rate. Under many conditions these quantitative aspects of population growth are well summarized by the logistic curve of Verhulst and Pearl.

The increased crowding of animals often results in harm to the animals involved. This may produce a lowered survival and even extinction. This is one phase of the modern concept of the struggle for existence which is essentially a statistical principle and deals with changes in the birth-death ratio.

By the interaction of automatic cooperation and competition, that is through the activities involved in the struggle for existence, we come upon a whole set of ecological principles that center about organic evolution. This is a field which many modern ecologists appear to have avoided. All the factors of natural selection, *e.g.*, variation, overproduction, struggle for existence and the survival of the fittest are definitely ecological except for the important matter of the origin of those crucial variations which are not environmentally induced. At this one strategic point genetics has its only distinctive claim in the whole of the evolutionary field; otherwise, evolutionary dynamics belong in the realm of ecology.

Almost all other evolutionary principles are also ecological in nature: Lamarckian use and disuse, if these ideas have any place in modern thinking, Buffonian induction, orthogenesis in part and orthoselection wholly, and of course all isolation whether geographic, ecologic or physiologic in character. Subsidiary evolutionary theories such as sexual selection, mimicry and adaptive radiation are also wholly or mainly ecological.

Ecology deals not only with individuals and with communities of these individuals; it is concerned also with species and with their relations. This widespread, useful concept is in part an ecological tool and in part an expression of ecological forces. Among the ecological principles related to species there is another important rule of Jordan's that the nearest ally of a given species tends to occupy an adjacent area. This may be expanded to state that related and neighboring species tend to occupy separate niches and hence are in less direct competition than they would be otherwise. Stated with slightly different emphasis this takes consideration of the fact that the closest competitors of a given individual are the members of its own species; this forms the basis of territorial relationships such as have recently been much discussed, particularly among birds. The next closest competition for the individual comes from members of closely related species with similar ecological requirements. Hence related species find greater stability in their community relations if they occupy separate niches.

There is another set of principles that concern us which center about geographical distribution. Among these there is the generalization that vigorous species tend to occupy more space the greater their age; this is generally known as the age and area hypothesis and has limited application. Related to this is the extension that old races on the road towards extinction tend to be locally distributed over wide areas. Another related principle is the depth-age formulation of A. Agassiz, which states for oceanic life that forms with the greatest range in depth are those that show the greatest span in time. Among other principles of geographic ecology there is the tendency of the animals in the Arctic to resemble those in the Antarctic. This is usually called the principle of biopolarity. There is also the tendency for tropical oceanic communities to have fewer individuals per species as contrasted with the large numbers of individuals of the same species in colder waters. The fundamental principle of the relative stability of the present ocean basins, which limits our ideas concerning the extent and importance of land bridges, although still a matter of discussion, seems to be reasonably well established.

Then there are the principles related to emigration or dispersal, among which may be mentioned the suggestion of Matthew and Griffith Taylor that primitive animals tend to be located in remote corners of the world far from their centers of origin. Under other conditions, the primitive forms are located in the center of distribution which may or may not also be a center of origin and a center of survival.

In conclusion we recognize the inadequacy of the present presentation. We have not listed all those principles known to us as definitely ecological, and the selection has been uneven in quality. Possibly more relatively unimportant principles have been included than important ones omitted. Even this brief summary indicates that, plentiful as are the facts, there is no dearth of major and minor ecological principles about which to orient them. We trust that the analysis here presented and which may be elaborated in the future may contribute toward a more adequate synthesis of ecological knowledge. We believe that focusing attention on a theoretical framework will lead to more important work in ecology.

OBITUARY

STUART T. DANFORTH
1900–1938

ORNITHOLOGISTS, entomologists and naturalists who have visited Puerto Rico in the past dozen years will mourn the death of Dr. Stuart T. Danforth, which occurred at West Boylston, Mass., on November 25. Going to Puerto Rico soon after his graduation from Rutgers in 1921 to visit his father, Ralph E.

Danforth, who was professor of biology at the College of Agriculture at Mayaguëz at that time, he commenced observations on the birds of the Cartagena Lagoon, which, supplemented by more intensive work in 1923–1924, constituted the field work of his doctorate thesis for which the degree was granted by Cornell in 1925. After a year as instructor in biology at Temple University, he succeeded his father at Mayaguëz, and has taught zoology and entomology there since. In connection with his teaching he continued constantly studies and collections of birds and insects, especially Coleoptera, and studies in the food of birds, not only in Puerto Rico, but also in Hispaniola, Cuba, Jamaica and the Lesser Antilles, especially in those areas and islands most difficult to reach. His vacations were always thus occupied, except when he came to the United States to work in libraries and museums in connection with his various finds. Ordinarily one or more of his students accompanied him on his trips.

"The ultimate aim of ornithology, to my mind, is to make use of birds to the limit of their capacity as servants of man. I believe that eventually we will know so well how to encourage and protect birds that they will be practically one hundred per cent. efficient in protecting our forests and crops from insect pests, and that poisonous sprays and other protective measures will be unnecessary in the vast majority of cases." From this statement, one can possibly understand how it happened that he published no entomological papers, although the large number of "Danforth" and "AMC (Agriculture and Mechanics College)" records in "Insectae Borinquensis" testify to the extent of his insect collections in Puerto Rico and to his generosity in making them available for publication in another's compilation. Nearly every year, however, marked the appearance of a technical paper on the birds of one of the Lesser Antilles, but the culmination of all his ornithological observations in the West Indies was the publication in 1936 of the illustrated "Los Pájaros de Puerto Rico," a handbook supposedly for school children, but actually including all the information available; a most fitting summary of his chosen life-work. Some years ago he presented a collection of bird skins to Cornell, while the remainder of his extensive collection was given to the United States National Museum.

GEORGE N. WOLCOTT

RECENT DEATHS AND MEMORIALS

DR. RAYMOND A. PEARSON, since 1935 special assistant to the administrator of the United States Farm Security Administration, previously from 1926 to 1935 president of the University of Maryland, died on February 13 in his sixty-sixth year.

DR. WILTON EVERETT BRITTON, state entomologist of Connecticut since 1901 and head of the department of entomology of the Agricultural Experiment Station at New Haven, died at New Haven on February 15. He had celebrated his seventieth birthday on September 18 but continued at the station until he became ill a few weeks ago.

GEORGE CHARLES EMBODY, professor of agriculture at Cornell University, died on February 17. He was sixty-two years old.

DR. IVAN C. JAGGER, senior pathologist in the Bureau of Plant Industry of the U. S. Department of Agriculture, died on February 16. He was in his fiftieth year.

DR. J. C. FLIPPIN, professor of clinical medicine and dean of the Medical School of the University of Virginia, died on February 16 at the age of sixty-one years.

CHARLES RICHARD CRANE, manufacturer of Chicago and active in the diplomatic and political history of the United States, died on February 15 at the age of eighty years. Mr. Crane was known to the biologists of the country for his part in the development of the Marine Biological Laboratory at Woods Hole, where he had a summer residence.

ARTHUR SMITHELLS, from 1885 to 1923 professor of chemistry at the University of Leeds and from 1923 to 1937 director of the Salters Institute of Industrial Chemistry, died in London on February 8 at the age of seventy-eight years.

SIR ROBERT WILLIAM PHILIP, of Edinburgh, who was knighted in 1913 for his work in connection with tuberculosis, died on January 26. He was eighty-one years old.

Nature reports the death of Paul Séjourné, free academician of the Paris Academy of Sciences, who was known for his work on the design and structure of bridges, aged eighty-seven years, and of Professor Josef Simon, professor of roentgenology and radiology in the Masaryk University, Brno, aged forty-one years.

THE hundredth anniversary of the death of Josiah Willard Gibbs, who was born on February 11, 1839, was commemorated by Yale University on February 16 with a memorial lecture by Dr. Charles A. Kraus, research professor of chemistry at Brown University and president of the American Chemical Society. Gibbs, regarded by many as the greatest American scientific man, was born in New Haven in 1839 and was professor in Yale University from 1871 until his death in 1903.