Teacher Notes

Themes

- What is light
- Light pollution
- Light impacts on humans and the environment

Key learning outcomes

- Learn about different forms of light and what they do
- Understand how artificial light can affect wildlife
- Discover how to minimise light pollution's impact on the environment

Key curriculum areas

- **Science:** Science Understanding; Science as a Human Endeavour; Science Inquiry
- **English:** Language; Literature; Literacy
- **HASS:** Skills
- **Cross-curriculum Priority:** Aboriginal and Torres Strait Islander Histories and Cultures
- **Cross-curriculum Priority:** Sustainability

Publication details

Lights Out: Saving the Night Sky

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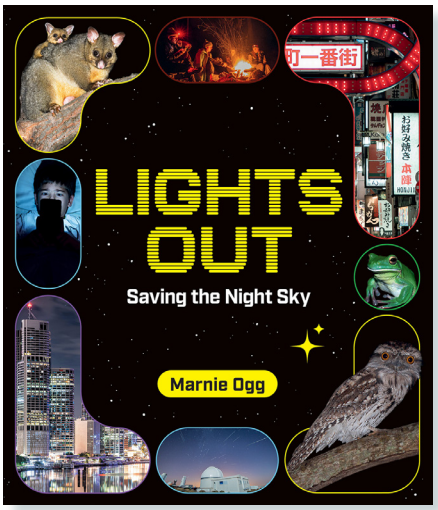

Lights Out

Saving the Night Sky

Marnie Ogg

About the book

You might know about air, water and plastic pollution, but did you know that light can be a pollutant too? In fact, it is the fastest growing pollution problem in the world! *Lights Out* explores our night skies and the impacts of light pollution.

Once, everyone could see a sky full of stars, but the bright lights we now use to illuminate our cities are making the stars much harder to see. This light pollution negatively affects our wildlife as well as the health and wellbeing of people.

Lights Out: Saving the Night Sky helps us understand how our actions are changing our once dark skies, and the simple steps that we can all take to reverse light pollution.

So, let's get enlightened and save our night sky!

Recommended for

Readers aged 9 to 12 (Years 4 to 6)

CSIRO PUBLISHING

Teacher Notes

About the author

Marnie Ogg is a dedicated dark sky advocate, raising awareness on light pollution's impact on wildlife, human health and the environment. Founder of the Australasian Dark Sky Alliance, her efforts helped create Australia's first Dark Sky Park and Urban Night Sky Place. Twice honoured by Dark Sky International, Marnie also successfully led a Guinness World Records campaign to measure light pollution globally.

Pre-reading questions or activities

1. Think about all the ways you use light, from the time you wake up to the time you go to bed.
2. From your house, can you see the stars in the sky at night?

Discussion questions

Science

1. If the lights go out in your house, what other light sources can you use?
2. Using pages 56 and 57 from the book, as well as doing your own research online, can you think of some more ways we use artificial light? *e.g. Fireworks, art installations, sports stadiums and venues*
3. Take a moment to think about the wildlife near where you live. Are they active during the day (diurnal), night (nocturnal) or at dusk and dawn (crepuscular)? Do you think they feel safe and comfortable living near your home? What changes could you make to help create a peaceful, safe place for them to live?
4. Look at the Australasian Dark Sky Alliance website (https://australasiandarkskyalliance.org/). As a class or in small groups, use the website to research more about light pollution. Create a list of three reasons why darkness matters to you personally.

English

1. Choose a plant or animal from the book, then write a short story about how light pollution impacts its habitat and wellbeing.
2. Throughout the book there are breakout fact boxes. Why do you think the author chose to include these?

Sustainability

1. Name three different animal species that can be negatively impacted by light. How does light pollution affect them?

Activities

Science

1. Insects and light experiment

Discover how different lights affect insects. (This activity will take place at home and at school.)

Materials needed:

- Three white fabric sheets or large, white pieces of paper
- Two light sources (one white light, one yellow light)
- Paper and pencil
- Timer or stopwatch (available on mobile phones)

Steps:

Set up the light stations: In an open outdoor space near your house, set up three 'light stations' by draping the white fabric or paper over chairs or another structure to make a small tent. Each tent should be around 20 metres apart.

Light it up:

- In the 'White light' tent, place a bright LED light or white bulb.
- In the 'Yellow light' tent, place a yellow torch or yellow bulb.
- Leave the third 'No light' tent completely dark.

Time to observe: Set a timer for 15 to 30 minutes. Discuss with friends or family where you think the most insects will gather and why. Will insects be more attracted to one colour of light than another?

Count the insects: After the time is up, check each tent carefully and count the number of insects on each sheet. Write down your results.

Discuss the results back in the classroom:

Which tent had the most insects?
Why do you think insects were attracted to one tent more than the others?
How does this relate to what you've learned about light pollution? For example, could too much white light affect insects and animals?

Wrap up: As a class or in small groups, think about ways to protect insects and other animals by reducing light pollution. Could using yellow or dimmer lights help reduce insect attraction at night?

2. Test if your sunglasses are polarising

1. Hold a pair of sunglasses in front of you.
2. Find a screen (such as a phone, tablet or computer) with a bright-white or light-coloured background.
3. Look at the screen through the sunglasses.
4. Rotate the sunglasses slowly sideways (turn them 90 degrees).

What happens?

Polarised light waves move in only one direction. Polarising sunglasses block the glare, making it easier to see clearly on sunny days. If your sunglasses are polarising, the screen will appear darker or even go black as you turn them. If nothing changes, the sunglasses are not polarising.

3. Finding the Southern Cross in the night sky

Learn how to spot the Southern Cross constellation in the Milky Way and use it for navigation.

Steps:

Go to a dark place: With your family, find a spot far from city lights for the best views. The darker the sky, the easier it will be to see stars.

Look south: The Southern Cross constellation is in the southern part of the sky. Position yourself to face south.

Find the Milky Way: The Southern Cross is part of the Milky Way, a cloudy band stretching across the sky. The Milky Way is full of stars and dust clouds, making it a great background for the Southern Cross.

Identify the cross shape: The Southern Cross, or Crux, consists of five stars. Four of these stars form a cross or kite shape, while a fifth marks the cross's foot. The constellation isn't very big – it's about the same length as your index finger held up to the sky.

Use the pointer stars: If you're struggling to find it, look for the two bright stars known as the pointer stars (Alpha and Beta Centauri). They lead directly to the Southern Cross.

Enjoy: Once you find it, enjoy its beauty. Consider using the constellation to add observations to a stargazing project, such as the Globe at Night citizen science campaign (see: https://globeatnight.org/).

English

1. Word scrambles

Unscramble the following words that relate to light pollution. (Hint: all words are found in the Glossary.)

Egrla
Lgtiiwht
Ctoanruln
Tglhi spsstare
Msotoryna
Vuteliortal
Wgloyks
Emsenoculibenic
Tculetr
Seral

HASS

1. Light classification adventure

Learn about the different types of artificial lights in your home by exploring and sorting them into categories.

Materials needed:

- Notebook or paper
- Pen or pencil

Steps:

Information gathering: Grab your notebook and pen, then walk around each room in your house. Look for different lights and write down what you find.

Categorise each light: Sort the lights into the following five categories. For example, the overhead light in your kitchen might be 'Useful' because it helps you see when cooking. A nightlight might be 'Safety' because it keeps you safe in the dark. Some lights may even fit into more than one category!

1. **Useful**: Lights that help you do things, such as reading or cooking.
2. **Entertaining**: Lights that make playtime or relaxation more fun, such as lights on a gaming console or colourful lights in a playroom.
3. **Educational**: Lights that help you learn, such as a desk lamp for studying.
4. **Technology**: Lights that show if something is on or off, charging or in standby mode, such as lights on a computer or TV.
5. **Safety**: Lights that keep you safe, such as nightlights or motion-sensor lights outside.

Discussion: In class, talk about your discoveries. Which category had the most lights? Did any lights fit into more than one category? Think about whether you use any lights more than others, and why.

2. Observing the Moon

Track the Moon's phases and see how it changes the night environment.

Materials needed:

- Notebook or diary
- Pen or pencil
- Torch (optional)
- Binoculars or small telescope (optional)

Steps:

Choose a spot: Find a place outside where you can see the Moon clearly. This could be your backyard, a park or a balcony.

Record your observations: For one month, go outside every night and list what you see in your notebook. Record:

- **Date and time**: Go outside at the same time each night if possible.
- **Moon phase**: Draw or describe the Moon's shape (for example, crescent, half, full).
- **Brightness**: Note how bright the Moon appears and if it casts shadows.
- **Sky conditions**: Describe the weather, clouds and the stars around the Moon.
- **Sounds and animals**: Listen for nocturnal animals, such as owls or frogs, and note if you see any creatures that seem active in the moonlight.
- **Reading with moonlight**: On full moon nights, try reading a book using only the moonlight. Write down your experience.

Reflection: At the end of the month, review your entries. How did the Moon's appearance change? Did it affect the night environment in any way? Discuss your findings with the class.

Aboriginal and Torres Strait Islander Histories and Cultures

1. The Emu in the Sky

Spot the emu shape in the Milky Way, a constellation used in some Indigenous Australian cultures.

Steps:

Find the Milky Way: Look up into the night sky on a dark autumn night to locate the Milky Way.

Locate the Southern Cross: Look for this cross-shaped constellation in the southern part of the sky.

Find the emu shape: Look along the dark patches in the Milky Way, which represent the emu. Its head is a dark patch called the Coalsack Nebula, located next to the Southern Cross. Its body stretches across the Milky Way.

Enjoy the emu: Take a moment to enjoy the beauty of this constellation. It's an important part of the night sky for Indigenous cultures.

Sustainability

1. Lighting detectives

Explore your surroundings and look for light pollution in action.

Steps:

Investigate: Take a walk around your school, local shops or neighbourhood. Look at all the outdoor lights and note if they seem too bright, unnecessary, or are on when no one is around. Are there any streetlights that could be on motion sensors? Are there bright lights shining upwards, adding to skyglow?

Find solutions: As a class or in small groups, think of ways to reduce light pollution.
Could motion sensors make lights turn on only when needed?
Could dimmers or timers help reduce brightness and save energy?
Would shields help direct light downwards, preventing it from pointing at the sky?

Bonus activity: Keep a journal of all the lights you observe, and sketch before-and-after pictures showing how better lighting could help reduce light pollution.

Australian Curriculum Links (Version 9.0)

Year level	Learning area: Science	Other learning areas
Year 4	**Science as a Human Endeavour: Use and influence of science** • Consider how people use scientific explanations to meet a need or solve a problem (AC9S4H02) **Science Inquiry: Planning and conducting** • Follow procedures to make and record observations, including making formal measurements using familiar scaled instruments and using digital tools as appropriate (AC9S4I03)	**English: Literature: Creating literature** • Create and edit literary texts by developing storylines, characters and settings (AC9E4LE05) **English: Literacy: Interacting with others** • Listen for key points and information to carry out tasks and contribute to discussions, acknowledging another opinion, linking a response to the topic, and sharing and extending ideas and information (AC9E4LY02) **HASS: Skills: Concluding and decision-making** • Draw conclusions based on analysis of information (AC9HS4S05) • Propose actions or responses to an issue or challenge that consider possible effects of actions (AC9HS4S06)
Year 5	**Science Understanding: Biological sciences** • Examine how particular structural features and behaviours of living things enable their survival in specific habitats (AC9S5U01) **Science Understanding: Physical sciences** • Identify sources of light, recognise that light travels in a straight path and describe how shadows are formed and light can be reflected and refracted (AC9S5U03) **Science as a Human Endeavour: Use and influence of science** • Investigate how scientific knowledge is used by individuals and communities to identify problems, consider responses and make decisions (AC9S5H02)	**English: Language: Language for expressing and developing ideas** • Understand how vocabulary is used to express greater precision of meaning, including through the use of specialist and technical terms, and explore the history of words (AC9E5LA08) **English: Literacy: Interacting with others** • Use appropriate interaction skills including paraphrasing and questioning to clarify meaning, make connections to own experience, and present and justify an opinion or idea (AC9E5LY02) **HASS: Skills: Questioning and researching** • Locate, collect and organise information and data from primary and secondary sources in a range of formats (AC9HS5S02) **HASS: Skills: Concluding and decision-making** • Propose actions or responses to issues or challenges and use criteria to assess the possible effects (AC9HS5S06)
Year 6	**Science Understanding: Biological sciences** • Investigate the physical conditions of a habitat and analyse how the growth and survival of living things is affected by changing physical conditions (AC9S6U01) **Science as a Human Endeavour: Use and influence of science** • Investigate how scientific knowledge is used by individuals and communities to identify problems, consider responses and make decisions (AC9S6H02)	**English: Language: Language for expressing and developing ideas** • Identify and explain how images, figures, tables, diagrams, maps and graphs contribute to meaning (AC9E6LA07) **English: Literacy: Interacting with others** • Use interaction skills and awareness of formality when paraphrasing, questioning, clarifying and interrogating ideas, developing and supporting arguments, and sharing and evaluating information, experiences and opinions (AC9E6LY02) **HASS: Skills: Concluding and decision-making** • Develop evidence-based conclusions (AC9HS6S05) **HASS Skills: Communicating** • Present descriptions and explanations, drawing ideas, findings and viewpoints from sources, and using relevant terms and conventions (AC9HS6S07)
All	**Cross-curriculum Priority: Aboriginal and Torres Strait Islander Histories and Cultures** • First Nations communities of Australia maintain a deep connection to, and responsibility for, Country/Place and have holistic values and belief systems that are connected to the land, sea, sky and waterways (A_TSICP1) **Cross-curriculum Priority: Sustainability** • Sustainable patterns of living require the responsible use of resources, maintenance of clean air, water and soils, and preservation or restoration of healthy environments (SS2)	

Related books from CSIRO Publishing

For younger readers:

- *Last Bat of the Night* (https://www.publishing.csiro.au/book/8178)
- *Shine, Star, Shine!* (https://www.publishing.csiro.au/book/8089)
- *Tiny Possum and the Migrating Moths* (https://www.publishing.csiro.au/book/8009)

For older readers:

- *A Hollow Is a Home* (https://www.publishing.csiro.au/book/7729)
- *Astronomy for Curious Kids: An illustrated introduction to the solar system, our galaxy, space travel—and more!* (https://www.publishing.csiro.au/book/8163)
- *The Great Australian Science Book* (https://www.publishing.csiro.au/book/8083)

Other CSIRO resources

CSIRO has developed and delivered a broad range of high-quality STEM education programs and initiatives for nearly 40 years. Our programs aim to inspire the pursuit of further STEM education among students and the community, to equip the emerging workforce with tomorrow's skill sets, and to strengthen collaboration between industry and classrooms across Australia. For more information visit: https://www.csiro.au/en/Education