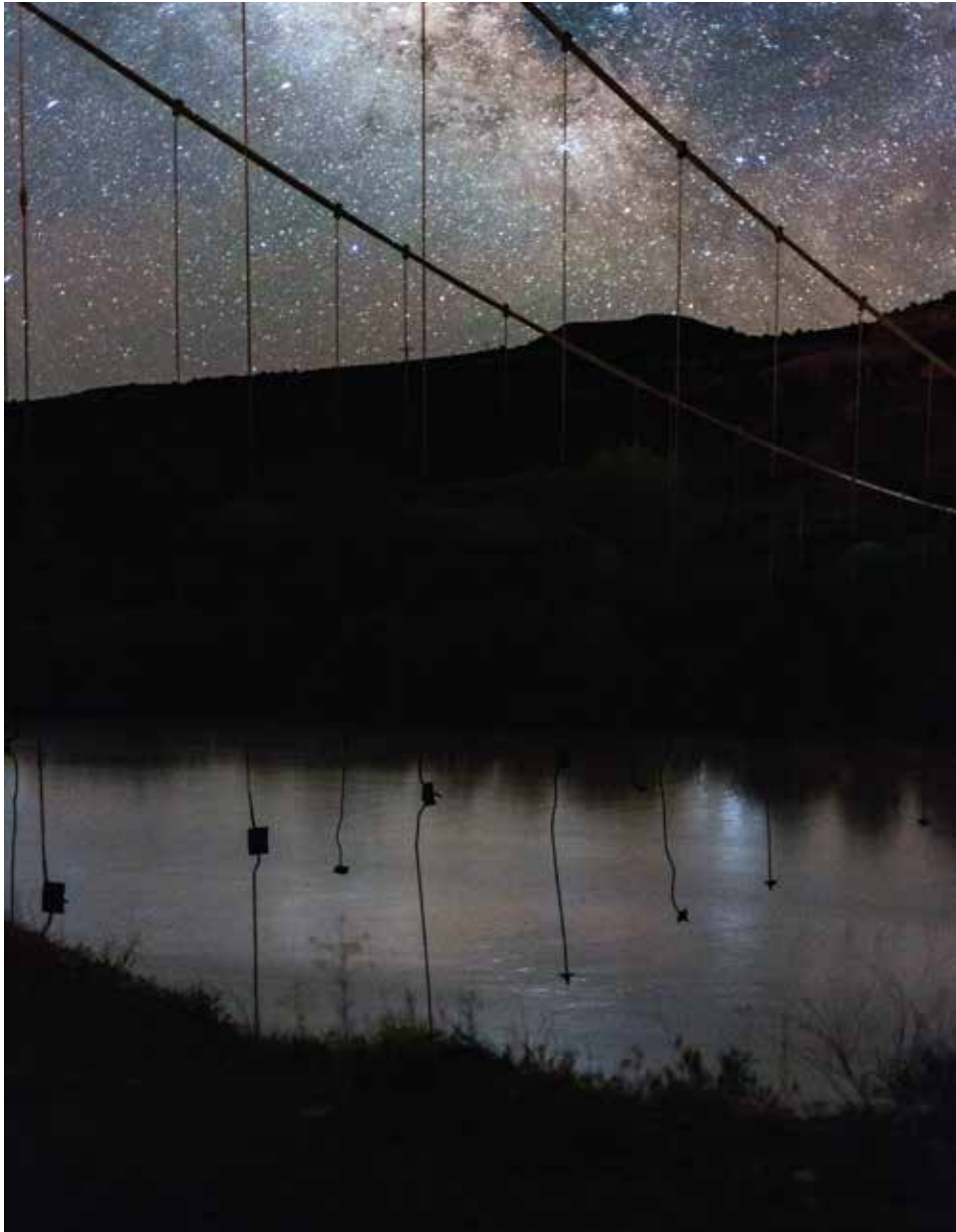


Photo: Bettymaya Foott

DRONE

Stuck together with duct tape and bungees
It hovers, counting the street lights
Lining our cities, which used to lie,
Patient animals, under the night. Now,

They buzz and shimmer, bad news, like us
Full of glitter: hear them always
Humming. Don't measure. Don't stargaze
If you're lost; when you can, look at space

Between glimmers and think of the continent
Where this idea arose full of distance
And travel, opening darkness all night. How

Do you track yourself through that -scape,
Pin to pinprick, fireplace to fire? Do you
Lose yourself if you can't get lost?

Katharine Coles

AN INTRODUCTION TO THE JDSS

PURPOSE

The worldwide loss of the natural night to the influence of artificial light at night (ALAN) is a profound environmental challenge. In recent years, this problem has attracted increasing interest and become a topic of systematic study. Because dark skies studies is highly trans-disciplinary, researchers are publishing their work in various disparate specialty outlets, making holistic, integrative work difficult. The Journal of Dark Sky Studies (JDSS) will provide a dedicated forum for this maturing field, allowing those engaged in work relating to dark skies and ALAN to share information, build upon each other's research, and examine global issues through various disciplinary lenses with the goal of identifying pathways to reduce and reverse the loss of dark skies.

VISION

JDSS aims to bring scientists, academics, artists, stakeholders, policy makers, and the general public together under a shared vision to protect the conservation of natural night skies. The journal will consist of three sections:

- 1) A peer-reviewed section highlighting academic research across all aspects of dark-sky studies. The editorial board for this section comprises experts in multiple fields of study related to dark skies along with reviewers looking to synthesize and share knowledge. Given the importance of timely publication, articles accepted under peer review will be published online as soon as they are accepted.
- 2) A creative response section capturing the wonder of experiencing dark skies and responding to its loss. This section will include poetry, stories, essays, music, photography, and videography focused on the night sky and artificial light.
- 3) A "news you can use" section describing local and global efforts to preserve dark skies. This is intended to be used as a platform to showcase success stories and serve as a resource for communities, groups, and individuals who are looking to preserve their local and regional dark skies.

Two issues will be published every year. Each issue will feature a dedicated section focused on rotating themes. The early-year issue will typically launch during International Dark Sky Week in April followed by a second issue in the Fall.

IMPORTANCE

The preservation of dark skies is of paramount importance given our fast-growing population and even faster rate of urbanization. Over 80% of people globally now live in areas where night skies are directly affected by light pollution, a number that will grow unless current lighting trends change substantially. Even areas near national, provincial, and state parks, locales typically associated with dark skies, are increasingly subject to light pollution, making stargazing even more challenging.

ALAN has been shown to have adverse consequences for a wide variety of species. For example, coastal cities' lights confuse sea

turtles, causing them to travel inland upon hatching, rather than to the ocean. City lights disrupt flight patterns and behavior of migratory birds, who waste energy circling lights and die in large numbers from exhaustion or from injuries sustained in collisions with internally lit glass buildings. ALAN also affects human physiology. Nighttime exposure to blue-rich white light, common in many LED lighting products, suppresses melatonin production, which in turn affects circadian rhythms and is potentially linked with a variety of chronic health issues.

Though lighting at night can be useful when used in specific contexts at appropriate levels, brighter lights are not always better. Glare from excessive light can impair nighttime vision, and some studies suggest that over-illuminating areas may actually increase crime rates. In addition, light emitted upwards or away from areas of interest wastes energy. While energy-efficient LEDs can greatly reduce the amount of electricity used for roadway and other exterior lighting, their full energy savings potential is often not always realized. Since LEDs produce large amounts of light cheaply, their use may decrease the financial incentive to reduce light consumption.

Finally, and of equal importance, light pollution disrupts our view of the larger cosmos. A sense of the immensity of the universe, visible only in darkness, gives rise to feelings of awe and wonder and is central to the human experience. The grandeur of the night sky has inspired artists, poets, and musicians across all cultures and remains of central importance in the cultures and traditions of indigenous peoples. Seeing the Milky Way in all its splendor, and through it feeling a sense of personal connection to the universe, can be a life changing experience.

Increasing awareness of the importance of preserving and reclaiming our dark skies is an ongoing effort. Enhancing collaboration and facilitating widespread understanding of both the effects of ALAN and the value of dark skies are essential to reversing the rapid loss of night. By working together - sharing research, ideas, and success stories - significant change is possible.

We hope you will join us on this exciting adventure!
The Editorial Board, Journal of Dark Sky Studies

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A BRIEF HISTORY OF THE DARK SKIES MOVEMENT: HISTORICAL MOTIVATIONS AND ONGOING CHALLENGES

By John Barentine (International Dark-Sky Association) and Randy Stanley (U.S. National Park Service Intermountain Region)

The natural night figures prominently in human culture. However, the advent of controlled fire, followed much later by sources such as gas and electric light, fundamentally changed humans' relationship to the nighttime environment. Artificial light at night (ALAN) is now widely used to extend the length of the functional day, enabling a nighttime economy and other activities not tied to natural light cycles.

Light is commonly associated with technological advancement and progress. It is a synonym for radiance, beauty and comprehension, while darkness often symbolizes fear, confusion, and chaos. However, both these stereotypes and ALAN itself come at a cost. Harmful effects of ALAN on both living things and the visibility of the night sky were observed from its introduction, but recognition of these harms only emerged in the 1960s. Identification of ALAN as a serious threat to ground-based astronomy followed in the 1970s. Astronomers began to characterize the problem, and cities near observatories moved to protect night skies through local legislation.

Conservation professionals took note of research showing negative effects of ALAN on wildlife ecology and the erosion of our natural night sky views. The U.S. National Park Service emerged as an early leader, developing the first regular night-sky interpretive programs in southern Utah in the U.S. and forming a national Night Sky Team to systematically study the influence of ALAN on parks. A broad community of activists and advocates coalesced into the International Dark-Sky Association, a non-government organization founded in 1988. Other regional groups, such as the British

Astronomical Association's Commission for Dark Skies, formed in response to local light pollution threats. The United Nations and other international bodies incorporated night-sky protection ideals into non-binding legal frameworks in the following decades. The growing consensus among researchers is that ALAN is truly an environmental pollutant.

Over 150,000 square kilometers of land worldwide are now under legal protection for nighttime darkness. Regional- and national-level legislation regulating outdoor lighting represents best practices to meet both light-pollution and broader environmental goals. Still, significant challenges remain. Sky-glow obscures the night sky from a third of the world's population, and light pollution grows in brightness and extent at an annual global average of two percent. Large-scale deployment of highly energy-efficient light emitting diode (LED) technology has made ALAN inexpensive and may be fueling a 'rebound effect' in which savings from the lower cost of lighting are redirected into the installation of more lights. We are rapidly losing vital natural darkness at the places in which we live and travel.

The dark-skies movement is therefore at a critical juncture, and its future success depends strongly on strategies and tactics implemented today. Future activism will likely engage issues of climate change and energy security, in particular. A sea change in our view of natural light and dark is needed to drive the problem toward solution. Now is the time to accelerate the pressure to create that change.

CULTURAL ASTRONOMY AND DARK SKIES

By Jessica Heim

The view of a dark, starry night sky has been a constant in human culture since time immemorial and has been an integral part of the fabric of daily life for people all across the world. This nightly backdrop has not only served as a source of inspiration for countless creative works but has also been of pivotal importance in timekeeping and navigation. Human attempts to better understand and predict the regular cycles of celestial bodies have played a key role in the development of astronomy and modern science, and experiencing a vista of myriad stars continues to inspire feelings of awe and a sense of connection, joining us not only to the larger universe and to our ancestors, but also to people across our planet. Cultural astronomy, the study of the role the sky has played in human culture across time and place, is highly relevant to dark sky studies, as it examines the many ways in which the view of the night sky is indeed important in human civilization.



Photo: Bettymaya Foot

The Dark Sky around the World

The International Union for the Conservation of Nature recognizes 150,000 km² of land across the world under specific legal protections for the night sky. The International Dark-Sky Association (IDA) has recognized more than 90,000 km² of these protected places as International Dark Sky Places. Visit www.darksky.org to learn more.

INTERNATIONAL DARK SKY PLACES

1. The positions of stars were central to Polynesian navigators, who used the positions of rising, setting and zenith stars to determine their location and direction at sea.

2. Teachings about the stars are essential aspects of native and First Nations cultures. Though effects of colonization have been detrimental to the flourishing of such knowledge, significant strides have been made in recent years to begin to revitalize star knowledge in these communities.

3. Death Valley, California, in the U.S. is the largest International Dark Sky Place recognized by IDA with 13,743 km² of protected lands.

4. Water-Glacier International Peace Park is the only park in the world with both international boundaries and cooperative, international dark sky protections.

5. The state of Utah has more International Dark Sky Places than any other U.S. state. In fact, with fifteen IDA recognized International Dark Sky Places, it has more than any country besides the United States.

6. The first designated Dark Sky Community was Flagstaff, Arizona, 2001; the first park was Natural Bridges, Utah, 2007; the first reserve was Mont-Mégantic, Québec, 2008.

7. South America's first International Dark Sky Place, the Gabriela Mistral International Dark Sky Sanctuary, was established in 2015 to protect the site of the Associated Universities for Research in Astronomy's (AURA) observatory in the Elqui Valley of northern Chile. It was also the world's first International Dark Sky Sanctuary. The Sanctuary is named in honor of the Chilean Nobel prize-winning poet Gabriela Mistral (1889-1957), who spent her childhood in the area.

8. In many cultures in the southern hemisphere, constellations are understood not only as groups of stars, but also as dark nebulae (opaque clouds of dust and gas in outer space) that are visible against the Milky Way background. Among these dark cloud constellations are the Incan mother and baby llamas.

9. Atacama Desert, Chile. By 2020 the Atacama will hold approximately 70% of the globe's astronomical observation infrastructure because of its altitude and dry conditions. Chile considers the quality of dark skies so critical to this region that the Office for the Protection of the Quality of the Sky (OPCC) was established.

10. Bodmin Moor, a UK Area of Outstanding Natural Beauty (AONB), was the first "working agricultural landscape" recognized by IDA as an International Dark Sky Place (2017).

11. The Danish islands of Møn and Nyord were the first places in the world to effect a dual protection for both a park as well as the surrounding community, ensuring preservation of nighttime darkness across the islands regardless of ownership status of the land. The Islands were recognized by IDA as International Dark Sky Places in 2017.

15. Coldrerio, TI, Switzerland: First community in Switzerland with environmental law for the avoidance of unnecessary light emissions (2007).

16. Veneto, Italy instituted a regional law against light pollution on June 26, 1997.

18. The Channel Island of Sark, United Kingdom, became the world's first dark sky island upon recognition as an International Dark Sky Community in 2011.

19. Prague, Czech Republic: First national law against light pollution in the world (February 27, 2002).

22. Hehuan Mountain, Taiwan, in 2019 became the first and only IDA-designated place on the island.

23. Yeongyang Firefly Eco Park in the Republic of Korea was designated in 2015 as the first IDA International Dark Sky Place in Asia. The park emphasizes its natural nighttime conditions as beneficial for health, tying it to the burgeoning "medical tourism" industry in East Asia.

24. Makhtesh Ramon (Ramon Crater), Israel's largest national park, in 2015 became the first International Dark Sky Place designated in the Middle East. The crater is an erosional landform whose sunken interior provides natural shielding from the light of distant cities, offering some of the finest views of the night sky in the region.

25. Citizen groups are combating light pollution in Mumbai, India, due to overwhelming construction projects that are a nuisance to entire neighborhoods.

26. Island of Lombok, Indonesia has observed increasing light intensity at the rate of over 10% annually.

27. Warrumbungle National Park in New South Wales is Australia's first International Dark Sky Park, protecting not only the site of Siding Spring Observatory for professional astronomy, but also the nighttime conditions in the Warrumbungle Mountains, which host a range of woodland bird species, many of which are threatened.

28. Pitcairn Islands International Dark Sky Sanctuary is the most remote place in the world protected for dark skies, some 2,170 km southeast of Tahiti, 5,310 km from Auckland, New Zealand, and over 6,600 km from Panama.

12. Chad, Central Africa Republic, and Madagascar are the most dark sky rich countries. Kuwait and Qatar are the most light polluted.

13. Morocco recently hosted the first light pollution conference in Africa (2018) in support of "the creation of a Dark Sky Reserve around the Oukaimeden observatory in Morocco."

14. Annual National Science Week events hosted at the Iziko Museums in Cape Town, South Africa, include activities related to preserving dark skies.

17. !Ae!Hai Kalahari Heritage Park in South Africa, an International Dark Sky Sanctuary, is the first park protected for dark skies operated and managed by indigenous people (2019).

20. Aboriginal Australian cultures date back tens of thousands of years, and the sky figures prominently in "Songlines" and "Dreaming," essential aspects of their understanding of the world. The "emu" is one of their dark cloud constellations.

21. Aoraki-Mackenzie International Dark Sky Reserve on the South Island of New Zealand has, since its designation in 2012, become a model for sustainable astrotourism, attracting thousands of visitors annually from across the world.