ECOLOGICAL RESEARCH IN EVERGLADES NATIONAL PARK

By Milton C. Kolipinski and Aaron L. Higer

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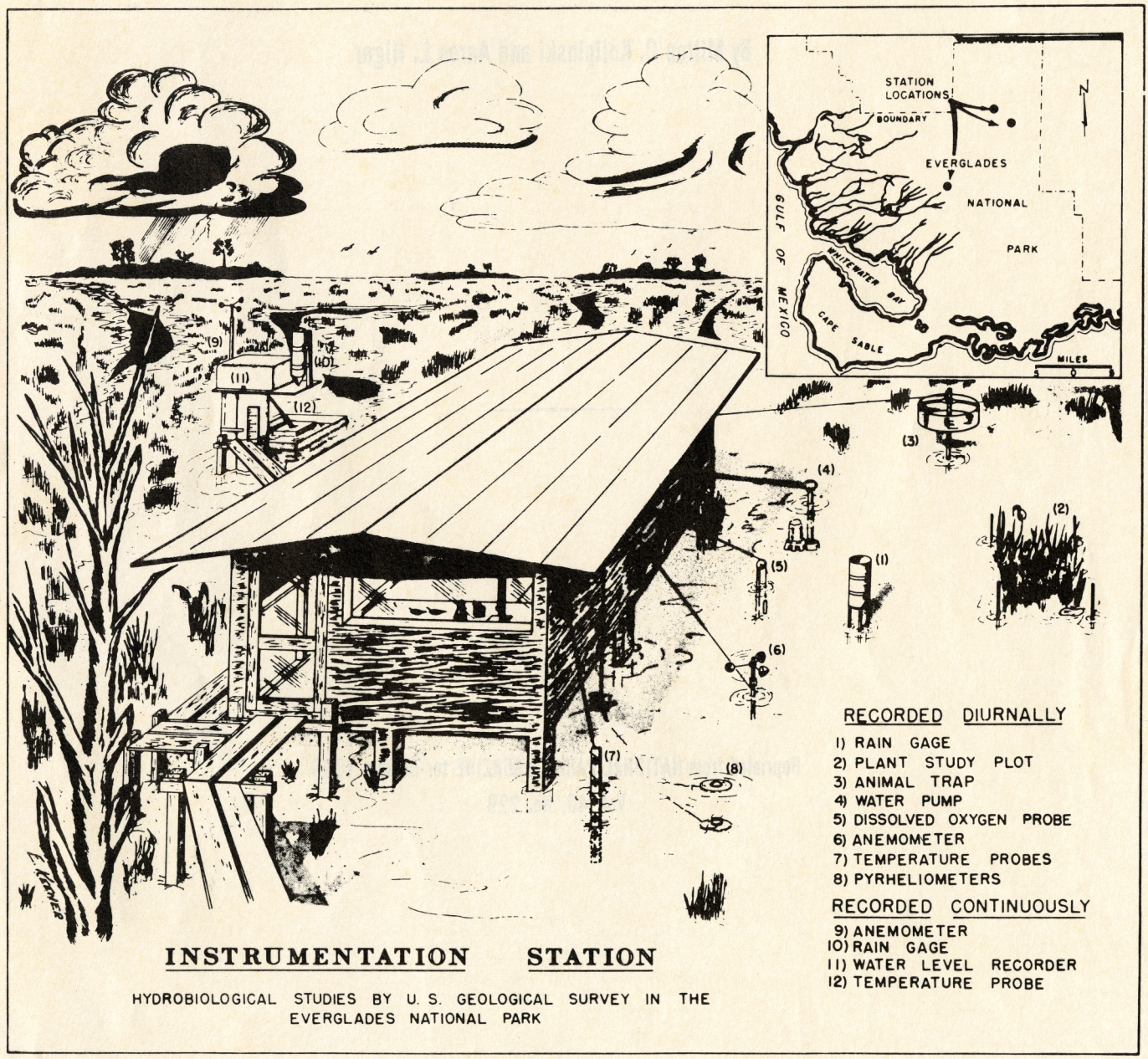


INSTRUMENTATION STATION

HYDROBIOLOGICAL STUDIES BY U. S. GEOLOGICAL SURVEY IN THE EVERGLADES NATIONAL PARK

THE EVERGLADES NATIONAL PARK, in southern Florida, encompasses low-lying fresh-water open glades interspersed with tree-islands sheltering alligator holes, all bordered by a brackish zone along the coastal shoreline. On slightly higher ground, a few feet above the fresh water, are stands of pine and oak. A myriad of birds, fish, reptiles, mammals, and plants live, give birth, and die in a delicately balanced hydrologic and biologic system that is the Everglades. The fresh-water glades is a broad, shallow river, poetically the "river of grass," which for countless ages has moved slowly southwestward from the center of the peninsula to the Gulf of Mexico.

Alternate dry and wet seasons for untold millenia created and maintained the ecological balance in the Everglades. In recent years, however, water diversions by man, above the northern boundary of the park, have altered the natural surface flow of water. Part of the water that formerly flowed southward is now impounded in large diked areas, for municipal and irrigation use during the dry months. However, the very lives of birds, other wildlife, and plants are dependent upon this impounded water, and the existence of Everglades Park is at stake.

Knowledge of water needs is essential to the management and preservation of the park as a biological sanctuary. For many years the U. S. Department of Interior's Geological Survey has been providing data on the water supply in and adjacent to the park. In 1964 the Geological Survey, in cooperation with the National Park Service, started an ecological research program to furnish additional facts on water needs and to assess the impact of the changes in the water supplies on the plant and animal life.

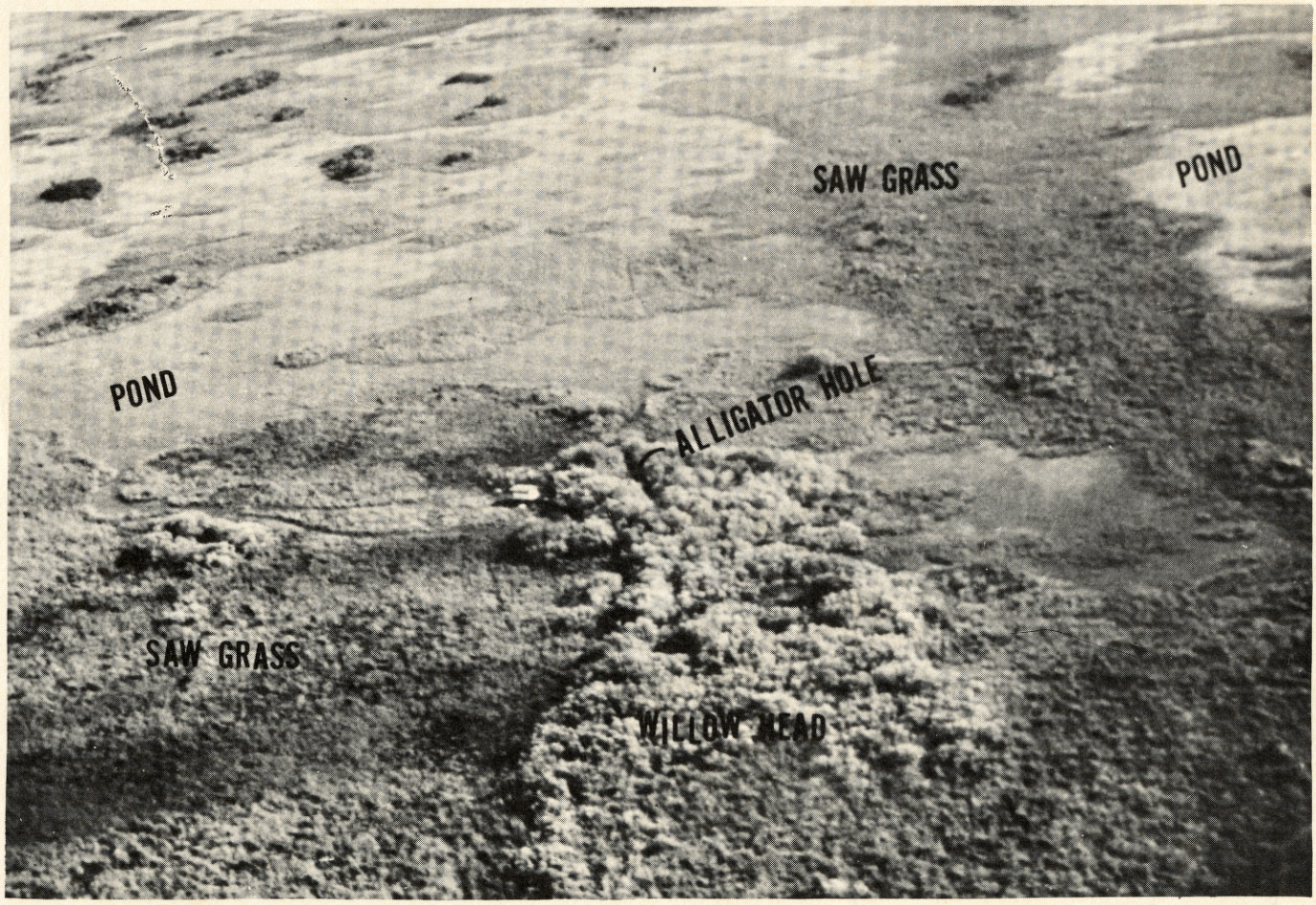
Study Sites

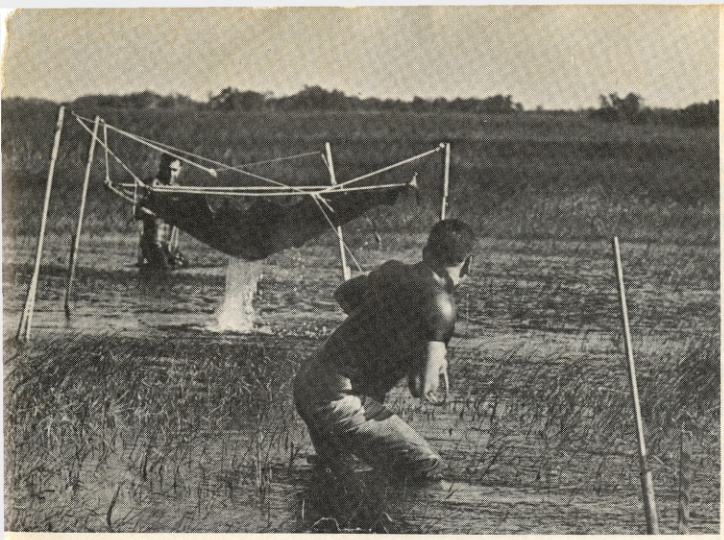
Three sites, representing a variety of aquatic environments, are being in-

Instrumentation stations have been built at remote locations in Everglades National Park to provide shelter for scientific equipment and researchers. At each visit by the scientists, measurements are made on an around-the-clock basis. Rainfall is measured at a gauge (1), plants are measured at study plot (2), animals are measured and counted using a specially-designed trap (3), water is pumped into the hut for chemical analysis (4), the amount of oxygen in the water is measured with a special probe (5), wind speed near the water is measured with an anemometer (6), water temperature at various depths is measured with probes (7), and the amount of sun's energy (solar radiation) that strikes the water surface is measured with pyrheliometers (8). In addition to these, continuous measurements are automatically made of wind velocity (9), rainfall (10), water levels (11), and water temperature (12) at all times, even when scientists are not at the site.

In the aerial view of the Everglades below the oval-shaped, dark areas in the background are tree-islands, or "heads." At the upper edge of the large willow head in the foreground (just to the left of the legend "alligator hole") is a hut housing instruments and personnel of the Geological Survey's ecological research program.

U. S. Geological Survey photograph: J. H. Hartwell





Newly devised traps for determining the density of aquatic animal populations in the open glades (left) and in alligator holes (right).

tensively studied: the fresh-water open glades, "alligator holes," and the brackish zone between fresh water and sea water.

The fresh-water Everglades consists of vast stretches of sawgrass interspersed with shallow ponds of water. Inhabiting the intermittent ponds are strands of aquatic sedges and grasses and a variety of swimming animals providing feeding grounds for marsh birds and whitetailed deer. During the rainy season the lower parts of sawgrass stems are immersed in water, but the slow seaward flow of the water and loss by evaporation and transpiration from plants gradually lower the water level until during the dry season it recedes into the underlying limestone. How do the animals manage to survive during the dry period, and how long can they withstand drought without being completely eliminated from the glades?

Abundant in the fresh-water Everglades is a biological and inorganic complex, called periphyton, composed basically of interlaced filaments and cells of algae, other microscopic plants, minute animals, and calcite forming a thick felt-like mat on the ground and around plant stems. Periphyton is chiefly responsible for the natural fluctuations in the chemical conditions of the water.

The alligator holes are present in many of the tree-islands interspersed throughout the open glades. Tree-islands are called hammocks if tropical mahogany and gumbo limbo trees predominate, or heads if willow, bay, or cypress trees predominate. Ecological conditions in fourteen of the hundreds of alligator holes in the park are currently under study.

A typical alligator hole may contain water to a depth of five feet during a high-water period or may be completely dry during an extreme drought. One hole, 60 feet by 40 feet, contains about 50,000 gallons of water during the wet season. Alligator holes serve as a vital last-ditch water refuge for fish and other wildlife during the dry season, and thus are essential to the biological survival of the Everglades.

Perhaps one of the more colorful pictures of wildlife activity in an alligator hole is given by Audubon in his description of the feeding habits of the wood ibis. Audubon states: "One of the most curious circumstances connected with this species is, that although the birds are, when feeding, almost constantly within the reach of large alligators, of which they devour the young, these reptiles never attack them; whereas, if a duck or heron comes within the reach of their tails, it is immediately killed and swallowed. The wood ibis will wade up to its belly in the water, around the edges of 'alligators holes,' without ever being injured; but should one of these birds be shot, an alligator immediately makes toward it and pulls it under water. The garfish is not so courteous, but gives chase to the ibises whenever an opportunity occurs. The snapping turtle is also a great enemy to the young birds of this species."

The brackish zone, a transition between the fresh-water glades and the open sea, is a distinct ecological entity. Here the shallow water of the glades funnels into stream channels as it flows southwesterly into the Gulf of Mexico. This zone of brackish water is as much as 12 miles wide; during the dry season it expands in an inland direction, and during the wet season it contracts seaward. At one upstream location, for example, the salt content of the water rises to about 60 percent of that in sea water during dry seasons. and decreases again to that of fresh water during wet seasons.

Plants and slow-moving animals in this transitional zone must be able to adjust to the fluctuations in the salt content of the water or perish. Fish and other faster-moving animals, however, can move upstream or downstream with changes in salinity of the water. One might expect a sparsity of wildlife in an environment of such drastic change, but a number of species common in both fresh and marine waters abound in the brackish zone. In fact, the brackish zone is a popular place for wading birds to build rookeries, probably because of the abundant food source in the form of aquatic animals.

The ecological research is aimed at defining the biological communities and the coincident variations in the period of water cover, water depth, salinity and other chemical and physical properties. Special traps are placed at

Dr. Kolipinski is an aquatic biologist with the Water Resources Division of the U. S. Geological Survey, Miami, Florida. Mr. Higer is a hydrologist with the same organization. They are associated in conducting the hydrobiologic aspects of the Survey's water resources investigations in the unique Everglades National Park of Florida.

instrumentation stations in remote locations in the park so that populations of animals in the water can be sampled and compared seasonally and from year to year. All fishes, aquatic insects and shrimps within a prescribed area and volume of water are captured, identified, counted, and then released. Their abundance serves as an index of the biological well-being of the environment because of their role as food for the larger, more prominent animals, including the birds and alligators. Changes in the occurrence and density of plants are recorded in study plots.

The effects of mineralized water from the deep, artesian groundwater system on animals and plants of the open glades are being studied. The tolerance of more than 20 species of aquatic animals to the salt in this artesian water has been tested in aquariums. The effects on plants are being observed on a two-acre study plot that is flooded at a rate of 1400 gallons per minute from a well 1300 feet deep. This study may determine the suitability of using this water to irrigate selected, restricted habitats during extreme drought to help preserve the biota.

Changes in vegetation that have occurred in the park since 1940 are being documented by study of aerial photographs taken in 1940, 1952, 1960 and 1964. Some changes in species composition, size, and shape of tree-islands, coastal mangrove forests, and plant communities in the open glades are natural, but some changes during the last several decades probably resulted from man's diversions of water that formerly flowed through the park.

The results of the ecological studies will be a prime factor in determining the timing and amount of fresh-water released into the park along the north boundry when based on the needs of the biota. The ecological and hydrological facts will aid in the preservation of the Everglades National Park as a wild, complex biological-hydrological system. ■

Ecological sampling stations in Everglades National Park are located on the map below. Shaded areas of map designate approximate locations of the Shark River and Taylor sloughs and the brackish zone (ecotone) between fresh and marine waters.

Federal Graphics, from a U. S. Geological Survey drawing