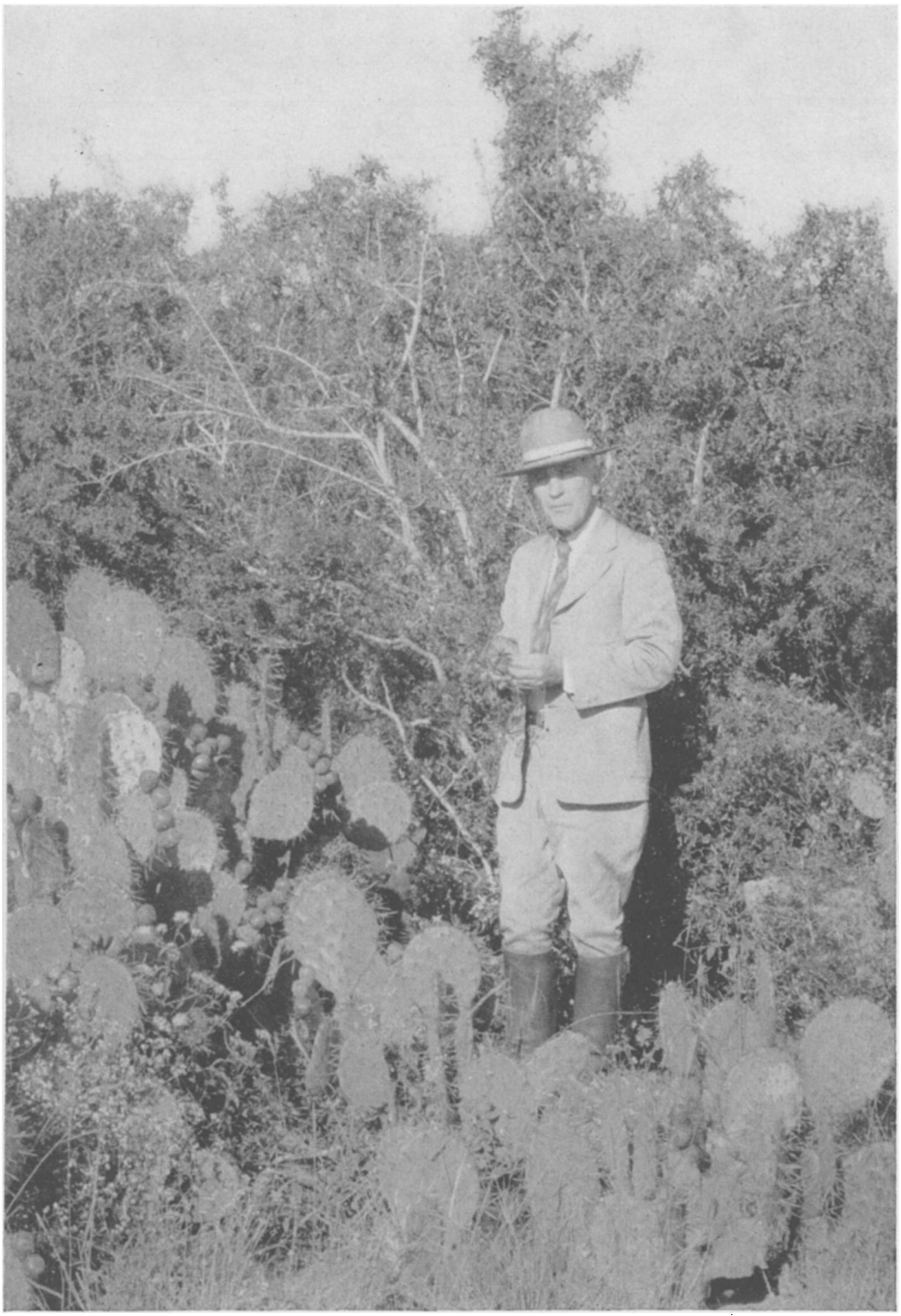

FREDERIC EDWARD CLEMENTS

1874-1945

FREDERIC EDWARD CLEMENTS

RAYMOND J. POOL
Department of Botany, University of Nebraska, Lincoln, Nebraska

Well do I recall the day in the early summer of 1904 when I first met Dr. Fred Clements. Our class in high school botany had learned of him from a guide for laboratory work which he had published. That summer day when Clements stepped from the local train in a small Nebraska town, we were on the platform to greet him. He and his wife were on their way to attend the Louisiana Purchase Exposition which was then in progress in St. Louis. It was thus that we met Dr. Frederic Edward Clements very early in the half-century during which he forged an amazing career as one of the world's outstanding figures in the general field of biology and in the rapidly evolving specialty of plant ecology. He was an unusually bold, brilliant pioneer as he set out to help to formulate the fabric and to mould the trend of American thought in teaching and research in plant ecology.

Clements entered the field of ecology at an opportune time and place. He was born September 16, 1874 in the shadow of the young University of Nebraska, which itself was only five years of age. The University was in the pioneer village of Lincoln, then less than ten years old, and in an area that had achieved statehood only seven years previously. Famous Indian battles were yet to be fought across the rolling grassland frontiers. The broad Nebraska prairies were largely yet to feel the plough. The stage was ready for the coming of the men of science who eventually were to make the flora and the natural vegetation of the vast Prairie Province of North America the best known and the most intimately known of all the world's great grasslands.

Young Clements entered the University of Nebraska when he was but sixteen. There he earned the B.Sc. degree in 1894, the A.M., in 1896, and the Ph.D., in 1898, the latter for outstanding work in phytogeography. His alma mater conferred the degree of LL.D. upon him in 1940. His thesis for the master's degree was entitled: "The Histogenesis of the Caryophyllales," and for the doctor's degree the thesis was on: "The Phytogeography of Nebraska." The latter work was published with Roscoe Pound as joint author. The two theses were early indicators of Clements' expanding interests in the fields of morphology, taxonomy, phylogeny, and ecology that were to characterize his entire life.

Dr. Clements served on the faculty of the Department of Botany at the University of Nebraska from the time he was appointed a laboratory assistant in 1894 until he resigned as a full professor in 1907. The latter year he accepted the position as Professor of Botany and Head of the Department of Botany at the University of Minnesota. He left Minnesota in 1917 to become a Research Associate in Ecology with the Carnegie Institution of Washington, D. C., a position to which he devoted the rest of his life. He and his wife, who for many years was his assistant and illustrator, lived in Tucson, Arizona until 1925 when they moved to Santa Barbara, California. During these years the Clementses maintained an interesting Alpine Laboratory on Pikes Peak in summer and, after the move to California, he also assumed the supervision of the work at the Coastal Laboratory of the Carnegie Institution at Santa Barbara during the winter months. During these many years of uninterrupted research, Clements familiarized himself with the vegetation of North America with a thoroughness that has never been surpassed.

Clements was a member of numerous state, national, and international scientific and professional organizations and societies. He served on International and American Nomenclature Commissions in 1905 and 1902 respectively. Member, British Ecological Society; Societas Phytogeographica Suecana; Real Academia Agricoltura Italiana; International Congress of Science, Secretary 1903. He became a member of the A.A.A.S. in 1896, elected Fellow in 1898, Councillor 1905 and 1909, and General Secretary 1910; Botanical Society of America 1898, Vice-President 1905, Councillor 1906-1910; Mycological Society of America, Secretary 1903; Society of American Naturalists, Director 1905; American Microscopical Society 1897; American Geographic Society 1900; American Breeders Association 1908; Ecological Society of America; Director, International Phytogeographical Excursion in America, 1913; Associate Editor, Mycologia 1907; American Society of Plant Physiologists; American Society of Mammalogists; Society of American Foresters; Paleontological Society of America; American Meteorological Society.

During his undergraduate and graduate years at Nebraska, he was a leader of scientific and

cultural organizations and was elected to Phi Beta Kappa and Sigma Xi. He served in official capacities in the latter societies, as well as in the Nebraska and Minnesota Academies of Science. He was an idealist of the highest type and his brilliance of mind and broad interest in many fields of science, history, politics, and society made him a sparkling conversationalist and companion. His approaches to the teaching profession, and to ecological research, were characterized by a boldness and originality which approached the iconoclastic at times.

A feature of Clements' early education, training, and experience that is not widely known was the depth and breadth of the foundation he laid for his career. He was doing extensive and intensive work in the field and laboratory on the taxonomy of the flowering plants and fungi and in phytogeography while still an undergraduate. He was a responsible assistant in the Department of Botany at a very early age. He had also taken much work in modern language and literature and in the classics. His thorough training in language was to prove a very valuable asset as, in later years, he endeavored to build a properly formed and meaningful set of scientific terms which the growing field of ecology badly needed. His sincere and constant effort to formulate and to stabilize a sensible, workable, and much-needed terminolgy for ecology was soon to mark him and in later decades to make him widely known.

At the beginning of the century, there were not a half-dozen ecologists in the whole world. When the "Phytogeography of Nebraska" was published there had been few serious attempts by anyone anywhere to analyze the structure and evolution of the vegetation of the world or any small part of it except in the most general way. There were then but a few observational phytogeographers even in the Old World. No one had yet subjected American habitats to a detailed analysis as to their origin, flora, structure, or life history as might be determined by ecological procedures. There were few or no instruments then available for such research and no one had set up acceptable methods for such investigations. The time was certainly ripe for the introduction and evolution of research methods in ecology. The development of a distinctive language by which ecologists could explain their especial interests and their findings to others was an imperative need.

The methods of ecological research and the ecological terminology that were evolved by Clements have been debated for a half-century. This is not the place to review this interesting phase of the history of plant ecology The subject has been argued and reargued throughout the world wherever ecologists have gathered. Much of the critical attitude on this matter has stemmed from rather small sources when comparative background and practical experience are considered. It is perhaps appropriate and sufficient at this point to state an old maxim that the "proof of the pudding is in the eating thereof."

When one observes that the Clementsian principles of dynamic ecology, and, yes, much of the Clementsian brand of ecological terminology, have for a long time been thoroughly tested and used in scores of intensive and extended researches on vegetation throughout the world, one may conclude that the "pudding" must have been pretty good. The writer of this brief *vita* has frequently noted the adoption of various Clementsian features of ecology in the research programs and publications of such significant fields as forestry, grazing management, soil conservation, general agriculture, and even in zoology. This has been all the more amazing to one who knew Clements as a man with little or no original background in scientific or practical agriculture. The jargon and point-of-view of the farmer, the forester, the rancher and stock grower were mastered by Clements long after he had formulated his ecological philosophy and developed his principles and practices. One of his greatest pleasures in later life was to follow the success of the various agricultural projects and other practical researches which had utilized the procedures that his own endeavors had established. A leading European ecologist has fittingly stated that: "I am sure that Clements is by far the greatest individual creator of the modern science of vegetation and that history will say so."

Dr. Clements passed away in Santa Barbara, California, July 26, 1945, without issue. His devoted wife, Dr. Edith S. Clements, widely known for her excellent work as a botanical draftsman and author, lives at present in La Jolla, California.

Publications

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1913. Rocky Mountain flowers.* With E. S. Clements. Wilson.

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FREDERIC E. CLEMENTS AS I KNEW HIM

ROSCOE POUND
Law School, Harvard University, Cambridge, Massachusetts

As a man, Frederic E. Clements was thoroughly conscientious, possessed of high ideals, and devoutly religious. He was tirelessly diligent, full of enthusiasm, very cooperative, and of good judgment. Also he showed the highest good taste in appearance and in all that he said and did. To all this I can testify with assurance from close association with him for more than a dozen years. I first saw him when, as a small boy, he used to deliver the morning paper. Later I saw him on the "scrub team" at football practice. But I did not become really acquainted with him till as a sophomore at the University of Nebraska he became a worker in the Botanical Survey of Nebraksa of which I was then Director.

It was my privilege to see him grow up as a botanist. As an undergraduate, he found himself in an atmosphere of great botanical activity especially in field work. Dr. Charles E. Bessey came to the University of Nebraska as Professor of Botany in the school year 1884-1885 and quickly attracted an enthusiastic group of students. In the school year 1885-1886, a group of seven began to work in the field together and to hold weekly meetings to read and discuss papers. This was the beginning of what became in 1887-1888 well-organized as the "Sem. Bot." Of those of the seven who went on in botany were J. G. Smith and myself of the class of '88, Herbert Webber of the class of '89, and A. F. Woods of the class of '90. I was Profesor Bessey's assistant in the school year 1888-1889, Webber held the place in 1889-1890, and Woods for some years after 1890-1891. In the school year 1891-1892, Smith and I started the Botanical Survey of Nebraska and the Flora of Nebraska. In July and August of 1892, Smith and I went through the sand-hill region of Nebraska on foot with a pack horse for supplies and instruments. We published at our own expense Part II of the Botanical Survey of Nebraska, Flora of the Sand-Hill Region, in April, 1893. After 1891, the "Sem. Bot." took in a number of graduate students of whom I remember particularly Rydberg, Saunders, and Shear, and work on the Botanical Survey and the Flora of Nebraska went on actively and continuously. Some or all of us went over substantially every part of the state collecting and observing.

As a freshman, Clements came into this active and enthusiastic botanical center in the school year 1890-1891 and took his degree of B.Sc. in June, 1894. In 1891, when he was a sophomore,

Woods and I were attracted by his zeal, ability and diligence. We devised a grade of "Cand." (I suppose *Candidatus*) for him and later promoted him to "Nov." (I suppose *Novitius*), and he entered actively into the work of the Botanical Survey and the Flora of Nebraska.

In 1895, I read Drude's "Pflanzengeographie von Deutschland" and published a review under the title "The Plant-Geography of Germany" in the *American Naturalist* for June, 1896. Clements and I had begun working together in that year after he succeeded Woods as Professor Bessey's assistant and we wrote together the portion of Part 4 of the Botanical Survey of Nebraska which had to do with the Fungi. This was published in January, 1896. At the time, after reading Drude's book, I got the idea of a Phytogeography of Nebraska. Clements took up the idea with enthusiasm and we worked upon it together at night (we were both busy in the daytime) for two years, publishing the first edition of our Phytogeography of Nebraska in 1898. We worked together on Fungi, on the Botanical Survey, and as editors and, in part, writers of the Flora of Nebraska until in 1901 pressure of professional work compelled me to give up regular activity in Botany. In particular, I remember how we worked out together by trial and error in the field the "quadrat method" described in our paper "A Method of Determining the Abundance of Secondary Species," published in *Minnesota Botanical Studies*, Vol. 2, June, 1898. This method he developed later into a more practical procedure. Besides the Phytogeography, we wrote together and published some seven papers between 1896 and 1898.

As we worked together, he told me he felt the need of linguistic training. The scientific curriculum had little place for languages beyond a small secondary school requirement of Latin. With characteristic energy, diligence, and determination he set to work to remedy the deficiency by self-teaching. I know the progress he made in Greek, reflected in his "Greek and Latin in Botanical Nomenclature" in 1902, and of his acquired ability to read in many languages. He even got a reading knowledge of Polish in order to be able to use Rostafinski's authoritative book on the slime-molds.

After 1894, Clements took the lead in the "Sem. Bot." and made it what it finally became. His great work was done in ecology after 1901 when I could no longer work with him and I know of it only from such botanical reading as I have been able to do in intervals of leisure. In 1907, he went to Minnesota as Professor and I to Northwestern as Professor of Law and to my great regret our paths parted.

Of his work in ecology, others are better qualified to speak than I who have been out of botany for fifty-two years. But as I read his writings after 1904 it seemed to me that he was increasingly developing a biological philosophy. I remember how he and I used to discuss Linnaeus' "Philosophia Botanica," a wholly unphilosophical book as we use the term philosophy today, and Spencer's "Principles of Biology" of which we had expected great things in the days when Comtian Spencerian positivism was almost a religion to scientists. Professor Bessey warned us that we would get nothing out of the book, but we read and discussed it only to find he was right. Our discussions during the controversy between the Darwinians and the Lamarckians at the beginning of the present century were more fruitful. Science has outgrown her philosophers. But Clements had an eminently philosophical mind.

The days of his work on the Botancial Survey of Nebraska were those of low salaries and meagre, if any, appropriations for research, field work, and printing. Much of the expense came out of our own pockets, which were empty enough. Much had to be begged from scientifically minded donors. Clements never grumbled, never became discouraged, never gave up. He went ahead uncomplainingly doing the best he could with what was available.

He played football in high school and, as I have said, on the "scrub team" in college. He rose to be an officer in the Cadet Battalion. He could and did walk a steady three and one-half miles an hour for hours at a time in the field. But I have suspected that this was largely a conscientious application of his will more than an exhibition of exceptional physical strength. His bodily strength was fortified by great strength of will.