SUBJECTS:
Science, Language Arts, History-Social Science

GRADE: 6th

Objectives

The student will be able to

- list two reasons why national parks are important
- list three valuable resources protected by parks
- explain why the night sky is a valuable resource

Background

THE NATIONAL PARK SERVICE
A Brief History, exerpted from an article by
Barry Mackintosh 1999

The national park concept is generally credited to the artist George Catlin. On a trip to the Dakotas in 1832, he worried about the impact of America's westward expansion on Indian civilization, wildlife, and wilderness. They might be preserved, he wrote, "by some great protecting policy of government... in a magnificent park.... A nation's park, containing man and beast, in all the wild and freshness of their nature's beauty!"

Catlin's vision was partly realized in 1864, when Congress donated Yosemite Valley to California for preservation as a state park. Eight years later, in 1872, Congress reserved the spectacular Yellowstone country in the Wyoming and Montana territories "as a public park or pleasuring-ground for the benefit and enjoyment of the people." With no state government there yet to receive and manage it, Yellowstone remained in the custody of the U.S. Department of the Interior as a national park—the world's first area so designated.

On August 25,1916, President Woodrow Wilson approved legislation creating the National Park Service within the Interior Department. The act made the bureau responsible for Interior's national parks and monuments, Hot Springs Reservation in Arkansas (made a national park in 1921), and "such other national parks and reservations of like character as may be hereafter created by Congress." In managing these areas, the Park Service was directed "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Interior Secretary Lane named Stephen T. Mather the Park Service's first director and Horace M. Albright assistant director. A policy letter Lane approved in 1918 elaborated on the bureau's dual mission of conserving park resources and providing for their enjoyment. While reemphasizing the primacy of preservation, it reflected Mather's and Albright's conviction that more visitors must be attracted and accommodated if the parks were to flourish. Automobiles, not permitted in Yellowstone until 1915, would be allowed throughout the system. Hotels would be provided by concessionaires. Museums, publications, and other educational activities were encouraged as well. The policy letter also sought to guide the system's expansion. "In studying new park projects, you should seek to find scenery of supreme and distinctive quality or some natural feature so extraordinary or unique as to be of national interest and importance," it directed. "The national park system as now constituted should not be lowered in standard, dignity, and prestige by the inclusion of areas which express in less than the highest terms the particular class or kind of exhibit which they represent."

Soon after Franklin D. Roosevelt took office in 1933, Albright accompanied the new president on a trip to Shenandoah National Park and mentioned his desire to acquire all the military parks. Roosevelt agreed and directed Albright to initiate an executive transfer order. Under the order, effective August 10, 1933, the Park Service received not only the War Department's parks and monuments but the 15 national monuments then held by the Forest Service as well as the national capital parks, including the Washington Monument, Lincoln Memorial, and White House. The addition of nearly 50 historical areas in the East made the park system and Park Service truly national and deeply involved with historic as well as natural preservation.

In 1964 Congress passed and President Johnson signed into law the Wilderness Act. Section 2(c) defines Wilderness as follows:

> A wilderness, in contrast with those areas where man and his works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to meean in this Act as an area of Federal land retaining its primeval character and influence, without permanenent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

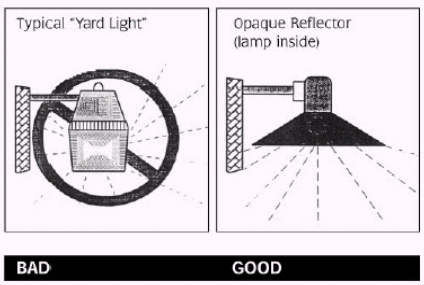
These resources and wilderness areas that the Park Service protects consist of natural landscapes—forests, deserts, mountains, seashores and islands; historic and cultural sites; and dark night sky landscapes. Part of the landscape in any site of the National Park system set aside to preserve wild nature includes the night sky. In order to see stars, planets, comets, and meteor showers we need a dark sky. A recent survey by the National Parks and Conservation Association indicated that more than 90% of visitors to parks expect to see a dark night sky. Dark skies are becoming an endangered resource even in park areas because people live in neighboring towns and cities and use lights at night. Most people are unaware of the types of lights used and the energy output/wattage. The night sky is a valuable natural resource in need of protection from **light pollution** or **urban sky glow.**

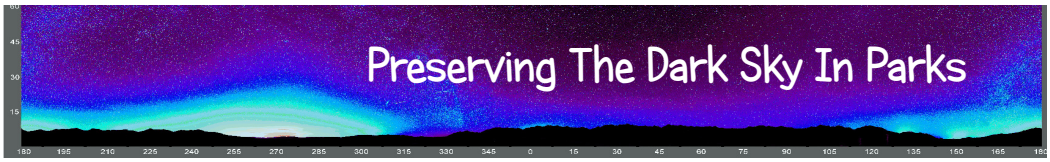
Light pollution is ineffective lighting directed up, down , and sideways used by our towns and cities.

Urban sky glow is the brightening skies over our towns and cities as a result of light pollution that is destroying our view of the universe.

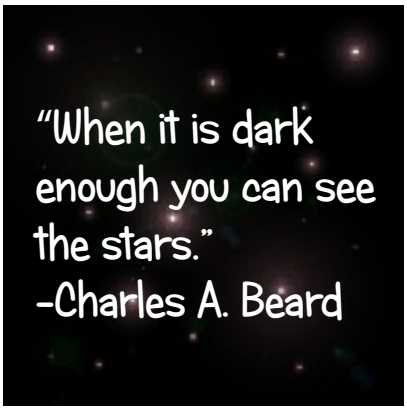
(Refer to IDA Information sheet #134)

A simple way to correct misdirected light is to use shields around fixtures that point the light downward where it is needed. Natural shields such as trees can also be utilized. Using already designed quality lighting fixtures that direct light where it is desired is another solution. Quality lighting is also being designed for more energy efficiency. If communities invest in quality directed and energy efficient lighting they will save money.





CREATE A DARK SKY PARK



Materials

light pollution maps of United States
local area maps
butcher paper
markers, pens, pencils
string (to line park boundary if done outdoors)
local natural materials (rocks, tree branches, water, etc)
lined and contruction paper for books, glue
scissors

Procedure

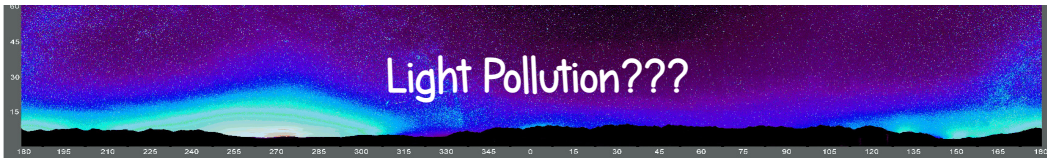
1. Discuss the concept of national parks with the students. Ask students if they have ever been to a national park. Ask students other questions such as: Why do we need or want parks? Who owns national parks and the night sky? What would their perfect park or preserve be like? A dark sky preserve can be re-created by controlling wasted light, not just by looking for a dark site or remote area. Emphasize that the night sky is recoverable, and even parks near urban areas can become dark sky preserves by reducing light pollution from nearby sources. Tell the students that the night sky will soon disappear and there is a immediate need to have local citizens think of the night sky as a valuable resource worth preserving in national parks

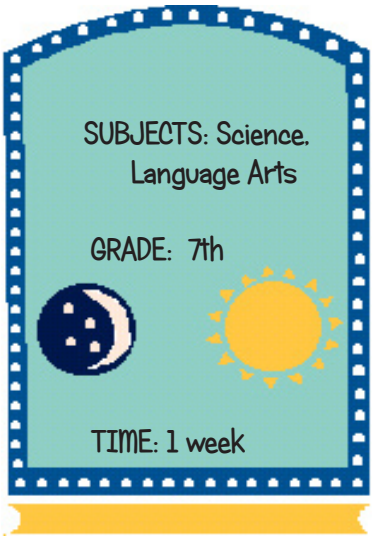
2. Divide the students into groups of four or more (recommend 5 per group). Each group decides on a method for creating and illustrating their perfect park. If the school grounds provide the space an outdoor area maybe used. Delineate an area on the ground with string representing the park boundary, create mountains, canyons, forests with natural materials like rocks, twigs, and sand. Otherwise students may use art media to illustrate or make a three dimensional model or diorama. Creating a book maybe another method.

3. Give each group a copy of the light pollution map for the United States. Ask the students to look for the darkest places left and identify what state it is in. See if they can identify nearby cities and already established parks and preserves.

4. Have each group draw an area on a local map representing their dark sky preserve. Encourage them to make it as large as possible. The students use their chosen method to illustrate the preserve. Each group should give their park a name and the park should incorporate significant land features and skyscapes worth preserving.

5. Each group presents their park to the class. If the students want to each park can also be presented to the local community or nearby public land agency.





Objectives

The student will be able to

- name and define three types of light pollution
- describe why light pollution is a problem
- through observation identify wasteful lighting situations

Background

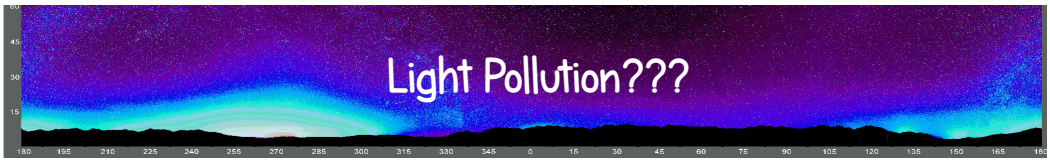
What is light pollution? **Light Pollution** — Light pollution refers to excess light, created by human activities, that brightens the night sky enough to hide many stars from observers. For most people around the world, the dark skies our ancestors had have disappeared. For the average person, light pollution means that even on a clear, moonless night, only a few stars may be visible. When a city grows up near an astronomical observatory, light pollution can make the observatory effectively useless. Unlike most forms of pollution, light pollution isn't persistent: turn the lights off, and the dark sky comes back immediately. Like other pollution, though, it is a side effect of industrial civilization: it comes from sources such as domestic lighting, offices, factories, street lighting, and lit sporting venues. Light pollution is most severe in the highly industrialised, densely populated areas of the United States and Europe, but even relatively small amounts of light can be important for sensitive applications - most major optical observatories have zones many kilometres in diameter severely restricting light emissions. Light pollution is not just a concern for astronomers. Light shining into the eyes of pedestrians and drivers can reduce visibility. It also reduces night vision, which takes an hour (or more) to return after exposure to bright lights. Light directed out at the viewer (away from a building) causes areas of deep shadow; much home security lighting actually makes houses easier to be broken into, because intruders have more places to hide Light pollution can be reduced by shielding street lamps so that they light the street below and not the sky above, and by turning off unneeded outdoor lights: for example, only lighting football stadiums when there are people inside saves energy and helps keep the night sky dark.

There are three kinds of light pollution—lights upward, light trespass, and outdoor lighting that is unnecessarily bright.

Uplight: any outdoor light where the direct beam can be seen from above, effectively illuminating the sky instead of the land for which intended. Examples: poor stadium or parking area lights, billboard lights that are positioned to illuminate from below for convenience in changing lamps but much of the light is misdirected upward.

Light Trespass: light from an outdoor fixture which directly illuminates any part of a land area that is not intended or authorized. Example: auto dealer lights may illuminate shops or homes across the street, the owners of which should have private property rights to be free from any intrusion.

Too much light: Even if lights are properly shielded and do not result in trespass, they can be extremely bright for their setting, resulting in lots of reflected light escaping upward from the surfaces they illuminate. Example: gas station lights under a canopy.



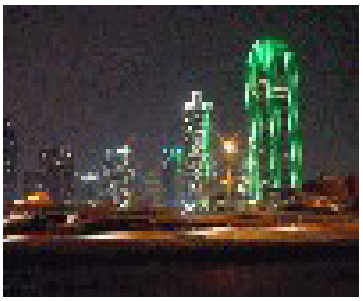
The International Dark-Sky Association (IDA) was incorporated in 1988 as a tax-exempt non-profit organization, exclusively for educational and scientific purposes. IDA's goals are to be effective in stopping the adverse environmental impact on dark skies by building awareness of the problem of light pollution and of the solutions, and to educate everyone about the value and effectiveness of quality nighttime lighting. IDA believes in a united approach that is very supportive of the many local and individual efforts. Much has been accomplished in some locations, but much more needs to be done everywhere. IDA is a good resource for further information: www.darksky.org ; 3225 N. First Avenue, Tucson, AZ 85719-2103

Refer to IDA information sheets #28 titled *An Introduction to Light Pollution*, and #134 titled *Light Pollution: The Problem, The Solutions*

Another problem with light pollution is that it causes wasted energy, which is often generated in power

Materials

pencils, pens
notebook paper
student data sheets
cameras
one large local town map



Procedure

1. Discuss with the class what light pollution is, explain the three types. Ask the students to give an example of each type that they may have seen at home or around town. Refer to the IDA information sheets where helpful.

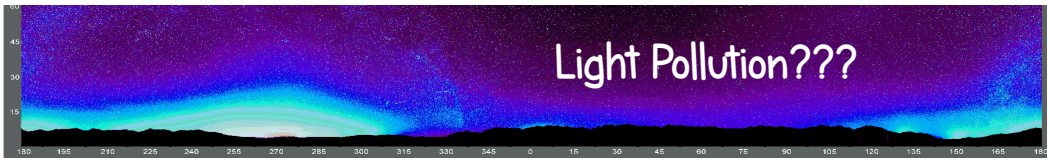
2. Students observe areas at school where light pollution exists. Using Student Sheet #1 each student records his/her observations where appropriate. Photos can also be taken whenever possible

3. Students find examples of light pollution at home or in their neighborhood. Observations are again recorded on Student Sheet #1. Photos can be taken if possible.

4. Students locate areas, parking lots in town with light pollution problems. On Student Sheet #2 each student records the location, name of business, source of light pollution. Photos should again be taken whenever possible.

5. Collect all the Student Sheet #2s from the class. Discuss the community findings with the class. As the discussion unfolds map each location/business on a large town map. Keep a count of how many locations are named more than once. Place the map and any photos that were taken on the wall in classroom for continued reference.

As a follow up activity the community information could be presented by members of the class to a town meeting.



Student Sheet #1

date _____

name _____

Location	Lighting Source (lamppost, streetlight, wall light, canopy)	Direction of Lighting (upward, down, outward)	Purpose of Lighting

Comments

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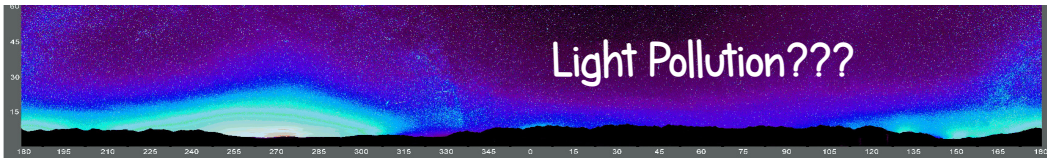

Student Sheet #2

date _____

name _____

Location	Name of Business	Type of Lighting/Shielding Used (Halogen, Low Pressure Sodium, Florescent)	Purpose of Lighting

Comments

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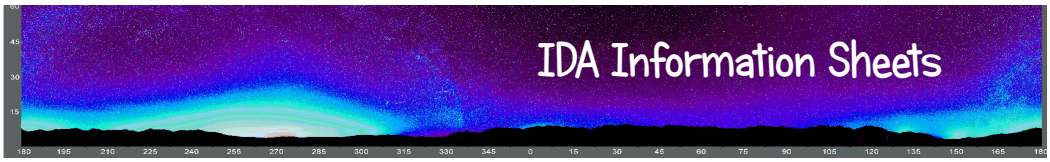


Background Information

What Is Light Pollution?

Light pollution is light where it is not needed or wanted. This unwanted light appears
--in the sky, causing sky glow
--shining into your yard or through your windows into your house, causing "light trespass"
--shining into your eyes, causing glare

That light can cause pollution is a new idea for most people, and many may think it is not really very important except to astronomers. But light pollution interferes with living systems in many ways, causing, for example, sea turtles to lose their way to the sea, migrating birds to become confused and strike buildings, and plant seasonal cycles to be disturbed. It also affects human hormone cycles and our day-and-night cycles of sleep and wakefulness. Using light carelessly wastes energy, resources used to make the energy, and interferes with everyone's visibility not only of stars but also of things on the ground that we need to see.

Stray light, in the sky or elsewhere, is wasted light – it is not needed for and does not help visibility. It is really a mistake that it is there. Why does it happen? It happens mostly because people don't think about it. Light fixtures that are poorly designed waste light by letting it shine upward or to the side, causing sky glow, light trespass, and glare. These fixtures are everywhere, at our homes and businesses, even in Flagstaff, AZ where they are more careful than most towns with lights.

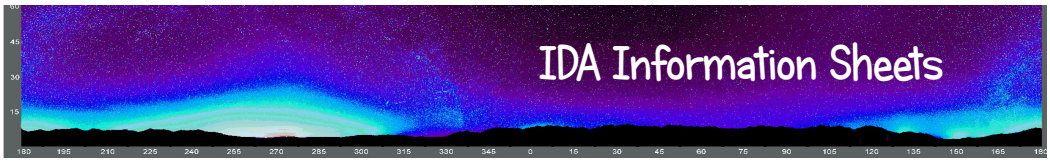
Why Does It Matter?

Though astronomers need naturally dark skies to see and learn about faint and distant objects in the Universe, dark skies are valuable for everyone – they have been a source of beauty and inspiration to all of Humankind for as long as people have been aware enough to raise their eyes from the ground and wonder. And light that provides visibility without waste or glare is vital for vision for everyone. Unfortunately, research is showing that in the U.S.A. fully two-thirds of us live under skies so bright we have lost the view of the Milky Way. And this loss comes mostly from just plain bad lighting – lighting that is not even doing a good job of showing us things we need or want to see on the ground.

What Can We Do About Light Pollution?

Unlike other forms of pollution, light pollution is easy to fix. Good-quality lighting produces very little pollution – it follows very simple principles: it puts the **right amount** of light, in the **right place**, and at the **right time**. Well-designed light fixtures, for our homes and businesses, properly located and installed, put the right amount of light onto the ground where and when we need it – not into the sky, not into our eyes. It really is that simple!

In this and following activities students will learn about the stars in the northern sky while they measure the light pollution in their backyards by counting how many stars they can see in a small part of one constellation. They will compare their view to other students in their class, as well as to other locations throughout their town. Where is the North Star? Where can we see the most stars? Where do we have the most light pollution?



What Happens When Our Eyes Adapt to the Dark?

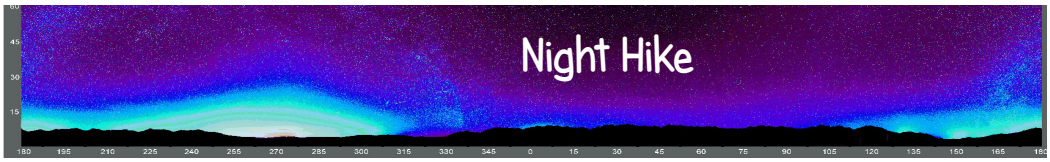
The human eye is a marvel in its ability to provide vision under a tremendous range of conditions, from full sunlight to full moonlight and less – a range of a million times in brightness! How do they do it?

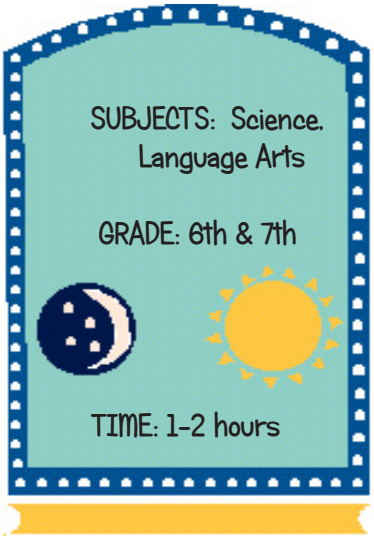
First and simplest, when light levels change the *size of our pupils* changes to allow more or less light into the eye. This change is quite quick, especially in young people, taking only a few seconds. When going from bright to dark conditions it can allow about seven times more light to enter the eye.

But the biggest change in sensitivity comes from another effect that fewer people are aware of – chemical changes in the light-sensitive tissue of the eye (the retina). When light falls onto the retina, it causes a change in chemicals there. These chemicals are called "photopigments." This chemical change causes a nerve impulse to be sent to the brain, and the brain interprets these nerve messages to allow us to see. When we enter dark conditions, the eyes produce a special photopigment called "visual purple." The longer we are in dark conditions, the more visual purple is produced, and the fainter light we can see. This buildup of visual purple takes much longer than changes in pupil size, requiring half an hour or more to reach maximum sensitivity. This process can increase the sensitivity by more than a thousand times compared to the sensitivity in bright conditions.

Why Is Peripheral Vision More Sensitive When Looking at Stars?

There are two types of cells in our retinas that are sensitive to light and that allow us to see. They are called "rods" and "cones" after their shapes. The cones allow us to see colors in bright lighting conditions; the rods are sensitive in very faint light conditions but cannot perceive color. In the center of our vision, where we use the area of the retina called the "*fovea centralis*," there are lots and lots of cone cells, allowing us to see color and fine details, but there are almost no rods. Outside of the *fovea centralis* there are fewer light-sensitive cells of all types, but most of them are rods. This is why under very dark conditions, where rods are active but cones are not, we cannot see very well in the center of our vision (we cannot read, for example, or see colors), but our peripheral vision (using the rods) is very sensitive.





Objectives

The student will be able to

- notice their eyesight night adapt after 20 minutes
- verbalize 3 human nighttime adaptations
- write their night hike experience into essay format

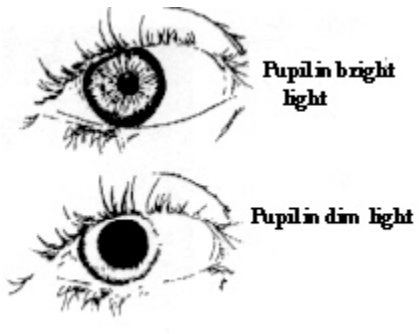
Background

Students may do this experiment at school or home before night hiking. Takes about 15 minutes+

Place a magnifying glass on the surface of the mirror. Look into the center of the magnifying glass with one eye. If you wear contact lenses or glasses, you may either leave them on or remove them. Adjust your distance from the mirror until you see a sharply focused and enlarged image of your eye. Notice the white of your eye, the colored disk of your iris, and your pupil, the black hole in the center of your iris. Shine a light into the pupil of one eye. If you are using a small mirror, hold the flashlight behind the mirror and shine the light around the edge of the mirror into your eye. If you are using a large mirror, bounce the flashlight beam off the mirror into your eye. Observe how your pupil changes size. Notice that it takes longer for your pupil to dilate than it does to contract. Notice also that the pupil sometimes overshoots its mark. You can see it shrink down too far, and then reopen slightly. Observe changes in the size of one pupil while you, or an assistant, shine a light into and away from the other eye. In a dimly lit room, open and close one eye while observing the pupil of the other eye in the mirror.

What's going on...

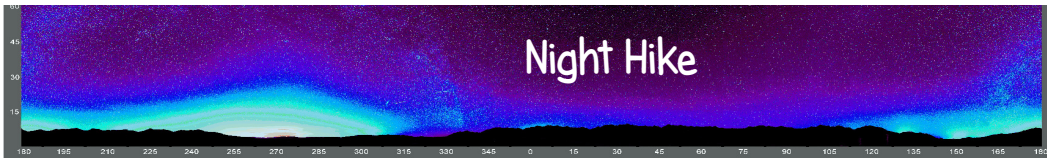
The pupil is an opening that lets light into your eye. Since most of the light entering your eye does not escape, your pupil appears black. In dim light, your pupil expands to allow more light to enter your eye. In bright light, it contracts. Your pupil can range in diameter from 1.5 millimeters (l/16th of an inch) to more than 8 millimeters (1/3 of an inch).



Light detected by the retina of your eye is converted to nerve impulses that travel down the optic nerve. Some of these nerve impulses go from the optic nerve to the muscles that control the size of the pupil. More light creates more impulses, causing the muscles to close the pupil. Part of the optic nerve from one eye crosses over and couples to the muscles that control the pupil size of the other eye. That's why the pupil of one eye can change when you shine the light into your other eye.

In this experiment, the light reflecting from your eye passes through the magnifying lens twice - once on its way to the mirror and once on its way back. Therefore, the image of your eye is magnified twice by the magnifying glass.

The size of your pupils actually reflects the state of your body and mind. Pupil size can change because you are fearful, angry, in pain, in love, or under the influence of drugs. Not only does the pupil react to emotional stimuli; it is itself an emotional stimulus. The size of a person's pupils can give another person a strong



impression of sympathy or hostility.

The response of the pupil is an involuntary reflex. Like the kneejerk reflex, the pupillary response is used to test the functions of people who might be ill or injured.

The pupil of your eye is also the source of the red eyes you sometimes see in flash photographs. When the bright light of a camera flash shines directly through the pupil, it can reflect off the red blood of the retina (the light-sensitive lining at the back of your eye), and bounce right back out through the pupil. If this happens, the person in the photograph will appear to have glowing red eyes. To avoid this, photographers move the flash away from the camera lens. With this arrangement, the light from the flash goes through the pupil and illuminates a part of the retina not captured by the camera lens.

Materials

magnifying glass
mirror
flashlight
red cellophane or red lens cover for flashlight
water
walking shoes, comfortable clothes
walking stick (helpful)

Procedure

1. Discuss with the class the background information provided, and any of your personal experiences with light adaptations and the eye. You can conduct the *background information experiment* in the classroom if desired.

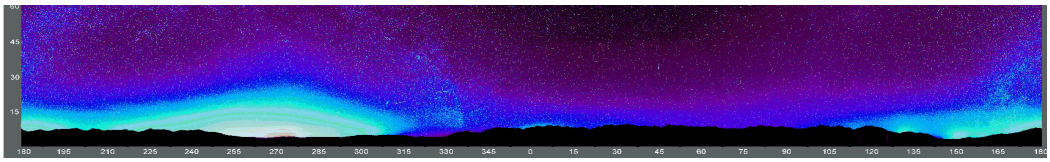
2. Conduct classroom discussions about students or your **night** hiking, working experiences.

3. Discuss common fears humans have when out at night--why we can't see as well as some animals, plain fear of darkness from childhood or bad experiences, safety issues, we are mostly diurnal creatures--most activity outside occurs during the day, evening hours.

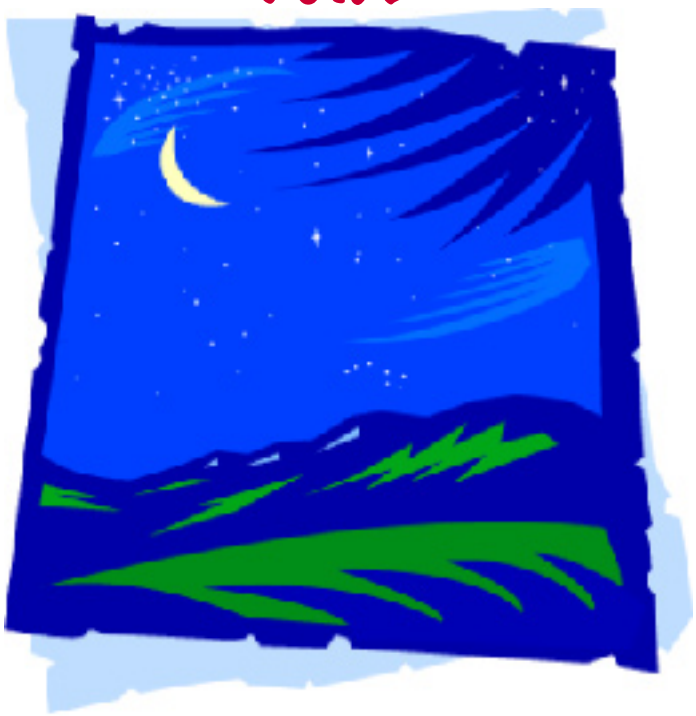
4. Make appropriate number of copies for each student to have a *Night Hiking Guide* card. Distribute cards before leaving school for the hike.

5. Select a safe, easily navigatable place to walk at night--open area, with as few obstacles as possible to prevent tripping. Location should ideally be familiar to most of the students, or have been walked at least once during the day.

6. Have a fun and safe night hike! Let the students know to be aware of all they sense as they will be writing an essay to describe the experience once back at school. The students can take notes right afterward if desired.



NIGHT HIKING GUIDE



SOME QUICK TIPS FOR ENJOYING YOUR NIGHT SKY

BEFORE YOU GO...

- choose an area you know well
- terrain that is fairly smooth & open
- wear comfortable shoes, jacket if needed
- bring a flashlight covered with red cellophane/cover, walking stick

HAVE A GOOD TIME!

YOU ARE AT YOUR STARTING POINT...

your eyes will take 15-20 min. to dark adapt.

While you are walking let your feet be your eyes—feel everything near you with them.

Let your other senses guide you—touch for objects close by, smell for orientation, hearing for awareness.

Your eyes will see more as they adapt to night—you may be tempted to use your flashlight, only turn it on if you want to see something up close.

What do you hear? smell? touch? Is there any wildlife in the area; can you tell what birds, reptiles, bugs are near? Are there water, rocks, trees you have to navigate?

Many people fear being out at night mostly because we lack experience & don't feel confident in all our senses.

You will be amazed at all you see & feel when out at night.