Concern for Ecosystems

Plants growing naturally in forests and grasslands can also be affected by UV. More UV-tolerant plants could take over and replace UV-sensitive plants, leaving fewer or different plant species present in the forest or grassland. Insects, birds, or other animals who use the UV-sensitive plants for home or food would be under stress. In this way, increased UV radiation can affect plants and animals in every part of the world.

Many algae living in surface waters in lakes and the sea are also sensitive to UV. Changes in these algae are likely to affect food supplies for fish, causing a ripple effect all the way up the food chain to humans.

Because changing ozone and UV levels may have serious impacts on the world's food supply and on natural ecosystems, scientists are working hard to understand these effects. These efforts, involving the National Park Service and other agencies, will help protect plant life, our lives, and the life of the planet.

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 and Plants

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

The Role of Ozone

You may have heard of ozone, or at least heard of the ozone hole. Ozone is a gas consisting of three oxygen atoms. Most of the earth's ozone is found in a layer 10 to 50 kilometers above the planet's surface in a part of the atmosphere called the stratosphere. Ozone is effective at absorbing ultraviolet (UV) radiation from the sun and preventing it from reaching plants and animals on Earth.

Scientists have found that the amount of ozone in this layer has been decreasing in recent decades. These decreases are linked to human releases of chemicals called chlorofluorocarbons (CFCs) to the atmosphere. Production of CFCs is now banned, although not all countries currently comply with these regulations. And, even with the regulations, CFCs can stay in the stratosphere for many decades. This means it could be many years before conditions return to normal.

Less ozone, more UV

The decreases caused by CFCs have led to the "ozone hole" discovered above Antarctica in 1985, and to lower ozone levels over North America, Europe, and Russia. With less ozone in the stratosphere, more UV radiation penetrates to earth.

UV Sensitivity in Plants

Plants may be vulnerable to these increased amounts of UV. Scientific studies have shown that some types of plants respond differently than others to UV. Soybean plants that were exposed to higher levels of UV light in greenhouses had smaller leaf sizes or grew less than those not exposed to increased UV. Other plants showed no signs of being affected at all. These plants are thought to be UV tolerant, while the ones affected are considered UV sensitive.

Implications for Agriculture

Quantifying the effects of increased UV on global agriculture is difficult at best. This is because of problems in separating UV effects from other factors affecting growth in the field.

Still, many experiments with crops have shown that increases in UV generally reduce plant growth. An example is rice, which is one of the most important food consumption crops in the world. Of 16 rice varieties tested for UV sensitivity, one-third showed reductions in plant size. Of over 50 soybean varieties studied, 2 of every 3 were found to be UV sensitive.

UV radiation can also influence sugarbeets, cucumbers, and other plants. Studies indicate that increased UV levels may leave these plants more susceptible to disease.