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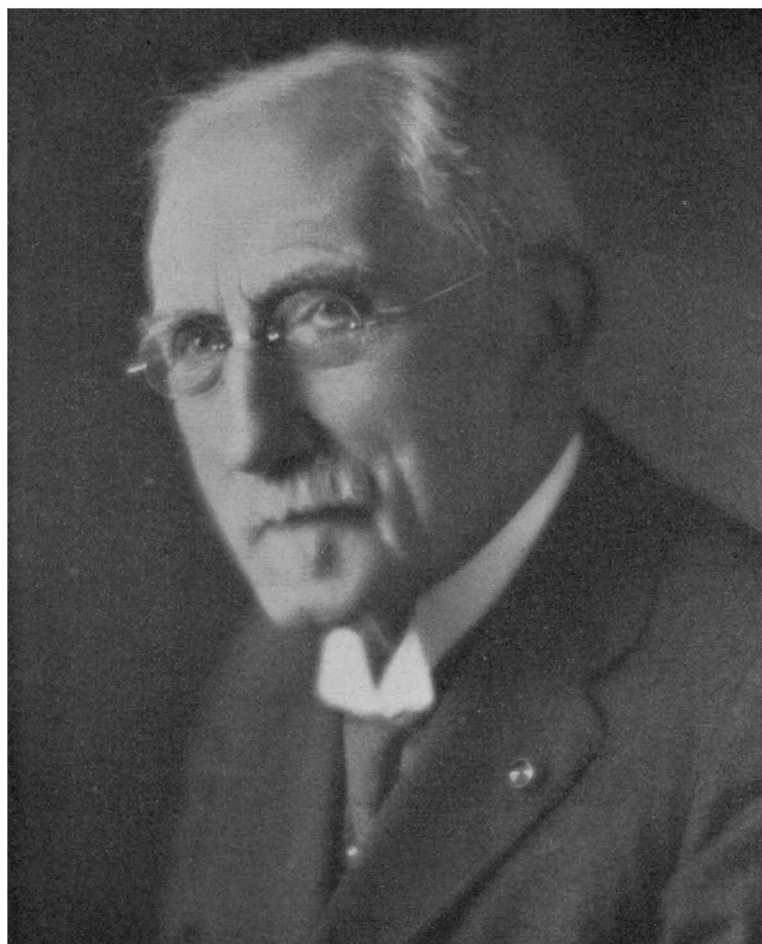
STEPHEN ALFRED FORBES

1844-1930

BY

L. O. HOWARD

PRESENTED TO THE ACADEMY AT THE ANNUAL MEETING, 1931



Stephen A. Forbes

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Chronology

- Born at Silver Creek, Stephenson County, Ill., May 29, 1844.
Attended the district school from school age to the age of 14.
1858-60, studied at home, under brother's instruction.
1860, attended Beloit Academy.
1861-5, soldier, U. S. Army.
1866-7, attended Rush Medical College.
1867, raised strawberries at Carbondale, Ill.
1867-9, studied and practiced medicine under a preceptor at Makanda, Ill.
1868-70, taught school and studied science at Makanda, Ill.
1870-1, taught school and studied science at Benton, Ill.
1871, studied at Illinois State Normal University.
1871-2, taught school and studied science at Mount Vernon, Ill.
1872-7, curator, museum of the Illinois State Natural History Society, at Normal, Ill.
1875-8, instructor in zoology, Illinois State Normal University.
1877, founded, and to 1917, Director, Illinois State Laboratory of Natural History.
1882-1917, State Entomologist of Illinois.
1884, Ph.D., University of Indiana.
1884-1909, professor of zoology and entomology, University of Illinois.
1886, awarded first-class medal of the Société d'Acclimatation de France, for scientific publications.
1888-1905, Dean, College of Science, University of Illinois.
1891-2, biological expeditions, Rocky Mountains, U. S. Fish Commission.
1893, special agent, U. S. Fish Commission; Director of the Aquarium, World's Columbian Exposition; Chairman, International Congress of Zoologists; President, American Association of Economic Entomologists; also pre-

- pared natural history exhibit of Illinois for Columbian Exposition.
- 1894, established Illinois Biological Station.
- 1901-7, President, National Society of Horticultural Inspectors.
- 1905, LL.D., University of Illinois.
- 1908, President, Illinois Academy of Science; American Association of Economic Entomologists.
- 1909-21, professor of entomology, University of Illinois.
- 1912, President, Entomological Society of America.
- 1917-30, Chief, State Natural History Survey.
- 1918, elected member National Academy of Sciences.
- Died at Urbana, Ill., March 13, 1930.

This chronology is taken from a pamphlet entitled "In Memoriam Stephen Alfred Forbes" published by the University of Illinois shortly after his death. To the chronology is added a list of the societies of which he was a member, which included among others the American Philosophical Society and the Entomological Society of France. It is also stated in the same paragraph that he was an honorary member of the American Ornithologists' Union; had been President of the Ecological Society of America, and that he was an honorary member of the International Congress of Entomology.

In the same pamphlet was printed a short article on Doctor Forbes' ancestry, education and character, written by his son Ernest Browning Forbes of the State College of Pennsylvania. He was the son of Isaac Forbes and Agnes Van Hoesen, and, racially speaking, was Scotch on his father's side and Dutch on his mother's, both theoretically and practically an admirable mixture. The first authentic record of his American ancestry is the marriage of Daniel Forbes in 1660 to Rebecca Perriman at Cambridge, Mass. There seem to be no authentic records of the origin of this Daniel or of his emigration from Scotland. From this Daniel, through Thomas, Aaron, Stephen, John and Isaac, came the subject of this sketch. Of his great grandfathers, three at least were soldiers in the Revolutionary War, namely, Stephen Forbes, who lived at Brookfield, Mass., and later at Hardwick in the same State, who served in a Hardwick company and was

given land in Vermont; Garrett Van Hoesen (on the mother's side), a sergeant in a company of sharpshooters under General Schuyler; and Captain Isaac Sawyer, a Yale student who served with distinction in the Sullivan campaign against the Iroquois in 1779.

It is Professor Ernest Forbes' opinion that among the later ancestors of his father those who left the deepest impress were his mother, who was a high-strung woman, and his paternal grandmother whose name was Anna Sawyer and who is said to have been the strongest source of the intellect of all of her descendants.

At the time of Stephen's birth at Silver Creek, Stephenson County, Illinois, the family lived in a log house on a small farm and in a condition of privation general among the pioneer families of the Middle West. His father was obliged to sell the farm upon which this log house stood, as the result of having endorsed a note for a friend, and had to begin again on a new farm, in a house built of slabs.

There were six children, namely, Flavilla Anna, born 1824, married 1842; Francis Van Hoesen, born 1828, died 1848; Mary Elizabeth, born 1831, married, 1850; Henry, born in 1833; Stephen, 1844, and Agnes Verneth, known as "Nettie," born 1845.

When Stephen was ten years old his father died. The older brother Henry was then twenty-one, but had been independent since he was fourteen, and at the time was working his way towards a college education for which he had prepared at Freeport and Rockford and on which he had made about two years' progress by private study. Stephen, his mother and Nettie were living on a farm of 140 acres, poorly equipped and heavily mortgaged, living in a cabin of a single room in which was a cook-stove at one end, two beds at the other, a trundle bed under one of them, and a dining table in the middle. At one side of the building was a little "lean-to" containing a single bed on which the father of the family died. The mother was broken in health, and the two younger children were practically helpless. Henry, however, stepped into the breach. Professor Forbes has written—

"Without an hour's hesitation he gave up his personal plans, abandoned his career for which he had already given brilliant promise, and took upon his own shoulders the burden of our support and education; and from that time on for the next seven years he was not our guardian merely, but he was our guardian angel.

"He saved enough on the farm to build us a comfortable home. He taught me French, sent me to Beloit to prepare for college, and helped my sister to the Woman's College at Northwestern University at Evanston; and when the Civil War broke out he sold the farm, paid off the still existing mortgage, gave my mother the residue of the family funds to live on with her eldest daughter Flavilla, borrowed the money with which to buy his horse and mine for the cavalry service, and to the war we went together, he as lieutenant and presently captain of our company, becoming later lieutenant colonel of the regiment and colonel by brevet." (From E. B. Forbes.)

As to the details of the Army service of S. A. Forbes, I am able to quote from an unpublished autobiographical sketch in a letter that he wrote in 1923 and which I take from the *Scientific Monthly* of May, 1930:

"My army service, concerning which you ask particulars, was begun by my enlistment as a private in Company B, 7th Illinois Cavalry, in September, 1861, when I was seventeen years old. At eighteen I was made orderly sergeant; at nineteen, second lieutenant, and at twenty, captain of my company. Just after my eighteenth birthday, when sent to carry an important dispatch to a distant outpost near Corinth, Mississippi, I was put upon the wrong road and presently found myself inside the rebel lines as a prisoner of war. Telling my captors that I had a verbal message only, which I refused, and they did not compel me, to disclose, I availed myself of an opportunity to tear up my dispatch, secretizing the fragments in the pistol holster on my saddle. At General Bragg's headquarters I was threatened with hanging if I did not produce my dispatch and was thoroughly searched for it, as was also my saddle, but nothing was found. Later in the day I had a brief interview with General Beauregard, in command of the rebel army after the battle of Shiloh, and a much longer one with a major of his staff, who ended by wishing me good luck, and telling me to appeal to him if I got into trouble. I was in prison four months, at Mobile, Alabama; Macon, Georgia; and Richmond, Virginia. Utilized my abundant leisure by studying Greek from books which I managed to buy at Mobile. When

paroled and released, I was sent to a hospital for three months to recover from scurvy and malaria, acquired in prison. Rejoined my regiment, reenlisted for the war, and was mustered out in November, 1865."

This is a very short and very modest account of the boy's war adventures. He was only twenty-one when he was mustered out (he had the rank of Captain at twenty), and yet he had seen nearly five years of service. The experience, apparently, hurt neither his mind nor his physique. Perhaps in the long run it was physically good for him; and the boy who used his days in a Confederate prison studying Greek was surely one whose mind was not rusting. Writing of him in *Science*, April 11, 1930, Dr. Henry B. Ward says, "It was a source of great delight to hear the story of those days, when on rare occasions he could be persuaded to relate to younger friends some of his experiences in the field."

And now as to the matter of education. In the unpublished autobiographical sketch from which we have quoted the paragraph regarding his army service, he states, "My formal education . . . was incomplete and fragmentary, partly because of the poverty of my family, my father, a pioneer farmer, having died when I was ten years old, and partly because the Civil War took me away as I was getting ready to enter college."

In the chronological list beginning this account occur the items, "Attended the district school from school age to the age of fourteen; 1858-60 studied at home under brother's instruction;¹ 1860 attended Beloit Academy."

The attendance at Beloit Academy in 1860 was a difficult one to bring about, on account of lack of money. Ernest Forbes writes in his account, "When the young Stephen was obliged to give up his studies at Beloit Academy, because the last available dollar was gone, he had to take his trunk to the railroad station in a wheelbarrow." And he has since written me, "This year at Beloit was enjoyed at the expense of real hardship for the family at home. The letters written to Stephen contained repeated

¹ Henry taught Stephen the French language, and Professor Henry B. Ward states that he studied Italian and Spanish at this time.

suggestions that he try to find a cheaper boarding place, and serious debate of his expressed desire to spend one dollar and twenty cents for a glass lamp, since his eyes suffered as a result of study by candle light."

According to S. A. Forbes' manuscript sketch, when he returned from the war he began and nearly finished a course in medicine at Rush College in Chicago. We must not be satisfied with this bare statement. In his printed account, Professor Ernest Forbes says, "He discontinued his medical studies before their completion, however, because his savings from his career as a soldier became exhausted and because a series of incidents having to do mainly with surgical operations without the use of anesthetics convinced him that he was not temperamentally adapted to medical practice." And then he goes on to write, "His interest in natural science was determined by an academic tradition in the family, by an agricultural background, by four years' out-of-doors experience in the Army, by a naturally thoughtful habit, and by a continuing scientific interest after the cessation of his medical studies."

The chronology shows that he raised strawberries at Carbondale, Ill., and taught school and studied science at Makanda and Benton, and that he studied at the Illinois State Normal University in 1871. It was about this period (in 1870) that his first notes were published, under the heading "Botanical Notes (from Southern Illinois)" in the *American Entomologist and Botanist* for September and October of that year. This journal was then edited by C. V. Riley, and each number contained a botanical section under the editorship of George Vasey then living at Richview, Ill. The notes by Professor Forbes had evidently been sent in by request. They were confined to the counties of Union and Jackson, Illinois, gave a running account of the topography of the region, and discussed the plant growth in such a way as almost to foreshadow his future interest in the broad study of environment and association that became known as ecology. At all events they secured the warm approbation of Doctor Vasey, with whom he corresponded frequently on botanical subjects.

In his unpublished autobiographical sketch, Professor Forbes, after referring to his unfinished course in medicine, goes on to say, “. . . but becoming infatuated with a study of the botany of southern Illinois I changed my plans, taught school for a living, and studied natural history as an avocation, with the result that when Major J. W. Powell, afterwards U. S. Geologist, resigned in 1872 as Curator of the Museum of the State Natural History Society at Normal, Illinois, I was chosen to succeed him there.”

The old Illinois State Natural History Society had been in existence since 1858. It was chartered in 1861. Its museum was housed in the building of the State Normal School at Normal. Its final business meetings were held in Bloomington, May 26th and June 22nd, 1871, and its museum was then formally passed over to the State of Illinois to be held by the State Board of Education “for the use and benefit of the State.” The earliest curator was Dr. J. A. Sewall, instructor in chemistry in the State Normal School and afterwards President of the State University of Colorado. The second curator was Major J. W. Powell, and he held this post when he made his well known western explorations. Major Powell's deputy in the Museum, who, however, served as the actual curator, was Dr. George Vasey. In 1872 Doctor Vasey was appointed Botanist of the United States Department of Agriculture in Washington and Curator of the U. S. National Herbarium under the Smithsonian Institution. He took the oath of office April 13 of that year.

Doctor Vasey (who was then a man of fifty) had a high opinion of young Forbes. They both belonged to the Natural History Society; Forbes had studied at the State Normal University in 1871, and, moreover, Doctor Vasey must have been impressed by the character of the notes Forbes had sent in for publication in the *American Entomologist and Botanist*. I take it, and in fact I have been told, that it was largely Vasey's recommendation that secured Forbes the appointment as Curator of the Museum in 1872.

Most of the facts in the last two paragraphs are taken from a long, careful and admirable address given by Professor Forbes on the occasion of a meeting called to establish the Illinois Acad-

emy of Sciences. It is entitled "History of the Former State Natural History Societies of Illinois," and was published in *Science*, December 27, 1907, pages 892-898.

For the next two or three years he was diligently occupied with his duties as curator, but found time to publish several papers, mostly relating to the study of natural history and how natural history should be taught—really educational papers. Then came the first Summer School of Natural History and his appointment as Instructor in Zoology in the Illinois State Normal University. In his 1907 address on the natural history societies of Illinois, he mentions this summer school and its effect in bringing about the organization of the second natural history society of the State. It will be interesting to quote his words:

"Under the influence of Darwin and Agassiz and Huxley, a transforming wave of progress was sweeping through college and school, a wave whose strong upward swing was a joy to those fortunate enough to ride on its crest, but which smothered miserably many an unfortunate whose feet were mired in marsh mud."

Has this movement ever been so concisely and perfectly put into words? He goes on to say,

"This wave reached central Illinois in the early seventies, with the effect to bring about in 1875 a summer school of natural history at the State Normal School—only two years, it will be noticed, after the first session of the Agassiz School at Penikese. Wilder of Cornell and W. S. Barnard, just back from Europe with a doctor's degree, were members of its teaching staff, together with Burrill of the State University, Thomas, the State Entomologist, and the present writer, who was also director of the school. Besides an abundance of living plants and animals of our own environment, we had great boxes and barrels of marine material in large variety, some of it received alive, secured by a most active collector engaged for the purpose, who scoured the New England coast for us from Portland to Buzzard's Bay."

The school was a notable success. The Philadelphia Centennial Exposition of 1876 deranged plans for its immediate continuance, but a second summer session was held in 1878 and the students organized themselves into the second of the Illinois State natural history societies. Obviously this summer helped

to turn Forbes' attention to aquatic things, for in December, '75, he published his first strictly zoological paper—on *Amblystoma*; and in the following year he published his "List of Illinois Crustacea with Descriptions of New Species"; and in 1877 was published the first of his papers on the food of birds, the first one on the food of fishes appearing in 1878. In 1878 also appeared the first of his strictly entomological publications, which happened to be on "Breeding Habits of *Corixa*" (an aquatic insect). It will thus be seen that much early work was done with aquatic forms. And during this early period he formulated plans for the starting of the State Natural History Survey which was a child of the Illinois State Laboratory of Natural History which was founded by Professor Forbes in 1877 and of which he continued to be the Director until 1917.

In his obituary notice in *Science* of April 11, 1930, Dr. Henry B. Ward says, "He will always be looked upon as the first and the leading worker in America on aquatic biology. When he started on his studies of fresh water organisms the inland waters of our country were practically unknown. He was the first man to write on the fauna of the Great Lakes, and to contribute to a knowledge of the food of fishes, a fundamental piece of work for the proper understanding of the factors concerned in solving questions that are involved in the preservation of our commercial fisheries."

It is safe to state further that he was the first man to start careful study of the food of birds, a subject that was taken up only a few years later by the old Section of Economic Ornithology started by C. Hart Merriam in the old Division of Entomology of the U. S. Department of Agriculture and that afterwards developed into the Bureau of Biological Survey.

In his work on the fauna and flora of the lakes and inland streams, he was a pioneer and was responsible for most important studies made by others. Professor C. A. Kofoid, now of the University of California, was associated with him for many years, and has sent me the following paragraph relating to this work:

"Professor Forbes early in his career took an interest in the microscopic life of fresh water. It bore fruit in his early papers

on the food of fresh water fishes. His studies in this field led to his interest in fresh water Entomostraca, an interest which led ultimately to the studies by Dr. Sharp on the Ostracoda, by his own son Dr. E. B. Forbes on the Copepoda, and by Mr. Schacht on the genus *Diaptomus*. His brochure of 1887, read before the Peoria Scientific Association and later reprinted with emendations, on "The Lake as a Microcosm" is a classic not only in its interpretation of a variety of lakes which he had investigated but also because it is probably one of the first if not indeed the first biological paper which recognizes the phenomenon of animal associations, the foundation of the modern science of ecology. His later work in this field was limited, by the development of his entomological interests, to explorations of the aquatic life in the waters of Yellowstone Park, of Lake Geneva, and his activity in founding and maintaining the Biological Station on the Illinois River, housed in a floating laboratory at Havana, Ill., and engaged in 1894-1900 in a continuous survey of the plankton of that stream prior to the opening of the Chicago Drainage Canal. This work resulted in my "Studies on the Plankton of the Illinois River." His interest in this work never flagged and he followed its course intimately and later in conjunction with Mr. Richardson investigated and reported on the destructive effect which the influx of sewage later had upon the life in this river."

It will be noticed in studying the bibliographical list appended to this paper that he rarely published anything about insects until early in the 1880's, his first work having been in connection with aquatic forms and with the food of fishes and birds; but in 1882, on the retirement of Cyrus Thomas, he was made State Entomologist of Illinois and two years later Professor of Zoology and Entomology in the University of Illinois. From that time on his writings naturally came to relate preponderatingly to insects.

Before we go into his work with insects, however, more must be said about his earlier work. At the memorial exercises held at the University of Illinois on March 15, 1930, an address was made by Dr. H. J. Van Cleave, a distinguished zoologist of a younger generation, who has done much work in aquatic zoology, and, rather than to attempt myself to evaluate Forbes' work at this earlier period, I will quote the words of the vastly more competent Doctor Van Cleave:

"Very early in his program, he became impressed with the significance of interrelationships between organisms and their environment. Before ecology had been conceived as an offspring of the biological sciences, Professor Forbes had adopted the ecological point of view in his published writings. As early as 1887, in a spirit of prophetic anticipation of the coming ecological era in North America, he delivered a paper on *The Lake as a Microcosm*, wherein he set forth the themes of interdependence of organisms and community of interests in aggregations of living beings. This ecological point of view has dominated his entire program of research. His contributions on insects, as well as those on fishes and on birds have been conceived in light of relationship to the environment and have always acknowledged man and human interests as essential though by no means exclusive factors of importance in the environment of organisms. As a consequence, even his economic studies have been engendered in that breadth of biological interpretation that renders them distinctive in their field.

"In his pioneer work on the food of birds, of fishes, and of insects, he contributed a wholly new method of attack upon problems in the interpretation of the economic status of animals. Many and marked have been the tributes paid him by subsequent workers in recognition of the importance of these pioneer studies.

"His early interest in the food of birds in its relation to their economic importance, found an extension in later years to a numerical study of birds in different localities. Thereby he sought a more exact means of interpreting the true value of birds in relation to agriculture.

"The long series of papers on the biology of the Illinois River, stands as one of the greatest monuments to Professor Forbes. These investigations, starting in 1894, were carried on under his leadership with the collaboration of Frank Smith, C. A. Kofoed, and R. E. Richardson, whose names will be perpetually associated with that of S. A. Forbes. Intensive work on the life of the Illinois River and correlation of physical conditions with distribution of life of the stream were carried on for a long period of years. When changed conditions made a continuation of this project seem unprofitable the researches had extended to that point where it was widely acclaimed that the Illinois River had been more thoroughly investigated as to its biology than any other river in the world.

.....
 "Much of his earlier work was upon the fresh water crustacea which at the time when he began his studies were practically

unknown in this country. A colleague, C. Dwight Marsh, an internationally recognized authority in this group, has evaluated Professor Forbes' earliest taxonomic studies with the statement: 'In North America articles were published regarding some forms in the early part of the century, but nothing recognizable appeared until S. A. Forbes commenced his series of papers. Although these papers were not extensive, they were exact and carefully worked out, and to Forbes may be given the credit of laying the foundation for all subsequent work in this country.'

"Some notion of the thoroughness of his studies may be gained from the fact that a paper which he published in 1876 is the most comprehensive work on the higher crustacea of Illinois which has appeared down to the present date. When Professor Forbes was accorded that signal honor of membership in the National Academy of Sciences, the significance of this early period of his work that had escaped the memory of many of his associates was again brought to light."

It is interesting to remember that the present writer was one of the proposers of Professor Forbes for the Academy, and that he drew especial attention to the significance of the early period of his work, largely for the purpose of emphasizing his great breadth of view as a zoologist and as an entomologist.

In 1882 Forbes was made State Entomologist of Illinois. At that time only three States had had officials with this title, namely New York, Illinois and Missouri; and with the appointment of C. V. Riley in Washington in 1878, Missouri abandoned work of this kind. The Illinois position was created by the State legislature in the winter of 1866-67. The first incumbent of the office had been a very extraordinary man, Benjamin D. Walsh, an Englishman by birth, of Cambridge training, who published only one report before his death. Walsh was succeeded by Dr. William LeBaron, who published four reports as appendices to the Transactions of the State Horticultural Society from 1871 to 1874. LeBaron died in harness, and was succeeded by Rev. Cyrus Thomas, who published a series of six reports extending over the years 1875 to 1880. After the publication of the last of these reports Thomas transferred his labors to the field of ethnology, and upon his withdrawal from office Forbes, then Director of the State Laboratory of Natural History, was appointed. He held the office from that time until 1917.

In 1894 the present writer gave an address entitled "A Brief Account of the Rise and Present Condition of Official Economic Entomology." At that time Forbes had published six reports, and I wrote of them in the following words:

"Prof. Forbes' reports are among the best which have been published. They are characterized by extreme care and by originality of treatment which has seldom been equaled. The practical end is the one which he has kept mainly in view. His experiments with the arsenites against the codling moth and the plum curculio were the first careful, scientific experiments in this direction which were made, and his investigations of the bacterial diseases of insects have placed him in the front rank of investigators in this line. His monographic treatment of the insects affecting the strawberry plant is a model of its kind, and the same may be said of his work upon the corn bill-bugs and of his studies of the chinch bug. In fact, whatever insect or group of insects has been the subject of his investigations, he has attacked the problem in a thoroughly original and eminently scientific and practical manner."

I feel sure, however, that, strong as is this praise, I did not do full justice to these reports nor to Professor Forbes' work. I was afraid of superlatives and hardly appreciated his breadth of view. From the start his work made a profound impression upon every one interested in the applications of science to agriculture, and he was chosen as the second President of the Association of Economic Entomologists, following C. V. Riley who, as the original proposer of the Association and as the official government entomologist, was naturally made its first President. It is interesting to note moreover that Forbes is the only man who was ever reelected to that office. This reelection occurred in the year 1908. It is perfectly safe to say that all through his active career he was looked upon as the leader among the economic entomologists of America—the man who commanded every one's respect and whose judgment was considered to be absolutely sound. And a man of this type was greatly needed among the men drawn from here, there and everywhere, in the opening up of this relatively new branch of applied science. He realized from the start and as a result of his former broad studies the necessity for the careful study of all of the ecological fea-

tures connected with the undue increase of a given species. He appreciated this before the words *ecology* and *ecological* came into use, and in a way he may be said to have been the founder of the science of ecology in the United States.

In 1917 the position of State Entomologist was merged into the Illinois Natural History Survey, and he continued as Chief of the Survey until the time of his death.

In 1884 he was called to Urbana as the head of the Department of Zoology and Entomology in the University of Illinois. The State Laboratory of Natural History was transferred to the University, and in 1917 became the Illinois Natural History Survey. His professorship of zoology and entomology in the University was changed in 1909, and he remained Professor of Entomology until his retirement as Emeritus Professor in 1921. He was Dean of the College of Science from 1888 to 1905, and after that was the Chairman of the Committee on University Educational Policy of the University Senate.

In the list of his writings, appended to this paper, will be found more than four hundred titles, but this does not include any reference to articles in fugitive journals or to any small published notes. Neither does it include the titles of such of his writings as do not concern Science. Two of them, of transcendent merit have come to my attention. His "Giersen's Cavalry Raid" was published in the Transactions of the Illinois State Historical Society, 1907, and his wonderful essay "War as an Education" appeared in the Illinois Magazine for October, 1911. Of these titles, 19 refer to educational matters, 74 to zoology aside from entomology, 10 to botany, 20 to ecology, 52 to general natural history, and 224 (a little more than half) to entomology. But this list of titles in entomology is somewhat misleading from the fact that it includes only as individual titles his reports as State Entomologist. Of these he published eighteen, and all were lengthy and included many topics of which the majority might well have appeared as separate entries in his bibliography.

All of his writings on entomological topics stand out conspicuously from the mass of publications on this subject. Here for the first time in the history of economic entomology a man not only of striking originality but of very broad biological sym-

pathies and experiences found himself engaged in the multifarious problems of insect damage to human interests. None of his predecessors or contemporaries in this field had his broad experience in biology or his broad outlook on nature. Therefore, especially in his general addresses, he established beyond question his leadership among all of his fellow workers. No one who heard or read his address to the Economic Entomologists at the meeting of the American Association for the Advancement of Science in Baltimore in December, 1908 (*Journal of Economic Entomology*, vol. II, no. 1, February 1909, pp. 25-35), will ever forget it. It made a very deep impression which has resulted in no end of good to all of us in our work and in our views of things.

So much for Forbes' scientific work. As to the man himself, we must devote some attention. In a charming paper on his "Ancestry, Education and Character," his son, Ernest B. Forbes, gives a very intimate insight into his father's character. It is in fact too intimate in part to be quoted here, although it was quite appropriate as a contribution at the memorial services in Urbana. I have selected the paragraphs that follow as indicating the man very clearly aside from his scientific achievements.

During the years 1861-65, his four-years' experience in the army constituted as intensive a course of instruction as any obtainable in college, and it was all education to the mind athirst and prepared to receive it. Enlisting in Company B of the Seventh Illinois Cavalry at the age of 17, he pursued his military studies as diligently as he had applied himself to books, and was made an orderly sergeant at 18, a lieutenant at 19, and captain of his company at 20. His company was on active duty during almost the whole period of the war, and he was under fire on 22 occasions including engagements at Clinton, Port Hudson, Byhalia, Moscow, Somerville, Collinsville, Okolona, Memphis, Campbellsville, Lynville, Franklin, and Nashville.

While in the vicinity of Corinth, Miss., he was captured while carrying a despatch, and spent four months in prison at Mobile, Macon, and Richmond. During this time, under desperately discouraging conditions, he maintained his morale by studying Greek; and later, after exchange, during a period of inactivity, he bought Spanish books, which he learned to read. It was all school, to the born scholar.

Of the educational value of his military experience he writes: "In one respect particularly, our experience was a hopeful prophecy, if not itself a cause, of subsequent success. Any one who had kept the solitary flame of his separate intellectual life steadily burning through all the blasts and storms of war, might reasonably believe that nothing that should happen to him thereafter could possibly extinguish it; and this, as we all know, is more than can be inferred from the completion of an ordinary college course. The eager hunger with which the students among us attacked the full tables at home, after four years or more of semi-starvation on a few husks and scraps, and the enthusiastic appreciation with which we embraced such long deferred opportunities as still remained to us, made it certain that no artificial graduation-day would put an end to our studies, and this, after all, is the best outcome of an education. Those of us who survived the Civil War in good health and strength, with morals unstained and minds still alert, have had no final cause to regret what seemed at the time the complete wreckage of our plans of life. To us war was not hell, but at the worst a kind of purgatory, from whose flames we emerged with much of the dross burned out of our characters, and with a fair chance still left to each of us to win his proper place in the life of the world."

In politics my father was a Republican, from the day when as a 14-year-old boy he listened to the Lincoln and Douglas debate at Freeport, Ill., on August 26, 1858. He came away from this historic event "quite aflame with enthusiasm for the new Republican party and especially for Lincoln as its champion, and equally incensed against Douglas as the leader and champion of the Democrats."

Of this occasion he has written, in part:

"When Lincoln arose to open the debate, my first feeling was a genuine shock of surprise, of disappointment, of chagrin at his homeliness, his awkwardness, his plainness of attire—at the farthest remove from the bearing, look, and dress of a boy's ideal; but when he began his argument in his high, penetrating voice, calm, clear, connected, and so simple and lucid that even I could follow it without effort, I got the first impression of my life of a truly lofty character and a great mind in vigorous action.

"Lincoln, as you will remember, made the opening speech at Freeport, and although his most telling points were enthusiastically applauded, there was practically nothing in the responses of his audience to indicate that there were any Democrats among them. Douglas, in fact, opened his rejoinder with a compliment, not to the speaker for his calm and persuasive speech, but to the assembly for 'the kind and respectful attention which they

yielded not only to political friends but to those opposed to them in politics.' He himself received at first the same kind of treatment, being even more frequently and vociferously applauded than Lincoln; but as he warmed up to his argument he began seemingly to try to irritate his opponents by calling them always 'black' Republicans, with an angry and contemptuous emphasis on the word 'black.' The taunt was received in silence for a few times, and then loud cries of 'white, white,' began to come from all directions, every time he used the offensive epithet, and the clamor presently became so great, after a peculiarly irritating application of it, that Douglas paused to remind his hearers 'that while Lincoln was speaking there was not a Democrat *vulgar* and *blackguard* enough to interrupt him.' It was at this point that my adhesion to republicanism became complete, and I shouted up to Douglas at the top of my boyish voice: 'Lincoln didn't use any such talk.' I was sharply reprovved by those about me, and told that I must not 'talk back'; and so stood in mortified silence until Lincoln again took the stand, when he began by saying: 'The first thing I have to say to you is a word in regard to Judge Douglas' declaration about the "vulgarity and blackguardism" in the audience, . . . that no such thing as he says, was shown by any Democrat while I was speaking. Now, I only wish, by way of reply on this subject, to say that while *I* was speaking, I used no "vulgarity or blackguardism" toward any Democrat.' With this elaboration of my own sentiment I need not say that I was relieved and delighted, or that I joined in the hearty laughter and applause with which . . . his rejoinder was received."

As a Republican, however, my father was, as in most other ways, an independent, and he never hesitated to "scratch" his ticket in favor of the Democrat when he believed the Democrat to be the better man.

My father's religious status is made clear by the following, which was written in 1923: "I was, and still am, a rationalist and an agnostic, for whom what is known as faith is merely assumption, often practically necessary, since in active life one must very often act *as if* he believed what he does not and cannot really know, but unexcusable in purely theoretical matters,"—but he drew a line through the words "and still am," and wrote above them the words "as a younger man." I think that this change was dictated by a growing hope that there is more to life than a scientist knows, or can know. At this time he was much attracted by the beauty and the comfort of the orthodox beliefs of his childhood, which he had lost during his scientific career.

Throughout life my father was active in the support of liberal religion, and, with my mother, initiated the movement which resulted in the establishment of the Unitarian Church of Urbana.

My father was reticent concerning his inner and deeper life, and, in 1923, in writing of things he would do differently if he were to live again he said, "I would be open, frank, and free with respect to my theories of life, and especially of religion, instead of leaving my children, so far as I was concerned, to find their own way in these difficult and important matters, as best they individually could. It was not indifference or thoughtlessness that influenced me, but, for one thing, a belief in individual freedom in this field, unprejudiced by authority exercised upon the helpless and defenseless child, and for another a conviction that my personal views were so far out of harmony with those of the ordinary American community that my children might find themselves strangers and even outcasts among their fellows if they were to follow my lead."

Physically, my father was characteristically restless, active, and energetic. While at the height of his powers his course through the Natural History Building could be traced by the slamming of the doors behind him. The attitude of command, attained during his extensive military service, was habitual, and he expected action on the part of his subordinates.

Until the last few years he exercised with phenomenal persistence. In the early days he did a great deal of walking, running, rowing, wood-chopping, club swinging, roller-skating and horse-back riding. He rode a bicycle for many years, and averred that his use of this vehicle added ten years to his life.

Later he drove an automobile and became locally famous for a long series of minor mishaps,—resulting from the facts that the automobile came late in the period of his physical adaptability, and that he drove to the accompaniment of his intensely concentrated thinking, without knowing that he failed to give the job his whole attention.

He learned to skate, swim, and to play golf with the generation following his own, but did not become proficient in these exercises. "Common" labor was uncongenial to him, and he once said that, for him, it would be "like hitching a race-horse to a dump cart."

Mentally he was quick, acute and alert; he delighted to deal with nice distinctions, and especially with complicated situations; and had a decided predilection for statistical and graphic presentation of products of research.

He was a poor sleeper, about five hours being his normal amount. The remainder of the night he spent reading, in bed.

He was throughout life a prodigious reader, of a wide range of serious literature. When delving into treatises in the fields of philosophy, ethics, psychology, pedagogy, metaphysics, genetics, scientific theory, and the method of science, his mind was enjoying its choicest diet; and by way of lighter reading he devoured quantities of French fiction.

Temperamentally he was in all ways a man of refined sensibility. He had a developed appreciation of the dramatic; and greatly enjoyed the theatre. His soul was attuned to the poetic, and he was devoted to Browning. When deeply moved he occasionally wrote an exquisite poem—to express himself—and then, characteristically, destroyed it. He loved music, and he played the organ in the days before pianos were common. He was naturally imaginative, and by early training was deeply religious.

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Since he was of an intensely intellectual type, he was easily bored by boresome people, and made but few intimate friends. There was, however, almost always some small and choice group of kindred spirits with whom he met for feasts of philosophy, and these men he enjoyed immensely.

During his later years, as his professional interests became more perfectly organized, and more securely established, my father was able to relax a certain degree of the pressure under which he had formerly worked, and to enjoy knowing a greatly broadened group of acquaintances. These years, therefore, were increasingly rich in gratifying personal relations.

It is characteristic of the man that even among his closest friends he was fair and temperate in his expressions regarding those whom he disapproved. He was much too wise to let himself hate anyone. On occasion, however, he could demonstrate a power of description equivalent to vivisection.

The dominant motive in my father's life was overwhelmingly that of scientific research in the public service. Research was, with him, not a conscious passion, I think; it was life itself—as natural as breathing; and his public-mindedness was no less spontaneous. It is true that he managed the investment of his savings with great interest but to have been condemned to a life devoted to private gain would have been for him genuine imprisonment.

The final, supreme demonstration of his superb morale was when with health, strength, friends of his own age, and wife all gone, he was able, through sheer intellectuality, to continue at his work, stimulated by the doing of new things, in the true spirit of youth, until 9 days from the date of his death, at the age of 85 years, 9 months, and 13 days.

I have already quoted from a letter recently sent me by Prof. C. A. Kofoed that portion relating to Doctor Forbes' early work on aquatic life and animal associations, and I now introduce another passage from the same letter which refers to Professor Forbes in other ways:

Intellectually Professor Forbes was a man of rare ability marked by an acquisitive mind and an unusual perspective of values. He early mastered the languages needed in scientific research. He read widely, and no work of importance escaped his keen eye. It was his wont to glance over the incoming literature in the library of the State Laboratory of Natural History, and he often dropped a casual word to his associates on the matters which interested him or which might interest others. His library reflected very well the breadth and activity of his intellectual and scientific interests. In spite of a certain aloofness, due apparently to an inherent shyness, he enjoyed conversation on the highest planes. He sought out and cultivated the acquaintance of those with whom he found and to whom he gave intellectual stimulus. He was the leading spirit in the "Theory Club"—a group of six, consisting of Professors Kinley (later President), Palmer (Chemistry), Townsend (Mathematics), Daniels (Philosophy) and myself the youngest of the group. We met regularly in the home of some member, and digested and discussed in a heavily nicotinized atmosphere such mighty treatises as Karl Pearson's "Grammar of Science" and Ward's "Naturalism and Agnosticism." As a dialectician, Forbes was keen in analysis, alike in attack on and defense of the position of the author under discussion and of his critics among our numbers. We came to look upon him much as an arbiter. He was at his best when he was in the midst of the clarification of some knotty problem in the philosophical relations of science, when with uplifted cigar in hand he would discourse, wittily, fluently and pointedly, till his cigar went cold, on subjects far afield from Hessian fly and corn aphids but with a familiarity and readiness as masterful as though he were in a group of his entomological colleagues.

It would be inferred very naturally from this that Forbes wrote unusually well. He did more than that. He was one of the ablest writers among scientific men. I have never read anything more perfectly done than his article "War as an Education," published in the *Illinois Magazine* for October, 1911. Others have called attention to this especial ability. Henry B.

Ward says (loc. cit.): "In all his writings he manifested a beauty of style that made them unusually appealing." Herbert Osborn called him "an adept in the use of language." C. L. Metcalf says, "His writings were characterized by their remarkable, simple, lucid expression." Dr. David Kinley, in his memorial address, refers especially to Forbes' "lucidity of expression," and goes on to say, "He was a master of literary style, writing with a simplicity and clarity that would serve as a model for many specialists in literature and rhetoric."

In the long quotation from Dr. E. B. Forbes a page or two back, the paragraph beginning with the words "Of the educational value of his military experience . . ." quotes the last paragraph from "War as an Education," and it was well worth quoting. But simply for delightful reading, let me quote one more paragraph from that remarkable essay. It relates to the call of the Civil War to the youth of that time:

I had prepared for college, and was "studying ahead" on the college course of the time as well as I could on a farm and under the tuition of an older brother, when the echo of the cannon in Charleston harbor drove all such ideas out of my mind. To remain quietly at home, busy with books and teachers while my comrades were thronging to the front to fight for *my country*, was simply impossible, and the mere thought of it intolerable. Indeed, I think that most of us were secretly glad that we had been born in the time when it was possible for a boy to do anything so wildly and gloriously different from what had been planned for him as to go to war. It was not to us a dilemma, a sacrifice; it was a privilege, an intoxicating opportunity; we could not be made to stay at home. And this was not by any means the result of our training. It was because of something born in us; it was in our blood—and it is in the blood of young Americans yet, peace gospels and Carnegie foundations to the contrary notwithstanding. The longing for adventure, the youthful spirit rising to the challenge of danger, the thrill of responsive feeling to the "call of the country," all merging in that irresistible swell of patriotic emotion which lifted a whole people on its mighty bosom—these were the influences within us and without us which made us feel for the time that war was the only thing in the world worth while.

Personally, Professor Forbes was tall (six feet or thereabouts), reasonably slender, muscular, active. People have

spoken of his "military carriage," the result of early army training. Although I had known him for more than forty years, I never noticed anything especially military in his bearing. I have just looked up a snapshot taken of him by Paul Marchal in 1913, and which is published in that famous French writer's book "*Les Sciences biologiques Appliquée à l'Agriculture dans les États Unis*" (Figure 111), and I find that, while the figure is straight, the head is advanced, confirming my recollection of him at that time. The picture was taken on Doctor Forbes' birthday. Marchal and I happened to visit him on that day and stayed to the family birthday dinner. In earlier years he had a notably quick step and military carriage.

His son Ernest has referred to his father's physical activities and to his later interest in certain outdoor sports. Henry B. Ward, in his account in *Science*, referring to his automobile driving, says, ". . . he often chuckled at a comment on his arrest for speeding on his eightieth birthday." He was a handsome, well featured man, of, I should say, a scholarly type. A very interesting comment on his personal appearance was made by Sir William Ramsey in a letter to Doctor Kinley written after a visit to the University of Illinois. I quote two paragraphs:

When I was in Champaign, Professor Forbes, whom I saw frequently, struck me as being strangely familiar and I was always puzzled as if I ought to have recognized him. It was only after I left that the explanation occurred to me. He is the typical Aberdonian of one, and that the commonest, type. There are two distinct types of Aberdonian, one like him, and it is the most characteristic, a big, powerfully built frame of a certain characteristic build, and with a certain aspect of face. This is the type that is regularly associated with Aberdeen. If a painter were instructed to paint a picture of the battle of Harlaw, where the Aberdeen Burghers, led by Provost Davidson, defeated the whole force of the Highlands (so far as the Highlands ever could be united in anything) and were looking about for a characteristic set of five men from whom he should make up the type of Provost Davidson, Professor Forbes would certainly be one of the five.

That is why Professor Forbes seemed to be such a familiar figure and personality. He was *the* typical Aberdonian of his

own kind, who had preserved the type absolutely unchanged. The Aberdonian never yields to circumstances but dominates them and remains himself (except in the case of a few persons who are conceited and therefore affect an Anglified accent, which only makes them comic).

In 1873 Professor Forbes married Clara Shaw Gaston, and her death in 1930 preceded his own by a few weeks only. It was a long, happy and very loving companionship. Two of Mrs. Forbes' colonial ancestors came over on the *Mayflower*, namely, John Tilley and John Howland. In her were combined French, Scotch, English and Welsh blood.

The devoted couple had five children—Bertha Van Hoesen (Mrs. Burton R. Herring), Ernest Browning, Winifred, Ethel (Mrs. Frank W. Scott), and Richard Edwin. The last-named died at the age of six years, in 1903, but all of the others are still living.

I must not conclude this account of Forbes' long and distinguished career without especial reference to an article entitled "Stephen Alfred Forbes—An Appreciation," by Frank Smith, then just retiring from his professorship in the University of Illinois, and published in *The Audubon Bulletin*, 1926, No. 17. Doctor Smith, himself a broad zoologist, gives an especially careful and appreciative survey of Forbes' work other than in entomology.

It will undoubtedly appear from what I have written that although the subject of this memoir did most important work in botany and in a number of branches of zoology, he was far more than a specialist in any branch. He studied the birds and the fishes and the insects and the life of the rivers and lakes, all as elements of a great complex, and he studied them broadly in their relations to their surroundings. Man himself was his starting ecological factor. In fact, it will be difficult if not impossible to point out a naturalist of his generation who was more original or broader or sounder.

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COMPILED BY H. C. OESTERLING, FORMER EDITOR,
ILLINOIS STATE NATURAL HISTORY SURVEY

Key To Abbreviations of Titles of Illinois Publications

- Bul. Sci. Assoc. Peoria, Ill....Bulletin of the Scientific Association of Peoria, Illinois.
- Ill. Acad. Sci. Trans....Transactions of the Illinois State Academy of Science.
- Ill. Adm. Rep....Administrative Report of the Directors of Departments of the State of Illinois.
- Ill. Agr. Exp. Sta. Bul....Bulletin of the Agricultural Experiment Station of the University of Illinois.
- Ill. Agr. Exp. Sta. Cir....Circular of the Agricultural Experiment Station of the University of Illinois.
- Ill. Blue Book....Blue Book of the State of Illinois.
- Ill. Crop Rep. Circ....Illinois Crop Report.
- Ill. Dept. Agr. Trans....Transactions of the Department of Agriculture of the State of Illinois.
- Ill. Ent. Exec. Rep....Executive Report of the Illinois State Entomologist.
- Ill. Ent. Off. Bul....Bulletin of the Illinois State Entomologist's Office.
- Ill. Ent. Off. Circ....Circular of the Illinois State Entomologist's Office.
- Ill. Ent. Off. pamphlet...Pamphlet of the Illinois State Entomologist's Office.
- Ill. Ent. Rep....Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois.
- Ill. Farm. Inst. Rep....Report of the Illinois Farmers' Institute.
- Ill. Fish Com. Rep....Report of the Illinois State Fish Commission.
- Ill. Hort. Soc. Trans....Transactions of the Illinois State Horticultural Society.
- Ill. Jour. Com....Illinois Journal of Commerce, Chicago.
- Ill. Lab. Nat. Hist. Bul....Bulletin of the Illinois State Laboratory of Natural History.
- Ill. Lab. Nat. Hist. Circ....Circular of the Illinois State Laboratory of Natural History.
- Ill. Lab. Nat. Hist. pamphlet...Pamphlet of the Illinois State Laboratory of Natural History.
- Ill. Nat. Hist. Surv. Bul....Bulletin of the Illinois State Natural History Survey.
- Ill. Nat. Hist. Surv. Ent. Circ....Entomological Circular of the Illinois State Natural History Survey.
- Ill. Nat. Hist. Surv. For. Circ....Forestry Circular of the Illinois State Natural History Survey.

- Ill. Nat. Hist. Surv. pamphlet...Pamphlet of the Illinois State Natural History Survey.
- Ill. Nat. Hist. Surv. Rep....Report on the Natural History Survey of the State of Illinois, issued by the State Laboratory of Natural History.
- Ill. Sch. Jour....Illinois School Journal, Bloomington.
- Ill. Sch. Rep....Report of the Superintendent of Public Instruction of the State of Illinois.
- Ill. Schoolm....Illinois Schoolmaster.
- Ill. Supt. Pub. Instr. Circ....Illinois Superintendent of Public Instruction Circular.
- Ill. Univ. pamphlet...Pamphlet of the University of Illinois.
- Ill. Univ. Quart....Quarterly and Fortnightly Notes of the Alumni Association of the University of Illinois.
- Ill. Univ. Rep....Report of the Board of Trustees of the University of Illinois.
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Report of the Director of the State Laboratory of Natural History (to the State Superintendent of Public Instruction), for the two years ending June 30, 1882. Ill. Sch. Rep., vol. 14, pp. lx-lxxi, 1883. (*Also as pamphlet*, 12 pp., 1883.)

1884

On the life-histories and immature stages of three Eumolpini. Psyche, vol. 4, pp. 123-130, pl. i, Jan.-Feb. 1884. (*See corrective note, ibid.*, vol. 4, pp. 167-168.)

Entomological notes of the season (1883). Ill. Crop Rep. Circ. 106, pp. 177-178, Mar. 1884.

Circular (on the corn plant louse and the Hessian fly). Ill. Crop Rep. Circ. 110, pp. 48-49, with 4 fig., May 1884.

The wheat-straw worm. Ill. Crop Rep. Circ. 112, pp. 14-15, with 1 fig., June 1884.

Supplementary report on insects affecting the strawberry. Miss. Vall. Hort. Soc. Trans., vol. 2, pp. 234-258, with 14 fig., 1884.

The tarnished plant bug. Minn. Hort. Soc. Rep. for 1884, pp. 339-342, 1884.

On a contagious disease of caterpillars. Ill. Hort. Soc. Trans., vol. 17, pp. 29-41, 1884.

Destruction of fish food by bladderwort (*Utricularia*). U. S. Fish Com. Bul., vol. 4, p. 443, 1884. (*Reprinted from Forest and Stream for Sept. 4, 1884.*)

Thirteenth Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) second annual report of S. A. Forbes, for the year 1883. Ill. Dept. Agr. Trans., vol. 21, *app.*, 183 + xxi pp., 15 pl., 1884. (*Also issued separately*, May 1884.) Contents as follows:

Letter of transmittal, notes of the year, etc. (9-12); the wheat-bulb worm (13-29); the wheat-straw worm (30-38); on insects affecting sorghum and broom-corn (39-56); the black-headed grass maggot (57-59); insects injurious to the strawberry (60-180); insects injurious to the apple (181-183).

(Statement of the origin and function of the Illinois State Laboratory of Natural History.) Introduction to Ill. Lab. Nat. Hist. Bul., vol. 1, p. 2, 1884.

Report of the Director of the State Laboratory of Natural History (to the State Superintendent of Public Instruction), for the two years ending June 30, 1884. Ill. Sch. Rep., vol. 15, pp. lviii-lx, 1884.

1885

Aberration in the perch. Amer. Nat., vol. 19, p. 192, Feb. 1885.

Description of new Illinois fishes. Ill. Lab. Nat. Hist. Bul., vol. 2, pp. 135-139, March 1885.

Miscellaneous notes on farm insects. Ill. Crop Rep. Circ. 118, pp. 193-194, Mar. 1885.

The root web-worm (*Crambus zeelus* Fernald). Ill. Crop Rep. Circ. 122, pp. 38-39, with 1 fig., May 1885.

Further notes on the root web-worm. Ill. Crop Rep. Circ. 123, pp. 48-49, with 3 fig., June 1885.

On some Illinois locusts (grasshoppers). Ill. Crop Rep. Circ. 125, pp. 27-30, Aug. 1885.

[—with T. J. BURRILL] Report on agricultural experiment stations. Ill. Hort. Soc. Trans., vol. 18, pp. 52-71, 1885.

A season's work in horticultural entomology. Ill. Hort. Soc. Trans., vol. 18, pp. 117-127, 1885.

(Letter to William Jackson, Mar. 8, 1884, on remedies for the cabbage worm, etc.) Ill. Hort. Soc. Trans., vol. 18, pp. 258-259, 1885.

Fourteenth Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) third annual report of S. A. Forbes, for the year 1884. Ill. Dept. Agr. Trans., vol. 22, *app.*, vii + 136 + xi + 120 pp., 12 pl., 1885. (*Also issued separately*, Sept. 1885.) Contents as follows:

Letter of transmittal (1); entomological calendar (3-8); contributions to agricultural entomology—I, on new and little-known corn insects (11-33), —II, notes on insects injurious to wheat (34-69), —III, brief notes on sorghum insects (70-71), —IV, on some clover insects (72-74); contributions to horticultural entomology

—I, on new and imperfectly known strawberry insects (77-82), —II, on a few grape insects (83-86), —III, on new insect enemies of the blackberry and raspberry (87-92), —IV, on the speckled cutworm as a cabbage worm (93-94), —V, notes on insects injurious to the apple and pear (95-102), —VI, on some insect enemies of the soft maple (103-111), —VII, insects injurious to the elm (112-115), —VIII, brief miscellaneous notes (116-118). Appendix: general indexes to the first twelve reports . . . (prepared by ANGE V. MILLER) —introduction (v-viii); systematic list of genera and species (ix-xix); general index to insects (1-68); general index to food plants (69-94); general index to remedies, natural and artificial (95-107). Index to the fourteenth report (108-120).

A catalogue of the native fishes of Illinois. Ill. Fish Com. Rep. for 1884, pp. 60-89, with ill., 1885. (*Also, ibid.* for 1900, pp. 59-80.)

1886

Miscellaneous essays on economic entomology. Ill. Dept. Agr. Trans., vol. 23, *app.*, pp. 1-126, 1886. (*Also issued separately*, 1886.) Contents as follows:

The entomological record for 1885 (5-25); experiments on the codling-moth and curculios (26-45) [*revised reprint from* Ill. Hort. Soc. Trans., vol. 19, pp. 103-124, 1886]; a second contribution to the life history of the corn plant-louse, by H. GARMAN (46-56); partial economic bibliography of Indian corn insects (with a systematic list of corn insects), by THOMAS F. HUNT (57-126).

(Letter) to nurserymen and fruit growers of Illinois (on insects injurious to young nursery stock). Ill. Ent. Off. Circ., 1 p., Feb. 1886.

Circular (on the Hessian fly). Ill. Ent. Off. Circ., 1 p., Mar. 1886.

Circular (on the plum curculio). Ill. Ent. Off. Circ., 1 p., Apr. 1886.

Studies on the contagious diseases of insects. Ill. Lab. Nat. Hist. Bul., vol. 2, pp. 257-321, with 1 pl., June 1886. (*Reprinted, in part*, Ill. Univ. Rep., vol. 13, pp. 294-301, 1887.)

Chinch bugs in Illinois. Prairie Farmer, vol. 58, p. 491, with 3 fig., July 31, 1886.

The chinch-bug in Illinois. Ill. Ent. Off. Circ., 8 pp., Sept. 1886. (*Reprinted*, Prairie Farmer, Sept. 25 and Oct. 2, 1886.)

Notes of the past year's work. Can. Ent., vol. 18, pp. 176-177, Sept. 1886.

Leptodora in America. Amer. Nat., vol. 20, pp. 1057-1058, Dec. 1886.

A contagious disease of the European cabbage worm, *Pieris rapae*, and its economic application. Soc. Prom. Agr. Sci. Proc., vol. 7, pp. 26-32, 1886. (*Also*, Ill. Univ. Rep., vol. 13, pp. 294-301, 1887.)

Experiments on the codling moth and curculios. Ill. Hort. Soc. Trans., vol. 19, pp. 103-124, 1886. (*Revised*, Ill. Dept. Agr. Trans., vol. 23, *app.*, 26-45, 1886.)

Report of the Director of the State Laboratory of Natural History (to the State Superintendent of Public Instruction), for the year ending June 30, 1885. Ill. Sch. Rep., vol. 16, lx-lxiii, 1886.

1887

- The chinch-bug in southern Illinois. Ill. Ent. Off. Circ., 2 pp., Apr. 1887. (*Also*, *Prairie Farmer*, vol. 59, p. 279, Apr. 30, 1887.)
 (Circular of inquiry on injury to grass lands by crane-fly larvae.) Ill. Ent. Off. Circ., 1 p., Apr. 1887.
 The relations of ants and aphids. *Amer. Nat.*, vol. 21, pp. 579-580, June 1887.
 (Circular letter requesting information on chinch-bug infestations.) Ill. Ent. Off. Circ., 1 p., July 1887.
 Arsenical poisons for the codling moth—record and discussion of experiments for 1885 and 1886. Ill. Ent. Off. Bul., no. 1, pp. 1-24, with 11 diagrams, 1887. (*Also*, Ill. Hort. Soc. Trans., vol. 20, pp. 109-118, 1887.)
 On the chinch bug in Illinois: present condition and prospects for 1887 and 1888; remedial procedure recommended. Ill. Ent. Off. Bul., no. 2, pp. 27-43, 1887.
 Second contribution to a knowledge of the life history of the Hessian fly. Ill. Ent. Off. Bul., no. 3, pp. 45-61, with 1 diagram, 1887. (Advance sheets from Ill. Ent. Rep. 15, 1889.)
 The lake as a microcosm. *Bul. Sci. Assoc. Peoria, Ill.*, pp. 77-87, 1887. (*Reprinted*, Ill. Nat. Hist. Surv. Bul., vol. 15, pp. 537-550, Nov. 1925.)
 (Reports as professor of zoölogy and entomology, for 1885-1886.) Ill. Univ. Rep., vol. 13, pp. 47-48, 100-102, 160-163, 1887.
 (Reports of the Director of the State Laboratory of Natural History, to the Regent of the University of Illinois, 1885-1886.) Ill. Univ. Rep., vol. 13, pp. 55, 93, 100-102, 1887.

1888

- On the present state of our knowledge concerning contagious insect diseases. *Psyche*, vol. 5, pp. 3-12 (bibliog. pp. 15-22), Jan.-Feb. 1888.
 The common apple-tree borers. Ill. Ent. Off. Circ., 4 pp., 7 fig., Feb. 1888.
 A new parasite of the Hessian fly. *Psyche*, vol. 5, pp. 39-40, with 1 fig., Apr. 1888.
 Studies of the food of fresh-water fishes. Ill. Lab. Nat. Hist. Bul., vol. 2, pp. 433-473, Apr. 1888.
 On the food relations of fresh-water fishes: a summary and discussion (with detailed recapitulation of data). Ill. Lab. Nat. Hist. Bul., vol. 2, pp. 475-538, July 1888.
 Note on chinch-bug diseases. *Psyche*, vol. 5, pp. 110-111, Sept.-Oct. 1888.
 (Letter on epidemic diseases of the chinch bug.) *Insect Life*, vol. 1, p. 113, Oct. 1888.

- The Western Society of Naturalists—a presidential address. *Amer. Nat.*, vol. 22, pp. 988-996, Nov. 1888.
- Relation of wheat culture to the chinch-bug. *Soc. Prom. Agr. Sci. Proc.*, vol. 9, pp. 27-34, 1888. (*Abstract*, *Insect Life*, vol. 1, pp. 222-223, Jan. 1889.)
- Unsolved problems in horticultural entomology. *Ill. Hort. Soc. Trans.*, vol. 21, pp. 92-97, 1888.
- Food of the fishes of the Mississippi Valley. *Amer. Fish. Soc. Trans.*, vol. 17, pp. 37-66, 1888.
- Report of the Director of the State Laboratory of Natural History (to the Trustees of the University of Illinois), as of June 6, 1887. *Ill. Lab. Nat. Hist. pamphlet*, 4 pp., 1888. (*See Ill. Univ. Rep.*, vol. 14, p. 48, 1889.)

1889

- Fifteenth Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) fourth report of S. A. Forbes, for the years 1885 and 1886. *Ill. Dept. Agr. Trans.*, vol. 24, *app.*, vi + 115 pp., 4 fig., 1889. (*Also issued separately*, Apr. 1890.)
- Contents as follows:
- Letter of transmittal (iv); the entomological record for 1885-86 (1-6); arsenical poisons for the codling moth (7-20); a second contribution to a knowledge of the life history of the Hessian fly (21-34) [*issued separately in advance*, 1887]; on the life history of the wheat bulb worm (35-39); on an outbreak of injurious locusts in central Illinois, by C. M. WEED (40-44); on some common insects injuriously affecting the foliage of young apple trees in the nursery and orchard, by C. M. WEED (45-85). Appendix: the present condition and prospects of the chinch-bug in Illinois (89-103) [*reprinted from Ill. Ent. Off. Bul.*, no. 2, pp. 27-43, 1887].
- Early occurrence of the chinch-bug in the Mississippi Valley. *Insect Life*, vol. 1, p. 249, Feb. 1889.
- An early note on the periodical cicada. *Insect Life*, vol. 1, p. 313, Apr. 1889.
- The grain plant louse in Illinois. *Ill. Crop. Rep. Circ.* 145, pp. 27-28, June 1889.
- Arsenical poisons for the plum and peach curculio. *Insect Life*, vol. 2, pp. 3-7, July 1889.
- Office and laboratory organization. *Insect Life*, vol. 2, pp. 185-187, Dec. 1889.
- (Report as professor of zoology and entomology, for 1886-1887.) *Ill. Univ. Rep.*, vol. 14, pp. 164-167, 1889.
- Report of the Director of the State Laboratory of Natural History (to the Trustees of the University of Illinois), as of Oct. 31, 1888. *Ill. Univ. Rep.*, vol. 14, pp. 185-193, 1889. (*Also as pamphlet*, 10 pp., 1889.)

1890

Note on the feeding habits of *Cermatia forceps* Raf. Amer. Nat., vol. 24, pp. 81-82, Jan. 1890.

The American plum borer, *Euzophera semifuneralis* Walk. Psyche, vol. 5, pp. 295-299, 3 fig., Jan. 1890.

Sixteenth Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) fifth report of S. A. Forbes, for the years 1887 and 1888. Ill. Dept. Agr. Trans., vol. 26, *app.*, xiii + 104 + 122 + ix pp., 6 graphs, 6 pl., 1890. (*Also issued separately*, Apr. 1890.) Contents as follows:

Letter of transmittal (vii); general record for 1887 and 1888 (ix-xiii); studies on the chinch-bug II (1-57) (*issued separately in advance*, 1889; *pp. 7-32 reprinted*, 1914); the corn bill bugs (58-77); the meadow maggots, or leather-jackets (78-83); notes on cutworms (84-97); the burrowing web-worm (98-101). Appendix: economic bibliography of the chinch-bug, 1785-1888 (1-122).

Note on an American species of *Phreoryctus*. Amer. Nat., vol. 24, pp. 477-478, May 1890.

The Hessian fly. Ill. Crop. Rep. Circ. 149, pp. 32-34, with 1 pl., June 1890. (*Also*, Ill. Agr. Exp. Sta. Bul. 12, pp. 377-379, with 1 pl., Nov. 1890.)

An American terrestrial leech. Amer. Nat., vol. 24, pp. 646-649, July 1890. (*Also*, Ill. Lab. Nat. Hist. Bul., vol. 3, pp. 119-122, Sept. 1890.)

On an American earthworm of the family Phreoryctidae. Ill. Lab. Nat. Hist. Bul., vol. 3, pp. 107-117, with 3 pl., Sept. 1890.

New and old insects. Ill. Hort. Soc. Trans., vol. 23, pp. 242-251, 1890. Synopsis of recent work with arsenical insecticides. Ill. Hort. Soc. Trans., vol. 23, pp. 310-324, 1890.

Preliminary report upon the invertebrate animals inhabiting Lakes Geneva and Mendota, Wisconsin, with an account of the fish epidemic in Lake Mendota in 1884. U. S. Fish Com. Bul., vol. 8, pp. 473-487, with 3 pl., 1890.

(Letter to the Board of Direction of the Agricultural Experiment Station, proposing field experiments for protection of crops against injury by chinch bugs.) Ill. Univ. Rep., vol. 15, pp. 17-18, 1890.

Biennial Report of the Director of the State Laboratory of Natural History (to the Trustees of the University of Illinois), for 1889-1890. Ill. Univ. Rep., vol. 15, pp. 243-245, 1890. (*Also as pamphlet*, 5 pp., 1891.)

1891

On some Lake Superior entomostraca. U. S. Fish Com. Rep. for 1887-1888, pp. 701-718, with 4 pl., 1891. (*Advance sheets issued* 1890.)

A summary history of the corn-root aphid. Insect Life, vol. 3, pp. 233-238, Jan. 1891.

- On the life history of the white grubs. *Insect Life*, vol. 3, pp. 239-246, Jan. 1891.
- The fruit bark beetle. *Ill. Agr. Exp. Sta. Bul.* 15, pp. 469-479, with 1 pl., Feb. 1891. (*Incorporated in* *Ill. Ent. Rep.* 17, pp. 1-20, 1891.)
- Partial list of duplicate insects in the collection of the Illinois State Laboratory of Natural History. *Ill. Lab. Nat. Hist. Circ.*, 19 pp., May 1891.
- On a bacterial insect disease. *N. Amer. Practit.*, pp. 401-405, Sept. 1891. (*Also*, *Amer. Mo. Micr. Jour.*, vol. 12, pp. 246-249, Nov. 1891.)
- The importation of a Hessian-fly parasite from Europe. *Insect Life*, vol. 4, pp. 179-181, Dec. 1891.
- The fruit bark beetle. *Ill. Ent. Off. Bul.*, no. 4, pp. 63-81, with 1 pl., 1891.
- Seventeenth Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) sixth report of S. A. Forbes for the years 1889 and 1890. *Ill. Dept. Agr. Trans.*, vol. 28, *app.*, xv + 90 + 36 + ix pp., 8 pl., *date on title-page* 1891. (*Also issued separately*, Feb. 1892.) Contents as follows:
- Letter of transmittal (vii); general record for 1889 and 1890 (ix-xv); the fruit bark beetle (1-20) [*issued as* *Ill. Agr. Exp. Sta. Bul.* 15, Feb. 1891]; experiments with the arsenical poisons for the plum and peach curculio (21-25); the American plum borer (26-29); on the common white grubs (30-53); additional notes on the Hessian fly (54-63); a summary history of the corn-root aphid (64-70); on a bacterial disease of the larger corn-root worm (71-73); notes on the diseases of the chinch bug (74-87). Appendix: an analytical list of the entomological writings of William LeBaron, M. D., Second State Entomologist of Illinois, compiled with the assistance of C. M. WEED, JOHN MARTIN, MARY J. SNYDER, and C. A. HART. (1-36). Index to the seventeenth report (i-ix).
- Horticultural entomology. *Ill. Hort. Soc. Trans.*, vol. 24, pp. 88-95, 1891.
- List of economic species of insects for public schools, with references to entomological literature. *Ill. Lab. Nat. Hist. Circ.*, 13 pp., 1891.
- The head of the English sparrow. *Ill. Lab. Nat. Hist. Circ.*, 10 pp., 1891.
- History and status of public school science work in Illinois. In "Educational Papers by Illinois Science Teachers," vol. 1, pp. 6-20, 1891.
- Pedagogical contents of zoology. In "Educational Papers by Illinois Science Teachers," vol. 1, pp. 38-48, 1891.
- Science in the country school. *Interstate Sch. Rev.* (Danville, Ill.), vol. 1, pp. 13 ff., 1891 (*not seen*).

1892

- Bacteria normal to digestive organs of Hemiptera. *Ill. Lab. Nat. Hist. Bul.*, vol. 4, pp. 1-7, Jan. 1892.
- The chinch-bug in Illinois, 1891-92. *Ill. Agr. Exp. Sta. Bul.* 19, pp. 44-48, Feb. 1892.
- Zoology in the public school: choice and arrangement of material. (*Ill.*) *Public Sch. Jour.*, vol. 11, pp. 319-321, 375-377, 429-431, Mar.-May 1892.

- The Illinois insectarium. *Amer. Nat.*, vol. 26, pp. 353-354, Apr. 1892.
 An all-around microscope. *Amer. Mo. Micr. Jour.*, vol. 13, pp. 91-92, Apr. 1892.
 Experiments with chinch-bugs. *Psyche*, vol. 6, p. 250, Apr. 1892.
 Address of first vice-president (Assoc. Econ. Ent., Aug. 15, 1892, Rochester, N. Y.) on contagious diseases of insects. *Insect Life*, vol. 5, pp. 68-76, Nov. 1892.
 (Food habits of the common yellow thrips.) *Insect Life*, vol. 5, pp. 126-127, Nov. 1892.
 (Letter to James Fletcher, on the Natural History Hall of the University of Illinois.) *Ottawa Naturalist*, vol. 6, pp. 133-135, Dec. 1892.
 The fruit-destroying insects of southern Illinois. *Ill. Hort. Soc. Trans.*, vol. 25, pp. 116-123, 1892.
 Answers to interrogations (on) horticultural entomology. *Ill. Hort. Soc. Trans.*, vol. 25, pp. 258-259, 1892.
 Report of the Illinois State Entomologist concerning operations under the Horticultural Inspection Act. U. S. D. A. Off. Exp. Sta. Bul. 12, pp. 1058-1060, 1892 (*not seen*).

1893

- A preliminary report on the aquatic invertebrate fauna of the Yellowstone National Park, Wyoming, and of the Flathead region of Montana. U. S. Fish Com. Bul., vol. 11, pp. 207-258, with 6 pl., Apr. 1893.
 (Provisional program for international congress of zoologists in connection with the Columbian Exposition at Chicago.) *Amer. Nat.*, vol. 27, pp. 762-763, Aug. 1893.
 Presidential address (Assoc. Econ. Ent., Aug. 14, 1893, Madison, Wisc.). *Insect Life*, vol. 6, pp. 61-70, Dec. 1893.
 Injuries to fruits by twenty-five worst fruit insects. *Ill. Hort. Soc. Trans.*, vol. 26, pp. 121-134 (*see also* pp. 199-204, with 25 fig.), 1893.
 Biennial Report of the Director of the State Laboratory of Natural History (to the Trustees of the University of Illinois), for 1891-1892. *Ill. Univ. Rep.*, vol. 16, pp. 284-288, 1893. (*Also as pamphlet*, 8 pp., 1893.)

1894

- The chinch-bug in southern Illinois, 1894. *Ill. Agr. Exp. Sta. Bul.* 33, pp. 397-399, June 1894.
 How to fight chinch bugs. *Prairie Farmer*, vol. 66, no. 31, p. 2, Aug. 4, 1894.
 The biological station of the University of Illinois. *Amer. Nat.*, vol. 28, pp. 723-724, 1894.
 A program of practice in horticultural entomology. *Ill. Hort. Soc. Trans.*, vol. 27, pp. 113-118, 1894.
 The chinch bug in 1894. Prospect for 1895. Contagious disease experiments, etc. *Ill. Ent. Off. Bul.*, no. 5, pp. 83-89, 1894. (*A brief statement of results published in full as Ill. Agr. Exp. Sta. Bul.* 38, 1895, and in *Ill. Ent. Rep.* 19, 1895.)

Damage to food-fish in Wabash River. U. S. 53d Congr., 2d Sess., H. R. Misc. Doc. no. 196, pp. 2-5, 1894. (*Also*, U. S. Fish Com. Rep. for 1893-1894, pp. 109-112, 1896.)

The Aquarium of the United States Fish Commission at the World's Columbian Exposition. Report of the director. U. S. Fish Com. Bul., vol. 13, pp. 143-158, 1894.

Biennial Report of the Director of the State Laboratory of Natural History (to the Trustees of the University of Illinois), for 1893-1894. Ill. Univ. Rep., vol. 17, pp. 304-323, 1894? (*Also as pamphlet*, 36 pp., 18 pl., 1894?)

1895

Eighteenth Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) seventh report of S. A. Forbes, for the years 1891 and 1892. Ill. Dept. Agr. Trans., vol. 31, *app.*, xi + 171 + xiii pp., 15 pl., *date on title-page 1894; probably not issued until 1895. (Also issued separately, Mar. 1895.)* (2d. ed., x + 149 + xii pp., 15 pl., 1920.) Contents as follows:

Letter of transmittal (vi); general record for 1891 and 1892 (vii-xi); a monograph of insect injuries to Indian corn—Part I (3-171), and index (i-xiii) [*reissued, in part, as* Ill. Agr. Exp. Sta. Bul. 44, May 1896].

Experiments with the muscardine disease of the chinch-bug, and with the trap and barrier method for the destruction of that insect. Ill. Agr. Exp. Sta. Bul. 38, pp. 25-85, with 7 pl. Mar. 1895. (*Incorporated in* Ill. Ent. Rep. 19, pp. 5-176, 1896.)

Preliminary note on a contagious insect disease. Science, vol. 2, pp. 375-376, Sept. 20, 1895.

1896

Nineteenth Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) eighth report of S. A. Forbes, for the years 1893 and 1894. Ill. Dept. Agr. Trans., vol. 32, *app.*, 206 + 65 + v pp., 13 pl., *date on title-page 1895, not issued before Apr. 1896. (Also issued separately, May 1896.)* Contents as follows:

Letter of transmittal (3); experiments for the destruction of chinch-bugs as they emerge from fields of small grain at harvest [with an analytical list of American articles consulted, 1824-1894] (5-176) [*issued, in part, as* Ill. Agr. Exp. Sta. Bul. 38, Mar. 1895]; laboratory experiments with chinch-bugs (177-189); the white ant in Illinois [with a descriptive list of economic articles consulted] (190-204). Appendix: the Mediterranean flour moth (*Ephestia kuehniella* Zeller) in Europe and America, by W. G. JOHNSON (7-65). Index (i-v).

Insect injuries to the seed and root of Indian corn. Ill. Agr. Exp. Sta., Bul. 44, pp. 209-296, with 61 fig., May 1896. (*Extracted from* Ill. Ent. Rep. 18, pp. 3-171, 1894.)

- Progress in economic entomology. Ill. Farm. Inst. Rep., vol. 1, pp. 103-112, with portrait, 1896.
- Recent progress in horticultural entomology. Ill. Hort. Soc. Trans., vol. 29, pp. 137-148, 1896.
- Summer opening of the biological experiment station of the University of Illinois. Ill. Univ. pamphlet, 24 pp., 11 pl., 1896.
- Biennial Report of the Director of the State Laboratory of Natural History (to the Trustees of the University of Illinois), for 1895-1896, and special report of the Biological Experiment Station. Ill. Univ. Rep., vol. 18, pp. 298-326, with 20 pl., 1896? (*Also as pamphlet*, 31 pp., 20 pl., 1896?)

1897

- The San Jose scale in Illinois. Ill. Agr. Exp. Sta. Bul. 48, pp. 413-428, with 2 fig., Apr. 1897. (*Cf.* Ill. Hort. Soc. Trans., vol. 30, pp. 109-124, 1897.) (*Incorporated in* Ill. Ent. Rep. 20, pp. 1-25, 1898.)
- Circular notice concerning the San Jose scale and other fruit insects. Ill. Ent. Off. Circ., 4 pp., July 1897.
- Agricultural methods with farm insects. Ill. Farm. Inst. Rep., vol. 2, pp. 22-25, with portrait, 1897.
- Entomological work at the University (of Illinois). Ill. Farm. Inst. Rep., vol. 2, pp. 28-33, 1897.
- Summer school of field biology and second summer opening of the University Biological Station: preliminary notice. Ill. Univ. pamphlet, 4 pp., 1897.

1898

- Twentieth Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) ninth report of S. A. Forbes, for the years 1895 and 1896. Ill. Dept. Agr. Trans., vol. 34, *app.*, vi + 112 + xxxii pp., 12 pl., *date on the title-page* 1897; *probably issued in* 1898. (*Also issued separately*, Mar. 1898.) Contents as follows:

Introductory note (v-vi); the San Jose scale in Illinois (1-25) [*issued as* Ill. Agr. Exp. Sta. Bul. 48, Apr. 1897]; field observations on white grubs (26-34); midsummer measures against the chinch-bug (35-44); a study of the causes of the disappearance of a chinch-bug outbreak (45-74); the spontaneous occurrence of white muscardine among chinch-bugs in 1895 (75-78); miscellaneous chinch-bug experiments (79-102); an entomological train wrecker (103-105); note on a new disease of the army worm (106-109). Appendix: the white pine Chermes, by E. L. STORMENT (iii-xxvi).

- The method of science. Sch. & Home Educ. (Bloomington, Ill.), vol. 18, pp. 113-119, Mar. 1898. (*Reprinted as pamphlet*, 23 pp., 1898.)
- The season's campaign against the San Jose and other scale insects in Illinois. Ill. Hort. Soc. Trans., vol. 31, pp. 105-119, 1898.
- State control of injurious insects. Ill. Farm. Inst. Rep., vol. 3, pp. 67-71, 1898.

Summer school of biology and third summer opening of the Illinois Biological Station. Ill. Univ. pamphlet, 7 pp., 5 fig., 1898.

Biennial Report of the Director of the State Laboratory of Natural History (to the Trustees of the University of Illinois), for 1897-1898, (including reports on the Biological Station and the Summer School). Ill. Univ. Rep., vol. 19, pp. 340-354, 1898? (*Also as pamphlet*, 31 pp., 10 pl., 1898?)

1899

The Museum of Natural History. Illini (Univ. Ill.), pp. 396-400, March 31, 1899.

The San Jose scale. Ill. Ent. Off. Circ. (*in poster form*), Apr. 1899.

Recent work on the San Jose scale in Illinois. Ill. Agr. Exp. Sta. Bul. 56, pp. 241-287, with 4 pl., July 1899. (*Incorporated in Ill. Ent. Rep. 21*, pp. 1-44, 1900.

Lessons from the year's work with the San Jose scale. Ill. Hort. Soc. Trans., vol. 32, pp. 50-61, 1899.

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[—with C. A. HART.] The economic entomology of the sugar beet. Ill. Agr. Exp. Sta. Bul. 60, pp. 397-532, with 97 fig. and 9 pl., Aug. 1900. (*Incorporated in Ill. Ent. Rep. 21*, pp. 49-184, 1900.)

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Twenty-first Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) tenth report of S. A. Forbes. iv + 184 + xxviii pp., 9 pl., 97 fig., 1900. Contents as follows: Introductory note (iv); recent work on the San Jose scale in Illinois (1-44) [*issued as Ill. Agr. Exp. Sta. Bul. 56*, July 1899]; the economic entomology of the sugar beet (49-184) [*issued as Ill. Agr. Exp. Sta. Bul. 60*, Aug. 1900].

Report of the Illinois State Entomologist (to the Governor) concerning operations under the horticultural inspection act, (as of Oct. 31, 1900). Ill. Ent. Off. pamphlet, 30 pp., 1900. (*Cf. Ill. Hort. Soc. Trans.*, vol. 34, pp. 213-215, 1901.)

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Nursery inspection and orchard insecticide work in Illinois. U. S. D. A. Off. Exp. Sta. Bul. 99, pp. 173-176, 1901.

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- Insects injurious to corn. Ill. Farm. Inst. Rep., vol. 6, pp. 80-82, 1901.
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- Biennial Report of the Director of the State Laboratory of Natural History (to the Trustees of the University of Illinois), for 1899-1900. Ill. Univ. Rep., vol. 21, pp. 8-10, 1901. (*Also a revised version as pamphlet*, 12 pp., 1901.)

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- Insecticide experiments for the San Jose scale. Ill. Agr. Exp. Sta. Circ. 53, 2 pp., May 1902. (*An abstract of Ill. Agr. Exp. Sta. Bul. 71 and 72.*)
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- Methods and results of field insecticide work against the San Jose scale. Ill. Agr. Exp. Sta. Bul. 80, pp. 463-502, with 9 pl., Oct. 1902. (*Incorporated in Ill. Ent. Rep. 22, pp. 27-66, 1903.*)
- The canker worm on apple trees and elms. Miss. Vall. Apple Growers' Assoc. Proc. for 1901-1902, pp. 38-41, 1902.
- Entomological notes and inspection report for 1901. Ill. Hort. Soc. Trans., vol. 35, pp. 142-152, 1902.
- Elementary biology in the public school. In "Superintendents' Round Table," (introductory discussion at DeKalb, Oct. 19, 1901, and synopsis of discussion at Chicago, Dec. 13, 1901) separate pamphlet, 20 pp., 1902.

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- How to make the farm attractive to the educated. Unity, pp. 316-318, Jan. 15, 1903.
- The scientific method in high school and college. Sch. Sci., vol. 3, pp. 53-66, May 1903.
- Notes on the insecticide use of the gasoline blast lamp. Ill. Agr. Exp. Sta. Bul. 89, pp. 145-154, Nov. 1903.
- Twenty-second Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) eleventh report of S. A. Forbes. viii + 149 + xx pp., 9 pl., 33 fig., 1903. Contents as follows:

Introductory note (viii); the corn bill-bugs in Illinois (1-26) [*issued as Ill. Agr. Exp. Sta. Bul. 79, Oct. 1902*]; methods and results of field insecticide work against the San Jose scale, 1899-1902

(27-66) [*issued as Ill. Agr. Exp. Sta. Bul. 80, Oct. 1902*]; experiments with lime and sulphur washes for the San Jose scale (67-90) [*issued as Ill. Agr. Exp. Sta. Bul. 71, Apr. 1902*]; experiments and observations on the use of crude petroleum and pure kerosene for the San Jose scale (91-95) [*issued as Ill. Agr. Exp. Sta. Bul. 72, May 1902*]; experiments with summer washes for the San Jose scale (96-97); on the principal nursery pests likely to be distributed in trade (98-138) [*issued as Ill. Agr. Exp. Sta. Circ. 36, July 1901*]; the canker-worm on shade and forest trees (139-144); the Colaspis root-worm (145-149).

Excellencies and defects of existing legislation for the control of insect and fungus pests. U. S. D. A., Off. Exp. Sta. Bul. 123, pp. 122-126, 1903.

Report of inspection and insecticide operations. Ill. Hort. Soc. Trans., vol. 36, pp. 120-121, 1903.

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Report of the Illinois State Entomologist (to the Governor) on the horticultural inspection law, (as of Feb. 1, 1903). Ill. Ent. Off. pamphlet, 30 pp., 1903. (*Cf. Ill. Hort. Soc. Trans., vol. 35, pp. 142-152, 1902; vol. 36, pp. 120-121, 1903.*)

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Directions for the preparation of the Oregon wash. Ill. Hort. Soc. Trans., vol. 37, pp. 20-21, 1904.

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The teaching of the scientific method. Nat. Educ. Assoc. Jour., vol. 43, pp. 879-888, 1904.

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Practical treatment of the San Jose scale. Ill. Agr. Exp. Sta. Circ. 85, 4 pp., Jan. 1905.

Illinois River plankton. Science, vol. 21, pp. 233-234, Feb. 10, 1905.

- Economic and industrial aspects of secondary school biology. Sch. Sci. Math., vol. 5, pp. 173-183, Mar. 1905.
- [—with R. E. RICHARDSON.] On a new shovelnose sturgeon from the Mississippi River. Ill. Lab. Nat. Hist. Bul., vol. 7, pp. 37-44, with 4 pl., May 1905.
- Field experiments and observations on insects injurious to Indian corn. Ill. Agr. Exp. Sta. Bul. 104, pp. 95-152, with 2 fig., Oct. 1905. (*Incorporated in Ill. Ent. Rep. 24, pp. 1-58, 1908.*)
- (Review of) American Insects, by Vernon L. Kellog. Sch. Sci. Math., vol. 5, pp. 777-778, Dec. 1905.
- Plum curculio in the apple orchard: a spraying experiment. Ill. Hort. Soc. Trans., vol. 38, pp. 91-107, with 4 pl., 1905.
- Report of nursery inspection and insecticide operations. Ill. Hort. Soc. Trans., vol. 38, pp. 108-114, 1905.
- (Conference on) insects injurious to corn. Ill. Farm. Inst. Rep., vol. 10, pp. 35-55, with portrait and col. pl., 1905.
- The principal insects injurious to the corn plant. Ill. Farm. Inst. Rep., vol. 10, pp. 220-308, with 69 fig., 1905. (*Composed of portions of Ill. Ent. Rep. 18 and 23.*)
- Twenty-third Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) twelfth report of S. A. Forbes. 273 + xxxiii pp., 8 pl., 238 fig., 1905. (*2d. ed., 280 + xxxviii pp., 1920.*) Contents as follows:
- Introductory note (viii); a monograph of insect injuries to Indian corn. Part II. The more important insect injuries to Indian corn (1-280) [*issued as Ill. Agr. Exp. Sta. Bul. 95, Nov. 1904.*]
- Executive report of the Illinois State Entomologist (to the Governor), including a report of operations under the horticultural inspection law, for 1903-1905. Ill. Ent. Off. pamphlet, 35 pp., 1905. (*Cf. Ill. Hort. Soc. Trans., vol. 37, pp. 229-238, 1904; vol. 38, pp. 108-114, 1905.*)

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- Comparative experiments with various insecticides for the San Jose scale. Ill. Agr. Exp. Sta. Bul. 107, pp. 243-261, Apr. 1906. (*Incorporated in Ill. Ent. Rep. 24, pp. 59-77, 1908.*)
- Spraying apples for the plum curculio. Ill. Agr. Exp. Sta. Bul. 108, pp. 265-286, with 3 diagrams and 4 pl., May 1906. (*Incorporated in Ill. Ent. Rep. 24, pp. 78-99, 1908.*)
- The corn root-aphis and its attendant ant. U. S. D. A. Bur. Ent. Bul. 60, pp. 29-39, Sept. 1906.
- Report of nursery inspection and insecticide operations. Ill. Hort. Soc. Trans., vol. 39, pp. 132-135, 1906.
- Fifty years' progress in the practical control of the insect and fungus pests of Illinois horticulture. Ill. Hort. Soc. Trans., vol. 39, pp. 219-227, 1906.
- (Report on) Entomology. Ill. Blue Book for 1905, pp. 528-529, 1906.

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- The cottony maple scale in Illinois. Ill. Agr. Exp. Sta. Bul. 112, pp. 343-360, with 8 fig. and 3 pl., Jan. 1907. (*Incorporated in* Ill. Ent. Rep. 24, pp. 100-117, 1908.)
- On the local distribution of certain Illinois fishes: an essay in statistical ecology. Ill. Lab. Nat. Hist. Bul., vol. 7, pp. 273-303, with 15 maps and 9 pl., April 1907.
- An ornithological cross-section of Illinois in autumn. Ill. Lab. Nat. Hist. Bul., vol. 7, pp. 305-335, April 1907. (*2d. ed.*, pp. 305-332, 1914.)
- On the life history, habits, and economic relations of the white-grubs and May-beetles. Ill. Agr. Exp. Sta. Bul. 116, pp. 447-480, with 1 fig., Aug. 1907. (*Incorporated in* Ill. Ent. Rep. 24, pp. 135-168, 1908.)
- Report of nursery inspection and orchard insecticide operation. Ill. Hort. Soc. Trans., vol. 40, pp. 124-128, 1907.
- Insects in relation to health. Ill. Farm. Inst. Rep., vol. 12, pp. 263-270, with portrait, 1907.
- Executive report of the Illinois State Entomologist (to the Governor), including a report of operations under the horticultural inspection law, for 1905-1906. Ill. Ent. Off. pamphlet, 27 pp., 1907. (*Cf.* Ill. Hort. Soc. Trans., vol. 39, pp. 132-135, 1906; vol. 40, pp. 124-128, 1907.)
- History of the former state natural history societies of Illinois. Science, vol. 26, pp. 892-898, Dec. 27, 1907. (*Also* Ill. Acad. Sci. Trans., vol. 1, pp. 18-30, 1908.)

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- Practical treatment for the San Jose scale. Ill. Ent. Off. Circ., 2 pp., Feb. 1908.
- Experiments with repellents against the corn root-aphis. Jour. Econ. Ent., vol. 1, pp. 81-83, Apr. 1908. (*Abstract of* Ill. Agr. Exp. Sta. Bul. 130, Dec. 1908.)
- Twenty-fourth Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) thirteenth report of S. A. Forbes. 168 + xvi pp., 8 fig., 11 pl., 1908. Contents as follows:
- Introductory note (vi), injury to corn by the timothy bill-bugs (1-7), field experiments on the corn root-aphis (8-29), field experiments for the protection of corn against chinch-bug injury (30-58) [*first 58 pp. issued as* Ill. Agr. Exp. Sta. Bul. 104, Oct. 1905]; comparative experiments with various insecticides for the San Jose scale (59-77) [*issued as* Ill. Agr. Exp. Sta. Bul. 107, Apr. 1906]; spraying apples for the plum-curculio (78-99) [*issued as* Ill. Agr. Exp. Sta. Bul. 108, May 1906]; the cottony maple scale in Illinois (100-117) [*issued as* Ill. Agr. Exp. Sta. Bul. 112, Jan. 1907]; the elm twig-girdler (118-134); on the life history, habits, and economic relations of the white-grubs and May-beetles (135-168) [*issued as* Ill. Agr. Exp. Sta. Bul. 116, Aug. 1907].

- Directions for the preparation and use of the lime and sulphur wash. Ill. Hort. Soc. Trans., vol. 41, pp. 21-22, 1908. (*Also, ibid.*, vol. 42, pp. 25-27, 1909; vol. 43, pp. 29-30, 1910.)
- Report of nursery inspection and orchard insecticide operations. Ill. Hort. Soc. Trans., vol. 41, pp. 196-201, 1908.
- (Abstract of) a statistical study of midsummer birds of Illinois. Science, vol. 27, pp. 918-920, June 12, 1908.
- The midsummer bird life of Illinois: a statistical study. Amer. Nat., vol. 42, pp. 505-519, Aug. 1908. (*Reprinted*, Ill. Lab. Nat. Hist. Bul., vol. 9, pp. 373-385, Jan. 1913.)
- Experiments with repellents against the corn root-aphis, 1905-1906. Ill. Agr. Exp. Sta. Bul. 130, pp. 3-28, Dec. 1908. (*Incorporated in* Ill. Ent. Rep. 25, pp. 1-26, 1909.)
- Habits and behavior of the corn-field ant, *Lasius niger americanus*. Ill. Agr. Exp. Sta. Bul. 131, pp. 31-45, with 1 pl., Dec. 1908. (*Incorporated in* Ill. Ent. Rep. 25, pp. 27-40, 1909.)
- Reports of the Director of the State Laboratory of Natural History (to the Trustees of the University of Illinois), for 1906 and 1907. Ill. Univ. Rep., vol. 24, pp. 29-30, 157-158, 393-394, 1908.
- (Report on) Entomology. Ill. Blue Book for 1907, pp. 493-494, 1908.

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- On the general and interior distribution of Illinois fishes. Ill. Lab. Nat. Hist. Bul., vol. 8, pp. 381-437, with 102 maps, Feb. 1909. (*Also in* "The Fishes of Illinois," Ill. Nat. Hist. Surv. Rep., vol. 3, pp. lxxii-cxxii, 1909.)
- [—with R. E. RICHARDSON.] The fishes of Illinois. Ill. Nat. Hist. Surv. Rep., vol. 3, cxxxi + 357 pp., 56 pl., 76 text fig.; 103 maps in a separate atlas; 1909. (*2d. ed.*, with 68 pl., 1920.)
- [—with A. O. GROSS.] The economic values of some common Illinois birds. Ill. Supt. Pub. Instr. Circ. 32, "Arbor and Bird Day," pp. 53-74, with 20 fig., 1909.
- Aspects of progress in economic entomology. Jour. Econ. Ent., vol. 2, pp. 25-35, Feb. 1909.
- Program of cooperative experiments by the farmer and the entomologist. Ill. Ent. Off. Circ., 4 pp., Mar. 1909.
- The general entomological ecology of the Indian corn plant. Amer. Nat., vol. 43, pp. 286-301, May 1909. (*Reprinted*, Ill. Nat. Hist. Surv. Bul., vol. 16, pp. 447-457, Apr. 1927.)
- Report on nursery inspection and orchard insecticide operations. Ill. Hort. Soc. Trans., vol. 42, pp. 63-66, 1909.
- Cooperation between the farmer and the entomologist. Ill. Farm. Inst. Rep., vol. 14, pp. 128-135, 1909.

Twenty-fifth Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) fourteenth report of S. A. Forbes. 124 + xxiii pp., 35 fig., 3 pl., 1909. Contents as follows:

Introduction (v-xi); experiments with repellents against the corn root-aphis, 1905 and 1906 (1-26) [*issued as Ill. Agr. Exp. Sta. Bul.* 130, Dec. 1908]; habits and behavior of the corn-field ant, *Lasius niger americanus* (27-40) [*issued as Ill. Agr. Exp. Sta. Bul.* 131, Dec. 1908]; the insect pests of clover and alfalfa, by J. W. FOLSOM (41-124) [*issued as Ill. Agr. Exp. Sta. Bul.* 134, Apr. 1909].

Introduction (to) contents and index of the reports of the State Entomologist of Illinois, XIII-XXIV, 1884-1908, pp. 5-7, 1909.

Executive report of the Illinois State Entomologist (to the Governor), including a report of operations under the horticultural inspection law, for 1907-1908. Ill. Ent. Off. pamphlet, 21 pp., 1909. (*Cf.* Ill. Hort. Soc. Trans., vol. 41, pp. 196-201, 1908; vol. 42, pp. 63-66, 1909.)

The Illinois State Laboratory of Natural History and the Illinois State Entomologist's Office. Ill. Acad. Sci. Trans., vol. 2, pp. 54-67, 1909.

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Report on nursery inspection and orchard insecticide operations. Ill. Hort. Soc. Trans., vol. 43, pp. 93-96, 1910.

The Brown-tail and gipsy moths. Ill. Hort. Soc. Trans., vol. 43, pp. 96-101, with 2 pl., 1910.

Recent work of the entomologist's office. Ill. Farm. Inst. Rep., vol. 15, pp. 140-150, with portrait, 1910.

The Hessian fly in Illinois. Ill. Agr. Exp. Sta. Circ. 146, 4 pp., Sept. 1910. (*Revised ed.*, 5 pp., June 1914.)

(Review) Catalogue of Canadian birds, by John Macoun. Science, vol. 32, pp. 343-344, Sept. 9, 1910.

Biological investigations on the Illinois River. Ill. Lab. Nat. Hist. pamphlet, 14 pp., 11 pl., 1910. *Includes*: I. The work of the Illinois Biological Station. (*Abstract*, Science, vol. 31, pp. 837-838, May 27, 1910.) II. The investigation of a river system in the interest of its fisheries. (*Cf.* Amer. Fish. Soc. Trans., vol. 40, pp. 179-193, with 2 pl., 1911).

Executive report of the Illinois State Entomologist (to the Governor), including a report of operations under the horticultural inspection law, for 1909-1910. Ill. Ent. Off. pamphlet, 11 pp., 1910. (*Cf.* Ill. Hort. Soc. Trans., vol. 43, pp. 93-96, 1910; vol. 44, pp. 90-93, 1911.)

Relations of the Illinois Academy of Science to the State. Ill. Acad. Sci. Trans., vol. 3, pp. 32-43, 1910.

[—with others.] Report of committee on an ecological survey (of Illinois). Ill. Acad. Sci. Trans., vol. 3, pp. 51-56, 1910.

1911

The chinch bug abroad again in Illinois. Ill. Ent. Off. Circ., 4 pp., May 1911.

- Household pests and their relation to public health. (Chicago) City Club Bul., vol. 4, pp. 77-80, May 1911.
- Economic entomology (abstract of an address). Ill. Farm. Inst. Rep., vol. 16, pp. 309-316, 1911.
- Report on nursery inspection and orchard insecticide operations. Ill. Hort. Soc. Trans., vol. 44, pp. 90-93, 1911.
- Forestry survey of Illinois. Ill. Hort. Soc. Trans., vol. 44, pp. 93-96, 1911.
- Some important insects of Illinois shade trees and shrubs. Ill. Agr. Exp. Sta. Bul. 151, pp. 463-529, with 67 fig., Oct. 1911. (*Incorporated in Ill. Ent. Rep. 26, pp. 1-67, 1911.*) (*Reprinted, Ill. Farm. Inst. Rep., vol. 21, pp. 244-294, 1916.*)
- The chinch-bug situation in Illinois: fall and winter measures to be taken. Ill. Agr. Exp. Sta. Circ. (*without serial number*), 4 pp., Nov. 1911. (*Reprinted, Ill. Farm. Inst. Rep., vol. 17, pp. 300-302, 1912.*)
- [—with others.] (Report of the) committee on ecological survey (of Illinois). Ill. Acad. Sci. Trans., vol. 4, pp. 24-27, 1911.
- J. A. West: in memoriam. Ill. Acad. Sci. Trans., vol. 4, p. 158, 1911.
- Twenty-sixth Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) fifteenth report of S. A. Forbes. 160 + xix pp., 133 fig., 1911. Contents as follows:
 Some important insects of Illinois shade trees and shrubs (1-67) [*issued as Ill. Agr. Exp. Sta. Bul. 151, Oct. 1911, and reprinted in Ill. Farm. Inst. Rep., vol. 21, pp. 244-294, 1916*]; miscellaneous economic insects, by CHARLES A. HART (68-98); on the more important insects of the truck-farm and vegetable garden, by J. J. DAVIS (99-160) [*also in Ill. Farm. Inst. Rep., vol. 16, pp. 216-263, 1911*].
- Report of the Director of the State Laboratory of Natural History (to the Trustees of the University of Illinois), as of June 3, 1909. Ill. Univ. Rep., vol. 25, pp. 200-201, 1911.
- Illinois Biological Station. Internat. Rev. Hydrobiol., vol. 4, pp. 226-227, with 1 pl., 1911.

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- Definite results of survey work on the Illinois River. Amer. Fish. Soc. Trans., vol. 41, pp. 75-89, with 1 map, 1912. (*Revised version, with new title: Chemical and biological investigations on the Illinois River, mid-summer of 1911. Ill. Lab. Nat. Hist. pamphlet, 9 pp., 1 map, 1912.*)
- What is the matter with the elms in Illinois? Ill. Agr. Exp. Sta. Bul. 154, pp. 3-22, with 4 fig. and 6 pl., Feb. 1912. (*Incorporated in Ill. Ent. Rep. 27, pp. 1-20, 1912.*)
- What should the state require of a negligent owner of a dangerous orchard? Jour. Econ. Ent., vol. 5, pp. 205-207, Apr. 1912. (*Also, Ill. Hort. Soc. Trans., vol. 45, pp. 77-81, 1912.*)
- Report on nursery inspection and orchard insecticide operations. Ill. Hort. Soc. Trans., vol. 45, pp. 74-75, 1912.

- The chinch-bug situation in Illinois: plans for a cooperative campaign. Ill. Agr. Exp. Sta. Circ. (*without serial number*), 7 pp., May 1912. (*Also*, Ill. Farm. Inst. Rep., vol. 17, pp. 302-307, 1912.)
- The 1912 chinch-bug campaign in Illinois. Ill. Ent. Off. Circ., 17 pp., 8 fig., Nov. 1912.
- The native animal resources of the state. Ill. Acad. Sci. Trans., vol. 5, pp. 37-48, 1912.
- Twenty-seventh Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) sixteenth report of S. A. Forbes. 143 + xvii pp., 6 pl., 93 fig., 1912. Contents as follows:
- What is the matter with the elms in Illinois? (1-20) [*issued as* Ill. Agr. Exp. Sta. Bul. 154, Feb. 1912]; on black-flies and buffalo-gnats (*Simulium*) as possible carriers of pellagra in Illinois (21-55) [*also in* Ill. Pellagra Com. Rep. for 1911, pp. 176-191, 1912, *and also issued separately*, 1912]; insects injurious to stored grains and their ground products, by A. A. GIRAULT (56-82) [*issued as* Ill. Agr. Exp. Sta. Bul. 156, July 1912]; report on insects injurious to flowering and ornamental greenhouse plants in Illinois, by J. J. DAVIS (83-143).
- Report of the Director of the State Laboratory of Natural History (to the Trustees of the University of Illinois), for 1909-1910. Ill. Univ. Rep., vol. 26, pp. 68-70, 1912.

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- The corn root-aphis in Illinois. Ill. Agr. Exp. Sta. Circ. (*without serial number*), 7 pp., Jan. 1913.
- The *Simulium*-pellagra problem in Illinois. Science, vol. 37, pp. 86-91, Jan. 17, 1913. (*Also*, Ent. Congr. (Oxford) Trans., vol. 2, pp. 477-485, 1913.)
- [—with R. E. RICHARDSON.] Studies on the biology of the upper Illinois River. Ill. Lab. Nat. Hist. Bul., vol. 9, pp. 481-574, with 21 pl., June 1913.
- Biological and chemical conditions on the upper Illinois River. Ill. Water Sup. Assoc. Proc., vol. 5, pp. 161-170, with 1 map and 3 diagrams, 1913.
- Needed legislation in the interests of horticulture. Ill. Hort. Soc. Trans., vol. 46, pp. 49-51, 1913.
- The apple flea-weevil in Illinois. Ill. Hort. Soc. Trans., vol. 46, pp. 53-55, 1913.
- Executive report of the Illinois State Entomologist (to the Governor), including a report of operations under the horticultural inspection law, for 1911-1912. Ill. Ent. Off. pamphlet, 24 pp., 1913. (*Cf.* Ill. Hort. Soc. Trans., vol. 45, pp. 74-81, 1912; vol. 46, pp. 49-51, 1913.)
- Report of the committee on an ecological survey (of Illinois). Ill. Acad. Sci. Trans., vol. 6, pp. 18-23, 1913.

1914

- The chinch-bug situation: present prospects and practical plans. Ill. Ent. Off. Circ., 3 pp., Feb. 1914.
- The chinch-bug in Illinois in 1914: preparations for the summer campaign. Ill. Ent. Off. Circ., 11 pp., 3 pl., Apr. 1914.
- Community operation and co-operation against fruit pests. Ill. Hort. Soc. Trans., vol. 47, pp. 171-176, 1914.
- Fresh water fishes and their ecology. Ill. Lab. Nat. Hist., pamphlet, 10 pp., 10 pl., 21 maps, 1914.
- Report of the Director of the State Laboratory of Natural History (to the Trustees of the University of Illinois), for 1911-1912. Ill. Univ. Rep., vol. 27, pp. 158-159, 1914.
- [—with others.] Report of the committee on an ecological survey of the state. Ill. Acad. Sci. Trans., vol. 7, pp. 12-16, 1914.

1915

- Recent Illinois work on the corn root-aphis and the control of its injuries. Ill. Agr. Exp. Sta. Bul. 178, pp. 405-466, with 18 fig., Jan. 1915. (*Incorporated in Ill. Ent. Rep. 28, pp. 1-62, 1915.*)
- Observations and experiments on the San Jose scale. Ill. Agr. Exp. Sta. Bul. 180, pp. 545-561, with 3 fig., Mar. 1915. (*Incorporated in Ill. Ent. Rep. 28, pp. 87-106, 1915.*)
- The chinch-bug in Illinois in 1915: preparations for the summer campaign. Ill. Agr. Exp. Sta. Circ. (*without serial number*), 16 pp., 1 map, 4 pl., Apr. 1915.
- Preliminary note on the life history of the codling-moth in Illinois. Ill. Ent. Off. Circ., 15 pp., 6 pl., May 1915.
- The danger to wheat from the Hessian fly. Ill. Agr. Exp. Sta. Circ. (*without serial number*), 1 p., Sept. 1915.
- Twenty-eighth Report of the State Entomologist on the noxious and beneficial insects of the State of Illinois, (*being the*) seventeenth report of S. A. Forbes. 106 + ix pp., 24 fig., 4 pl. 1915. Contents as follows:
Recent Illinois work on the corn root-aphis and the control of its injuries (1-62) [*issued as Ill. Agr. Exp. Sta. Bul. 178, Jan. 1915*]; observations and experiments on the San Jose scale (63-79) [*issued as Ill. Agr. Exp. Sta. Bul. 180, Mar. 1915*]; life history and habits of the northern corn root-worm (80-86); the San Jose scale, by P. A. GLENN (87-106) [*issued as Ill. Agr. Sta. Circ. 180, Apr. 1915*].
- The ecological foundations of applied entomology. Ann. Ent. Soc. Amer., vol. 8, pp. 1-19, 1915.
- Insect and fungous pests of the nursery that should be classed as dangerous. Ill. Hort. Soc. Trans., vol. 48, pp. 153-161, 1 pl., 1915.
- Insect pests and their control. Ill. Farm. Inst. Rep., vol. 20, pp. 187-191, 1915.

The insect, the farmer, the teacher, the citizen, and the state. Ill. Lab. Nat. Hist. pamphlet, 14 pp., 1915.

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