The National Park Service

Natural Resource Information Division
Fact Sheet Series

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Measuring Ultraviolet Radiation in National Park System Units (updated)

by Kathy Tonnessen, Rocky Mountain Cooperative Park Study Unit

Background

In September 1996, the National Park Service and the U.S. Environmental Protection Agency (EPA) signed an interagency agreement to cooperate on a program of long-term monitoring of environmental stressors in National Park System (NPS) units[1] and research the effects of the stresses on ecosystems. Fourteen NPS units are included in the *Park Research and Intensive Monitoring of Ecosystems Network 3w2* (PRIMENet): Acadia, Big Bend, Can yonlands, Denali, Everglades, Glacier, Great Smoky Mountains, Hawaii Volcanoes, Olympic, Rocky Mountain, Sequoia-Kings Canyon, Shenandoah, Theodore Roosevelt, and Virgin Islands national parks. These parks are representative of major ecosystem types and were chosen because of their status as Class-1[2] air quality parks.

In these parks, the National Park Service is sponsoring the monitoring of air quality including ozone, wet and dry deposition, visibility, and meteorology. EPA added UV-B monitors in these parks to determine changes in irradiance that may be affecting human health and ecosystem processes.

Ultraviolet radiation monitor in Glacier National Park, Montana

Why Monitor UV?

In 1985, the scientific community discovered the stratospheric ozone hole over the Antarctic through which more damaging UV-B reach the surface of the earth. Ozone thinning has been detected throughout the globe, and seasonal depressions in this protective shield are most severe at the poles. Stratospheric ozone depletion is the result of anthropogenic air pollutants known as chloroflurorcarbons (CFCs), which cause catalytic reactions in the stratosphere that destroy ozone molecules. In 1987, the major polluting nations signed the *Montreal Protocol on Substances that Deplete the Ozone Layer*, which called for phasing out such chemicals as freon, a particularly harmful CFC.

Because of the long lifetimes of CFCs in the upper atmosphere, scientists are not certain when the ozone thinning will be reversed. The actual exposure of humans and ecosystems to this form of solar radiation must be determined to understand which systems are being damaged. To chart the changes from the CFC control programs, re-

[1] National parks and other entities of the National Park Service such as national monuments, national rivers, wild and scenic riverways, national scenic trails, and others are called *units* and collectively constitute the *National Park System.*

[2] A classification established by the U.S. Congress to implement the prevention of significant deterioration of air quality in specific areas, including national parks larger than 24.3 km^2 (6000 acres).

searchers must also monitor the seasonal variability in both the UV-B reaching the surface and in the total column ozone that filters out UV.

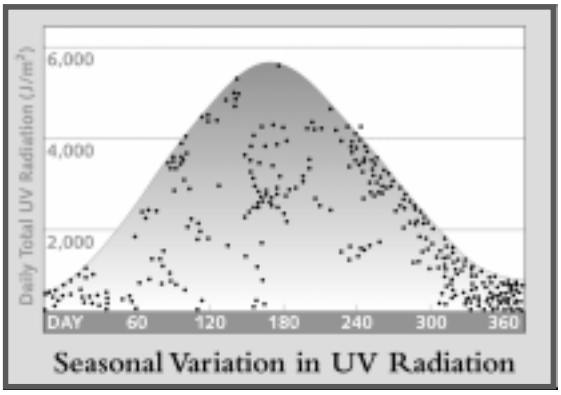
Effects of UV-B on biological systems include:

- an increase in human skin cancers and cataracts
- damage to phytoplankton and reduction in growth of fishes, molluscs, and crustaceans
- damage to DNA and photosynthesis in plants
- possible effects on animals including benthic invertebrates and amphibians.

UV Monitoring

Each of the 14 PRIMENet sites will be equipped with a Brewer spectrophotometer, an instrument designed to measure different wavelengths of light, and the focus will be on the ultraviolet spectra (UV-B radiation is in the 300-320 nm range of light). These instruments track the sun as they monitor the variation in solar irradiance throughout the day. They also record other data such as total column ozone and ambient concentration of gases. These data are then used to calculate the dose of UV at the surface of the Earth. Because of the influence of sun angle, clouds, and other forms of air pollution, the seasonal variation in UV-B detected at the surface is large. Therefore, it will take many years of monitoring to detect trends in the incidence of UV-B.

The fourteen NPS units complement a larger Brewer network in the United States that includes eight monitors located in cities. These monitoring devices have also been deployed in Canada and on other continents to allow global assessment of the status of the stratospheric ozone layer.



Seasonal Variation in UV Radiation

Partnerships

The two major contributors to this long-term research and monitoring program are the National Park Service and the Environmental Protection Agency. Other significant contributors are researchers from the U.S. Geological Survey, the USDA Forest Service, the National Oceanic and Atmospheric Administration, and universities.

Program Status

In FY 2000, UV-B monitors and a full complement of air monitors were operating in all 14 selected NPS units. This cooperative monitoring program is being complemented by process-level ecological research into the effects of UV on arid-land terrestrial processes and amphibian populations. The annual PRIMENet meeting of park staff, researchers, and EPA liaisons was held in November 1999 in Sequoia National Park. Participants reviewed monitoring and research results with a focus on the amphibian/UV project in six PRIMENet parks. This effort will be complemented in FY 2000 by expanded work on amphibian monitoring and inventories in PRIMENet parks sponsored by the NPS Inventory and Monitoring Program and the USGS National Amphibian Monitoring Program.

Current information about the program is available at http://www.nature. nps.gov/ard/prime.

For further information contact:

Dr. Kathy Tonnessen
National Park Service
Rocky Mountain Cooperative Ecosystem Studies Unit
School of Forestry
University of Montana
Missoula, Montana 59812
e-mail:kathy_tonnessen@nps.gov