preservation of air quality in the parklands, and this value is not localized to residents of the Southwest, and that Americans are willing to pay for clean air through higher entrance fees and/or utility bills. It was the hope of the authors of this article to get to this nation's decisionmakers information on the value of good visual air quality so that these decisionmakers could evaluate the costs of air pollution control vis-à-vis the benefits of visibility protection.

As discussed in the Summer 1982 issue of *The George Wright FORUM,* I would like to remind the reader that the opinions and interpretations expressed in these articles do not necessarily represent the position of the Department of the Interior or the National Park Service. A reading of the various materials will not serve as a substitute for a briefing by or discussion with representatives of the Solicitor's Office or Department of Justice officials. However, a thorough understanding of the subject matter discussed in the articles will provide the manager or planner with the background needed to insure that the briefings and discussions are more meaningful and productive.

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AN OUTDOOR LABORATORY
The Indiana Dunes

EDITOR'S NOTE: The following is reprinted from the June issue of the *Save the Dunes Council Newsletter.* It was written by Florence Broady and presents a lively look at the history of the Indiana Dunes plus a reference to the famous father of GWS member Dr. Charles E. Olmsted III (University of Northern Colorado). She also refers to Sacred Sands, a new book by another GWS member, J. Ronald Engel (Meadville/Lombard College, Chicago), a book well worth one's time (distributed by Harper and Row, 352p.). Indiana Dunes Superintendent Dale Engquist points out that the fourth paragraph is "probably legendary" but the grain of truth is at least as alive there as it is in the apocryphal story of the Yellowstone campfire--a legend that served the National Park Service well for a long, long time.

Dunes lovers see and feel the charm of the Indiana Dunes, the beaches, the woods, the plants and wild flowers, the sand dunes themselves, some high and spectacular, others low and manageable. But how many can tell why 10 leading European scientists visiting the United States in 1913, when asked what they would most like to see, the four sites named were: The Grand Canyon, Yosemite, Yellowstone Park and the Lake Michigan dunes? Professor Henry Cowles who shepherded them on their trip, after having visited dunes sites in Europe, was in his element, and the group tramped happily far and

wide in the Indiana Dunes.

Undoubtedly the other sites named provided far more spectacular scenery. When asked why the group included the Indiana Dunes, Cowles replied, "First, because in the Dunes is an utterly unique community of life...the common meeting ground of trees and wild flowers from all directions...a marvelous cosmopolitan preserve, a veritable floral melting pot." Plant succession, which might almost be called plant evolution, is clearly illustrated in this "outdoor laboratory" for those who have eyes to see.

To understand the visiting scientists' request in more detail, the best explanation so far is provided in the chapter entitled "The Birthplace of Ecology" in Ron Engel's book, *Sacred Sands*. Numerous scientific articles on the subjects of the various sciences represented have appeared but they are mainly for the scientists whose disciplines are involved. This brief and sketchy note attempts to summarize some of the high spots of the scientific significance of the Indiana Dunes.

It seems well established that Professor Cowles' first glimpse of the Indiana Dunes was from the window of the Michigan Central Railroad, predecessor of the South Shore, in 1896 on his way to a meeting in Chicago. He happened to look out and see an unusually diverse and rare mixture of plants growing together in a nearby swamp. A true scientist, he was so excited about it that he got off the train at Gary, hired a horse and buggy to go back and examine the area. The upshot of the incident was that he broke his connection with one of the eastern universities, joined the faculty of the University of Chicago, spent the rest of his professional life researching the Chicago area centered in the Dunes.

Henry Chandler Cowles published his first dissertation on the subject in the *Botanical Gazette*: "An Ecological study of the sand dune flora in Northern Indiana." To this day one of the most popular studies is a walk through notable and unusual wild flowers, meeting once a week for several weeks and headed by a professional botanist.

The study of plant succession was Cowles' goal and from it he learned the evolution of the land which produced the plants. He pointed out that no land formation is less stable than a sand dune. To quote from one of his articles: "...By burying the past, the dune offers to plant life a world for conquest, subject almost entirely to existing physical conditions...the advance of the dune makes all things new...The primary motive then, which prompted this present study was the feeling that nowhere else could many of the living problems of ecology be solved more clearly; that nowhere else could ecological principles be subjected to a more rigid test."

Cowles divided the process of dune succession into five major

stages: (1) the primitive formation of the beach, (2) the embryonic or stationary beach dunes, (3) the active or wandering dunes, (4) the arrested or transitional dunes, (5) the passive or established dunes.

Cowles discovered the bog sometime before 1913 during his many trips in the Dunes and took his classes to visit it. His students agree that one of the most fascinating parts of their trips was walking over the "quaking dome shaped mattress of water soaked vegetation. At its center was a raised island of tamarack and cedar surrounded by a sea of cattails and sedges." To Cowles and his students the island seemed like the "center of creation itself." Cowles called it a "history book with a flexible cover." The bog, named Cowles Bog, is now a national registered natural landmark.

Geology

Geologists study the dunes largely for the effects of the glacier sand. They point out that in the Lakeshore is the most completely preserved Great Lakes geological evolutionary sequence in the entire Great Lakes basin. To quote more of Engel's book, page 159: "Twenty thousand years ago, the head of Lake Michigan was covered by a great ice sheet (the last one--there were several) that blotted out the evolution of the land and its communities of life began all over again. The winds and waves went to work on the rocky shores of the glacial lake and soon tons of sand were piling up."

"Century after century this went on," Fuller, one of the leading geologists, wrote, "until the new earth measured many square miles spread out as a crescent about the southern end of the lake." While the outer edge was 20,000 years old, the inner ring built up only yesterday. This provided a living panorama of the natural history of 20,000 years, between the outer and inner rims, and thus the story of the earth itself.

In the period 1875 to 1925, the glacial and post glacial geography of the upper Mississippi Valley and the Chicago glacial plain were unraveled by Midwest geologists, a sort of stage for the 20,000 year evolutionary drama of the Dunes. Thomas Crowder Chamberlain was the geologist most responsible for the view of the Dunes as a "new earth."

The ice sheets pretty much leveled the Chicago plain, but deposited the sand forming the sand dunes. Formations we would call ridges are evidences of the glaciers and often mark their boundaries. Mantles of glacial drift mark the spots where the restless ice masses ceased moving for a time. The landscape inside the Indiana Dunes National Lakeshore represents seven successive stages of the Lake Michigan shoreline levels. The last sheet was especially important, Engel points out, "because as it melted, it created a lake in the depression between the Valparai-

so Moraine and the retreating ice front. When the water reached a certain height, it overflowed to the west along the line of the present Des Plaines River valley. This was the beginning of Lake Chicago, the ancestor of the present Lake Michigan. There were several more or less distinct stages in the history of Lake Chicago, marked by the ridges of beach sand and gravel deposited when the waters of the lake were stationary. Geologists Salisbury and Alden identified three major stages: the Glenwood when the water stood about sixty feet above the level of Lake Michigan, the Calumet at 35 or so feet, and the Tolleston at 20 feet. After the Tolleston stage a new outlet was opened to the north, the lake fell to its present level, and the history of Lake Michigan began."

Animal Ecology

Another fascinating branch of the Dunes studies is animal ecology, first noted by C. M. Child of the Zoology Department of the University of Chicago in 1903. He noted the potentialities of the sand ridges in the Dunes for the study of the relation of plant and animal succession. His first study was of the tiger beetle *(Cicindela)* and he noted that the plant societies and their changes correspond with the changes in the tiger beetle. These changes were caused by the changing soil conditions created by the succeeding plant associations.

So much scholarly work has gone into the study of animal ecology in the Indiana Dunes that it is almost an insult for a layman to try to outline it. To name a few of the studies in this regard: Ecological Succession II, Pond Fishes; Preliminary note on the Distribution of the Tiger Beetle *(Cicindela)* and its relation to plant succession; Life Histories and larval habits of the tiger beetles; (reported in the Journal of the Linnean Society of London) Ecological Succession; Stream Fishes and the Method of Physiography Analysis II; Pond Fishes.

Among the more recent scientists who have been most interested and helpful in the Save the Dunes movement was the late Charles E. Olmsted, Chairman of the Department of Botany, University of Chicago. Those of us who journeyed so often to Washington to persuade Congress to authorize the Park (finally succeeded in 1966) came to know Professor Olmsted quite well. He testified a number of times before House and Senate committees in favor of the proposed Park, and his testimony as to the scientific importance of the Dunes, and his prestige, carried great weight.

Professor Cowles and other early scientists in the region would be enthusiastic about the studies of the Dunes now being conducted by the Park Service, much of it aimed at preserving the important features. The science division of the Indiana Dunes National Lakeshore is composed of four scientists: Ronald J. Hiebert, Ph.D., Chief of Science Division, plant ecologist;

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