SEE THE DARK

DARK SKY MINI-UNIT

EDUCATORS' GUIDE

BE OUTDOORS
APPALACHIAN MTN CLUB

www.SeeTheDark.org

OVERVIEW

This mini-unit is designed to introduce students to light pollution, the negative effects it can have on living things, and possible solutions. It is a three-day unit with each day consisting of a 60-minute class period. Times can be adjusted to meet school-specific needs.

The mini-unit is meant to be a brief introduction appropriate for middle school students. Adjustments to the difficulty level can be made (e.g., higher reading levels for articles or more in-depth definition/explanation of light pollution, etc.) based on classroom-specific needs.

NGSS STANDARDS

Students who demonstrate understanding can:

MS-ESS3-3. **Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*** [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific principles to design an object, tool, process or system.

Disciplinary Core Ideas

ESS3.C: Human Impacts on Earth Systems

- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.
- Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

Crosscutting Concepts

Cause and Effect

- Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.

Connections to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

- The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.

RESOURCES

Day 1

- Online Planetarium for Night Sky Picture
- Online Planetarium Teacher Reference Sheet
- Globe at Night for Map Data
- Dark Sky Meter App for Map Data
- Defining Light Pollution

Day 2 - Links to Student Readings:

- What Is Light Pollution?
- Animals Need the Dark
- Sea Turtle Conservation
- The Devastating Role of Light Pollution in the 'Insect Apocalypse'
- Light Pollution
- Another Reason to Flip Off the Light Switch: Light Pollution
- Artificial Light Is Playing Havoc Over Earth and Disrupting Many Cycles
- Philly to Dim Lights to Make It Safer for Birds in Flight
- Light Pollution Can Foil Plant-Insect Hookups
- Pollution From New Technologies Threatens Astronomy

Links to Video

- Light Pollution 101
- Science Bulletins: Light Pollution - Beyond the Glare

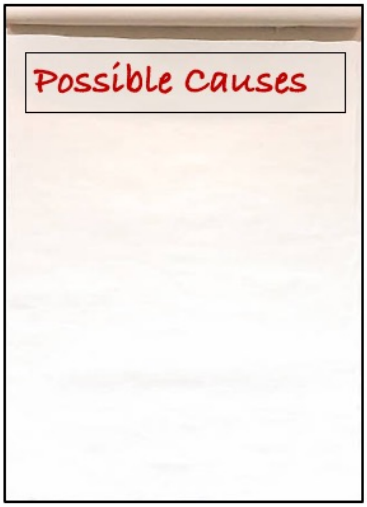
A library of resources may be found at www.SeeTheDark.org

LESSON PLANS

35 Minutes	**Day 0** Getting Ready
10 minutes	Prior to starting the unit, provide students the opportunity to observe the night sky and sketch what they observe. This would most likely be given as a homework assignment. (In order to complete the assignment, students need to observe the sky on a day when there will be mostly clear skies at night; therefore, some advance planning is necessary.) **Student Directions:** 1. After the sun has set and the sky is dark, observe the sky. 2. In your Student Notebook, make a sketch of what you observe.
15 minutes	**Teacher Prep** Use https://in-the-sky.org/skymap.php (Online Planetarium) to download a picture of your night sky. For guidance using the Online Planetarium website, use this reference sheet. Online Planetarium Teacher Reference Sheet
10 minutes	**Teacher Prep** • On Day 1, you will define light pollution with the class. • For help with defining light pollution refer to the following online article: https://www.darksky.org/light-pollution/

60 Minutes	**Day 1** **Explore the Phenomenon** **Causes of Light Pollution**
10 minutes	**Gallery Walk** 1. Students leave their sketch of the night sky on their desk. 2. Students walk around the classroom observing their classmates' sketches. 3. Students record their observations in the Noticing column and record any questions they have in the Wondering column. NOTICE | WONDER |
5 minutes	**Night Sky Small Group/Whole Group Discussion** 1. Project image of the local night sky created using the Online Planetarium website. Sample picture:  2. Students add their noticings and wonderings to their Night Sky Sketch Notice/Wonder Chart.

20 minutes	**Small Group** 1. In small groups have students discuss the following and record notes in the Small Group Discussion Part a Chart A. What differences do you notice about your sketches and the projected image? B. What do you think causes these differences? 2. Explore places where this happens: A. (If small groups do not have access to the internet, this can be done as a whole class with the teacher projecting the maps.) B. Gather data using maps from the following websites: https://www.globeatnight.org/map/?2020 or https://www.darkskymeter.com/lpmap.html D. Students record notes in the Small Group Discussion Part b Chart as they discuss the following question: How does this data help explain the causes of light pollution?
5 minutes	**Demonstration** During the demonstration, students should record their observations in the Demonstration Observations Chart. 1. Using the classroom projector, project the local night sky image from the Online Planetarium website. Start by having as much light as possible in the classroom (i.e., lights on, shades up, and shine a light on the screen, if necessary). *Students should see very few, if any, of the dots on the image.* 2. Next remove half of the light from the room (i.e., turn the lights out, turn out the extra light on the screen). *Students should see more of the dots on the image.* 3. Finally, try to make the classroom as dark as possible. *Students should be able to see the local night sky in its entirety.*

5 minutes	**Turn and Talk or Small Group Discussion** 1. Students discuss the observations they made during the demonstration.
5 minutes	**Define Light Pollution** 1. Light pollution 2. For help with defining light pollution refer to the following online article: https://www.darksky.org/light-pollution/
2 minutes	**Turn and Talk or Small Group** Students discuss their ideas about the causes of light pollution in their neighborhood.
8 minutes	**Whole Class Discussion** 1. Create a Possible Causes list on chart paper. 2. Record student ideas presented during the whole group discussion. 3. Students should also record notes in Whole Group Discussion: What is causing light pollution in our neighborhood? Chart: 

60 Minutes	**Day 2** **Effects of Light Pollution on Living Things** **Possible Solutions**
	Students work in small groups to discover: • Why is light pollution a problem? • Why does it matter if we can see the night sky? • What are possible solutions?
	The following are sample articles/resources you can assign to different groups. Additional resources may be used, as well. • What Is Light Pollution? • Animals Need the Dark • Sea Turtle Conservation • The Devastating Role of Light Pollution in the 'Insect Apocalypse' • Light Pollution • Another Reason to Flip Off the Light Switch: Light Pollution • Artificial Light Is Playing Havoc Over Earth and Disrupting Many Cycles • Philly to Dim Lights to Make It Safer for Birds in Flight • Light Pollution Can Foil Plant-Insect Hookups • Pollution From New Technologies Threatens Astronomy **Links to Video** • Light Pollution 101 • Science Bulletins: Light Pollution - Beyond the Glare

30 minutes	**Jigsaw Activity** 1. Assign each group one or more articles/resources to research different aspects of light pollution. 2. As students work through their resource(s), they should record what they learn (take notes) in the Research Notes section of their notebook. Notes should be grouped by problems caused by light pollution and possible solutions. 3. Each group should prepare a 2-3 minute presentation about what they learned from their article/resource. This should include what they learned about how light pollution affects living things and how we can mitigate those effects. 4. If groups have access to the internet, they can also do some online research.
20 minutes	**Group Presentations** 1. Give each group 2 to 3 minutes to present their findings. 2. While groups are presenting, students should take notes in Notes on Presentations by Other Groups. 3. While groups are presenting, the teacher should record ideas on two separate pieces of chart paper: one for Organisms Affected, and one for Possible Solutions.
10 minutes	**Introduce Digital Photo Essay Project** 1. Review with students the Digital Photo Essay guidelines 2. Assign groups to work on one of three aspects of the project: A. What is light pollution? B. What impact does light pollution have on living things? C. How can we minimize light pollution?

DIGITAL PHOTO ESSAY GUIDELINES

Assignment

Create a video of 2-3 minutes in length using photos of the night sky captured in your community.

What is a digital photo essay?

A digital photo essay is a series of photos that tell a story. For this assignment, you may use photo captions or narration to help tell your story.

Instructions

- **Step 1:** Decide what your video will be about. Use resources including www.SeeTheDark.com. Decide which video creation program you will use (PowerPoint, iMovie or Windows Movie Maker) and whether your video will use captions or narration.
- **Step 2:** Go outside and take your photos. For this assignment, you will need 15-20 pictures. Take more pictures than you need in case you end up not liking some.
- **Step 3:** Pull your pictures together using PowerPoint, iMovie, or Windows Movie Maker. Add captions or narration.
- **Step 4:** Export your video file.

Telling Stories with Images Resources:

- How to make a photo essay
- Climate Changes is a Woman's Issue
- Photo Essay Examples 1
- Photo Essay Examples 2

Video Creation Resources:

- Turning PowerPoint Into Video
- Windows Movie Maker Tutorial
- iMovie Tutorial

SEE THE DARK COMPETITION

Classes may choose to enter their photo essays in the AMC See The Dark Competition. The goal of the competition is to raise even greater awareness of the importance of dark skies and to share experiences of the dark sky across urban, suburban and rural communities.

PRIZES

- **GRAND PRIZE (1): See The Dark Experience**

  One lucky teacher and their class will win a two-night stargazing experience at the Appalachian Mountain Club's Little Lyford Lodge in Maine's Moosehead Lake region. The only International Dark Sky Park in New England, the location is one of the best places for stargazing in the region. Prize includes accommodations for up to 45 participants, including students and chaperones, and bus transportation for schools within 400 miles of Greenville, Maine.

- **SECOND PRIZE (2): Stargazer Package**
  Our Stargazer Package prize will increase your classroom resources with items including a Dobsonian 12" telescope with accessories, night sky projector, and star charts for the whole class.

ELIGIBILITY

- The contest is open to United States students in grades five through eight attending public, private, parochial, or home schools.

ENTRY REQUIREMENTS

- Post your digital photo essay about the dark sky on either **Twitter** or **Instagram**. Be sure to include the hashtag **#SeeTheDark** in your posts. Posts without the hashtag will not be considered.
- Postings may be done by either students, teachers, administrators or the school/district, depending on your district's social media policy.
- The **deadline** for posting is **December 16, 2022.**
- More than one entry per class / school is permitted.
- Digital photo essays must be the original work of the student(s).
- Submissions using copyrighted materials will be disqualified.

SEE THE DARK COMPETITION

JUDGING CRITERIA

- **Content (60%)**
  - Demonstrated understanding of light pollution, its environmental impact, its impact of views of the night sky, and mitigation options.
  - Originality in presenting the topic.
  - Critical analysis of the topic.
  - Use of third-party research.

Presentation (40%)
  - Quality of photos and videos.
  - Structure of the essay (introduction, arguments, conclusion)
  - Conventions (vocabulary, grammar, etc.)

Winners will be announced in early February 2023.

Questions may be sent to info@seethedark.org.