Douglas Wilcox, Ph.D., Water Resource Specialist (including the wetlands); Norman Henderson, M.A., Biologist; Lou Brunansky, Air Quality Specialist.

More than 20 studies either are being conducted or are in the planning stage. All we can do in this short sketch is to name a few of them: Ambient Air Quality Monitoring at the Indiana Dunes National Lakeshore; Acid Precipitation Monitoring; Air Pollution Effects on Vegetation; Monitoring of Beach Nourishment at Mount Baldy; Small Mammal Studies; and many more. These are all studies conducted by the Park Service. In addition, 14 studies mainly at the graduate or post graduate level are being conducted by outside organizations. These include Audubon-sponsored bird censuses, faunal habitat, soil arthropods, pond creatures, and many others. A complete list of projects kept over the past 12 to 15 years by the Superintendent would be very long. The studies mentioned are a few of those going on right now and do not include the ones the Park Service is responsible for.

For those seriously interested in the Dunes ecology we strongly urge you to read Ronald Engel's book *Sacred Sands*, with particular reference to the chapter entitled "The Birthplace of Ecology." To the uninitiated the book opens up a new and fascinating world.

Florence Broady, Save the Dunes Council, June 1983.

PARK SUPERINTENDENT RESPONDS
to "Acid Rain" Article

Doyle Kline

EDITOR'S NOTE: Integrity, guts and tact--all three qualities went into the following letter to the editor, sent by Doyle Kline, Superintendent of Big South Fork National River and Recreation Area (PO Drawer 630, Oneida, TN 37841) to Tom Purkey, manager of Plateau Electric Cooperative and to the editor of the Oneida Independent Herald, where it was printed on June 2, 1983.

As a park Superintendent charged with the responsibility of preserving and protecting the natural resources of the Obed Wild and Scenic River and Big South Fork National River and Recreation area, I read with interest the article on acid rain ("Acid Rain Laws May Increase Bill") that appeared in the April 1983 issue of Plateau Electric News. Information about acid rain is currently reaching the American public through periodicals, newspapers, and newscasts, and we are encouraged by your paper's efforts in that area. Much of your newspaper article is responsible and accurate, but the complexity of the acid rain problem has led to some emotionalism and misinterpretation of

facts. I would like to point out some errors of fact in your article, present objective and more balanced views of the controversies, and offer information that would help your readers better understand acid rain and how it affects us all.

1. The term "acid rain" has been popularized by the media in place of the more accurate term "atmospheric deposition." Atmospheric deposition refers to all kinds of materials--liquids, solids, or gases--that are deposited in wet or dry forms from the atmosphere onto land and water surfaces. Wet deposition includes material found in rain, snow, hail, dew, fog, and frost. Dry deposition refers to dry fallout of particulate matter such as dust, soil particles, sea salt, fly ash and organic particles, and aerosols or suspended compounds such as ammonium sulfate and ammonium nitrate. Gases, such as carbon dioxide and oxides of sulfur and nitrogen, that are absorbed directly from the atmosphere by plant foliage, soil, or bodies of water are also lumped with dry deposition.

Wet deposition--acid or acid-forming material incorporated in precipitation--is easier to sample and quantify than dry deposition, and thus has received the most research attention and publicity to date. Dry deposition, however, is also a serious environmental problem that is currently receiving increased attention.

2. Your article states, "Recent estimates are that about 60 percent of total atmospheric sulfur and nitrogen oxides are produced by natural resources such as volcanoes and normal bacterial activity in soil." This statement is erroneous. The ratio of emissions from natural sources to those from man-made sources is ill-defined, leading to controversy about which source is most responsible for acid rain. Because of sampling problems at regional and global levels, the controversy is not likely to be resolved quickly. In the meantime, attention has been focused on man-made sources of air pollution that can be estimated with reasonable accuracy, and are of interest because they are voluminous and ever-increasing. For example, in 1977 the US Environmental Protection Agency (EPA) estimated that the United States' sulfur oxide emissions were 27 million metric tons per year, and for nitrogen oxides it was 23 million metric tons per year. The EPA also expects sulfur emissions to increase by as much as 25 percent in the coming decade as energy sources shift from fuel oil to domestic coal. In addition, about 95 percent of the present sulfur emissions in eastern North America come from man-made sources. Today, a large coal-fired power plant can emit in a single year as much sulfur dioxide as was blown out by the May 18, 1980, eruption of Mount St. Helens in Washington State--some 400,000 tons.

3. Your article states that "if it were possible to wholly eliminate all man-made pollutants on Earth, rain and snow would remain acidic with a pH often below 5.0," and that "there is no scientific evidence to prove that the acidity in our lakes and rivers is increasing." These two statements are not only false

but misleading. Evidence for the occurrence of long-term increases in the acidity of precipitation in North America include the following: (1) increases in the average annual acidity of precipitation in the years between 1955-56 and 1975-76; (2) changes in the alkalinity of surface waters, especially for the Hinckley Reservoir near Utica, New York, a major public drinking water supply; (3) changes in the amounts and patterns of fuel use in the United States and Canada since the industrial revolution began about 1850; and (4) changes in the sulfate and lead content of Greenland ice also since about 1850.

The average acidity of rain and snow in large parts of the eastern United States is now between 4 and 4.5. This is 40 to 50 times more acidic than what would be expected from natural sources of acidity. If all man-made sources of pollution were to be eliminated, the amount of acidity in rain and snow would undoubtedly decrease, based on the scientific evidence obtained from the 1955-56 to 1975-76 studies.

4. Your article goes on to state that "there is no evidence that acid rain is a hazard to public health." Yes, there is! Scientists have found that high acidity also increased the solubility of toxic heavy metals, such as aluminum, mercury and lead. These toxic metals can contaminate the fish and, in some cases, make them unsafe to eat. New York's Hinckley Reservoir has acidified to such an extent that when its water passes through household plumbing systems, lead from the soldered joints dissolves into the water at concentrations higher than the maximum levels recommended by the New York Department of Health.

Homeowners in the western Adirondacks area of New York recently have been complaining of corroding plumbing systems and suspicious-tasting tap water. Dr. G. Wolfgang Fuhs, an environmental scientist with New York's Department of Health, inspected area springs, wells and municipal water supplies and found home systems and springs with elevated levels of lead and copper. For each family, Dr. Fuhs had the same advice: Let faucets run a few minutes after nonuse overnight to lower metal concentrations before drinking or cooking.

5. Your article further states that some experiments have shown that acid water "increases crop yields." This is only partially true. Short-term fertilization effects due to atmospheric deposition of ammonia and nitrate tend to offset long-term nutrient leaching and other detrimental effects of acid precipitation on farm crops and forest ecosystems. Negative effects of atmospheric deposition on forest growth are most likely when nutrient deficiencies or imbalances are increased by acid deposition. A West German study recently linked acid deposition with the death of trees' feeder roots and the subsequent decline in forest growth.

In certain industrialized regions of the world, substantial damage to forests and agricultural crops is caused by the dry deposition of toxic gases. Sulfur dioxide, ozone, oxides of nitrogen, fluoride, and hydrogen chloride cause serious economic damage to crops and forests that must be considered together

with the possible effects of acid deposition. Recent experiments have shown that a combination of acid precipitation and ozone caused greater reduction in yield of soybeans than ozone alone.

6. Finally, your article states that "acid precipitation with a pH far lower than 5.0 has been recorded on many occasions in the Amazon jungle, Hawaii and even in the far South Pacific--areas far removed from the US power plants." While this statement is true, it merely illustrates that the acid rain phenomenon is a global problem that is not restricted to any one region or country. Furthermore, there are power plants not only in the US but in other industrialized regions of the world--Europe, Canada, the USSR, the Middle East, Africa, and Australia.

In summary, important changes are taking place in the chemical climate of the Earth. These changes are affecting the lakes, streams, fields and forests on which both the abundance and quality of our life depends. Wise management of these resources requires communication among biologists, hydrologists, atmospheric chemists, meteorologists, regulatory strategists, and both industrial and political leaders in the United States and other countries. Let us continue that communication by focusing our collective knowledge on the development of more adequate plans for management of air quality and its effects on plants, animals, soils, surface waters and materials. The current debate about possible revision of the Clean Air Act is one of the important occasions for such collective thinking.

Doyle Kline, Superintendent, Big South Fork National River and Recreation Area, Oneida, Tennessee.

REVIEW

THE NATIONAL PARK SERVICE, by William C. Everhart (Boulder, Colorado: The Westview Press, 1983), 198 pages, $23.50 hardcover, $10.95 paperback.

Bill Everhart's, *The National Park Service,* is a short book that all persons interested in the Service and the National Park System will want to read. It provides information, food for thought, commentary and, for old hands, a twinge or two of nostalgia. NPS Director Dickenson wrote that Bill's credentials for commenting on the Service "are as good as any man can have." All who know Bill will agree, and the book confirms this judgment. It reflects his deep knowledge of the Service, his insight and his ability to detect irony. The text displays his sense of humor, affection for the Service and its people--"his touchable heart," and his refreshing candor.

This is not a repeat of the Everhart book of the same title written a decade ago; the Service has changed somewhat since then, and there are those who would alter it even more. Bill has commented on much of this. For instance, some will agree with and others might resent his observation that the energy and idealism that once characterized the Service, if they have not vanished, are "victims of a slight recession."