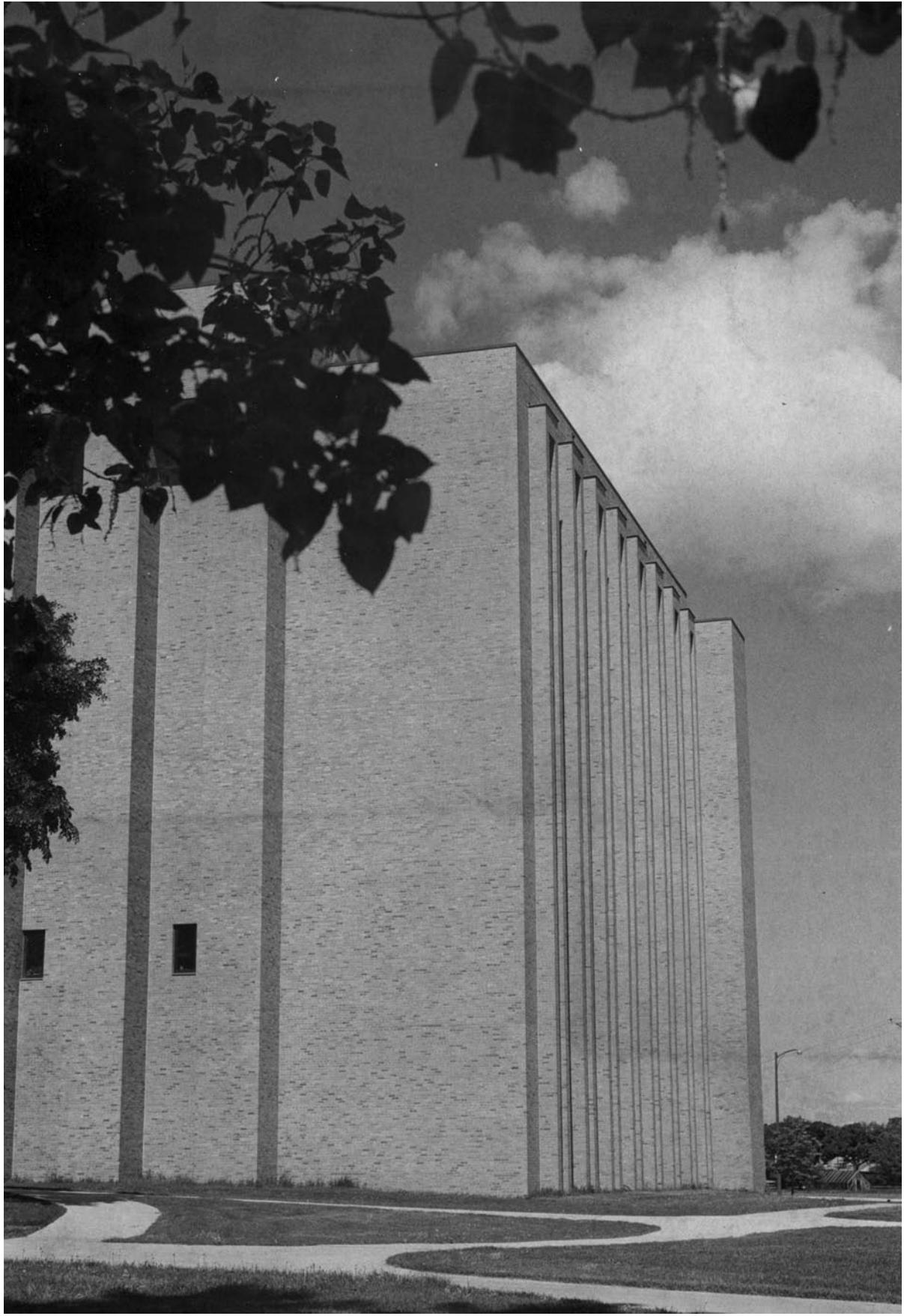


DEPARTMENT OF ENTOMOLOGY, FISHERIES, AND WILDLIFE



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## Preface

Alexander Carlton Hodson was an employee of the University of Minnesota during 47 of the 87 years of this historical account. This near half-century of his tenure was an important period in the development of the Department of Entomology, Fisheries, and Wildlife, as the reader will be immediately aware. But what may not also be clear is the fact that A. C. Hodson himself, particularly in the post-World War II decades of such rapid changes, played significant roles not only in shaping the history of the Department about which he writes but, indeed, in influencing to an important degree the history of the University of Minnesota as a whole.

He was born June 17, 1906, in Reading, Massachusetts; his family was in the house-painting business, and Alec joined the enterprise as a young man. Later he attended the University of Massachusetts (B.S., 1928), and then the University of Minnesota (M.A., 1931, and Ph.D., 1935). During this graduate student period, he also attended the University of Washington's Puget Sound Biological Station in the summer of 1930, where he studied marine ecology under the tutelage of Victor E. Shelford, an experience which was to have a profound influence upon his later career. He studied and worked as a Teaching Assistant, and later as an Instructor, while a graduate student in the Departments of Zoology, and Entomology and Economic Zoology. Through his career in the latter Department, he moved up through academic ranks to Professor, and finally to Head of the Department in 1960. In 1962, he was instrumental in changing the Department's name to Entomology, Fisheries, and Wildlife. In 1974, at the age of 68, he retired.

Such are the bare-bones vitae of Dr. A. C. Hodson's professional career: the beginning, the preparations, the progression in academic position, the retirement--with dates and places. But omitted from this brief paragraph are details of his accomplishments and professional activities that would require, not only additional paragraphs, but many pages.

His professorial activities include a long period of undergraduate and graduate teaching, primarily in animal ecology and forest entomology. A literal parade of graduate students - more than 70 - passed under his guidance. He published widely in the areas of forest insects, pest problems of fruit and field crops, and the interrelationships of insects and micro-organisms in stored grain. His emphasis was always on the organisms' population dynamics. He was quick to point out not only where insect pest control was required, but also circumstances when, because of the insect's natural history or population development characteristics, the application of insecticides would be unnecessary or even detrimental. Among his major scientific contributions were his studies on the population dynamics of the forest tent caterpillar, such that predictions could be made of defoliation damage well in advance; similar predictions were made possible for the apple maggot, as the result of his studies on the population ecology of this species. His basic approach to entomological problems was through an understanding of the insect's ecology and its dynamic relationship to the rest of the ecosystem.

Dr. Hodson's list of professional society associations, public service special assignments, and administrative and academic committee responsibilities is long and detailed. The diversity of his interests and abilities is legion: he counseled University presidents on problems of great import, as well as a neighbor child with a butterfly collection;

he chaired numerous selection committees for deans and vice-presidents, served on the St. Paul Campus landscaping committee, and edited a newsletter to staff in the armed forces in World War II. One of his best-liked assignments was as a member of the University of Minnesota Press advisory committee. He also served on advisory committees for the University's field stations at Itasca and Cedar Creek, and for two periods of several years each as a member of the University Faculty Consultative Committee. He was instrumental in obtaining approval and funding - and seeing the final construction - of the department's new building, completed in 1968. Perhaps his favorite special project was the collection of phenological data each year - recording the times of natural events as seasons progressed - now for 35 years a continuous record, and still proceeding. Even this list is far from complete. Through all he maintained a close relationship to students and to staff in his Department, with boundless great energy and a never-flagging sense of good humor.

He received many honors: Fellow of the Entomological Society of America and the American Association for the Advancement of Science, Distinguished Service Award from the Minnesota Academy of Science and the Society of Sigma Xi, Award of Merit from Gamma Sigma Delta, and elected officerships in the Ecological Society of America and the Entomological Society of America. The A. C. Hodson Ecology Lecture series, held in 1975 at the University, was a testament to his impact both in research and upon his students, and included presentations from his former advisees now making their own scientific contributions; the series was published as "Insect Ecology, Papers Presented in the A. C. Hodson Ecology of Lectures," in 1977.

On the sunny, springtime morning of May 27, 1976, the new building that houses the Department of Entomology, Fisheries, and Wildlife was renamed in his honor - Hodson Hall. At the brief outdoor ceremony, representatives of the University administration, faculty, secretarial staff, family and many of his former students, gathered to honor A. C. Hodson and wish him well.

Today he lives in St. Paul with his wife, Audrey Jane, in their home of long standing, where they garden and house-paint. He retains an emeritus office in Hodson Hall, where he continues to work productively, assembling further research reports on forest insect studies for publication.

Thomas F. Waters  
St. Paul, Minnesota  
October 1976

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The Department of Entomology, Fisheries, and Wildlife  
1888-1974  
(Chronological and Somewhat Anecdotal)

A. C. Hodson

The earliest record of the presence of an entomologist in Minnesota dates back to 1823 in an account of Thomas Say's expedition to the source of the St. Peter's River, long since renamed the Minnesota River. A little more than 50 years later, in 1876, a man by the name of Allan Whitman was appointed by Cyrus Thomas of the U. S. Entomological Commission to report on the Rocky Mountain locust in Minnesota. His account can be found in the first report of the Commission, published in 1878. Probably the first person to teach entomology in Minnesota was O. W. Oestlund. He had served as entomologist with the Minnesota Geological and Natural History Survey from 1885 to 1890, and later taught entomology in the University's Department of Animal Biology (Zoology) from 1891 until his retirement in 1926. However, instruction in entomology was announced as early as 1871. In the first edition of the "Minnesota University Almanac," which preceded bulletins, it was stated that there were 4 faculty members in the College of Agriculture and the Mechanic Arts, and that agriculture is to be conducted along the following lines:

Chemistry - Geology and Mineralogy  
Botany - Horticulture and Pomology  
Zoology - Anatomy, Entomology, Ornithology, Stock Breeding, Veterinary Science, Poultry, Insects Injurious to Vegetation, and Pisciculture

The inclusion of ornithology and pisciculture in the subject matter coverage suggests that entomology, fisheries, and wildlife were grouped together at a very early time in the history of the University. To be sure, there were neither any students in the College at that time nor were there more than 30 for another 35 years.

During these early years and continuing to the present, faculty members were cross listed as full members of the College of Science, Literature and the Arts and the College of Agriculture. In the years 1874-77 Newton W. Winchell, the State Geologist, was a faculty member in both Colleges and taught geology, mineralogy, botany, and zoology. The 1874 University Calendar describes a course in economic entomology with Harris's Insects Injurious to Vegetation to be used as the text. There is no indication as to whether Winchell or his successor W. C. Hall ever taught this course, but both were listed on the faculty of the College of Agriculture. Although there is no record of Dr. Hall teaching entomology there is concrete evidence that he was interested in insects. In our first Department Collection Accession Book there is a record of his collecting a variety of insects and spiders along the North Shore of Lake Superior in 1879. The practice of having joint appointments between colleges on the two campuses

was common in these early days. In 1885 Henry Nachtrieb is listed as an Assistant Professor of Biology in both the College of Science, Literature and the Arts and the College of Agriculture. He had such a joint appointment at least until 1895, but there is no evidence of participation in our Department instructional program. He retired as chairman of the Department of Animal Biology in 1923.

In 1888, the year following the passage of the Hatch Act by Congress, the staff of the Minnesota Agriculture Experiment Station was selected. Prominent among the six new staff members was Otto Lugger who was appointed Station entomologist and botanist, and sole member of the newly established Division of Entomology and Botany in the University College of Agriculture. Two years later, in 1890, he was referred to as instructor of zoology and entomology with the titles of lecturer in the School of Agriculture and professor in the College. He continued as Station entomologist and botanist in the Experiment Station until his death in 1901.

#### Rocky Mountain Locust Studied



Professor Otto Lugger at work.

When Professor Lugger arrived in Minnesota he was confronted with a number of serious insect pest problems. Among the most important were an invasion by the infamous Rocky Mountain locust and severe damage to small grains by chinch bugs. He quickly made a name for himself by working closely with farmers to develop large scale control operations to combat these pests, and perhaps more than anything else by presenting his extensive knowledge of insects in popular language. His six annual reports, numerous bulletins and articles in local papers gave him well-earned public recognition.

Perhaps his most ambitious project was the artificial propagation and distribution of fungus spores to be used in biological control of chinch bugs. This activity was supported by funds provided by the legislature specifically for this purpose in an Act passed in March 1895. This Act stated that "It shall be the duties of the Entomologist at the Experiment Station of the University of Minnesota...to procure the necessary equipment and assistance and proceed to combat chinch-bugs and other insect plagues and to propagate such contagion or infection as is supposed to be destructive to chinch-bugs and other insects that are destructive to crops in this state; such contagion or infection shall be propagated at the State Experiment Station, and in such quantities as may be necessary to supply the farmers of this state with the same when required, and shall be furnished to them free of charge..." The sum of \$5,000.00 was appropriated to be payable to Professor Lugger upon approval in writing by the Governor. Obviously he was successful in mass propagation of spores because during 1895 he distributed 14,877 boxes of fungus spores to 1,941 farmers. Most of them farmed in Minnesota, but farmers in 13 other states, ranging from Colorado to New York, also applied for and received shipments of spores. Lugger in reporting on this activity in the First Annual Report of the Entomologist of the State Experiment Station (1896) was careful to point out that "None of the diseases that kill chinch-bugs can be called a true remedy, as we can do one part of the work, while climatic conditions must do the other."

When Otto Lugger died May 21, 1901, he left a significant legacy to the Department. In addition to the annual reports which provided vivid accounts of injurious and beneficial insects in the state there was an extensive library and a large insect collection. The library he acquired by purchasing books, mostly from the D. E. Stechert importing company with state funds provided for the investigation of the control of various insects. In 1896 alone he used 7 percent of his budget for this purpose as reported in the Annual Report of the Entomologist of the State Experiment Station. The insect collection, which contained an estimated 180,000 specimens, was assembled by collections made by Lugger and his associates, by purchase, and by the exchange of large numbers of specimens with other persons and institutions here and abroad. In a letter dated 1890 from Laurence Brunner, head of the Entomology Department at the University of Nebraska, Brunner referred to grasshopper specimens received from "far away Minnesota--the Land of the Noble Red-man." He and Lugger had exchanged specimens of Orthoptera. Brunner closed his letter thus, "This note was written during 'stolen time' so it savors of watermellon--please try to appreciate as you would stolen." More detail concerning the life history of Professor Lugger will be presented in Appendix A, "Biographical Sketches," as will that of some other staff members who appear on stage during this historical account.

For a short time after Lugger's death in 1901 E. B. Forbes, the son of Stephen A. Forbes, returned to serve as Station Entomologist. Previously he had worked as one of Lugger's assistants in 1897, and later became Director of the Institute of Animal Nutrition at Pennsylvania State College. According to a letter written by Forbes in 1940, Professor Lugger went to Europe a few days after Forbes arrived in Minnesota, and left him \$10 with which to run the office for 8 months. The Experiment Station Director bailed him out by arranging for him to have access to and use Lugger's state

appropriation. Forbes had terminated his service with Lugger before the end of his first year because he could not in good conscience continue to work with him. Among other things, Lugger told Forbes that he could write his next 10 Annual Reports without ever leaving his office. On the other hand, Dr. L. O. Howard had some very kind words for Lugger. He said, "...that he was a very well-trained entomologist, a great humorist and a man of great information. His administration of his office in Minnesota was most successful and his annual reports were sound, extensive, and widely read."

In 1902 Frederick L. Washburn succeeded Lugger as Chief of the Division. The following year, in 1903, the State Legislature passed a law designating the University Experiment Station Entomologist as the State Entomologist. Lugger had assumed that he had this title much as he had "assumed" that he had a Ph.D. degree from The Johns Hopkins University. At this time there was another change. Washburn's position was no longer referred to as Station Entomologist and Botanist. In addition to his Experiment Station responsibilities Washburn also served in the College as Professor of Entomology and in the School of Agriculture as Professor of Zoology and Entomology. Washburn started immediately to build the Division staff by obtaining the services of A. G. Ruggles as Assistant Instructor in 1902. His teaching activities and those of others who have joined the staff over the years will be described in some detail in Appendix B, "Development of Department Teaching Program." In the next year, 1903, the first insect taxonomic paper appeared, "The Collembola of Minnesota" by Joseph E. Guthrie, who was on the staff of the State Geological and Natural History Survey. This paper was published as Zoological Series IV of the State Geological and Natural History Survey edited by Henry Nachtrieb, Professor of Animal Biology, who was appointed in 1891 as State Zoologist and curator of the University Zoological Museum.

Ruggles collected extensively and soon added much to the Department insect collection. His research covered a wide range of problems as was common in his day. The few bits of evidence suggest that he concentrated more on vegetable and shade tree insects. Ruggles carried a heavy teaching load in both the School of Agriculture and the College of Agriculture. More will be said about that in the review of the Department instructional programs. He was joined by Henry J. Franklin who was listed as instructor in 1909 and was engaged principally in teaching in the School of Agriculture. The following year Franklin was replaced by E. B. Stafford who held the rank of Assistant in Entomology. He taught in both the School and College. In 1912 C. W. Howard joined the staff as Assistant Professor, and, according to Dr. W. A. Riley, introduced the first offering of a course on insects and diseases. This may not be completely accurate because the 1909-10 Calendar includes a new course in "Insects and Diseases" to be taught by Washburn. Howard took his M.S. degree in the Department in 1913 and, in addition to teaching parasitology and medical entomology, contributed much toward organization and expansion of the library. Howard served on the Department staff as Associate Professor for 2 years and then moved to Canton, China, where he was Professor of Biology at Lingnan University and Director of the Silk Experiment Station. He had had previous foreign experience soon after his graduation from Cornell University in 1904, having served as Entomologist in the Transvaal for 4 years and as Chief of the Entomological Section of the Department of Agriculture of Mozambique, Portuguese East Africa from 1908-1912.

William Moore, who joined the staff in 1913, also had been active abroad. Before coming to Minnesota in 1913 he served 3 years' as lecturer in Entomology and Zoology at the Potchefstroom Agricultural School in South Africa. Thus it can be seen that staff involvement in overseas activities is nothing new. Moore was an insecticide specialist and taught toxicology. He was the first person in this country to make use of tear gas as an insecticide (an Italian published on its use the same year, 1917). He also developed the idea of the electrical charge of leaf surfaces and spray particles as factors in the adhesion of insecticides to foliage. Much to the regret of his associates here he accepted a position with the USDA in 1921, and in 1923 became Research Entomologist with the American Cyanamid Company.

In an unpublished memorandum Dr. Riley comments on the fact that, though Dr. Washburn was a Harvard man, it is interesting to note that the younger men who joined his staff were all Cornellians who had come under the influence of the famous teacher, John Henry Comstock. Riley goes on to say that this was due in large part to the influence of Professor Ruggles who had received both the B.S. and M.S. degrees from Cornell.

### Bee Culture Established

During Washburn's tenure as Chief of the Division, a Division of Bee Culture was established in 1913 in the University Department of Agriculture. Apparently this action came in response to requests by the Minnesota Beekeeper's Association, and Father Jager, a Priest and beekeeper from St. Bonifacius, was named Chief of the new Division. Washburn had offered one course in "Elements of Beekeeping" earlier in 1907, but the teaching in this area expanded rapidly under Professor Jager's direction, with courses in both theoretical and practical beekeeping being offered in both the School and College instructional programs. Thus Minnesota was the first to establish a separate department for beekeeping teaching and research, and most probably is the only one to have been established in the U.S.

At the time of Jager's appointment, most of the bees kept in Minnesota were an inferior black variety. Thus, his first task was to introduce queens of the superior Italian race. Many of these queens were obtained from Yugoslavia and Austria. As the result, from 1915 to 1922, about 6,000 queens of the introduced variety were reared in the University apiaries and sold to Minnesota beekeepers.

Father Jager retired on October 1, 1928, and at the same time the Bee Culture Division was incorporated into the Division of Entomology and Economic Zoology. Just before his retirement, Father Jager sent a note to James Hambleton, the Federal Apiculturist, saying, "I will devote myself to queen breeding and queen rearing, packaged bees, comb honey production, and my church work. This will give me complete liberty in any action."

Department Name Changed

In passing, it should be mentioned, to avoid confusion, that the Department name was changed from the Division of Entomology and Botany to Division of Entomology in 1902, and to Division of Economic Zoology in 1916. Three years earlier the Divisions of the Department of Agriculture were subdivided into sections. Our Division had four staff members and four sections: Economic Vertebrate Zoology, Economic Entomology, Parasitology, and Research in Economic Zoology, each with a leader, and an annually appointed or elected Division Chairman. Washburn was appointed Chairman for a year and it is possible that his dissatisfaction in playing this role may account for his stepping down as administrative officer in 1917. He continued to serve on the staff as Economic Zoologist until his retirement in 1926. In 1918, when Dr. William A. Riley became Division Chief, the name was changed again to Division of Entomology and Economic Zoology. According to the President's Report to the Board of Regents for 1918 the organization of Divisions into Sections was abandoned because: "This experiment in democratic organization resulted in a large increase in the number of staff who had administrative duties to perform with consequent serious interruption of the teaching and research duties, and an undesirable decentralization of administrative responsibility for the policies and business affairs of the divisions." With the organization of the Institute of Agriculture in 1952 all Divisions in what had been called the Department of Agriculture since 1903 were thereafter called Departments. In 1962 our Department name was changed once more to its present title of Entomology, Fisheries, and Wildlife. Please accept my reference to Department in the early portions of this discourse as if it were a Generic Taxon.

At the beginning of the illustrious Riley era, which began in 1918, the staff consisted of William A. Riley and Frederick Washburn, Professors; Arthur Ruggles and William Moore, Associate Professors; Oscar Oestlund and Royal N. Chapman, Assistant Professors; and Samuel Graham and Warren Williamson, Assistants. One of Dr. Riley's first acts was to divest himself of the title and responsibilities of State Entomologist. As he has stated, "As promptly as could be arranged he (Professor Ruggles) was then made State Entomologist, a position which by law devolved upon the head of the Division, (I was 'king for a day')." Ruggles served as both University Professor and State Entomologist until his retirement in 1943.

In a letter from Dr. Riley to Professor Ruggles dated August 18, 1917, while he was thinking about coming to Minnesota, Riley said among other things, "I am too thoroughly imbued with the Comstock doctrine to believe that a broad department can be built up on any other than the general science basis." He referred to Professor Oestlund's remarkable knowledge of the aphids and the presence of the brilliant young ecologist, R. N. Chapman, as Minnesota assets. He said further in another letter with reference to the position offer from Dean Thatcher, Dean of the College of Agriculture at Minnesota, "However I could not give a reply without more definite assurance as to what the position might lead to and without as to the Department appropriations, library facilities and prospects for developing the entomological library." It is clear that library development was prominent in his thinking even before he arrived in Minnesota. He

also called attention to the need for a new Department building (one was completed 50 years later). Another condition for Riley's being willing to come to Minnesota was the arrangement for his joint appointment with the Department of Animal Biology.

### Insect Display Cases Initiated

The first major staff appointment made by Dr. Riley was that of Professor Harry Knight who was placed in charge of the insect collection and was instrumental in initiating the preparation of the insect display cases which attracted the attention of old and young for many years in the third floor corridor of Coffey Hall. Dr. Riley explains Dr. Knight's departure in 1925 by saying, "Iowa State College was having a post-war expansion which, unfortunately for us, enabled them to out-bid us." Dr. Riley also employed graduate students to teach animal biology in the School of Agriculture, a practice which preceded his arrival and was continued for many years. Among the early ones were Anna Wentz, Florence Defiel, Simon Marcovitch and Samuel Graham. The first M.S. degree offered in the Department was awarded to C. W. Howard in 1913, and Samuel Graham and Marshall Hertig received the first Ph.D. degrees in 1921.

The wooden floor of the room in the northwest corner of the third floor of Coffey Hall, which served as the Department Head's office, had very conspicuous acid burns which probably date back to when Professor Howard was teaching parasitology there. With Dr. Riley's joint appointment with Zoology, he arranged to have parasitology and medical entomology taught as joint offerings of the two Departments and in the Zoology building instead of in Coffey Hall. This move served as a precedent for other joint appointments and the joint offering of other major courses in the two Departments. There had been an earlier attempt to bring the Departments closer together as indicated by Department of Agriculture Faculty Meeting minutes of May 8, 1916. "Rearrange the bulletin placing the course descriptions of the Division of Economic Zoology and the Department of Zoology of the College of SLA in one group under the head 'Zoology.' This request was made by the Division of Economic Zoology in order to show the special relation which exists between their Division and the Department of Animal Biology." Note that department of Zoology and Animal Biology were interchanged in the quotation.

### Students Petitioned

Students had also been concerned about some College of Science, Literature, and the Arts offerings as shown by the Student Petition in 1909 which reads as follows: "We, the undersigned, while impressed with the excellence of course I in zoology given at the State University, believe that possibly six hours a week for the entire year is too much time for Agriculture students to put upon morphology. We further believe that it would be a desirable thing to give elementary entomology to all freshmen in the Agricultural College as a preparation for the special courses in later years." One of the signers was Samuel A. Graham who said in his comments, "It is my opinion that a course in elementary entomology would be advantageous to foresters and agriculturalists and should be substituted for languages or some other academic subject."

The precedent for joint appointments and the joint offering of courses enabled Dr. Riley to retain the services of Royal N. Chapman when he was being wooed by Cornell University. Chapman had an appointment as Instructor in Zoology and Riley arranged an appointment for him as Assistant Professor of Zoology and Assistant Entomologist in the Experiment Station in 1918 as part of a reorganization of the Division of Entomology. Dr. Chapman commented further on the interdepartmental relations subject in response to a request from Dean Coffey with regard to Riley's influence on the Division of Entomology and Economic Zoology. In his March 11, 1925, letter to the Dean he said, "Last but not least he has joined in the spirit of a true University the Division of Entomology with the Department of Biology in a way that is demanded of any two departments with such unity of subject matter."

### Graduate Levels More Firmly Established

Shortly after Dr. Riley's arrival, collegiate work on the graduate level was more firmly established by assembling an outstanding faculty. A letter received by Dr. Chapman, soon after he became Chief of the Division in 1926, from the Chief of the Federal Bureau of Entomology attests to this last statement. He said that they had more applications from their various staff members for leaves of absence to do graduate work at Minnesota than for any other American university. Riley also expended considerable effort in building up the Department library, effectively promoted the growth of the insect collection, and encouraged the development of fundamental research.

Dr. Riley worked to maintain and build up the staff to accomplish his aims with a serious handicap. In the President's Report to the Board of Regents in 1920 it is stated that Minnesota was next to the bottom in salaries as compared with 10 state universities and had lost 25 percent of its faculty at the professional rank. But he had a good nucleus with such persons on the staff as Washburn, Ruggles, Knight, Moore, Chapman and Graham. During the period 1920 to 1925 he was able to add only one new position. In 1922 Clarence Mickel accepted an appointment as the first Extension Entomologist on a half-time basis while he completed his graduate work. Upon completion of the Ph.D. degree program in 1925, Mickel was appointed Assistant Professor with half-time to be devoted to Extension and half-time to replace Dr. E. R. O. Horlbog who had served as curator for 1 year after Dr. Knight resigned. Two years later Mickel discontinued the Extension work. He assumed the teaching of entomology in the Animal Biology Department with a joint appointment after the retirement of Dr. Oestlund, who also had held a joint appointment.

From October 1922 to June 1923 Professor Washburn was on a sabbatical leave to collect insects and other animals in certain Polynesian Islands. He spent another year in the South Pacific just before he retired in 1926. Washburn prepared a detailed report on his collecting expeditions in which he included advice to other entomologists who might be planning a trip to these far away islands. The kinds of collecting equipment, personal clothing and photographic supplies needed were covered

thoroughly. He also said, "Since money is not always desired by the natives, articles for trading (to secure labor and other services) are useful. The following will be found acceptable: Pipes, tobacco, caps, shirts, playing cards, watches (the latter given only for great favors), mouth organs, whistles, flashlights, fish hooks, belts, necklaces, dolls, and colored calico."

The Riley era was interrupted in 1925 when President Coffman asked him to become Chairman of the Department of Animal Biology upon the retirement of Professor Nachtrieb. It was during Riley's tenure as Chairman that the Department name was changed from Animal Biology to Zoology. He served in this capacity until 1930 when he returned for a second tour of duty as Chief of the Division of Entomology and Economic Zoology for another 14 years. The relocations of Dr. Riley caused some dislocation for prospective graduate students in entomology. The author, for one, had corresponded with Dr. Riley, the entomologist, to arrive in Minnesota in 1928 to find that his advisor and assistantship were in Zoology, not in Entomology.

Royal N. Chapman replaced Dr. Riley as Chief of the Division in 1926. He had become well known for his work on stored-product insects and more specifically for his pioneer work in quantitative animal ecology. In a very significant paper entitled, "The Quantitative Analysis of Environmental Factors" published in Ecology in 1928 he presented the results of Tribolium population studies and set forth his Biotic Potential--Environmental Resistance principle. He admittedly borrowed the idea for this principle from Fourier and Ohm who developed what is known as Ohm's law, which gave quantitative expression to the transmission of electricity through various conductors. With reference to Ohm's stated purpose Chapman said, "Again we ecologists may do well to pause and consider whether it would not be an advantage if it were possible, by a few principles briefly stated, to make the great variety of facts, which are known in our branch of science, appear as unity to the mind." His principle went far to achieve this goal with the presentation of the formula  $C = Bp/R$  where C was the concentration of insects, Bp the biotic potential of the species, and R the physical and biotic environmental resistance to population growth. When his book, Animal Ecology was published in 1931 it soon became used very widely and stimulated a shift from mostly qualitative and descriptive ecological research to a quantitative approach.

Dr. Chapman escaped briefly from administrative work when he enjoyed a Guggenheim Fellowship and a Rockefeller Foundation traveling fellowship in Europe in 1926-27. Before he left there was one new staff position filled by Dr. Maynard Johnson who taught comparative anatomy in the Department of Animal Biology and two courses: Varieties and Habits of Fur-bearing Animals and Economic Vertebrate Zoology in the Division of Entomology and Economic Zoology. During Chapman's absence A. G. Ruggles acted as Chief of the Division. William C. Cook taught Dr. Chapman's courses in ecology and Dr. Hertig and William Robinson were appointed Assistant Professors in the Department. During the next 2 years, Cook, Graham and Robinson resigned to accept positions elsewhere. Cook had become well known for his ecological work on cutworms, and more particularly for his pioneer work on bioclimatic zonation of injurious insects. Robinson was one of the first to suggest that bound water might be responsible

for the winter hardiness of insects. Graham had been employed during the summers by the USDA Division of Forest Insects. His research was carried at Itasca Park where he also taught forest entomology at the Forestry Summer Session. The first edition of his Forest Entomology textbook was published in 1929, which established him as one of the leaders in the field. Upon leaving the University he became Professor of Forest Entomology at the University of Michigan where he remained until he retired.

### Limnological Research Started

The first limnological research was undertaken in 1926 by Maynard Johnson. A project, supported in part by the Ten Thousand Lakes Association, entitled, "A Study of the Productiveness of Minnesota Lakes in Fish and Fish Food" was carried on for 3 years. This research was published in 1933 as an Experiment Station Technical Bulletin. The general problem as outlined by Dr. Riley follows: "In view of the number and importance of the lakes, and the growing demands on their fish resources by the increasingly large number of tourists, it was decided to begin a biological study of certain lakes with special reference to factors affecting their productivity." Johnson's published preliminary report dealt chiefly with the physical and chemical conditions found in the lakes studied. University President Coffman received a copy of the research proposal and responded with an amazing letter to Dean Coffey in which he said in part, "I have, for the last 3 or 4 years been reading the reports on the study of fish food and fish propagation in this and neighboring states." He concluded that the various varieties of fish depend upon each other for food rather than on vegetation and goes on to say, "Whenever the balance of nature is destroyed, that is whenever any variety of fish is eliminated in a given lake, it affects the propagation and survival of other varieties of fish." An amazing statement?--President Coffman was a former Dean of the College of Education--not a fish biologist.

In this connection it may not be amiss to recall a proposal made by Henry Nachtrieb soon after he was appointed State Zoologist in the Geological and Natural Survey. He said, "The time for establishing a fresh-water biological laboratory in Minnesota is ripe, and no citizen can more effectively perpetuate his name than by endowing and equipping such a laboratory as indicated, and his investment cannot be made more safely and profitably than under the care of the University of Minnesota." This statement can be found in his first report published in 1892. There was a Freshwater Biological Institute, such as he proposed, established 80 years later in 1972 on the shore of Lake Minnetonka.

In 1926 Professor Washburn retired to devote his time to painting, lecturing and writing. He died of pneumonia the following year. Also while Chapman was away a very colorful individual, Dr. R. A. Wardle, was brought to Minnesota from the University of Manchester, England as a visiting Professor. He endeared himself to the graduate students because of his dramatic lectures and his habit of inviting them to join him on visits to a local burlesque show. Other personnel changes in 1922 were the appointments of Herbert Parten to replace Dr. Mickel as Extension Entomologist,

Leslie Orr as Instructor to teach forest entomology and continue the forest insect research that Graham had had underway at Itasca State Park, and A. L. (Skook) Strand as Instructor in insect toxicology. Dr. Strand left in April of 1931 to become head of the Department of Zoology and Entomology at Montana State College in Bozeman. He played this role for a short time and then was chosen President of that institution in 1937. He moved again, in 1942 to become President of Oregon State University. Shortly after his retirement he joined the Minnesota delegation at breakfast at the time of the Entomological Society of America annual meeting in Portland. He announced that he was running for County Commissioner and that he would win because he always won elections; he did (the power of positive thinking). Strand was replaced in 1931 by Dr. H. H. Shephard who had been employed by the Bureau of Entomology in Washington, D. C.

### Fumigant Use Patented

In 1927 Dr. Chapman wrote to Dean Coffey with reference to a patent in Chapman's name for the use of a fumigant, Chlorpicrin-Carbon tetrachloride mixture, to be used for the control of stored grain pests. This was set up as a Public Use Patent and for a number of years the royalties created a modest fund used to help support entomological research in the Department.

In 1928 several notable events took place. With the retirement of Professor Jager the Division of Bee Culture was incorporated in the Division of Entomology and Economic Zoology. Dr. Maurice Tanquary was appointed professor of beekeeping, and he and an instructor named James Thompson, who had worked with Father Jager, taught beekeeping in both the College and the School. Dr. Tanquary was already engaged in commercial beekeeping in the Red River Valley and was encouraged to continue his commercial beekeeping operations during the summer months.

### Game Management Begun

Without question the most significant event was the beginning of the game management research and teaching program in the department. As will be described more fully in Appendix B, there had been precursors in the form of several courses offered by Washburn and Johnson--people who never would have considered themselves game managers. The launching of the game management enterprise involved a bit of trauma. President Coffman wrote a lengthy letter to Dean Coffey and Dr. Chapman in October of 1928 in which he said that upon his return from a trip abroad he found a proposal from Aldo Leopold on his desk. In this proposal Leopold suggested the University might be willing to participate in a wildlife project concerned with a demonstration of natural quail farming, and accept an Institute Fellowship for this purpose. Coffman states in his letter, "Of course, the primary purpose of this proposal is to promote the interests of the sporting arms and ammunition manufacturers; they want more quail so that more arms and ammunition can be sold. The University has no interest in the project for that purpose." This view was expressed because the

Fellowship and support for the research was to be provided by The Sporting Arms and Ammunition Manufacturer's Institute, and Coffman was not about to do business with a commercial concern. Little progress was made until Herbert L. Stoddard and Leopold convinced him that the University would not be dealing directly with a "commercial concern" because the U.S. Bureau of Biological Survey would select the Fellow and administer the expenditure of funds. This seemed to mollify the President and Dr. Chapman was permitted to proceed with the negotiations, but he had to keep in mind a condition stated at the close of the letter from President Coffman which was, "I think that the proposal, in case you should decide to recommend it, should make it possible for the University to discontinue this project on three months notice." Leopold suggested to Coffey and Chapman that pheasants or ruffed grouse would be more appropriate subjects for investigation in Minnesota than quail. The agreement approved by President Coffman in April of 1929 had the following purpose: "The object of this agreement is to promote useful knowledge by conducting an investigation into the life history and ecology of ruffed grouse, and other birds or animals found to be involved in game population cycles."

Stoddard was asked to select one of several candidates for the Institute Fellowship and he "heartily approved the appointment of Ralph King," a student of Chapman's who was a Teaching Assistant in Zoology. King was appointed on June 1, 1929, and started what since has become recognized internationally as an outstanding upland game research investigation through the efforts of Dr. William Marshall and Gordon Gullion. Leopold was unhappy about the rumor that Dr. Chapman was to leave for Hawaii. He expressed his disappointment in a letter to Chapman dated May 1, 1930. He said, "... the principal reason why Stoddard and I recommended the present location for the study of ruffed grouse was to get the advantage of your advice and leadership resulting from your study of animal populations."

King established a name for himself in his first research report in which he described a grouse census method which he called the Strip Census of Grouse Broods (Game Survey Bulletin #7, 1931), but it has been referred to more commonly as the "King Census Method" ever since. He was appointed as an Instructor in the Department in 1930 and served until 1937 when he left to become Head of the Syracuse University Department of Forest Zoology and Director of the Roosevelt Wildlife Forest Experiment Station. While at Minnesota he introduced the first truly wildlife management courses, taught forest zoology at Itasca State Park when the Biological Summer Session started in 1935, and directed the research of the first students to earn the Masters Degree in Wildlife Management. Ralph "Terry" King was an organizer and in 1936 the first President of the "Society of Wildlife Specialists" which became The Wildlife Society the following year.

As mentioned earlier, Professor Wardle had joined the staff in 1927 as a Visiting Professor. He was followed in 1929 by Dr. Karl Friedrichs from Rostock, Germany who taught animal ecology during the fall and winter quarters, 1928-29. In 1945 Dr. Friedrichs wrote a sad letter to Dr. Mickel in which he said, "I lost everything by the war: my sons, my little fortune, my library and collections, and my home, for Rostock lays in the Russian Zone."

During the year 1930-31 Dr. Mickel studied in England, Germany and France on a Guggenheim Foundation Fellowship and many other significant events took place from 1930 to 1932. Dr. Chapman resigned on June 30, 1930, to become Director of the Experiment Station in Honolulu of the then newly formed Pineapple Producer's Cooperative Association. The next year he also became Dean of the Graduate School of Tropical Agriculture at the University of Hawaii. He was replaced as Chief of the Division of Entomology and Economic Zoology by Dr. W. A. Riley who once again was relocated in the University system. Chapman's move brought about other changes. Dr. Samuel Eddy, a professor in Zoology, taught Chapman's fall and spring quarter ecology courses and A. C. Hodson was appointed as an Instructor in Zoology to assist Dr. Eddy and teach the winter quarter experimental ecology segment of the course on the St. Paul Campus. Other notable events in 1930 were the appointment of Alexander A. Granovsky as Associate Professor and the resignation of Maynard Johnson.

Dr. Chapman brought Granovsky to Minnesota from Wisconsin on the recommendation of Dr. J. G. Leach, a University plant pathologist, who had been actively interested in the role of insects in transmitting plant diseases. Leach and Granovsky were to initiate a joint course offering and cooperate on research in this area, and in 1931 they offered a course called "Insects in Relation to Plant Diseases." This was probably the first or at least one of the first of its kind in the country, but not the first time an entomologist and a plant pathologist had presented a joint course offering here. Professor A. G. Ruggles and Dr. E. C. Stakman joined forces to give a combined course in "Plant Pest Control" in 1917.

### Visiting Professors Were Memorable

In the spring of 1930 the staff and graduate students were privileged to hear a series of lectures given by Dr. F. V. Silvestri from Italy, who was recognized as the foremost authority on biological control in the world. His volatile Italian enthusiasm was most evident when he participated in field trips with the students. On one such trip to a study area being used by Ralph King in Pine County, Silvestri turned over so many logs while looking for Protura that the local Indians became excited about the number of bear in the vicinity. He was followed in 1921 by perhaps the most colorful of the colorful visiting professors in the person of Dr. Friedrich S. (Fritz) Bodenheimer. He came to Minnesota from the Hebrew University in Jerusalem after having been previously active in ecological research in Germany for many years. He lectured during the spring quarter in what can be described as a very dogmatic fashion. This performance was very inconsistent with the warning he gave his audience at the beginning of each lecture--"Scientists must not be dogmatic." Dr. Bodenheimer initiated the practice of having department seminars on Thursday nights, and he broadened the horizon of the students by basing many of his lectures on his experience in Europe and the Near East.

In the spring of 1932 the staff and students once again were privileged to attend lectures given by an outstanding individual. Dr. C. B. Williams came to visit us from the Rothamstead Experiment Station in England, where he was head of the entomology section. For many of his lectures he drew upon his considerable experience as an insect ecologist in the British Colonial Service in Trinidad, Kenya and Egypt. When a student asked him what one had had to do to become a Colonial Officer he answered this way. He had asked his Ph.D. advisor what he should study before going before an examining board. The answer was something like this: They expect you to be a well qualified entomologist so they will ask you whether you can ride a horse, play poker, play tennis, hold your whiskey, etc. They will want to know whether you can keep your sanity and "bear the whiteman's burden" in the tropics. He always used a black insect net with the explanation that it would not be as obvious on a tram.

During the 1931-1932 school year Dr. Riley was a visiting professor at Lingnan University in Canton China. He served as Vice-President of the American Board of Trustees of that University and as a Corresponding Member of the Peking Society of Natural History. He was followed a few years later by Dr. Franklin Wallace who taught at Lingnan for 4 years in a department chaired by one of Dr. Riley's graduate students, Dr. H. T. Chen. When Dr. Riley returned in 1932 he became the first President of the newly organized Minnesota Academy of Science. That same year the forest insect laboratory used by Graham and Orr at Itasca Park burned to the ground. Orr and his family lived in the building and all their possessions, including his thesis data, were consumed. The laboratory was rebuilt in 1934 and now serves as faculty cabin #10.

#### Depression Burden Eased

One other 1932 event deserves passing comment. The country was in the midst of a deep depression. In the President's Report to the Board of Regents for 1930-32 it is stated that staff earning \$1,200.00 or less would work 1 week without pay; those earning over \$1,200.00, 2 weeks without pay. This was done to ease the burden on the State Treasury without cutting salaries. As a point of reference, the salary of an Instructor was about \$1,800.00 at that time.

#### Pest Grasshoppers Researched

In the President's 1932-1934 Report, considerable attention is given to the need for research on pest grasshoppers. The Midwest was plagued by drought and outbreaks of grasshoppers aided by drought and high summer temperatures. Personnel in the State Entomologist's office, particularly Thor Aamodt, Ruggles' assistant, devoted nearly full time to devising new methods for dealing with the menace and by organizing intensive County control programs. Several graduate students benefited by having summer employment during the 5 major outbreak years. As if the grasshopper scourge were not enough, in the 1930's there also were severe outbreaks of June beetles. Dr. Granovsky devoted much of his time to white grub research near the campus and at a Forest

Nursery at Cass Lake. He was employed during the summer by the USDA Division of Forest Insects for this work. Though the Department budget was tight, Dr. Riley was able to employ Dr. Nellie Payne as a visiting professor in 1933. She had studied under the direction of Dr. Chapman and was noted for some of the early work on insect cold-hardiness. It was also in 1933 that Dr. Mykola Haydak was employed to work with Dr. Tanquary in apiculture. His first appointment was as an Assistant with the magnificent salary of \$900 per annum.

In a document dated February 28, 1934 Dr. Riley has this to say about the Department: "The Division of Entomology and Economic Zoology is that agency of the University which is directly charged with the teaching and investigation of animal life in its economic aspects." The document was entitled, "Research Work of the Division of Entomology and Economic Zoology Relating to Problems of Conservation." The specific projects mentioned were the following:

Wildlife census methods, state game survey, cycle study, food habits of upland game species, waterfowl and lead poisoning, spring burning and wildlife, mortality studies of upland game species, game range studies as indicated by interspersion, juxtaposition and amount of periphery, and studies of parasites of wild animals.

One might imagine a staff of 5 or 6 people to manage this comprehensive research program, but instead two people in the Division were responsible; one Instructor, Ralph King, and a Research Associate who was a parasitologist on a joint appointment with Veterinary Medicine. For a number of years the Division employed one of Dr. Riley's students, either as an advanced Ph.D. candidate or as a postdoctoral appointee, to carry on cooperative research of diseases of wildlife with the State Conservation Department and the University Division of Veterinary Medicine. Also in 1934 a Game Management Curriculum was established in Forestry in which King participated. The curriculum was open to—"Foresters who are interested in preparing for game protection and management work and students in agriculture who may be interested in the commercial aspects of this field." It should be noted also that Dr. Mickel was elected Secretary-Treasurer of the Entomological Society of America in 1934.

#### Summer Sessions Established at Itasca

The most important event of 1935 in which the department was much involved was the establishment of the Summer Biology Session at the Forestry and Biological Station at Itasca State Park. The biology teaching program at Itasca was initiated by Dean Freeman who became known as the "spiritual leader" of the Station. Our Dr. A. A. Granovsky was appointed Director and doubled as instructor in entomology. Ralph King was on the staff to teach Methods in Field Zoology with Granovsky and a course in Principles of Wildlife Conservation. Comptroller William T. Middlebrook approved Freeman's proposal with the understanding that the operation of the Biology Session would not cost the University any money. A more complete account of the department's responsibilities in this venture will be given in Appendix B.

Leslie Orr resigned in June 1935 to work in Milwaukee as a forest entomologist in the USDA Division of Forest Insects. Dr. Riley asked Alexander C. Hodson, who had been appointed as an Instructor in 1931, to assist Dr. Ralph Dawson, from Zoology, in teaching a course in Field Zoology at the Forestry Summer Session at Itasca. Hodson also was asked if he would be willing to "pinch hit" as a forest entomologist until a replacement for Orr could be found. He "pinch hitted" for more than 30 years. From 1936 to 1941 Mickel and Hodson offered the Field Zoology course at Itasca for sophomore forestry students. It was during this time that Hodson became very much involved with the ecology of the forest tent caterpillar. Some would say that he could or would talk about little else.



Circa 1935 left to right: A. G. Ruggles, A. A. Granovsky, R. H. Daggy, C. E. Mickel, M. C. Tanquary, H. H. Shephard, unidentified, W. A. Riley, A. C. Hodson, D. M. Hatfield, R. T. King, and M. H. Haydak.

By 1935 the wildlife program had developed to the point that Donald Hatfield, a graduate student in the department, was appointed as a part-time instructor to assist Ralph King and to teach Methods of Field Zoology at Cloquet, and on campus a course called Varieties and Habits of Fur Bearing Animals. With King's resignation in 1937, Dr. Gustav Swanson was appointed as an Assistant Professor in April 1937. He had been Associate Professor of Game Management in the University of Maine Forestry Department. He soon found a use for the large pheasant pens that had been built on the hill overlooking the field plots on the present site of the new Horticultural Science and Landscape Architecture building. There he continued some research initiated by King on upland game bird feeding habits. This same year, 1937, the entomologists in the Department were hosts for the annual meeting of the North Central Branch of the Entomological Society of America in the St. Paul Hotel.

When President Guy Stanton Ford succeeded Lotus Coffman, who died in September of 1938, he had this to say, "Despite Vincent's witty description of the presidency of a state university--'as a benevolent dictatorship tempered by assassination,' it is a vantage point from which to view the mind and working of American democracy." He also told the Regents, "I'm young and impetuous and you'd better keep an eye on me." Ford was 65 at the time and had served 25 years as Dean of the Graduate School.

The most significant event in 1939 has to be the return of Dr. Royal N. Chapman to the University as Dean of the Graduate School. An arrangement was made by Dr. Riley and Dean Coffey to provide laboratory space in the basement of Coffey Hall where Dr. Chapman could continue some of his population research. The space provided later served as an office for Drs. Hodson and Chiang. Dean Coffey also agreed to make a Research Assistantship available for Dr. Chapman. Riley in writing to the Dean about the selection of an appointee said, "It is necessary to pick a man who has preparation in both French and German as well as in the biological sciences and chemistry." Dr. Chapman was able to serve as Graduate Dean for only a few months. He died on December 2, 1939, as the result of an embolism in the pulmonary artery. As a youth he had suffered from poor circulation which came close to causing blindness at one time. A few days before his death he tried to move a heavy box of books he had received from Hawaii and this effort caused a blood clot in one leg. During the night the blood clot moved and became lodged in his pulmonary artery. The author of this missive had the opportunity to visit with Dean Chapman the afternoon before his death, during which time his possible collaboration with Chapman on a revision of his textbook on Animal Ecology was discussed at some length.

In 1938 or 1939 Professor Ruggles was one of three people selected by the Bureau of Entomology to evaluate the gypsy moth control program: in particular the value of a barrier zone that was maintained to prevent western movement of this insect.

#### Cedar Creek Area Begun

During the period 1940-1942 there were only a few events to be reported. Dr. Harold Shephard was granted a leave of absence in 1940 to study grain storage problems in the southern states, the West Indies, and Central America. Dr. Swanson was engaged in cooperative research with the Soil Conservation Service on a study of woody plants whose fruits are regularly eaten by upland game birds. He and they were most interested in Lespedeza capitata, the native bush clover. In 1941 he was granted a leave of absence for a year to carry out a special assignment with the U.S. Fish and Wildlife Service. He was replaced for that year by Laurits Krefting, an employee of the Fish and Wildlife Service assigned to the North Central Forest Experiment Station on campus. Donald Quimby was appointed as a part-time Instructor to teach Mammalogy and also Forest Zoology at Cloquet. In 1942 he received his draft notice and was on leave in the Army. After the war he returned to serve again as an Instructor and complete his graduate work. It was also in 1942 that the Minnesota Academy of Science and the University became partners in the development of the Cedar Creek Natural History Area.

#### Frenatae Modeled After Cornell Club

In 1943 a grand old man, Professor A. G. Ruggles, retired from the University. As mentioned earlier, he had played the dual role of University Professor and State Entomologist. Until the State Department of Agriculture was organized in 1922 the State Entomologist by law was the University Experiment Station Entomologist, paid by the University. In 1922 the office of State Entomologist was transferred to the State

Department of Agriculture so Ruggles held a split appointment from 1922 until his retirement. He was responsible for administrating the nursery and apiary inspection services and insect pest control campaigns. Through his wise and persistent efforts the inspection programs became welcomed whereas at one time the inspectors had been looked upon as little more than unwelcome police officers. Professor Ruggles had been honored in 1922 by election as President of the American Association of Economic Entomologists. He also left his mark on Department graduate students because in 1915 he started the Entomology Club called Frenatae, which met every Monday afternoon for several decades and was managed by graduate students. It was modeled after the Cornell Club called Jugatae. In 1943 Thor Aamodt, who had served as assistant under Ruggles, was appointed Assistant Professor in the Department and succeeded Ruggles as State Entomologist. He taught one course in Regulatory Entomology.

### Department Served War Effort

During the years now under consideration, the United States was at war and the University made its various contributions to the war effort. Among them was a course required of all senior medical students, most of whom would be commissioned in the Army or Navy upon graduation. This course was called Tropical Medicine and Parasitology. Dr. Minnich, Chairman of the Zoology Department, prevailed upon Dr. Riley to give the lectures which he continued to do even after his retirement in 1944. One of the two laboratory instructors who assisted him in this course was A. C. Hodson. He described this assignment as one of "fighting the war in Minneapolis." Many others contributed to the war effort in other ways. There were 40 department graduate students, most of whom were serving in the Army, Navy or U.S. Public Health service as commissioned officers. The first Department newsletter was produced in 1942 to keep those away in service informed of events on campus. They also included excerpts from letters sent home by servicemen and women. Dr. Riley introduced the 5th Newsletter with this statement, "Wherever this newsletter finds you, be it at home or abroad, in baking tropics, or in scorching desert, or coral ridges or mosquito swamps, in the war torn world, we wish to send you greetings from a much changed campus and quiet laboratories, where only recently they echoed with happy voices of busy graduate students. Those that are left here are trying to carry on, in so far as possible, a full share of research work without graduate assistants." This newsletter was mailed out in February 1943. Another quite different war project was initiated by Dr. Swanson in 1943. This was a domestic rabbit production study sponsored by the Fish and Wildlife Service. During its short existence the Department staff benefited during the months of meat shortages because something had to be done to dispose of the excess rabbits produced.

In 1944 Dr. Riley retired after a distinguished performance as the head of the Department. He was regarded, along with such notables as Drs. Gortner, Hays and Stakman, as one of the pillars of the University. He acquired the reputation deservedly, while at the same time exhibiting a quiet, somewhat withdrawn demeanor, which for some people made him seem unapproachable. Those who have not known him will get the picture when it is recalled that on the hottest day in summer he would mow his lawn

or dip for mosquito larvae while wearing a stiff collar, necktie, suit jacket and felt hat. But under that felt hat was an outstanding biologist, a superior teacher, and a highly respected humanitarian. His professional colleagues acknowledged his stature by electing him President of the American Society of Parasitologists in 1931.

During the 1943-44 school year Dr. Shephard was given a leave of absence to serve in Washington as Senior Industrial Specialist with the War Food Administration. Dr. Clarence Mickel was appointed as acting Chief of the Division before being made Chief in 1945. He was elected President of the Entomological Society of America in 1944. The Division suffered a loss during this year because of the death of Dr. Tanquary on October 25, 1944. With the resignation of Dr. Swanson to become Assistant Director of the Division of Wildlife Research of the U.S. Department of the Interior, Shephard away on a leave of absence, and Tanquary's death, the staff was reduced to its smallest number for several years. Only Drs. Mickel, Granovsky, Haydak, and Hodson were left to hold the fort. About the same time further steps were taken to dismantle the quite extensive natural history museum which occupied considerable space on the third floor of Coffey Hall. It had been assembled primarily by Professor Washburn to be used in teaching biology to the School of Agriculture students.

Upon becoming Chief of the Division, Dr. Mickel immediately started to rebuild the staff. Dr. Haydak was promoted to Associate Professor and given the responsibility for the teaching and research formerly under the direction of Dr. Tanquary. Dr. Richard Daggy was appointed as an Assistant Professor to assume curatorial duties and teach economic entomology. He had served in the Navy as a medical entomologist in the South Pacific area. Two key positions were filled in 1945 with the appointments of Drs. William Marshall and A. Glenn Richards as Associate Professors. Dr. Marshall had had broad and valuable experience with the U.S. Forest Service, the National Park Service, the U.S. Biological Survey and the Fish and Wildlife Service. Dr. Richards had been on the faculty of the University of Pennsylvania. He brought with him a research grant sponsored by the Federal Office of Scientific Research and Development and Dr. L. K. Cutkomp who had been assisting Dr. Richards on war research. Dr. Marshall replaced Dr. Swanson as Associate Professor of Wildlife Management and Dr. Richards was appointed to a new position as Associate Professor of Insect Physiology with a cross appointment with Zoology. Last but not least a young man by the name of Huai C. Chiang arrived in January 1945 to start graduate work and serve as a Research Assistant in the Department. In a letter to Professor Ruggles, who had moved to Alabama following his retirement, Dr. Mickel had this to say about Chiang, "He appears to be a very able boy." Perhaps the understatement of the year. For a while Dr. Chiang was our only graduate student.

### Fisheries Management Launched

Another very significant event took place in 1946. The year before there had been correspondence between Dr. Mickel and Henry Schmitz, Dean of the College of Agriculture, Forestry and Home Economics suggesting that the Division undertake teaching and research in fisheries management. This action was coupled with lengthy

discussion on a proposal from the Zoology Department to the end that the Division of Entomology and Economic Zoology should assume responsibility for the teaching and research in fish culture and fisheries. This move was justified by Dr. Mickel's explanation that it would strengthen the offerings in game management and wildlife and promote a more harmonious and cooperative relationship between the University and the State Department of Conservation. Included in a letter to Dean Bailey was the proposal that Dr. Marshall spend one third of his time supervising some research projects carried on by the Conservation Department. In return Dr. Lloyd Smith, who was Head of the State Bureau of Fisheries Research, would devote one third of his time to teaching courses in fisheries in our Department. This he did during the fall of 1946. During the next 6 months Dr. Smith was employed by the National Park Service and then returned to become a permanent member of the Department staff on July 1, 1947. The State Legislature appropriated \$5,000.00 per year for 2 years to help support the teaching of fisheries. About the same time Albert Burroughs was appointed as an Assistant Professor to teach Medical Entomology and Donald Quimby was reappointed as a part-time instructor in wildlife after his discharge from the Army. In this fashion major steps were taken to strengthen the research and teaching productivity of the department. Not the least of Dr. Mickel's efforts in this direction was the appointment in 1946 of R. E. Snodgrass, a world authority on insect morphology, as Visiting Professor. It was also in 1946 that the Wildlife Manager's Club was recognized as an official student organization by a Senate Committee. There is a record of its existence as an informal club in 1942. Much later, in 1973, it became a Student Chapter of The Wildlife Society.



Circa 1949, C. E. Mickel checks with his secretary, Claire Quitter, while in foreground are Greta Olson, left, and Nora Matsushima, stenographers.

### DDT Tested During War-time

Before moving on, some of the other war time activities deserve brief attention. Dr. Shephard was able to allocate small amounts of DDT to the department to be tested as part of the war food production effort. Some of it was used by Hodson to control flies in dairy barns, and by Dr. Granovsky for tests on potato and other vegetable insect pests. In 1945 Dr. Granovsky carried out the first large scale tests of DDT for the control of the potato leafhopper with remarkable success. At this same time there is correspondence which indicates that the Department was not recommending the use of DDT for the control of fruit insects because of the uncertainty about its potential health hazard when sprayed on fruit. Dr. Mickel carried out a project sponsored by the Quarter Master Corps on the damage to soybean flour by stored product insects.

Dr. Laurence Cutkomp left the University for 1 year to serve as Associate Entomologist with the Tennessee Valley Authority in Alabama, and then returned in 1947 to accept an appointment on the staff as Assistant Professor. His primary responsibility was to replace Dr. Shephard as insect toxicologist. Dr. Shephard had decided not to resume his duties at the University when his leave of absence to do war work in Washington terminated. That same year, 1947, Dr. Richard Daggy resigned his position and was replaced by Dr. Herbert Milliron to assume curatorial duties and teach economic entomology. It was in 1947 that Professor A. G. Ruggles died at his retirement home in Alabama. Also in 1947 Dr. Mickel was elected President of the International Great Plains Entomological Conference. Dr. Richards became a member of the Executive Committee of the Entomological Society of America and Dr. Granovsky was elected National President for the Rebirth of the Ukraine. Dr. Gottfried Fraenkel of the Imperial College of Science, in London, England was invited as Visiting Professor to lecture on insect nutrition during the spring quarter of 1947.

### Corn Borer Traveled Here

In 1943, a single specimen of the European corn borer was found in Minnesota and by 1947 the population exploded. The fall survey of 1947 showed that Minnesota had the heaviest population in the country. As the result, Thor Aamodt, the State Entomologist, was able to obtain funds for corn borer research from the State Executive Committee with the understanding that the Experiment Station would provide matching funds. This arrangement was completed in 1948 and Dr. Chiang, who received his Ph.D. that year, was appointed as a Research Fellow to undertake corn borer research at the Southern Agricultural Experiment Station at Waseca. That same year Dr. F. G. Holdaway was invited by Dr. Mickel to come to Minnesota to coordinate the corn borer research. He was an Australian who had done his Ph.D. work under Dr. Chapman and had, previous to coming to Minnesota, served as Head of the Department of Entomology at the University of Hawaii for 11 years.

Albert Burroughs, who had been appointed jointly with Zoology in 1946 as an Assistant Professor to teach Medical Entomology, had a research interest dealing with the epidemiology of equine encephalitis and Dr. Brooks served as one of his

assistants on this project. During 1949-50 Burroughs was on a leave of absence to study B-encephalitis in Japan under the auspices of the U.S. Army. In his absence Dr. Alexander Graham Bell Fairchild from the Gorgas Laboratory in Panama taught medical entomology. Burroughs left the University in 1951 and accepted a position with the U.S.

Public Health Service. In 1949, Dr. Milliron resigned and was replaced temporarily by Dr. Roger Anderson to teach Economic Entomology. By 1948 the Department was feeling the effects of the so-called "Veterans Bulge" and it became necessary to change the scheduling of some courses. For example, Economic Entomology had to be offered all three quarters and also during the summer. Dr. Alvah Peterson from Ohio State was invited to teach the summer session and Herman Spieth taught the course during the next two summers. During 1948-49 a number of personnel changes in the Department took place. Dr. Edwin Cook was appointed as an Instructor to teach Economic Entomology



Examining fishing seines left to right:  
W. H . Marshall, L. L. Smith, and J .R. Beer.

and be responsible for the insect collection. Dr. James Beer was employed as an Assistant Professor in wildlife and Dr. Henry Griffiths had a joint appointment with Veterinary Medicine as a parasitologist. In 1949, Dr. Thomas Gochnauer was appointed as Research Associate to carry on research on bee diseases. The funds for this purpose came from a special legislative appropriation prompted by the Minnesota Beekeepers Association.

It was in 1949 that Dr. Smith was appointed Editor of the Transactions of the American Fisheries Society and initiated his extensive study of fish populations at Red Lake in cooperation with the Indians on the Red Lake Reservation and the U.S. Fish and Wildlife Service. This same year Dr. Granovsky was given the honorary degree of Doctor of Agricultural Science by the Ukrainian Poly technical Institute and was elected to membership in the Shevchenko Scientific Society. In the fall there was a staff and graduate student party at which the 1000th meeting of Frenatae was celebrated.

During 1950-52 the University was faced with the disheartening problem of retrenchment. Because of this the Department lost one of its two Teaching Assistantships. On a sadder note, Dr. Granovsky suffered a very severe heart attack which disabled him for about a year. On the brighter side it was in 1951 that Dr. Richards' classic monograph, The Integument of Arthropods, was published by the University Press. Because of this and

his extensive research in this area he was often introduced as "Mr. Cuticle." It was also at this time that Dr. Marshall was away on a sabbatical furlough from October 1951 to June 1952 to review wildlife programs and practices, and to conduct a survey for the Wildlife Management Institute on food and cover plantings for upland game. That same year Dr. Hodson served as Secretary of the Entomological Society of America.

### Divisions Became Departments

In 1952 the University Department of Agriculture was reorganized to become the Institute of Agriculture. As part of the reorganization, the Divisions became known as Departments with Heads instead of Chiefs. About this same time the Department's Fishery and Wildlife Curriculum appeared for the first time in the 1951-53 College Bulletin. One of the requirements was attendance at a Biology Summer Session at Itasca State Park. One faculty addition occurred in 1952 when Dr. Ralph Barr was appointed to replace Dr. Burroughs as medical entomologist. Dr. Barr resigned to accept an appointment at the University of Kansas in 1955. While here he produced a first class bulletin on the Mosquitoes of Minnesota which was beautifully illustrated by his wife Sylvia.

Late in the winter of 1952 Dr. Hodson received a call from Dr. Raymond Darland at Duluth asking if there was anyone available to teach entomology at the Duluth Branch during the 1953 spring quarter. He suggested that Dr. Chiang might be interested--and he was. To use Dr. Darland's words, "We fell in love with him" and as the result Dr. Chiang continued on the Duluth staff for 8 years. In the meantime he continued his corn borer research at Waseca on a summer appointment as a Research Associate in our Department.

During the period 1952-1954, Dr. Marshall was able to initiate an "Institute for High School Teachers of Biology" at the Biology Station at Itasca with funds from the Hill Family Foundation and the National Science Foundation. This proved to be fortunate for the Itasca Biology Session which had had serious problems of student enrollment at that time. Dr. Granovsky was given active membership in the Academie Internationale Libre des Sciences et Lettres in Paris, and Dr. Smith was named Chairman of the Aquatic Life Advisory Committee of the Ohio River Valley Water Standards Commission.

In the next biennium, 1954-56, additional staff members were recognized in various ways. Dr. Mickel became Chairman of the North Central Branch of the ESA, Dr. Marshall was elected President of the Minnesota Academy of Science, and Dr. Hodson was elected President of the local chapter of Sigma Xi and Treasurer of the Ecological Society. Dr. Cutkomp was awarded a single quarter leave to study electro-physiology techniques at Edgewood Arsenal and at Tufts College. There was one addition to the staff in 1955 with the appointment of Dr. Roger Price as an Instructor. Dr. Price had a joint appointment with Zoology and replaced Dr. Barr as medical entomologist in the Department.



University President O. Meredith Wilson (seated) chats with A. A. Granovsky during presentation of Granovsky's Ukrainian collection. Left to right: Vice President Lunden, Vice President Shepherd, T. L. Smith, Chairman of the University Immigrant Archives Committee, and E. B. Stanford, Director of libraries.

at a very appropriate ceremony in his office. His teaching of Plant Diseases was taken over by Dr. Allan Peterson who had been appointed as an Assistant Professor in 1954. Dr. Peterson's duties included leadership of the vegetable insects project and collaboration with Dr. Holdaway on legume insect research. It was also in 1956 that Dr. Marion Brooks was appointed as an Instructor. She had been working in Dr. Richards' laboratory for several years as a Research Associate.

Two staff members enjoyed sabbatical leaves during the 1956-58 biennium. In 1956 Dr. Chiang was awarded a Guggenheim Fellowship to study at Cambridge University, England. The following year Dr. Richards carried on research at the Max Planck Institute for Biology at Tubingen, Germany. Dr. Richards was a Guggenheim Fellow and Fulbright Research Scholar. While Dr. Chiang was away, Dr. Daniel Dresden, Director of the Laboratory for Research on Biocides at Utrecht, Holland, was a Visiting Lecturer. He was a well-organized and systematic individual as anyone would quickly learn from looking at his lecture notes. Opposite each topic to be presented was a drawing of a small clock face with the hands arranged to indicate when he should have completed the presentation of each topic.

Dr. Mickel participated in the University's cooperative program with Seoul National University in Korea from April until September in 1957. This experience gave him the opportunity to visit other far eastern areas and India. Also in 1957 Dr. Peter Crocroft was invited as a Visiting Professor in wildlife for one quarter. He and his wife had both been very active in research on mammal populations. Dr. Marshall was made Acting Director of the Forestry and Biological Station this year.

In 1956 the most outstanding event was the retirement party honoring Dr. Granovsky for his 26 years of service as a Professor in the Department. Among others expressing their appreciation for his service were the Minnesota Nurseryman's Association and the Greenskeepers' Association. Following retirement Dr. Granovsky had a National Science Foundation grant to work on aphid taxonomy. After that he devoted much of his time to organizing his extensive and valuable collection of Ukrainian literature, letters and newspapers. This collection was presented as a gift to the University Library, which was acknowledged by University President O. Meredith Wilson

of Insects in Relation to Plant

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In 1958 the fisheries teaching and research in the department were augmented handsomely by the appointment of Dr. Thomas Waters as an Assistant Professor in January 1958. Dr. Waters was responsible for instruction in Fisheries Investigation and Management Techniques and the advising of undergraduate and Graduate students. He soon found Valley Creek near Afton where he initiated his pioneer work on the diurnal rhythms of the drifting of aquatic organisms and means of quantifying stream productivity. Another important 1958 event was the appointment of John Lofgren as Extension Specialist in entomology. His appointment and the development of the Pest Clinic with the help of graduate students greatly improved the public service contributions of the department. It was also in 1958 that Gordon Gullion joined the staff as a Research Fellow. He was selected to work with Dr. Marshall on ruffed grouse research at the Cloquet Forest Research Center. During the spring quarter of 1958 Dr. C. B. Williams once again was invited to the campus as a Visiting Professor. He had recently retired as Chief Entomologist of the Rothamstead Experiment Station in England. This same year his book on Insect Migration was published. One reviewer said, "This is a pioneer book, a real milestone in the progress of Biology." Before and after retirement Dr. Williams carried on extensive light trapping and he explained that his wife could not come to Minnesota with him because she had to stay home to run the light traps.

There were two retirements in 1957 and one in 1958 worthy of note. In 1957 Herbert Parten, who had served for 32 years as Extension Entomologist, retired because of ill health. In December of that year Thor Aamodt resigned his joint position as University Professor and State Entomologist in the State Department of Agriculture. Since then he and his son have developed a highly productive orchard business near Stillwater which they had started several years earlier. In 1958 Dr. Dwight Minnich retired after 28 years as Zoology Department Chairman. He had replaced Dr. Riley as Chairman when Riley returned to again become Chief of the Division in 1930. Dr. Minnich was noted for his eloquence as a lecturer, his pioneer work in sensory physiology, and his invaluable collection of old prints. He died in 1965 soon after arriving in Paris on what was to have been his last old print collecting expedition.

#### Forestry Deleted Game Management

Effective fall quarter 1959, through a curriculum revision, the Forestry Game Management was deleted from the School of Forestry offerings. This move placed an additional burden on the fisheries and wildlife staff who had to make adjustments to accommodate an increased enrollment. During the 1958-60 biennium there were other events deserving some comment. The new Student Center was dedicated and the School of Agriculture was terminated. Dr. Smith again became editor of the Transactions of the American Fisheries Society, Dr. Richards was Chairman of the Publications Committee of the American Society of Zoologists, Dr. Cutkomp became Chairman-elect of the North Central Branch of the ESA, and Dr. Waters served as Vice-President of the Minnesota Section of the Wildlife Society.

The year 1960 marked the end of another illustrious career with the retirement of Dr. Clarence E. Mickel on June 30. It should be added that, while his career as an administrator terminated, his career as an entomologist has not to this date. He has continued to publish research on his favorite subject, Mutillid taxonomy. Among other articles, in 1969 he completed an annotated bibliography entitled, "Two Hundred Years of Mutillid Research" which was published in 1970 as an Experiment Station Technical Bulletin. Dr. Mickel was finding it difficult to find a publisher so Dr. William Hueg, then Director of the Experiment Station, was approached to see whether a manuscript of a Professor Emeritus could be handled by the Experiment Station. His answer, "Of course we can do this for Clarence." Mickel had had to abandon much of his research during his 16 years as Department Head because he wished to carry on a policy that he had inherited from Dr. Riley. He believed, as Dr. Riley had before him, that his principal responsibility was to foster an environment in which the faculty and students could prosper. This he did very well because shortly after he retired the American Council on Education announced in 1964 that the Department ranked sixth in the nation in entomology. The Department fisheries and wildlife program, though not included in this report, also was regarded highly throughout the country. To flashback for a moment, as is done in the movies, it is recalled that the American Council on Education published a rating of Graduate Schools in various fields in 1934. For entomology, four institutions were starred: Cornell, Harvard, Iowa State, and Minnesota.

At Dr. Mickel's retirement party two former graduate students were presented with the University's Distinguished Service Award. They were Dr. C. B. Phillip, Director of the Rocky Mountain Laboratory at Hamilton, Montana, and Dr. Robert Glenn who was or soon was to be Deputy Minister of Agriculture in Canada. Dr. Walter Carter, Principal Entomologist with the Hawaiian Pineapple Canners Association, was to have been honored at that time but was on an assignment in Ghana. He was presented with his award the following spring. The only other Department students to have received this award were Drs. A. L. Strand and Samuel Graham.

Dr. A. C. Hodson replaced Dr. Mickel as Department Head on July 1, 1960. He had a brief apprenticeship while serving as Acting Head while Dr. Mickel was in Korea. Dr. Marshall became Director at the Lake Itasca Forestry and Biology Station in 1960 while continuing as a Professor of Wildlife in the department. He assumed this position upon the retirement of Dr. T. Shantz-Hansen who had succeeded Dr. Granovsky as Director. During the school year 1960-61 Dr. Marshall was on a sabbatical leave to work in New Zealand on a Fulbright Fellowship. He studied the ecology of mustelids under the auspices of the Bureau of Animal Ecology of the New Zealand Department of Scientific Research and Investigation. In his absence the staff and students were privileged to have a number of distinguished wildlife biologists here to give lectures and participate in a graduate student wildlife seminar. Among them were Paul Errington, Graham Cooch, Olaus Murie, and Robert Rudd. Dr. John Tester, at that time an Assistant Scientist in the Museum of Natural History, was appointed as an Instructor to take over some of Dr. Marshall's teaching duties. Dr. Tester continued on the staff on a part-time basis until 1967. While Dr. Marshall was in New Zealand during the summer of 1961, Dr. Daniel Frenzel became Acting Director at the Itasca Biology Summer Session. Also in 1961 Dr. H. C. Chiang returned to the Department after having been on the Duluth faculty for 8 years. He took over the ecology teaching for Dr. Hodson and became leader of the corn insect research project.

### 1962--Department Changed Name

Dr. Lloyd Smith started what has become a major project on water quality in relation to fisheries in 1961. The initial research was done on the Rainy River to investigate the effects on fish of wood fibers and hydrogen sulfide found in the effluent from paper mills. That same year Dr. Marshall initiated his pioneer studies on the tracking of ruffed grouse by radio telemetry at Cloquet. The next year, 1962, the name of the Department was changed once again to Entomology, Fisheries, and Wildlife. The intention was to have a name more self-explanatory for the University community and the public by spelling out the nature of disciplines embraced by the Department.

On October 2, 1963, Dr. William A. Riley passed away in the nursing home where he and his wife had lived for several years. He had not suffered but had been unable to communicate with others for about two years.

### Changes Brought College of Biological Sciences

During the 1962-64 biennium President Wilson had arranged to have a very extensive review of the University organization. His move was prompted by a request of two departments, Geology and Astronomy, to leave S.L.A. and become administratively associated with the Institute of Technology (IT). He also had been approached by the departments of Botany and Zoology which were dissatisfied with their location in S.L.A. After several months when he gave every vested interest an opportunity to express its "best of all worlds," the College of Science, Literature and the Arts became the College of Liberal Arts; Geology and Astronomy joined IT as requested, and there remained the question--what to do about Botany and Zoology? After many more long and frequent deliberations the College of Biological Sciences was created in 1965. It included initially Botany, Zoology, Biochemistry, and a new Department of Cellular Biology and Genetics. A little later the Department of Ecology and Behavioral Biology was formed with some of our staff listed as adjunct professors.

In 1963 Dr. James Beer was appointed Editor of the Journal of Mammalogy. This same year a new building for the Department was recommended as a high priority item to the Legislature by the Board of Regents. The department faculty had provided the Central Administration with square foot information as a basis for the formal request. Unfortunately, the Legislature failed to provide even planning money for this venture at this time. In the fall of 1964 Dr. Mykola Haydak, who had become recognized internationally for his work on bee nutrition and pollen substitutes, took a single quarter leave to accept an Australian Fellowship to study brood rearing under Australian conditions where there were pollen deficiencies.

In 1965 a number of significant events occurred. On January 1, 1965, Dr. Frederick Holdaway suffered a fatal heart attack. He had been in poor health for some time. Dr. Holdaway had been project leader on corn borer research and for extensive legume pest investigations. He also was responsible for teaching economic entomology and introduced the first offering of a course dealing with plant resistance to insect attack. Dr. E. B. Radcliffe, who had been working under the direction of Dr. Holdaway, was

promoted from Research Associate to Assistant Professor to take over some of Dr. Holdaway's duties. That same year, 1965, Dr. Phillip Harein was appointed as an Associate Professor and Extension Entomologist, and Dr. Smith received an award for the best fishery research paper from the American Fisheries Society. Again in 1965, two staff members had the opportunity for foreign duty. Dr. L. K. Cutkomp went to Vienna, Austria to serve for 2 years with the International Atomic Energy Agency. He traveled extensively while giving particular attention to the application of the sterile male techniques for the control of fruit flies. Dr. Peterson spent 3 months in Chile investigating insect problems in legume seed production.

In 1965 and 1966 there were two memorable events in Dr. Haydak's life. First, he was able to attend the XXth International Beekeeping Congress in Bucharest, Rumania, and secondly, he retired on June 30, 1966. While in Europe he visited bee culture experiment stations in England, Germany, Czechoslovakia, Rumania, Switzerland, and France. The Minnesota Beekeepers gave generous support to help finance this trip as an expression of their deep respect and affection for Dr. Haydak. It is certain that he would have had better communication with his foreign colleagues than most of us because he had a reading knowledge of the English, French, German, Ukrainian, Russian, Czech, Slovak, Polish, Servian, Croatian, Bulgarian, Spanish and Italian languages, and was able to speak fluently in five of them.

#### New Building Authorized in 1965

Of the many important events in the life history of the Department one which occurred in 1965 was exciting. The State Legislature passed a bill authorizing the construction of a new building for the Department to cost \$2,536,250. This was the authorized figure, but they appropriated one million fewer dollars with the direction that the University (meaning the Department) would obtain the missing dollars from other sources. Consequently, the Department faculty soon became engaged in a stupendous effort to secure a building grant from the U. S. Department of Health, Education and Welfare. They were partly successful by obtaining \$770,850 from the Federal Office of Education. The final cost for constructing and furnishing the building was \$2,664,042. The difference between the original appropriation plus the Federal Grant and the final figure was supplied from a Legislative contingency fund. In addition, the National Science Foundation granted the Department \$88,000, supplemented with \$24,800 as matching funds from the University, to provide special research installations for aquatic biology, ecology and systematics. One important item obtained from this source was a 612 foot deep well for the fisheries wet laboratory. The Department was fortunate in being able to move the library from Coffey Hall to the new building. Nearly all new equipment was furnished for it with building funds.

The construction of the main buildings started in June 1967 on the hillside overlooking the agricultural field plots. A head house and greenhouse and a honey laboratory were constructed in other locations. Most of the moving was completed in October 1968. One can be sure that this was an eventful experience because the



The new building dedication March 24, 1970 brings happy looks from left to right: University President Malcolm C. Moos, A. C. Hodson, and Institute Dean Sherwood O. Berg.

Department had been crowded into space on the third floor, the attic and in the basement of Coffey Hall. It also occupied the second floor of the livestock pavilion. As explained to the University Administration and the Legislature, the Department was running out of places where new burrows could be found. Also it was and always had been obliged to operate in spaces that never were intended for the use that had to be made of them. The new building was dedicated on March 24, 1970. The dedication program included remarks by President Malcolm Moos and Dean Sherwood Berg with Drs. Chiang, Beer and Smith speaking for the Department Staff.

As mentioned earlier, Dr. Riley had anticipated that there would be a new building soon after his arrival in 1918. In 1946 Dr. Mickel wrote to Professor Ruggles and among other things said, "We are beginning to beat the tom-toms for a new building and I believe we are making some progress." Department records from 1948 show that the specific needs for new facilities were presented to Dean Bailey. There was only a 20-year delay. While the building was under construction, the University architect was quoted in the Minnesota Daily as having referred to the building as a "Contemporary Fortress." The following morning this Ode appeared in Hodson's office. After 2 or 3 years Dr. Allan Peterson finally admitted authorship.

A MIGHTY FORTRESS  
(To be sung with stately dignity and resounding force)  
A mighty fortress, our abode;  
It has few windows in it.  
We love fluorescence over head  
And space of wall infinite.

With insects crawling all around  
And fish swimming below  
Our hopes for building now abound  
A mighty fortress all aglow.

Oh, Lord, give us a new abode  
 With walls no gun can render,  
 And bright fluorescents over head  
 In artificial splendor.

With additional teaching space made available by the new building the two last courses to be offered by Department staff in the Zoology Building were moved to the St. Paul Campus. These were Dr. Price's courses in Medical Entomology and Introductory Entomology.

In April 1965, while the State Legislature was considering University new building requests, a fire destroyed the auditorium in Coffey Hall. Many people suggested that Hodson might have attempted to burn down Coffey Hall to be sure to have a new Department building. A few weeks later a lightning strike caused extensive damage to Coffey Hall. Within a few days of this event, during a Consultative Committee meeting, President Meredith Wilson teased Hodson about starting the fire, but when he was informed about the lightning strike he said to him, "In that case I will be on your side."

During the first year of the 1966-68 biennium, Dr. Herbert Kulman was appointed as an Associate Professor to take over the teaching and research in forest entomology. Since finishing his graduate work at Minnesota, he had served as a professor of entomology at the University of West Virginia and the Virginian Polytechnic Institute. Dr. Richard Mackie, a student of a former student, Dr. Quimby, at Montana State University, was appointed as an Assistant Professor to replace Dr. William Marshall. Dr. Marshall had left the Department temporarily to become Director of Field Biology Programs in the College of Biological Sciences. He was administratively responsible for the Lake Itasca Biology Sessions and the Cedar Creek Natural History Area. That same year Dr. A. Glenn Richards was away on a sabbatical leave as a Visiting Investigator at the Max Planck Institute for Behavioral Physiology. He also served as a Guest Lecturer at the University in Munich. Also in 1966 Dr. Thomas Waters was on a single quarter leave with headquarters at Utah State University while studying stream drift in mountain streams.

During the second year of the biennium, Dr. Basil Furgala was appointed as an Associate Professor to replace Dr. Haydak in the area of apiculture. He had been employed in the Apiculture Section of the Canada Department of Agriculture. While there he worked in a laboratory supervised by Dr. Thomas Gochnauer, who had resigned his position here in 1961.

### Institute Reorganized

The most significant campus event during the next biennium, 1968-70, was the reorganization of the Institute of Agriculture. It became an administrative umbrella over three Colleges: Agriculture, Forestry, and Home Economics, and three functional areas, the Experiment Station, the Agricultural Extension Service, and International Programs. This Department had vigorously supported a somewhat different alignment. It recommended a College of Natural Resources which would incorporate the following units, most of which were already environment related and functioning within the Institute as administrative units or instructional programs: the Department of Entomology, Fisheries, and Wildlife;

the School of Forestry; the Department of Soil Science; a Department of Resources and Community Development; and a Department of Water Resources. This proposal received considerable favorable comment but was found unacceptable for political reasons. In 1968 Professor John Lofgren went to Chile for about two years to establish and conduct courses in Agricultural Extension under the auspices of a University cooperative program with the Catholic University in Santiago. During the year 1968-69 Dr. Lloyd Smith served as President of The American Fisheries Society.

### Enrollment Swelled

By this time the enrollment in the fisheries and wildlife program had grown to the point where the four faculty members were swamped with both teaching and advising responsibilities. On this basis it became possible to obtain a new staff member with the primary duty of advising the lower division undergraduate students. The person selected, one of our former graduate students, Dr. L. Daniel Frenzel, was appointed as a Professor in fisheries and wildlife on June 1, 1969. Previously he had been on the faculty of Macalester College since 1957. In addition to student advising, Dr. Frenzel offered a very popular service course called Principles of Fisheries and Wildlife Management mostly for students in forestry. He also continued wolf studies which he had been carrying on while at Macalester and initiated an investigation of the bald eagle. The following year, 1970, Dr. Mackie resigned to accept a position at Montana State University in Bozeman. He had been very successful in developing a big game research project with concentration on moose population ecology and management. He was replaced by Dr. James Peek who had served as a Research Fellow under the direction of Dr. Mackie. That same year Dr. William Marshall asked to be relieved of his position as Director of Field Biology Programs in the College of Biological Science and returned to the Department as Professor of wildlife management. Also in 1970, Dr. Marshall enjoyed a single quarter leave to travel in Portugal, France, North Africa and the Azores to study European woodcock habitats.

In 1971 the faculty suffered a loss with the death of Dr. James Beer. He had a massive heart attack while on a field trip at Basswood Lake. This was an area dear to him because he had spent many summers there at the Wilderness Research Center while investigating mouse population fluctuations. He had also been engaged in research on bats, pocket gophers, beaver, ectoparasites of birds and mammals, and radio telemetry studies on spruce and sharptail grouse.

Dr. James Peek, who had replaced Dr. Mackie as big game ecologist, resigned in 1973 to accept a position at the University of Idaho. Our big game specialists, like elk, proved to be migratory animals. They enjoyed a short visit to the lowland meadows but soon returned to their first love, the mountains of the West. The position which became vacant upon the death of Dr. Beer was filled by Dr. James Cooper in 1972. Dr. Cooper was a waterfowl specialist with a particular interest in goose behavior and ecology. The following year the Department was able to obtain the services of Grady Mann as a Wildlife Extension Specialist on a temporary appointment for 1 year. The

last four events, occurring in 1974, were the appointment of Dr. Peter Jordan who came from Yale to be responsible for teaching and research in the big game area previously handled by Drs. Mackie and Peek, the regular appointment of Dr. Ira Adelman as an Assistant Professor in fisheries, and a foreign experience enjoyed by Drs. Radcliffe and Cutkomp. Dr. Radcliffe spent 5 weeks in the spring of 1974 in Central and South America. He gave a series of lectures on pest management in Colombia and visited the International Potato Center in Lima, Peru. Dr. Cutkomp spent spring quarter, 1974 in Bombay and Delhi, India, consulting on research involving the sterile-male technique, particularly with the red palm weevil.

On June 30 Dr. A. C. Hodson retired and was replaced as Department Head by Dr. Milton Weller. The fact that Hodson had lived in and with the department for more than 40 years may excuse him for being presumptuous enough to have presented this Department scenario as a chronological sequence of scenes on the University stage, with comments on the entrances and exits of its actors.

## Appendix A--Biographical Sketches

In this section the biographies of some of the former members of the Department faculty will be sketched. Many who made significant contributions to the evolution of the Department will not be included either because information was not readily available or because highlights of their life and careers are included in the text of the Department history. The vitae of present staff members also are not included because their life histories and accomplishments are on file in the Department office.

### Otto Lugger 1844-1901

Otto Lugger von Hagen was born in Hagen, Westphalia, Germany, September 15, 1844. His father was Fritz Lugger von Hagen, a professor of chemistry in several educational institutions of Prussia. He was an original investigator in scientific and experimental chemistry and became a man of great prominence in scientific and educational circles. His ancestors were mostly descendants from an old Prussian family who were officers in the Prussian Army, whose records are traced back to the 14th century. Otto Lugger, the name he assumed upon coming to this country, was educated at the Gymnasium at Hagen, and later at the Universities at Bonn and Berlin. He entered the army in a cavalry regiment and became a lieutenant in 1864. He left the army to enter the Polytechnicum at Berlin and later at Heidelberg. When he came to this country in 1865, he secured a position with the Engineer Corps of the U. S. Army.

From 1865-67 he was engaged in a survey of the Great Lakes. While doing this work he became interested in entomology and did considerable collecting of insects. Soon he became acquainted with C. V. Riley and, when Riley was made State Entomologist of Missouri in 1868, Lugger went with him as an assistant. He was with Riley from 1868 to 1875. In 1875 he married and went to Baltimore where he became curator of the Maryland Academy of Sciences and Naturalist of the City Park. He remained there for 10 years when in 1885 he was appointed Assistant in the Division of Entomology of the U. S. Department of Agriculture. There he worked with Dr. L. O. Howard.

Otto Lugger came to Minnesota as Entomologist and Botanist in the Minnesota Experiment Station in 1888. He capitalized on his extensive writings to the extent that he was able to secure from the State Legislature sums of money at each session to carry on entomological work in the state. In 1899 he became a Charter Member of the American Association of Economic Entomologists. Other mention of his accomplishments is given in the Department history text.

### Frederick L. Washburn 1860-1927

Dr. F. L. Washburn was born on April 12, 1860, in Brookline, Massachusetts. He entered Harvard University in 1878 and received the B.A. degree in 1887. For some years after that he traveled abroad and spent some time at The Johns Hopkins University, and was awarded the M.A. degree by Harvard in 1895. From 1887 to 1888

he served as Instructor at the University of Michigan. Then he moved to Oregon where he held the title of Entomologist and State Biologist. He was Chief of the Division of Entomology at Minnesota from 1902 to 1918. He continued on the faculty as Economic Zoologist until retirement in 1926. In 1927 he died of pneumonia after a short illness.

In May of 1902 Washburn came to Minnesota to replace Otto Lugger. He continued to produce annual reports, some of which were illustrated with colored plates. He also assembled a collection of mounted birds and mammals in Coffey Hall which provided a natural history museum that was used in teaching biology in the School of Agriculture. During World War I he took an active interest in Belgium hares in order to help increase the food supply of the country. As a result of these activities, he produced a book on rabbit farming. In 1922 and again in 1925 Professor Washburn went on collecting expeditions to the South Sea Islands. In addition to collecting insects and other animals he captured the flavor of the Islands through photographs and his painting. Upon his return to this country he gave lectures on life in the Islands which were illustrated by colored lantern slides. Upon his retirement he immediately started devoting his time to painting, lecturing and writing. In 1911 he was elected President of the American Association of Economic Entomologists. He published two books: Injurious Insects and Useful Birds and the Rabbit Book.

#### Arthur Gordon Ruggles 1875-1947

Professor Ruggles was born in 1875 in Annapolis Royal, Nova Scotia. He graduated from the Truro Agricultural School and taught for awhile at Provincial Schools. He entered the College of Agriculture at Cornell University and was granted the B.S. degree in 1901. His graduate work was interrupted briefly but he returned to complete work for the M.A. degree in 1904. In 1902 he joined the staff at Minnesota as Assistant Entomologist in the Experiment Station and remained at the University of Minnesota for 41 years (25 years as State Entomologist). During the year 1912-1913 he served as entomologist of the Pennsylvania Chestnut Blight Commission, and in 1940-41 he was chairman of a committee requested by the Bureau of Entomology and Plant Quarantine to evaluate work on the control of the gypsy moth. Professor Ruggles was elected President of the Entomological Society of America in 1937, and served from 1935-1946 as permanent President of the International Great Plains Entomological Conference.

A. G. Ruggles was an outstanding teacher. When he became responsible for state regulatory work, his approach from the beginning was that of an educator rather than an officer of the law. He was genuinely interested in problems and frank and open in his approach to those with whom he dealt as State Entomologist. As a colleague, Arthur Ruggles always was consulted on Departmental matters, for his prime consideration was the best interest of the Department rather than sectional or personal. A friend of Professor Ruggles quoted a 16-year-old boy who had worked one summer for Ruggles as saying, "Why, Professor Ruggles is just like you Mr. Jensen, just like a boy and fun to be with."

Royal N. Chapman 1889-1939

R. N. Chapman was born at Morristown, Minnesota, September 17, 1889. His preparatory was done at Pillsbury Academy in Owatonna, in southern Minnesota. Chapman entered the University of Minnesota in 1910 and received his B.A. degree in 1914. For his M.S. degree, which he obtained in 1915, he worked on the life cycle of the two-lined chestnut borer, Agrilus bilineatus, with Professor A. G. Ruggles at Minnesota. Chapman obtained a Fellowship at Cornell University in 1915 and received his Ph.D. degree under Comstock in 1917. After receiving his degree he returned to Minnesota as a teaching fellow in the Department of Animal Biology during 1917 and 1918. During the first World War Chapman worked on stored food insect problems and later became interested in population studies of insects. In 1918 he was promoted to Assistant Professor and Assistant Entomologist of the Minnesota Experiment Station, and in 1923 his rank was raised to Associate Professor. In 1925 he was made full Professor and Chief of the Division of Entomology and Economic Zoology while Dr. W. A. Riley was Head of the Department of Zoology. During 1926 Dr. Chapman held a Guggenheim Fellowship and in 1927 a Rockefeller Foundation traveling fellowship in Europe. While he was away, Professor Ruggles was Acting Head of the Division of Entomology.

In 1930 Dr. Chapman accepted a position as Director of the Experiment Station of the Hawaiian Pineapple Growers Association and Dean of the Graduate School of Tropical Agriculture at Hawaii. He was at Hawaii until July 1939 when he again returned to Minnesota as Dean of the Graduate School. After a short illness, Dr. Chapman died in Minneapolis on December 2, 1939, at the age of 50. His premature death was a great shock to his many friends and associates.

Dr. Chapman was a former president of the Entomological Society of America and was editor of Ecological Monographs and of the general Entomological section of Biological Abstracts. His earlier economic work was on certain forest insects, later on stored food insects. His bulletin on stored food product insects enjoyed wide popularity in Minnesota. Chapman's work in ecology is even more widely known than his work in economic entomology, especially his researches on experimental populations of Tribolium confusum. His text, Animal Ecology, was used as an ecology text and reference book throughout the country. Administrative duties in his last 15 years curtailed the amount of research he was able to do. Dr. Chapman's genial personality and likable character endeared him to his colleagues and to his many friends and his early death was a great loss.

Father Francis Jager 1869-1941

Reverend Francis Jager, for many years Chief of the Division of Bee Culture at Minnesota, was one of the nation's best known bee-men. When the Division of Bee Culture was established in 1913 at the University, Father Jager was invited to take charge and through his official connection here became well known to honey producers generally.

He was born April 2, 1869 in Austria. During the first World War he served in the Balkans as an interpreter for the Red Cross and as a chaplain in the Serbian Army. Later he was assigned to the United States relief commission. At that time he formed a friendship with King Alexander of Yugoslavia. The king gave Father Jager the decoration of the Order of Sava in recognition of his war service. In 1917 he was elected President of the National Beekeepers' Association.

Father Jager retired from the University in 1918 to devote more time to his beekeeping and his church. For some years he had spent the winter months in Louisiana where he had an apiary from which he supplied bees and queens for his 300 colonies left in Minnesota. He was taken ill on his last trip to Alexandria, Louisiana, and died 3 weeks later on January 30, 1941. He was buried in the parish cemetery at St. Bonifacius where he established the church in 1909, and where he served until 1920 when he transferred to Mound, Minnesota. Father Jager was a magnetic speaker and the star attraction on many convention programs. Unfortunately, he wrote little for publication. The craft might have been greatly enriched had he passed on the vast store of information which he was able to accumulate.

Maurice C. Tanquary 1881-1945

Dr. Tanquary was born near Lawrenceville, Illinois, in 1881. He was reared on a farm there. He started his professional career as a school teacher and then attended college at Vincennes University. It was at the University of Illinois that he earned the Ph.D. degree.

In 1912 Dr. Tanquary became an Instructor at Kansas State College, and after a short period there obtained a leave of absence to join the Crocker Land Expedition of D. B. McMillan. During the 3 years of the expedition he suffered many hardships which left their mark on him. He returned to Kansas for a while and then in 1920 went to the Texas Agricultural Experiment Station as Chief of the Division of Entomology and State Entomologist. In 1924 he resigned this position and went to North Dakota where he established himself as a commercial beekeeper. He was very successful in this enterprise where his innovations in beekeeping (use of packaged bees, for example) attracted national attention. In 1928 he accepted a Professorship at the University of Minnesota. He was characterized by his friends as a progressive conservative.

William A. Riley 1876-1963

William A. Riley, professor emeritus and former head of the Department of Entomology, Fisheries, and Wildlife was born January 10, 1876, at Mankato, Minnesota, and died October 2, 1963. He attended high school at Topeka, Kansas, and at De Pauw Academy, and did his undergraduate work at De Pauw University. De Pauw honored their distinguished alumnus with the D. Sc. degree in 1926. His graduate training was received at Cornell University where he earned the Ph.D. degree in 1903.

Dr. Riley was an instructor at De Pauw University for 2 years and taught some courses at Columbia University, Cornell Medical College and New York University. He joined the staff at Cornell as an instructor in 1899, and advanced to Professor of Entomology and Parasitology in 1912. In 1918 Dr. Riley came to Minnesota as Professor and Chief of the Division of Entomology and Economic Zoology (now Department of Entomology, Fisheries, and Wildlife). He served in this capacity until 1925 when he became Chairman of the Department of Zoology on the Minneapolis Campus. When Dr. Royal N. Chapman, who had succeeded him as Division Chief on the St. Paul Campus, left for Hawaii in 1930, Dr. Riley returned to his former position in the Department of Entomology and Economic Zoology where he remained until his retirement in 1944.

During the summer of 1922, Dr. Riley was engaged in hookworm investigations in Puerto Rico and in 1926 in the Republic of Panama. In 1931-32 he was visiting professor at Lingnan University, Canton, China, and at the invitation of the Biological Society of China visited various institutions in central and north China. He devoted many years of service and gave generously from personal income to Lingnan University, of which he was a Trustee.

Dr. Riley was noted early in his career for his research on insect anatomy and fine structure, although his first two published papers were on mycological subjects. In about 1909 he turned his attention to problems in parasitology and produced a Handbook of Medical Entomology in 1915. His text on Medical Entomology written jointly with O. A. Johannsen in 1932 became a standard reference in the field. Altogether there are over 150 titles in his list of published work. During Dr. Riley's productive life he was best known for his teaching and graduate student training. Those who had the good fortune to work directly under him became devoted disciples. The Department of Entomology, Fisheries, and Wildlife at the University of Minnesota can appreciate his contributions forever because he was primarily responsible for the development of an outstanding professional library there.

Dr. Riley's professional competence was recognized in a number of ways. He was a Charter Member and Fellow of the Entomological Society of America, and its President in 1917. In 1931 he was President of the American Society of Parasitologists, and its Editor for medical entomology in 1942-44. He also was the first President of the Minnesota Academy of Science. Dr. Riley represented several organizations, including the U. S. Government, the Entomological Society of America, and the University of Minnesota at the International Congresses of Entomology and of Zoology held at Lisbon in 1935, serving as chairman of the Section on Parasitology and Economic Zoology at the International Congress of Zoology. He was listed in Who's Who in America and was a member of a number of professional societies including the Society for Tropical Medicine, the A.A.A.S., The Society of American Naturalists, the Association of Economic Entomologists, The Society of American Zoologists, The American Society of Parasitologists and the Entomological Society of America.

Frederick G. Holdaway 1902-1965

Dr. Holdaway was born on September 13, 1902, in Bundaberg, Queensland, Australia. He was awarded the B.Sc. degree from the University of Queensland where he graduated with Honors in Biology in 1925. He served as Assistant Lecturer at Adelaide University for 1 year and then spent the next year, 1926-27, as a graduate student at Cornell University. In 1927 he continued his graduate study at Minnesota and received the Ph.D. degree in 1928. Before returning to Australia he spent 1 year as a Resident in Research at the University of Toulouse, France, while employed as Research Entomologist for the Australian Council for Scientific and Industrial Research. His mission to England and Europe was to search for parasites of the sheep blowfly. In 1934-37 Dr. Holdaway was a Lecturer part-time in the Australian Forestry School in Canberra. In 1937 he became Head of the Department and Entomologist of the University of Hawaii Agricultural Experiment Station. He was engaged as Special Entomologist for the Imperial Bureau of Biological Control, Canada, for 5 months while on sabbatical leave from Hawaii in 1947. While on leave he worked in association with Dr. Harry Smith at the California Citrus Experiment Station on biological control of scale insects threatening natural vegetation of Bermuda.

In 1948 he joined our staff at the University of Minnesota. Until his death on January 1, 1965, Dr. Holdaway had been responsible for coordinating research on the European corn borer and was the leader of a project dealing with insects affecting legume seed production. He advised several graduate students and taught a beginning course in economic entomology. He developed a strong interest in plant resistance to insect attack and initiated a graduate course on this subject. Much of the time while at Minnesota he had poor health and on New Year's Day, 1965, he suffered a fatal heart attack.

Samuel Graham 1891-1967

Dr. Graham was born in Salisbury, Maryland, in 1891 and died at his home in Ann Arbor, Michigan, in 1967. He received the B.S. degree in forestry at the University of Minnesota in 1914, and M.S. degree from Cornell University in 1916 and a Ph.D. in entomology at Minnesota in 1921, one of the first two Ph.D. degrees to be awarded to graduate students in the Division of Entomology and Economic Zoology at Minnesota.

When he returned from Cornell in 1916 he was employed by the State Entomologist, Professor Washburn, and in 1918 was appointed as an Instructor in entomology. He served from 1922 to 1927 as an Assistant Professor in the Department. His teaching and research were in forest entomology. During this period of time he was employed on a part-time basis as a special investigator in forest entomology by the Canadian and U. S. Departments of Agriculture.

In 1927 Dr. Graham accepted an appointment as an Associate Professor in the College of Natural Resources at the University of Michigan. He taught forest entomology, ecology of the forest, forest biology, and principles of wildlife management while at

Michigan. His textbook, Principles of Forest Entomology, was used widely. He also co-authored a book on survival under wilderness conditions. In 1953, Dr. Graham was honored by being awarded the University's Outstanding Achievement Award during the 50th anniversary of the University's School of Forestry.

#### Mykola H. Haydak 1898-1971

Dr. Mykola H. Haydak, was born May 12, 1898, in the Ukraine. He studied at the University of Kiev, Ukraine, and attended the Ukrainian University at Praha and the Ukrainian Agricultural Academy at Podebrady, Czechoslovakia. He graduated with distinction from the College of Agriculture and Forestry at the Polytechnic Institute at Praha with a degree in Ingeneur of Agronomy. Dr. Haydak was a volunteer in World War I, starting as a private. In 1922, he was honorably discharged from the Ukrainian People's Republic Army as a 2nd lieutenant in field artillery. For 2 1/2 years he worked at the State Bee Culture Institute of Czechoslovakia as a scientific aide. He was also temporarily in charge of an apicultural field station there. He arrived in the United States in June 1930, and entered graduate school at the University of Wisconsin working under Professor H. F. Wilson and Dr. H. Steenbock on problems of bee nutrition. He received his Ph.D. at the University of Wisconsin in 1933. After July 1933 he carried on research work and teaching at the University of Minnesota.

Dr. Haydak was known throughout the world for his research on bee nutrition, including the role of royal jelly and the influence of food composition on bee growth, caste determination and the aging of bees. He also devoted considerable time to problems of apiary management, particularly the problem of overwintering under Minnesota conditions, and the formulation of pollen substitutes for brood rearing. His work on bee nutrition and pollen substitutes was recognized abroad by receipt of an Australian Fellowship to study bee nutrition under Australian conditions, and an invitation to deliver a review paper on bee nutrition at the XXth International Beekeeping Congress in Bucharest, Rumania. While in Europe he visited bee culture experiment stations in England, Germany, Czechoslovakia, Rumania, Switzerland and France.

The utopia of abundant food resources has long been expressed in the phrase, "a land flowing with milk and honey." In the 1930's Dr. Haydak carried out an experiment to test this point. He lived on milk and honey for several weeks and discovered that they alone did not provide an adequate diet. However, he said that a mixture of milk and honey, supplemented with synthetic thiamine and vitamin C is satisfactory food for a person on a restricted liquid diet.

Dr. Haydak published over 225 scientific and popular articles on apiculture. His scientific reading and travel were enhanced by his reading knowledge of the English, French, German, Ukrainian, Russian, Czech, Slovak, Polish, Servian, Croatian, Bulgarian, Spanish and Italian languages. He was able to speak 5 of them fluently.

He was a member of the Entomological Society of America, Shevchenko Scientific Society, Ukrainian Free Academy of Arts and Sciences, Gamma Sigma Delta (presented with the Award of Merit by this Honor Society in 1967) and Sigma Xi.

Dr. Haydak was regarded with affection and respect by all who knew him. He was almost revered by the hobby and commercial beekeepers of Minnesota, most of whom had participated in Beekeeping Short Courses which he had conducted for many years on the St. Paul Campus and out in the state.

Dr. Haydak passed away on August 12, 1971, after a long illness.

James Robert Beer, 1918-1971

Dr. J. R. Beer, Associate Professor of wildlife management, University of Minnesota, died on August 24, 1971 after nearly 2 months of courageous battle to overcome a massive heart attack suffered while he was in the field in northern Minnesota.

Dr. Beer was a native of Oregon and graduated from Battle Ground High School in Washington. He attended Washington State University where he received the B.S. degree (1940) and the M.S. degree (1941) in Wildlife Management. While in Washington he carried out research on blue grouse and waterfowl. His first professional employment was as a game biologist with the Montana Game and Fish Division for 1 year. He then worked 3 $\frac{1}{2}$  years as a lead draftsman for the Kaiser Industries in Vancouver, Washington. From 1945 to 1949 he was a graduate student at the University of Wisconsin where he received the Ph.D. degree in 1949. During this period he developed an intense interest in the ecology of bats, muskrat populations and the red-winged blackbird.

Dr. Beer joined the University of Minnesota staff in 1949 where his primary responsibility was teaching courses in mammalogy and wildlife techniques. In more recent years he also taught courses in upland game and wildlife ecology. His research interests involved continued work with bats, small mammal and bird populations, ecology of the pocket gopher, ectoparasites of birds and rodents, and radiotelemetry studies of spruce and sharptail grouse. His approach to problems revolved around field studies combined with analyses of physiological conditions in the laboratory. While at Minnesota he co-authored the book Mammals of Minnesota and served as editor of the Journal of Mammalogy from 1962-1964.

He was a member of the Wildlife Society, the American Society of Mammalogists, American Ornithologists Union, Ecological Society, Wilson Ornithological Society and the honor societies Phi Sigma and Sigma Xi.

His students and co-workers knew him mostly for his active participation in field projects where he displayed an amazing capacity to obtain large quantities of specimens and data. Many times he worked under adverse field conditions or in remote localities with great vigor and zeal.

Alexander A. Granovsky 1887-1976

Dr. Granovsky was born on November 4, 1887, in Berezcy, Ukraine. In 1905 he graduated from a first grade agricultural school and then majored for a year in economics and sociology at the Rieu Institute of Economics and Social Sciences. Because of his objection to Russian treatment of the Ukraine he was unable to be employed as a teacher or be admitted to any of the Russian educational institutions. For this reason he realized he would have to leave the country to achieve his ambitions and be free to express his convictions.

In 1913 he was able to secretly cross the border and make his way to England enroute to the U.S.A. He spent some time in Chicago with a Ukrainian family and then moved to Colorado where he attended Colorado State University from which he was graduated in 1918 with a major in entomology and zoology. He served in the U.S. Army with 10 1/2 months of duty overseas. Before returning to Colorado he spent 4 months at the Sorbonne. After he returned he taught high school for a few years and was principal of one. His next move was to go to the University of Wisconsin for graduate work in entomology. There he earned the M.S. degree in 1927 and the Ph.D. degree in 1938. While at Wisconsin he was an instructor from 1922-1926 and an Associate Professor until 1930 when he came to Minnesota as an Associate Professor.

Dr. Chapman invited Dr. Granovsky to come to Minnesota to work with an outstanding plant pathologist, Dr. J. G. Leach, who had become interested in insect transmission of plant diseases. Together they offered a course on this subject in 1931. One of his special interests was the study of aphid biology and taxonomy. Soon after he arrived the state was plagued with outbreaks of white grubs. He devoted the major portion of his research time to the biology and ecology of these insects for several years. During part of this time he was employed during the summer by the Bureau of Entomology to investigate the control of white grubs in a forest nursery at Cass Lake. He also was responsible for a project on the biology and control of pests of vegetables including potatoes. While working on this project he was the first entomologist in the country to carryon large scale field tests of DDT for control of potato insects. In 1935 Dr. Granovsky became the first Director of the Biology Session at the Itasca Forestry and Biological Station. He served as Director for 4 years and taught entomology there for a few years after he was replaced as Director.

After Dr. Granovsky retired in 1956, he spent 2 years studying aphid taxonomy with the aid of a National Science Foundation grant. When the grant was not renewed he turned his attention to his large and valuable collection of Ukrainian publications. In 1966 he presented this collection to the University. University President O. Meredith Wilson and Edward D. Stanford, Director of Libraries, accepted this gift of a large collection at a ceremony in President Wilson's office. Among those present were two Vice Presidents and T. L. Smith, a historian and chairman of the University Immigrant Archives Committee. This single gift, Smith said, makes the Ukrainian section of the archives a valuable addition to a collection which is richer in immigrant materials than any other American or European library. When his health permitted, Dr. Granovsky spent much of his time cataloging the collection in the Walter Library on the Minneapolis Campus.

Clarence E. Mickel 1892-

Dr. Mickel was born February 29, 1892, in Lincoln, Nebraska. He first attended school at the English Academy in Mexico City, Mexico, where his family had moved. After graduation from high school in 1909 he worked as a shipping clerk for the Marshall Oil Co. in Lincoln and as a salesman in Sioux Falls, South Dakota, for a few years. In 1913 Dr. Mickel entered the University of Nebraska and majored in entomology. He received the B.S. degree in 1917 and was appointed the first Extension Entomologist in Nebraska. He obtained a leave to enlist in the U.S. Army and was commissioned 2nd Lieutenant in the Reserve Corps in 1918.

In 1920 Dr. Mickel resigned his position at Nebraska to accept a position as Research Entomologist with the American Beet Sugar Company, Rocky Ford, Colorado. When the company curtailed its research program in 1922 he accepted a half-time position as the first Extension Entomologist at Minnesota which permitted him to be employed while completing his graduate work. At Minnesota he received the M.S. degree in 1923 and the Ph.D. degree in 1925. Upon completion of the Ph.D. degree he was appointed Assistant Professor with half-time to be devoted to Extension and half-time to the curatorship of the insect collection. He discontinued the Extension work in 1927 and assumed the responsibilities of teaching entomology in the Zoology Department. His joint appointment with Zoology continued until retirement.

During the summers of 1928 and 1929 he held a special appointment with the Bureau of Entomology and Plant Quarantine and worked on insect collections at the U.S. National Museum. Dr. Mickel received a Guggenheim Foundation Fellowship in 1930 which permitted him to study his pets, the Mutillids, at the British Museum in London, the Zoological Museum in Berlin and at the Museum of Natural History in Paris. In 1957 Dr. Mickel had the opportunity to spend 6 months in Korea at Seoul University as one of the University faculty who participated in a cooperative program there.

Dr. Mickel served as Secretary-Treasurer of the Entomological Society of America from 1936 to 1947 and as its President in 1944. In 1945 he succeeded Dr. W. A. Riley as Head of the Department of Entomology and Economic Zoology. In 1956 he was elected Chairman of the North Central Branch of the ESA and he served several years as Permanent President of the International Great Plains Conference of Entomologists (1946-1955).

During his very active career Dr. Mickel became a world authority on the family Mutillidae. Since his retirement from the University in 1960 he has to date (1974) continued to publish taxonomic treatments of this group.

## Appendix B. Development of the Department Teaching Program

Almost from the beginning the Department faculty held cross appointments with another unit such as the School of Agriculture, either with or without compensation from outside the department. Likewise faculty in the Department of Animal Biology were listed as members of our Department. For example, Otto Lugger and A. G. Ruggles in the early days did most of their teaching in the School of Agriculture and Professor Nachtrieb and Oestlund in the Department of Animal Biology were named in early bulletins as members of our department. For these reasons a brief statement on the interrelationship will be presented before developing the history of instruction.

Originally the University was organized into a Preparatory School (lower division) and a Collegiate Department (upper division). There were two Colleges in the Collegiate Department, Science Literature and the Arts and Agriculture and the Mechanic Arts. The School of Agriculture was not established until 1888. In the 1888-89 University Calendar it was announced that the School would open on October 1, 1890, with an interesting statement of its purpose. "It is to provide a good business education (in agriculture) of high school grade, fair mechanical skill, with the habit of themselves making and mending rather than buying; a practical knowledge of the alphabet of the natural sciences so that they (the students) can read and observe intelligently in the lines of their work. All this in the School of Agriculture: beyond this is our College of Agriculture, in which these subjects will continue to meet the demands of the farmer and that most important class in agriculture; lecturers, professors, physicians and statesmen." At the beginning and for most of life of the School of Agriculture students spent 2 years each with 12 weeks of classroom instruction and a summer practical project. For many years the majority of the students on the "Farm Campus" were enrolled in the School. In the year 1891-92 there were 104 students in the School and none in the College. Four years later there were 204 students in the School and only 9 in the College. This disparity in numbers continued for many years. As late as 1905 there were 530 School students and 32 enrolled in the College, with 27 faculty members in the School and 17 in the College. It wasn't until 1916 that the enrollments became nearly equal with 781 in the School and 732 in the College, for it took many years for the public to see any reason why a farmer had any need for had any need for a college education.

In 1875 the University Almanac gives the description of a course in economic entomology: "Brief general view of the animal kingdom, general character of insects; characters and peculiarities of those families containing useful or injurious members; together with a specific study of the most important individuals of these families." Harris's Insects Injurious to Vegetation was used as a text but the instructor was not named. There was also a Farmer's Lecture as a short course in which entomology was included. Professor Winchell was in charge of Zoology courses in the University and was listed on the College of Agriculture faculty so he may have offered this course.

The same course description appeared in the University Calendar for a few more years as a collegiate offering. In the 1890 Bulletin of the School of Agriculture Otto Lugger was named as instructor offering a course with the following description. "Instruction of a practical nature--Classification to distinguish between useful and injurious insects and, apply remedies intelligently as remedies must be selected according to the kind of insects to be combatted. Insecticides--Arsenicals, kerosene emulsion, pyrethrum. Natural remedies and nature's methods of preventing the increase of injurious insects is also taught. The relation of other animals to insects is also taught to enable the student to know both his friends and his foes." In 1892 a course in Zoology in the School was given by Lugger in which chiefly Minnesota vertebrates were considered: their classification, their habits and food, their relation to the farmer.

The SLA Bulletin for 1892-93 includes the first mention of entomology in a biology course covering taxonomy, ornithology, ichthyology and entomology. The instructor or instructors are not named but Professor Oestlund was likely to have been involved. A few years later, 1898 the instructor for each course was named and Oestlund was responsible for taxonomy and entomology. After Lugger's death in 1901, Professor Washburn offered the entomology courses in both the College and the School of Agriculture with little change in the course descriptions. The next year the Department's collegiate courses were increased to include general entomology, economic entomology, forest entomology and the comparative anatomy and histology of insects. A. G. Ruggles, an Assistant Instructor, was responsible for the last three. The forest entomology course was open only to students in forestry.

By 1907 Professor Nachtrieb was giving a course in medical zoology in the Animal Biology Department and elements of beekeeping offered by Professor Washburn was mentioned for the first time in our Department course listing. The next year a new Zoology course was given by Washburn in the School of Agriculture. It covered the 4-footed pests of the farm--rabbits, gophers, squirrels, etc. as well as injurious and beneficial birds.

The facilities of the Division of Entomology and Economic Zoology in Coffey Hall were described as, "Well lighted laboratories with modern equipment are at the disposal of college students for both undergraduate and graduate work." There also is a mention of the large series of insects and a collection of birds and mammals for study.

In 1908 entomology was listed as a separate course for the first time in the Animal Biology Department curriculum. "The course covers, in general, the elements of entomology, structure, function, development, and economics, leading up to a discussion of the principles of taxonomy and their application to the classification of insects. Folson's Entomology and Hertwig's Zoology were used as textbooks and general guides. At this time the College of Agriculture Bulletin listed courses offered in the Department of Animal Biology and vice versa. The following year the SLA Bulletin announced a course offered by Professor Nachtrieb on Economic Zoology described as follows: "Lectures on the uses of animals and their products, the production and protection of those animals of special economic importance, and the methods of protection against some of the disease producing animals." This might be thought of as one of the first attempts to consider some aspects of game management in the

University. Another such attempt was announced in the 1909 Agriculture Bulletin. Professor Washburn gave a course on Game Protection and Fish Culture which was described as, "Relation of game and other birds, and of various four footed animals, to forest protection. Habits, range, usefulness or the contrary. The manner of protecting large and small game, fish and birds." In the Graduate School Bulletin for 1911-12 there also was a course in our Department called Economic Zoology which included, "Lectures and references on wild and semi-domesticated animals of special economic importance; the bearing of the habits and relationships of these animals to profitable and economic use, and protection against extermination; and the consideration that should decide for or against the extermination of so-called injurious animals." It was also at this time that Dr. C. W. Howard offered his course Insects and Diseases for the first time.

By 1914 the Department faculty consisted of Professors Washburn, Ruggles, Howard and Moore. A new course in Coccidae was given by Moore, and Howard and Boyd (Professor in Veterinary Medicine) offered one called Animal Parasites.

It was at this time that Professor Ruggles organized the entomology club called Frenatae which met every Monday afternoon for another 4 or 5 decades. It was modeled after the Jugatae Club at Cornell University. In the School of Agriculture curriculum there was a new course offered by Dr. Moore called Farm Zoology. It was described as a study of parasitic protozoa, worms, snails, frogs, salamanders, toads, lizards, snakes, birds, mammals of importance to the farmers, and their control (them, not the farmers' I'm sure). In the President's Report for 1914-15 there is special mention that the policy of utilizing thoroughly qualified graduate students as assistants in Station laboratories and field work is proving advantageous to the Station as well as to the Graduate School and the students. In the College Bulletin for those years there were three new courses announced: Nursery Inspection, State Laws, Quarantines etc.--Washburn; Home Economics Entomology--Howard; and Action of Insecticides--Moore.

The Department of Animal Biology offered a course in General Ecology of Insects in the 1917-18 Bulletin. The instructors were Oestlund and R. N. Chapman. From there it can be seen that Dr. Chapman became involved with ecology instruction early in his career. By this time the Department was teaching Animal Biology, Animal Parasites and Insect Pests of Plants in the School of Agriculture. The instructors were Marcovitch, Howard and Ruggles, respectively. In the year 1918-19, the staff consisted of Riley and Washburn, Professors; Moore and Ruggles, Associate Professors; Oestlund and Chapman, Assistant Professors, and Samuel Graham and Warren Williamson, Instructors. Graham assisted Ruggles in teaching Forest Entomology and Riley took over Insects and Public Health, Animal Parasites and Parasitism and Relations of Insects to Disease. The Department Chief did his share of teaching and then some because Dr. Riley also gave an advanced course on the Histology and Development of Insects. He also taught a course in the School. Chapman now was teaching both General and Advanced Ecology in the Department of Animal Biology with a cross listing in our Department. During this same school year the change from semester to quarter system occurred. In 1920 a new course on Insects of Forest Products was offered by Graham. The other advanced courses were General Ecology of Insects--Chapman, Advanced General Entomology--Oestlund, Biology and Taxonomy of the Aphididae--Oestlund,

Histology and Development of Insects--Riley and Insecticides and their Action--Moore. At least the advanced courses in Entomology, Ecology and Parasitology were given as three quarter sequences and all three quarters had to be taken to get a grade. In the summer of 1920 the Department offered 5 introductory courses, and 4 graduate courses.

Courses in the Division of Bee Culture were offered by Professor Jager and an Instructor named G. C. Matthews. There were three courses: Elements of Beekeeping I and II, Advanced Beekeeping, and Queen Raising. The description of the latter was, "Queen judging, principles of reproduction, grafting, drone-raising, mating, nuclei, mailing, requeening. In connection with the University Farm queen bee raising station." The first beekeeping short course was offered by Father Jager in 1920. In 1922 there was a summer offering of Economic Entomology taught by Dr. H. B. Hungerford from the University of Kansas, and Professor Washburn introduced a new course entitled, "Varieties and Habits of Fur-bearing Animals." He also still was teaching Forest Zoology and Economic Vertebrate Zoology. Also in 1922 in the Division of Bee Culture the courses had multiplied to: Elementary Bee Science, Industrial Beekeeping, Advanced Beekeeping, Queen Raising, Bee Diseases, and Study of Honey. The College apiary was located on the hillside below Home Economics. Our Department courses were the same as indicated before.

In the Department of Agriculture Report to the President (1923-24) one finds this: "A back-to-the-land movement got under way. Homesteading was popular. Ambitious young men foresaw a career for themselves as farmers. Both country and city parents encouraged their sons to prepare themselves for farming. Consequently it was a period of remarkable growth in Agricultural College enrollment."

By 1926 Maynard Johnson was teaching Varieties and Habits of Fur-Bearing Animals and Economic Vertebrate Zoology in our department and Comparative Anatomy in the Department of Animal Biology. Matthews, Assistant Professor of Beekeeping, resigned and was replaced by James W. Thompson. No other changes in course offerings or staff are mentioned. In the 1927-28 school year, Dr. Mickel taught the Advanced Course in General Entomology and Introductory Entomology after Professor Oestlund's retirement in 1926. The course continued to be offered in the Zoology building on the Minneapolis Campus. One major event occurred about 1925 or 1926 which affected the offering of the winter quarter of the Advanced Ecology course. It had been given on the Minneapolis Campus but was moved to Coffey Hall about this time. Dr. William Cook, who had replaced Dr. Chapman while he was on sabbatical leave, designed a series of six temperature control cabinets. These cabinets were located for many years in the basement of Coffey Hall. Dr. Chapman also had acquired new temperature and humidity control equipment from the Carrier Co. The designer of the Carrier cabinets would have been surprised to see them used for the rearing of insects, mice, etc. Their purpose had been to provide constant temperature and humidity control to standardize the spinning of silk thread used in the production of silk stockings and dress goods. After these pieces of equipment were acquired the experimental ecology section of the ecology course was given in Coffey Hall during the winter quarter because such laboratory facilities were not available in Zoology.

By 1930 the Department staff included Professors Chapman, Riley, Ruggles and Tanquary; Assistant Professors Johnson, Mickel, Strand and Dawson; and Instructor Harvey Ahrens who worked with Dr. Tanquary in beekeeping. Dr. Dawson taught a 2-quarter course in Zoology to students in Agriculture, Forestry, and Home Economics. For a short time he gave a third quarter of beginning entomology. The following year a course in forest entomology was given by Leslie Orr who had worked with Dr. Graham, and Ralph King offered a new course in Methods in Field Zoology at Cloquet. Another new course in 1931 was the Insects in Relation to Plant Disease course given by Leach and Granovsky. Dr. Harold Shephard was in charge of the course on Insecticides and Their Action formerly offered by Dr. Strand. In 1932 a new Game Management Curriculum was established by the Division of Forestry. Ralph King was very much involved. He developed course outlines and did much of the teaching. It was said that this curriculum had close affiliations with recreational activities which constitute a large source of income to the state. In the description of the Game Management Curriculum requirements in the 1932-34 College Bulletin, there is the following statement, "Not less than 24-30 credits to be in addition to the required courses in Economic Zoology and Zoology to be selected in consultation with, and with the approval of, the adviser, and the Chief of the Division of Economic Zoology." The only changes in 1933-34 were mentioned that Ralph King now taught a course in Game Management in addition to Methods in Field Zoology and that Dr. Samuel Eddy and Hodson were the instructors in Ecology. Hodson also offered a course in Insect Ecology. There had been a curriculum in Fur Farming on paper under the curriculum in General Agriculture, but apparently it was never very active. In the 1923-24 Bulletin it was mentioned only as a Program: "The prices of furs during the past few years have stimulated greatly the interest in fur-bearing animals. The College does not offer a special curriculum but the important studies underlying the course are already provided."

In covering the instructional changes during the past few years little has been said about the involvement of the Department staff in School of Agriculture teaching. Seven courses were offered regularly: Biology, Animal Biology, Insect Pests of Plants and four courses in beekeeping. In 1935 our staff who offered these courses were Professors Ruggles and Tanquary and Leslie Orr, an Instructor. At this time the Department faculty was teaching in the Summer Biology Session at Itasca Park. Dr. A. A. Granovsky served as Director and taught Field Entomology, and King gave a course on Methods in Field Zoology. Orr had resigned his position so Hodson taught Forest Entomology and collaborated with Dr. Ralph Dawson in the teaching Field Zoology at the Forestry undergraduate Summer Session at Itasca. In 1936 a Forest Zoology course was taught by Donald Hatfield to senior foresters during their spring quarter at Cloquet. King had been giving this course at Cloquet.

In the combined Class Schedule for 1936-37 the Wildlife Management Curriculum appears for the first time as Curriculum III in Agriculture. The Game Management Curriculum was still operating in Forestry. Drs. Mickel and Hodson were listed as the instructors in Field Zoology at the forester's Itasca Summer Session and King and Granovsky continued their teaching at the Itasca Biology Session.

In 1938 Gustav Swanson replaced King at the Itasca Biology Session and taught Natural History of the Higher Vertebrates in addition to Principles of Wildlife Conservation. Between the foresters' Summer Session and the Biology Session there was a University of Scouting week for inservice training of Scoutmasters. Hodson taught a short course in entomology and one on conservation of wildlife for several summers. King and Swanson lectured in a course called Basic Wealth offered by the General College. Swanson gave three lectures for 2 or 3 years on Fur Farming, and Avian and Aquatic Wildlife.

The following year (1939) Royal N. Chapman returned from Hawaii to assume the Deanship of the University Graduate School. He initiated a practice of inviting a group of about 30 graduate students to his home on Sunday afternoon. He was able to do this for only a little more than a month because of his untimely death on December 2, 1939. This same year Donald Hatfield taught a new course in Mammalogy and Swanson offered one on Waterfowl and Upland Game Birds.

By 1940 the Department staff consisted of Riley, Mickel, Ruggles, Hodson, Hatfield, Swanson, Tanquary, Haydak, Granovsky and Shephard. Those teaching in the School of Agriculture were Riley, Ruggles, Tanquary and John Hughes, a graduate student. It became the practice to have a graduate student teach the biology courses in the School of Agriculture. Two of the faculty just listed completed their careers by retirement: Professor Ruggles in 1943 and Dr. Riley in 1944. By 1942 the forestry enrollment had been reduced so that Dr. Mickel could teach the Field Zoology course at Itasca alone, although Hodson continued to participate in the University of Scouting program in both 1942 and 1943. In 1941 Donald Quimby had been appointed to replace Hatfield. He taught Forest Zoology at Cloquet and Mammalogy on campus. Toward the end of World War II the faculty had been reduced to five, Mickel, Granovsky, Haydak, Swanson and Hodson. Quimby had gone off to war and Dr. Tanquary had passed away in 1944. When Dr. Mickel replaced Dr. Riley as Department Head in 1945 the years 1945-47 brought some major changes in the faculty. Drs. Shephard and Swanson resigned and Drs. Marshall, Richards, Smith and Daggy were appointed. The Combined Class Schedule for 1945-44 shows Dr. Swanson teaching six courses in the wildlife areas. The load was still unbelievably heavy after Dr. Marshall replaced Swanson. In the 1945-46 Class Schedule, he was shown to be responsible for Waterfowl and Upland Game Birds, Mammalogy, Wildlife Management, Methods in Wildlife Management and for Techniques of forest Wildlife Management (Cloquet).

The College Bulletin for 1946-48 shows a major change in the number of courses offered by the Department. The new ones were Insect Physiology Richards, Ecology of Terrestrial Vertebrates - Marshall, Fishery Biology and Management - Smith, Fisheries Resources - Smith, Principles of Economic Entomology - Daggy and Legal, and Regulatory Aspects of Pest Control - Aamodt. These were in addition to courses such as Ecology, Advanced General Entomology and Medical Entomology which had been offered for several years. The College Bulletin for 1947-49 lists the staff as Professors Mickel, Granovsky and Hodson; Associate Professors Haydak, Marshall, Richards, and Smith; Assistant Professors Aamodt, Burroughs, and Cutkomp and

Quimby as Instructor. By 1947 it had become necessary to teach the undergraduate course in Economic Entomology (Ent 5) all three quarters and during the summer. Among the visitors who taught the summer offering beginning in 1947 and for several years thereafter were Professors W. T. Hayes and Alvah Peterson from Illinois and Ohio, respectively, and Herman Spieth from the City College of New York. Peterson and Spieth also taught at the Biology Session at Itasca.

The 1949-50 Bulletin shows Dr. Richards offering a course in Biological Microscopy sponsored by Zoology and our Department. The Fish and Wildlife Management curriculum was announced for the first time and three other new courses were described. These were: Mill Pests and Their Control - Hodson and Cook; Introduction to Fish and Wildlife Management - Marshall and Smith; and Fishery Biology and Management - Smith. James Beer had been added to the staff to teach Mammalogy and advise undergraduates. Hodson, Cook and Cutkomp taught Economic Entomology to undergraduates.

By the time the 1951-52 school year rolled around the only changes were in staff assigned to courses. Principles of Economic Entomology was given by Cutkomp and Medical Entomology by Ralph Barr. Holdaway had been added to the staff with the title of Lecturer and Ralph Barr as an Instructor. In 1955 Dr. Roger Price was appointed to replace Dr. Barr. There were no significant changes in staff or course offerings until 1957 when Dr. Thomas Waters was appointed as an Assistant Professor and Thor Aamodt resigned. About this time the School of Forestry announced that their Forestry Wildlife Curriculum would be deleted from their offerings effective fall quarter 1959. There was marked change in the purpose of the School of Agriculture, which by now was serving students who wished to supplement their high school education rather than those who had not completed high school. It was intended for those who did not plan to go through 4 years for a degree. In the 1956-58 Graduate Bulletin Fishery and Wildlife Management were listed separately for the first time. The Department now offered three majors, Entomology, Fisheries, and Wildlife. Dr. Brooks was appointed as an Instructor and offered a new advanced course in Insect Microbiology. Dr. Cook also gave a new course on Insect Embryology and Histology. Dr. Waters offered a new course called Fishery Habitats and Development and Dr. Louis Berner (University of Florida) taught both the Field Entomology and Immature Insects courses during the summer at Itasca.

During the period 1960-62 there were significant changes in both staff and course offerings. Dr. Hodson replaced Dr. Mickel as Department Head, and Dr. Chiang transferred from the Duluth campus back to the Department to take over the ecology teaching for Hodson. Dr. Marshall was appointed as Director of the summer Biology Sessions at Itasca and was away on sabbatical leave from October 1960 to July 1961. In his absence Dr. John Tester taught a wildlife course. The Department staff at this time included Professors Hodson, Holdaway, Marshall, Richards, and Smith; Associate Professors Beer, Cook, Cutkomp, Haydak and Peterson; Assistant Professors Price and Brooks. The major course changes were a restructuring of the Advanced General Entomology course which had been offered for many years by Dr. Mickel, and a new distribution of courses in wildlife. The entomology course at first carried the old name but differed in context. Dr. Cook covered morphology in the fall, Dr. Brooks embryology and development in the winter, and Dr. Richards physiology in the spring. Taxonomy, which had made up about two-thirds of the course when Mickel was teaching it, was not covered. One of the features of Mickel's

course, long remembered with pleasure by the student participants, was the annual spring field trip to an area near the Iowa border. The changes in the wildlife program were the introduction of four new courses which were offered on alternate years. These were Fur Bearers - Beer, Upland Game - Beer, Waterfowl - Marshall, and Big Game - Marshall. While Dr. Marshall was on leave Drs. Tester and Frenzel taught the Ecology of Terrestrial Vertebrate course at Itasca the summer of 1961. At that time Dr. Daniel Frenzel was on the staff of Macalester College. There has been reference several times to cross listing of courses and joint staff appointments with Zoology. By this time the Zoology faculty list included Drs. Brooks, Chiang, Cook, Price and Richards. Our list included Drs. Underhill and Wallace from Zoology.

In the next biennium (1961-63) the Advanced General Entomology course which had been restructured had three titles: Insect Morphology - Cook, Microanatomy and Development of Insects - Brooks, and Insect Metabolism and Coordination Richards. These courses were offered on the St. Paul Campus. Five new courses, one called Principles of Systematics was given by Cook, a course called Introduction to Fisheries and Wildlife Management was required of all fisheries and wildlife students. The fisheries and wildlife staff with some invited speakers handled this course. Dr. Cook offered a course in Aquatic Entomology and Dr. Holdaway gave two new courses, Biological Control and Resistance of Plants to Insect Attack. The format of the undergraduate course in Economic Entomology was changed and offered by Holdaway as Insect Life. The only change in the 1965 College Bulletin was the announcement of a new course on Problems in Microtechnique given by Dr. Brooks. In 1966 Dr. Cook took over the Field Entomology and Aquatic Entomology at Itasca, courses which had been given by outside professors for several years. Dr. Price offered a new course in Advanced Insect Taxonomy and Dr. Radcliffe a course called Integrated Control. The latter replaced two courses formerly offered by Dr. Holdaway. About this same time Dr. Richard Mackie was appointed to teach some of the courses given by Dr. Marshall who had left the department to join the staff in the College of Biological Science. Dr. Basil Furgala was appointed as an Associate Professor to carryon research and teaching in apiculture, and Dr. Herbert Kulman joined the staff to be responsible for the forest entomology teaching and research which Hodson had been doing.

During the 1968-70 biennium Dr. L. Daniel Frenzel was appointed as a Professor with the principal responsibility for advising fisheries and wildlife students and undergraduate teaching. He was appointed chairman of the Fisheries and Wildlife Subcommittee of the College Curriculum Committee. He assumed the role of coordinator of the fisheries and wildlife teaching program in the Department with great success. In short order there were a number of significant changes in the organization of the Fisheries and Wildlife Curriculum. The first is seen in the 1967-69 College Bulletin. The students had earned a degree in Fisheries and Wildlife and the change shows two majors--Fisheries or Wildlife with a common lower division program. In the next edition of the Bulletin a new Graduate Study Preparation Option in fisheries is described. About this time it became necessary to close new student applications for admission for a year. In 1971 the course required of all beginning students was given as a non-credit course and renamed Orientation in Fisheries and Wildlife. As mentioned earlier the

students now could declare an upper division major in either fisheries or wildlife. The next step indicated in the 1971-72 Bulletin was the designation of the lower division as a Pre-Fisheries and Wildlife Curriculum and entry requirements for declaring a major that called for 90 credits or more with a G.P.A. of 2.3 or better in specific courses.

The most significant change from previous practice for the Fisheries and Wildlife Curriculum was announced in the 1973 College of Agriculture Bulletin with the following statement. "Admission of beginning freshman and new students with advanced standing to the pre-fisheries and wildlife curriculum will be on a limited and selective basis. Acceptance will be based on previous academic performance and other indicators of scholastic potential." In addition, students were required to have earned a G.P.A. of 2.75 or better in certain selected courses in order to declare a major in the upper division. These more restrictive requirements were protested by a few faculty members in other departments. However, the Department proposal prevailed in spite of our being accused of being elitists who were violating the principle that all who desired should be admitted and should be allowed to declare a major with only a C average. This proposal was made for a variety of reasons. The student enrollment in fisheries and wildlife had increased to 250 with no corresponding increase in faculty. Temporary relief had been achieved by closing admission for one year. But there had to be a more satisfactory solution to solve the advising and course management problems. Moreover, the job situation created great difficulty in the placement of all but the better graduates. So it seemed both logical and reasonable to devise a system which would accommodate the best qualified applicants and produce an environment conducive to the development of a high quality product in smaller numbers.

The summer requirement for majors in fisheries and wildlife had specified, for a number of years, summer attendance at a biological station such as the one at Lake Itasca. When the enrollment increased so much as to make it difficult to accommodate all the eligible students at Itasca an alternate requirement was introduced. The students could go either to a Biology Station, be engaged in professional summer employment, or some similar professionally oriented field activity. In 1973 another move was made to give wildlife students a chance for field instruction and experiences. A spring quarter session was begun whereby the students received part of their instruction for the first few weeks on campus and then went to the Forestry and Biological Station at Itasca for the remainder of the quarter. Also in 1973 a curriculum in entomology was included in the College Bulletin for the first time. There were two options--one called Insect Population Management and another called Graduate Study Preparation. With this move the possibility of an undergraduate major in entomology was advertised. While there had been a very few undergraduates in the Department, the program in entomology had been designed almost exclusively for graduate students.

From its beginning in 1935 recommendations for the selection of instructors to teach entomology at the Biology Summer Session at Itasca were made by the Department. As mentioned in the history text, Drs. Alvah Peterson (Ohio State), Louis Berner (Florida) and Herman Spieth (City College of New York) were visiting

Professors for several years. In addition there were George Byers and Robert Beer (Kansas) and Glenn Wiggins (Royal Ontario Museum -Toronto). Dr. Edwin Cook from our Department also spent several summers teaching Field Entomology and Aquatic Insects at these summer sessions.

This quite lengthy account of the historical development of the department instructional programs is based mainly on a review of the University Almanacs, Calendars, and Bulletins from 1871-1974.

## Appendix C. Highlights of Department Research Activities

### A. During 1888 to 1901

Because of serious threats of grasshoppers and chinch bugs to the state agriculture, Otto Lugger and his assistants directed much of their time toward control methods. The results of these efforts and accounts of the biology and control of many other insect pests were written annually in the Reports of the Experiment Station Entomologist. The first of these Reports to the Governor was published in 1896 for the year 1895. Washburn continued to produce annual reports while he was State Entomologist. The last one written by A. G. Ruggles appeared in 1922. A great deal of Lugger's energy went into the type of work we now think of as extension entomology.

### B. During 1902 to 1917

Professor Washburn and more particularly Professor A. G. Ruggles and his assistants carried on a large number of experiments on the control of pests of food and ornamental plants with some emphasis on vegetable insect pests.

As an important part of these activities, many species of insects were reared in an outdoor insectary, and the results are recorded in a ledger book kept at least during the years 1909 to 1915. Some of these early tests of methods for the control of insects such as the cabbage maggot involved what today seem like odd practices. They included placing mixtures of sawdust and glue or sawdust impregnated with creosote around the plants. In other experiments the soil around the base of the plants was covered with cotton wool, lime or waxed paper. One of the materials tested as a possible bait for grasshoppers was horse manure tea. William Moore began his research on fumigants which led to the development by Chapman of chloropicrin for the control of grain infesting insects. Professor Washburn had a special interest in vertebrates so he directed some of his attention to the control of rodents such as the pocket gopher and the raising of Belgian hares for food. The staff and student interest in research was not confined to pest control as indicated by the title of Samuel Graham's Master's thesis in 1915. It was "The external morphology of Agrilus bilineatus." Professor Ruggles served as his advisor.

Professor Ruggles requested a sizable space in the west end of the basement of Coffey Hall to be used as a spray laboratory and pesticide storage area. The limestone wall on one side was plastered and painted black to serve as a surface on which the spray patterns of various types of nozzles could be tested or demonstrated to students. In this room there was a collection of power and hand sprayers of many types, including 2, 30-year old orchard sprayers with 300-gallon wooden tanks. In the early 40's Mickel and Hodson tried to get Professor Ruggles to dispose of the antiques but he would not part with them. After he retired in 1943 and was safely far away in Alabama, the antiques were offered as contributions to a war-time scrap metal drive. One of the 300 gallon wooden tanks was taken by the Poultry Department to be used for watering turkeys on a range. We wondered how they would handle the lead arsenate residue in the bottom of the tank.

### C. During 1918-1925

The publication lists for this period serve as a source of information on research activities. William Moore investigated the properties of spray materials to improve their spreading and sticking properties and carried on research on fumigants. The biology and control of stored food pests received much of Dr. Chapman's attention. He and his graduate students began quantitative ecological studies which became a hallmark for the Department. It was at this time that Samuel Graham began his investigations of forest insects. The greatest volume of published work presented the results of taxonomic research by Harry Knight and Clarence Mickel on Mirids and Mutillids, respectively. Professors Washburn and Mickel carried on intensive studies on the control of pocket gophers with calcium cyanide. This procedure had been recommended by William Moore who had joined the American Cyanamid Co. after leaving the University.

### D. During 1926-1930

This time when Dr. Chapman was Chief of the Division represents a brief period in the Department history, but it was an eventful one. Maynard Johnson carried on rodent control investigations and initiated his limnological studies which are described in some detail in the history text. The greatest activity involved Dr. Chapman and his students in both field and laboratory ecological research. It was during this time that Drs. Robinson and Payne carried on their insect cold-hardiness investigations, and when Dr. Chapman developed the background material for what became a widely accepted book on Animal Ecology. During two summers a field course in ecological research was offered by Dr. Chapman and participated in by 4 graduate students each summer. The results of their field studies were published in Ecology under these titles, "Studies in the ecology of sand dune insects" and "A comparison of temperatures in widely different environments in the same climatic area." Dr. Strand was aided in his research on fumigants by the construction of a fumigant chamber in the basement of the insectary building located southeast of Coffey Hall.

### E. During 1931-1944

A glance at the list of publications suggests that the Department might be a branch of the National Museum. The numbers and the quality of taxonomic papers are impressive. In addition to many papers published in journals there were 10 Technical Bulletins published by the Experiment Station. Most of them were produced from Ph.D. thesis data. This should not be surprising when one considers that the majority of the graduate students were doing their thesis research on taxonomic and/or anatomical problems under the direction of Clarence Mickel. This graduate student distribution persisted up until World War II. Other examples of productive research activity during these years are listed below only as they come to mind.

1. Biology and control of insects affecting stored-product insects--Shephard and students.
2. Bee management problems including over-wintering of bees, bee diseases, and the role of honey bees in pollination--Tanquary and Haydak.
3. It was during this period that Dr. Haydak carried on his early work on insect nutrition and the development of pollen substitutes. He worked for about seven years with the biochemist, Dr. L. S. Palmer, on a study of the nutritional value of bee foods. While all this was going on Haydak operated a large apiary at the University Fruit Breeding Farm near Excelsior.
4. Dr. Riley supervised projects on the endoparasites of domesticated and game animals and the ectoparasites of game and fur-bearing animals. The research was carried on cooperatively between the Department, the Division of Veterinary Medicine, and the State Conservation Department. Particular attention was given to the parasites of mink and foxes.
5. Research on relation of insects to the incidence and spread of plant diseases was initiated by Drs. Granovsky and Leach.
6. One other project under the leadership of Dr. Riley was concerned with the parasites and symbiosis of insects. Particular attention was given to insects which harbored stages of parasites of vertebrates such as turkeys, ducks, and dogs.
7. Extensive studies on the biology and ecology of white grubs which were present in outbreak numbers in the 1930's--Granovsky.
8. Ruffed grouse investigations in Pine County and the Cloquet Forest Research Center were initiated by Ralph King. At this time there was widespread interest in the investigation of the factors responsible for the periodic fluctuations in abundance of game species.
9. Still another project directed by Dr. Riley dealt with the distribution and abundance of mosquito pests of man and animals.
10. Studies on insect defoliators of forest trees included the extensive research by Hodson and Ruggles on the ecology of the forest tent caterpillar. It was during the war years that Hodson developed the use of ammonia baits for timing the emergence of the apple maggot.
11. Reginald Salt published a Technical Bulletin on insect cold-hardiness, which was a highly significant piece of research. Many years later Salt was awarded the Gold Medal by the Canadian Entomological Society for that and much additional definitive work on this subject.

A record of the publication output from 1918 to 1942 shows that the Department of Entomology and Economic Zoology was the most productive of all the Departments with the exception of Biochemistry. During these years there were 29 Technical Bulletins with a total 1,607 pages. The number of Journal Series Bulletins was 6 with 276 pages and there were 266 papers in scientific periodicals with a total of 3,451 pages. The grand total of all these research publications was 301 papers with 5,324 pages. Twenty Department of Agriculture units, including the Branch Stations, were reported in this summary. Our production represented 14 percent of the total number of publications and 13 percent of the total number of pages. The corresponding figures for the Department of Agricultural Biochemistry were 19 percent and 15 percent, respectively. The Department of Plant Pathology and Botany had only one less paper during those years, but plant pathologists were less verbose because the number of pages was 11 percent of the grand total of 34,128 pages.

#### F. During 1945-1960

During the first few years of this period most of the research dealt with the kinds of research mentioned before. The few early changes or additions were greater emphasis on potato insect control including the first large scale tests of DDT carried on by Dr. Granovsky, and Dr. Richard's new project on the structure and permeability of the insect cuticle. The latter was the beginning of a long series of experiments which brought Dr. Richards international recognition. He authored the book, The Integument of Arthropods, published in 1951.

As time went on, a number of new and significant developments occurred. There had been an outbreak of equine encephalitis in northwestern Minnesota and North Dakota. To learn more about this problem Dr. Burroughs carried on an investigation of the epidemiology of arthropod-borne encephalitis. Dr. Lloyd Smith initiated his extensive long term study on fisheries biology and management problems in the commercial fishing enterprise in the Red Lakes. He also was interested in research on year-class formation in game fish. Other fisheries investigations initiated during this time were the studies of the mechanisms of biological production in streams under Dr. Thomas Waters. Through the efforts of the Minnesota Beekeepers Association a new project on bee diseases was initiated by Dr. Thomas Gochnauer with funds from a special legislative appropriation. A major research undertaking had its beginning in 1948 when European corn borer research was started with Holdaway, Hodson, Cutkomp, and Chiang involved in its various aspects.

After 1950, Hodson devoted much of his time to an investigation of the population dynamics of the forest tent caterpillar during an outbreak which lasted about 10 years and caused complete defoliation of trees in more than 3 million acres of forest land. Toward the end of the outbreak an extensive cooperative study on the effects of defoliation was carried on with the School of Forestry. Funds were provided by the Iron Range Resources and Rehabilitation Commission. During the latter part of this period Dr. Kulman carried on some very significant studies on the ecology of the jack pine budworm during the course of an outbreak of this species.

The ruffed grouse research at Cloquet, under the direction of Dr. Marshall, was greatly expanded by participation of graduate students and with the appointment of Gordon Gullion to devote full-time to grouse research at the Cloquet Forest Research Center. Mammals were not neglected because Dr. Beer investigated the movements, reproduction, and survival of beaver. He also looked into the role of mice in relation to the contamination of grain, and he started a long-term mouse population study at Basswood Lake. Cook and Beer joined forces to study natural populations of ectoparasites on wild rodents.

A new venture was undertaken by Hodson and C. M. Christensen (Plant Pathology) to investigate the association of molds and insects invading stored grain. With the help of some very able graduate students it was shown for the first time that granary insects and mites could both introduce molds into grain bulks and also create conditions favorable for their multiplication.

Two Regional projects were carried on involving the cooperation of entomologists in several states. Dr. Peterson participated in one which dealt with the migration of the potato leafhopper. The other was a cooperative investigation of factors influencing corn borer populations out of which grew a biologically significant study of differences in corn borer biotypes in the corn belt. Dr. Chiang provided most of the leadership. Dr. Cutkomp gave most of his research time to the mode of action of insecticides and also carried on insecticide tests for fly control or cattle. During these same years Dr. Haydak continued his widely acclaimed research on bee nutrition and continued to operate the large apiary at the Fruit Breeding Farm.

#### G. During 1961-1974

One of the outstanding features was the development and experimental use of radio telemetry for the study of ruffed grouse behavior, territoriality, and dispersal under terms of a National Science Foundation grant to Dr. Marshall. This event made it possible to investigate features of grouse ecology and management hitherto almost impossible. Coupled with this advance was the discovery by Gullion of the great importance of aspen male flower buds as winter food for the ruffed grouse. This discovery was a significant contribution to the understanding of forest management practices conducive to grouse survival and habitat selection. The ruffed grouse project became known internationally as an outstanding example of first class upland game bird research. Dr. Marshall expanded this type of research at Cloquet by initiating some very interesting studies on the woodcock. He also had students investigating the behavior, movement, and other aspects of Canada goose population dynamics.

Dr. Beer continued his mouse population census work at Basswood Lake and had students investigating populations of spruce and sharptail grouse in northwestern Minnesota. During this time he also worked with a student on the behavior and other features of pocket gopher biology. The research on mammals was greatly expanded when Drs. Mackie and Peek became engaged in studies of the ecology of moose and deer, and more especially the problems of land use and forest management as related to the management of those big game species. An important predator of both deer and moose, the timber wolf, was studied intensively by one of Dr. Albert Erickson's students to determine

home ranges and pack movement. Erickson was curator of mammals in the Bell Museum but held a Graduate School appointment in our Department. The use of radio telemetry played an important role in all these just mentioned research activities. Dr. Frenzel also contributed to the wolf story by studying wolf scats to determine feeding habits, particularly as they might relate to deer harvest and wolf predation. Dr. Frenzel also developed an extremely interesting study of the bald eagle where again tracking with radios and marked individuals made it possible to identify and study its nesting and migration habits and the establishment of territories.

During these years the fisheries research took an important turn in anew direction. Dr. Smith received a sizable grant to investigate the effects of fiber waste from paper mills on fish eggs and juvenile fish. This venture into the field of water quality concern seems almost to have anticipated the national concerns in this area which arose a few years later. As time went on, the investigations on water quality as related to fisheries were greatly expanded to include studies on the effects of hydrogen sulphide and cyanide on fish growth and survival. Most of these studies could not have been attempted were it not for the excellent wet laboratory facilities designed by Dr. Smith for the new Department building. While all this was going on Dr. Waters and his students were adding to our knowledge about the periodic drift of arthropods in streams. They were able to demonstrate the controlling factors causing the periodical occurrence of the drift and its importance in stream productivity.

In reviewing the entomological research highlights for 1961-1974, we will start with the activities of the taxonomists. Dr. Cook and his graduate students gave special attention to aquatic insects, particularly members of the family Chironomidae because of their importance as environmental quality indicators. Dr. Price expanded his investigation of bird lice systematics by making an intensive study of the Mallophaga found on pocket gophers. This investigation has developed into a first class biogeographical study with many important implications. Among them is the suggestion that the lice may be better "taxonomists" than the mammalogists when it comes to discriminating among sub-species of pocket gophers.

The work on corn insects accelerated during these years. The corn borer research climaxed or, perhaps better, it reached a high point, and new corn rootworm studies were undertaken. The high point referred to was the organization of a truly international cooperative research project which was initiated by Dr. Chiang in 1968 at the time of the International Entomological Congress held that year in Moscow. He was able to bring together entomologists from 10 countries, most of them, including Russia, being from behind the "Iron Curtain." Field tests were designed to be carried out in each country and in the fall a workshop was arranged to be held in one of the countries represented. There now are 15 nations involved and there have been seven workshops where the current year's work and plans for the next year were reviewed. Minnesota hosted the group in the fall of 1974. The corn rootworm investigations included extensive studies of the ecology and control of these species under the direction of Dr. Chiang and John Lofgren. Chiang was responsible for the ecological work and Lofgren carried on tests with a variety of insecticides for control.

The forest insect investigations included further ecological studies on the forest tent caterpillar by one of Dr. Kulman's students and the addition of research on the larch sawfly and other sawflies. Detailed life tables were prepared for the forest tent caterpillar. One interesting phase of the work has been the introduction of parasites of the larch sawfly with the follow-up to determine their establishment and dispersal. Other field studies were those undertaken by Drs. Peterson and Radcliffe. Peterson concentrated his efforts on pests of bluegrass which rapidly had become an important seed crop in northwestern Minnesota. He also worked closely with an agronomist, Dr. Laddie Elling, on insects affecting the seed crop of legumes. One of the outcomes of this work was the demonstration of the practical use of post-harvest fires for the control of certain of the bluegrass pests. Dr. Radcliffe's investigations included long-term studies on the resistance of plants to insect attack including the resistance of potato varieties and species to the green peach aphid. He also carried on intensive investigations of the value of a variety of insecticides for the control of potato and other vegetable pests. Most recently Dr. Radcliffe has been engaged in surveys to determine the presence and abundance of the alfalfa weevil which was found for the first time in Minnesota in 1970.

The investigation on the relationships between granary insects and storage molds was continued by Dr. Phillip Harein and his associates. The scope of the research was broadened by the inclusion of studies on the ability of grain and flour infesting insects to harbor disease causing bacteria, and the effects of the toxic products of fungi on insect development and survival.

Dr. Richards' research in physiology and electron microscopic studies on insect fine structure engaged most of his attention during the first several years of this period. He was concerned with physiological events associated with threshold temperatures for insect development and a number of investigations on the fine structure of cuticle and other anatomical features. In the later years of the period his research took a different direction. It involved the effects of so-called desiccating agents on the rate of insect drying and on mortality rates. Other research in the area of insect physiology was carried on by Dr. Brooks-Wallace. She built an internationally recognized story concerning insect symbionts on research which she started under the direction of Dr. Richards. Coupled with this research has been the design of studies to determine the relations of symbionts to insect nutrition, studies on the action of insect virus, and the development of insect tissue culture techniques. Dr. Cutkomp's research on the mode of action of insecticides involved two main thrusts. The first was the relation between rhythmic changes in insect metabolism with the toxicity of certain insecticides, and secondly the effects of a number of insecticides on insect enzyme systems. He also has looked for evidence of pesticide resistance in corn rootworms and mosquitoes.

The honey bee research continued by Dr. Furgala after Dr. Haydak's retirement moved away from bee nutrition which had been Haydak's main interest. Instead he developed research on Nosema disease of honey bees to the extent that it has aroused international interest, and has been involved in the use of honey bees for pollination of sunflowers, a rapidly growing industry in the state. It may be of some interest to report that the Ph.D. thesis of Marshall Hertig in 1921 was entitled, "Some phases of the pathological history of the honey bee with special reference to infection with Nosema apis."

In reviewing the highlights of research in the Department a few short-term research projects have not been mentioned. One of these was carried on by Dr. Mickel during World War II to determine the ability of certain insects to damage soybean products. Another investigation under the direction of Dr. Mickel was a very intensive and extensive study of insect and rodent contamination of grain in all sites from the field to transportation, storage on the farm, in county elevators and in terminal storage facilities. A third project sponsored by the State Legislature was concerned with the conflict between commercial and sport fishing in Lake of the Woods. A fourth such short-term project was Dr. H. C. Chiang's study of Midge swarming supported by a National Science Foundation grant.

## Appendix D. Additional Comments on Certain Topics and Events

### I. History of the Library

The library of the Department of Entomology, Fisheries, and Wildlife originated about 1904 or 1905 with the acquisition of Professor Otto Lugger's fine and extensive personal library. Lugger had built up this collection with some of the funds appropriated by the Legislature for the investigation and control of pest insects in the state. It was housed in Room 305 on the third floor of Coffey Hall. Dr. F. L. Washburn, who succeeded Lugger and was Chief of the Division from 1902 until 1918, made no purchases, but he did enlarge the collection by exchange. His clerk, in addition to her other duties, had charge of the library. Between 1912 and 1917 C. W. Howard, Instructor and later Associate Professor, organized the library collection and made the first move to arrange for the purchases of periodicals and further exchanges.

Just before Dr. W. A. Riley became Chief of the Division in 1918 he had stated that one of the conditions for his acceptance of an appointment at Minnesota would be for Dean Thatcher to provide additional funds for the development of the library. After he became Chief, many volumes were bought from German dealers especially as the exchange rate was then favorable.

About 1927 the library with its old wooden shelves was moved into Room 309 which recently had been vacated by the Division of Agricultural Economics. At the time of this move funds for additional steel shelves became available. From 1925 to 1930, while Dr. R. N. Chapman was chief of the Division, the library demanded more and more attention. In July 1931, Mrs. Marie Spiestersbach, an employee in the Division, was transferred to the library payroll as the first library assistant. Incidentally, thousands of the tiny labels on insect specimens are her handiwork. In 1929 the Department was able to purchase the large and very valuable apiculture library from Father Jager.

Dr. Riley returned from Zoology in 1930, where he had been Chairman for a few years, and served again as Chief until his retirement in 1944, when Dr. C. E. Mickel then became Chief of the Division. It is due in great measure to Dr. Riley's and Dr. Mickel's past interest and support of the library that our rank among the top University and College libraries was achieved. Especially noteworthy were the taxonomic and apiculture holdings during their time. In more recent years, through the personal interest and dedicated efforts of Dr. Lloyd Smith, other entomology material and the holdings in the fields of fishery biology and wildlife management have been greatly expanded.

In June 1953, after extensive remodeling, bound periodicals, staff reprints and Technical Bulletins were shelved in additional space made available when the Agricultural Library moved to its new building. Extra space was required to accommodate needs for expansion in 1953 by partitioning off a portion of a classroom adjoining the library. With Dr. Mickel's retirement in 1960, Dr. Lloyd Smith became the Department's library consultant with the responsibility of approving all orders and suggesting materials to be purchased.

The Entomology Library, a branch of the Agricultural Library moved from Coffey Hall to the new Entomology, Fisheries and Wildlife Building in October 1968. It has an audio-visual room, office and workroom, and a large well-lighted stack and study area which with tables and a number of individual carrels will seat 63 people. As of 1975, the collection covered the three fields of entomology, fisheries, and wildlife having 18,500 bound volumes, over 20,000 documents, and 485 current periodical subscriptions. The entomology collection is the largest and a noted one. All one has to do is to hear the "oh's and ah's" of visitors who express their envy upon visiting the library to have a greater appreciation of its worth.

Over these many years the library collection has been supervised by fifteen librarians, excluding two office clerks first assigned to this task. Among them was Mrs. Tanquary, the widow of Dr. Maurice Tanquary. Since 1964 the Department has been most fortunate in having the services of Mrs. Evelyn Gish as librarian. Her unselfish personality and dedication to service to students and faculty alike have been outstanding.

## II. Insect Collection

Contributions to the University insect collections were started at least as early as 1879, 9 years before Otto Lugger was appointed as Experiment Station Entomologist and Botanist. The first accession book lists a wide variety of insects and spiders collected by C. W. Hall along the North Shore of Lake Superior in late summer 1879. Six years later, in 1885 and for many years thereafter, there are a large number of entries showing specimens collected by Professor Oestlund. Much of his collecting was done in Hennepin and Ramsey counties. He also collected extensively in Traverse and Big Stone counties. Because of his special interest, aphids made up a large proportion of the insects that he collected. Inasmuch as there was no entomological activity in the College of Agriculture during those early years it is likely that these extensive collections were managed either under the auspices of the Department of Animal Biology or the Minnesota Geological and Natural History Survey. This assumption is supported in part by a statement in the 1913-14 SLA Bulletin which says, "The entomological collection of over 3000 named Minnesota insects is particularly rich in Aphidae and the Guthrie collection of Collembola."

Soon after Professor Otto Lugger arrived at Minnesota he started to build up a Department collection by personal collecting and exchange of specimens with a large number of individuals here and abroad, and by purchase. At the time of his death in 1901 it is estimated that there were about 180,000 specimens in the collection. When A. G. Ruggles joined the staff in 1902 he immediately began to add large numbers of specimens to the collection. He and Professor Washburn who succeeded Otto Lugger as Chief of the Division made very significant contributions. In addition to collecting in the state Washburn did extensive collecting in the South Sea Islands on his two expeditions into that area. During Washburn's term as Division Chief a number of other individuals added their bit to the insect collection.

The insect collection became more than a catch-as-catch-can operation when in 1914 a formal Experiment Station Project (Insect Collection) was initiated with A. G. Ruggles named as Leader. There were two sub-projects: A. The Insect Collection, Room 306, Administration Bldg., University Farm and B. The Insect Collection at Itasca Park. The objectives were: "To keep our insect collection in the best way for the money allotted and to gradually build up certain groups by outside collections and purchases." A second objective was: "To build up and preserve a collection of insects of the park (Itasca State Park) that will be useful for scientific and popular purposes. Particular stress is to be placed on tree insects." The sources of maintenance were State Entomologists Fund, \$50 and Station Maintenance \$50. You can guess how difficult it would be with this budget to engage specialists to work over different groups and employ "expert labor" which would be required for pinning, labeling, and mounting newly collected insects as proposed in the Project Statement.

Soon after Dr. W. A. Riley became chief of the Division in 1918 he secured the services of Dr. Harry Knight who was placed in charge of the collection. Knight also was instrumental in initiating the preparation of insect display cases. The display of insects started by him evolved into an extensive arrangement of about 90 Comstock drawers which for many years rested on the tops of museum cabinets lined up in the third floor corridor of Coffey Hall. The text describing the insect groups in the drawers consisted of pages removed from Comstock's textbook. A duplicate set was prepared and mounted on a wall on the second floor of the Zoology building. Two of the students who spent many hours preparing these displays were Horace Lund, who much later became Head of the Department of Entomology at Georgia, and Lloyd Smith, who became Professor of Fisheries in our Department. After the move to the new building the insect displays were completely redone and the cases mounted on a corridor wall in 1971.

Dr. Mickel continued to serve as curator of the collection with the help of graduate students for a number of years. During this time the collection was expanded greatly by material added by him as he carried on his extensive studies on the Mutillids, and by the specimens left by graduate students working on taxonomic thesis problems. Other specimens were obtained by exchange with specialists around the world and from material sent in for identification. Also the very valuable Oestlund collection of aphids had been acquired after his death. Immediately after World War II Drs. Daggy and Milliron were appointed for short periods to serve in part as curators of the museum. Then in 1949 Dr. Edwin Cook assumed this responsibility.

Soon after his appointment in 1955 Dr. Roger Price became interested in bird lice and in 1961 changed the direction of his research on mosquitoes to a systematic study of the Mallophaga. As the result of his efforts, the University has one of the largest collections of this group in the world. About this same time the cooperative work of Drs. Beer and Cook added a large number of specimens and species of the Anoplura to the very extensive louse collection.

In 1959 Experiment Station funds were obtained to set up a post-doctoral position as a Research Fellow to carry out the detailed curatorial duties in the museum. The first person to receive such an appointment was Dr. Frederick Stehr. He was followed by Drs. K. C. Kim and P. J. Clausen.

The next important event in the history of the insect collection was brought about when the new Department building was ready for occupancy in 1968. The old wooden specimen cases, which were large and cumbersome, were replaced with metal "Lane" cabinets purchased to a large extent with funds provided by a grant from the National Science Foundation. In the new facilities in the building it became possible to house one of the largest University maintained museums of its kind in North America in an especially designed room of 2,500 square feet. The pinned material is contained in 299 12-drawer cabinets, the alcohol material in about 1,300 racks each holding 248 dram vials, and slide mounted material in 2,555 100-capacity slide boxes.

The following account of the present status of the collection and a computerization of the holdings was prepared by Ronald Hellenthal, an exceptional student, who was responsible for the programming.

"In the fall of 1972 the entire insect collection was counted to obtain information required for an application for membership in the Association of Systematics Collections. This count showed the collection to contain slightly over 2 million specimens with 66.9 percent determined to 34,058 species. Among its holdings were over 10,000 types including 544 primary types.

The huge labor which went into the count of the collection made it desirable to preserve this information in a form which could be conveniently used and easily updated to show future acquisitions. This was accomplished with a computer program which produced a catalog of family holdings, giving the numbers of determined and undetermined specimens, types, species, and storage locations in the Museum. The first catalog was produced on November 27, 1972, and has been updated yearly since.

In October 1974 loan information was incorporated into the museum data base, and an additional program was developed to produce a separate directory of outstanding loan records. This directory was cross-referenced by borrowers, institutions, loaned taxa, and loan numbers, dates, and conditions. The main catalog program was modified so that loaned specimens were shown distinct from specimens in the Museum. This enabled easy recounting of specimens and simplified record handling when loans were sent or received. Another program, written at this time, performs regular loan correspondence with borrowers. This program writes every borrower a yearly notice summarizing their outstanding loans, and includes a form which must be signed and returned. The first letters were mailed in late October 1974, with hopes that replies would be received before the National Entomological Society of America meetings at Minneapolis in early December. Replies to about half the letters were received before the meetings, and these resulted in the return of many old loans, and numerous corrections to the loan and address records. Additional letters were sent on several occasions in 1975 to persons who had not responded to the first letter, and by February 1976, promises of return or renewals were received for all but 2 of the 144 outstanding loans.

In July of 1975 a grant was received from the U. of M. Graduate School for purchase of a Teletype computer terminal for the Museum. The terminal was received in August, and programs were developed for entry of museum data. A computerized insect identification system, developed in 1973, became available in the museum at this time."

### III. The International Great Plains Conference of Entomologists

At its inception in 1921 this organization was called the International Great Plains Crop Pest Committee. From then until his death in 1932, Norman Criddle, a Canadian, served as permanent President. Minnesota participated from the beginning along with Montana, Wyoming, North Dakota, and South Dakota. The Canadian provinces were Alberta, Saskatchewan, and Manitoba. Meeting places tended to alternate between the United States and Canada. At these meetings informal discussions on pest problems of the region were aired. In 1938 Professor Ruggles was elected permanent president and served in this capacity until World War II. No meetings were held during the war and Dr. Mickel became the permanent President in 1946. In 1956 he retired from this position and was replaced during the next 6 years by non-Minnesotans. Then in 1965 John Lofgren became permanent chairman. Meetings were held for 3 more years, until 1967 when the organization ceased to exist. At the last meeting in 1967, which was held in Saskatchewan, John Lofgren was the only American present.

### IV. Relation of the Department to the Office of the State Entomologist

In 1903 the State Legislature passed a law designating the University Experiment Station Entomologist as the State Entomologist. Professor Washburn was the first to hold this title. Because of the arrangement the office of the State Entomologist was one and the same as the Department office. This situation continued until 1922 when the State Department of Agriculture was created and the regulatory and inspection service and the Office of the State Entomologist were included. The State Entomologist and his staff continued to be housed in Coffey Hall with the Department, to the advantage of both, until they were moved to the State Office Building in St. Paul in 1961. Professor Ruggles received most of his salary from the University and continued to teach and carry on research while serving as State Entomologist. When he retired, Thor Aamodt replaced him as State Entomologist and also taught one course for the Department with a part-time appointment as Assistant Professor. The title of State Entomologist was dropped by legislative action in 1958. Aamodt also had the title of Director of the Division of Plant Industry and this title continued to designate the person responsible for insect and disease regulatory and inspection work. With the move to St. Paul the close relations which had been enjoyed by the staff of both units were drastically changed by the geographical separation.

V. Relations Between the Department and the State Department of Conservation  
(Natural Resources)

During the 1930's there were at least three activities when the department and the Division of Game and Fish entered into cooperative ventures. An Experiment Station project on Animal Parasites of Furbearing Animals involved the Conservation Department, the Division of Veterinary Medicine, and our Department. At that time the emphasis was on the parasites of pen-raised mink and fox. From 1937 to 1949 another cooperative project called Ectoparasites of Game and Fur-bearing Animals grew out of the original project and also included the active participation of the State Division of Game and Fish. During the next 4 years, 1945-1949 another cooperative project called Endoparasites of Domestic and Game Animals was initiated by Dr. Henry Griffiths, a member of the Division of Veterinary Medicine staff who held a joint appointment in our Department. Prior to Dr. Riley's retirement in 1944 he had served as leader of the cooperative project. The persons actually responsible for parasite identification and research on game parasites were either advanced graduate students or post-doctoral appointees. Among those serving in this role were F. G. Wallace, Wilfred Olson, Arnold Erickson, and Jules Cass.

During the depression years, Civilian Conservation Camps were established throughout the forested areas of the State. In most of the camps there was a Game Technician to carry on game management operations. Ralph King was asked by the State Conservation Department to serve as Technical Supervisor of these game specialists. They conducted grouse censuses and did considerable habitat mapping. King also conducted a state game survey under the auspices of the Conservation Department. In the last years that King was on the staff he initiated another cooperative project dealing with upland game food habits. The working personnel were supported by three agencies: Works Progress Administration, National Youth Administration, and the State Division of Game and Fish. When Dr. Swanson replaced King he continued these food habit studies for a while.

In 1946 an agreement was made between Dr. Bailey, Dean of the University Department of Agriculture, and Chester Wilson, State Commissioner of Conservation, to have Dr. William Marshall devote one third of his time for consultation with the State Division of Game and Fish personnel in exchange for Dr. Lloyd Smith spending one third of his time teaching a fisheries course in our Department.

In 1956 funds from the Conservation Department were provided to assist Marshall in the ruffed grouse research at Cloquet. Two years later this support was expanded and Gullion came to the project. This partial support of their research has continued annually to the present. Another unit of the State Department of Natural Resources (Conservation), the Division of Forestry, later actively participated in forest habitat manipulation as a means of favoring grouse populations in the Crow Wing Natural History Area and the Mille Lacs Wildlife Management Area.

Cooperation between the Department and the Conservation Department was not limited to game management research activities, for the Department fisheries research also benefited from this association. From 1955 to 1958 two of Dr. Smith's graduate students investigated year-class formation of northern pike and large mouth bass. Their studies were supported by Dingel-Johnson funds administered by the Conservation Department. Several years later a Lake Superior investigation was carried on to determine possible causes of the decline in the herring population. In 1971 Dr. Smith supervised a study on the potential of Burbot as a species that could be harvested economically. These two projects were supported by Federal Commercial Fishery funds also administered by the Department of Natural Resources.

For these and other studies such as for three projects on white tailed deer, and forest insect investigations, the Department of Conservation assisted very effectively by funding assistantships, or by providing facilities, equipment and personnel service.

## VI. The Department Supporting Staff

In previous sections there has been no mention of the invaluable service of the Department secretarial staff. No attempt will be made to recall all those who contributed so much to the friendly and efficient operation of the Department office. However, two individuals do stand out in this regard. They were Mrs. Helen Karow and Mrs. Mildred Richert. Helen served as department secretary for 16 years before moving to become senior secretary in the Short Course Office in 1948. In the first Department Newsletter, dated June 5, 1942 Dr. Riley said, "The most important part of our Division is still functioning perfectly (I refer of course to the office force). Mrs. Karow as 'Headman' makes things run smoothly."

In 1951 Mildred Richert was appointed as Secretary and before she retired in 1973 was promoted to Executive Secretary. Her husband retired from University service the same year, and between them they established a record because their combined service time added up to about 72 years. Mrs. Richert was regarded by all as the Department "Mother." The respect and affection bestowed upon her by the young women in the office and by staff and students was extraordinary. Both of these remarkable women who devoted about 38 years to the Department could be characterized as being very efficient without being officious.

## VII. Extension Activities

The Department was engaged in extension work long before there was an Extension Division or a staff member employed as an Extension Specialist. Both Professors Lugger and Washburn devoted a large proportion of their time to the preparation of newspaper releases and extension-type publications in addition to personal contacts with state farmers and nurserymen. In fact, most of their professional activity would be considered extension work today. Much the same situation continued in part after Dr. Riley succeeded Professor Washburn as evidenced by the hundreds of letters he and Professor Ruggles wrote in response to requests for information on

a wide spectrum of insect and rodent pest problems. After Professor Ruggles became State Entomologist in 1918 the nursery and apiculture inspection services, which he directed, became widely accepted by the operators to a large extent because the inspectors carried on a very effective extension program along with their regulatory duties. As time went on, the extension service provided by the Department was shared by all the faculty.

In 1922 Clarence Mickel accepted a half-time appointment as the first Extension Entomologist which permitted him to carryon graduate work while employed in this position. Upon completion of his Ph.D. program he was appointed as an Assistant Professor with half-time on Extension and half-time as curator of the insect collection. He served in this dual role until 1927. At this time Herbert Parten was appointed as a full-time Extension Specialist in entomology. He served as the only Extension Entomologist until his retirement in 1957. He worked with the County Agents in a variety of problems but gave much of his attention to two quite different problems, greenhouse pest control and the control of rats, mice and pocket gophers. All the staff continued to contribute to the Department extension activities, but the heaviest load was borne by Cook, Granovsky, Cutkomp, Haydak and Hodson.

With the retirement of Mr. Parten, John Lofgren was appointed as Extension Specialist in entomology in 1958. Soon after his arrival he initiated a 4-H program in entomology which by 1974 had attracted about 1,600 participants. The youth program in entomology also included school visitations. In the fiscal year 1972-73 alone, over 50 school visits were made by students and the Extension staff with presentations made to over 2,400 sixth grade students. Professor Lofgren also continued and developed the Insect Pest Clinic which had been started in 1957 with the half-time summer appointment of Basil Furgala when he was a graduate student. The clinic grew rapidly as an important public service. It wasn't long before more than 20,000 telephone calls and 5,000 or more letters of inquiry were handled annually by the small clinic staff. It became necessary to provide full-time coverage for the year with additional student help during the summer.

Until 1965 John Lofgren, with some help from other faculty members to be sure, carried the full entomology extension load. In 1965 when Dr. Phillip Harein accepted an appointment as Extension Specialist, it was possible to have the Extension duties shared. Harein gave special attention to problems raised by mill, elevator and pest control operators, and pesticide safety education. Lofgren devoted much of his time to working with farmers, pesticide dealers and County Agents on field crop insect problems. A few years later in 1970, David Noetzel was appointed to the Extension staff to manage the clinic, conduct beekeeping short courses and the 4-H program, and deal with special problems rising from the rapid development of sunflower and wild rice production.

In addition to the attention given to insect outbreaks such as a green bug or armyworm outbreak the Extension staff has been responsible for a large number of meetings with farmers arranged by County Agents and a variety of special institutions, forums, and short courses. Among them have been Retail Dealer and Pesticide Applicator meetings to bring them up-to-date on control recommendations, meetings with

groups such as the Minnesota Elevators Association, Pest Control Operators and the annual Field Days at the Branch Experiment Stations. In all cases special emphasis has been placed on the proper use of pesticides and pesticide safety.

In 1973 Grady Mann was given a temporary appointment for 1 year as a Wildlife Extension Specialist. Attempts had been made, without success, over several years to have such a specialist on the staff.

#### VIII. Graduate Students--Degrees Awarded

The first graduate student to be awarded an advanced degree by the department, was Charles W. Howard who received the Master of Science degree in 1913. When one considers the importance of grasshoppers as pests of Minnesota crops, it was not surprising to find Howard's thesis with the title, "Methods of control of Acrididae of economic importance with special reference to Minnesota conditions." His thesis dealt with the environmental factors which cause mortality of grasshopper eggs and newly hatched nymphs, particularly soil and weather conditions. Thus, ecology has been a major concern of the Department from the beginning of the graduate program.

The next two individuals to earn the M.S. degree were Royal N. Chapman (1915) and Jean Plant (1916). Chapman much later became Chief of the Division and still later Dean of the Graduate School at Minnesota. Miss Plant's degree, awarded in 1916, is notable because she was the first woman to receive an advanced degree in the Department. She was followed soon by Florence Defiel who earned the M.S. degree in 1921. It was also in 1921 that the first Ph.D. degrees were awarded. The recipients were Samuel Graham and Marshall Hertig.

The first advanced degrees in Wildlife were awarded to Louis Fried, Lawrence Hiner, Laurits Krefting, Robley Hunt and Lester McCann who were recipients of the M.S. degree in 1938. Ralph King directed their thesis research. One year later, in 1939, Donald Hatfield was awarded the Ph.D. degree in the Wildlife area. In the Fisheries graduate program two M.S. degrees were granted to John Appleget and Robert Butler in 1951. The first two Ph.D. degrees in Fisheries were awarded to Donald Franklin and Martin Laakso in 1959.

The number of degrees awarded is presented by decades in Table I. The total numbers of M.S. degrees in Entomology, Fisheries, and Wildlife up to and including 1974 were 187, 24 and 70, respectively. The corresponding numbers of Ph.D. degrees were 152, 18, and 28. The total number of advanced degrees granted to entomologists was 339 of which 93 percent were men and 7 percent women. Of this total of 339 graduate students in Entomology 233 or about 69 percent were U.S. citizens and 196 or 31 percent came from a total of 14 foreign countries. The data in Table II show the countries of origin. Of these countries Canada and China (including both the Chinese mainland and Taiwan) contributed the largest number of foreign students with India a strong third.

Table I.

Degrees in Entomology

<u>Master of Science</u>				<u>Doctor of Philosophy</u>				
	♂	♀	U.S.	Foreign	♂	♀	U.S.	Foreign
1913-24	9	2	10	1	5	0	5	0
1925-34	32	4	30	6	16	1	15	2
1935-44	24	0	20	4	30	1	23	8
1945-54	32	3	21	14	22	1	13	10
1955-64	47	0	27	20	43	1	20	24
1965-74	26	8	27	7	30	2	22	10
Totals	170	17	135	52	146	6	98	54
	(187)				(152)			

Degrees in Wildlife

<u>Master of Science</u>				<u>Doctor of Philosophy</u>				
	♂	♀	U.S.	Foreign	♂	♀	U.S.	Foreign
1935-44	11	0	11	0	1	0	1	0
1945-54	19	0	19	0	1	0	1	0
1955-64	7	0	6	1	7	0	6	1
1965-74	28	5	33	0	19	0	19	0
Totals	65	5	69	1	28	0	27	1
	(70)				(28)			

Degrees in Fisheries

<u>Master of Science</u>				<u>Doctor of Philosophy</u>				
	♂	♀	U.S.	Foreign	♂	♀	U.S.	Foreign
1945-54	5	0	5	0	0	0	0	0
1955-64	7	0	7	0	6	0	5	1
1965-74	12	0	12	0	12	0	12	0
Totals	24	0	24	0	18	0	17	1
	(24)				(18)			

Table II.

<u>Graduate Students from Foreign Countries</u>									
<u>Master of Science - Entomology</u>									
Canada	China	India	Egypt	Philippines	Korea	England	Other	Total	%
12	18	5	3	3	2	2	7	52	27.9
<u>Ph.D. - Entomology</u>									
21	10	9	3	4	2	0	5	54	35.5
<u>Master of Science - Wildlife</u>									
0	0	0	1	0	0	0	0	1	1.4
<u>Ph.D. - Wildlife</u>									
1	0	0	0	0	0	0	0	1	3.6
<u>Master of Science - Fisheries</u>									
0	0	0	0	0	0	0	0	0	0
<u>Ph.D. - Fisheries</u>									
1	0	0	0	0	0	0	0	1	5.6

NB - Other - M.S. Argentina-1, Iraq-1, Japan-1, Mexico-1, South Africa-2, Tanzania-1

Ph.D. Iraq-1, Malaysia-1, Mexico-1, South Africa-2

In the Wildlife area of the total advanced degrees numbering 98 there was 93 men (95 percent) and 5 women (5 percent). Only 2 foreign students earned advanced degrees in Wildlife. The corresponding figures for graduate students in Fisheries were a total number of 42 of whom there was only one foreign student and no women.

#### IX. Department Undergraduates

The undergraduate enrollment figures given in Table III include majors in both Entomology and in Fisheries and Wildlife. They are very incomplete for all the years covered in the Department history because enrollment by major areas was not available prior to 1954. The number of students registered as majors in entomology makes up a very small percentage of the annual totals enumerated. The number registered in the fisheries and wildlife program accelerated rapidly from 1965-66 through 1972-73. The marked drop seen for 1973-74 reflects the Department restriction placed on the admission of new students seeking to major in fisheries or wildlife. A detailed account of the change in the admissions policy is given in Appendix B.

The number of undergraduates awarded the B.Sc. degree is presented by academic years in Table IV. The data were obtained from the College Faculty Meeting Minutes. Before 1935 those graduating were listed only as students in Agriculture, Forestry or Home Economics so it was not possible to obtain areas of specialization before that time. A few individuals may have been missed in scanning the voluminous minutes but it is reasonable to conclude that there were approximately 580 students who earned the Bachelor of Science degree in fisheries and wildlife from 1935 to 1974. Fishery courses were not taught prior to 1946 and only since 1967 has it been possible for students to declare a major in fisheries or wildlife, but for this report they are grouped together. There was a marked increase in the number awarded degrees from 1947 to 1951 which was due, at least in part, to the increased enrollment of World War II veterans. A second even more marked increase began in 1966 with the growing interest of both young men and women in the conservation of natural resources. Accompanying the increase in the number of degrees awarded after 1966 was a doubling of the percentage of the students registered each year who earned degrees. The most striking change in the retention figures occurred in the academic year 1973-74 with 31 percent of the 119 students enrolled that year being awarded the B.Sc. degree. The previous high had been 19 percent for the year 1970-71.

The figures just given apply only to fisheries and wildlife students majoring in the Department. In addition, there were about 80 students who specialized in wildlife management in Forestry. The largest numbers receiving their degrees in Forestry were recorded during two periods; from 1937-1942 and from 1948-1951.

As shown in Table IV the number of students who earned the Bachelor of Science degree in entomology has been small. During the period of time covered in this summary there have been only about 23. This may be explained in part by the fact that prior to the descriptive statement in the 1975-77 College Bulletin there had not been more than a cryptic reference to entomology as a possible undergraduate major in the Department.

Table III. Department Undergraduate Enrollment

1954-1974								
<u>Students Registered</u>								
Year	54-55	55-56	56-57	57-58	58-59	59-60	60-61	61-62
No. Students	42	40	64	75	86	75	96	106
Year	62-63	63-64	64-65	65-66	66-67	67-68	68-69	69-70
No. Students	131	122	131	174	173	168	190	196
Year	70-71	71-72	72-73	73-74				
No. Students	210	225	238	119				

Table IV Undergraduate Degrees - 1934-1974