Nightscape

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International Dark-Sky Association

#106 / December 2021

From the

Executive Director

Twenty years ago, IDA recognized Flagstaff, Arizona, as the world's first International Dark Sky Place. Today, more than 180 dark-sky places have been certified on every inhabited continent. These include remote dark-sky sanctuaries, like the island of Niue in the southern Pacific Ocean; reserves, like Mont-Mégantic in Canada, which has a population of 225,000 and is just a couple of hours' drive from Montréal; and beloved parks like Grand Canyon National Park in the U.S., Yorkshire Dales National Park in the U.K., and NamibRand Nature Reserve in Namibia.

"What if we are the last generation to see the night sky?"

Diane Knutson, President
IDA Board of Directors

"What if we are the generation that gets it right?"

Col. Ron Garan
former astronaut

And they are working! A recent study found that light emissions decreased in communities in or near International Dark Sky Places, while it grew in places farther away. In the face of runaway global growth in light pollution, this gives us hope — hope that light pollution can be stopped and, ultimately, reversed.

But as you will read in this issue of *Nightscape*, that hope is threatened by a new and rapidly emerging threat. Since we wrote about satellite megaconstellations in the Fall 2020 issue, worrying new projections suggest that the rapid increase in satellites, and the accompanying debris, could outshine the brightness of the natural night sky by as much as 250%. At that point, approximately half of all visible stars would be erased by "satellite smog." Though less obvious in places that are already awash in skyglow, the increase in megaconstellations could be catastrophic for the world's remaining dark-sky sites. There is no place on Earth beyond their reach.

We recognize the potential benefits that satellites can bring to the world by expanding access to the internet to remote communities. But we are deeply concerned that there has not been a meaningful environmental review or consultations with affected communities. Unless we stand up for a dark, unpolluted sky, and the myriad benefits it brings for people and the planet, it will become collateral damage in the industrialization of space.

Because of this, IDA is calling for an immediate pause in the launching of satellite megaconstellations until a government-wide coordinated environmental review and public-consultation process is completed. We are confident that, if this is done, the engineering talent exists to protect the dark sky while allowing this new technology to develop.

Please visit darksky.org to learn more about this issue and how you can get involved.

For the night,
Ruskin Hartley
ruskin@darksky.org

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Nightscape

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From the Editor

Time seems to pass both slowly and quickly in this epoch of pandemic. A greying sky and shortening days mark another November at my home in London — a reminder that, at this latitude, we will soon enjoy long, dark nights, the winter solstice, and time for stargazing, candles, and cozy blankets. Perhaps where you are, days are stretching into a welcome summer, or staying at a constant, equatorial warmth. As I reflect on how often I use the changing of seasons as markers of time, I'm reminded this isn't the same everywhere — weather and seasons (or lack thereof) vary tremendously around the world. And yet we are all inhabiting the same planet: this one teeny rock floating around in space. And we all live under one sky.

"Under One Sky" was the theme of this year's IDA Global Conference, which was the largest gathering of dark-sky advocates in history. IDA's staff and Board of Directors worked hard to once again make it a truly international event. We had more than 2,000 members, supporters and night-sky-curious attendees from every continent, with webinars and workshops by night-sky advocates from China to San Francisco, Malaysia to Québec, Kenya to Pakistan. The chat was filled with greetings, hellos, holas, and nihaos from around our world, and it was greatly inspiring.

So often, night-sky advocacy can feel lonely, and it was wondrous to be reminded of how many kindred souls are out there, working to protect our night. We all live under one sky, and the night means something important to each of us, both individually and within our larger communities and cultures.

The conference ended with an inspiring panel featuring former astronauts Col. Ron Garan and Dr. John Grunsfeld, who spoke poignantly about how we are all aboard "Spaceship Earth" and that we need to think of each other as fellow crew members working together to protect our spaceship. Facing the climate and biodiversity crisis, it's clear we must understand Earth as one ecosystem, of which humans are just a small part. Everything we do affects other things, so we need to work in solidarity. Our global community of advocates, supporters, and conservationists proves time and again how people from all backgrounds, countries, and cultures can work together to protect our planet.

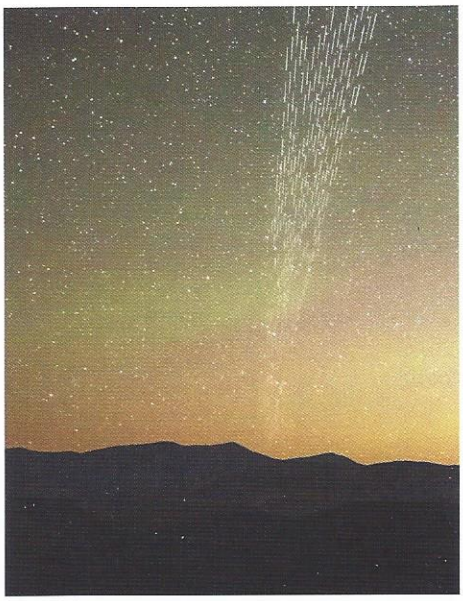
This issue is dedicated to the question "Who owns the night sky?", the theme of Aparna Venkatesan's conference keynote address. We have taken the opportunity to examine the rise of satellite megaconstellations and how they contribute to light pollution — a complex issue that many talented minds are considering. It was an instructive and challenging problem for me to research and write about. Also within:

- A new Letter to the Editor feature
- Meet IDA member Patrizia Bortolin, a wellness practitioner from Italy
- A celebration of 20 years of the International Dark Sky Places program
- Advocate highlights from around the planet
- This year's Annual Award winners

Wherever you are in the world, I hope that, when you next look up at the night sky, you will be reminded that we are all here with you, looking at the same sky, too.

Megan Eaves
nightscape@darksky.org

On the cover



"Megaconstellation over Craters of the Moon National Monument" by Matt Dieterich

"I captured a timelapse video that revealed Starlink satellites passing overhead and created this image by stacking 50 individual timelapse video frames. Great care needs to be taken by society to ensure technology does not alter our view of the night sky forever."

Follow Matt:
instagram.com/mattdieterich
youtube.com/mattdieterich

Join one of his 2022 photography workshops:
www.mattdieterich.com/workshops

Who owns the night sky?

BY Megan Eaves

In March 2020, as the world descended into COVID-19 lockdown, I began hosting an online event called #Starentine, leading social media users in stargazing from wherever they were in the world through their windows, urban balconies, back gardens, and fire escapes. The event was picked up by a few news outlets and we soon had participants from Italy to Kazakhstan and Australia to New England. People were connecting with the night sky under the worst circumstances and finding solace under the stars. Many were also noticing the light pollution around their homes for the first time.

After one session, I received a panicked message from a participant worried about a series of strange lights they had seen passing through the night sky at oddly regular intervals.

"I thought it might be a satellite, but it wasn't just one. There were so many lights! I don't want to sound crazy, but I really thought it was an alien invasion," they admitted.

I quickly explained that we were (disappointingly) not being invaded by aliens. The lights were, in fact, satellites – scores of them; a new type being sent up in "megaconstellations" (string-of-pearls formations) by Elon Musk's company, Starlink, to provide internet to rural areas.

> The sky belongs to everyone.
> Space is a global commons.
> All people are impacted by changes in the sky.
> The sky is part of the environment.
> Ecosystems depend on the night sky and on each other.
>
> SATCON2 COMMUNITY ENGAGEMENT WORKING GROUP

History of satellites

The most basic definition of a satellite is anything orbiting a celestial body. The Moon is a satellite of Earth, as Europa is of Jupiter. All planets are satellites of a star. In 1957, the Soviet Union launched the first human-made, artificial satellite, Sputnik 1. Its batteries lasted for three weeks, and it continued to orbit for two months before eventually crashing back into Earth's atmosphere.

Sputnik 1 was the first in a series of satellites sent up by both the Soviet Union and the United States and it launched a race for who could put a human into space first. In 2021, the Space Race has taken a new trajectory as, for the first time, commercial operators like SpaceX, OneWeb, and Project Kuiper are vying to put many thousands more artificial satellites into lower Earth orbit (LEO) and beyond.

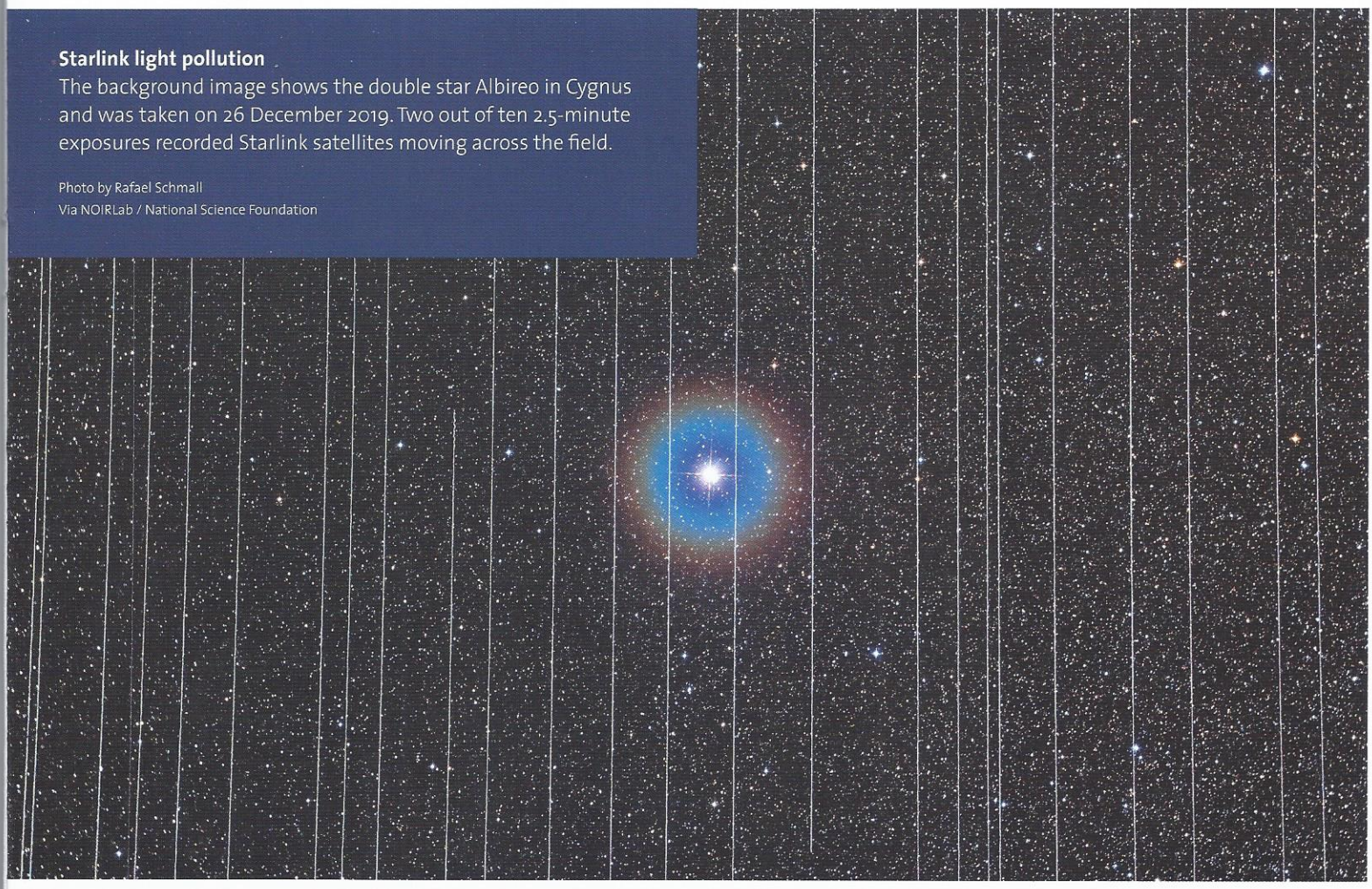
The industrialization of space

In 2018, a few thousand operational satellites orbited the Earth. SpaceX's Starlink satellites launched in May 2019 — the first 60-strong megaconstellation of a total of 12,000 approved by the U.S. Federal Communications Commission (FCC). It's estimated that by 2030 there may be more than 100,000 satellites in orbit, the vast majority owned and operated by private firms.

This is a rapidly moving industry with very little oversight. There is currently no national or international regulation of on-orbit activities of any kind beyond the 1967 Outer Space Treaty, which only governs weapons and general concepts of due regard, harmful contamination, and harmful interference. No treaty or law limits how many satellites can be orbited.

Aparna Venkatesan is a cosmologist researching the impacts of megaconstellations, particularly their effects on Indigenous communities (she was also the keynote speaker at IDA's Global Conference this November). In June 2020, Aparna was one of 40 experts who came together for SATCON1, a workshop to assess the impact of satellite constellations and possible mitigation strategies. Four working groups were formed focused on observations, software (algorithms), community engagement, and policy.

This year, SATCON2 addressed implementing those strategies and recommendations. Adjacently over the past two years, the UN Office for Outer Space Affairs (UNOOSA) held its Dark and Quiet Skies for Science and Society conferences



Starlink light pollution
The background image shows the double star Albireo in Cygnus and was taken on 26 December 2019. Two out of ten 2.5-minute exposures recorded Starlink satellites moving across the field.

Photo by Rafael Schmall
Via NOIRLab / National Science Foundation

on the growing threat of artificial light at night, and dedicated a full day to satellite megaconstellations.

Impacts of satellites

The most well-publicized impact of the new megaconstellations is visual: astronomers and astrophotographers capturing light streaks that disrupt images and scientific data, like the ones shown on this issue's cover. But their effects go far beyond optical intrusion. There are predicted to be dramatic increases in space debris, radio frequency interference, orbital traffic and collisions, environmental fallout in the upper atmosphere or oceans after satellite decommissioning, and increasing global sky brightness.

A June 2021 paper by researchers including John Barentine and Salvador Bará studied increased sky glow caused by sunlight reflected and scattered by orbiting space objects. The preliminary estimates showed an increase of up to 10% in night-sky brightness caused by natural sources of light, based upon the existing number of satellites in orbit. This is already the critical limit adopted in 1979 by the International Astronomical Union for the light pollution level not to be exceeded at the sites of astronomical observatories. By 2030, they projected a 25-fold increase in the number of objects in lower Earth orbit. That equates to an increase in night-sky brightness of 250% above the natural background. As noted in the SATCON2 report, "if this scenario is fully realized, it would ... [diminish] the number of stars visible to the unaided eye by a factor of about two."

Olivier Hainaut, an astronomer at the European Southern Observatory (ESO), and his team ran a simulation of 64,000 satellites and found that overall sky brightness would increase by about 0.3%. That increase could reach 4%, with some regions seeing a 40% increase in case all the 64,000 satellites were ground into dust through catastrophic collisions.

In basic terms, satellites cause light pollution and pose a major threat to the visual enjoyment of the night sky and the study of the cosmos from Earth. Worse, satellites orbit the whole planet and can cause an increase in skyglow over otherwise protected areas, such as International Dark Sky Places.

Commercial megaconstellations also pose risks to observation satellites with a scientific remit. For example, in 2019, the European Space Agency (ESA) had to move an observation satellite to avoid colliding with a Starlink satellite, after fail-

Continued on page 6

Continued from page 5

ing to reach SpaceX by email. And when the vast numbers of megaconstellations reach the end of their relatively short lifespans (3–4 years), they become space debris waiting to collide with important science satellites and even crewed launches.

Together, all of this paints a concerning picture when combined with research published in September by Alejandro Sánchez de Miguel at the University of Exeter. It was the first study of global light emissions between 1992 and 2017 and found that light pollution has increased by at least 49% over 25 years globally, with estimates of up to 400% in some areas.

Cultural and biological heritage of the night sky

The unpolluted night sky is a critical part of many Indigenous cultures and histories. For example, the cosmology of Aboriginal Australians includes night-sky constellations formed of the dark patches in between stars, which are already being interrupted by the presence of skyglow and satellite streaks. An October 2021 *Vice* article quoted a number of Indigenous leaders and community members as calling megaconstellations a form of "astro-colonialism."

In a recent paper in *Nature Astronomy*, Aparna Venkatesan wrote that "the manner and pace of 'occupying' near-Earth space raises the risk of repeating the mistakes of colonization on a cosmic scale. We must consider the impact of satellite constellations, and related future initiatives, on the essential human right to dark skies and on cultural sky traditions."

Beyond the human impacts, there are significant effects on other living things. IDA Board of Directors member Kevin Gaston, Professor of Biodiversity & Conservation at the University of Exeter, U.K., says that most of the biodiversity that we are familiar with is fundamentally controlled by natural light cycles and has been for most of the duration of life on Earth. "We shouldn't be surprised when we start messing with those cycles, that most organisms are going to respond." He also says we need to see funding calls for research into the unknown consequences of megaconstellations.

Get involved

Below are IDA's principles for preserving the quiet enjoyment of the night sky and protecting the general public from the impacts of megaconstellations. You can join IDA in calling for a pause in further megaconstellation launches.

1. Stewardship of the night sky is a shared responsibility that requires participation and consultation with all stakeholders.

2. The cumulative impact on night sky brightness attributed to satellites does not exceed 10 percent above natural background levels.

3. Maintained satellite brightness is below the threshold for detection by the unaided eye.

4. Satellite visibility is an unusual occurrence.

5. Launch schedules and orbital parameters are made publicly available in advance.

Adopted January 2020. Amended September 2021

Satellites: good or bad?

As with artificial light at night, the question of satellites is complex. Observation satellites offer important data about Earth's surface, weather, and climate change. Speaking at the 2021 UN Climate Change Conference (COP26), Jörg Schulz, Climate Service and Product Manager at the European Organisation for the Exploitation of Meteorological Satellites said, "Long-term sustained observations from space are key for climate monitoring and we need to do everything to maintain them."

Satellites do a lot of good. They allow us to study life in space and allow for deep-space astronomical observing. Both the International Space Station and Hubble Space Telescope are satellites.

Megaconstellations themselves offer internet connectivity to rural and underserved communities where fiber broadband might be painstaking to install. But given these are the same communities whose cultural heritage they also often put at risk, the balance and trade-offs must be considered carefully.

Who owns the night sky?

I asked Connie Walker, a scientist at the National Science Foundation's astronomy center, NOIRLab, co-chair of the SATCON2 organizing committee, and IDA Board of Directors mem-

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ber, why this issue is important for lovers of a dark night sky. She told me, "Everyone who enjoys the night sky and/or uses space as a resource should consider the various ways satellite constellations impact humanity. The goal for the use of space should be a shared vision that supports and respects all of its users."

So who owns the night sky? The answer seems simple to me. No one does, and therefore we must collectively care for the sky as a global commons. When taken with a broader view toward climate change, global exploitation, the patriarchy, colonialism, unmitigated growth, extractive industry, and environmental destruction, as well as advancement, progress, and equality, we see the interconnectedness of everything.

Human beings have a fundamental responsibility to respect and protect the planet, indeed the universe, we inhabit — not as owners but as stewards with the technology, consciousness, science, heritage, and emotions to understand how.

As NASA astronaut Ron Garan so eloquently put it during the Global Closing of IDA's 2021 Under One Sky Conference: "We are all crew members aboard 'Spaceship Earth' and need to think of each other as fellow crew members, all working together to protect our ship" ★

LETTER TO THE EDITOR

Our community has embraced the dark-sky movement

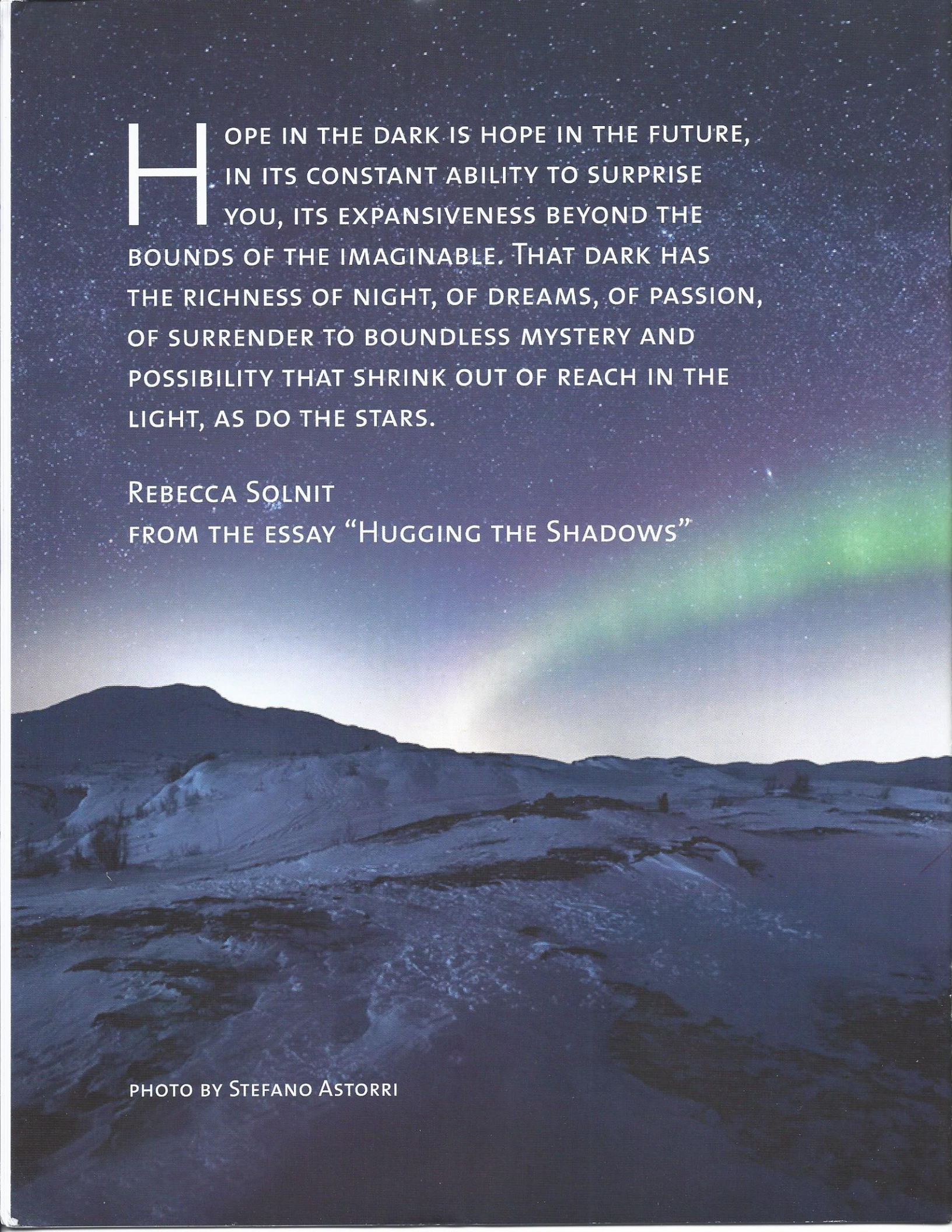
I just discovered the International Dark-Sky Association over the last year. I am now a self-appointed advocate and volunteer dedicated to this fairly new frontier in environmental conservation and preservation of the night sky. I am a life-long reading teacher and am excited to educate others about the importance of preserving the legacy of the night.

I wanted to let you know that our community of Ken-Caryl Ranch [southwest of Denver] in Colorado, U.S., has embraced the dark-sky movement. Recently, our Homeowners Association Architectural Committee updated its outdoor-lighting rules and regulations in line with the "Five Principles for Responsible Outdoor Lighting". In addition, all outdoor lights must be off by midnight, including all decorative and landscape lighting.

On 11 September, our community held its Fall Fest/Barn BrewHa. I was in charge of the IDA and Lights Out Colorado booth. I spent the day educating residents and handing out the brochures that IDA sent to me. It was a big success and I plan to set up another booth for our Spring Extravaganza. Residents were thrilled to win motion-activating light bulbs in the raffle. Several of the winners asked if they could help with the booth in the spring.

I hope that my story might motivate others to join and/or be active in their communities, too.

Thank you all you do for the night,
Katherine Webster
Ken-Caryl Ranch, Colorado, U.S.



HOPE IN THE DARK IS HOPE IN THE FUTURE, IN ITS CONSTANT ABILITY TO SURPRISE YOU, ITS EXPANSIVENESS BEYOND THE BOUNDS OF THE IMAGINABLE. THAT DARK HAS THE RICHNESS OF NIGHT, OF DREAMS, OF PASSION, OF SURRENDER TO BOUNDLESS MYSTERY AND POSSIBILITY THAT SHRINK OUT OF REACH IN THE LIGHT, AS DO THE STARS.

REBECCA SOLNIT
FROM THE ESSAY "HUGGING THE SHADOWS"

PHOTO BY STEFANO ASTORRI

2021 Annual Awards

BY Lauren Scorzafava

Each year, the International Dark-Sky Association recognizes and celebrates the incredible achievements of individuals and groups who are committed to our mission to preserve the night. As leaders in their communities, the awardees play a crucial role in strengthening the global dark-sky movement and empowering others to join the fight against light pollution. Here, we celebrate and congratulate our 2021 award winners.

Crawford Hunter Lifetime Achievement Award

IDA's highest honor given to individuals who have contributed an extraordinary effort to light pollution abatement.

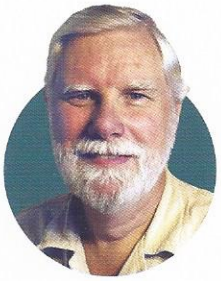
Jaime Zamorano

SPAIN

Jaime is a driving force of light pollution research in Europe. He coordinates the Spanish Light Pollution Research Network (REECL) and led the team that designed the TESS-W (Telescope Encoder and Sky Sensor) to monitor sky brightness.

The Dr. Arthur Hoag and William T. Robinson Award

An individual who has been outstanding in educating government and the public about outdoor lighting-control ordinances.



Robert Dick

CANADA

Over 25 years, Robert Dick has contributed an extraordinary effort to light pollution, including creation of the Canadian Guidelines for Outdoor Light — the first set of lighting guidelines to acknowledge the biological impact of artificial light at night.

Galileo Award

For achievements in research or academic work on light pollution over a multi-year period.

Salvador Xurxo Bará Viñas

SPAIN

Professor of optics at Universidade de Santiago de Compostela, Salvador Bará has made significant achievements in light-pollution modeling and monitoring, evaluating non-visual effects of light at night, and developing new techniques for light-pollution photometry.

Bob Gent Community Leadership Award

For outstanding achievement at the local level in combating light pollution and fostering support for IDA.

Nobuaki Ochi

JAPAN

Nobuaki Ochi leads IDA Tokyo and was instrumental in the designation of Japan's International Dark Sky Places. He introduced a light-pollution education program for students in Japan, and measured light pollution reductions during the 2011 Tōhoku earthquake.

Lighting Design and Technical Innovation Award

Individuals or entities that promote quality outdoor lighting.

Dana Stefanoff / Crossroads LED

U.S.

Nocturnal Habitat Protection Award

Those who have been instrumental to the conservation of terrestrial and/or aquatic nocturnal habitats.

Department of Agriculture, Water, and Environment

Mark Carey, Amelia Cook, Jessica Armstrong, Geoff Richardson, Isabelle Straughair, Rebecca Haughey, Kevin Yang, Karen Arthur, Jessica Barradough, Rebekah Collins, Clayton Woods, Belinda Harding, Narelle Montgomery, Fiona Bartlett, Natan Perring

AUSTRALIA

Rising Star Award

Honors students of any grade level who demonstrate an enthusiasm for and commitment to dark-sky conservation or research into natural darkness and light pollution.

Emma Schmidt

U.S.

Maria Scricco

U.S.

Antonio Schmuch and Moritz Wolf

GERMANY

Abhi Gudipati

U.S.

Mont-Mégantic International Dark Sky Reserve

Photo by ©Guillaume Poulin

Dark Sky Defender Award

Given to individuals and organizations in recognition of their efforts to promote and advance the mission and programs of IDA to preserve night skies on each of the six inhabited continents.

Noorali Jiwaji

TANZANIA

Emma Zulaiha Binti Zulkifli

MALAYSIA

Gareth Davies

NEW ZEALAND

Jurji Stare

SLOVENIA

Jane Slade

U.S.

Alejandro Sommer

ARGENTINA

Dark Sky Place of the Year Award

A recent exceptional achievement by or for an International Dark Sky Place.

Mont-Mégantic International Dark Sky Reserve

CANADA

Director's Discretionary Award

Given at the discretion of the Executive Director to recognize exceptional work to protect the night through policy, technology, or fostering awareness of the dark-sky movement.

Andrew Griffith MP and Chris Cook / All-Party Parliamentary Group on Dark Skies

U.K.

MEET A MEMBER

Patrizia Bortolin

In this issue, we get to know IDA supporter Patrizia Bortolin — a spa-concept designer, globetrotter, creative wellness researcher, and hospitality project manager from Italy.

Do you find a connection between your work in wellness and the night sky? From your perspective, how do the two intersect?

When I need to find comfort and hope, I look upward into the dark sky, to the stars, and tune in with the silence. I also look at the night sky to express my gratitude. Many important guided meditations that I have practiced mention night skies and stars, the aim being to find inner space and a sense of calm. I've participated in forest bathing sessions at night; also full-moon rituals with amazing masters. I've attended unforgettable lectures given by creative designers and scientists talking about our connections with the stars. All this knowledge and experience is now part of the wellness concepts I design. I am currently consulting at a luxury wellness resort in northern Italy — Preidlhof (www.preidlhof.it) — where guests can choose to sleep under the stars. I recommend it to everyone attending emotional healing retreats because it makes a difference to the end results.

How did you come to know IDA and what inspired you to get involved as a member?

My brilliant father, Gino, dedicated his life to electric energy. When we were growing up, he instilled in us the belief that electricity should be conserved and not wasted. He brought us into amazing natural places to contemplate the stars and listen to stories. As a result, I feel a deep connection with the stars and the sky at night. At home, I tend to keep just the minimum light necessary so as not disrupt the atmosphere and the natural silence created by the dark. I find it very soothing and respectful. I happened to see one of the messages from an IDA activist, "Save the stars and the dark sky," and that immediately resonated with me.

Where is your favourite place to view the night sky and why?

I have many memories of unforgettable night skies, which remain embedded in my heart: in India, during life-changing meditation retreats; at Maramia, an ashram in West Bengal (India) with the most loving people I know; on a silent cruise ship crossing the Atlantic; in the Norwegian fjords, and many more. I now live in South Tyrol, Italy, and here it's easy to find spectacular places to admire the night sky.

How do you share the importance of the night sky and the issue of light pollution in a world so inundated with challenges?

I always include the night sky and stars in the wellness concepts I design. I find creative ways to connect the importance of preserving the night sky with the benefits to our soul and our development. I specialize in sustainable hospitality and transformational wellness, where great attention is given to light pollution and the healing benefits of dark, calm nights.

Are measures being taken to protect the night sky in Italy? What are your concerns around light pollution where you live?

Where I live in northern Italy, a lot of attention is given to light pollution and to sustainability. There was a big project to create unpolluted dark-sky parks. Many wellness hotels I know are supportive of this. Preidlhof, where I work now, is very conscientious about the night sky. However, this is not the case everywhere, but things are improving. I hope to be part of future wellness projects and to be able to design spaces and experiences integrating the IDA's goals and ethos. I've named my wellness consultancy "Glowing Flow" to connect the glowing stars with the ocean's waves, to express our place among the stars and the natural flow of the universe. ★

Connect with Patrizia and learn more about her work on LinkedIn: www.linkedin.com/in/patriziabortolin

Left: A nighttime event in the Alps near Patrizia's home in Naturno, between Italy and Austria. Right: A monk lights a candle at Maramia Ashram in India.

Advocate highlights

News snippets from our network of dark-sky advocates around the globe.

Pennsylvania, U.S.

In September, **Pittsburgh** adopted a dark-sky **lighting ordinance** that will see 35,000 street lights replaced with IDA-compliant fixtures and up to 8,000 new ones installed.

bit.ly/3HqJCCE

Sark, Channel Islands

A set of **dark-sky stamps** have been released to commemorate the 10th anniversary of **Sark**'s designation as the world's first Dark Sky Island.

bit.ly/SarkDarkSkyIsland

Photo by Ben Fiore

Celebrating 20 years of **International Dark Sky Places**

On October 24, 2001, A Flagstaff, Arizona, U.S., became the world's first International Dark Sky City, having already enacted the first-ever outdoor-lighting ordinance way back in 1958. IDA's first such designation sparked a movement to preserve and protect dark sites.

Since Flagstaff, we have welcomed many more, and today, there are over 180 International Dark Sky Places (IDSPs) across 21 countries raising awareness about dark-sky conservation.

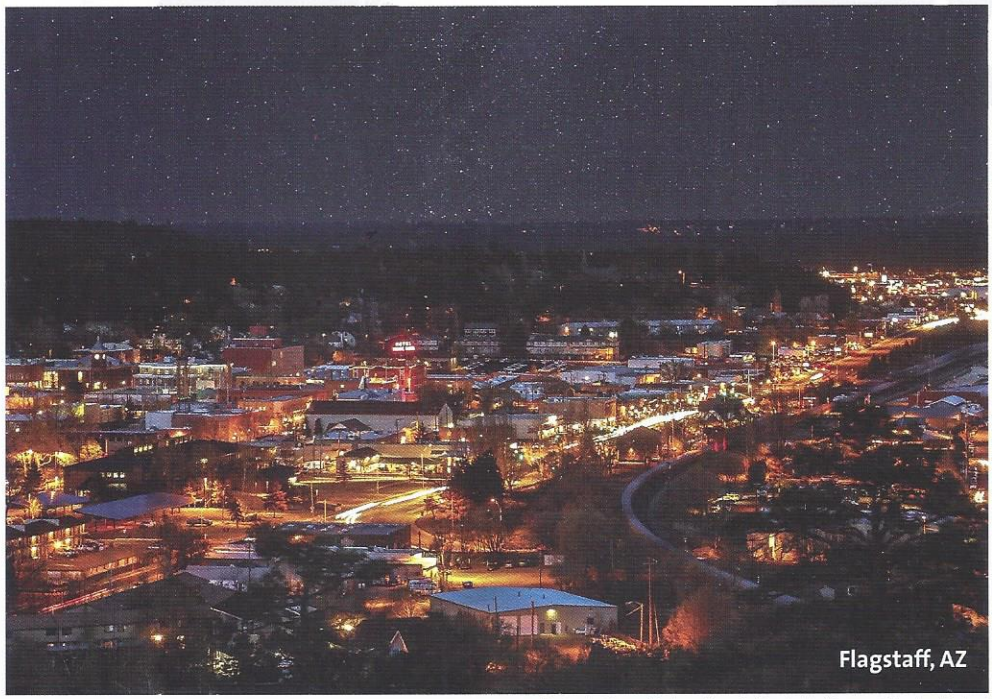


Photo by Harun Mehmedinović / Gavin Heffernan / Skyglow Project

Pakistan

Influencer **Luke Korns** created a video about his journey to **northern Pakistan** with IDA advocate **Rayan Khan** to experience a naturally dark sky for the first time. It has garnered over **295,000 YouTube views** so far.

youtu.be/Yuen7pF5C1w

Missed IDA's Under One Sky Global Conference?

Visit our YouTube channel to watch all of the sessions and workshops.

conference.darksky.org

Newly Certified **International Dark Sky Places**

New Parks

1. Lyndon B. Johnson National Historical Park (Texas, U.S.)
2. Mammoth Cave National Park (Kentucky, U.S.)
3. Milton Reimers Ranch Park (Texas, U.S.)
4. Watoga State Park (West Virginia, U.S.)
5. Top of the Pines (Colorado, U.S.)

New Reserves

6. Millevaches Regional Nature Park in Limousin (France)

New Communities

7. Bisei Town (Ibara City, Japan)
8. North Ronaldsay Dark Sky Island (Scotland)

New Urban Night Sky Places

9. Fry Family Park (Ohio, U.S.)
10. Stacy Park (Missouri, U.S.)

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LIGHT TO PROTECT THE NIGHT

Five Principles for Responsible Outdoor Lighting

1 Useful

Use light only if it is needed

All light should have a clear purpose. Consider how the use of light will impact the area, including wildlife and their habitats.

2 Targeted

Direct light so it falls only where it is needed

Use shielding and careful aiming to target the direction of the light beam so that it points downward and does not spill beyond where it is needed.

3 Low Level

Light should be no brighter than necessary

Use the lowest light level required. Be mindful of surface conditions, as some surfaces may reflect more light into the night sky than intended.

4 Controlled

Use light only when it is needed

Use controls such as timers or motion detectors to ensure that light is available when it is needed, dimmed when possible, and turned off when not needed.

5 Color

Use warmer color lights where possible

Limit the amount of shorter wavelength (blue-violet) light to the least amount needed.