The amount of UV radiation reaching the parks is an area of special concern. Since the 1970s, ozone high in the atmosphere has been decreasing. This allows more ultraviolet (UV) radiation to reach the earth's surface, and the effects of this increased UV radiation are not well known. Scientists with the National Park Service, U.S. Environmental Protection Agency, and other agencies and universities have been studying these impacts and have found links between UV exposure and skin cancer and eye disorders in humans. UV radiation has also been linked to negative effects on plants and aquatic ecosystems.

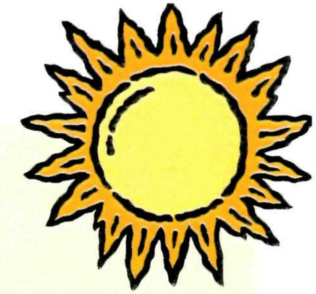
UV radiation may also influence air quality in the parks. The brownish smog layers obscuring park views are the result of chemical reactions that take place in the presence of sunlight. More UV radiation may speed up these chemical reactions and could increase the amount of smog and low-altitude ozone present. This makes the challenge of improving air quality and views in the parks much more difficult.

The National Park Service and U.S. Environmental Protection Agency: Partners in Monitoring UV

In 1996, the National Park Service and the U.S. Enviromental Protection Agency established the Park Research and Intensive Monitoring of Ecosystems Network (PRIMENet). PRIMENet provides long-term monitoring of visibility, ground-level ozone, atmospheric particulates, UV radiation, and meteorological conditions. These measurements help scientists better understand how changes in these quantities affect human health and various ecosystem processes.

PRIMENet stations have been set up at 14 national parks, including Acadia, Big Bend, Canyonlands, Everglades, Denali, Glacier, Great Smoky Mountains, Hawaii Volcanoes, Olympic, Rocky Mountain, Sequoia-Kings Canyon, Shenandoah, Theodore Roosevelt, and Virgin Islands. These parks are home to many major ecosystems and have also been designated as Class-1 air quality parks. The U.S. Congress established this air quality classification to aid in maintaining and improving air quality in these areas.

PRIMENet measurements are shared with the U.S. Geological Survey, the U.S. Department of Agriculture, and several universities for use in tying atmospheric changes to ecosystem responses. Changes in human health, plants, aquatic ecosystems, and other species have already been documented and may be directly related to changes in UV. Monitoring these amounts, in coordination with studies of the affected ecosystems, can help scientists better understand the ecosystems' response to changing UV levels.



UV Radiation and Air Quality in the Parks

Produced by the University of Colorado and NOAA's Air Resources Laboratory in collaboration with the National Park Service and PRIMENet.

The views in our national parks are changing. Haze in the parks can obscure visibility, so that the views we see are not the views that were seen in the past. Visibility is, simply, the ability to see through the atmosphere. Reductions in visibility are related to the quality of air in the parks.

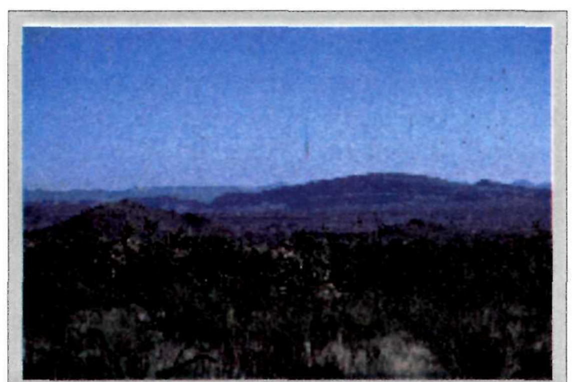
The same factors that reduce visibility can have detrimental effects on human health. Ingredients in smog, including low-atmosphere ozone, nitrogen dioxide, and particulate matter, can irritate the human respiratory system, hinder breathing, and cause headaches. Long-term exposure can damage sensitive areas of the skin and other tissues, leading to respiratory disease or to premature aging of lung tissue. Exposure to low-atmosphere ozone and other ingredients in haze can also harm plants, trees, and other ecosystems.

Declining Air Quality in Our Parks

Over the years, air quality in the parks has been observed to decline, sometimes substantially. In some park locations, air quality is currently no better than in major cities. This is due to local sources as well as pollution that is transported from elsewhere. A primary contributor to the decreases in air quality is regional haze. This haze is the result of pollution from a variety of sources, including cars, power plants, and unpaved roads. Regional haze can be the result of dust, smoke, soot, or other particles called aerosols scattering sunlight in the atmosphere. As more sunlight is scattered, landscape features become hidden by a dense, milky cloud of haze. Colors of the sky and landscape begin to fade, and skyline features appear as outlines and shadows rather than as sharp, clear images.

Haze can also be the result of chemical reactions among various pollutants from automobile emissions. Car exhaust contains a variety of chemical compounds, including nitrogen oxides, carbon monoxide, and other compounds known as reactive hydrocarbons. These compounds arise from combustion and from unburnt fuel. Ultraviolet sunlight interacts with these gases to create a brownish haze layer called photochemical smog. Ultraviolet radiation also reacts with terpenes and other hydrocarbons formed naturally by plants and trees. These reactions can contribute to the formation of smog.

The major toxic ingredient of photochemical smog is ozone. Ozone has beneficial effects when it is located high in the atmosphere: it blocks harmful ultraviolet (UV) radiation from reaching vulnerable plants and animals on Earth. In the lower atmosphere, ozone can be toxic. It can affect plants and other organisms, cause damage to human lungs, and has been linked to damage of rubber products and other materials.



The image on the left shows Big Bend National Park in Texas on a clear day. The image on the right is the same scene on a hazy day. Photos from the National Park Service.