

History of Forestry  
at the  
University  
of  
Missouri-Columbia

by R. H. Westveld

SR 120

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Published by  
College of Agriculture  
University of Missouri-Columbia  
1970

Publication made possible through gifts to the School of Forestry  
Development Fund

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## FOREWORD

The history of any activity provides a background for understanding how and why various events occurred at different times and it furnishes a basis for profiting from the past to build a stronger future. Since all history is seldom recorded in publications, dependence must be placed to some extent on the memory of individuals and on facts they can supply. The author was a member of the faculty of the University of Missouri-Columbia for nearly 22 years of the 32 years that a degree program in forestry was offered and for 2½ years of the 10 years that the pre-forestry curriculum was offered. He initiated the pre-forestry curriculum in 1936 and he served as chairman of the Forestry Department from 1947 to 1957 and as director of the School of Forestry from 1957 to 1965 when retired from that position. Therefore he initiated many of the forestry activities and has intimate knowledge of many developments.

Publications cited are listed at the ends of chapters. Other published and unpublished sources of information that were utilized are: University of Missouri catalogues, College of Agriculture Announcements, School of Forestry Announcements, Missouri Log, Forestry Alumni News, minutes of meetings of the Faculty of Forestry Department and School of Forestry, minutes of selected meetings of the Board of Curators, and minutes of meetings of the Forestry Alumni Association.

R. H. Westveld

### ACKNOWLEDGMENTS

The author acknowledges, with thanks, the counsel and assistance of members of the faculty of the School of Forestry. He is indebted especially to Donald P. Duncan who urged him to write the history and who reviewed the entire manuscript. Special credit is due Richard C. Smith who reviewed Chapter II. Individual members of the faculty provided information for and reviewed the research projects for which they were responsible, described in Chapter IV. Several typists provided invaluable assistance through the typing of the manuscript; special thanks are due Alba Bottino who typed the major part.

## Chapter I

### THE EVOLUTION OF FORESTRY

Some type of activity in forestry has been in operation at the University of Missouri-Columbia since an act of the legislature established the Agricultural and Mechanical Arts College in Columbia February 24, 1870. The nature and extent of forestry activity has varied widely over the years, the first effort being concerned only with resident instruction when forestry was one of the topics covered in a broad course in Agriculture. Later, instruction was gradually expanded until in 1912 a five-year curriculum in Forestry was listed in the university catalogue. Shortly thereafter a small research program was initiated and in 1926 the third phase—forestry extension—was added with the appointment of an extension forester effective July 1, 1926.

The evolution of forestry can best be recorded and understood by dealing with specific periods of time in the history of the University.

#### Early Activities 1871 to 1912

The first class of students in agriculture enrolled in the College of Agricultural and Mechanical Arts in September of 1870. The university catalogue describing the program in agriculture names 16 specific subjects, including forestry, in which lectures would be given. The first forestry course was entitled, *Forests—Their Importance and Management*. In its description the following statement appears: "Our forests are disappearing too fast for the future prospects of the country. It requires a generation to grow a forest. Each generation, therefore, should provide fuel and timber for the next."

In the university catalogue for the year 1871-1872, George Swallow is listed as professor of agriculture, geology, and botany. In the listing of courses for either the junior or senior year in agriculture, two forestry topics are listed under Economical Botany: (1) Forestry and (2) Experimental Culture of Forest Trees. This instruction program appeared in each of the university catalogues until 1879.



A revision of the course of study in the College of Agricultural and Mechanical Arts appears in the university catalogue for the year 1879-1880. During the fifth semester a course in pomology and forestry and in the sixth semester, a course in entomology and economic botany, are listed. No description of these courses was given.

The following year George Husmann, who did not have an academic degree, is listed as professor and superintendent of pomology and forestry.

In the university catalogue for the year 1880-1881, forestry and meteorology were listed as the topics in one of the courses in the junior year of the agricultural curriculum. At this time the catalogue did not carry course descriptions and credit hours were not assigned to the courses. Professor Husmann did some tree planting to provide laboratory demonstrations for the students. He became so intrigued by the plantings that in his report to the dean of the College of Agriculture for 1880-1881 he strongly recommended that farmers be urged to plant catalpa trees for fence posts and railroad ties. In this report he stated that the income from catalpa plantations would in most cases exceed the income from corn and wheat. This is unquestionably the first example of an extension effort in forestry at the University of Missouri, details of which are reported in the chapter on forestry extension.

In 1881 the Department of Pomology and Forestry was merged with the Department of Horticulture with Prof. S.M. Tracy as chairman.

The University catalogue for the year 1883-1884 does not list forestry as one of the topics of agriculture, but in the following year (1884-1885), forestry reappears as a topic in a course in horticulture and landscape gardening. This listing was retained through the school year 1887-1888 but in the year 1888-1889 and the following year forestry is listed as a topic in horticulture only.

In the university catalogue for 1890-1891, forestry is listed as one of eight broad topics included in the course in horticulture. Although specific courses are not described in this catalogue a course listed as "Horticulture, Forestry" is listed in the third year of the four-year curriculum in agriculture. No credit hours are shown for any of the courses. This description was retained in the catalogue for the next year.

In the catalogue for the school year 1892-1893, separate curriculums in agriculture and horticulture are listed. The first semester of the fourth year in the horticulture curriculum lists a course covering forestry and landscape gardening. The forestry part of the course is described as follows: "Consists of lectures on the value, characteristics and cultivation of economic species of forest trees with a discussion of scientific forestry. The lectures are supplemented with required readings, practical work in the forest-tree nursery and excursions to the natural woodlands near Columbia."

The University catalogue for the year 1893-1894 lists a course in forestry taught by Prof. Keefer in the horticulture curriculum for the second semester of the third year. The following is quoted from the catalogue, "This subject is taught by lectures with required readings. It includes the influence of forestry on climate, the management of forests and the specific characteristics of the principal economic trees of America." The following year there was no change in the description of the course but Prof. Whitten is listed as the instructor. The catalogue also included the

following statement, "Elective courses in forestry can be arranged for academic students in the senior year."

No changes in the description occurred for a few years but in the catalogue for the school year 1898-1899 the description of the forestry course in the horticulture curriculum was changed to read as follows: "In this course are considered the influence of forestry on climate, soil and flow of streams; the management of forests; the characteristics and uses of typical woods; the specific characters of our principal forest trees in their winter condition; and something of the forest geography of the country." Mr. Howard was listed as the instructor for the course. A period of about five years of stability in the content of the course occurred. In the catalogue for the school year 1904-1905 Asst. Prof. W. L. Howard and Mr. Favor are listed as instructors and added to the description of the course was the following: "forest mensuration; a brief review of the principal diseases and insects affecting trees."

In the catalogue for the school year 1905-1906 acting Asst. Prof. J.K. Shaw is listed as a substitute for Prof. Howard who was on leave of absence. The following year Prof. Howard was back teaching the course and was assisted by W.H. Chandler, an assistant in horticulture.

The first significant change in the course offerings in forestry in nearly 40 years occurred in the school year 1907-1908 when three courses were offered. The course offerings and their descriptions were:

**Principles of forestry**—(1 credit) Lectures, assigned readings, and excursions. Studies of forest trees while in their winter condition. Characteristics and uses of typical woods. The forest nursery; planting and care of forests; forest mensuration; reforestation; forest fires, their prevention and control. The farm woodlot. Growing timber posts for telephone poles etc. Diseases and insects affecting forest trees. Timber preservatives; forest geography. Distribution of species. Influence of forests on climate, streamflow, etc.

**General forestry**—(1 credit) Lectures. A popular discussion of the meaning and scope of forestry and the practical application of forestry principles to large and small areas.

**Forest economics**—(3 credits) Lectures and assigned readings. History of forestry. A review of the present status of forestry in the United States and other countries. Relation of forests directly and indirectly to the public welfare. National policy toward reforestation of wastelands. Extent and management of national forests and forest reserves. Statistical studies of timber prices with influencing factors and causes.

In 1908-1909 the course in principles of forestry included the following statement: four Saturday afternoon excursions to be arranged. (Counts toward a degree in civil engineering).

During the same year the course which had previously carried the title "General Forestry" was renamed "Introduction to Forestry" and the course in "Forest Economics" was renamed "Forest Economy." The description of the latter course was revised to read as follows: "A review of the present status of forestry in the United States and other countries. Relation of forests directly and indirectly to the public welfare. The forest as a national resource. Exports and imports of forest

products. Statistical studies of timber prices with influencing factors and causes.” (Credit for this course counted toward a degree in the College of Arts and Science).

Forestry courses at this time were listed as electives in the agricultural curriculum.

In 1909-1910 the description of the course in forest economy was revised and simplified to read as follows: “Lectures, recitations and readings. The forest as a national resource. Relation of forests directly and indirectly to the public welfare.”

### Forestry Department 1912-1921

At least two factors were responsible for the establishment of a forestry department in 1912. Sometime prior to 1910 the College of Agriculture asked the Forest Service of the U.S. Department of Agriculture to make a study of forest conditions in the Ozarks and prepare a manuscript which was later published as Bulletin 89 of the Missouri Agricultural Experiment Station, bearing the title, “Forest Conditions of the Ozark Region of Missouri.” Samuel J. Record, a forest assistant in the Forest Service, was assigned to this job. The author made a number of recommendations. One of these was “to devise and direct a permanent policy along the lines suggested, the establishment of a regular course in forestry at the University of Missouri.” He also recommended that the instructor in charge of this department should be a technically trained forester who, besides his regular duties of instruction, should have charge of the forestry work of the state.

Ferguson (1959) stated that circumstances that led to the organization of the Department of Forestry were not clear. He went on to say that perhaps Dr. F. B. Mumford, dean of the College of Agriculture, was influenced by the recommendation of Samuel J. Record. He also suggests that Dean Mumford may have been influenced by the Conference of Governors called by Theodore Roosevelt in 1909, a conference which dealt with the conservation of natural resources. He states further that the establishment of the Department of Forestry was a university administration decision and was not taken in response to public demand. He states, “There was little public interest in forest conservation in Missouri at that time.”

On June 7, 1911, the Board of Curators appointed John Arden Ferguson professor of forestry, effective September 1, 1911, at a salary of \$2500 per annum. Ten months later, April 3, 1912, the Board of Curators authorized the establishment of the five-year curriculum in forestry leading to the degree Master of Forestry. However, students completing the fourth year of the program were awarded the degree, Bachelor of Science in Forestry.

Ferguson, a graduate of the Yale School of Forestry, served for two years as an instructor of forestry at Pennsylvania State College before coming to Missouri. In September, 1912, E.C. Pegg, who at that time was employed by the U.S. Forest Service, was added to the forestry faculty. In December, 1912, Prof. Ferguson resigned from the faculty of the University of Missouri and returned to Pennsylvania State College as head of the Department of Forestry. Prof. Pegg carried on alone for the remainder of the year and conducted the second summer camp on university forest land in Butler County in 1913. In September, 1913, Frederick Dunlap, research forester at the Forest Products Laboratory and a graduate of Cornell, was appointed professor of forestry in charge of the department.

The facilities of the Department of Forestry were minimum (Talbot 1959). It was given some space on the first floor of the Agriculture Building, which was already occupied by two instructors. In addition to a desk and chairs there was space for a blackboard and for a forestry library. The College of Agriculture made funds available for the purchase of various forestry instruments needed for instructional purposes. A small piece of land in back of the Agriculture Building was made available for a forest-nursery and a large acreage of forest land which the University had acquired under the Land Grant Act was made available for field work. A few years later when the Physics Building was completed, space was provided in it for the Department of Forestry. Space included two offices, stenographer's office, a large classroom, and a laboratory.

When the department was established, only two states adjacent to Missouri offered programs leading to degrees in forestry. These were at the University of Nebraska and Iowa State College. Both institutions had initiated programs in 1904. The forestry department at the University of Nebraska however was abolished in 1915. Presently, all states bordering Missouri offer curriculums leading to a degree in forestry, all of them except Iowa State have been established between 1946 and 1958.

The catalogue of the University of Missouri for 1911-1912 carried the following statement about the curriculum in forestry: "Theoretical principles will be given at the university and practical applications will be taught on the university forests of 50,000 acres in the Ozarks. A 'forest camp' of eight-weeks duration during the summer session will include the following subjects: Forest Mensuration, Silviculture, Lumbering and Forest Surveying."

The first summer camp was held in the shortleaf pine forest near West Eminence in Shannon County in 1912 on lands of the I.B. White Lumber Company (Talbot 1959). It was a tent camp where every one, including the faculty, shared in the many chores that had to be done. Talbot (1959) recalls the good fellowship—the evening "sings," "Fergie's" (Prof. Ferguson's) lunch-stop pep talks, and escapes to "ye olde swimmin' hole." He remembers the heat, the ticks, the chiggers and the "skeeters." He refers to the occasional raiding of the food supply by Ozark razorbacks, making it necessary for Prof. Ferguson to hitch-hike a log train into town to replenish the food supplies. Conditions in these early camps were in sharp contrast to today's air-conditioned cabins, modern kitchen and dining room, and good classroom facilities. However, today's summer camp students cannot avoid the heat, ticks, and chiggers while working in the woods, but they have better means of protecting themselves against the latter. The nine reports listed by Talbot (1959) as a part of the summer camp activity are small in number compared to today's requirement.

The initial curriculum included 23 forestry courses, 13 of which were required during the first four years of the 5-year curriculum. The other 10 forestry courses were required during the fifth year. The period from April 1 to June 1 of the fifth year was devoted to making a working plan for a forest tract. The first four years included the following subjects with number of credit hours shown in parenthesis: English (5), Chemistry (8), Botany (16), Foreign Language (10), Geology (13), Engineering Drawing (3), Physics (5), Manual Arts (5), Civil Engineering (5), Mechanical Engineering (3), Political Science (5), Horticulture (2), Mathematics (5),

Meteorology (1), Entomology (3), Economics (5), Topographic drawing (1), Zoology (5), Forestry (34). The four Botany courses included General Botany, Physiology, Mycology, and Tree Diseases. The program did not include any elective courses.

The fifth year of the program required 28 credit hours, 22 of which were in Forestry. No changes occurred in the forestry curriculum until the school year 1916-1917 when the number of forestry courses was reduced from 23 to 20. The summer camp courses which previously had been listed in the same manner (including description) as courses offered during the regular school year were no longer listed as such. However, the summer camp was still required of students in the forestry curriculum.

The first major change in the forestry curriculum appeared in the university catalogue for the school year 1918-1919. Credit hours for the summer camp were increased to 16 by the inclusion of courses in tree diseases and tree insects, courses which previously had been offered on the campus at Columbia. In revision of the curriculum, 13 credits of electives were included and the number of credit hours required to earn the Bachelor of Science in Forestry was increased to 143. The following courses, the number of credit hours shown in parenthesis, made up the first four years of the forestry curriculum: English (6), Chemistry (8), Physics (5), Geology (8), Botany (16), Civil Engineering (6), Mechanical Engineering (2), Political Science (5), Mathematics (10), Zoology (5), Economics (5), Accounting (3), Entomology (2), Animal Husbandry (3), Forestry (46), Electives (13).

It should be noted that the mathematics was increased from five to 10 credits. The change involved the addition of a five-credit course in analytical geometry with an introduction to calculus. Five credit hours of algebra and trigonometry were retained in the curriculum. The ten credit hours of a foreign language which had been in the curriculum from the start were eliminated.

The 1919-1920 university catalogue did not list the forestry curriculum but did list three forestry courses: General Forestry, Farm Forestry, and Wood Technology, each for three credit hours. This change apparently was in anticipation of the abolishment of the Forestry Department and with it the forestry curriculum. This issue of the University catalogue listed Frederick Dunlap as a member of the staff of the Agricultural Experiment Station. However, the catalogue for the school year 1920-1921 did not list any forestry courses and listed no one on the staff of the Agricultural Experiment Station.

It has been noted that the Forestry Department was initially under the direction of Prof. John A. Ferguson. He was ably assisted by Ernest C. Pegg, instructor and later assistant professor. When Ferguson returned to Pennsylvania State University in 1913, Howard DeForest was appointed on January 18, 1913, as acting assistant professor of forestry to handle some of the courses previously handled by Prof. Ferguson. The faculty then consisted of Ernest Pegg and Howard DeForest. On April 4, 1913, the Board of Curators appointed Frederick Dunlap to the position of professor of forestry effective September 1, 1913. DeForest subsequently resigned from the faculty. The staff then consisted of Prof. Dunlap and Prof. Pegg as fulltime members, aided by student assistants, the most notable of whom were Murrel W. Talbot and Victor C. Fallenius.

Early in its history the Department of Forestry was assigned the administration of land generally known as the agricultural college lands (these were the land grants made to the University of Missouri). At the meeting of the Board of Curators of February 18, 1914, the responsibility for the administration of the agricultural lands was authorized and the Department of Forestry was authorized to make a reconnaissance survey at a cost of not to exceed \$500. At the same time the professor of forestry was authorized to appoint forest guards at an annual cost not to exceed \$270 payable from the college land fund.

Although the Board of Curators authorized the Department of Forestry to expend no more than \$500 for the forest survey, the board, at its meeting on June 28, 1915, authorized the allocation of \$1,000 to complete the survey of forest land. In 1917 the Board at its meeting of May 30 approved a plan submitted by the professor of forestry for cooperation with rural communities for protection of the forest and made available \$300 from the College of Agriculture lands as a forest protection fund. On January 1, 1919, the Board of Curators received and filed a report from Prof. Dunlap dealing with the protection of timber lands and agricultural lands in Dunklin County and authorized that the present method of protection be continued so long as it was effective.

A ledger maintained by Prof. Dunlap shows income and expenditures for the college lands beginning in 1915 and extending through most of 1919. Apparently, the employment of forest wardens did not prove effective because expenditure for their salaries is shown only for 1915 and 1916. Most of the expenditure of college land funds was for levy and drainage fees for which nearly \$4,000 was spent over a period of four years. This suggests that some of the lands were located in the Bootheel portion of Missouri. Income from these lands came chiefly from leases, the amount from this source totalling approximately \$4,000. Other sources of income were from the sale of logs, sale of land, and miscellaneous income.

Research was initiated in the Department of Forestry with an initial allocation on July 1, 1911 of \$500. Annual allocations of \$750 for research were made to the department from 1912 to 1918. The final allotment of \$1,000 was made in 1919. Ernest Pegg (1959) reported that by 1913 the department had three research projects in operation. They dealt with forest tree seeds, preservative treatment of various species of wood, and basket willow culture.

In addition to funds for the administration of the agricultural college lands and for research, the department operated with several other funds. These included agricultural laboratories appropriations which ranged chiefly between \$300 and \$500 per annum; sales and fees which during the five-year-period, 1915-1920, produced more than \$1,800 of income, mostly from the sale of fuel wood, logs, and willow rods; the forest survey fund; and the forestry camp fund. The latter fund obviously was set up for the operation of the forestry summer camp.

During the nine-year period of operation of the Department of Forestry, 17 persons were awarded degrees. At its meeting of June 7, 1921, the Board of Curators abolished the Department of Forestry effective September 1, 1921. Neither the minutes of the board meeting nor publications of the university offer any explanation for this action. At its meeting on May 14, 1921, the Board of Curators instructed the secretary of the board to inform Prof. Dunlap that the action abolishing the Department of Forestry automatically abolished the position

of professor of forestry. At its meeting on July 7, 1921, the Board of Curators denied Prof. Dunlap's request for a year of sabbatical leave.

The first formal move by the Board of Curators to do forestry extension work occurred at its meeting on June 8, 1926, when Frederick Dunlap was appointed extension forester on a half-time basis effective July 1, 1926. The position was financed through December 31, 1926, from \$1,500 from federal Clarke-McNary funds and \$100 from Agricultural Extension Service funds. The appointment was terminated June 30, 1927, again without any explanation in the board's minutes.

The Forestry Society, an organization of students and faculty of the Department of Forestry was organized in February, 1912. Apparently its operation was discontinued in September of 1917. At least there is no record of its activities following that time. The organization was succeeded in 1936 by the Forestry Club. The history and activities of the Forestry Society and of the Forestry Club are covered fully in Chapter VI.

### **Pre-Forestry Curriculum 1936-1946**

No professional forestry courses were offered from 1921 through 1936. However, a course in farm forestry was listed in some of the University catalogs and was offered from time to time in the Department of Horticulture. The course at various times was taught by three different persons, Thomas Talbert, Horace Major, and Carl Vinson.

Interest in forestry throughout the state was stimulated in the early 1930's by the establishment of the Civilian Conservation Corps and two units purchased by the federal government which ultimately became national forests encompassing more than 1,300,000 acres. Just what factors led to the establishment of the pre-forestry curriculum in the Department of Horticulture in 1936 are uncertain. R. H. Westveld was appointed asst. professor of forestry effective January 1, 1936, and was given the responsibility for developing a two-year pre-forestry curriculum. At a later date the name of the Department of Horticulture was changed to Department of Horticulture and Forestry.

The pre-forestry curriculum included 55 credit hours exclusive of military science and physical education. Four forestry courses totaling 13 credits constituted a part of the pre-forestry curriculum. It also included six credits of English, six credits of botany, eight credits of chemistry, three credits of engineering drawing, five credits of mathematics, three credits of zoology, three credits of civil engineering, five credits of economics and three credits of soils.

Initially, approximately 25 students were enrolled in the pre-forestry curriculum and by the time the United States entered World War II enrollment had grown to about 45 students. The enrollment decreased rapidly from 1941 until after World War II. The pre-forestry curriculum was terminated in the summer of 1946 when a four-year curriculum leading to a Bachelor of Science in Forestry took its place.

On July 1, 1936, forestry extension again became a part of the university program and Ralph H. Peck was appointed extension forester.

When R. H. Westveld resigned September 1, 1938, Peck assumed Westveld's position and Elliott W. Zimmerman, who took leave from the U. S. Forest Service for one year, was appointed extension forester. In 1939 Leighton E. McCormick

was appointed extension forester, replacing Zimmerman. Also in 1939, C. Willard Leach was appointed instructor of forestry to assist with the teaching program. A second extension forester, Calvin Bowen was also appointed in 1939. In 1940 W. C. Sechrist was appointed to the staff of the Agricultural Experiment Station to carry on a survey of wood using industries.

The pre-forestry curriculum was terminated in the summer of 1946 and replaced in the fall of that year by a four-year Forestry curriculum in the Department of Horticulture and Forestry.

#### **Forestry Curriculum (Department of Horticulture and Forestry) 1946-1947**

The four year forestry curriculum leading to a Bachelor of Science in Forestry went into effect the first semester of 1946. Prof. Ralph Peck was in charge of the curriculum, and Calvin Bowen who had been engaged in extension work was transferred to teaching. February 1, 1947, Richard C. Smith was appointed assistant professor of forestry, thus providing a staff of three persons to teach the new curriculum. The curriculum included 24 courses in forestry, totaling 64 credit hours. The curriculum provided that students in their senior year would spend the last eight weeks of the last semester taking courses involving primarily field work at the university forest near Poplar Bluff.

In April, 1947, Prof. Peck died.

#### **Forestry Department, School of Forestry 1947**

R. H. Westveld was invited to Columbia in May of 1947 to discuss the possibility of taking over the administration of the forestry curriculum. In his conversations with Deans Trowbridge, Shirky, and Crosby he stressed the importance of striving for a program which would be accredited by the Society of American Foresters. In answer to his question as to whether this was the goal of the University, he received a positive reply. He then suggested that the best means of achieving this goal would be through the establishment of a Department of Forestry. At the time of his appointment as professor of forestry and chairman of the department in June, 1947, the Board of Curators also created the Department of Forestry. Thus the curriculum after a year of operation was transferred from the Department of Horticulture and Forestry to the Department of Forestry.

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## Chapter II

### DEVELOPMENT AND GROWTH SINCE 1947

The significant development and growth of forestry at the University of Missouri occurred after 1947. Development of the national forests and the state forestry work under the direction of the Division of Forestry of the Missouri Conservation Commission created strong interest in forestry throughout the State. There were indications that the university must play an important role in the forestry development. In recognition of these facts the administration of the Department of Forestry, later the School of Forestry, with strong backing and encouragement from the university administration gradually developed objectives upon which it was possible to develop a sound program in resident instruction, research, and extension.

#### **Objectives**

Objectives of the forestry program have changed over the years as the needs and opportunities changed. The first objective in 1947 was to develop a program in resident instruction at the undergraduate level, leading to a bachelor of science in forestry, which would have the quality that would lead to early accreditation by the Society of American Foresters. This meant assembling a staff of sufficient size and quality, the development of sufficiently adequate facilities, backed by adequate

financing, and a sound curriculum to meet the minimum requirements for accreditation by the Society of American Foresters. By the fall of 1948 a minimum staff of seven persons (one on part-time basis) had been assembled after Richard C. Smith went on leave to pursue work toward a doctor's degree at Duke University.

One of the early objectives was to develop good communication with the students and to encourage them to participate in activities outside the classroom. The Forestry Club provided an excellent opportunity for such activity. The 12-weeks summer camp at the university forest which was required of all students provided the opportunity to develop a closeness between the faculty and the students and an esprit de corps within the department.

By the fall of 1949, after Robert E. McDermott took leave to pursue a doctor's degree at Duke University, the teaching and research staff consisted of eight persons. The Society of American Foresters gave the curriculum a listed status in 1948 which simply meant that the curriculum was sufficiently broad in scope and included essential courses in forestry. During 1949 the department asked the Society of American Foresters to review its program to determine whether the forestry curriculum might qualify for accreditation. After reviewing the data which the department had provided, the society sent a three-man review team composed of Myron Kreuger of the University of California, Paul A. Herbert of Michigan State University and Hugh Steavenson, a forester practicing in Missouri, to Columbia to evaluate the faculty, facilities, financial support, and other matters which formed the basis for accreditation. Early in 1950 the council of the Society of American Foresters accredited the forestry curriculum.

After the undergraduate curriculum was accredited it seemed desirable to develop a limited graduate program since this could provide one means of strengthening the research program. Approval by the Graduate Council of the University of Missouri for offering a master's degree in forestry was secured later in 1950. At this point the objectives of the department were to continue to strengthen the undergraduate and graduate programs, to develop a research program that would eventually meet the needs of the state, and to strengthen the extension program which was handled by one person.

As the research program expanded through improved financial support and as more interest developed in graduate study it became an objective late in the 1950s to strive for offering a program leading to a doctor's degree in forestry. It was not possible to consider this seriously until 1960 when the school moved into the new Agriculture Building. However, considerable advance preparation was made for a few years prior to 1960. In 1962 the Graduate Council, after careful review of the facilities and the qualifications of the faculty of the School of Forestry, gave approval for offering a doctor's degree program in forestry.

The objectives continued to be strengthening of resident instruction, research, and extension through the building of a larger staff of well-qualified persons through increased financial support from all sources and efficient use of all resources.

### **Informing the Public**

In the belief that any university program, to be successful, must be understood by the general public and by high school students and counselors, every effort has

been made through various means to accomplish this purpose. To acquaint students with the various curriculums in the School of Forestry and the opportunities in the different fields of work, the faculty have participated in numerous career day programs at high schools. On the campus, the School of Forestry participated in 1957 in the Science Student's and Teacher's Day which was designed to interest students in some of the applied fields of science. From 1962 to 1967 the School of Forestry participated in University Day, a day which was set aside on the campus for high school students to become acquainted with all the educational opportunities at the university.

Since the curriculum in wood products and building materials management (originally known as the forest products marketing curriculum) was not understood as well as the forestry curriculum, a special effort was made beginning in 1952 to acquaint parents and high school students with this curriculum. The Southwestern Lumbermen's Association was very helpful in this public relations program. The director of the school appeared on the program of one of the annual meetings of this organization and discussed this curriculum at meetings of four of the five regional lumber dealers' associations in the state. The Southwestern Lumberman's Association provided space during its convention at the Municipal Auditorium in Kansas City for a School of Forestry exhibit during 1964, 1965, and 1966. A faculty member was available at all times to discuss the wood products and building materials management curriculum with interested persons.

After the residential and light construction curriculum was established in 1961 the Home Builders Association of Greater Kansas City provided space at its Home Show for a School of Forestry exhibit in 1962, 1963, 1964, and 1965. This provided an opportunity to acquaint parents and prospective students with this new curriculum. A faculty member of the School of Forestry was available at all times to discuss this program.

In an effort to acquaint the citizens of Missouri with the research program of the School of Forestry and with the importance of research to the development of forestry and the wood using industries in the state two bulletins were published. They were *Bulletin 709—Research in Forestry and Wood Products* and *Bulletin 792—Research—The Key to the Development of Missouri's Forest Resources and Wood-Using Industries*.

Another means of informing certain segments of the public about the university's forestry program was through meetings of the state-wide forestry committee of the Missouri Conservation Federation. This provided a means of acquainting interested persons with the forestry program and its needs.

The School of Forestry Advisory Council, which was organized in 1958, provided an excellent means of acquainting a small group of interested and influential persons in the school's program and needs. This is discussed more fully in a later section in this chapter.

### **Facilities for Instruction and Research**

The facilities for the forestry program in 1947 were minimal. The Department of Forestry had three offices in Whitten Hall, two classrooms, a laboratory, and an office in one of the temporary buildings directly south of Waters Hall. As the staff

increased in size two additional offices were made available in another temporary building a few years later.

The new Agricultural Building was completed in 1951. It included an excellent laboratory to accommodate 32 students, two storerooms, and an office assigned to the Department of Forestry.

Late in 1952 a temporary building consisting of 33 rooms and approximately 11,000 square feet of space was made available to the department. After considerable remodeling which provided reasonably satisfactory offices, classrooms, and laboratories, the department moved into this building on February 3, 1953. Facilities in these two buildings constituted the facilities of the school until June, 1960, when the School of Forestry moved into the new Agricultural Building where well planned laboratories for both teaching and research and classrooms and offices became available. This space, consisting of approximately 23,000 square feet was divided between the first and second floors of the building. The space is made up of two teaching laboratories, one of which is used for work in dendrology, wood technology and forest pathology, and the other for work in forest mensuration, forest photogrammetry, and forest graphics, a classroom, research laboratories, and numerous offices. Some space originally planned for research in wood preservation and related work has been remodeled and made into office space to accommodate the increasing number of graduate students. In 1968 the space shortage became so acute that the University administration assigned a residence to the School which has been used for offices for graduate students.

*The University Forest* of approximately 7,300 acres, located in Butler County approximately 15 miles northeast of Poplar Bluff, is utilized both for teaching and research. For 12 weeks during the summer it is the headquarters for the summer camp which is now attended by all forestry students following their junior year. Here is where the students receive their field training in a variety of subjects. The University Forest was developed from certain lands which the University had acquired under the Land Grant Act. Originally, the university administration assigned 9,000 acres made up of 29 individual tracts to the Department of Forestry for its use. During 1947 a student dormitory, a bath house, a dining hall and kitchen, a faculty building, and a residence were built to provide the basic buildings needed for the forestry summer camp.

It was soon evident that these facilities were quite inadequate since the dining hall had to serve the dual purpose of a place to eat and a classroom, and the faculty had wholly inadequate lodging facilities.

In 1948 a small circular-saw sawmill, purchased from the Corley Manufacturing Company of Chattanooga, was installed. This piece of equipment was considered necessary in connection with the summer camp instruction in sawmill operation. Eventually this equipment was considered inadequate and in 1963 the Corley Manufacturing Company gave a No. 4 Corley sawmill to the university. The Simonds Saw and Steel Company of Fitchburg, Mass., gave the university a 56" inserted circular tooth saw and the Phelps Fan Manufacturing Company of Little Rock gave the university a sawdust blower. This provided much better equipment not only for student instruction but for the short courses in sawmill operation given for personnel of the Missouri Conservation Commission and operators of small sawmills.

In 1955 when regional research funds from the U. S. Department of Agriculture were assigned to the department, a wood utilization building housing a planer, moulder, and other equipment, a dry kiln and a lumber storage shed were constructed to provide needed facilities for the research.

Within the next two or three years after the first buildings were constructed a classroom and office building and a new faculty building were constructed. It soon became evident that the water supply was not adequate. This became critical in 1957 when a comprehensive study was made of the future needs in buildings and other facilities. A faculty committee composed of Lee K. Paulsell, Richard C. Smith, and Peter Fletcher made a careful study of the future needs at the University Forest. In September, 1957, they filed a report entitled, "A Plan for the Development of the University Forest." The committee recommended that \$13,000 be made available immediately, that \$43,000 be made available for the 1957-59 biennium and \$22,000 be made available for the period 1959-1963.

The recommendations of the committee were accepted in part by the university administration and funds were made available immediately for drilling a new deep well to replace the old one. During the period 1958 to 1960 the student dormitory, the bath house, original faculty building and the dining hall and kitchen were demolished. They were replaced by a new dining hall and kitchen which accommodate 60 people, a new bath house, and five eight-man student cabins. In addition, the electrical system was placed underground, a new sewage system was constructed, and a garage was built. During the following two years the classroom and office building was remodeled to provide additional office space and a small field research laboratory. A new open-air classroom and an all-weather lodging facility for research assistants were constructed.

During the period 1959-1960 authority was granted by the Federal Communications Commission to operate radio equipment on the wave length of the Missouri Conservation Commission. This provided an opportunity to develop 24-hour a day communications with the Missouri Conservation Commission, the U. S. Forest Service, and the Missouri State Park Board at Wappapello. Radio equipment was installed at the residence in the University Forest to provide 24-hour a day service, an important component in fire control.

It was apparent very soon after the Department of Forestry acquired the 9,000 acres from the university for administrative purposes that the widely separated small tracts presented many problems in administration and fire control. During the period from 1921 to 1947 when these lands were given little attention by the university several persons had built homes and other buildings on some of the university land. This created problems in theft of timber and in the starting of fires. When these people were asked to leave they made promises that they would but the majority continued to reside in their homes. The university administration was reluctant to take legal action.

In the early to mid 1950s the University explored with the Forest Service of the U. S. Department of Agriculture the possibility of exchanging some of its land for adjacent Forest Service land in order to consolidate its holdings. It was found that the Land Grant Act allowed the university to sell these lands but not to exchange them for other lands. The Forest Service expressed a desire to make the exchange but the legal authorities stated that legislation by the Congress of the

United States and by the General Assembly of Missouri would be needed to allow such an exchange. Legislation was introduced in both legislative bodies and was passed by both of them. President Eisenhower signed P.L. 85-282 which allowed for the exchange of land between the Forest Service and the University of Missouri. Governor Blair somewhat earlier had signed a bill passed by the General Assembly for the same purpose.

Representatives of the Forest Service and the School of Forestry examined Forest Service and university lands which were suggested for exchange and placed a monetary value on them. The exchange was finally consummated in 1959. The Forest Service lands in general were of higher quality than university lands and as a result the university received a smaller acreage in the exchange. The School of Forestry also asked the university administration to be relieved of the administration of certain low-quality, high-hazard lands in some of the southern tracts. This was granted. Consequently, after the exchange and the withdrawal by the university administration of some of the lands from the School of Forestry's jurisdiction the school had 11 tracts with an area of 7,300 acres instead of the 9,000 acres which it had in 1947.

In 1964 it was apparent that if the University Forest was to serve its most useful purpose for research some improvements would be necessary. A request for \$25,000 was approved by the administration and later included in the appropriation of the General Assembly. The money was allocated for the fiscal year 1965-1966. These funds were used for developing two additional watersheds for watershed management research, for a small greenhouse and for the construction of 12 miles of additional roads.

The forested areas of the University Forest, which probably constitute at least 95% of the area, are composed largely of mixed hardwoods, chiefly oaks and hickories, typical of the Ozark region. However, in some limited areas shortleaf pine dominates the stand or constitutes a significant part of it. The timber is relatively young, with a limited quantity of trees of saw-log size. The forest is fairly typical of the Ozark region although in general the land is probably of somewhat lower quality than the average of the region.

*The Weldon Spring Experimental Forest* is a part of the Weldon Spring Experimental Farm located 85 miles east of Columbia. The forested area is approximately 4,500 acres in size. It occupies the rolling hills along the Missouri River where the soil is chiefly loess. This area was a part of a larger tract acquired by the federal government during World War II and used for the installation of facilities for the manufacture of explosives and other war material. Prior to acquisition by the federal government the woodlands had been in private hands, owned chiefly by people of German origin who maintained their woodland areas in good condition. Much of the soil is of high quality and supports excellent stands of white oak, black oak, and a few other species of oak as well as such significant species as walnut and black cherry. Several open fields have been utilized for planting conifers in connection with research on cultural practices for the production of Christmas trees.

Fifteen miles south of the campus along the Missouri River is the 80-acre *Schnabel Arboretum and Demonstration Woods* donated to University by Mr. and Mrs. John Schnabel of St. Louis. The timber on this area and the quality of the site

are similar to those of the Weldon Spring area except that some northern species, notably basswood and sugar maple, occur here in moderate quantity.

The *Ashland Arboretum and Wildlife Area* located approximately 20 miles southeast of Columbia is administered by the Zoology Department. The area was developed as a federal project by the Resettlement Administration during the 1930s. It contains 2,000 acres and supports several hundred acres of second growth natural mixed hardwoods and 30 to 40 acres of plantations, chiefly of conifers. Limited areas of this tract have been made available by the Zoology Department to the School of Forestry for research purposes.

The Agricultural Experiment Station operates three extensive research centers, one each in northwest, southwest, and southeast Missouri. Most of the land is open land used for agricultural purposes but the School of Forestry has utilized small areas for the establishment of Christmas tree plantations. This provides an opportunity for studying the behavior of various species under different soil and climatic conditions.

The Agricultural Experiment Station also operates what is known as the South Farm, located six to eight miles south of Columbia. Only limited use of this farm has been made by the School of Forestry for the production of special planting stock for studies.

## Faculty

The faculty has grown in size and quality since the four-year forestry program was established in 1947. Beginning with a staff of three persons in the fall of 1947 the teaching and research faculty grew to seven persons by the fall of 1948, to twelve by 1957, and to 14 by 1958. By 1969 the teaching and research staff was composed of 20 persons, two with joint appointments in other departments (Appendix A), and the extension staff of three persons. Some of the faculty members who joined the staff having a master's degree as their highest degree later earned the doctor's degree. Twelve of the 20 members of the teaching and research staff have doctors degrees.

Turnover in staff has not been critical except in 1959 when two senior members, Peter W. Fletcher and Robert E. McDermott resigned. During the 12 years prior to that time only three persons resigned (exclusive of temporary appointees brought in while faculty members were on leave to continue their education). Since 1959, there have been three resignations from the faculty.

From 1947 to December, 1962, only one member of the faculty was engaged in extension activities. Although he devoted his efforts primarily to timber land management he also attempted to do some limited work in the field of wood utilization. In 1962 Fred Taylor was appointed extension specialist in wood utilization and marketing to provide assistance to owners of small wood-using industries. Taylor resigned in May, 1965, and was replaced by Miles Brown in April, 1966.

When R. H. Westveld retired from the directorship of the School in September, 1965, Donald P. Duncan was appointed Professor of Forestry and Director.

After the State Technical Services Act was passed by Congress the School of Forestry submitted a merit project for extension work in wood utilization in

Missouri, Arkansas, Oklahoma, and Kansas. The project which had the support of the four states was approved by the U. S. Department of Commerce and became active in September, 1967, when Edwin Wheeler was appointed to fill the new position. A year later when Congress appropriated less funds to finance the Department of Commerce, the Department withdrew its financial support for merit projects. Wheeler continued to work in the four states for three months, the financing being provided by the Missouri Agricultural Extension Service. Since late in 1968, Wheeler has worked exclusively in Missouri.

### **Reciprocal Agreements**

Since the states of Kansas and Nebraska did not offer four-year degree programs in forestry, President Ellis in the early 60s explored the possibility of developing reciprocal agreements with these states whereby their students could come to the University of Missouri for their forestry education without paying out-of-state tuition and in turn students from Missouri could go to Nebraska or Kansas for their education in fields in which the University of Missouri offered no degree programs. In 1962, such an agreement was consummated between the University of Missouri and the University of Nebraska and in 1965 a similar agreement was consummated between the University of Missouri and Kansas State University. Enrollment of students from these two states gradually increased, reaching 37 in the fall of 1969.

### **College of Agriculture Advisory Council**

In 1951 Dean John H. Longwell organized a College of Agriculture Advisory Council, the purpose of which was to review the College's programs in resident teaching, research, and extension, to evaluate these programs and to make its recommendation for improvement. Committees were appointed to consider the programs in individual disciplines. The committee on forestry was composed of D. B. Mabry of the T. J. Moss Tie Company (now Moss-American, Inc.); Leo Drey, owner of the Pioneer Forest; Ed Woods, manager of the Pioneer Forest; Charles Fritschle, operator of a small sawmill; and T. L. Wright a small forest land owner.

In the fall of 1953 this committee went on record favoring the establishment of a College of Forestry. At the meeting of the Advisory Council the University administration expressed its approval of this view. In December, 1953, the forestry committee met with Westveld to discuss a 10-year plan for forestry which had been prepared earlier in the year. At meetings of the Advisory Council in March, 1954, and in March, 1956, the forestry committee restated its previous recommendation for the establishment of a College of Forestry. Unquestionably, these recommendations by the forestry committee played a part in the establishment of the School of Forestry as a unit in the Division of Agricultural Sciences in July, 1957.

### **School of Forestry Advisory Council**

From the experience with the College of Agriculture Advisory Council it seemed that an independent School of Forestry Advisory Council would be more useful to the School. Therefore, in the summer of 1958 Westveld met in St. Louis with a group of 12 forest industry and land owners at a luncheon sponsored by the



T. J. Moss Tie Company. He outlined the purposes and functions of such an advisory council and after considerable discussion the group agreed that such a council would be useful to the School. Those in attendance indicated that they would be willing to serve on the council. The Director of the School then proceeded, during the summer of 1958, to contact a representative group of persons of high caliber who were active in various phases of work in forestry in Missouri. A large majority of those contacted were flattered to be asked to serve on the Council and quickly accepted.

By the time of the first meeting, 59 persons constituted the original School of Forestry Advisory Council and 51 of them attended the first meeting in Columbia on November 7, 1958. The first meeting was devoted to acquainting the members with the various phases of work of the School of Forestry and to organizing the council into working groups composed of persons with specialized interests in various phases of forestry or of forest industries.

Two classes of membership were established, regular members and ex-officio members. The ex-officio members are representatives of various public organizations, such as the Forest Service of the U. S. Department of Agriculture, the National Park Service of the U. S. Department of Interior, the Missouri Department of Conservation and the Missouri State Park Board and the Soil Conservation Service of the U. S. Department of Agriculture. The director of the School of Forestry serves as secretary of the council.

Five working groups were established: (1) land management, (2) sales, (3) manufacturing, (4) tree service and landscape, and (5) recreation. The land management working group was composed of owners and managers of forest land and included representatives of the Forest Service, the Missouri Conservation Commission, and the Soil Conservation Service.

The sales group at the time of its organization was composed of retail lumber dealers and commission lumber salesmen. Later, representatives of the chapters of the American Institute of Architects in Kansas City and St. Louis and representatives of the Home Builders Associations of Greater Kansas City and St. Louis were added. These groups were added because of the significant part they play in the use of wood.

The manufacturing working group was composed of owners of wood-using industries that produce various types of wood products.

The tree service working group originally was composed of persons engaged in arboriculture and related types of work and a few nurserymen. It soon became obvious that the nursery interests were being served elsewhere and in reorganizing this group, membership was confined to persons engaged in tree service work. The group was renamed tree service.

The recreation working group was composed of persons interested in the use of land for recreation. Originally, it included representatives of the Missouri Park Board, the National Park Service, and operators of private out-door recreation facilities. Later, as the Missouri Conservation Commission became involved more and more in recreation activity as a result of the enactment of the Land and Water Conservation Act, a representative of that organization was added to this group.

The second meeting of the council was held at the University Forest in the fall of 1959. This provided the members of the Council an opportunity to become

acquainted with the facilities and types of research that were being carried there.

During the first two years, meetings of the Advisory Council consisted of a meeting of the entire council and a meeting of the individual working groups. Approximately an equal amount of time was devoted to the two parts of the meeting. It became evident, however, after two years of experience that the various topics which needed to be discussed could not be adequately covered in this period of time. A meeting of the executive committee, which is composed of the officers and the immediate past chairman of the council and the chairman of the individual working groups, met to discuss this matter and to draw up a tentative constitution which would guide the activities.

The executive committee suggested that each of the working groups meet sometime in the spring, preferably during May and June, and that the meeting of the entire council be held in the fall. This recommendation and the proposed constitution were approved by the members at the annual meeting in 1960. Since then, the fall meetings have been devoted to providing the council members with information about the progress of the school's various programs, about new programs that the school has undertaken and about programs and activities within the university as a whole that are of significance to the School of Forestry. In this manner the members are kept well informed about the School of Forestry and university activities.

The working group meetings in the spring were devoted to discussions of research results, plans for undertaking new research, summer job opportunities for students, short courses, and any other matters which the members wish to bring up that they feel may be of benefit to the School. The working groups have been particularly helpful in planning the subject matter for the various short courses which have been held during the past several years. Each working group has sponsored, with the School of Forestry, at least one short course in their particular field of interest. Members of the faculty attend the meetings of the working groups in which they have a particular interest and benefit from ideas presented by members of that working group.

In 1967 the Council decided to hold, on a trial basis, a one and one-half day meeting in October, 1968, with one-half day devoted to working group meetings and the remainder of the time devoted to a meeting of the entire Council.

Although there has been considerable turnover in the membership of the Advisory Council since it was established in 1958, there is a good nucleus of men who have served on the council since 1958. Approximately 25 of the members have had membership on the council since that time. Many of those who have been dropped from the Advisory Council have been transferred to positions outside the state. Only a few persons have been dropped because of decreasing interest in the work.

In 1963 the council approved the establishment of a development committee whose purpose would be to encourage individuals and organizations to contribute funds to the School for strengthening its programs. Several people have made contributions annually since that time. The Advisory Council has been responsible for the establishment of 10 scholarships during the past 10 years.

## Chapter III

### RESIDENT INSTRUCTION

The undergraduate and graduate programs offered from 1912 to 1921 are discussed in chapter I. This chapter will deal with the programs that have been developed since 1946. A new undergraduate program in forestry was offered at that point to replace the two-year pre-forestry curriculum which had been offered since 1936. A graduate program leading to a Master's degree was approved by the graduate council in 1950 and the graduate program leading to the Doctor's degree was approved by the graduate council in 1962.

An undergraduate program in forest products marketing was initiated in the fall of 1952 and an undergraduate program in residential and light construction was initiated in the fall of 1963.

Freshmen had to meet the general University admission requirements of 15 units of high school work, satisfactory high school records, and the recommendation of the high school, but no other specific entrance requirements for admission were stated in the School of Forestry Announcement until 1958. Prior to that time it was *recommended* that students have three units of mathematics and three units of English in high school. The 1958-59 announcement stated that the student *must* have three units of English and two units of mathematics to be accepted for admission into the School of Forestry. The Announcement also stated that in the fall of 1960 students *must* have three units of high school mathematics to be accepted into the School of Forestry. Provisional admission to the school was permitted if a student had less than the required mathematics, but such students were required to make up their mathematics deficiencies in college with no college credit granted for the work.

The 1960-61 School of Forestry Announcement added as a requirement, one unit of science. In the 1967-68 School of Forestry Announcement eight units of electives were added as a specific requirement. All students have been required to take entrance tests to determine their proficiency in mathematics, English, and general knowledge. The purpose of the English and mathematics tests is to determine the level of English and mathematics in which the student should be enrolled.

### Forestry Curriculum

The curriculum which was offered in the fall of 1946 required 136 credits for graduation, including four credits of military science and four credits of physical education. The curriculum included a nine-week summer field camp for which eight credits were granted. During the senior year students would spend the period March 1 to June 1 at a field camp where field work was offered in courses in which lectures were given during the first month of the second semester in Columbia.

The curriculum included 24 courses in forestry totaling 66 semester credits. The arrangement of the courses in the curriculum is shown in the 1946-47 forestry curriculum in Appendix C and in a condensation in Tables 1 and 2.

When a new faculty was assembled during the school year of 1947-48 there was immediate dissatisfaction with some aspects of the curriculum and a revision was immediately undertaken. The field camp in the senior year was eliminated and the summer camp following the sophomore year was increased from nine to 12 weeks with 12 credits allowed for the camp. The number of forestry courses was reduced from 24 to 21 and the number of credit hours in forestry was reduced from 66 to 56. The changes can be noted in Tables 1 and 2 and the 1948-49 forestry curriculum in Appendix C.

The number of elective credits was increased to 17. Students were encouraged to select their electives from seven groups: *general electives, graduate study or research, forest land management, forest wildlife management, forest recreation and municipal forestry, forest utilization, and business aspects of forestry*. The objective of this plan was to encourage students to broaden their training and to choose some of their electives in the field in which they hoped to seek employment.

Since the 1948 revision of the forestry curriculum, four major revisions have been made, in 1953, 1958, 1965, and 1968. The details of each of these curriculum changes are shown in Appendix C and comparisons in the broader aspects of the changes can be made in Tables 1 and 2.

A comparison of the six representative curriculums shows that the semester credit hours in forestry subjects have varied from 55 to 66 and in non-forestry subjects, from 73 to 89. The lowest proportion of non-forestry subjects (53 percent) occurred in the 1965-66 curriculum and the highest proportion (62 percent) occurred in the 1953-54 curriculum. The greatest change in the non-forestry subjects has been in the social sciences and humanities requirement where the semester credit-hour requirement has been more than doubled, from eight in 1946-47 to 21 in 1965-66 and 17 in 1968-69. This change is designed to provide the prospective forester with a broader perspective of human desires and needs.

Although the semester credit-hour requirement in mathematics has not been changed in more than 20 years (5 credits), the requirement has been made more demanding for qualified students (See 1965-66 and 1968-69 forestry curriculums in Appendix C). Beginning in 1965, qualified students could substitute analytical geometry and calculus for college algebra and trigonometry and in 1968 qualified students were required to make the substitution.

A cursory review of the total credit-hour requirements may not reveal an increase but a more careful study will show one. If both physical education and

TABLE 1. SEMESTER CREDIT-HOUR DISTRIBUTION OF NON-FORESTRY SUBJECTS IN FORESTRY CURRICULUM FOR SIX SELECTED YEARS

| Subject                                     | 1946-47 | 1948-49 | 1953-54 | 1958-59 | 1965-66 | 1968-69 |
|---|---------|---------|---------|---------|---------|---------|
| Physical Sciences                           | 13      | 13      | 15      | 16      | 18      | 15      |
| Mathematics                                 | 5       | 5       | 5       | 5       | 5       | 5       |
| Chemistry                                   | 8       | 8       | 5       | 5       | 8       | 5       |
| Physics                                     | 0       | 0       | 5       | 6       | 5       | 5       |
| Biological Sciences                         | 13      | 13      | 8       | 5       | 8       | 8       |
| Botany                                      | 8       | 8       | 8       | 5       | 8       | 8       |
| Zoology                                     | 5       | 5       | 0       | 0       | 0       | 0       |
| Earth Sciences                              | 8       | 8       | 6       | 6       | 6       | 6       |
| Geology                                     | 3       | 3       | 3       | 3       | 3       | 3       |
| Soils                                       | 5       | 5       | 3       | 3       | 3       | 3       |
| Social Sciences<br>and Humanities           | 8       | 13      | 13      | 13      | 21      | 17      |
| Economics                                   | 5       | 5       | 5       | 5       | 4       | 5       |
| Political Sci-<br>ence                      | 0       | 5       | 5       | 5       | 5       | 3       |
| Social Science                              | 3       | 3       | 3       | 0       | 6       | 6 or 3  |
| Humanities                                  | 0       | 0       | 0       | 0       | 6       | 3 or 6  |
| Cultural Course                             | 0       | 0       | 0       | 3       | 0       | 0       |
| Communications                              | 9       | 9       | 12      | 12      | 12      | 12      |
| Applied Ento-<br>mology                     | 3       | 0       | 0       | 0       | 0       | 0       |
| Principles of<br>Wildlife Conser-<br>vation | 3       | 0       | 3       | 0       | 0       | 0       |
| Surveying                                   | 3       | 3       | 3       | 3       | 3       | 3       |
| Statistics                                  | 0       | 0       | 0       | 0       | 2       | 3       |
| Physical Edu-<br>cation <sup>1</sup>        | 4       | 4       | 4       | 4       | 0       | 0       |
| Military Sci-<br>ence <sup>2</sup>          | 4       | 4       | 4       | 4       | 0       | 0       |
| Electives                                   | 2       | 17      | 21      | 16      | 3       | 11      |
| Total                                       | 70      | 84      | 89      | 79      | 73      | 75      |

<sup>1</sup>Required for graduation but without credit beginning in 1965

<sup>2</sup>Not required for graduation and if taken, no credit given

TABLE 2. SEMESTER CREDIT-HOUR DISTRIBUTION OF FORESTRY SUBJECTS IN FORESTRY CURRICULUM FOR SIX SELECTED YEARS

| Forestry                             | 1946-47 | 1948-49 | 1953-54 | 1958-59 | 1965-66 | 1968-69 |
|--------------------------------------|---------|---------|---------|---------|---------|---------|
|                                      | 66      | 56      | 55      | 63      | 66      | 64      |
| Administration <sup>1</sup>          | --      | --      | --      | --      | 3       | 3       |
| Camp Management                      | 1       | --      | --      | --      | --      | --      |
| Cartography                          | 2       | 2       | 2       | 2       | --      | --      |
| Dendrology                           | 6       | 5       | 5       | 6       | 4       | 4       |
| Economics <sup>1</sup>               | 2       | 3       | 3       | 5       | 4       | 4       |
| Entomology                           | 3       | 3       | 3       | 3       | 3       | 3       |
| Engineering                          | --      | --      | --      | 2       | 2       | 2       |
| Fire Control and Use                 | 3       | 3       | 3       | 2       | 2       | 2       |
| General                              | 3       | 3       | 3       | 3       | 2       | --      |
| Graphics <sup>2</sup>                | --      | --      | --      | --      | 2       | 2       |
| Improvements                         | 3       | 1       | 1       | --      | --      | --      |
| Range and Watershed <sup>3</sup>     | --      | --      | --      | 1.5     | 3       | 3       |
| Range and Wildlife                   | 3       | --      | --      | --      | --      | --      |
| Recreation and Wildlife <sup>3</sup> | --      | --      | --      | 1.5     | 3       | 3       |
| Timber                               | 8       | 3       | 3       | 3       | 1       | 1       |
| Mensuration <sup>1</sup>             | 6       | 7       | 7       | 7       | 7       | 7       |
| Orientation <sup>4</sup>             | --      | --      | --      | --      | --      | 0       |
| Pathology                            | --      | 3       | 3       | 3       | 3       | 3       |
| Photogrammetry                       | --      | --      | --      | 3       | 2       | 2       |
| Policy <sup>1</sup>                  | 2       | 2       | 2       | 1       | 2       | 2       |
| Regulation <sup>1</sup>              | --      | --      | --      | --      | 2       | 2       |
| Reports                              | --      | 1       | --      | --      | --      | --      |
| Seminar                              | 2       | --      | --      | --      | --      | --      |
| Silvics                              | 3       | 4       | 4       | 4       | 7       | 7       |
| Silviculture                         | 10      | 5       | 5       | 5       | 5       | 5       |
| Utilization                          | 6       | 8       | 8       | 8       | 6       | 6       |
| Wood Anatomy and Identification      | --      | --      | --      | --      | --      | 3       |
| Wood Technology                      | 3       | 3       | 3       | 3       | 3       | 0       |
| Total - forestry and non-forestry    | 136     | 140     | 144     | 142     | 139     | 139     |

<sup>1</sup>The subject matter in administration, economics, part of the mensuration, policy, and regulation (some phases of timber management) is covered in three 5 semester credit courses identified as "Forest Management".

<sup>2</sup>Replaced cartography in 1965.

<sup>3</sup>Included with some other subject matter in a course titled "Forest Resources Management" from 1958 to 1965.

<sup>4</sup>Required course without credit which replaced "General Forestry".

military science (for which credit was given until 1960) were still required, the semester credit-hour requirement in 1968-69 would be 11 credits higher than it was in 1946.

Changes in the coverage of forestry subjects, with a few exceptions, have been minor, often consisting of a realignment of subject matter based on current changes in philosophy and on practice in the field. The reduction of 10 credits in forestry subjects in the 1948 curriculum revision resulted from a reduction of five credits each in timber management and silviculture. In the most recent revisions the realignment in subject matter in forestry has been aimed at giving more emphasis to the multiple use of forest land, a philosophy which is now practiced widely.

A management-utilization field trip which had been offered as either a one- or two-credit elective course for about 15 years was added to the requirements in 1962 as a one-credit course. The objective was to broaden the students' perspective in the fields of management and utilization by observation of forestry operations outside of Missouri. Most of the trips were made either to the Lake States or to one to three southern states, although one trip was made to Colorado. In the 1965 revision of the forestry curriculum this field trip was made a two-credit course, which followed a 10-week summer camp.

The number of elective credits in the forestry curriculum has varied from a low of two credits in the original curriculum (1946-47) to a high of 21 in the 1953-54 curriculum.

A major change in the forestry curriculum was made in 1965 when the optional program was initiated (See 1965-66 forestry curriculum in the Appendix C). The optional program made it possible for the student with a better-than-average grade-point average and well-defined educational objectives to leave certain specified courses with a maximum of 24 semester credits out of his program and to substitute other courses with an equivalent number of credits for them. The optional program was revised somewhat in 1968 but it retained its basic structure.

### **Forest Products Marketing**

During a visit with the executive officer of the Southwestern Lumbermen's Association in 1950 the chairman of the forestry department learned that the owners of retail lumber and building materials businesses were having great difficulty in finding properly qualified persons to serve as assistant managers or managers of their businesses. He suggested that since relatively few schools offered training in this field the Department of Forestry at the University of Missouri might wish to explore the possibility of offering such a program. Upon investigation it was found that four forestry schools in the United States were offering undergraduate educational programs designed to meet the needs of the lumber and building materials businesses. Since there appeared to be good opportunities for employment of properly trained persons in positions other than the retail lumber and building materials businesses the department decided to offer a program in this field.

The chairman of the department asked the executive officer of the Southwestern Lumbermen's Association to appoint a small committee to work with him in developing a curriculum which would equip graduates to qualify for positions as assistant managers or managers of retail building material businesses, positions in

the wholesale wood products field, positions as commission lumber salesman, and positions in other related fields.

After a few meetings, the committee agreed upon a curriculum to be titled "Forest Products Marketing." It was offered for the first time in the fall of 1951. The freshman year of the curriculum was designed so that students could transfer from the forest products marketing curriculum to the forestry curriculum or from the forestry curriculum to the forest products marketing curriculum without being seriously handicapped. The two curriculums had only one different course in the freshman year and only three different courses during the sophomore year. In addition to 39 credits in mathematics, science, and English, the curriculum included 12 forestry courses for 25 credits and six business courses for 16 credits.

The forestry courses included general forestry, softwood and hardwood dendrology, forest reports, forest utilization, wood in light construction, logging and milling, wood technology, timber seasoning and preservation, and forest products marketing. The business courses included general economics, elementary accounting, business law, principles of marketing, retailing, and credits and collections. Other significant courses in the curriculum were engineering drawing, engineering materials, advertising principles and practice, farm buildings, psychology, and applied psychology.

Students in this curriculum spent four weeks following the sophomore year at the summer camp at the University Forest where instruction in forest utilization, and wood in light construction was given. The curriculum emphasized courses in forestry which dealt with the properties and uses of wood and courses in business which would be useful to the manager of a small business. The curriculum required 140 credits, including military science and physical education, for graduation. The 1951-52 curriculum is in Appendix D.

Minor changes were made in the curriculum in 1953, 1956, and 1957. The most significant changes involved the addition of a second accounting course, a course in principles of selling and a course in architectural drawing and home design.

Major changes in the curriculum were made in 1958 including the renaming of the curriculum to wood products merchandising (See Appendix E). The four weeks at summer camp were dropped since one of the courses did not seem to be particularly pertinent to the program and the subject matter of the other course could be offered just as well in Columbia as at the summer camp. The business phases of the curriculum were strengthened by adding marketing management and sales control. After this revision the curriculum contained eight forestry courses totaling 22 credits and nine business courses totaling 25 credits. To emphasize the various career opportunities in this field electives were listed in four categories: (1) retail lumber sales and management, (2) wholesale and sale representatives, (3) paper and paper products, and (4) research and development.

In 1964 the name of the curriculum was changed to wood products and building materials management. The purpose of this change was to emphasize to the prospective student the management aspects of the positions for which their training was designed. As a result of the several changes over a period of years, the curriculum had 13 credits of electives. A reduction in elective credits was in part



due to the fact that in 1965, the total of credits required for graduation was reduced to 130.

Although numerous career opportunities were available to the students who graduated from this curriculum the program failed to attract many students. At no time were there as many as 25 students per year enrolled in the curriculum. In 1968 the curriculum was terminated, but by choosing the management option of the new wood products curriculum students can qualify for positions in wood products and building materials management.

### **Residential and Light Construction Curriculum**

In 1962, representatives of the Kansas City and St. Louis American Institute of Architects and the Home Builders Association of Greater Kansas City and St. Louis were added to a membership of the School of Forestry Advisory Council. These representatives became active in urging the School of Forestry to develop a curriculum in residential and light construction. They indicated that home builders were having difficulty in finding suitable trained personnel to serve in various capacities in their companies.

The director of the School of Forestry met with a committee of the Home Builders Association of Greater Kansas City to explore this suggestion. After two meetings, a curriculum was agreed upon (Appendix F). It became effective in the fall of 1963. It differed from the curriculum in wood products and building materials management in that greater emphasis was placed on engineering and architecture. Home builders also required knowledge of a greater variety of subjects than the person engaged in managing a retail or wholesale lumber and building material business.

The curriculum was made up of 21 credits in mathematics and science; four credits in social sciences and humanities, 25 credits in business courses; six credits each in architecture, civil engineering, and speech; nine credits in English; three credits in landscape design, advertising, architectural drawing and home design, and design fundamentals, and 13 credits in forestry involving five courses. The forestry courses included general forestry, wood technology, forest products, wood in light construction, and estimating. Electives constituted 23 credits of the total of 130 credits required for graduation. The 1963-64 curriculum is in the Appendix. Minor changes in the curriculum reduced the electives to eight credits by 1968.

Enrollment in the residential and light construction curriculum was always small and the curriculum was discontinued in 1968. However, students with an interest in this field as well as in wood products and building materials management can, through careful selection of electives, qualify themselves for work in these fields by choosing the management option in the new wood products curriculum.

### **Wood Products Curriculum**

In 1968 the faculty of the School of Forestry approved the discontinuance of the wood products and building materials management and the residential and light construction curriculums and the offering of a new curriculum in wood products (See Appendix G). In the program students may major in one of three fields: wood science, utilization, or management by choosing 30 credits in courses that will meet the requirements of the particular field of specialization. The forestry core of this

curriculum consists of 30 credits in 10 courses namely forest products, wood technology, mechanical properties of wood, seasoning and preservation, wood gluing, finishing, and machining, wood industry management, economic analysis in wood processing, wood harvesting and utilization, chemical and physical properties of wood, and forest products seminar. The curriculum also requires 38 credits in the following subjects: mathematics, statistics, economics, communications, a physical science, a social science, and a course to meet the University requirement of a course that includes a discussion of the Missouri Constitution. The curriculum requires 130 credits for graduation and includes 22 credits of electives.

### **Special Lectures**

To provide the students with contact with outstanding scientists in various fields of forestry and wood utilization several distinguished scientists have spent one or two days giving lectures in their particular field of specialization and have made themselves available to the students to discuss in person the opportunities in their fields of interest.

In April, 1954, the forestry department sponsored a university assembly lecture with Dr. Ralph M. Lindgren, chief of the Division of Forest Disease Research at the forest products laboratory at Madison, Wisconsin, giving two lectures. At one of the lectures which was open to the general public he spoke on the subject, "Wood Deterioration and the Home Owner." The second lecture was a more technical one entitled, "Recent Research on Wood Deterioration by Fungi."

From 1961 to 1966 the National Science Foundation in cooperation with the Society of American Foresters and the Society of Wood Science sponsored a series of lectures. Arrangements were made through the sponsoring societies.

In the spring of 1961, Dr. Lee James, forest economist at Michigan State University, spent three days on the campus and gave a series of lectures on various phases of forest economics.

In April, 1962, Dr. Francois Mergen, forest geneticist at Yale University, gave a series of lectures on forest genetics and tree improvement.

In the fall of 1962, Dr. Eric Anderson, wood technologist in the New York State College of Forestry, spent three days giving a series of lectures in his chosen field.

In February, 1963, Dr. John S. Boyce retired forest pathologist at Yale University, gave a series of lectures in his field of specialization.

In the spring of 1965 four persons gave lectures in their field of specialization. Prof. Paul Casamajor, a lecturer in the School of Forestry at the University of California, gave three lectures on various aspects of the forest fire problem. Dr. George Marra, a wood technologist at Washington State University, gave three lectures on various phases of wood utilization. Ross Tocher, a member of the faculty of the Utah State University, gave two unsponsored lectures in the field of forest recreation. Dr. S. Dennis Richardson, Director of Research for the New Zealand Forest Service, lectured on the subject of "Forestry in Red China."

In the spring of 1966 Dr. Frank Woods of Duke University gave a series of lectures on various aspects of forest ecology. The following month Dr. Eric T. Panshin presented three lectures, each one dealing with specific phases of wood utilization and wood industries.

A contribution of \$200 from the Benson family of Columbia, Mo. (Robert B. Benson, George B. Benson, Margaret B. Benson Virkkunen and Amelia L. Benson) made it possible to defray a part of the expenses of the Benson Memorial Lecture. The donors wished to honor the memory of their father and husband who had always been interested in forestry when he was living and engaged in the retail lumber business. This lecture was given in November, 1966, by William Hagenstein, president of the Society of American Foresters. His subject was "The Wonderful World of Wood." The lecture was given in the evening and was open to the general public as well as students in the School of Forestry. It was attended by approximately 250 people. While on the campus for two days Mr. Hagenstein spoke informally to three classes on timely subjects.

In 1969 a second Benson Memorial Lecture, financed by the Benson family, was sponsored by the School. Dr. Herbert O. Fleischer, director of the Forest Products Laboratory at Madison, Wis., used as his subject "Forestry and the New Society." Approximately 250 persons, mostly students, attended the lecture.

In 1969, four visiting scientists were sponsored by the School of Forestry. Dr. John Haygreen, wood technologist at the University of Minnesota presented a lecture on "Uses of Aspen Lumber." His lecture was sponsored by the Society of Wood Science and Technology and the National Science Foundation. Dr. William E. Reifsnyder, professor of forest meteorology and biometeorology spoke on "Silviculture in Bavaria" before a class in silviculture and spoke on "Computer Simulation of the Energy Budget and Microclimate of a Forest" before a university assembly lecture. Professor Dewitt Nelson of Iowa State University and retired director of the California Department of Natural Resources presented two lectures—"Conflicts in Conservation" and "Multiple Use of Natural Resources." His appearance was sponsored by the Society of American Foresters and the National Science Foundation.

In September, 1969, Dr. Theodore T. Kozlowski of the University of Wisconsin gave lectures to two classes. One lecture was entitled "Food Relations in Woody Plants, the other was entitled "Water Stresses in Trees."

### **Undergraduate Enrollment and Graduates from School of Forestry**

Enrollment in undergraduate programs by years and semesters and number of baccalaureate degrees conferred are shown in Table 3.

Undergraduate enrollment increased from 1947 to 1949 after which there was a decline for three years as a result of a decrease in the number of persons attending the University under the GI bill. By 1954 enrollment exceeded the previous high enrollment and from that time to the present has shown an annual increase except for a few years.

The first undergraduate class was graduated in 1949 with 15 persons receiving Bachelor of Science in Forestry degree. After a high of 31 graduates in 1950 the number of graduates declined steadily through 1954, then increased most years that followed. The high in undergraduate degrees was reached in 1968 when 43 persons received the Bachelor of Science in Forestry degree.

TABLE 3. NUMBERS OF STUDENTS ENROLLED IN UNDERGRADUATE PROGRAMS IN SCHOOL OF FORESTRY AND NUMBER OF GRADUATES

| School Year | First Semester | Second Semester | Graduates |
|-------------|----------------|-----------------|-----------|
| 1947-48     | 113            | 100             | 0         |
| 1948-49     | 128            | 112             | 15        |
| 1949-50     | 130            | 115             | 31        |
| 1950-51     | 117            | 90              | 23        |
| 1951-52     | 96             | 85              | 24        |
| 1952-53     | 101            | 99              | 11        |
| 1953-54     | 109            | 99              | 14        |
| 1954-55     | 132            | 115             | 21        |
| 1955-56     | 128            | 116             | 14        |
| 1956-57     | 155            | 151             | 26        |
| 1957-58     | 158            | 151             | 34        |
| 1958-59     | 161            | 157             | 38        |
| 1959-60     | 174            | 136             | 31        |
| 1960-61     | 146            | 136             | 29        |
| 1961-62     | 164            | 150             | 21        |
| 1962-63     | 170            | 158             | 23        |
| 1963-64     | 191            | 163             | 31        |
| 1964-65     | 194            | 189             | 32        |
| 1965-66     | 210            | 204             | 41        |
| 1966-67     | 217            | 195             | 30        |
| 1967-68     | 233            | 218             | 43        |
| 1968-69     | 244            | 208             | 27        |

### Graduate Programs

The type of graduate program in forestry offered from 1912 to 1921 is described in chapter I. Soon after the undergraduate program in forestry was reestablished in 1946 the forestry faculty became interested in the possibility of offering a graduate program leading to a Master of Science degree. The faculty wanted the stimulation of working with graduate students, and were interested in expanding their research through the use of graduate students who might be employed as assistants on a part-time basis.

Enrollment in the graduate program from 1950 to 1961 was small because funds for graduate assistantships were very limited. It was not until after the passage in 1962 of the McIntire-Stennis Act, which made funds available directly to the state forestry schools, that funds for assistantships became significant. As increased appropriations were made under this act and as the allocation of funds to the University of Missouri School of Forestry increased, and later as National Defense Education Act fellowships became available to the School of Forestry, graduate enrollment showed a significant increase and reached a high of 31 the second semester of the school year 1968-69. The full effect of the increased

enrollment in graduate programs in forestry has not yet shown up in the number of graduates receiving the Master and Ph.D. degrees.

### **Master of Science Program**

When it appeared that the undergraduate program might be accredited by the Society of American Foresters, the department petitioned the graduate council for permission to offer graduate work leading to a Master of Science degree. Approval was given in 1950. Under the initial program a student had to complete a minimum of 32 credits, part of which would be devoted to a thesis. Generally, from eight to 10 credits were devoted to the research and writing of the thesis. When the program was initiated, the Graduate School required that 16 credits, or half of the total credits, must be taken in the department in which the individual was working for the degree. Furthermore, half of the total credits had to be in courses numbered 400 and above, which are courses specifically designed for graduate students.

In 1960 the requirement of a thesis as part of the graduate program was waived for students not particularly interested in research. In lieu of a thesis, such students were required to prepare a comprehensive report which would involve the amount of effort required to earn a minimum of 4 credits. Relatively few students have chosen this type of program.

Prior to 1958 no record was kept on the number of students enrolled in graduate study in forestry. A record was, however, kept of the number of Master degrees conferred in forestry. Prior to 1958, 12 Master of Science degrees were conferred, the first ones being conferred in 1950. Table 4 gives enrollment figures by year since 1958 and gives the number of Master degrees conferred since 1950.

### **Doctor's Degree Program**

As a greater proportion of the forestry faculty had earned Ph.D. degrees by the late 1950s, a strong interest developed among the faculty in offering a Ph.D. program in forestry. Facilities for research were wholly inadequate at that time, but the dean of the Graduate School suggested that the School of Forestry begin compiling information which the graduate council would need to evaluate whether the school was qualified to offer the Ph.D. degree. The school was to move into the New Agriculture Building in 1960 where several excellent laboratories for research would be available. Late in 1960 the school submitted the required information to the graduate council for its consideration.

A committee of three members of the graduate council, including the dean of the Graduate School, met three times with a committee of the faculty of the School of Forestry to secure information to supplement the written report prepared by the School of Forestry and to raise pertinent questions regarding the offering of a doctor's degree in forestry.

Early in 1962 the graduate council, upon recommendation of the committee, gave its approval for offering a graduate program in forestry leading to the Ph.D. This program is subject to the rules and regulations of the Graduate School. Its requirements are similar to those of graduate programs leading to the Ph.D. at most colleges and universities. Initially a reading knowledge of two languages was required, but in recent years a substitution of an adequate knowledge in a field pertinent to the student's interests may be substituted for one of the languages. The

TABLE 4. NUMBER OF STUDENTS ENROLLED IN GRADUATE STUDY AND NUMBER OF MASTER OF SCIENCE DEGREES CONFERRED IN FORESTRY

| School Year | First Semester | Second Semester | M. S. degrees conferred |
|-------------|----------------|-----------------|-------------------------|
| 1949-50     |                |                 | 2                       |
| 1950-51     |                |                 | 0                       |
| 1951-52     |                |                 | 4                       |
| 1952-53     |                |                 | 1                       |
| 1953-54     |                |                 | 1                       |
| 1954-55     |                |                 | 0                       |
| 1955-56     |                |                 | 2                       |
| 1956-57     |                |                 | 0                       |
| 1957-58     |                |                 | 1                       |
| 1958-59     | 3              | 4               | 1                       |
| 1959-60     | 6              | 6               | 4                       |
| 1960-61     | 5              | 10              | 2                       |
| 1961-62     | 5              | 5               | 8                       |
| 1962-63     | 10             | 7               | 2                       |
| 1963-64     | 10             | 4               | 6                       |
| 1964-65     | 17             | 8               | 4                       |
| 1965-66     | 19             | 12              | 7                       |
| 1966-67     | 20             | 13              | 4                       |
| 1967-68     | 22             | 25              | 5                       |
| 1968-69     | 31             | 27              | 8                       |

number of credit hours required for the Ph.D. is not a set figure, but in general, the student must devote the equivalent of three years after earning the baccalaureate degree or two years after earning the Master of Science degree of full-time study and research to complete the requirement. Through 1969, five persons have earned the Ph.D. degree in forestry.

### Short Courses

Short courses have constituted a part of the forestry program since 1937 when a three-day short course was offered. The purpose of this short course was to analyze problems in forest land administration and to coordinate efforts which would lead to their solution. Some of the topics chosen were aimed at setting the stage for the establishment of a state forestry program in the immediate future under the Missouri Conservation Commission. All federal agencies having an interest in proper use of forest land were represented on the program. Approximately 125 persons attended the short course.

The second two-day forestry short course was held in Columbia in February, 1938.

In March of 1950 the Department of Forestry cooperated with the Departments of Agricultural Engineering, Field Crops, and Horticulture in offering a short course in weed and sprout control.

After a lapse of 12 years the next forestry short course was offered in the fall of 1950 at the University Forest. It was a two-day course dealing with sawmill and woods operations and was designed particularly for the farm foresters of the Missouri Conservation Commission.

In February, 1951, a Missouri Forestry Conference of two days was offered, at which new techniques and developments in forestry and wood utilization were discussed by specialists in their particular field.

In 1951, at the request of the Missouri Rural Electrification Administration, the department cooperated with the Departments of Field Crops and Agricultural Engineering in a short course dealing with the control of brush on electric line rights-of-way.

In February, 1953, a short course in aerial photographs in forestry was offered for the benefit of those foresters who had had no training in this subject when they were in college. Fifteen foresters from the U. S. Forest Service and the Missouri Conservation Commission attended this specialized short course.

In 1954 a three-day short course was given in logging and milling at the University Forest for employees of the Missouri Conservation Commission.

In 1954 the first of a series of retail lumber training institutes was given at the request of the Southwest Lumbermen's Association. This short course, designed to upgrade the training of employees of lumber and building materials businesses, covered a period of three weeks and was attended by 34 students from 7 states. The institute was repeated in 1956 and 1957. Considerable help in offering the subject matter was given by a large number of representatives of the lumber and building materials industry. In 1962 a two-week retail lumber training institute was repeated twice with 32 attending the first session and 31 persons attending the second session. This program was repeated in 1963, but the short course was offered only once. Twenty-two representatives from the wood products industries and members of the faculty of the School of Forestry served as teachers. These courses were attended by persons from five states, with approximately two-thirds of the enrollment coming from Missouri.

In May, 1958, a conference on diseases and insects of forest and shade trees was sponsored by the School of Forestry. The subject matter of the short course was designed to meet particularly the needs of personnel of the Missouri Conservation Commission. However, personnel from the U. S. Forest Service, some city park departments, and cemeteries attended the conference with the total attendance being 70 persons.

In October, 1958, the School of Forestry, in cooperation with the Missouri Forest Industries Committee, sponsored the Missouri Forest Resources Conference, which was attended by approximately 400 persons. The purpose of the conference was to review the past accomplishments in forestry and to outline the forestry needs to make adequate progress in the development of Missouri's forest resources in the future. Twelve speakers, representing various governmental agencies and private industry, appeared on the program. Senator Symington and Missouri Attorney General Dalton addressed the conference.

In May of 1960 the School of Forestry cooperated with the Division of Resources and Development, Missouri Conservation Commission, and U. S. Forest

Service, in holding a conference at the Montauk State Park for the benefit of paper companies and other wood-using industries which were interested in learning more about the forest resources of the state.

In October, 1961, the first of a series of forestry short courses designed to meet the needs primarily of the technical foresters in the state were offered. This was followed by short courses in 1962, 1963, 1965, 1967, and 1968. Each of these short courses covered a period of two days and each dealt with timely significant topics which would be helpful to foresters in their daily work. Approximately 80 persons attended each of these short courses. The offering of these courses was requested by the land management working group of the School of Forestry Advisory Council, and members of this group assisted in the choice of topics for the short courses.

At the request of the tree service working group of the School of Forestry Advisory Council, the first tree service short course was offered in December of 1963. The second one was offered in December, 1964, the third in December, 1965, and the fourth in November, 1966. The objective of these short courses was to upgrade the personnel of companies engaged in arboriculture and tree service work. Attendance varied from 40 to 65.

At the request of the recreation working group of the School of Forestry Advisory Council, the School of Forestry offered its first outdoor recreation short course in January, 1967. It was attended by 130 persons. The second such short course was offered in February, 1968, and was attended by 80 persons. The third short course in outdoor recreation was offered early in 1969.



## Chapter IV

### DEVELOPMENT OF RESEARCH

Although some research was developed during the period 1912-1921 and the period 1936-1947 the significant development of research did not begin until 1948. This early research is described briefly in chapter I. This chapter will deal with the period following 1948.

#### Objectives of Research

The objectives of research are stated in two unpublished reports. The first one prepared in 1959, was entitled, *Facts About the School of Forestry Research Program*. The second, entitled *Information for Comprehensive Review of Forestry Research Program, University of Missouri, by Cooperative State Research Service*, was prepared in 1964. Those reports were prepared by R. H. Westveld, director of the school. In the 1964 report the objectives of the research program were stated as (1) to contribute in every way possible to a strong undergraduate educational program, (2) to provide a basis for graduate training, (3) to assist in solving the state's problems in forestry and wood products, and (4) to provide subject matter for extension programs. The latter objective was not included in the 1959 report.

The 1964 report also stated that the initial role of the research program was to organize the work so that each faculty member could devote approximately 50 percent of his time to research and that his research effort would be concentrated primarily during one semester during which time he would devote virtually all his time to research. This goal had not been achieved by 1964 since only six of the 10 members of the faculty in Columbia were devoting 50 percent of their time to research, although two members of the staff, one located at the Weldon Spring Experimental Farm and one at the University Forest, were devoting more than 50 percent of their time to research.

#### Factors Influencing Development of Research Program

Several factors influenced the development of the research program, particularly during the 10 or 15 years after 1948. The chief influences were: (1)

commitment to the development of an undergraduate program which could be accredited at an early date, (2) limited finances, (3) limited numbers of graduate assistants, (4) the research program of the Forest Service of the U. S. Department of Agriculture. The last factor is so significant that it is discussed fully in the section which follows. The members of the faculty who were appointed chiefly in 1947 and 1948 had little or no experience in teaching and therefore had to devote a maximum amount of time to the development of their courses. Consequently, a minimal amount of time could be devoted to research. From the standpoint of the undergraduate educational program this apparently was a sound approach because the forestry curriculum was accredited by the Society of American Foresters in 1950.

With a research budget in fiscal year 1948-1949 of approximately \$6700 which grew to approximately \$30,000 for fiscal year 1953-1954, it is obvious that funds for research were limited. The graduate program initiated in 1949 theoretically made it possible to employ graduate assistants to assist faculty members, but the limited student interest in graduate study and the small size of the research budget did not make it feasible to employ more than a maximum of two or three graduate assistants.

The research program developed slowly but positively until the budget reached \$61,000 during the fiscal year 1955-1956. Within a few more years it reached \$80,000. A substantial expansion of the research program in the immediate future was anticipated. The additional funds were invested primarily in additional faculty, with the objective of lightening teaching loads and providing more time for faculty research.

There was little increase in the annual budget for research from 1956 to 1960 so the appointment of additional faculty proved to be a rather unwise decision. Since the funds for operation of the research projects and for the hiring of graduate assistants could not be increased, the research program reached a plateau until 1963 when the first allotment of funds from the appropriation for the McIntire-Stennis Act became available and funds for the Agriculture Experiment Station were increased. Since then the program has grown substantially and in 1968-69 the budget reached approximately \$290,000.

### **Relation of School of Forestry Programs to the Forest Service Program**

The first research by the Forest Service was initiated in 1935 when one person working out of the Central States Forest Experiment Station in Columbus, Ohio, spent a limited amount of time in Missouri. In 1948 that organization established a branch office in Columbia. This was made possible by an appropriation of \$30,000 by the Congress for this specific purpose.

Provision for cooperation between the Forestry Department of the University and the Forest Service was made through a memorandum of understanding between the Forest Service and the Curators of the University approved in 1948 and revised in 1959. Initially, the Forest Service research program was in the field of timber management and range management with the timber management research devoted largely to the management of shortleaf pine, and with much of this work located on the Sinkin Experimental Forest near Salem.

Later research was undertaken in the fields of forest fires, forest pathology and entomology, watershed management, forest economics, and timber-range land. The Forestry Department chose to devote its major effort in research to (1) silviculture of hardwoods, (2) wood technology and products (3) Christmas tree culture and marketing, and (4) economics and marketing, with greatest emphasis in the field of silviculture.

As the Forest Service program in the fields of pathology, economics, and watershed management developed it seemed that the school, which had full professors on its staff in each of these fields, could strengthen its overall program by expanding in them. Cooperative work with the Forest Service was therefore developed in these three fields.

The chairman of the Forestry Department had the impression that research in these three fields would always constitute a part of the Forest Service program. This did not prove to be the case. The work in forest pathology which was initiated in 1953 was transferred in 1964 to a new laboratory at Delaware, Ohio. The research in watershed management which was initiated in 1956 was discontinued in 1958, and the research in forest economics which was initiated in 1958 was discontinued in 1960.

Thus, three fields in which the school felt it could develop considerable strength through cooperation with the Forest Service no longer constituted a part of the active research program of the Forest Service in Columbia and adjustments in the School's program had to be made. Some cooperative aid funds in these three fields were allotted to the School by the Forest Service, chiefly for the employment of graduate assistants.

By 1965 the Forest Service was committed to work in four fields: (1) silviculture of hardwoods, (2) timber-range land use, (3) wildlife habitat, and (4) fire. At that time the school was active in only one of these, silviculture of hardwoods.

The school continues to work both formally and informally with the Forest Service in developing its total research program. In 1962 the staffs of the two agencies had several meetings designed to outline the research needs of Missouri. These conferences resulted in the publication of Bulletin 792, Research—The Key to the Development of Missouri's Forest Resources and Wood-Using Industries.

In 1959 the Forest Service began a survey of the state's forest resources in order to update the information which had been secured by a similar survey approximately ten years earlier. It was possible to intensify the survey when the General Assembly of the State of Missouri appropriated a specific appropriation of \$80,000 for the biennium 1959-1961.

The Forest Service, U. S. Department of Agriculture, has had a staff of from three to eight professional foresters in Columbia at its research center which serves primarily the state of Missouri. Since the establishment of the center in 1948 three persons have served as the representative of either the Central States Forest Experiment Station or the North Central Forest Experiment Station. Dr. Franklin G. Liming served in that capacity from 1948 to 1959, Dr. Robert A. Ralston served from 1960 to 1967, and Dr. Richard A. Watt has served since the fall of 1967. Twenty-six persons, including the experiment station representatives, have served

on the staff. These include Floyd Bryan Clark, S. Clark Martin, Joseph F. Arnold, Thomas W. Jones, William D. Buchanan, Theodore W. Bretz, Kenneth A. Brinkman, John H. Ehrenreich, Ronald Z. Whipkey, John H. Farrell, Arthur D. Partridge, Frederick H. Berry, Kenneth W. Seidel, Hewlette Crawford, Willis Vogel, Arlo Dalrymple, Ardell Bjugstad, Robert M. Loomis, Robert McQuilkin, John S. Crosby, John L. Millet, Paul S. Johnson, and Michael E. Newhouse and three administrative representatives, Franklin G. Liming, Robert A. Ralston, and Richard F. Watt.

Personnel of the School of Forestry engaged in some cooperative research with personnel of the Research Center. This was especially true in the fields of forest pathology, forest economics, and watershed management. Dr. Bretz, after joining the forestry faculty, worked closely with Dr. Partridge and Dr. Frederick Berry on the oak wilt disease. Dr. Smith worked in the field of forest economics with Dr. John H. Farrell. Dr. Fletcher worked with Ronald Whipkey on problems in the field of watershed management. Two of these persons were located for a short time in Springfield and four of them were located in Salem, two of them for relatively long periods of time.

Some of the field work of the Research Center is carried out at the Sinkin Experimental Forest near Salem. In 1968 one professional forester and two forest technicians were located at Salem. The following professional foresters have served on the staff at Salem: Nelson F. Rogers, R. E. Phares, R. F. Buttery, and Larry McKinley.

### **Cooperation with State Agencies**

Since the School of Forestry felt that it had the responsibility for the State's share of the Forestry research program, this responsibility was identified through a cooperative agreement with the Forestry Division of the Missouri Conservation Commission in 1948. Under this agreement the school received \$2500 from the Forestry Division annually until July 1, 1967. Since that date, \$3500 has been received annually. For several years following execution of the agreement, a four-man committee, two representing the Forestry Division and two representing the Agricultural Experiment Station, met annually to review the progress of the school's research program and to discuss its future development. Ultimately these annual meetings were discontinued with the understanding that any member could request a meeting of the committee if he felt it would be desirable. Since organization of the School of Forestry Advisory Council in 1958, its annual meetings have provided excellent opportunities for communication about the forestry research program and members of the committee have not felt the need for independent meetings.

In 1962 the School of Forestry felt it should initiate research in forest recreation. It felt it needed the counsel and support of the Missouri State Park Board and that year a cooperative agreement was entered into between the School of Forestry and that agency. Initially, the State Park Board provided \$2500 annually and the grants have varied somewhat from this initial figure in recent years. Several conferences have been held in which the director of the Missouri State Park Board and a couple of members of the School of Forestry faculty have participated.

### Research Facilities

The description of the research facilities is brief since they are covered in more detail in chapter II. One of the facilities, the University Forest of 7300 acres in Butler County (near Poplar Bluff) is as important in the educational program as it is in the research program.

The research laboratory facilities in Columbia were reasonably adequate from 1960 until about 1967 when the rapid expansion of the research program made the facilities inadequate. The research laboratories in Columbia are located in the Agriculture Building which was completed in 1960. This building contains laboratories for research in tree physiology and ecology, timber testing, forest pathology, and there is space for refrigeration and preparation of research materials. The total laboratory space is approximately 6500 sq. ft. Greenhouse space in Columbia has always been totally inadequate and has never consisted of more than 1000 sq. ft.

Field facilities for forestry research are reasonably adequate. They consist of the University Forest previously referred to, the Weldon Spring Experimental Farm, the Schnabel Research and Demonstration Woods, and through the cooperation of the Department of Zoology, the Ashland Arboretum. Three of the Agricultural Research Centers have also been used to a limited extent for research.

The opportunities for research are greatly enhanced by an excellent library, a good computer center, and the facilities of the Agricultural Chemistry Department which provide all types of service for chemical analysis.

### Scope of Research

The research which has been in operation since 1948 can be classified in 12 broad categories: (1) silviculture, (2) ecology, (3) economics, (4) forest survey, (5) marketing, (6) forest fire protection, (7) pathology, (8) watershed management (9) wood technology and products, (10) tree physiology, (11) genetics, and (12) forest recreation. The research has been done under 38 different projects, 20 of which had been terminated by 1968. The individual projects vary greatly in scope and in the amount of money expended on them. In terms of money spent on the projects which had been closed by 1964, they varied from \$2000 on a project entitled "Value of Forest Management" to \$83,000 on a project called "Marketing Paneling." On projects which were still in operation on June 30, 1964, the largest expenditures had been \$119,000 for a project entitled "Wood Technology," \$105,000 for a project entitled "Oak Wilt," and \$81,000 for a project entitled "Cutting Methods." The largest sums of money have gone into projects in the fields of silviculture, wood technology and products, forest pathology, economics, and ecology.

The 18 projects in operation in 1968 can be classified in 10 fields of work with three projects in silviculture, two in wood technology and products, four in economics, two in tree physiology, two in genetics and one each in watershed management, ecology, forest recreation, computer programming, and forest soils.

### Review of Program

The research program in forestry has been constantly under review either on an informal or formal basis. Annual reviews were made by the U. S. Department of

Agriculture until 1964, and since then have been made at intervals of three or four years. Reviews chiefly on an informal basis, consisting of conferences of school staff with staff members of the Forest Service and the Missouri Department of Conservation have occurred periodically. The first formal review was made in October, 1959, by a committee of the School of Forestry Advisory Council which was formally organized in 1958.

The committee was given a 24-page report entitled *Facts About the School of Forestry Research Program*, which provided them with background information about the organization of forestry research within the Missouri Agricultural Experiment Station, the purposes of the School of Forestry research program, sources of income for research, past expenditures for various lines of research by years, a list and brief description of each project in operation, its plans for the immediate future, and its budget request for the biennium 1959-1961. In general, the committee felt that the school had used its resources rather effectively, although it did believe that the program might be more effective if the scope of research were not so diversified. The committee strongly recommended that the school be provided with a modest increase in its budget for research.

The committee was composed of D. Howard Doane, retired president of Doane Agricultural Services, serving as chairman; K. Starr Chester, research chemist, Alton Boxboard Company; Clyde Ruble, president, Ozark Flooring Company; Walter George, director of research, Gaylord Division, Crown Zellerbach Corporation; Myron Gwinner, Christmas Tree Producer; Leo Dry, owner of Pioneer Forest; Charles Buffum, president of LaCrosse Lumber Company; and Hugh Steavenson, owner Forrest Keeling Nursery.

The Committee, with the exception of Mr. Buffum and Mr. Steavenson, met all day at Poplar Bluff on Thursday, October 1, 1959. Dr. R. H. Westveld met with the committee to answer questions of the members and to provide additional background information.

The committee's recommendations, which were in the form of a written report included in the School of Forestry Advisory Council meeting minutes, were rather general. These recommendations were: (1) Research in the economic utilization of low-grade timber and waste mill products from processing plants should be pursued aggressively; (2) research should be aimed toward more productive and more efficient use of forest land, and should include research in disease and insect control, fire prevention, improvement of composition of stands, control of grazing, and others; (3) research should be aimed at proper evaluation of land for its highest future and potential use with particular reference to present and future forest land; (4) the research program should include both basic and applied research; (5) the advisory council should emphasize before legislative groups the advantages and necessity for carrying on basic research; (6) the committee encourages an inflow of ideas from outside sources in order that the School's research program can be as effective as possible; (7) the results of research must be put in the hands of those who will apply it in a practical way; (8) research budgets for the School of Forestry must be increased but the committee does not wish to name a specific amount of increase in the budget. Budget planning should extend far enough into the future to assure completion of needed long time projects.

The second formal review of the research program was made in November, 1964, by the Cooperative State Research Service of the U. S. Department of

Agriculture at the request of the director of the School of Forestry prior to his retirement. The committee was composed of four members, two from the Cooperative State Research Service and two from other agencies chosen from a small list of persons provided by the School of Forestry. The two representatives of the Cooperative State Research Service were Philip Joranson and William Cummings. The other representatives were Harold Wilm, director of the New York Department of Conservation and Carl Stoltenberg, chairman, Department of Forestry at Iowa State University. The in-depth review of the research program covered a period of four days. All members of the faculty of the School of Forestry were in attendance at the daily meetings except during those periods when they had classroom commitments.

The committee in advance of their arrival in Columbia had received a 113-page report entitled, *Information for Comprehensive Review of Forestry Research Program University of Missouri by Cooperative State Research Service*. This report provided the committee not only with detailed information about the history and current program in forest research but with information about the forestry situation in Missouri and the objectives of the school and its undergraduate and graduate programs.

The committee provided the Missouri Agricultural Experiment Station with a written report of its review.

Since the report of the research review committee is administratively confidential, the recommendations are not reproduced but some generalized statements which express their recommendations are given. The recommendations were: (1) The School of Forestry should attempt to develop cooperative research with other departments in the University, such as Sociology, Engineering, Physics, and perhaps Zoology. Staff members should judiciously seek financial assistance from foundations and other agencies. More graduate scholarships and part-time assistance should be sought, and cooperative studies should be planned with outside agencies interested in forestry research; (2) a searching analytic review and projection of forestry research programs seems desirable; (3) realignment of some project assignments is desirable in order to utilize more effectively the training of individual staff members; (4) the School of Forestry needs to provide the soundest possible foundation for graduate study and research toward the doctorate program which has now been in operation for about three years; (5) there should be increased coordination in the research program of the School of Forestry and the U. S. Forest Service.

### Results of Research

No attempt is made to discuss the results of all forestry research. Readers who are interested in more information can refer to the publications which have been issued through the Agricultural Experiment Station. The results of a few of the more significant projects are described.

Research in Christmas tree culture and marketing has been significant to the state's economy. It has pointed the way to the production of quality trees and resulted in expansion of Christmas-tree planting from 6000 trees in 1956 to over 1 million in 1968. Missouri-grown Christmas trees compete readily in the market place with trees grown elsewhere.

Information from a study of the distribution of shortleaf pine in relation to geological formations and soils has provided a guide to the forest manager in managing that species.

A new piece of equipment for making fire lines by blowing organic matter from the soil surface was developed by research. It gives the fire fighter a new tool for fighting forest fires.

A better understanding of the tax problem by the owner of forest land resulted from a study of forest-land taxation and provides a basis for equitable taxation of forest land.

Research that developed improved techniques for producing oak paneling and demonstrated the economic feasibility of producing it opened new opportunities for using low-grade oak lumber.

The oak-wilt research, although not yielding satisfactory methods for controlling the oak-wilt disease, has demonstrated that control methods which were thought to be satisfactory were not effective. This discovery kept landowners from spending money on methods that would have failed.

### Research Projects<sup>1</sup>

Research was initiated soon after the Department of Forestry was established. The annual report of the Agricultural Experiment Station for the period ending June 30, 1912, lists three lines of work, but apparently none was recognized as a formal project. The first study dealt with the growing of seedlings of Kentucky coffee tree, catalpa, and black locust in a nursery. The second investigation, in cooperation with the Forest Service of the U.S. Department of Agriculture, dealt with basket willow culture. The third line of work dealt with phenological observations designed to obtain more definite knowledge of the time of leafing, blossoming, and fruiting of important forest trees. Since there is no reference in later reports of the Agricultural Experiment Station to the nursery work and the phenological observations, it is assumed that these investigations were quickly discontinued.

The first formal projects are listed in the report of the Agricultural Experiment Station for the period ending June 30, 1913. These projects were: (1) a study of the effect of storage conditions on the vitality of forest tree seeds, (2) an investigation of methods of culture of varieties of basket willow, and (3) a study of methods of prolonging the service of wood fence posts. Ernest Pegg was listed as the project leader for these projects. Apparently, the project dealing with forest tree seed storage was short lived, because the only further reference to it occurred in the report for the Agriculture Experiment Station for the period ending June 30, 1914. In this study the seed of 15 different tree species was packaged in three different packaging materials and stored under different temperatures. The 1914 report states that "the vitality of the tree seeds was generally low after two years."

### Culture of Black Willow

*Initiated in 1912; terminated in 1923.*

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<sup>1</sup>The information in this section is based on the project plans, annual work plans and annual progress reports and annual reports of the Missouri Agricultural Experiment Station.



*Project Leaders: Ernest Pegg (1912-1922), T. J. Talbert (1922-1923), Other University personnel: A. M. Burroughs (1922-1923).*

When the investigation of the culture of black willow was initiated, 3,445 cuttings of six varieties of willow were planted (1912) but nearly all were lost because of bad planting conditions. In the spring of 1913, another 6500 cuttings were planted and 10,000 cuttings were planted in 1914. No comment on this project appeared in the annual report of the Agricultural Experiment Station for the period ending June 30, 1915. The 1916 report states that gross yields of as much as \$500 per acre of willow rods were obtained but the average that might be expected was \$200 to \$300 per acre. The 1917 report deals with the costs of willow culture, the difference in yields from various varieties, and the relative value of tip cuttings versus lower stock cuttings. Progress on the project was reported in the annual report of the Agricultural Experiment Station for the period ending June 30, 1918, but the 1919 report contained no reference to basket willow culture. Ernest Pegg was no longer listed as a member of the Agricultural Experiment Station staff. Sometime prior to June 30, 1923, the willow culture project evidently was transferred to the Department of Horticulture, since a brief statement on this project is listed under projects of the Department of Horticulture in the annual report for the year ending June 30, 1923. Apparently, the project was discontinued shortly thereafter, because no further reports appeared in subsequent annual reports of the Agricultural Experiment Station.

### **Treatment of Fence Posts**

*Initiated 1913; terminated 1966.*

*Project Leaders: Ernest Pegg (1913-1918), J. C. Wooley (1919-1936), R. H. Westveld (1936-1938), J. C. Wooley (1938-1939), R. H. Peck (1939-1947), K. C. Compton (1947-1952), W. J. O'Neal (1952-1964), J. H. Smith (1964-1965). Other University Personnel: L. K. Paulsell, T. W. Bretz, L. Leney, Wilbur Enns.*

The project dealing with the preservative treatment of fence posts, begun under the project title, "A Study of the Methods of Prolonging the Service of Wood Fence Posts," was active for many years. During the year ending June 30, 1913, 550 posts of several Missouri tree species were cut, treated, and set in the ground the following year. This project was carried by the Department of Forestry and reported on regularly by Prof. Ernest Pegg through 1918. Following the abolishment of the Department of Forestry, the project was apparently transferred to the Department of Agricultural Engineering in 1921 because the report on this project is listed under that department in the annual report of the Experiment Station for the year ending June 30, 1922.

Prior to 1919, reports were made annually on various fungi which attack fence posts (at one time reported to number 20) and on the failure of the posts of various species. The annual report of the Agricultural Experiment Station for the year ending June 30, 1923, states that a new series of fence post treatments was undertaken and the posts set in the ground. Reports on the fence post project, prepared by Prof. W. C. Wooley, appeared in annual reports of the Agricultural

Experiment Station through June 30, 1936. The results of the 25 years of research are included in Missouri Agricultural Experiment Station Bulletin 374, entitled *Effect of Treatment on Fence Posts*, by W. C. Wooley.

Work on the preservative treatment of fence posts did not end with the publication of Bulletin 374. When the pre-forestry curriculum was established in the Department of Horticulture in 1936, a project entitled "Increasing the Durability of Fence Posts" was established in the Department of Horticulture with the Department of Agricultural Engineering cooperating. R. H. Westveld became the project leader. Three hundred fence posts of 14 different species were cut in early 1937 and later treated with a variety of different preservatives. The most extensive research was done on black oak and basswood, two species which were known to have a very short life without preservative treatment. Fifteen different treatments involving seven different preservatives for various periods of treatment were applied.

When R. H. Westveld resigned September 1, 1938, the fence post project apparently was temporarily taken over by the Department of Agricultural Engineering because in the report for the Agricultural Experiment Station for the year ending June 30, 1939, the Department of Agricultural Engineering reported on the project. However, the primary responsibility for the project came back to the Department of Horticulture the following year since the report for the Agricultural Experiment Station for the year ending June 30, 1940, was prepared by R. H. Peck of that department. No progress report on the fence post project appeared between 1941 and 1950.

In 1950, 265 posts were cut, peeled, stacked for seasoning, and measured for statistical purposes. Included were posts of black oak, cottonwood, hickory, elm, and black locust. Hickory and ash were subjected to treatment with pentachlorophenol and to pressure treatment with creosote.

In 1955, 770 posts of ash, hickory, cottonwood, elm, and black locust, were treated with three different preservatives. The posts were placed in a field test plot at the Weldon Spring Experimental Farm. Seventy-five posts of sycamore, oak, shortleaf pine, and hickory, which were treated by the double diffusion method at the logging show at St. James in October of 1953 were also added to the test plot. Two hundred seventy-five posts, consisting of 75 cottonwood and 50 each of ash, elm, hickory, and black oak, were treated by the double diffusion method and placed in a Weldon Spring experimental plot. Seventy-five additional posts (15 of each of the five species) were treated at Weldon Spring with a proprietary treatment (osmosalts). This treatment included 15 posts each of ash, elm, hickory, black oak, and cottonwood.

No new work was initiated after 1955, but annual examinations were made of the test posts at both Weldon Spring and Columbia.

Results of the work were reported by W. J. O'Neil in 1954 as Bulletin 612, *Tests on Treated Fence Posts*, and in 1963 as Bulletin 808, under the same title.

### **Christmas Trees as a Crop**

*Initiated 1937; Terminated 1968*

*Project Leaders: R. H. Westveld (1937-1938), R. H. Peck (1938-1947), R. E. McDermott (1948-1950), R. B. Polk (1950-1968)*

*Other University Personnel—L. K. Paulsell, J. M. Nichols, R. A. Ryker, D. J. Janes, W. G. Yoder*

*Forest Service Personnel—W. D. Buchanan*

The initial objective was to determine which tree species could be grown satisfactorily into quality Christmas trees in Missouri. As the project developed, and as it was determined which species would grow successfully in Missouri, the emphasis shifted to studies of cultural methods which would produce high-quality trees. This led to experiments with fertilizers, pruning, control of insects and other pests, site preparation, and eventually into genetics research.

The first Christmas tree plantations, which were established in three different locations, included Douglas-fir, balsam fir, southern balsam fir, white spruce, Norway spruce, eastern red cedar, and jack pine. In 1940 it was reported that jack pine and eastern red cedar showed the greatest promise for Christmas tree production in Missouri.

Prior to 1950 the Christmas tree research was operated on a small scale, but in 1950 it was expanded to include some research on fertilizers and pruning. The expanded work was carried on at two locations, the Weldon Spring Experimental Farm and the Ashland Arboretum and Wildlife Area. Five different fertilizer treatments were applied to extensive plantings at Ashland. Site preparation involving complete plowing, plowing of furrows, and scalping became an important part of the work. In 1950, 15,720 seedlings of jack pine, Scotch pine, and several miscellaneous species were planted at the Weldon Spring Experimental Farm. Fertilization, site preparation, pruning, spacing, mulching, and comparison of species were studied with this lot of trees. During this same year some preliminary research was done on the marketability of various species. Eventually the marketing study was set up as a separate project. During 1952 and thereafter, work was concentrated on Scotch pine, since it appeared to be the most promising species for the production of high-quality trees. Interest was not lost in jack pine, however, and occasional superior Christmas tree phenotypes in this variable species were reserved as a future breeding base.

In 1952, the first research on the control of vegetation was initiated. This investigation was started because on some sites, particularly on those where fertilizer had been used, vegetative competition was interfering with the development of the trees. Control of vegetation was carried out by hoeing, application of a mulch, and application of chemical sprays. In the spring of 1951, 880 seedlings were planted at the Ashland Arboretum and Wildlife Area. Planting consisted of two different forms of Scotch pine, Norway spruce, white fir, and Douglas-fir.

Because of continuing damage to trees by deer, research on control of deer damage was initiated in 1953.

Because of damage to some plantations by the Nantucket pine tip moth, research was initiated in 1954 on the control of this insect. During the same year, seed from various sources of jack pine and Scotch pine was secured with the objective of growing seedlings from these seeds and initiating provenance studies of the two species. Seven thousand seedlings of jack pine were planted in 1955. They were grown at the state nursery from 22 lots of seed secured from various sources. A limited number of these trees which showed special characteristics were selected

for special care in order that they might be allowed to develop to their fullest.

In 1955, 10,000 Scotch pine seedlings were machine-planted at Weldon Spring as a phase of a production-scale study of Christmas tree production. Some of the results of the research to that date were incorporated into a 21-minute motion picture entitled *Cash and Conservation with Christmas Trees*. A four-page mimeographed manuscript entitled *Recommendations for Growing Christmas Trees* was prepared. Later, as new information was garnered, this manuscript was periodically supplemented and revised. Publicity on the increasing prospects of successful Christmas tree production in Missouri was obtained through occasional TV and radio programs and releases to the press.

During 1957, research designed to genetically improve stock for Christmas tree production was expanded to include (1) parent progeny testing, (2) interspecific crosses of jack pine to lodgepole pine, sand pine, and spruce pine, and (3) performance testing of various species using geographical and ecotypic selections. During the year the project leader personally collected Douglas-fir seed from 11 locations in Colorado, Arizona, and New Mexico in order that adequate tests could be made of the adaptability of Douglas-fir to Missouri conditions. Three additional sources of Douglas-fir seed from Idaho, Oregon, and Washington were secured through correspondence.

In addition to seed of Douglas-fir, the project leader collected seed of Arizona cypress from six sources, blue spruce seed from two sources, white fir seed from three sources, pinyon seed from four sources, and Southwestern limber pine seed from one source. These seeds were later planted in the state nursery and when the seedlings were large enough, they were planted as a part of the species testing already in progress.

Some work was initiated on mechanical cultivation between rows as a means of increasing seedling survival and vigor. An article entitled "How We are Growing Christmas Cheer" appeared in the December 14, 1957, issue of the *Missouri Ruralist*. An article entitled "Tip Moth Control Studies" was published in the November, 1957, issue of *Missouri Forestry and Forest Industries*.

During 1958, considerable effort was directed at controlled pollination of cones on selected jack pine trees. Although controlled pollination presented some real problems during 1958, the extent of these problems became more evident during 1959 when unfavorable weather in combination with techniques and materials used in bagging of ovulate structures brought these problems into sharp focus.

In 1960, research on controlled pollination techniques for jack pine and white pine was intensified. Sixteen bagging treatments were used.

In October of 1961 cones were collected from 18 jack pine trees on which controlled pollination had been accomplished in the spring of 1960. Seedlings were produced from these seeds for later establishment of plantations. In the spring of 1961 additional jack pine trees were cross-pollinated.

In the spring of 1961, five locations well dispersed over Missouri were selected for the planting of seedlings from 93 seed sources of Scotch pine. This work was as a part of a North Central Region project and involved close cooperation between personnel at various state experiment stations in the region and the U.S. Forest Service. This particular Scotch pine provenance stock was produced and distributed

under the supervision of Dr. Jonathon Wright, forest geneticist in the Department of Forestry at Michigan State University.

The results of some of the research with controlled pollination was the subject in 1962 of a master's degree thesis entitled *Artificial Extraction Effects on Pine Pollen Vigor* by Russell Allen Ryker.

In 1963, when the first funds under the McIntire-Stennis Act became available the controlled pollination work was set up as an independent project through a special grant from funds made available under this act in competition with the various eligible schools.

In 1964, a bulletin entitled *Christmas Trees—A Missouri Crop*, by R. Brooks Polk, was issued as Bulletin 820. The material in this publication drew upon the many years of research on Christmas tree culture and marketing.

In 1965, test plots of blue spruce, white fir, and pinyon pine of known origin were established at the Ashland Wildlife Area. A randomized complete block of eight Douglas-fir races was also established.

In 1966, R. Brooks Polk collaborated with five other authors in preparing an article, "Performance of Scotch Pine Varieties in the North Central Region," which appeared in Volume 15 of *Silvae Genetica*. This article summarized early results obtained in the seed origin testing of Scotch pine in the North Central Region. Polk also prepared an article entitled "Reproductive Phenology and Precocity as Factors in Seed Orchard Development" which appeared in the 1966 Proceedings of the *Fifth Central States Forest Tree Improvement Conference*.

This project was terminated in 1968 and a summary file report will be prepared. Some phases of this project were transferred to a new project, "Genetic Investigations in Forestation," and other phases which were initiated in 1963 under the project title, "Moisture in Pine Pollination," are being continued under that project.

After the project was terminated, results of research on the Nantucket pine tip moth was the subject of a master's degree thesis by William G. Yoder in 1969 entitled "A Study of the Nantucket Pine Tip Moth in Missouri: Its Life Cycle and the Influence of Predators and Precipitation Deficits upon its Infestation Levels."

## Rehabilitation of Missouri Forests

*Initiated 1948; Terminated 1968*

*Project Leaders—J. M. Nichols (1948-1954), L. K. Paulsell (1955-1968)*

*Other University Personnel: R. H. Westveld, R. Hortin, P. W. Fletcher, P. Y. Burns, D. Shaw, I. L. Sander, A. J. Nash, G. S. Cox, C. D. Settergren, P. G. Scowcroft.*

This project was the first new project started after the establishment of the Department of Forestry in 1947. It was a broad project designed to study several problems involved in rehabilitating the rundown forests of Missouri. Three lines of work were started initially. These were: (1) investigation of acorn production, (2) direct seeding of acorns, and (3) study of the effects of fire on trees and the site. Four other sub-projects were initiated later.

In the investigation of acorn production, the objective was to determine the quantity of acorns produced annually by several species of oaks of different sizes and to determine the condition of the acorns produced. The first results of the investigation were published in 1954 as Bulletin 611, *Acorn Production in the Missouri Ozarks*, by J. M. Nichols, Paul Y. Burns, and Donald M. Christisen. The sub-project was transferred the same year to a project entitled Ecological Studies in Forestry. The objectives of the sub-project were altered somewhat. The second report in 1960 was the subject of a master's degree thesis by Syed Shah Ali, entitled *Factors Affecting Acorn Production of Selected Species and Areas in Missouri*. A second bulletin on acorn production, the data for which was secured as part of another project, was Research Bulletin 750, *Pin Oak Acorn Production and Regeneration as Affected by Stand Density, Structure, and Flooding*, by Leon S. Minckler and Robert E. McDermott, dated 1960.

The sub-project was terminated in 1963.

The initial work with direct seeding of acorns was confined to three species—scarlet oak, black oak, and white oak. The first work was designed to determine the effect of litter upon germination and survival. Because of severe damage by mice, research in 1950 was concentrated on methods of controlling this damage. Acorns were treated with eight different repellents and some acorns were protected by hardware cloth cones. Later, under another project, the effect of fire in reducing litter to discourage rodents was tested.

In 1951 the sub-project dealing with direct seeding was expanded to include shortleaf pine.

In 1954, the results of the direct seeding research were published as Bulletin 609, *Direct Seeding of Oak in Missouri*, by J. Milford Nichols.

The sub-project was terminated in 1959.

To study the effect of fire on trees and site, six permanent sample plots were established at the University Forest. Two of the plots were kept in their natural condition, two were burned annually, and two were to be burned at intervals of five years.

In 1950 a second set of six fire plots was established at the University Forest on a site which was different from the one where the first plots were established.

In 1957 the results of burning on Ozark hardwood stands were summarized in Research Bulletin 640, *Effects of Burning on Ozark Hardwood Timberlands*, by Lee K. Paulsell. In 1965 research on the effects of fire on hardwood forests in the Missouri Ozarks was the basis for a master's degree thesis by Paul G. Scowcroft, entitled *The Effects of Fire on the Hardwood Forests of the Missouri Ozarks*.

In 1950 research was initiated on the control of inferior species. This work was aimed particularly at the control of sprouts originating from cut trees. The work included several different species, several different chemicals, different methods of treatment, and different seasons of treatment. In some of the research, there was cooperation with the U.S. Forest Service and Agricultural Research Service. The first results of this research were recorded in a master's degree thesis by J.M. Nichols in 1952, entitled *Effects of Chemicals on Tree Species*. Bulletin 615, written in 1954 by S. Clark Martin, J. M. Nichols, and Dayton L. Klingman, entitled *Controlling Woody Plants with 2, 4,5-T; 2,4-D and Ammate*, discussed the results of the research.

The sub-project on the control of inferior tree species was transferred to a station-wide project, participated in by the Departments of Agricultural Engineering, Horticulture, Forestry, Field Crops, and the U.S. Department of Agriculture.

During 1957 the results of the work on the control of inferior tree species were incorporated into Research Bulletin 638, *Control of Woody Vegetation*, by J. Milford Nichols.

Research was initiated on the pruning of oaks in 1950. The objective of this project was to improve the quality of trees for lumber. The initial work involved 280 scarlet oak trees on two sites—a ridge top and an east facing slope. It included pruning during different seasons and to variable heights.

Bulletin 581, entitled *Oak Pruning in the Missouri Ozarks*, by Paul Y. Burns and J. Milford Nichols was issued in 1952. This report was based upon detailed examination and study of some trees which had been pruned in 1937 by the U.S. Forest Service.

In 1952, thirteen additional pruning plots were established in young oak stands in Butler, Shannon and Boone counties.

In 1959 the work on pruning was placed on a maintenance basis, which meant annual examination of the trees on various plots.

In 1951 a new sub-project dealing with the conversion of low-value hardwood stands to conifers was started. Forty one-tenth acre plots were established and various methods were used to dispose of the inferior hardwoods. In 1952, five species of conifers—Scotch pine, shortleaf pine, white pine, loblolly pine, and eastern red cedar—were planted on the treated plots.

In 1954, twenty additional plots for the study of the improvement of low quality understocked hardwood stands were established and ten of these plots which were planted in 1955 were treated in preparation for the planting. In 1959 the research was put on a maintenance basis.

In 1951, a new sub-project entitled *Decay and Defect in Missouri Trees* was started. The objective of this research was to determine the quantity of decay and defect in Missouri oaks and to relate these to external indicators. Preliminary results of the research were reported in 1952 in a master's degree thesis by Dale L. Shaw, entitled *Defects in Missouri Oaks*. In 1953 more complete results were reported in a master's degree thesis by Ivan L. Sander, *Defects in Oak Sawtimber in Missouri*, and in 1955 in Bulletin 642 *Fire Scars and Decay in Missouri Oaks*, by Paul Y. Burns.

The project was terminated in 1968 but manuscripts for master's degree theses and experiment station bulletins are still pending.

### Missouri Forest Plantations

*Initiated 1948; Terminated 1954*

*Project Leader - R. W. Dingle*

*Other University Personnel - R.B. Polk, R. Hortin, R.H. Westveld, P.W. Fletcher*

The objectives of the project were (1) to determine the relative degree of success of various tree species in plantations as measured by survival, health, and rate of growth, and (2) to determine the extent to which such factors as soil

texture, soil moisture, aspect, slope, precipitation, insects, disease, and grazing are responsible for the success or failure.

The project was supported by funds from the Agricultural Experiment Station, the U.S. Forest Service, and the Forestry Division of the Missouri Conservation Commission.

Most of the work on the project consisted of an examination of selected plantations throughout the state to determine the factors which were responsible either for the success or failure of the plantations. It was hoped that the results of this study would suggest factors which should be studied intensively to secure more conclusive answers to the success or failure of forest plantations. As a part of the work on shortleaf pine an intensive study was developed to determine the extent to which soil conditions affected the growth of this species.

The field work on the project which involved a part of the time of three persons was completed by 1951, after which the analysis of the data was undertaken. The project yielded two publications, one a bulletin and the other a research bulletin of the Agricultural Experiment Station. The research bulletin by Richard W. Dingle, *Relationship of Shortleaf Pine Growth to Soil Properties*, was issued in 1954 as Research Bulletin 541. Bulletin 640, by Richard W. Dingle and Peter W. Fletcher, entitled *A Survey of Forest Tree Plantings in Missouri*, was issued in 1955.

#### **Forest Management and Utilization (Weldon Spring)**

*Initiated 1950; Terminated 1954*

*Project Leader: L.K. Paulsell*

*Other University Personnel: P.W. Fletcher*

The project was established soon after the acquisition of the Weldon Spring Experimental Farm by the university. Some of this work was done in cooperation with the departments of Soils, Agricultural Engineering, and Animal Husbandry. The Northern Ozark Research Center of the U.S. Forest Service was involved in a limited way.

Seven lines of work are listed in the project plan as follows: (1) inventory of timber stand and growth, (2) plan of management of the forest, (3) methods of timber management for various products, (4) forestation of bare land and the management of the resultant stand, (5) farm forest unit, (6) effects of various management practices on soil fertility and on soil and water conservation, (7) methods of utilizing trees of various species, sizes, and condition classes most profitably. It is obvious from the titles of these sub-projects that some phases of the work could not be classified strictly as research. It is evident also that some of the projects were so broad in nature that they inevitably would have to be reconsidered for more specific and intensive research.

The work on the inventory and growth of timber stands was completed late in 1950. Based on the information secured, a manuscript for a master's degree thesis was prepared in 1950 by Lee K. Paulsell entitled *Management Plan for the Weldon Spring Experimental Forest*.

During 1952 three studies were initiated under the sub-project dealing with timber management for various products. These studies were (1) effects of forest



grazing, (2) cottonwood management, and (3) silvics of eastern redcedar.

Most of the work at Weldon Spring was temporarily terminated in 1953 when the forester in charge of the area resigned. Some of the work that was initiated there was continued elsewhere and later when a forester was stationed at Weldon Spring, research was resumed mostly under new project titles. Results of some of the earlier research were published later under the new projects.

### **The Value of Woodland Management in Missouri**

*Initiated in 1949; Terminated 1954*

*Project Leader: P. Y. Burns*

Interest in the subject was stimulated in part by the interest of the Federal Reserve Bank of St. Louis in securing specific information on the income that could be derived from managed forests in Missouri. The objective of the project was to determine the financial returns from managed woodlands over a period of time and to study the present condition and value of these woodlands. The work involved the location of the relatively few managed woodlots, individual studies of the records which had been maintained by the owners, and then a field study of the condition and value of the woodlands.

Paul Burns gave an oral report based on the study of seven managed woodlands October 19, 1949, at a meeting of the Missouri Bankers Association in Van Buren. In 1950 a master's degree thesis entitled *Income Possibilities from Small Woodlands in Missouri* was written by Edwin H. Glaser. In 1950 results of this study were published as Circular 349, *Value of Farm Woodlot Management*, by Paul Y. Burns.

The second phase of the project which was to deal with the growth and yield of Missouri timberland was initiated in 1952 when thirty permanent sample plots were established in managed woodlands. Each tree on the plots was numbered and several types of data were recorded. In 1954 after the project leader resigned, the work was transferred to a new project of broader scope entitled "Economics of Timber Production."

### **Utilization and Marketing of Farm Woodland Products**

*Initiated 1951; Terminated 1954*

*Project Leader: R. C. Smith*

*Other University Personnel: R. Hortin, J. Ochrymowych, W. J. O'Neil, R. H. Westveld*

Its objective was to determine if products from farm woodlands in Gasconade, Osage, and Franklin Counties were being utilized and marketed as effectively as possible. These three counties were chosen because the timber stands were better than the average for the state and the general impression existed that the owners of the woodlands were doing a better-than-average job in utilization and marketing. However, there was some question as to whether trees were being converted into the most valuable products and marketed most effectively.

A detailed survey of 351 randomly selected plots was made to determine the condition of the woodlots and their rate of growth. The farm operators were interviewed on a random sampling basis to determine the amount of wood products

required for home use on the farm, the amount of wood products and timber bought, the amount of timber sold and price received, the amount of work expended in harvesting timber, and the farm owner's interest in, and knowledge of, woodland management, the condition of the woodland, and the equipment the owner had with which to do woods work. A survey was also made of the various outlets for disposing of wood products.

Although the market for some wood products was rather limited, many landowners were not taking advantage of public assistance either in managing their woodlands, or in disposing of their products most effectively. The results of the study were published in 1954 as Bulletin 623, *Marketing Farm Woodland Products*, by Richard C. Smith.

### Techniques for Improving the Results of Forestation

*Initiated—1952; Terminated—1968*

*Project Leader: R. W. Dingle (1952-1953), R. B. Polk (1954-1968)*

*Other University Personnel: P. W. Fletcher, L. K. Paulsell, J. M. Nichols, R. H. Westveld, R. A. Musbach, C. D. Settergren, D. J. Janes.*

The overall objective was to carry on research to provide a basis for developing forestation techniques which would lead to improved results in forestation. Initially the project dealt with two problems, (1) effect of insecticides, fertilizers, and soil conditioners on the success of black walnut and (2) determination of the species that would be most suitable for fence post plantations.

A study of the success of planting black walnut initially dealt with the effect of treatment of seedlings and the planting hole on survival and growth of planted one-year-old black walnut seedlings. The tests involving treatment of seedlings made use of DDT and chlordane for the control of insects and use of krillium soil conditioner and a fertilizer. Both of the latter were used to improve soil conditions. Each of these four treatments was used singly and in every combination of the four treatments. The results were studied for two or three years and then, with a change in personnel, the work was discontinued.

The first research designed to determine species most suitable for fence post plantations dealt with locating thornless trees of Osage-orange and black locust which would provide a source of cuttings for developing planting stock of these species. Superior strains of eastern redcedar were also sought. Research dealt with various cultural methods which would develop suitable planting stock of the two hardwood species. After two or three years of work the research was terminated when the project leader resigned from the university.

When a new project leader took the responsibility for the project, the research was reorganized along the following lines: (1) propagation of woody cuttings, (2) methods of planting, (3) methods of site preparation for planting, (4) planting versus direct seedling, (5) fall versus spring planting, (6) testing of stock from various seed sources, and (7) site adaptability of timber species.

In 1955 twenty-two experimental plots involving 4,896 trees of nine hardwood species were planted at the Weldon Spring Experimental Farm. Part of the trees were hand planted and others were machine planted. In some of the plots a single species was planted; in other plots all nine species were planted on mixture. This

will ultimately provide an opportunity to compare the development of the trees in both pure and mixed stands.

In 1955 twelve experimental plots involving 7,200 seedlings were planted at Weldon Spring. Three methods of site preparation were used, row plowing, full plowing of the site, and no plowing. Weed control was later incorporated into this experiment. The two methods of weed control used were mowing of the vegetation and treatment with chemicals. Also in 1955, 360 nuts of black walnut and 360 red oak acorns were direct seeded to compare the survival and development of trees originating from seed to those which had been developed as 1-0 nursery stock. The walnut seed and the acorns were not protected against rodents and all of the seed was destroyed before germination took place. Severe drouth was responsible for heavy loss of seedlings planted in 1955.

In 1956 four conifers—scotch, red, white and jack pine—and five hardwood species—black walnut, white oak, red oak, black cherry, and green ash—were planted at Weldon Spring. The same types of site preparation were used in these experimental plots as were used in those established in 1955. Eight hundred seedlings of each species, red oak, black cherry, and green ash were planted at Weldon Spring. The same types of site preparation were used in these experimental plots as were used in those established in 1955. Eight hundred seedling of each species, for a total of 7,200 seedlings were used. The plantings were divided between east and west slopes. As in 1955, seeds of black walnut and acorns of red oak were also planted.

In 1956 seedlings of loblolly pine and shortleaf pine from two different seed sources were planted at Weldon Spring Experimental Farm and the Ashland Arboretum and Wildlife Area. Seventy-nine trees of each species were planted on two different sites. This was cooperative undertaking with the U.S. Forest Service which supplied the planting stock.

A total of 2,880 seedlings and acorns of white oak, red oak, and black oak were planted in 1958 on three soil types at the Weldon Spring Experimental Farm, the Ashland Arboretum and Wildlife Area, and the Schnabel Demonstration Woods. On some of the experimental plots acorns and seedlings were protected through use of hardware cloth. On one replication of plots, seedlings were wrapped with heavy aluminum foil as a protection against rodents.

In 1959 experimental plots of baldcypress, sweetgum, and American sycamore were planted at the Delta Research Center in southeastern Missouri. The objective was to determine the relative adaptability of the species to a lowland, flood-susceptible site typical of that area.

Annual examinations of all experimental plots established between 1955 and 1959 were made with the objective of determining survival and rate of growth of trees under the variety of conditions found on the various experimental plots. The first publication based on the five years of work was a master's degree thesis by Carl D. Settergren in 1960 entitled *Initial Survival of Oak in River Hills*. A second master's degree thesis in 1961 by Solomon Quaynor was entitled *Site Preparation as a Cultural Measure in Establishing Pine Plantations on Old Fields in Central Missouri*. This report dealt with jack pine and scotch pine.

In 1961 cuttings and seedlings of two local races of *Populus deltoides* were planted at the Delta Research Center. Planting stock and cuttings were secured

from southeast Missouri and from the Missouri river lowlands near Boonville.

In 1964, experiment plots were established at the Delta Research Center to study the effect of weed control on cottonwood, sycamore, and silver maple. Several kinds of mechanical and chemical treatments were studied.

A second set of experimental plots to study the effect of weed control on cottonwood was established in 1966 at the Weldon Spring Experimental Farm. This work supplemented the work initiated in 1964.

In 1956 the first research on the poplar hybrid, *Populus alba* L. X *P. grandidentata* Michx, from southeast Iowa was begun and tests of seedlings (1-0 stock) of eastern cottonwood, *Populus deltoides* Bartr. were undertaken. Cuttings of the hybrid were used for comparison with seedlings of eastern cottonwood. In 1957 a spacing study of eastern cottonwood involving spacings of six feet by eight feet, eight feet by nine feet, and nine feet by 12 feet was established on an upland and a bottomland site at the Weldon Spring Experimental Farm. Due to loss caused by flooding in the spring of 1957 replanting was necessary in 1958.

In 1960 research was initiated in a nursery bed on the campus in Columbia on vegetative propagation of the poplar hybrid *Populus alba* X *P. grandidentata*.

In 1962 an experiment with the hybrid poplar involving three different diameters of cuttings ( $\frac{1}{4}$  inch,  $\frac{1}{4}$  to  $\frac{1}{2}$  inch, and over  $\frac{1}{2}$  inch), three planting methods, and the use of a hormone was initiated.

Results of some of the research at the Delta Research Center was the basis in 1965 of a master's degree thesis by Loren Floto entitled *Evaluation of Southeast Missouri Cottonwood Plantations*.

In 1966 a study of biological control of the Nantucket pine tip moth was initiated making use of two predators.

### Effect of Forest Cover on Soil and Water Resources

*Project Leaders: P. W. Fletcher (1952-1959), L. K. Paulsell (1959-1966), C. D. Settergren (1966- )*

*Other University Personnel: R. A. Musbach, W. T. Semago, D. J. Janes, D. R. DeWalle, D. L. Boehm*

*U. S. Forest Service Personnel: K. G. Reinhart, R. Z. Whipkey, E. A. Johnson*

*U. S. Weather Bureau: V. Alexander*

In the initial work basic stream-flow records were obtained for the period 1921 through 1951 on five major drainage basins in forest areas and on four watersheds in which agricultural land was predominant. All existing precipitation records for these drainage basins were tabulated and weighted mean monthly values for each basin were calculated.

Relationships were analyzed between rainfall and runoff over a 31 year period for the months of February, March, and April when runoff is usually most responsive to monthly rainfall.

The first comprehensive report on the results of a small watershed study was a master's degree thesis by Ronald D. Whipkey in 1958 entitled *Some Basic Hydrologic Relationships for Three Small Watersheds in the Missouri Ozarks*.

The revised thesis was published in 1959 as Research Bulletin 692, *Precipita-*

*tion and Runoff from Three Small Watersheds in the Missouri Ozarks*, by R. Z. Whipkey and P. W. Fletcher.

Another phase of the project was concerned with the effect of timber cutting and surface soil conditions on soil moisture. The study was based on the establishment of 20 plots in fully stocked pole-size shortleaf pine and mixed oak stands in Reynolds and Butler counties. The overstory and understory were subjected to a variety of treatments to determine the effect of a variety of factors on soil moisture. Records of temperature, humidity, rainfall, wind movement, and water evaporation were recorded.

In one phase of the study of soil-moisture, interception of precipitation by hardwood litter and different densities of crown canopy was studied rather intensively. This work was in progress from 1958 to 1960 and was the basis for a master's degree thesis entitled *Interception of Precipitation by Hardwood Litter*, by William T. Semago. Peter Fletcher resigned from the university in 1959, and Andrew J. Nash revised the manuscript of the thesis which was then published in 1962 as Research Bulletin 796, *Interception of Precipitation by a Hardwood Forest Floor in Missouri Ozarks*, by William T. Semago and Andrew J. Nash.

A piece of equipment developed for field measurement of a soil's water transmission rate was the basis in 1957 for the article, "A device for rapid field measurement of a soil's water transmission rate," *Soil Science Society of America Proceedings* 21:560-562, by Peter W. Fletcher.

Some of the soil-moisture research was done in cooperation with the Vicksburg Research Center of the Southern Forest Experiment Station of the Forest Service. This research was the basis for Research Bulletin 800, *Comparative Influence of Hardwood Trees, Litter, and a Bare Area on Soil-Moisture Regimen*, by Howard W. Lull and Peter W. Fletcher, published in 1962. In 1957 an article by Peter W. Fletcher and R. E. McDermott entitled "Moisture Depletion by Forest Cover on a Seasonally Saturated Ozark Ridge Soil" was published in Volume 21, pages 547 to 550 in the *Proceedings of the Soil Science Society of America*.

In 1958 a small watershed at the University Forest in Butler County was selected for intensive study of streamflow. A weir was constructed and instruments were installed to provide a continuous record of water stage. Topographic and vegetational surveys of the watershed were made to relate streamflow to topographic and vegetation conditions. For several years streamflow records have been maintained for the undisturbed forest. Eventually it will be subjected to various stand treatments to determine the effect of such treatments on streamflow. Based on the records secured on the small watershed at the University Forest on which records had been maintained for seven years, a master's degree thesis entitled "The Hydrologic Budget on an Ozark Watershed," by D. R. DeWalle was prepared in 1966. D. R. DeWalle also was the author in 1966 of an unpublished manuscript entitled *Baseflow and Springflow Components on a Forested Ozark Watershed*.

During the fiscal year 1965-66, work on three additional gaging installations equipped with "h-type" flumes was completed. This provides an opportunity for the study of runoff following a variety of forest treatments.

In 1966 a cooperative study on fire damage to water resources in the eastern United States was carried out for the Forest Service of the U. S. Department of Agriculture. This research was used as the basis for a doctor's degree thesis at

Colorado State University in 1967 by Carl D. Settergren entitled "The Effects of Fire on Wildland Hydrology."

### Utilization of Native Timbers and Residues

*Initiated 1952*

*Project Leaders: L. Leney (1952-1960), E. A. McGinnes (1961- )*

*Other University Personnel: J. P. Pastoret, J. H. Smith*

This project was initiated under the title "Wood Technology." The broad objective of the project was to do research which would result in better utilization of the timber resources and in the production of better quality products in more efficient manner.

Since no research in wood use had been done previously in Missouri the initial objectives of the project were (1) to survey the wood technology problems of the Missouri wood-using industries through observation and contact with the owners of the industries and (2) to develop a wood technology laboratory which would be adequate to do research on the more significant problems.

During the first two years more than 70 wood-utilization plants were visited to observe the techniques of processing various wood products and through observation and discussion with the owners of the plants to determine the most significant problems in the utilization of wood. During this same period sufficient equipment was obtained to begin research on the more significant problems.

After the industry survey was completed the decision was made to organize the research into four broad types of studies: (1) structure and properties of wood, (2) modification of wood properties (through seasoning and the application of preservatives or other materials to the wood), (3) improvement of techniques for fabricating products, and (4) uses of low-grade wood and residues.

During the period 1952-1960 the major effort was devoted to studies of moisture relations in wood as they relate to seasoning, to the cutting of wood for veneer, and to the amount and kind of wood residue produced by the various wood-using industries.

Research on the cutting of wood for veneer was reported in Research Bulletin 744, *Mechanism of Veneer Formation at the Cellular Level*, by Lawrence Leney in 1960. The results of some of the research reported in this bulletin were developed into a motion picture entitled *A Study of Veneer Formation*.

When the project leader resigned in 1960 the new project leader, appointed early in 1961, made some revisions in the project plan. He revisited most of the wood-using plants in the state to gain first-hand information on the processing and marketing techniques in use and to gather a characterization of the wood-using industries. In this survey, which covered a period of about two years, more than 100 plants were visited. The results of this survey were published in 1965 as Bulletin 824, *A Survey of Wood Using Industries in Missouri*, by E. A. McGinnes, Jr. A condensed version of this publication was published as an article, "The Wood Using Industries of Missouri," in *Missouri Business*, volume 14, pp. 4-15.

One of the first new lines of research initiated by the new project leader was a study of growth and other factors in relation to the quality of wood. The first study was limited to shortleaf pine. Specific gravity, growth rate, chemical

characteristics, summer wood, fiber length, fiber wallthickness and fibril angle were investigated in relation to the quality. The results of this research were published in 1963 as Research Bulletin 841, *Growth Quality Evaluation of Missouri-Grown Shortleaf Pine*, by E. A. McGinnes, Jr., and condensed in an article by R. A. Ralston and E. A. McGinnes, Jr., in 1964, "Shortleaf Pine Wood Density Unaffected by Ring Growth," in *Southern Lumberman*, Volume 208, pages 17 to 19. Since then a similar study has been made of scarlet and black oak.

A special study in the field of growth-quality relations of shake in black walnut is in progress. This defect constitutes a real problem for wood-using industries which rely entirely on black walnut.

In 1965 a study of dimensional stability of oak as influenced by temperature, humidity, and grain direction was initiated.

In 1965 a study of the amount and variation of extractable material in redcedar logs was initiated when it was found that the novelty industry which makes extensive use of redcedar was encountering serious difficulty with bleed-through in the finishing of their products. In the study of this problem, the effects of radiation (ultra violet, visible, and infra-red), wood extractables, sealers, and methods of packaging were studied.

Since the growth-quality evaluation of wood became such a significant phase in the research on this project, this research was set up under a separate project in 1964.

### **Economics of Timber Production**

*Initiated 1953; Terminated 1962*

*Project Leaders: P. Y. Burns (1953-1954), R. C. Smith (1954-1962)*

*Other University Personnel: A. J. Nash, A. B. Cole, R. H. Westveld*

During the nine-year period that the project was active, four sub-projects dealing with widely different subjects were activated. The topics with which they dealt were (1) growth and yield of oak stands, (2) taxation of forest land, (3) forest site evaluation, and (4) case studies of income from small woodlands.

The objective of the first sub-project was to determine the growth and yield of well stocked stands of oak, composed chiefly of trees of sawtimber size, on a variety of sites. The research was initiated as a part of the project, called "The Value of Woodland Management in Missouri" (see description of this project). After the transfer of the research to the new project, additional field plots were established to bring the total number to 150.

In 1956, five years after the establishment of the first plots, they were remeasured and the data on 75 plots which had not been disturbed by fire or cutting were used in the analysis which was the basis for Research Bulletin 700, *Growth in Well-Stocked Natural Oak Stands in Missouri*, by Andrew J. Nash. A master's degree thesis by Francis Holt in 1963 entitled *An Analysis of Growth Rates of Oak in Missouri* was written on the basis of a second remeasurement of the growth plots and further analysis of the data.

The work on the sub-project dealing with taxation of forest land was designed to determine the actual taxation per acre and the extent, if any, to which taxation of forest land was a deterrent to the practice of forestry. Data on assessed valuation

and taxes over an 11-year period, 1944-1954, were obtained from 836 owners representing 123,308 acres of entirely forested land and 281 owners of cleared and improved farm land representing 20,803 acres in 26 counties in the Ozark region. The results of the forest taxation study were published in 1957 as Research Bulletin 624, *Taxation of Forest Land in South Missouri*, by Richard C. Smith.

The primary objective of the sub-project, case studies of income from small woodlands, was to determine current income from timber of rural householders in Dent County and to estimate possible future income. Secondary objectives were to determine the owners' attitudes toward growing timber as a crop, woods fires, timber stand improvement work, and the need for credit with woodland and timber as collateral. The master sample of the United States Department of Agriculture was used to make the selection of householders who were interviewed and whose woodlands were inventoried. The sample was the same as that used by personnel of the Department of Agricultural Economics in their study on resources and levels of income of rural households.

Growth studies and cutting recommendations were also determined for these timber tracts. One hundred fifty-eight households constituted the sample, of which 18 were vacant, 71 were non-farm households, and 69 were farm households.

A formal written schedule of questions was not used to interview the householders but the information and data obtained were recorded immediately after the interview. Each forest property was mapped by stands based on crown size and crown density, and the timber inventory was made by stand classes. Rate of growth for the past 10 years of one tree on each plot was recorded. The number and grade of logs in each saw-timber tree were recorded during the field survey. The trees were recorded by four classes, (1) those to be left, (2) unmerchantable trees to be cut, (3) merchantable trees to be cut, and (4) cull trees. The data obtained in this sub-project provided the basis for a master's degree thesis in 1959 by Alex B. Cole, entitled *The Forest Resources of Rural Householders in Dent County, Missouri*. The manuscript of the thesis was revised by Alex B. Cole and Richard C. Smith and published in 1960 as Research Bulletin 740, *The Forest Resources of Rural Householders in Dent County, Missouri*.

The sub-project on forest site evaluation was transferred in 1958 to a new project entitled "Forest Site Evaluation."

### **Marketing the Timber Crop**

*Initiated 1953; Terminated 1958*

*Project Leaders: R. C. Smith (1953-1954), W. J. O'Neil (1954-1958)*

*Other University Personnel: J. M. Nichols, Lawrence Leney, L. K. Paulsell.*

This project dealt with three problems but two of them were transferred to other projects and are discussed under these. The work on the preservative treatment of fence posts was initiated many years previously and was transferred to another project in 1958. The initial work on the use of low-grade oak lumber for manufacturing paneling was initiated under this project, but when the research was greatly expanded and funds became available from regional research funds of the U. S. Department of Agriculture, a new project to cover this more adequately was established.



The major research of this project was done on a subproject entitled "The Effect of Lumber Grading on Sale Value of Lumber." Four small sawmills whose operators were willing to undergo the inconvenience involved in the study were selected. At each of these mills a record was kept of the output of lumber from each log. The gross and net volume of each log was recorded. Each piece of lumber from each log was classified by standard hardwood lumber grade and recorded by thickness, width, and length. Board-foot content of each piece of lumber was calculated from the recorded measurements. Actual sawing time for each log was recorded to determine the cost of lumber manufacture. Time lost by mill breakdown or other causes was eliminated from the sawing time.

The field work was completed late in 1956 and the results of the research are recorded in Research Bulletin 685, *Selling Mill-Run and Graded Oak Lumber*, 1959, by W. J. O'Neil.

### Marketing Christmas Trees

*Initiated—1953; Terminated—1966*

*Project Leaders: R. B. Polk (1953-1956 and 1961-1966), L. K. Paulsell (1956-1961)*

*Other University Personnel: J. M. Nichols, D. J. Janes*

This project was an outgrowth of the research on the production of Christmas trees in Missouri. It had two objectives: (1) to determine the size and nature of the Missouri Christmas tree market and (2) to test consumer demand and marketing techniques for Missouri-grown Christmas trees. The initial work was concerned with contacting wholesalers and retailers of Christmas trees to determine their preferences on species, tree grades, and general marketing practices. In the early stages of the study, Christmas trees grown at the Weldon Spring Experimental Farm were marketed through a retailer in St. Charles to determine the reaction of consumers to locally grown trees compared to species grown elsewhere. Similar sales were made in two retail lots in Columbia; one in Kirkwood; and one in Weldon Spring.

In 1956 the project became a part of a North Central Region project. The consumer preference studies were coordinated with those of the cooperating states. The regional project was terminated in 1959.

In December, 1956, a consumer acceptance study was made in two communities—Jefferson City, in the 25,000 to 50,000 population class, and in the rural area surrounding Monroe City, a rural community in the 1000 to 2500 population class. Consumers were interviewed by telephone to determine whether they purchased Christmas trees, whether the foliage of trees was treated, what species they purchased, and what size tree they purchased. In Jefferson City, 174 successful interviews were held and in the rural area around Monroe City, 155 were held. Retailers in 17 towns ranging in population from the 1000 to the 25,000 to 50,000 population class were interviewed in December, 1956, and January, 1957, to determine the sources from which they secure trees, whether their business is limited to Christmas trees or whether the Christmas tree business is a part of a larger business, and how they price the trees (height, grade, or percentage mark-up).

Eleven wholesalers in Kansas City and St. Louis were interviewed to determine how and where they secured their trees, their feeling about tree quality, and the kinds of problems they encounter in their business.

In December, 1957, consumer interviews were held in 30 towns and cities. In addition, displays of six Christmas tree species, each represented by three grades, were shown in Columbia and Kirkwood where customers were asked to choose the species and grade they preferred.

A limited number of interviews with retailers and wholesalers in St. Louis and Kansas City were held in December, 1957, and January, 1958, and in some succeeding years to determine trends and changes in marketing at the retail and wholesale levels. Christmas trees grown by the School of Forestry at the Weldon Spring Experimental Farm and the Ashland Arboretum and Wildlife Area were marketed both at the retail and wholesale level to follow closely trends and problems in marketing.

Limited work was done in the spraying of trees to improve color, particularly of Scotch Pine which sometimes develops a yellowish-green color at the time of harvesting. This color deterioration makes the trees less acceptable in the market place. In 1958 the results of the research were recorded in Bulletin 719, *Marketing Christmas Trees in Missouri*, by Lee K. Paulsell and J. Milford Nichols. Bulletin 820, *Christmas Trees—A Missouri Crop*, by R. Brooks Polk, published in 1964 and referred to in the discussion of "Christmas Trees as a Crop," contains some information on Christmas-tree marketing which was obtained in this project.

## Reproduction and Forest Stand Improvement Cuttings

### *Initiated—1953*

*Project Leaders: P. W. Fletcher (1953-1954), R. H. Westveld (1954-1956), L. K. Paulsell (1957-1960), J. M. Nichols (1961- )*

*Other University Personnel: R. C. Smith, R. B. Polk, Paul Burns, A. J. Nash, R. A. Musbach, D. J. Janes, G. S. Cox, C. D. Settergren, A. J. Valiunas*

This project was initiated under the title, "Cutting Methods." Initially, the project was limited to cutting methods in mature stands, but when the decision was made to study cutting methods in immature stands also, the title of the project was changed to make it more descriptive of the research. The project ultimately dealt with four types of studies: (1) thinning of cottonwood, (2) stand improvement of immature mixed oak stands, (3) reproduction cuttings in mixed oak stands, and (4) growth and reproduction studies in previously cut mature stands.

The first study, initiated under another project, was concerned with various degrees of thinning in an eight-year-old plantation at the DuPont State Forest and an eight-year-old natural stand at the Weldon Spring Experimental Farm. The objective of the study was to determine the effect of various types of thinning on the growth and development of young cottonwood stands.

Eight one-tenth acre plots in an eight-year-old plantation at the DuPont State Forest were established. Four of the plots were thinned to a basal area of 57 square feet from the original 86 square feet per acre.

At the Weldon Spring Experimental Farm two blocks of five plots each were established in a natural eight-year-old stand of cottonwood. In the first block two plots were thinned from the basal area of 86 to 57 square feet per acre and one plot was left as a check. In the second block three plots were thinned from a basal area of 79 square feet to a basal area of 56 square feet per acre. The check plots had a basal area of 87 square feet per acre. Each tree on all plots was identified with a number and the diameter breast high and height were recorded. The first remeasurement of the plots occurred three years after the plots were established.

The first results of the research were reported in a master's degree thesis in 1956 by David Neebe entitled *Thinning of Eastern Cottonwood in Missouri*. The plots were remeasured in 1959 and the updated information was published as Research Bulletin 733, *Thinning in Eastern Cottonwood in Missouri*, by David J. Neebe and Peter W. Fletcher in 1960. The research on cottonwood was discontinued in 1959 when the project leader for this subproject resigned.

In 1953 there was little market for oak trees smaller than saw-log size. Since it was anticipated that a market for smaller trees would eventually develop it was considered desirable to determine the effect of various types of stand improvement work on the growth and development of the young oak stands. A 32-year-old mixed oak stand at the University Forest was chosen for this study. Initially, 12 plots were established in this stand and the following year six additional plots were established in order that the scope of the study might be broadened. A light and moderate stand improvement cut was applied to each of three plots while three plots were clear-cut and three were left as a check. The purpose of the clear-cutting was to determine whether stands of this type which had been damaged frequently by fire in the past might develop into better quality stands by clear-cutting and relying on the new stand which would develop from sprouting. On the second set of plots established, all trees except the 50 or 100 crop trees were cut.

On the first 12 plots established, one-half of all trees left after cutting were pruned. The trees were remeasured at five-year intervals. The first results of this research were reported in a master's degree thesis by Algrid J. Valiunas in 1967, entitled "Crop Tree Release Thinning of Immature Oak in Missouri." During the first few years after the plots were established the area experienced a severe drought, which killed many trees, undoubtedly critically affecting the results of the study.

In 1961 a soil moisture study was initiated to determine differences in soil moisture at different depths in stands which had been treated differently. By-weekly measurements of soil moisture were taken at six-inch depth increments to a depth of 48 inches. Bulk densities of the soil were determined for each six-inch layer.

In 1957 nine two-acre plots were established at the Weldon Spring Experimental Farm in a stand to which a partial cutting had previously been applied. The objective of this study was to determine the effect on the stand of the removal of undesirable species and to determine the cost of such work.

In 1953 fifteen one-fifth acre plots were established at the Weldon Spring Experimental Farm in partially cut stands to determine the effect of cutting on rate of growth and development of reproduction. Later the number of plots was increased to 30.

In 1954 work was started on a study of various reproduction methods of cutting. Initially six one-acre plots were established both at the Weldon Spring Experimental Farm and the University Forest. Five different cutting methods were applied and one plot at each location was retained as a check plot. The cutting methods involved were (1) 11-inch diameter limit, (2) 15-inch diameter limit, (3) salvage cutting, (4) marked silvicultural cut, and (5) high-grade cutting.

The number of plots was ultimately increased to 18 at each location through the establishment of additional plots in 1956 and 1958. Complete information on tree diameter and height, tree condition, and quality was recorded. All plots were measured at five-year intervals. During the past few years analysis has been made by graduate students of the data secured over approximately a 15-year period. The results of this research will form the basis for two or more master's degree theses.

### Investigation on Oak Wilt

*Initiated—1952*

*Project Leader—T. W. Bretz (1952-1967)*

*Other University Personnel—O. J. Dooling, V. D. Ammon, W. K. Vogt*

*Forest Service Personnel—T. W. Jones, W. D. Buchanan, A. D. Partridge, F. H. Berry*

This project was initiated by the Department of Botany in cooperation with the Department of Forestry and the Division of Forest Pathology of the U.S. Department of Agriculture as one phase of a project entitled "Investigations on Diseases of Forest and Shade Trees." In 1953, a project entitled "Investigations on Oak Wilt" was established as a regional project (NC-22) of the North Central Region. The Department of Forestry of the University and the U.S.D.A. Divisions of Forest Pathology and the Forest Insect Investigations participated in the initiation of the project. The two federal divisions provided both personnel and funds for carrying on the research. During the period 1951-1954 the National Oak Wilt Research Committee, a committee of the National Oak Flooring Association, contributed approximately \$20,000 for the support of the research.

The project was transferred to the forestry department in 1954 when Dr. T. W. Bretz, who had worked on the project as an employee of the Division of Forest Pathology and later of the Forest Service of the U. S. Department of Agriculture, was employed by the university forestry department. At this time it was decided that the full effort in research in forest pathology should be devoted to the oak wilt disease because of its vital importance to the forests of Missouri. During the period that the Division of Forest Pathology and the Forest Service cooperated on the research, one or more forest pathologists and one entomologist worked cooperatively with the University. In 1964 the Forest Service decided to concentrate its research in forest pathology and entomology at Delaware, Ohio, and the department continued the project alone.

The objectives in the 1952 project plan were: (1) to make a survey of the distribution of the disease and to determine how critical the disease was, (2) to study the parasite and (3) to develop control measures for the disease. As research developed new information about the disease it became evident that a number of

different types of research should be carried on simultaneously. When the project plan was revised in 1956, six different types of studies were listed in the plan. These studies were: (1) distribution of the disease in Missouri (this is a continuation of work done previously), (2) the plants affected by the disease and determination of differences in susceptibility of species and varieties, (3) the morphology, physiology, and pathogenicity of the causal organism, (4) the mode of infection, growth of fungus, emergence of fungus from diseased tree, dissemination of the causal organism, seasonal development and influence of environmental factors on its development, (5) the transmission of the fungus between hosts, and (6) methods of controlling the disease (this is a continuation of work initiated in 1952).

The project plan was revised in 1961. This plan listed four studies involving variability among isolates of the causal organism and two studies on possible means of fungus dissemination and modes of infection.

In the 1965 revision of the project plan the study of possible means of fungus dissemination and modes of infection was concentrated on the small oak-bark beetle. Study of variability in the fungus was intensified. The third objective in the 1965 revision was the preparation of a monograph for the American Phytopathological Society's monograph series.

In 1967, when a Department of Plant Pathology was created in the College of Agriculture, this project was transferred to the new department. The project director was appointed chairman of the new department. In December of that year the project director died leaving the future of the monograph on oak wilt uncertain.

Much research must still be done to arrive at an effective means of controlling the disease. The following articles and bulletins have been issued on results of the research.

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### Ecological Studies in Forestry

*Initiated - 1953 Terminated - 1963*

*Project Leader: R. E. McDermott (1953-1959) J. M. Nichols (1959-1963)*

*Other University Personnel: P. W. Fletcher, L. K. Paulsell, R. A. Musbach, D. J. Janes*

The project was made up of four unrelated sub-projects, one of which (Acorn Production) was started under another project (Rehabilitation of Missouri Forests). All of the work on this subproject is discussed under the latter project. Work on this subproject was formally terminated in 1963 but considerable data which needs to be analyzed is still available. The results of this later work will undoubtedly be published as an Experiment Station Bulletin.

A subproject entitled Forest Succession of Bottomland Hardwoods in southeast Missouri was initiated in 1954. The purpose of the subproject was to determine the trends in succession on the bottomland hardwoods which are characteristic of poorly drained land in this area. This research was an outgrowth of a study which Robert E. McDermott had undertaken while at Duke University working toward his doctor's degree. The first phase of the study involved subjecting seedlings of several species occurring on bottomland sites to different degrees of flooding.

The first results of this research were reported in Research Bulletin 557, *Seedling Tolerance as a Factor in Bottomland Timber Succession*, by R. E. McDermott, published in 1954. As the sub-project was terminated in 1955 and the work was transferred to a project with broader objectives, entitled "Effect of Stand Treatment on Growth, Seed Production, and Regeneration of Bottomland Hardwoods."

Research on the silvics of eastern redcedar was initiated informally in 1951 as a study for a graduate student.

This research showed enough promise to justify the initiation of a subproject of broader scope. The effects of various fertility levels and sunlight intensities on tops and roots and on the winter color of foliage were studied. The results were the basis for a master's degree thesis entitled *Mineral Nutrition and Growth of Eastern Redcedar* by Julian Ochrymowych in 1952. The graduate thesis was revised and published as Research Bulletin 577, *Mineral Nutrition and Growth of Eastern Redcedar in Missouri*, by Peter W. Fletcher and Julian Ochrymowych in 1955. Research Bulletin 587, *Influence of Light and Nutrition on Color and Growth of Redcedar Seedlings*, by R. E. McDermott and Peter W. Fletcher, was published in 1955.

A subproject to study the effects of grazing on vegetation and small trees was initiated in 1952 at the Weldon Spring Experimental Farm and the Pioneer Forest south of Salem. Observations were made on fenced and unfenced areas of forest land to determine the difference in the development of vegetation in the two areas. Initially, the work was of an observational nature with the intent of gathering quantitative information, but due to the effects of drouth and change of personnel the work never reached this stage.

### **The Effect of Soil and Parent Material on Distribution of Native Ozark Timber Species**

*Initiated - 1955 Terminated - 1959*

*Project Leader: R. E. McDermott (1955-1959)*

*Other University Personnel: P. W. Fletcher*

Although broad in scope, the initial objective was to work chiefly with shortleaf pine. The following objectives were established in the original project plan: (1) relationship of loess distribution to the occurrence of shortleaf pine and post oak, (2) relationship of geologic parent material to shortleaf pine distribution, (3) shortleaf pine as an early phase of old field succession on residual soils derived from granites and porphyries, (4) a geologic interpretation of the Clarksville Soil

Series with particular reference to residuum stratigraphy of the Roubidoux and Gasconade formations as they are related to forest types.

Composition of the forest was recorded and analyzed on a variety of sites with different soil types and different geologic parent materials. Topographic position was also taken into account.

Greenhouse studies were undertaken to determine the influence of various moisture levels on the survival and growth of shortleaf pine and several species of oak.

Results of the field studies are contained in Research Bulletin 625, *Influence of Geologic Parent Material and Climate on Distribution of Shortleaf Pine in Missouri*, by P. W. Fletcher and R. E. McDermott, published in 1957. The project was terminated in 1959 when the two leaders of the study resigned from positions at the University of Missouri.

### **Use of Forced Air in Forest Fire Control**

*Initiated - 1956 Terminated - 1961*

*Project Leader: J. M. Nichols*

*Other University Personnel: L. K. Paulsell*

The project had one objective: to develop a new type of forest-fire-fighting equipment using forced air to move leaves and litter in building fire lines.

Contact was made with various companies that produced blowers which might be suitable. Two types of blowers, (1) axial flow blower which could be mounted on a crawler tractor and (2) a light portable blower were obtained from two companies. After the blowers were tested and found to have certain shortcomings, both companies made changes to adapt them for this special purpose. Most of the preliminary testing was done at the University Forest where records were kept on (1) effective width of fireline, (2) speed of line construction, (3) maneuverability, (4) transportation, and (5) maintenance requirements. After several adjustments had been made in the blowers and in their use they were tested by both the U. S. Forest Service and Missouri Department of Conservation during forest fires where firelines had to be constructed. Both organizations were well enough satisfied with the usefulness of this type of equipment that they purchased several of the hand blowers.

The project was terminated in 1961 and the results of the research were published in 1959 as Bulletin 725, *A New Idea in Fire Fighting - Air Blast Line Building*, by J. Milford Nichols and Lee K. Paulsell.

### **Marketing and Processing of Hardwood Paneling**

*Initiated - 1955 Terminated - 1961*

*Project Leader: R. C. Smith (1955-1961)*

*Other University Personnel: Lawrence Leney, L. K. Paulsell, W. J. O'Neil, R. A. Musbach*

The research on this project was initiated in 1953 as a subproject entitled "Use of Defective Oaks" under the project entitled "Marketing of the Timber Crop." In



1953, conferences were held with Columbia, Mo., architects to get their views on the future of hardwood paneling in the interior of homes. The consensus was that the use of paneling would undoubtedly continue to expand and that the future of paneling was good. It appeared that paneling might provide an outlet for lumber derived from low-quality oaks.

Eighty-nine logs from 58 so-called cull trees at the University Forest were converted into approximately 8,600 board feet of rough lumber in 1954. After four months of air drying in stacks, 4100 board feet of lumber suitable for paneling was graded and kiln dried. The machining of this lumber into paneling was done at a local flooring manufacturing plant. The paneling was separated into three different grades: Wapello (essentially clear panels), Osage (small streaks, knots, and splits permitted), and Montauk (defects unrestricted). These panel grades were correlated with standard lumber grades and time and cost records were kept on each phase of the processing.

In 1955, at a meeting of the North Central Forestry Research Committee, projects that might be supported by regional funds of the Department of Agriculture were discussed. A proposal made by University of Missouri for a project on marketing and processing of hardwood paneling was approved as a regional project. The Missouri Agricultural Experiment Station served as project leader with the experiment stations of Illinois, Indiana, Michigan, and Minnesota participating in some phases of the project which had the following objectives: (1) to determine suitable methods of manufacturing paneling, (2) to determine costs of processing and pricing of products, (3) to determine consumer preferences, (4) to determine suitable finishing materials and methods of application, and (5) to develop suitable methods for installing paneling.

The initial research in 1955 was largely exploratory. A pilot study of consumer preference was made. Several sales were contracted of paneling manufactured in 1954. A small study to correlate standard lumber grades required to produce different grades of paneling was initiated. Twenty different finishing systems were prepared on sample boards. This involved use of different materials and methods of application with the objective of selecting from these a smaller number of the more promising finishing systems for more intensive research.

Some preliminary work on installing paneling with nails was done. The design and construction of a laboratory nailing device was accomplished. Assistance of a mechanical engineer was obtained in designing a metal clip for fastening panels. It soon became apparent that to carry on an adequately controlled study it would be necessary to install the needed facilities for the manufacture of paneling at the University Forest. Plans were made for the construction of a building for air seasoning the lumber, and the acquisition of a small dry kiln and a molder and auxiliary equipment.

During 1955, twelve thousand board feet of oak timber were logged and sawed into one-inch lumber. The project leader consulted with the staffs of the agricultural experiment stations of Illinois, Indiana, and Michigan on plans for future research.

During 1956, all physical facilities for handling the seasoning and processing of oak paneling were installed. Twenty-nine thousand board feet of oak timber were

logged and sawed into one-inch lumber, and were air seasoned and kiln dried. This lumber and that produced in 1955 provided a good supply for carrying on the studies of processing of oak paneling and for relating standard oak lumber grades to the three grades of paneling.

During 1956, preliminary studies of consumer preference, finishing materials and their application, and fasteners and their use were continued. Limited work was done on the cost of processing and pricing of the products. In 1957, materials were prepared for the consumer preference studies and a questionnaire for the study was designed. The materials used in the consumer preference study consisted of stereo-pairs of photographs in color showing different panel patterns, finishes, and installation methods.

The consumer study was carried out in 1958 in Missouri, Illinois, Indiana, and Minnesota. Three-hundred eighty-three homeowners were interviewed to determine: (1) their interest in the use of oak paneling in their homes, (2) in which rooms they would be most likely to use paneling, and (3) their preference for different grades of paneling, different finishes, and different installation methods. On the basis of prices established for the different paneling grades, those who were interviewed were asked to indicate which grade or grades of paneling they would be most likely to use.

Seventy-two retailers of building materials were interviewed to determine whether they believed their customers would buy oak paneling and to get their views on the quantity of sales that would be needed to make oak paneling a desirable item for them to handle.

Studies of finishing materials and methods of application were continued during 1957 and 1958. Finishing materials were lacquers and varnishes and the application was by brush or by spray gun. The most promising of the materials and methods were studied rather intensively.

During 1957 the most promising fasteners for installation were studied and nearly 3500 tests were made. Three types of nails were used in installation. In some tests nails were driven into the paneling with a hammering machine and in others holes were drilled into the paneling before the nails were driven in. A mock-up wall frame four feet by eight feet was subjected to stress, forcing the wall out of square, to determine the effectiveness of the fasteners and the effect which the distortion might have on the paneling.

During 1958 the grade-yield studies were continued on 9,000 board feet of one-inch lumber, bringing the total on which grade-yield studies have been made to more than 21,000 board feet. The cost of processing all this material was recorded also. Most of the data needed in this research project was gathered by the end of 1958. The effort in 1959 was devoted to preparation of a manuscript which was published in 1959 as University of Missouri Station Bulletin 737 and North Central Regional Publication 101, entitled *Oak Paneling—Its Processing and Marketing*, by Richard C. Smith, Lee K. Paulsell, and Lawrence Leney.

In 1960 some exploratory work was done on the manufacture of yellow poplar into paneling. An exploratory study of the use of air-seasoned lumber in the manufacture of paneling was made. By the end of 1960 it was felt that no additional research was necessary and the project was terminated in 1961.

## Effect of Stand Treatment on Growth, Seed Production and Regeneration of Bottomland Hardwoods

*Initiated 1955*

*Project Leader: R. E. McDermott (1955-1959), J. M. Nichols (1959- )*

*Other University Personnel: L. K. Paulsell, R. A. Musbach, D. J. Janes*

*U. S. Forest Service Personnel: L. S. Minckler*

This project was initiated in cooperation with the Research Center of the U. S. Forest Service at Carbondale, Ill. Since the acorns which are produced by pin and other oaks in the bottomland hardwoods are an important source of food for wild ducks, these forests have significant value not only for timber production but for the production of acorns. Initially, 18 half acre plots were established in bottomland hardwood stands. Half were in stands in which the trees were mostly under 10 inches in diameter. The other half were in stands in which most of the trees were over 10 inches in diameter. Later the number of experimental plots was increased to 36.

Half of the plots were subjected annually to flooding and the other half were left in a natural condition. Half of the plots in both types of stands were thinned to 40 square feet of basal area and the other half to 60 square feet of basal area. Three plots were left as checks with 75 to 90 square feet of basal area. It was therefore possible to study the effect of stocking and flooding on growth, seed production, and regeneration of bottomland hardwoods.

Results of the research were published in Research Bulletin 750, *Pin Oak Acorn Production and Regeneration as Affected by Stand Density, Structure and Flooding*, by Leon S. Minckler and Robert E. McDermott in 1960. A second publication dealing exclusively with acorn production was issued in 1965 as Research Bulletin 898, *Pin Oak Acorn Production on Normal and Flooded Areas*, by Leon S. Minckler and Donald Janes. In 1962 Donald J. Janes was the author of a master's degree thesis entitled *Radial Growth Rate and Sprouting Characteristics of Silver Maple as Affected by Competing Forest Trees*.

### Trees of Missouri

*Initiated 1958 Terminated 1962*

*Project Leader: R. E. McDermott (1958-1959), C. D. Settergren (1959-1962)*

*Other University Personnel: Andrew Tau*

The project was initiated to develop a satisfactory publication on the identity and characteristics of trees of Missouri.

The project had three objectives: (1) to develop photographic techniques and records, (2) to resolve species identification and distribution, (3) to assemble descriptive material through library studies. Andrew Tau of the Photo Service worked closely with the project leader in developing satisfactory photographic techniques for photographing bark, buds, fruit, flowers, and leaves of the important tree species of Missouri.

To establish definite identity of species, considerable work was done at the Shaw Botanical Garden Herbarium and at the Illinois Museum of Natural History.

The project leader consulted frequently with the late E. J. Palmer, a recognized authority on some of the genera with which he had worked extensively during his life.

Field work on the project was completed in 1960. Publication of the bulletin was delayed until 1962 because the original project leader resigned from the University of Missouri and a new project leader had to take over the responsibility of the project late in 1959. Results of the research were published as Bulletin 767, *Trees of Missouri*, by Carl Settergren and R. E. McDermott.

### **Forest Site Evaluation**

*Initiated 1958 Terminated 1968*

*Project Leader: A. J. Nash*

*Other University Personnel: none*

The original objectives were (1) to determine the influence of various site factors on the growth and yield of Missouri's forests and (2) to develop a practical classification of forest site based on measurable factors.

The research was to include six different species but the initial research was confined to shortleaf pine. Later some work was done on a few oaks.

The project plan was revised in 1963 with the following stated objectives: (1) to determine the practical application of assessing site for shortleaf pine by means of the theoretical equations developed during the first five years of the study, (2) to determine the relationship between site index and site factors for major wood-producing species in Missouri other than shortleaf pine.

The field work was done in three different geographic areas of the state which represented different geologic formations and soil types. The three areas were (1) the Granite Hills Region of St. Francois and Iron county, (2) Oregon county, and (3) Dent county.

Data were gathered on 309 temporary plots about equally divided between the three geographic areas. The field data collected were designed to determine the extent, if any, to which topographic and soil factors influenced the growth rate of shortleaf pine. An attempt was made to secure information on plots representing a wide range in age and topographic conditions.

The physical factors of the site which were measured were slope, aspect, slope position, soil texture, soil structure, amount of organic matter, amount of precipitation, and rate of the evapo-transpiration. In the final analysis, the topographic factors which were used as independent variables were combined into two categories: slope and aspect, and slope position. The soil factors which were used in the final analysis were texture, stone content, and consistency of the B-horizon.

The field measurements and observation of independent variables were evaluated according to their effect on soil moisture availability and the central premise of this study that soil moisture is a limiting factor in the growth of shortleaf pine in Missouri. The results of the research were published in 1963 as Research Bulletin 824, *A Method of Classifying Shortleaf Pine Sites in Missouri*, by Andrew J. Nash.

In 1960 a supplementary objective to study the relationship between the mineral nutrient content of shortleaf pine foliage and site index was added. Three individual trees from which foliage was to be taken were selected in each of the plots examined. The foliage of the three trees was mixed to provide a representative sample of foliage from the site. Other information secured in the field included height and diameter of each tree and its radial growth during the previous 10 years. Soil samples were also taken for laboratory analysis. Both soil and foliage were analyzed for the quantity of the various nutrients used by the trees. The results of this study were the basis for a master's degree thesis entitled *An Exploratory Study of the Foliar Nutrient Contents of Shortleaf Pine in Missouri*, by Melvin R. Koelling, in 1961.

Although the project was not terminated until 1968, for all practical purposes the work was terminated in 1965 when the project leader took leave of absence for three years to work in India.

### State Survey of Forest Resources

*Initiated 1959 Terminated 1962*

*Project Leader: R. H. Westveld*

*Other University Personnel: A. J. Nash, L. K. Paulsell, R. A. Musbach, J. M. Nichols, R. S. Brundage, G. F. Begeman, E. P. Allen, J. Lowe, T. E. Jordan, H. T. Hambrick*

*U. S. Forest Service Personnel: James T. Morgan, J. J. Mendel, D. A. Gansner, B. L. Essex, C. D. Chase*

In January, 1958, the Forest Service of the U. S. Department of Agriculture began the second forest survey in Missouri. Through the cooperation of the Missouri Conservation Commission and the T. J. Moss Tie Company (now Moss-American, Inc.) an intensive survey was made of a 14-county area in southeast Missouri. This was undertaken in the hope that State funds would become available in 1959 to intensify the survey throughout the rest of the state. The objective of the survey was to secure sufficiently detailed information by counties on the quantities, species, and location of the forest resources of the State.

The General Assembly of Missouri appropriated \$80,000 for the period July 1, 1959, to June 30, 1961, so that the survey undertaken by the Forest Service could be intensified throughout the state. Such information was considered to be of great value to the wood-using industries of the state and to out-of-state wood-using industries that might be considering locating manufacturing plants in Missouri.

The School of Forestry employed six persons for all or part of the period from July 1, 1959, to June 30, 1961, the equivalent of more than eight man years, and made them available to the Forest Service to obtain the desired information. Aerial photographs were used to identify the different forest types and condition classes in order that adequate stratified samples could be selected and identified in the field. Detailed data on individual plots were taken in these selected areas. In order that adequate information on cull could be secured a special intensive study was made according to tree condition classes.

The Missouri Agricultural Experiment Station published five bulletins based on the research, which were written by staff members of the Forest Service. These were Bulletin 779, *Timber Resources of the Eastern Ozarks*, by Joseph J. Mendel published in 1961; Bulletin 797, *Timber Resources of the Missouri Prairie Region*, by David A. Gansner and Clarence D. Chase, published in July, 1963; Bulletin 845, *Timber Resources of Missouri's Southwestern Ozarks*, by David Gansner, published in 1966; Bulletin 846, *Timber Resources of Missouri's Riverborder Region*, by David Gansner and Burton L. Essex, published in 1966; and Bulletin 847, *Timber Resources of Missouri's Northwestern Ozarks*, by David Gansner, published in 1966. The Forest Service published Resource Bulletin CS-2 by David Gansner in 1965, entitled *Missouri's Forests*.

### Marketing Wood Products

*Initiated 1959 Terminated 1963*

*Project Leader: R. C. Smith*

*Other University Personnel: T. H. Meredith, J. K. Myers*

The project had two objectives: (1) to study marketing organization for various wood products and (2) to study the retailing of Missouri-produced lumber. The second objective was dropped early in 1960 when a timber products marketing project for the North Central Region was approved and regional funds were allotted to the project. In the revision of the project three objectives were established: (1) to evaluate how effectively existing marketing practices reflect wood use demands back to wood processors and timber producers, and reflect producers supplies forward to primary manufacturers or concentrators; (2) to determine the costs and margins of moving forest products from the woods to primary manufacturers or concentrators; and (3) to determine the changes in marketing practices which might raise marketing efficiencies and strengthen working relations between landowners, producers, processors and market agents.

In the regional phase of the project, marketing practices for the following products were studied: lumber (including box bolts), veneer, container veneer, cooperage, pulpwood (including particle board), piling, poles, and posts.

In Missouri, processors of charcoal, round mine timbers, and handles were also studied. Research was done in 14 counties: Bollinger, Butler, Dent, Carter, Crawford, Iron, Madison, Oregon, Reynolds, Ripley, Shannon, St. Francois, Washington, and Wayne. In this area all producers of cooperage, posts, and poles were interviewed. This included 30 primary producers, 11 intermediate marketing agents, and 33 producers of timber.

The interviews with these individuals and with those dealing in mine props, charcoal, handle blanks, handles, and pulpwood were held in 1960. A census of the 357 active sawmills was made during this same period. Fifty-one percent of the sawmills were portable. Some of this information was utilized by R. C. Smith for an article entitled "Forests in the Economy of the Eastern Ozarks," which appeared in the *Business and Economic Review* for November-December, 1960.

During 1961, eighty-eight sawmill owners whose mills produced in excess of 100,000 board feet annually and 60 producers of sawlogs were interviewed. To

obtain information on location, structure, organization, and operation of timber markets by types of products, the following information was gathered during the interviews: (1) location and size of timber products markets, (2) number of buyers and sellers, (3) records of selling and buying specifications and terms of sale, (4) influence of rough or manufactured product marketing on other levels of product refinement, and (5) geography of the flow of products within.

To determine the general efficiency of markets the following information was sought during the interview: (1) degree to which markets are organized, (2) seller's knowledge of markets and supplies of products available for sale, (3) buyer's knowledge of markets and supplies of products available for sale, (4) number of timber purchases and sales, (5) financial position of buyers and sellers and methods of financing raw timber purchases and sales, (6) storage facilities and practices concerning inventories, and (7) competition among buyers and sellers.

To secure information on cost and margin the following information was obtained during the interview: (1) prices at different points of the marketing chain from standing tree to stage beyond primary manufacture, by species, quality classes, and type of product, (2) cost at different points of the marketing chain from standing tree to the state beyond the primary manufacture, by species, quality classes and type of products, and (3) calculated margins between costs and prices.

One phase of the research formed the basis for a master's degree thesis in 1962 entitled *Marketing Forest Products in the Eastern Ozark Region* by Ted H. Meredith. Although the project was terminated at the end of 1963 a second master's degree thesis entitled, *Marketing Activities of Sawmill Industry in Eastern Ozarks*, by John K. Myers, in 1964 utilized certain portions of the data.

When the project was terminated in May, 1963, one regional publication had been released. It is North Central Regional Publication 145, by R. F. Manthy and L. M. James, entitled *Marketing Post, Poles, and Piling*. Two other regional bulletins have been released: *Marketing Pulpwood in Selected Areas of the North Central Region* by R. S. Manthy and L. M. James, North Central Regional Research Publication 156, 1964, and *Marketing Cooperage Timber in Selected Areas of the North Central Region*, by M. R. C. Massie and L. M. James, North Central Regional Research Publication 152, 1964.

## A Study of Oak Reproduction in Missouri

*Initiated 1959*

*Project Leader: L. K. Paulsell*

*Other University Personnel: J. M. Nichols, D. J. Janes, R. A. Musbach, D. A. Walters, James E. Wuenscher, John D. Shafer*

This project had the following objectives: (1) to evaluate the oak reproduction present in oak stands in chosen areas in the state with regard to species, age, size, condition, growth form, site, and past history; (2) study of the year to year development and change of oak reproduction on controlled field plots; and (3) using the results of objectives 1 and 2 to prescribe ways of securing successful regeneration of oak stands. Some of the work was done in cooperation with the U. S. Forest Service.

The major part of the research was done on sample plots on which different practices were applied at the Weldon Spring Experimental Farm and the University Forest. However, limited research was done in two tracts of mature oak, one in Wayne County and one in a virgin hardwood stand in Warren County.

The initial work at Weldon Spring involved the establishment of 27 plots composed of nine groups of three plots. Three treatments were applied to the canopy—50 percent of canopy removed, full canopy removal, and no canopy removal. On one plot in each group no treatment was applied to the reproduction. On another plot the oak reproduction was cut off at ground line to produce new stems and on the third plot trenching was applied to sever the roots of the overhead canopy, thus reducing competition for soil moisture.

In addition to the 27 plots established at Weldon Spring, two irregular area plots were established on which four strip samples each were established at random. On one area the canopy was removed and on the other the canopy was left. Both strips were burned to kill the tops of existing reproduction.

On both sets of plots all reproduction stems were marked with an aluminum tag and record of species, size, condition, and growth form were recorded for each individual stand.

Also at the Weldon Spring Experimental Farm, 4,200 acorns of northern red oak were planted on 42 plots using the following seven ground treatments: (1) raking litter, (2) burning litter, (3) chopping of litter in soil, (4) raking of litter and chopping of soil, (5) litter and soil chopped, then seeded, (6) litter burned, seeded, and soil chopped, (7) no treatment of soil or litter.

Three years after study plots were established at Weldon Spring Experimental Farm a similar set of plots was established at the University Forest.

In 1965 a study was made of two near-virgin oak stands in Wayne County. Six study areas, each containing 30 milacre reproduction plots, were established and the plots were inventoried. Factors of light, moisture, topography, aspect, soil, and litter were evaluated. Reproduction material was collected for laboratory analysis, classification, and age-size determination. This study yielded a master's degree thesis in 1967 by D. A. Walters entitled *A Study of Reproduction on Two Tracts of Mature Timber in the Missouri Ozarks*.

A study of reproduction was made in 1966 in a virgin hardwood stand in Warren County in east-central Missouri. This research yielded a master's degree thesis in 1967 by James E. Wuenscher entitled *A Vegetational Analysis of a Virgin Hardwood Stand in East Central Missouri*. Some of the data obtained in this research was used by James E. Wuenscher and A. J. Valiunas for a paper entitled "Resettlement Forest Composition of the River Hills Region of Missouri" in the *American Midland Naturalist*, Volume LXXVIII, pages 487-495. The data from work at the Weldon Spring Experimental Farm and the University Forest have been analyzed. After data are collected over a longer period, one or more publications will be produced.

The most recent phase of oak reproduction research has involved a greenhouse study of the effects of various shade levels on the growth and development of scarlet oak seedlings.



## A Study of Factors Affecting Sprouting Vigor in Oak

*Initiated 1960 Terminated 1967*

*Project Leader: G. S. Cox*

*Other University Personnel: A. R. Vogt, G. F. Christoff*

This project was supported financially by the National Science Foundation, the U. S. Forest Service, and the Missouri Agricultural Experiment Station. The project had two major objectives: (1) to determine the influence of carbohydrate content on sprouting, and (2) to determine the influence of hormones on sprouting. In the first objective, the goal was to evaluate the carbohydrate content in sprout development of oak trees throughout the year to determine the influence of carbohydrate reserves on oak seedling sprout development. Under the second objective the goal was to determine if auxin produced by the apical bud controls sprouting and to explore the possibility of presence of growth inhibitors in dormant basal buds. As the project progressed, new studies were initiated as an outgrowth of information secured in the earlier research.

The first study was concerned with the influence of carbohydrate content on sprouting. The influence of nitrogen and carbohydrate content on basal sprouting of pin oak was studied. Two intensities of light were used: full sunlight and 20 percent sunlight. In each of these situations pin oak was grown in an infertile soil and a fertile soil to which 500 pounds of nitrogen per acre had been added. Another study investigated the influence of light on sprouting intensity of white oak. Trees under a canopy and in the open were de-topped to promote sprouting. One-half of a four-foot section of the bole of each tree was covered by a closed shelter which reduced light intensity to a minimum. Leaves, buds, cambial tissues, branches, and twigs were collected. These tissues were analyzed to determine their growth substance content.

To study the influence of hormones on sprouting, six studies were initiated. In one of these studies auxin in three concentrations was applied at weekly intervals to stumps of de-topped young oak trees. This work was done in the greenhouse and in one field location. Three studies investigated laboratory methods for extracting and identifying growth controlling substances in dormant buds. These methods involved freeze-drying of plant materials, extraction and purification of the hormones by alcohol, hexane, and acetonitrile, separation by paper chromatography, and quantitative determination of the auxins by bioassay. Another study investigated the effects of double-cutting of the stem. The top of a plant was severed and 24 hours later the second cutting was made to remove the top portion of the stump. The purpose of the study was to investigate the possibility that a growth substance which reduces the sprouting is transported up from the roots to the freshly cut surface and that a second cutting removes much of this substance. Another related study investigated the influence of the stem, leaves, and lateral buds on the sprouting of basal buds by removing leaves, lateral buds, terminal buds, and sections of the stem, both singly and in combination.

Another study investigated the influence of growth hormones and light on basal bud sprouting. Indoleacetic acid and maleic hydrazide in combination with IAA were studied in relation with basal bud sprouting. The role of indoleacetic

acid, gibberellic acid, kinetin and inositol on the sprouting of oak seedlings was investigated. To determine variations in the endogenous auxins in the buds, leaves, branches, and bole of open-grown black oak seedlings, samples from these plant parts were extracted, chromatographed and bioassayed at monthly intervals during the year.

The final investigation in this project studied the changes in the level of growth hormones in black oak and white oak acorns. The project was terminated in 1967 but three papers were still in the process of being written.

The project yielded the following theses, dissertation, and published reports: (1) a master's degree thesis by A. R. Vogt in 1962 entitled *The Influence of Auxin on the Sprouting of Oak Seedling*, (2) an abstract by Gene S. Cox and Albert R. Vogt in 1964 entitled "The Effect of Light on Initial Sprout Production of White Oak" which appeared in the *1964 Proceedings of the Society of American Foresters*, (3) a paper by Albert R. Vogt in 1965 entitled "Experimental Control of Carbohydrate Levels in Tree Seedlings" which appeared in the *1965 Proceedings of the Missouri Academy of Science*, (4) a master's thesis by Gary F. Christoff in 1966 entitled *The Role of Indoleacetonitrile and Indoleacetic Acid in the Germination of Black Oak & White Oak Acorns*, (5) a Ph.D. dissertation by Albert R. Vogt in 1966 entitled *An Investigation of Physiological Factors Controlling Initial Sprouting of Oak*.

### Sawmill Efficiency in Missouri

*Initiated 1961 Terminated 1964*

*Project Leader: R. C. Smith*

*Other University Personnel: R. M. Mischon*

The objective of the project was to determine time requirements for sawing hardwood logs of different diameters and to investigate the influence of investment in sawmill equipment on rate of lumber output and variable costs of production. The secondary objectives of the study were to determine the size of the marginal log for typical Ozark sawmills, to identify the nature and relative importance of the elements composing non-productive time and to recommend ways it might be reduced. The investigation was carried out at four sawmills which were carefully selected on the basis of cooperation from the sawmill owner. All of the mills were small and representative of many of the mills which operate in the Missouri Ozarks. Two of the mills produced from 7000 to 9000 board feet of lumber per day, one mill produced between 2500 and 3500 board feet per day and the fourth mill produced between 4500 and 5500 board feet of lumber per day.

The species, scaling diameter at its small end, and the length of each log were recorded. From this information gross volume of lumber in each log was computed. Net volume, after allowing for the amount of cull was determined by standard scaling practices. The time required to convert each log into lumber was recorded. Non-operating time was also recorded. The number of pieces of rough lumber from each log was recorded by width and thickness in inches, and length in feet. Information was recorded also on the type of equipment and investment in it.

The results of this study were first reported in a master's degree thesis by Raymond M. Mischon entitled *Sawmill Efficiency in the Eastern Ozark Region* in 1963. The material in the thesis was revised and published in 1964 as Research Bulletin 860, *Sawmill Efficiency in the Eastern Ozark Region*, by Raymond M. Mischon and Richard C. Smith.

### **Growth and Development of Upland Hardwood Timber Stands**

*Initiated 1962*

*Project Leader: R. C. Smith*

*Other University Personnel: R. A. Musbach, Lee K. Paulsell*

The objective of this project is to study the growth and development of upland hardwood stands with particular reference to tree mortality, growth, changes in species composition, and changes in stand structure as indicated by tree diameters. One hundred eighty, one-tenth acre sample plots were established at the University Forest. Location of the plots was predetermined in the office by random selection. Descriptive information recorded for each plot included: aspect, topographic position, slope percent, site quality, stand-size class, density, general vigor and condition, recommended saw-timber harvest and recommended girdling of cull trees.

Tree data recorded varied with the size of the tree. For trees 11 inches diameter at breast height (d.b.h.) and larger the following information was recorded: ingrowth, condition, cause of death (subsequent years), total height, merchantable height, grade of butt log, crown class, and soundness. In a 1/20 acre plot the same data were recorded for trees between 5 and 10.9 inches d.b.h. On a 0.01 acre plot for trees between 1 inch and 4.9 inches the following data were recorded: species, d.b.h., ingrowth, condition, and cause of death. For trees 1-inch in diameter on a 0.001 acre plot the count of number of trees was taken by species.

The plots have been re-examined each year for tree mortality. Trees were remeasured in 1967, five years after plot establishment. Summary of sample plot classification to show frequency distribution of independent variables, including aspect, topographic position, slope, and site quality was completed for the 180 plots. Tables have been made to show mean stand and stock, species, composition of the stand, 5-inch d.b.h. and larger, and the quality of the sawtimber component that is 11 inches and larger.

No meaningful trends are expected to develop until at least 10 years and possibly 20 years after establishment of the plots.

### **The Carrying Capacity of Different Forest Sites for Different Recreation Uses**

*Initiated 1962*

*Project Leader: R. H. Westveld (1962-1965), C. D. Settergren (1966-1967), K. C. Chilman (1968- )*

*Other University Personnel: G. S. Cox, D. P. Duncan, K. B. Downing, R. D. Weigel, J. J. Rowland*

The project was initiated in cooperation with the Missouri State Park Board. The objectives are: (1) to determine the effect of different kinds and intensities of

recreational use in different types of forest stands on the soil; (2) to determine the effect of different kinds and intensities of recreational use in different types of forest stands on vegetation; (3) to determine the point at which recreational use of forest land causes a deterioration in the recreational value of an area and/or deterioration in other values (watershed, wildlife, etc.) on the recreational area and adjacent areas; and (4) to establish standards of carrying capacity of different forest sites for different recreational uses based on the results of objective 3.

Initially, plots were established in forest areas on Lake Ozark, Bennett Springs, Table Rock, and Roaring River State Parks which had been used for recreation for an extended period of time. Later plots were established on parts of two of the state parks on areas which were not yet used for recreation, in order that the progress in soil and vegetation changes could be ascertained.

An inventory of all trees and herbaceous vegetation was made annually. Mechanical analysis of soil from each of the areas was made and a periodic record of soil moisture was obtained with a nuclear soil-moisture probe. Records of attendance at each of the parks were obtained to enable relating of the degree of soil and vegetation changes to intensity of park use.

In 1967 persons using the recreational facilities at three state parks were interviewed to determine what types of people visit them, what their objectives are, and how they react to various types of facilities and vegetative cover. This information was then compared with similar data collected 30 years ago in the Missouri parks.

The research yielded a master's degree thesis by Dennis M. Cole, *Recreational Impact on Forest Sites in the Missouri Ozarks*. A second master's degree thesis by William J. Voyles entitled *Visitor Characteristics at Selected State Parks* was produced in 1968. A third master's degree thesis was authored by Richard D. Weigel in 1969 entitled "*Open Space Inventory for Regional Recreation: An Initial Application to St. Louis County, Missouri.*"

## **Taxation of Forest Land**

*Initiated 1963*

*Project Leader: R. C. Smith*

*Other University Personnel: R. M. Mischon*

The original research on taxation of forest land was done under a subproject entitled "Economics of Timber Production." The results of that research are reported under that project. The subproject was terminated in 1960.

Research on taxation of forest land was revived in 1963. The objectives are: (1) to record levels of assessed values and taxes on forest land, and to evaluate trends in taxation as they affect forest landowners, (2) to study trends in owner tenure of forest lands as expressed by tax records and supplementary studies, (3) to identify and express, quantitatively, the factors which contribute to market value of forest land.

The study of assessed values and taxes was made on essentially the same tracts of land as those used in the original study but figures were extended from 1954 to 1963. This provided information over a period of 20 years. The results of the

expanded study were published in 1965 in Research Bulletin 833, *Trends in Forest Taxes in South Missouri*, by Richard C. Smith and Raymond M. Mischon.

### **A Study of the Energy and Water Balance of Forest and Range Sites**

*Initiated 1964*

*Project Leader: G. S. Cox*

*Other University Personnel: W. L. Decker, F. Holt, David Miller, H. E. Garrett*

The project has two objectives: (1) to determine energy and water fluxes through soil-plant interfaces of certain forest and range sites and (2) to utilize the heat balance of the plant community to determine rates of evapotranspiration from growing canopies of forest and adjacent grass openings and to compare this with the evapotranspiration determined by the water balance method.

The research is being done at the Ashland Arboretum and Wildlife Area approximately twenty miles from Columbia. The study area is in a second growth, even-aged, mixed hardwood stand classified as a white oak-red oak-hickory type in which the dominant and codominant trees average 50 years in age. The soil is classified as Weldon Silt Loam.

Soil samples were taken from a soil pit at 6-inch intervals to a depth of 66 inches. Soil was analyzed for particle size using the soil hydrometer method of Bouyoucos and moisture retention at 1/3 and 15 atmospheres pressure. Bulk densities of the entire profile were determined with a Nuclear Chicago P-20 depth density probe which measures wet densities and a P-19 depth moisture probe which measures water content.

Vegetation on the plots was analyzed and recorded.

Data compiled by the United States Weather Bureau for nearby Columbia were used to characterize the climate.

In 1965 a tower which supports a net radiometer, hygrometer, anemometer, thermocouple and a rain gauge above the forest canopy was installed. Similar sensors were installed six feet above the ground. Heat flow discs were placed beneath the soil to determine the energy exchange rate between the soil and the air. A network of rain gauges and access tubes for soil moisture measurements with a neutron probe were also installed.

Beginning in 1966 data from the meteorological sensors had been recorded by an automatic data logger which incorporates a digital multimeter.

In 1965 the instrumentation for the study was described by Francis Holt and Gene S. Cox in an article entitled "Instrumentation for Micrometeorological Studies in Hardwood Forest Stands" in the *1965 Proceedings of the Missouri Academy of Science*, page 9. The study yielded a master's thesis by David R. Miller entitled *The Water Balance of an Oak-Hickory Timber Stand in Central Missouri* in 1967 and a Ph.D. dissertation by Francis T. Holt in 1968 entitled *The Energy Budget and Water Balance of an Oak-Hickory Timber Stand in Central Missouri*.

### **Financial Aspects of Silvicultural Practices in Immature Timber Stands**

*Initiated 1964*

*Project Leader: R. C. Smith*

*Other University Personnel: J. L. Powell, D. M. Ostermeier*

The over-all purpose of the study is to evaluate timing and cost of silvicultural operations under various conditions of site, species composition, and stocking of timber stands in relation to anticipated money returns. More specifically, the project has three objectives: (1) to learn short-term rates of value growth produced by various investments in timber growing stock in mixed oak stands; (2) to determine pay-out periods and rates of net money return from shortleaf pine plantations under alternative product markets; and (3) to forecast profitability from timber stand improvement and conversion of hardwood stands to shortleaf pine.

Most of the research to date has been devoted to the first objective. Since a computer program had to be developed for handling the data, a program was first tested on eight tracts of intensively managed southern pine. Subsequently, a model for analysis was prepared. Log grades and grade-yield studies were used to estimate property value which was converted to the stumpage value. The value of non-merchantable trees depends on growth rates and discounting of future values.

Some investigation has been made of rates of return from shortleaf pine plantations under alternative product markets and the effect of selected silvicultural practices on timber growing profitability.

In 1969, John L. Powell was the author of a master's degree thesis entitled "Harvesting Optimum Shortleaf Pine Products for an Integrated Market."

**Potential Markets for Furniture Woods in the North Central Region**

*Initiated 1964 Terminated 1967*

*Project Leader: R. C. Smith*

*Other University Personnel: R. R. Cutler*

This project was initiated as a regional project of the North Central Region with Minnesota, Wisconsin, Michigan, Iowa, Missouri, Illinois, Indiana, and Ohio participating. The research was concentrated on the four industry sectors which use the most wood. These are (1) wood household furniture not upholstered, (2) wood household furniture, upholstered, (3) wood office furniture, and (4) public building and related furniture and fixtures.

The objectives of the study are (1) to describe the location, size, operations and products produced, (2) to determine types of raw materials used as well as their sources and technical requirements, (3) to determine the factors influencing decisions in choice of raw material for furniture manufacture in which lumber or other wood products are suitable components to better evaluate the substitutability of native hardwoods in this use.

The plan of research was developed by a technical committee of the North Central Region composed of representatives of the participating states. The Missouri Agricultural Experiment Station was assigned 65 furniture manufacturers who were interviewed on the basis of plans developed by the technical committee. It was possible to contact only 43 of these firms since the other 22 were no longer in business or had moved. A preliminary analysis of the Missouri data was sent to the technical committee for inclusion in the region-wide analysis. Some of the

results of the research were quoted by Richard C. Smith in 1967 in an article entitled "When is a Dollar More Than a Dollar" in *Cross-Tie Bulletin*, Volume 40, pages 45-50.

### **Fomes Annosus Root and Butt-Rot of Pinus Echinata in Missouri**

*Initiated 1964 Terminated 1968*

*Project Leader: T. W. Bretz*

*Other University Personnel: L. Newby, D. B. Drummond, J. W. Chesebro*

The objectives of the project were to investigate (1) the production and dispersal of *F. annosus* inoculum with particular reference to its source, kind, and seasonal fluctuations, (2) the nature and importance of various infection courts in relation to the introduction and spread of the disease in shortleaf pine plantations, (3) the nature of the disease in shortleaf pine and the extent of fungus invasion within infected trees, and (4) the effect of various biotic and abiotic agencies in the growth and survival of the fungus.

Through 1967 research had been done in the following areas: (1) seasonal infection of shortleaf pine, (2) use of urea and borateem and *Peniophora gigantea* on shortleaf pine stumps to prevent stump infection, (3) nutritional studies of the fungus, and (4) extent of bole infection by the fungus.

Three master's degree theses were produced in 1966 from the results of the research. These were: *Carbon Utilization by Fomes Annosus* by Loy Newby, *Fluctuation in Fomes Annosus Inoculum Levels and Infection Rates in Missouri* by David B. Drummond, and *Fomes Annosus on Shortleaf Pine in Missouri: Studies Concerning Duration of Stump Susceptibility to Infection, Stump Protection, and Type of Bole Invasion* by John W. Chesebro.

In September, 1967, the project was transferred to the newly created Department of Plant Pathology.

### **Growth-Quality Evaluation of the Wood of Missouri's Commercial Tree Species**

*Initiated 1964*

*Project Leader: E. A. McGinnes, Jr.*

*Other University Personnel: C. I. Chang, F. A. F. Kandeel*

This project, which was initiated as a McIntire-Stennis project early in 1964, has three objectives: (1) growth-quality evaluation of normal xylem tissue for Missouri's commercial tree species with emphasis on the genera *Quercus*, *Pinus*, and *Juniperus*; (2) growth-quality evaluation of abnormal xylem tissue for Missouri's commercial tree species with emphasis on the three genera named under objective 1, and (3) study designed to emphasize and clarify within-tree variation and patterns thereof of xylem tissue for Missouri's commercial tree species with emphasis on the same three genera.

In addition to measuring wood quality in terms of such parameters as specific gravity, fiber dimensions, chemical composition, and others, the effect of environmental factors upon these wood-quality parameters is being investigated.

Investigations of growth-quality of black and scarlet oak which were initiated under the project entitled "Utilization of Native Timbers and Residues" in 1963 were continued. Results of this research were published in 1967 as Research Bulletin 912, *Growth-Quality Evaluation of Black and Scarlet Oak Grown in Missouri*, by E. A. McGinnes, Jr. and R. A. Ralston.

Because of the prevalence of shake defect in oak and walnut, research was initiated on this problem in 1964. Over a two-year period 5,000 butt logs of oak and walnut were examined for various types of shake defect. Special attention was given to walnut because of the high value of the raw product and its importance in specialized industries which use this species. The anatomical structure of walnut samples exhibiting shake were studied under the microscope in an effort to gain an insight into the cause of shake. These studies produced two manuscripts in 1965: "Extent of Shake in Missouri Oaks," *Forest Products Journal*, Vol. 15, p. 190, by E. A. McGinnes, Jr., and "Shake in Oak and Walnut," 1965 Proceedings of the *Missouri Academy of Science* (Abstract), by E. A. McGinnes, Jr.

In 1968 the following articles were published, "Extent of Shake in Black Walnut" by E. A. McGinnes, Jr., in *Forest Products Journal*, Volume 18, pages 80-82, and "Histological Changes Associated With Graft Incompatibility in *Pyrus communis* var. Bartlett," by Dan F. Millikan and E. A. McGinnes, Jr., in *Missouri Academy of Science Transactions*, Volume 2.

Various wood characteristics of six species to determine their pulping potential are under study. The species being studied are sycamore, American elm, red elm, silver maple, black gum, and sweet gum. Moisture content, percent of extraneous substance, specific gravity, fiber length, and cellulose content are being studied from the pith to the bark of wood samples taken from the trees.

Since eastern redcedar is important to the novelty industry and since finishing and discoloration of this species presents problems, research initiated under "Utilization of Native Timbers and Residues" is being continued on these difficulties. Increment cores have been taken from redcedar trees and used for the measurement of extractable content, specific gravity, growth rate, and other wood quality parameters. Various treatments of the wood have been used in an effort to find ways and means of overcoming the discoloration in the finishing.

During 1969 Research Bulletin 960, *Selected Wood Properties of Eastern Redcedar (*Juniperus virginiana*, L.) Grown in Missouri*, by E. A. McGinnes and T. W. Dingeldein, was completed and "Frequency and Selected Anatomical Features of Included Sapwood in Eastern Redcedar" by E. A. McGinnes, S. A. Kandeel, and P. S. Szopa was published in *Wood Science* 2 (2), pp. 100-106.

Research has been initiated with the Department of Horticulture (Dr. D. F. Millikan) on the subject of graft incompatibility in several species of fruit trees. Under this project research is concerned with the cellular structure of the wood at the point of union of various experimental grafts.

### **The Role of Moisture in the Artificial Pollination of Pines**

*Initiated 1964*

*Project Leader: R. B. Polk*

*Other University Personnel: D. J. Janes*



The project was initiated as a McIntire-Stennis project in 1964 after some preliminary investigation of the role of moisture in the artificial pollination of pines was begun in 1961 under the project "Christmas Trees as a Crop." The objectives of the project were (1) to clarify the functional role of microphyllar fluid in pine pollination, (2) to determine the origin of microphyllar fluid and conditions attending its formation, (3) to investigate the microclimate of pollen bags, especially with regard to a possible disturbance of the role played by atmospheric moisture in the pollination of *Pinus* spp., and (4) to conduct controlled pollinations and interpret results in terms of the preceding objectives.

The initial research dealt with the effects of soil moisture and relative humidity and controlled pollination on yield of seed. To create contrasting conditions of humidity and temperature around the individual trees during the pollination period, test trees were enclosed in tree chambers designed and operated to achieve desired treatment effects. Records of temperature and humidity within the chambers were maintained and through the use of a factorial experiment, it was possible to test five chamber treatments, four pollen bag treatments, and two positions of strobili. This work was repeated during a second year because of the unusual wetness during the pollination period during the first year of the experiment.

Following a two-year inactivation of work under this project, it was decided to include in the experimental basis for this seed production research some apparently necessary control of soil moisture. At present, new field installations are being made that will provide more ready means of irrigation than were available originally on the tight clay soils that characterize the experimental area. Once these new test plots have been established, it will also be possible to control internal drainage of soil around the test trees. No publications have been produced under this project.

### Changes in Protein Synthesis Mechanisms During Winter Hardening in *Mimosa*

*Initiated: 1966*

*Project Leader: G. N. Brown*

*Other University Personnel: S. Sasaki, D. R. Bielefeld, J. R. Brandle, T. Ho, V. C. Karnstedt, W. S. Regan, P. Schnare*

The purpose of the study is to gain information on changes in protein synthesis mechanisms during winter hardening and to relate the corresponding morphological changes to these molecular responses. The specific objectives are: (1) to investigate responses of synthetic rates and functional characteristics of transfer RNA's and ribosomal RNA during winter hardening, (2) to investigate responses of DNA template activity during winter hardening, (3) to investigate responses of polysome activation patterns during winter hardening, (4) to investigate responses of ribonucleases during winter hardening, (5) to investigate responses of synthetic rates of proteins during winter hardening, and (6) to investigate relationships between morphological changes and responses of the first five objectives during winter hardening.

Since many biochemical techniques have not been satisfactorily developed for application to higher plant tissues, the first research effort was devoted to modification of these techniques for such application. The techniques required to

study most of the specific objectives listed above now have been successfully applied to higher plant tissues in our laboratory.

The following articles have been published, based on the research results:

- Brown, G. N., 1969, Changes in Ribonucleic Acid Fractions During Maturation of Mimosa Epicotyl Tissues. *Plant Physiology* 44:272-276.
- Brown, G. N., D. R. Bielefeld and V. C. Karnstedt. 1969. Changes in mimosa epicotyl soluble nucleic acid patterns: Comparisons between changes related to growth rate and changes related to degree of maturation. *Plant and Cell Physiol.* 10:899-908.
- Sasaki, S. and G. N. Brown. 1969. Changes in nucleic acid fractions of seed components of red pine (*Pinus resinosa* Ait.) during germination. *Plant Physiology* 44(12).

Papers presented during 1968:

- Brown, G. N. Changes in Some Aspects of Protein Synthesis During Development in Mimosa Epicotyl (Missouri Academy of Science)
- Brown, G. N. Changes in Specific Ribonucleic Acid Fractions During Development in Mimosa Epicotyl Tissues. (American Assoc. of Plant Physiology, M. W. Section)
- Brown, G. N. Quantitative and Functional Changes in Specific Ribonucleic Acid Fractions During Development of Mimosa Epicotyl Tissues (American Assoc. of Plant Physiology, Annual Meeting)
- Brown, G. N. Responses of Protein Synthesis Mechanisms in Mimosa Seedlings to Temperature Stresses. (Tree Physiology Workshop, Society of American Foresters)
- Brandle, J. R. Quantitative Changes in RNA of Mimosa Seedlings Following Gamma Irradiation (Missouri Academy of Science and American Association of Plant Physiology)

In 1969 a master's degree thesis was written by David R. Bielefeld entitled "The Quantitative and Qualitative Changes in the Soluble Ribonucleic Acid Distribution Due to the Effect of High Temperatures upon Mimosa Epicotyl Tissue." The following papers presented in 1969 are in press.

- Brown, G. N. and S. Sasaki, Fusion of Foliar Appendages of Young *Pinus resinosa* Ait. Seedlings after Treatment with CDEC and EFTC. (Missouri Academy of Science)
- Brown, G. N. and V. C. Karnstedt, Extraction and Characterization of Soybean and Mimosa Aminocyl-Transfer RNA Synthesis (Missouri Academy of Science)
- Brown, G. N. and W. S. Regan, Characterization of an Unusual Lightweight RNA-DNA Fraction in Mimosa Epicotyl Tissues. (Missouri Academy of Science)
- Sasaki, S. and G. N. Brown. Changes in Nucleic Acid Profiles of Seed Components during Germination of *Pinus resinosa* Ait. *Plant Physiology* (Supplement) 44:7.
- Brown, G. N. and W. S. Regan. Characterization of an Unusual Light-Weight RNA-DNA Fraction in Mimosa Epicotyl Tissues. *Plant Physiology* (Supplement) 44:8.

Ho, T. and G. N. Brown. Patterns of ribonuclease activity during winter hardening and cold stress in mimosa seedlings. (Proceedings) Society for Cryobiology

### Genetic Investigations in Forestation

*Initiated 1967*

*Project Leader: R. B. Polk*

*Other University Personnel: P. D. Schnare*

Genetics research was initiated in 1956 under a project entitled "Christmas Trees as a Crop," when controlled pollinations of *Pinus banksiana* Lamb were started. Other forms of genetics research, particularly with various species of the genus *Populus* and with poplar hybrids, were undertaken under a project entitled "Techniques for Improving the Results of Forestation." A third type of genetics research was initiated under a project entitled "The Role of Moisture in the Artificial Pollination of Pines" in 1964. These investigations are described under the projects named above. With the increasing importance of genetics research and the decision to terminate or phase out within another year the Christmas tree and forestation projects referred to, it was logical to organize all of the genetics research under a single new project.

The objectives of the new project are: (1) to determine inherent patterns of intraspecific differences in certain forest trees, (2) to determine breeding values of selected trees, and (3) to study such basic genetic-related problems as: (a) factors, both natural and man-induced, affecting early seeding, (b) factors affecting the periodicity, abundance, and quality of seed crops, and (c) methods of vegetative propagation, including apomixis.

The long-term nature of tree genetics research, along with difficulties encountered in obtaining appropriate materials, make it imperative that a variety of goals be pursued simultaneously. Provenance tests will provide a basis for determining both local and regional genetic diversity within species. Interspecific relationships will also be considered. Progeny tests of selected phenotypes will be made, employing wide as well as local crosses. In studying factors affecting tree regeneration, such variables as rootstocks and genotypes will be studied. Research during the first five years will be concentrated in the genus *Pinus* with *sylvestris* and *banksiana* as major species.

The initial work in 1967 consisted of (1) follow-up on research from projects that had been terminated and (2) initiation of an 80-origin provenance study of *Pinus ponderosa*.

The 1962 progeny test of *Pinus banksiana* was measured in terms of several variables and the plantation was thinned. The plantation is being supplemented by grafting selected phenotypes into the area for further breeding tests. It is anticipated that the stand will provide a seedling-clonal seed orchard until better parental sources of seed are made available through additional selection.

Survival, growth, and phenological records were obtained in the 1966 *Pinus banksiana* provenance planting.

Final records were obtained in the 1961 provenance study of *Pinus sylvestris* prior to selection of superior trees and subsequent thinning. The selected trees, to

be supplemented by additional selections in neighboring states, are to be used to establish graft clones in a breeding orchard. Initial site preparations, including soil amendments, for the orchard area have been made. In addition, a rootstock outplanting was made for the purpose of banking grafts of superior phenotypes.

The following publications have been produced:

- Polk, R. Brooks 1967. Phenology and Precocity as Factors in Seed Orchard Development. *Proc. Fifth Central States Forest Tree Improvement Committee.*
- Polk, R. Brooks 1967. Effects of Seed Source on Scotch Pine Performance. *Research Reports, Southwest Center, University of Missouri.*
- Polk, R. Brooks 1967. Some Concepts and Procedures in Forest Tree Improvement. *Mo. Log* 20:20-23.

In 1969 Paul D. Schnare was the author of a master's degree thesis entitled *A Provenance Study of Jack Pine in Central Missouri.*

### **Public Assistance Programs and Their Effect on Management of Private Forests in Missouri**

*Initiated 1967*

*Project Leader: J. M. Nichols*

*Other University Personnel: J. J. Monterastelli, C. L. Santhuff*

The first research in this field was initiated in 1965 on an informal basis when a candidate for a master's degree made a study to determine the effect of the Missouri State Forestry Act on taxation of forest land. The work was established on a project basis in February, 1967. The objectives of the project are to investigate public assistance programs (State Forestry Act, Cooperative Forest Management Act, Agricultural Conservation Program, Soil Conservation Service forestry related programs, University Extension Service programs, Department of Conservation tree seedling production and distribution programs, or others) for the purpose of determining the effects on timber production, owner incomes, ownership patterns, and timberland market values.

Informal research which was initiated in 1965 was the basis for a master's degree thesis in 1966 by Aaron K. Speckhart, *Forest Taxation with Special Reference to the Missouri State Forestry Act.*

In 1958 U. S. Forest Service personnel interviewed the owners of 105 randomly selected tracts of timberland in Wayne County to determine the level of timber management activities. In 1967 the owners of these same tracts of land were interviewed in an effort to determine ownership change and the changing attitudes of owners. A master's thesis is in preparation.

Recent purchasers of timberland in six southeast Missouri counties were interviewed in 1967 to determine market values, reasons for purchase, availability of timber to market, and management practices. This study was the basis for a thesis in 1969 by J. J. Monterastelli, *Market Value of Forest Land in Southeast Missouri and Its Relationship to Intended Land-Use and Owner Characteristics.*

### **Multivariate Analysis of Forest Ecological Data**

*Initiated 1968*

*Project Leader: F. G. Goff*

*Other University Personnel: Allen N. AuClair, J. H. Huber, J. J. Rochow, Paul H. Zedler*

The first objective was to describe the forest ecology of Menominee County, Wisc., including (a) pattern of composition, (b) pattern of population structure within stands of differing composition, (c) the rate of compositional change in forests of differing composition and structure, (d) species diversity of forests of differing composition and structure, (e) the ecological amplitude of component species, (f) the relationship between forest composition, structure, compositional change, diversity, and edaphic conditions, (g) patterns of intraspecific structural relationships, and (h) relationship between tree species composition and composition of herb-shrub layer. A second objective was to describe the forest ecology of the state of Michigan. The third objective was to ascertain the availability of data from other states and conduct preliminary screening and analysis of such data. Included was data from Indiana, Illinois, Wisconsin, Missouri, and other states within the deciduous forest biome.

Quantitative methods have been developed for the analysis of forest composition and successional patterns. These methods have been applied to forest inventory data from Menominee Forest in northern Wisconsin to provide a mathematical description of forests with that area.

In 1969, John J. Rochow was the author of a master's degree thesis entitled, *Gradient Analysis in Mid-Missouri Forests*.

## Chapter V

### FORESTRY EXTENSION

Forestry extension work had its origin in 1926 when Frederick Dunlap was appointed to the position of extension forester. Since the work was terminated a year later it is reasonable to assume that the program had little effect on the practice of forestry by woodland owners because a program of this type can hardly get organized in such a short time.

Forestry extension has been a continuous program since July 1, 1936, when Ralph H. Peck assumed the position of extension forester. During most of the 30 years that the extension program has been in operation it has been handled by one individual. For a short period from 1939 to 1942 and for a part of 1946 two men constituted the forestry extension staff.

Ralph H. Peck served as extension forester until October of 1938 when he transferred to resident teaching. R. H. Westveld had resigned from the teaching position earlier in the year. Peck was replaced by Leighton E. McCormick on February 10, 1939, after Elliott W. Zimmerman had served as acting extension forester from October 1, 1939, until January 31, 1939.

McCormick served as extension forester until his death June 29, 1968. The vacancy created by the death of McCormick was filled July 1, 1969, by the appointment of John P. Slusher.

Calvin Bowen was appointed extension forester on November 16, 1939. Both he and McCormick served in the Armed Forces from 1942 to 1946. Between 1946 and December 1, 1962, McCormick was the only person devoting his time to forestry extension work. In December, 1962, Fred Taylor was appointed extension specialist in utilization and marketing in order that the wood-using industries of the state might be properly served by an extension program. Taylor resigned May 31, 1965, and was replaced by Miles Brown April 18, 1966.

In 1967 the School of Forestry was awarded a merit project in the field of wood technology and utilization under the Technical Services Act. This program, which covers the states of Missouri, Arkansas, Oklahoma, and Kansas, went into operation with the appointment of Edwin Wheeler September 1, 1967, and continued until November 30, 1968, when, as a result of reduced appropriations by Congress, federal financial support was withdrawn. Since then Wheeler's work has been confined to Missouri.

For those who are not aware of the difference between the forestry extension program of the Agricultural Extension Service and the farm forestry program of the Forestry Division of the Missouri Conservation Commission, it should be pointed out that the purpose of the extension program is entirely educational in nature. The educational effort may be carried out by the extension specialist at the request of the county agent or it may be carried out directly by the county agent. The farm forestry program of the Forestry Division is a service program. The state farm foresters assist individual timberland owners in the management of the timber and in locating suitable markets for their products.

The Agriculture Extension Service has carried out its educational program in various ways. From 1936 until 1945 the program was organized by projects and subprojects. Forestry was recognized as a single project, divided into subprojects. Initially, the forestry project was made up of these four subprojects: (1) plant a farm windbreak, (2) planting for erosion control, (3) pine planting for reforestation, and (4) woodlot improvement. Within a few years the first three projects were combined into a single subproject called forest planting. The name of the woodlot improvement project was changed to woodland protection and improvement and then a new subproject, timber harvesting and marketing was added. Subsequently a subproject entitled "Cooperative Farm Forestry Program" was added because the enactment of the Norris-Doxey Act made it necessary to have a subproject under which a farm forestry plan for Missouri could be developed. At the end of 1939 there were still four subprojects. Work in wildlife management was added to the responsibility of the extension forester but a new subproject was not added since the work in this field could be covered under two of the existing subprojects.

By 1946 when McCormick and Bowen returned to the University from the Armed Forces the Agricultural Extension Service was stressing a program called Balanced Farming. Under its principles the farm unit was to be operated in such a way that the most efficient use would be made of all resources, physical and human, to provide the best living for the farm family. Under this concept, forestry was to make its contribution to a farm plan. This did not materially change the type of work carried on in forestry extension but it did mean that a different approach to the forestry problems had to be taken. It became necessary to make the forestry work a part of the management plan for the individual farm.

During the first few years of the Balanced Farming Program, forestry extension suffered somewhat of a setback because county agents and others who were developing farm plans did not have enough background in forestry to feel competent to develop this facet. The statement was made in one of the annual reports of the extension forester that often the farm plan stopped at the edge of the woodland. This problem was gradually overcome through an educational program for the county agents and through the development of the farm forestry program of the Forestry Division of the Missouri Conservation Commission. The number of farm forestry projects operated by the Forestry Division had increased from two to six by 1946. At the end of 1968, 25 of these farm forestry projects were in operation each covering two or three counties. There were also two urban forestry projects (St. Louis and Kansas City).

In 1960 after a change in the administrative personnel of the Agricultural Extension Service a new phase of work was added to the Forestry Extension

program: county program planning. Two years later, in 1962, the Extension program was oriented around educational objectives. In forestry five objectives were established. The following year, 1963, the program was oriented around audience groups with one or more objectives for each of these groups. In 1964 the major problems, the extension educational objectives, and the results and methods used for each major audience were developed.

The amount of time devoted to extension activities in various phases of forestry work has changed over the years. Whereas during the first few years tree planting received major attention, in 1961 no time was devoted to this activity except as a part of program planning and agent training. Likewise, utilization and marketing received very little attention during the early years of the forest extension program whereas in 1968 it received the attention of one full-time extension worker and part of the time of another extension worker. The latter worked on a regional basis in the states of Arkansas, Oklahoma, Kansas, and Missouri until November, 1968, when his work was limited to Missouri.

All phases of the forestry extension program have been publicized through news media with major emphasis on newspapers and radio. Television has been used to some extent. Radio transcripts have been prepared regularly for transmission to the majority of the radio stations in Missouri. New information on technological developments in the various fields have been publicized through the various news media. In 1956 a quarterly publication entitled *Missouri Forestry and Forest Industries* was published. This publication which went to more than 400 persons, including county agents, served as a vehicle to transmit information on various phases of forestry to interested persons. Eventually it provided woodland owners with information on the prices being paid for different types of woodland products in various parts of the state.

The remainder of this chapter is devoted to a review of the types of extension activities and the accomplishments resulting from these activities for each of the major phases of forestry that have been covered by the extension program.

### Tree Planting

Tree planting was one of the first phases of forestry in which extension work was carried on. When the program began in July, 1936, there was no source of tree planting stock at a low price. Therefore, the first step was for the Agricultural Extension Service to enter into an agreement with the Forest Service of the U. S. Department of Agriculture to produce planting stock at the federal nursery at Licking. The stock was for sale to landowners at a nominal cost (\$2.00 per thousand for hardwoods and \$3.00 per thousand for conifers). Ordinarily, planting stock is produced by the state forestry agency but in 1936 no such agency existed in Missouri. In 1938, after a state forester had been appointed, the agreement with the Forest Service was terminated and a similar agreement was entered into with the Forestry Division of the Missouri Conservation Commission.

In the tree distribution program, the responsibility of the Forestry Division of the Missouri Conservation Commission was to produce tree planting stock at its nursery and to arrange for its distribution to the counties. In recent years the distribution has been by truck. The responsibility of the Agricultural Extension



Service is to promote the tree planting program, to arrange with the county agents to obtain tree orders from landowners, and then to transmit these orders to the State Forester.

Since few trees had been planted in Missouri previously it became necessary to carry on tree planting demonstrations. For the first few years of the planting program the extension foresters devoted much time to this activity, spending a large portion of their time during two or three months in the late winter and early spring. As the county agents became familiar with tree planting techniques they supplemented the tree planting demonstration work and eventually such activities were carried on by county agents in more than half of the counties.

It soon became evident that demonstrations of planting technique did not cover the full needs of the tree planting program. Low survival in some plantations demonstrated that some of the tree species were being planted on sites to which they were not adapted. Therefore more and more attention was given to training county agents to discuss the site adaptability of various species.

As interest developed in the early to mid-1950s in the establishment of Christmas tree plantations, more emphasis was given to them. By 1958 the interest in this activity had reached the point where it seemed desirable for the Christmas tree producers to organize themselves to gain advantages of their combined efforts.

The Extension Forester suggested to some of the leaders in Christmas tree production that they form an association. This was done in September of 1958. This organization began with less than 40 members but by 1968 had a membership of 80. The Extension Forester worked closely with this group, particularly in helping them plan their summer meetings which were held in the field where various types of cultural practices could be demonstrated.

Factors other than the educational program which contributed to gradual expansion of the tree planting program were the ACP payments of \$7.50 per acre which were available for tree planting. Payments for tree planting under the Conservation Reserve program of the Soil Bank Act of 1957 also contributed to an expansion in tree planting. The availability of tree planting machines through the Forestry Division of the Missouri Conservation Commission beginning in 1957 also stimulated tree planting.

The accomplishments of the educational program in tree planting can be measured fairly well by the increased interest and the increase in the number of trees planted over a period of years and by the improved survival of the trees which were planted. In the spring of 1937 approximately 700,000 trees were planted on 188 farms in 50 counties. The number of trees planted, the number of land owners participating, and the number of counties participating showed an increase in 1939 and by 1941 more than 1.5 million trees were planted by 1021 landowners in 105 counties.

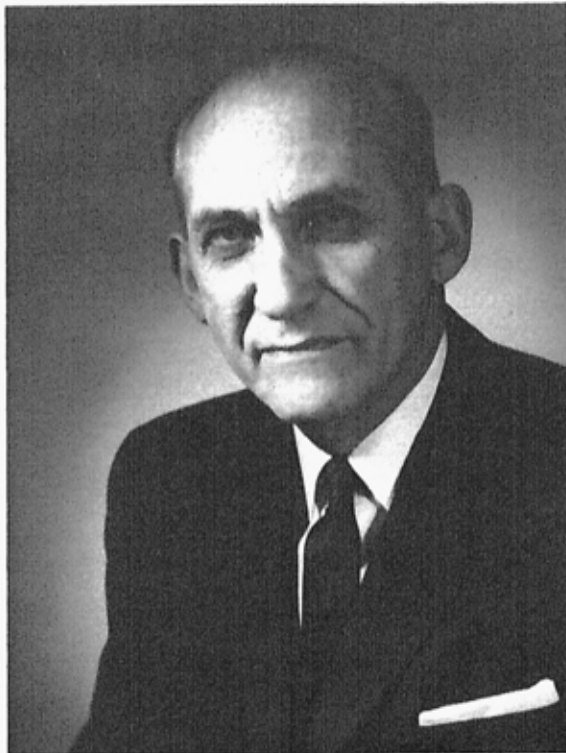
The effect of the nation's participation in World War II when the number of trees planted and the number of farmers participating declined was due in part to a shortage of labor. The decline stabilized during the war but in 1947 tree planting showed some increase again. A temporary decline occurred from 1949 through 1952 but in 1953 tree planting again increased in popularity. Thereafter, the increase was rather rapid and gradually became somewhat stabilized at approximately 4.5 million trees in 1966. In addition to commercial forest tree species,



*Frederick Dunlap, professor of forestry and chairman, Department of Forestry, September 1, 1913 to September 1, 1921.*



*John A. Ferguson, chairman, Department of Forestry, September, 1911 to October, 1912.*



*R. H. Westveld, chairman, Department of Forestry (1947-1957), and director, School of Forestry (1957-65).*



*D. P. Duncan, director of the School of Forestry since 1965.*



*The Department of Forestry occupied three offices in Whitten Hall from 1947 to 1953 and additional space in a temporary building.*

*For several years before the Department of Forestry was discontinued in 1921, it had two staff offices, a stenographer's office, a large classroom, and a laboratory in Stewart Hall, home of the Physics Department for many years.*

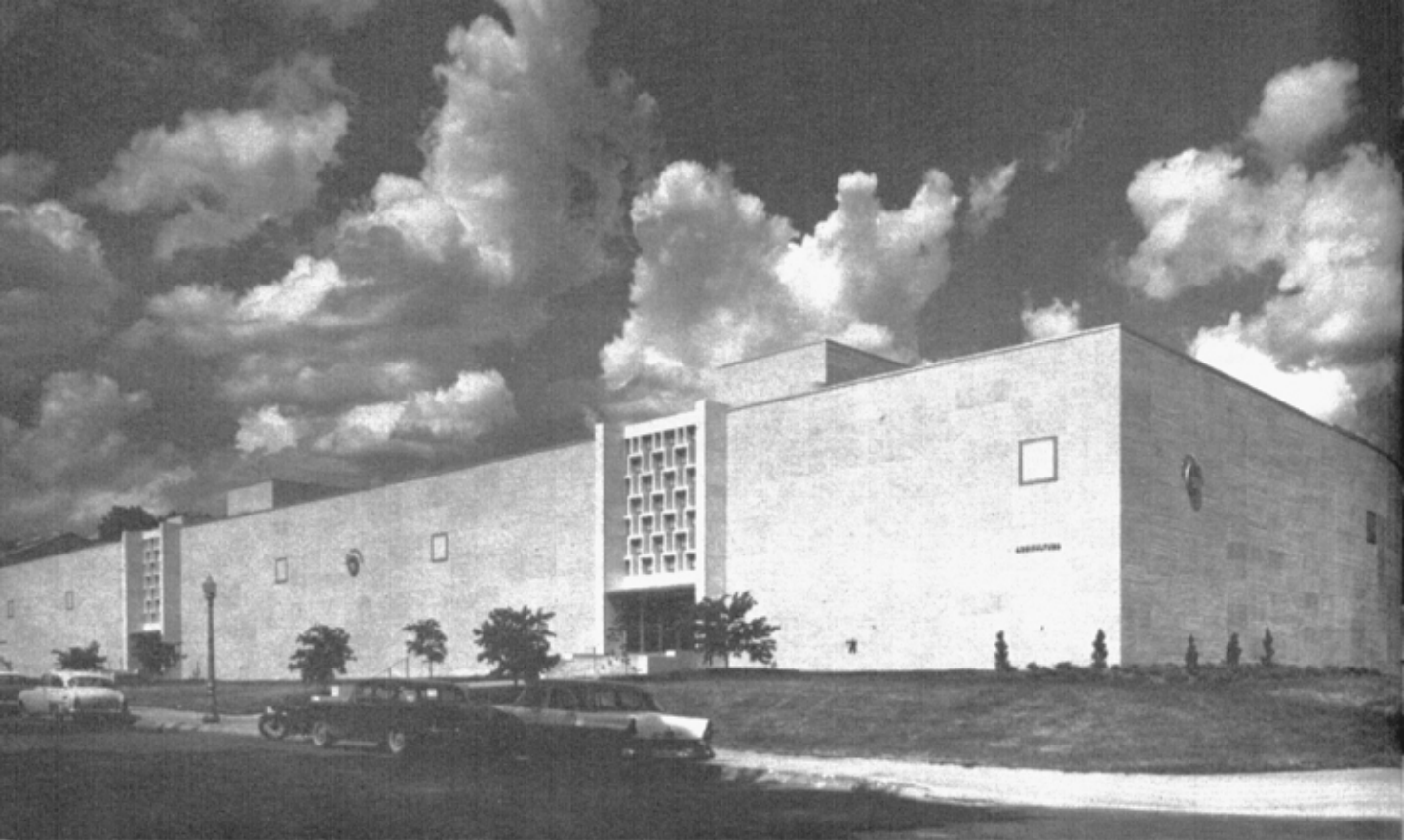




*Two classrooms, a laboratory, and an office in a temporary building supplemented the area occupied in Whitten Hall by the Forestry Department from 1947 to 1953.*

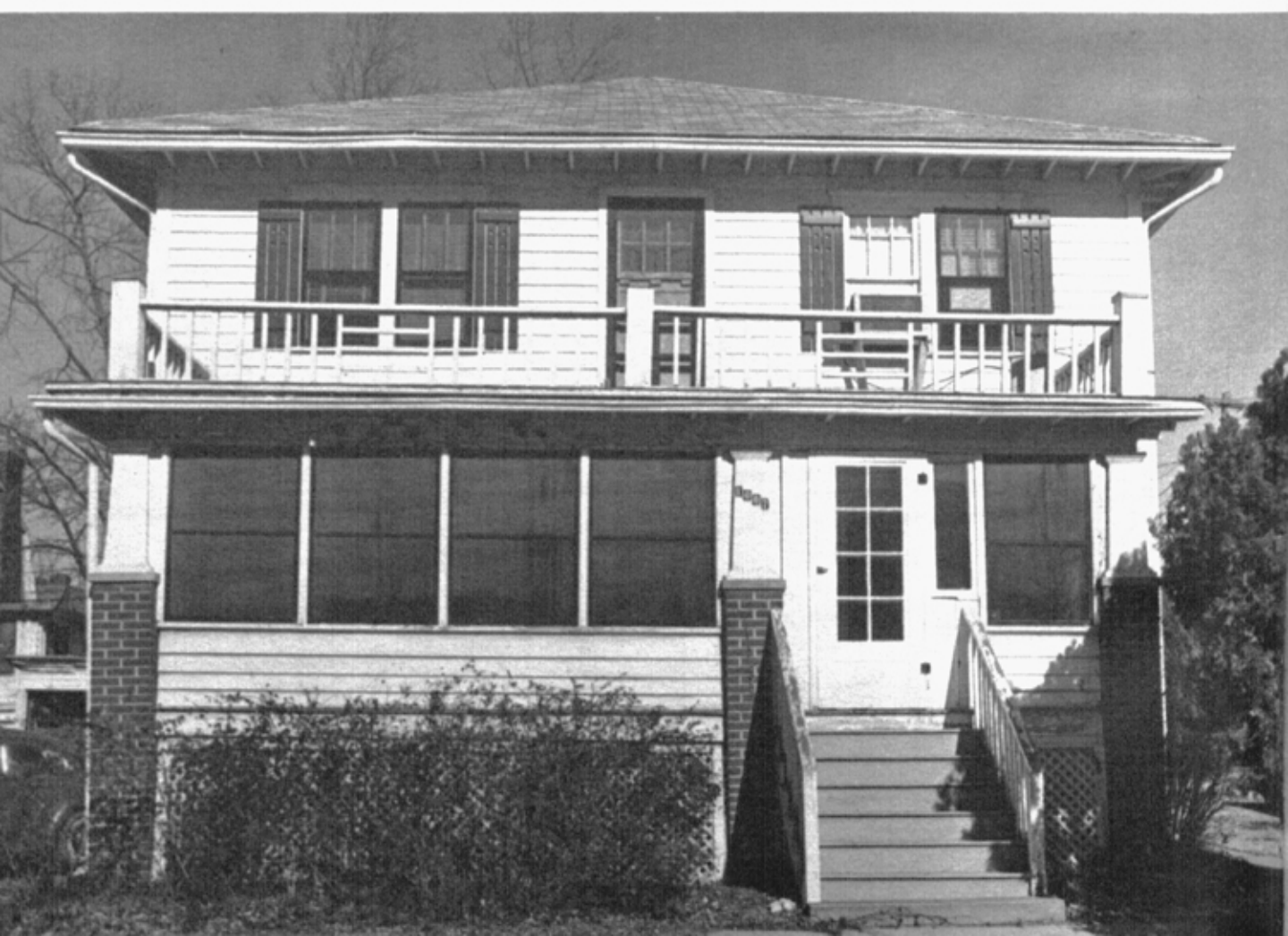
*From 1953 to 1960, the Department of Forestry carried on its activities in a temporary building of 11,000 square feet. The building consists of two wings (the second one similar to the one shown here) connected by a hallway and furnace room.*





*The School of Forestry has occupied approximately 23,000 square feet on two floors of the Agriculture Building since 1960.*

*A residence on Rollins Avenue has provided office space for 12 to 17 graduate students since 1968.*





*The 32 students who participated in the Retail Lumber Training Institute, February 5 to February 17, 1962, together with six of the instructors.*



*The 1959 meeting of the School of Forestry Advisory Council, held at the University Forest, included a tour of some of the teaching and research facilities. Here the members learn about research in forest hydrology and watershed management.*



*Lumber storage shed at the University Forest.*

*A small sawmill, replaced in 1963 by a more efficient mill, was installed at the University Forest for summer camp instructional use and research.*





*In 1955-56 a wood utilization building housing a planer, molder, and other small equipment, a dry kiln, and a lumber storage building were built at the University Forest to provide facilities needed for a comprehensive research project on wood paneling.*

*The residence for the forester at the University Forest, built in 1947, and remodeled and enlarged in 1959, is the only one of the five buildings constructed in 1946-47 from old Civilian Conservation Corps building that is still in use.*



*An office and classroom building, built in 1949-50 at the University Forest, was remodeled in 1960 to provide more office space and a research laboratory when a new classroom building was built.*

*The open-air classroom at University Forest.*







*The kitchen-dining hall at University Forest.*

*A view of some of the five eight-man student cabins at University Forest.*



*A faculty building with a lounge and six bedrooms was built at the University Forest in 1949-50 to provide adequate facilities for faculty engaged in summer camp instruction and graduate students engaged in research.*

*A four-stall garage (left) and a repair shop and equipment building to adequately service and protect automotive and other equipment were built at the University Forest during the period 1958 to 1961.*



considerable numbers of multiflora rose bushes and a variety of shrubs were planted to improve sites for wildlife. The height of interest in the planting of multiflora rose occurred in 1961 when approximately five million of these plants were planted.

As more landowners became knowledgeable in the financial rewards that would come from Christmas tree production more landowners planted larger numbers of trees for this purpose. In the early 1950s relatively few Christmas-tree plantations were established. By 1966, a total of 1080 landowners in 95 counties planted 1,275,000 Scotch pine trees, most of the planting being done with the objective of producing Christmas trees. The quality of Christmas trees produced in Missouri has improved steadily as Christmas tree producers have become better acquainted with the importance of selection of proper species and applying cultural practices, particularly shearing, to improve quality.

During the first several years of tree planting, survival of trees in the plantations was very low. It was not uncommon for only 25 percent of the planted trees to survive. In recent years as many as 55 percent of the planted trees have survived. Although this may appear to be relatively low it is considered satisfactory under Missouri climatic conditions.

### **Woodland Production and Management**

This phase of forestry work was carried under the title of Woodland Management until 1961 when the title was changed to Woodland Production and Management, implying a broader approach to the problem. Woodland production and management deals with all aspects of the development of woodlands for the various products they are capable of producing.

During the first few years of forestry extension work, the interest in this phase was very limited due undoubtedly to the fact that immediate financial rewards and improvement in timber production would not materialize. The landowner needed to take the long-range view that the yield of woodland products both in quantity and quality might not occur for as much as 10, 20, or even 30 years.

Immediately after World War II special training sessions were developed for county agents, Soil Conservation Service personnel, and others in the steps involved in analyzing and making management recommendations for woodlands. The first farm forester was appointed by the Missouri Conservation Commission in 1940, eventually the number was increased to twenty-five. This program has greatly enhanced the efforts of the extension forester who has worked closely with the farm foresters in all aspects of their work. He has on several occasions participated in the annual training programs for farm foresters to provide them with information which would make them as effective as possible in working with the Agricultural Extension Service. As the number of farm forestry projects was gradually increased by the Forestry Division of the Missouri Conservation Commission the county agents had closer access to professional foresters. They quickly took advantage of the opportunity to call on them when landowners asked for assistance in woodland management.

Timber stand improvement was one phase of woodland management that was given early attention in the educational program of the extension forester. Timber stand improvement has as its objective the improvement of woodlands through the removal or killing of undesirable trees which interfere with satisfactory growth of

the higher quality trees. As early as 1940 timber stand improvement demonstration plots were established.

The first payments for woodland improvement were made in 1937. The payments were \$2.50 per acre. One requirement for payment was that the woodland be given complete protection from grazing. This served as a deterrent to adoption because many woodland owners wished to utilize their woodlands for grazing of livestock. The nationwide interest in all phases of management of woodlands which developed in 1960 following a national survey of the forest resources stimulated interest in all phases of woodland management.

Gradual acceptance of timber stand improvement as a practice for which payments could be made under the Agricultural Conservation Program helped to stimulate interest in timber stand improvement. By 1960, eighty-two counties had approved payments for timber stand improvement work. However, the amount of funds available for this practice was relatively small until 1964 when \$100,000 was earmarked for timber stand improvement work in 83 counties.

Soon after World War II the American Forest Products Industries, Inc. developed the Tree Farm Program. Its purpose was to stimulate interest in good woodland management. The sponsoring agency in Missouri was the Missouri Forest Industries Committee. The Extension Forester was a member and served as the committee's secretary. Under this program, if a landowner met certain standards in woodland management his woodland was certified as a Tree Farm and he was given recognition by a sign indicating that the owner's woodland was classified as a Tree Farm. The committee publicized this program with the objective that more woodland owners would be encouraged to practice good woodland management.

When county forestry program planning was organized in 1961, an opportunity was provided to carry on educational programs with new groups, not only in woodland production and management but in all phases of forestry.

Another program which was independent of the forestry extension program but contributed particularly to the opportunities for timber stand improvement was the training of forest technicians, a cooperative project of the Department of Education and the State Employment Security Division. Under this program 180 trainees participated in a 10-week training program in timber stand improvement and related matters in 1964. This made available a relatively large number of persons who were skilled in the art of timber stand improvement and related woodland management practices.

The accomplishments of the woodland production and management phase of the forestry extension program can be measured by the amount of timber stand improvement work that was done, by the number of woodland management plans that were prepared, and by the number of Tree Farms that were certified. The first concrete evidence of the effect of the educational program occurred in 1947 when woodland management plans were included in the Balanced Farming plans for 241 farms in 50 counties. Since then the number of woodland management plans prepared each year has varied considerably but there have usually been between 100 and 250. Of particular significance is the fact that in 1966 the county agents referred 781 requests for woodland management assistance to the Farm Foresters of the Forestry Division of the Missouri Conservation Commission.

The practice of timber stand improvement was slow to develop but by 1960, 249 landowners in 82 counties received benefit payments under the Agricultural Conservation Program. In 1964, the first year that \$100,000 was earmarked for timber stand improvement, 381 landowners in 63 counties carried out the practice and received payments. In 1966, 465 landowners in 54 counties completed timber stand improvement work under the conservation program. Interestingly, landowners who did not receive cost-sharing payments applied the practice to 14,600 acres of timber land, whereas those who received payments applied the practice to 8,862 acres. Landowners evidently were beginning to realize the value of timber stand improvement and many of them were willing to apply the practice without compensation.

The first Tree Farms were dedicated in 1949 when three landowners received this recognition. Interest in the Tree Farm program increased gradually and in 1961 nineteen Tree Farms were certified in Missouri. By 1963 there were 134 Tree Farms involving more than 212,000 acres of timber land. By 1966 the number of Tree Farms had increased to 160, involving nearly 240,000 acres of woodland.

### **Timber Utilization and Marketing**

The work on this phase of forest extension work began in 1939 under the title Timber Harvesting and Marketing. Only a limited amount of educational work was carried on by the extension forester prior to 1942. At that time three foresters were employed jointly by the U. S. Forest Service and the War Production Board to further the production of wood needed for the war effort. These men were located in Columbia, Ironton, and Springfield. Shortly thereafter the Forestry Division of the Missouri Conservation Commission established two farm forestry marketing projects with the Forest Service and The Agricultural Extension Service cooperating in the undertaking. Foresters were located at Farmington and Pineville to cover seven counties. More emphasis in extension was immediately shifted to the harvesting of timber and the use of native timber for farm buildings.

After World War II, considerable interest was developed by woodland owners in estimating the volume of their timber and planning for its harvest. This interest developed because the markets for all types of wood products were good. It soon became evident that many landowners were selling their timber for a lump sum rather than by a price per unit of measure. In 1947 the extension forester placed increased emphasis on training sessions for county agents on the measuring, marketing, and selling of timber products.

In 1952 he began holding conferences with individual sawmill owners in order that they might better understand the views that were developing among woodland owners on the sale of their timber and also to encourage the sawmill owners to produce improved quality lumber. Eighteen sawmill owners were visited by the extension forester in 1952. In October of 1953 the first Forestry Logging and Sawmill Equipment demonstration was held at Meramec Springs. The primary purpose of this demonstration was to give the wood-using industries an opportunity to become acquainted with the modern equipment available for logging and sawmilling. Incidental to this major objective was some educational work on good management of woodlands. A second demonstration for the benefit of the wood-using industries known as the Wood Industry Show was held in October,

1965. The third one was held in 1967, and the fourth one in 1968. Approximately 5,000 persons attended each of these demonstrations.

By 1962 the extension forester did not have to devote much time to extension work in timber marketing except through correspondence. The farm foresters of the Missouri Conservation Commission were handling this in an effective way as a service project since most of the important timber counties were covered by farm forestry projects.

The accomplishments of the extension program in wood utilization and marketing prior to 1963 are not as easily measured as those in other extension activities. Although definite figures are not available, it is a well-known fact that most woodland owners are now selling their timber on a price per unit of measure rather than on a lump sum basis, and as a result, are in most cases being paid what the timber is actually worth. The publication once each year of the timber price ranges in different sections of the state in the *Missouri Forestry and Forest Industries* since 1958 has been helpful to the landowner in obtaining an equitable price for his timber.

With the appointment of Fred Taylor on December 1, 1962, the extension activities in wood utilization and marketing were expanded greatly since he was to devote full-time to the extension program in this field. However, it was first necessary for him to spend considerable time visiting the various wood-using industries to determine what their major problems were. He found that the dry kiln operators, most of them employed by manufacturers of flooring, furniture, and gunstocks, were doing an inadequate job in operating the kilns to produce the best quality of seasoned lumber. They had little understanding of wood-moisture relations and were not using proper drying schedules in operating the kilns. During 1963 and 1964 the owners of virtually all dry kilns in the state were visited by the extension specialist who gave personal attention to their problems. Study was also made of methods used in air seasoning of lumber which in many cases were found to be unsatisfactory.

To publicize the expanded program in wood utilization and marketing the extension specialist prepared news releases and radio transcripts and appeared on television. He also gave talks before the Advisory Council of the School of Forestry and the Missouri Bankers Association. In 1963 the first issue of *Bibliography of Current Information for Industries* was published. Subsequently, the name was changed to *Current Information for Industry*. This publication, distributed twice a year, contains abstracts of articles which deal with the latest technological developments in the wood-using industries which could be helpful to Missouri industries in improving the quality of their products and the efficiency of their operations. The publication is distributed to a mailing list of approximately 400.

In 1964 a bulletin was prepared on air seasoning. This subject also constituted a part of the sawmill short courses which were held in 1964 and 1965.

It is difficult to evaluate the accomplishments of the extension work in kiln drying and air seasoning of lumber but one gunstock manufacturer was sufficiently impressed by the dry kiln work that he undertook a study of defects in drying with the objective of determining the extent of defects and then developing kiln drying schedules which would overcome this problem.

Study of sawmill operation practices and discussions of sawmill operation with many sawmill operators demonstrated that the majority were using improper sawing methods and were not keeping their equipment in good operating condition. Most sawmill operators were at a disadvantage in marketing their lumber profitably because of the lack of knowledge of lumber grades. Furthermore, the management personnel were unable to evaluate the probable economic returns from capital improvements. In an attempt to overcome these deficiencies the extension specialist held two sawmill short courses in 1964 and one in 1965. Assistance in the sawmill short courses was provided by a sawmill specialist from the U. S. Forest Service and the extension specialist in business management. The topics covered in these one-day short courses included profitable sawmill operation, seasoning of wood, sound management practices and the workmens' compensation law. Attendance at these short courses varied from 18 to 40 persons. In 1964 a bulletin on air seasoning and a Guide Sheet on sawmill alignment were prepared. In 1965 meetings were held with county extension directors to acquaint them with sawmill problems in order that they might supplement the work of the wood utilization and marketing specialist.

The accomplishments of the extension program with the sawmill operators is difficult to evaluate; however, in 1964 one sawmill operator installed a band resaw to reduce waste and increase production. A wood pallet manufacturer installed a modern sawmill with debarker, making it possible for him to convert the waste into chips.

In 1967 a sawmill study was made for the crosstie industry to determine the relative profit from the production of crossties and side lumber and from the production of lumber only. The study showed that profits were greatest when crossties and side lumber were produced.

Considerable attention was given during 1963 to the wood pallet industry. Visits to the pallet manufacturing plants and discussions with the operators revealed that in general the marketing system was ineffective and that the operators lacked an adequate knowledge of their production costs to serve as a guide in pricing. Customer acceptance of pallets produced in Missouri was found to be poor. During 1963, four educational meetings for pallet manufacturers were held in southcentral and southeast Missouri in cooperation with the wood utilization specialist of the Forestry Division of the Missouri Department of Conservation. These meetings led to the formation of the Missouri Pallet Manufacturers Association. This provided an opportunity for the pallet manufacturers to discuss common problems and to promote the use of wood pallets. During the 1964 meeting of the Missouri Pallet Manufacturers Association the following subjects were discussed: (1) cost accounting systems, (2) compensation laws, (3) unemployment insurance rates, (4) determination of costs of pallet production, (5) attempts in the formation of a pallet pool in St. Louis, and (6) work planning and job cost analysis.

One of the major accomplishments of the extension program with the pallet manufacturers referred to previously was the installation by one of the major manufacturers of a modern sawmill with a debarker which provided the opportunity for conversion of waste into chips, thus increasing profits.

During 1964, particular attention was given to the manufacturers of flooring, furniture, novelties, and other special products. The major problems encountered

with this group were a lack of knowledge of modern technology and the inability of the management personnel to evaluate the probable economic returns from capital improvements. Considerable time of the wood utilization and marketing specialist was given to working with individual plant operators in suggesting the installation of new equipment or realignment of the existing equipment in such a manner as to secure maximum efficiency in production. In 1965 the extension specialist organized a tour of wood-using industries in North Carolina and Virginia which provided an opportunity for Missouri manufacturers to observe modern methods in production of furniture, novelties, and other specialized products. Representatives of ten wood-using industries went on the tour.

In 1966 the Office of Economic Opportunity in one of the counties called on the wood utilization and marketing specialist for assistance in guiding a new company which was attempting to become established in a wood-working business. Two leading wood products firms interested in the possibility of particleboard manufacture asked the extension specialist for assistance in making feasibility studies.

In 1964 considerable interest developed in the preservative treatment of fence posts. The extension specialist in wood utilization and marketing prepared two Guide Sheets dealing with various aspects of this subject.

In 1967 the format of the publication, *Current Information for Wood-Using Industries*, was redesigned to emphasize the idea that new technology equals more profits. At the request of the wood-using industries, the extension specialist, in cooperation with the research staff of the School of Forestry and the wood utilization specialist of the Missouri Department of Conservation, made plans for the preparation of a Missouri Wood Handbook.

In 1967 the Extension Specialist was invited by WDAF-TV of Kansas City to participate in a television program which would deal with the home use of wood.

In 1967 the Agriculture Extension Service was awarded a merit project in wood utilization and marketing under the State Technical Services Act, thus providing an opportunity to expand the educational work in wood utilization and marketing. An extension specialist was appointed September 1, 1967. The project was operated for about 15 months on a regional basis covering the states of Arkansas, Oklahoma, Missouri, and Kansas. The work of this specialist supplemented the work of wood utilization and marketing specialists in the individual states and provided an opportunity for an exchange of ideas. After December 1, 1968, this work was confined to Missouri.

## Youth Development

Educational programs for the youth of Missouri were begun in 1936 when the forestry extension program began. Most of the work has been done with the 4-H Clubs, although some work has been done with other youth groups. The initial work done with 4-H Clubs was in the development of projects for club members. The first of these was the tree identification project, followed by a tree planting project. In addition, the extension forester participated every year after World War II in county 4-H Club camps as well as the State Conservation Camp. At these camps, the young people were taught good woodland management, fire protection,

tree identification, planting, and forestry practices which would improve the habitat for wildlife.

In 1954 a forestry camp for 4-H Club and F.F.A. members was established at the University Forest. This program continued for ten years. The camp was of five days duration and instruction was given in forest protection, forest measurements, tree identification, logging, wildlife conservation and management, and sawmilling. It was the hope that the boys that attended these camps would return to their communities as leaders in forestry work. A recreational program constituted a part of the camp program.

The results of certain phases of the educational program for the youth can be measured fairly well but some phases are difficult to evaluate. The number of boys and girls participating in the forestry projects has always been relatively small, varying from 200 to 300 persons. Approximately 1000 boys and girls participated in some type of forestry activity about every year and as many as 2000 boys and girls have participated in tree planting each year. Prior to 1953 the number of trees planted by boys and girls was less than 100,000 per year but the figure reached 142,000 that year. Since 1960 the number of trees planted by youngsters has ranged between 500,000 and 750,000 per year.

The 4-H and F.F.A. camp was attended by 16 boys from the Ozark counties in 1954, the first year that the camp was operated. There was a gradual increase in the number of boys attending until the number stabilized at between 30 and 35 per year. During a few years the number exceeded 35 and during the last year that the camp was offered in 1964, 40 boys attended the camp. The camp was discontinued at that time in order that an evaluation could be made of the accomplishments of this activity. Contact was made with 86 of the 282 boys that attended the camp during the 10-year period. Relatively few of the boys were serving as leaders in forestry work in their communities. It had been hoped that many of them would serve as leaders. The program was discussed with the county agents in the counties from which the boys had come to get their views on the value of continuing the camp.

Many good things were said in favor of continuing this activity but there was a general feeling that much more should have been accomplished with the manpower that was used in operating the camp. Suggestions were made of possible substitute activities for the 4-H-F.F.A. camp if the camp was abandoned. By 1968 no decision had been made either on discontinuing the camp or developing substitute activities which might involve a larger number of boys.

The accomplishments of forestry educational programs in the county and state conservation camps cannot be evaluated. Large numbers of youth became familiar with forestry activities and with the importance of forestry and unquestionably this has served a useful purpose in the education of the boys and girls of the state.

### **County Forestry Program Planning**

National emphasis on more efficient timber production resulted from a nationwide forestry survey which indicated that a much better job must be done in timber production if the Nation was to meet its timber needs in the future. Following the survey, emphasis was placed for the first time in 1960 on considering timber in the over-all economy. The first activity aimed at this objective was the



development of the County Forestry Program Planning, particularly in 1960 and 1961 and continued thereafter. In 1961 the extension forester conferred with the extension staffs of the seventeen southcentral Missouri counties which had been designated for rural area development. Forestry committees were established in many counties. This provided the extension forester with an opportunity to work to a greater extent with the county agents and the forestry committees in emphasizing the over-all importance of forestry and the opportunities in securing new wood-using industries in the communities. As a result of this shift of emphasis in the forestry extension program it is interesting to note that in 1961 25 percent of the extension forester's time was devoted to program planning and agent training. Thirty percent of his time was devoted to timber marketing and utilization, 34 percent to timber production and management, and 11 percent to youth development. No time was spent by the extension forester on tree planting.

There had been recognition of the fact for many years that many of the county agents did not have a good understanding of forestry and for those serving in the Ozark counties this deficiency was significant. To overcome this deficiency two forestry workshops each were held for a period of three days at the University Forest in 1961 for county agents and Soil Conservation Service personnel from the southeast and southcentral Missouri counties. A third such workshop was held in 1962. These three workshops provided an opportunity for county agents and Soil Conservation Service personnel to obtain broad understanding of the forestry situation in Missouri. The extension forester had the cooperation of the personnel of the School of Forestry, the Forest Service Research Center, the Forest Service of the U. S. Department of Agriculture, the Missouri Conservation Commission, and the Extension Service.

In 1964, the forestry specialist, assisted by R. B. Polk of the staff of the School of Forestry who is engaged in research in tree planting, held two district training schools on tree planting.

The extension forester advised the county forestry committees on how to secure information on timber resources and on the types of industries that might be attracted to various communities. In 1962 the Forest Industry Reports prepared by Ebasco under a contract with the Department of Commerce and Industrial Development became available. These reports, based on studies of several wood-using industries, describe the types and volume of timber needed, labor, and transportation requirements and other matters of significance to these industries. These reports provide valuable background information for the county forestry committees and stimulated their interest in securing the type of information needed to make forestry a more significant part in the economy of the county. Work with the rural area development panels or county forestry committees continues to be a significant activity of the extension forester. In 1964 at the request of the Farm and Home Administration the extension forester met with three technical action panels in four rural development areas to discuss the economic aspects of forestry. These meetings were attended by personnel of the Farm and Home Administration, the Agricultural and Stabilization Conservation Service, the U. S. Forest Service, Missouri Conservation Commission, and Extension Service from 12 southcentral and southeast Missouri counties.

The accomplishments of the county forestry planning work is difficult to evaluate but certain facts are more or less obvious. Most of the county agents in the Ozark counties have a much better understanding of the economic importance of forestry as a result of attending one of the three forestry workshops at the University Forest. They are in a much better position to organize the forestry work in their counties and to work effectively with other governmental agencies, the forestry committees, and the panels in the rural area development counties.

The forestry committees and the rural area development panels have worked diligently in obtaining information on forest resources, available labor, transportation, and other information needed to attract new wood-using industries to their communities. As a result of their work, a number of communities have attracted charcoal kilns, wood preservation plants, and in a few cases other types of wood-using industries. One county has attracted a new wood fiber plant.

### **Miscellaneous Forest Extension Activities**

The extension forester has devoted a limited amount of time to activities other than those discussed.

Soon after World War II, when attention was given to proper development of the farmstead in connection with the Balanced Farming program, considerable interest developed in the planting of ornamental and shade trees. The forestry extension specialist worked with specialists in other fields, particularly the home demonstration agents, in providing information on the planting and care of ornamental and shade trees. By 1964 the demand for this type of information had become widespread. The extension forester developed a set of slides covering the important points in shade tree planting and maintenance. This set of slides was duplicated and made available to counties in which there was an interest. This work by the extension forester has undoubtedly resulted in better survival and better maintenance of ornamental and shade trees.

Two meetings were held for Missouri bankers to acquaint them with the economic opportunities in woodlands. The first meeting held in 1949 and the second, in 1951, were sponsored by the Agricultural Extension Service in cooperation with the Federal Reserve Bank of St. Louis, the Missouri Bankers Association, and the Missouri Conservation Commission.

By 1963, considerable demand had developed for information on physiological damage and diseases in shade trees and measures needed to control them. The extension forester developed literature on these subjects and made it available to county extension personnel.

In the early 1960's interest was developing rapidly in the use of forest land for recreational purposes. In 1965, the St. Louis County Planning Commission requested from the extension forester information on timbered areas and their possible development for recreational purposes in St. Louis County. The extension forester worked with this committee in providing the information.

## Chapter VI

### THE STUDENTS

#### Student Profile

Students in the School of Forestry have many characteristics which are common to all students on the Columbia campus but they also exhibit some characteristics and abilities which apparently differ from the whole student population. In the section which follows an analysis is made of the students' performances on SCAT tests, their high school backgrounds, their academic performance in various courses during their freshman year, their grade point averages during their first semester, their reasons for choosing a curriculum in the School of Forestry, and their family backgrounds. Some of these studies were initiated in the fall of 1965.

#### SCAT Test Performance

Performances on the SCAT test of freshmen entering the School of Forestry between 1965 and 1968 are based on 50 to 66 students per year. The results of the analysis are shown in Table 1.

It is obvious that there was not much variation in the SCAT scores of freshmen entering the School of Forestry between 1965 and 1968. This is in agreement with

TABLE 1. SCAT SCORES OF FRESHMEN  
FROM 1965 TO 1968

| SCAT<br>Score Class | Percent of Total |      |      |      |
|---------------------|------------------|------|------|------|
|                     | 1965             | 1966 | 1967 | 1968 |
| Below 30            | 0.0              | 1.5  | 0.0  | 2.0  |
| 30 - 39             | 10.0             | 24.6 | 18.5 | 19.6 |
| 40 - 49             | 43.3             | 36.9 | 38.9 | 27.5 |
| 50 - 59             | 31.7             | 29.2 | 37.0 | 45.1 |
| 60 - 69             | 11.7             | 7.7  | 5.6  | 5.9  |
| 70 - 79             | 3.3              | 0.0  | 0.0  | 0.0  |
| Basis No.           | 60               | 66   | 54   | 51   |

findings based on all freshman students from 1966 to 1968 at the University of Missouri-Columbia (Anonymous, 1968). During each of these years a large proportion of the students fell between 40 and 59, which is regarded as average. Between 66 and 76 percent of the entering freshmen fall within this range. The proportion of students scoring over 60 is small and has declined somewhat since 1965. A study by Miller (1967) of freshmen entering the University of Missouri-Columbia in 1959-60 shows that 70 per percent of the students in the University as a whole scored between 40 and 59 while 82 percent of freshmen in the School of Forestry scored between these figures. It is evident that the capability of freshmen enrolling in the School of Forestry is similar to that of students enrolling in other divisions.

Table 2 shows the distribution of SCAT scores of 47 freshmen entering the School of Forestry in 1968 on three parts of the SCAT test—college English, verbal, and quantitative. These freshmen did best on the quantitative part of the test, more than 50 percent of them making a score of 50 or higher.

TABLE 2. DISTRIBUTION OF SCORES ON THREE PARTS OF THE SCAT TEST FOR FRESHMAN ENTERING IN 1968

| SCAT<br>Score Class | Percent of Total |        |              |
|---------------------|------------------|--------|--------------|
|                     | College English  | Verbal | Quantitative |
| Below 30            | 4.3              | 0.0    | 2.1          |
| 30 - 39             | 25.5             | 12.7   | 21.3         |
| 40 - 49             | 46.8             | 51.1   | 23.4         |
| 50 - 59             | 10.6             | 25.5   | 48.9         |
| 60 - 69             | 12.7             | 10.6   | 4.3          |

They scored better on the verbal than on the college English test. The superiority of the students on the quantitative part of the test substantiates the results of a study by Krauskopf (1966). He states "in sum, the university gets a student with good ability, better in quantitative than in the verbal test. This is a pattern more typical of the midwest than of colleges on either coast. It is also a pattern more typical of engineering and science students than of students in the

TABLE 3. NUMBER OF YEARS OF HIGH SCHOOL MATHEMATICS TAKEN BY FRESHMEN ENTERING DURING 1965 to 1968

| Number of<br>years | Percent of Total |      |                 |      |
|--------------------|------------------|------|-----------------|------|
|                    | 1965             | 1966 | 1967            | 1968 |
| 0                  | 1.6              | 1.5  | 0.0             |      |
| 1                  | 3.2              | 0.0  | 2.0             | 2.0  |
| 2                  | 24.8             | 15.2 | 18.4            | 7.8  |
| 3                  | 28.0             | 48.5 | 38.8            | 43.1 |
| 4                  | 42.6             | 34.8 | 40.8            | 47.1 |
| 5                  | 0                | 0    | 0               | 0    |
| Basis No.          | 61               | 66   | 49 <sup>1</sup> | 51   |

<sup>1</sup> Record not available on all freshmen

humanities and social science.” The generally satisfactory performance of the students on the quantitative portion of the SCAT test may be related to the fact that the proportion of students entering the School of Forestry with four years of high school mathematics has gradually increased.

<sup>1</sup> Record not available on all freshmen

Among the freshmen entering in 1968 nearly 50 percent had had four years of high school mathematics and in many cases this included an introduction to analytical geometry and calculus. Ninety percent of the freshmen entering in 1968 had had either three or four years of high school mathematics whereas in the class entering in 1965, 70 percent had had three or four years of high school mathematics.

#### Academic Performance in Mathematics and English

Tables 4, 5, and 6 show the distribution of grades of forestry freshmen in college algebra, trigonometry, and English composition.

TABLE 4. DISTRIBUTION OF GRADES OF FORESTRY FRESHMEN IN COLLEGE ALGEBRA

| Grade | Percent of Total |      |      |      |
|-------|------------------|------|------|------|
|       | 1965             | 1966 | 1967 | 1968 |
| A     | 11.4             | 13.8 | 10.3 | 14.6 |
| B     | 13.6             | 17.2 | 20.5 | 12.2 |
| C     | 45.5             | 37.9 | 35.9 | 51.2 |
| D     | 18.2             | 20.7 | 20.5 | 12.2 |
| F     | 11.4             | 10.3 | 12.8 | 9.8  |
| Del.  | 0.0              | 0.0  | 0.0  |      |

TABLE 5. DISTRIBUTION OF GRADES OF FORESTRY FRESHMEN IN TRIGONOMETRY

| Grade | Percent of Total |      |      |      |
|-------|------------------|------|------|------|
|       | 1965             | 1966 | 1967 | 1968 |
| A     | 21.6             | 14.7 | 9.1  | 10.3 |
| B     | 13.5             | 20.6 | 27.3 | 17.2 |
| C     | 37.9             | 47.1 | 33.3 | 34.5 |
| D     | 13.5             | 11.7 | 15.1 | 20.7 |
| F     | 13.5             | 5.9  | 15.2 | 17.2 |

TABLE 6. DISTRIBUTION OF GRADES OF FORESTRY FRESHMEN IN ENGLISH COMPOSITION

| Grade | Percent of Total |      |      |      |
|-------|------------------|------|------|------|
|       | 1965             | 1966 | 1967 | 1968 |
| A     | 0.0              | 0.0  | 0.0  | 2.5  |
| B     | 12.0             | 11.3 | 20.0 | 5.1  |
| C     | 44.0             | 50.0 | 54.0 | 71.8 |
| D     | 32.0             | 16.1 | 8.0  | 5.1  |
| F     | 12.0             | 22.6 | 18.0 | 15.4 |

Forestry freshmen make better grades in the two mathematics courses than they do in English composition. It is noteworthy that they rarely make a grade of A and only limited numbers make a grade of B in English composition. Their performance in the fall of 1968 was much poorer than that of all freshmen at the University of Missouri-Columbia (anonymous, 1969). In contrast, substantial numbers of students make grades of A and B in both college algebra and trigonometry. However, in the fall of 1968, forestry students made fewer B grades and more C grades in college algebra than all freshmen at the University (anonymous, 1969). The proportion of students making a grade of A or B in trigonometry is somewhat higher than the proportion making these grades in college algebra. This may be due in part to the fact that the students are enrolled in trigonometry during the second semester whereas they are enrolled in college algebra during the first semester. The first semester of adjustment may be helpful to them in coping with college work.

### High School Science

Table 7 shows the number of years of high school science taken by freshmen entering during the period 1965-1968.

TABLE 7. NUMBER OF YEARS OF HIGH SCHOOL SCIENCE TAKEN BY FRESHMEN ENTERING DURING 1965 TO 1968

| Number of Years | Percent of Total |      |                 |      |
|-----------------|------------------|------|-----------------|------|
|                 | 1965             | 1966 | 1967            | 1968 |
| 0               | 0                | 0    | 0               | 0    |
| 1               | 12.9             | 7.6  | 14.6            | 5.9  |
| 2               | 35.2             | 47.0 | 31.3            | 29.4 |
| 3               | 29.6             | 27.3 | 31.3            | 33.3 |
| 4               | 22.2             | 18.2 | 22.9            | 29.4 |
| 5               |                  |      |                 | 2.0  |
| Basis No.       | 54               | 66   | 48 <sup>1</sup> | 51   |

<sup>1</sup>Record not available on all freshmen

The number of students taking either three or four years of high school science has increased during the past two years. The proportion of students taking two, three, or four years of high school science among the freshmen entering in 1968 is about equally divided.

### Academic Performance in Botany and Geology

The distribution of grades of forestry freshmen in general botany and physical geology is shown in Tables 8 and 9.

The academic performance of forestry freshmen in both general botany and geology has improved since 1965. The improvement has been much greater in geology but it should be noted that the performance during 1965 and 1966 was especially bad. Whether the greatly improved performance in geology in 1968 is due to a change in grading system is not known. Generally speaking, the proportion of students making A and B grades in botany and geology is substantially lower than

TABLE 8. DISTRIBUTION OF GRADES OF FORESTRY FRESHMEN IN GENERAL BOTANY

| Grade | Percent of Total |      |      | 1968 |
|-------|------------------|------|------|------|
|       | 1965             | 1966 | 1967 |      |
| A     | 0.0              | 3.1  | 12.0 | 6.1  |
| B     | 8.2              | 23.5 | 12.0 | 10.2 |
| C     | 42.6             | 45.3 | 54.0 | 69.4 |
| D     | 29.5             | 10.9 | 6.0  | 6.1  |
| F     | 19.7             | 17.2 | 16.0 | 6.1  |
| Inc.  | 0.0              | 0.0  | 0.0  | 2.0  |

TABLE 9. DISTRIBUTION OF GRADES OF FORESTRY FRESHMEN IN PHYSICAL GEOLOGY

| Grade | Percent of Total |      |      | 1968 |
|-------|------------------|------|------|------|
|       | 1965             | 1966 | 1967 |      |
| A     | 0.0              | 3.9  | 6.5  | 0.0  |
| B     | 12.0             | 7.6  | 19.6 | 46.7 |
| C     | 44.0             | 33.9 | 39.1 | 40.0 |
| D     | 32.0             | 30.2 | 19.6 | 6.7  |
| F     | 12.0             | 24.3 | 15.2 | 3.3  |
| Del.  |                  |      |      | 3.3  |

the proportion of students making A and B grades in college algebra and trigonometry, with the exception of physical geology in 1968.

#### Grade-Point-Average in First Semester

Table 10 shows the grade-point-average of freshmen in the School of Forestry during their first semester on the campus.

There has been a notable improvement in scholastic achievement of freshmen during their first semester since 1965. The proportion of those making a

TABLE 10. G. P. A. OF FRESHMEN IN SCHOOL OF FORESTRY DURING THE FIRST SEMESTER

| G. P. A.<br>Class | Percent of Total |      |      | 1968 |
|-------------------|------------------|------|------|------|
|                   | 1965             | 1966 | 1967 |      |
| 0.0-0.49          | 6.8              | 7.6  | 5.5  | 2.0  |
| 0.50-0.99         | 13.6             | 9.1  | 10.9 | 8.0  |
| 1.00-1.49         | 18.6             | 22.7 | 14.5 | 8.0  |
| 1.50-1.99         | 23.7             | 13.6 | 21.8 | 20.0 |
| 2.00-2.49         | 23.7             | 27.3 | 23.6 | 36.0 |
| 2.50-2.99         | 10.2             | 12.1 | 9.1  | 16.0 |
| 3.00-3.49         | 3.5              | 4.5  | 5.5  | 10.0 |
| 3.50-4.00         | 0.0              | 3.0  | 9.1  | 0.0  |

grade-point-average of 2.00 or higher has increased from 37 percent in 1965 to 62 percent in 1968. During both 1966 and 1967 the proportion was 47 percent. There has been a substantial decrease in the proportion of students making a grade-point-average under 1.00 during the first semester. This means that a larger proportion of freshmen are surviving after the first semester.

### **Transfer Students**

Each year from 15 to 35 students who have had from one to three years of education at another institution or who have had the initial part of their education in a division of the University of Missouri other than the School of Forestry transfer to the School of Forestry. The number of transfer students, particularly from Kansas and Nebraska, has increased substantially during the past few years as a result of the reciprocal agreement which permits students from these states to enroll at the University of Missouri School of Forestry without the payment of out-of-state tuition. Transfer students do not take the SCAT tests, consequently, the type of information available on freshmen is not available on transfer students. The impression exists that the transfer students perform better academically during their first semester on the campus than do freshmen during their first semester. The data on academic performance during the fall of 1968 confirm this conclusion. Seventy-nine percent of the transfer students made a grade-point-average of 2.00 or higher while 62 percent of the freshmen achieved this record.

### **Choice of Curriculum in School of Forestry**

The reasons that both freshmen and transfer students give for choosing a curriculum in the School of Forestry suggests that they lack a fundamental understanding of the work. For example, 66 students, representing approximately 54 percent of the 123 students who were asked why they chose a curriculum in the School of Forestry, stated that their decision was based on the fact that they liked outdoor work. Eighteen percent made the choice because of their general interest in trees. Approximately 6 percent had become interested in the School of Forestry through discussions with a forester and a similar number had developed an interest through discussions with their high school counselors. Several other reasons, none of which were particularly pertinent, were given for their choice of a curriculum in the School of Forestry.

### **Family Backgrounds**

The family backgrounds of the freshmen and transfer students who entered the School of Forestry in the fall of 1968 varied greatly. Information on 78 fathers revealed that 23 percent had less than a complete high school education, 36 percent had graduated from high school, 19 percent had had some college education and 22 percent had had four years or more of college. Similar information on the mothers of 68 students revealed that 16 percent had less than a complete high school education, 51 percent had graduated from high school, 15 percent had one to three years of college and 18 percent had four years or more of college.

### **General Interests**

Students in the School of Forestry generally have limited interest outside of the activities of the School of Forestry. Few participate in intercollegiate athletics;



only one alumnus earned a varsity letter in football and two earned varsity letters in track during the 20 years from 1949 through 1969. Furthermore, relatively few of the students participate in campus politics, dramatics, or other activities that are available to them. On the other hand the students support the Forestry Club quite well. Normally, approximately 60 percent of the undergraduates enrolled in the School are members of the Forestry Club.

### Student-Faculty Relations

Relations between students and faculty have always been excellent. Consequently, the esprit-de-corps in the School of Forestry has been high. Several factors have contributed to this favorable situation. The faculty members have always had an "open-door" policy under which students are free to consult with faculty members on either academic or personal matters at any time. Faculty members who serve as counsellors, except the freshman-transfer student counsellor, generally act as counsellor for approximately 15 students, thus giving them ample time to perform their task effectively. The forestry summer camp which is a requirement for all students enrolled in the forestry curriculum brings students and faculty in close contact for 12 weeks, a condition which contributes to student-faculty relations. Furthermore, most faculty members are members of the Forestry Club and participate in its activities.

### Forestry Club

The counterpart of the Forestry Club, the Forestry Society, was organized February 6, 1912, by the members of the class of 1913. With the assistance of Prof. Ferguson, a constitution and by-laws was drawn up and officers were elected. The second meeting of the members was held February 20 at the home of Prof. Ferguson at which time the upper classmen voted to invite the underclassmen to become members of the Forestry Society. On October 12, 1912, the Forestry Society adopted khaki trousers, flannel shirts, boots or leggings, and red bandanas as the official costume for forestry students. On December 17, 1912, a farewell banquet was held for Prof. Ferguson who was leaving to become head of the Forestry Department at Pennsylvania State College. He suggested that the banquet be made an annual affair.

On October 14, 1913, the Forestry Society voted to serve refreshments at every meeting, and to finance this, the dues were raised to \$1.00 per year, payable at \$.50 per semester. November 11, 1913, the members of the society passed a motion that any member not attending regular meetings would be fined five cents unless he notified the entertainment committee in advance. The by-laws also provided that a person who was to give the program for the meeting and did not appear would be fined 25 cents.

At a meeting December 9, 1913, the possibility of securing use of one issue annually of the *College Farmer* to feature forestry was discussed. Upon consultation with the staff of the *College Farmer* it was found that the staff of the publication was unwilling to cooperate. Prof. Dunlap suggested that the Forestry Society might like to consider the publication of a forestry annual.

At a meeting April 28, 1914, the by-laws on non-performance on a program was amended to increase the penalty from \$.25 to \$1.00.

According to the minutes of the Forestry Society, which extend from February 6, 1912, to September 29, 1917, the Society held annual campfires in the fall and the members participated in Farmer's Fair and Parade. The records are not clear as to whether banquets were held annually. The membership for the school year 1915-16 is listed at 18.

May 18, 1916, the Intercollegiate Association of Forestry Clubs invited the University of Missouri Forestry Society to petition for admission to membership in the Association. At a meeting September 26, 1916, the members voted to apply for membership. At this meeting the members voted to allow members to bring lady friends to the fall campfire.

At a meeting October 19, 1916, it was suggested that a committee be established to explore the possibilities of establishing a scholarship for a freshman. The last available minutes of meetings of the Forestry Society were for September 29, 1917. It is not known whether any meetings were held after this date. It has been definitely established however that there was no organization of forestry students from 1921 to 1936.

When the pre-forestry curriculum was established in 1936 a Forestry Club was organized. There are no records of the activities of this group but it is known that the club held bi-weekly meetings and that the programs dealt with subjects of particular interest to forestry students.

The club became inactive during World War II but became active again in the fall of 1946 when the four-year curriculum in forestry went into effect.

With the inception of the four-year forestry curriculum the number of students increased and with it the interest and enthusiasm in the Forestry Club increased. The meetings which are held bi-weekly are usually divided into two parts—business and educational and social. The business is usually concerned with one or more of the Club activities. Speakers on forestry or related subjects are drawn from public agencies such as the Forest Service, the Missouri Department of Conservation, the University, and private industry.

The Forestry Club has always been one of the most active student organizations on campus and its members have always been deeply interested and enthusiastic about their organization.

During the life of Farmer's Fair the Forestry Club frequently entered floats in the Farmer's Fair Parade. The first entry, in 1947, won first place for the Club. The 1953 entry also won first place and third place prizes were received in 1955, 1956, and 1957.

On several occasions the club entered a float in the annual Homecoming Parade. In 1961 the club float won first place in the off-campus division.

The club held its first dance in the fall of 1947. This event has been continuous except for the fall of 1949. In 1948 the dance was known as the Forester's Stomp but in 1950, after a lapse of one year, the dance was renamed the Paul Bunyan Bounce, and has been known by this name since.

The oldest annual event of the Forestry Club is the fall campfire which was held for the first time in the fall of 1948. On this occasion new members are initiated into the club.

In the fall of 1950, concern developed among the members about inadequate financing of the club to provide support for traditional annual events and develop

new events which many members felt were desirable to broaden the base of interest among forestry students. During the school year 1950-51 a committee worked on a new constitution which was adopted during the school year. This constitution provided for an increase in annual dues to \$5.00 and established the Paul Bunyan Bounce, a banquet and a barbecue as recognized activities of the Club.

A spring barbecue was held for the first time in the spring of 1947 and has been an annual affair since then. For the first several years a field day and a baseball game between students and faculty members were a part of the activities at the spring barbecue.

The club has been active in a number of intramural sports, including basketball, softball, football, and volleyball. At one time the club sponsored teams in virtually every intramural sport but in recent years its other activities have taken more time and the sports program has received less attention. From 1955 through 1958 the club sponsored a bowling team in the student bowling league.

The first Forestry Club banquet was held in the spring of 1952. For several years the banquet was open only to members of the Forestry Club, but in 1959 the banquet was opened to dates and wives of Forestry Club members. The banquet provides an opportunity for recognizing scholarship winners and sponsors of the scholarships and students who have won other types of honors. Some administrative officers from the University of Missouri-Columbia and some administrators of federal and state forestry agencies are guests of the club. The Westveld Awards—one award to a member of each of the four classes—were established on the occasion of the first banquet. The freshman award goes to the freshman who had the highest scholastic average during his first semester; the sophomore award goes to the sophomore who during his freshman and sophomore year has been most active in the Forestry Club; the junior award goes to the junior who had the highest scholastic average during his freshman and sophomore years in courses other than forestry; and the senior award goes to the senior who has most effectively combined high scholarship and leadership for and service to his fellow students.

Individuals or representatives of organizations which sponsor scholarships in the School of Forestry are guests of the Forestry Club. The banquet features different types of entertainment and a speaker. In 1961 the Headless Axe Awards—one for a student and one for a faculty member—were initiated. The awards are given annually to the student and faculty member making the "greatest goof" during the year.

Although the income from membership dues was theoretically intended to cover the cost of the various Forestry Club activities, the expanded program under the 1950-51 constitution could not be of the scope and quality that was desired if the membership dues were the only source of income. The sale of Christmas Trees, first undertaken in 1948, became an important source of supplemental revenue. For a period of ten years the sale of Christmas Trees was a relatively small undertaking and the Forestry Department Christmas Tree plantations were the sole source of trees. As the project was enlarged in 1959, some of the trees were obtained from plantations of private landowners, and in recent years these private plantings have been the chief source of trees.

With the objective of increasing the net revenue from the sale of Christmas Trees, the club established its first Christmas Tree planting in 1962 on land of the

Ashland Arboretum and Wildlife Area. In 1965, new members of the Forestry Club were required as a part of their initiation to work in the Christmas tree plantations on pruning and cleaning activities. It is anticipated that in the near future the club will have sufficient Christmas tree plantations to provide adequately for their needs. The Christmas tree sales have netted several hundred dollars annually.

In the fall of 1961 the Forestry Club obtained its first concession at the stadium at football games. Members who participated in this activity were able to watch at least a part of the football game at no cost. Net income from individual games has varied from around \$50 to occasionally more than \$100. The total income annually has varied from \$200 to more than \$300.

Another money-making activity was carried on by the club in the spring of 1952 when some members planted trees and made release cuttings on lands of the James Foundation at St. James.

One of the most significant features of the Forestry Club banquet occurred in 1959 when Murrell W. Talbot of the Class of 1913 was presented a Certificate of Merit by the president of the University of Missouri Alumni Association for outstanding service to his profession.

The Mid-West Foresters' Conclave sponsored by the Forestry Schools of the Mid-West had been in operation for some time when the University of Missouri Forestry Club decided to participate for the first time in 1962. This event features a number of field contests and social activity. The club has never been outstandingly successful at this event, the highest it has placed being third among eight schools in the fall of 1965. The club was the host for this event in the spring of 1965.

Since the fall of 1964 the club has held a field day having the primary objective of developing competence in the various field events held at the Mid-West Foresters' Conclave. Whereas the Conclave has been held in the fall through 1964, the event was changed to spring in 1965.

In the fall of 1965 the club participated in field activities at Salem which were held in conjunction with the wood industry show. They participated again at the wood industry show at West Plains, in the fall of 1968.

The *Missouri Log*, published by the Forestry Club, came into being in 1948 when volume I, a 60-page booklet, was published. Since then it has been published annually and has grown into a publication of 88 to 96 pages. The *Missouri Log* records all the club activities and the activities of Xi Sigma Pi. The booklet is well illustrated photographically. It contains individual photographs of seniors and group pictures of other classes and Forestry Club members. It also contains several feature articles, which in recent years have been developed around a central theme. Each volume of the *Missouri Log* is dedicated to an individual who has made a major contribution to some phase of forestry or related work, usually in Missouri. Many of the individuals so honored have been Missourians. Individuals other than personnel of the University of Missouri-Columbia who have been honored are:

Paul D. Kelleter (1948), Missouri's first professional forester. He had more than 40 years of service to forestry, 33 of which was with the U. S. Forest Service.

William L. Hall (1949), charter member of the Society of American Foresters. Hall spent nearly 20 years with the U. S. Forest Service and more than 35 years as a consulting forester.

I. T. Bode (1950) was best known as director of the Missouri Conservation Commission for more than 20 years.

Major Edward M. Stayton (1951), an engineer. Stayton served as Chairman of the state-wide Forestry Committee of the Missouri Conservation Federation for five years.

George O. White (1952) State Forester of Missouri for 20 years.

Edward N. Munns (1955) whose career included nearly 40 years with the Forest Service, mostly in research.

Murrell W. Talbot (1956), forestry class of 1913, whose career included more than 30 years in range research with the U. S. Forest Service.

G. Kenneth Milliken (1960), Executive Vice President of the Southwestern Lumberman's Association.

Joseph Jaeger Jr. (1961), director, Missouri State Park Board.

Ernest J. Palmer (1962) and eminent self-educated plant taxonomist who worked for 30 years for the Arnold Arboretum.

Osal B. Capps (1963), district forester and since 1960, state forester, Missouri Department of Conservation.

Congressman Clifford McIntire and Senator John Stennis (1964), authors of P. L. 87-788 which authorized the appropriation of funds for forestry research at state colleges and universities.

William E. Towell (1967), district forester, farm forester, assistant state forester, assistant director, and from 1957 to 1967 director, Missouri Conservation Commission.

Leo A. Drey (1968), owner of the 136,000-acre Pioneer Forest and an active supporter of the School of Forestry programs.

Sam M. Arnold (1969), owner of Arnold Lumber Co. of Kirksville, and active supporter of the School of Forestry programs.

University personnel who have been honored by the Missouri Log are R. H. Westveld (1957 and 1965), former director, School of Forestry; Elmer Ellis (1958), President, University of Missouri 1954-1966; and Theodore W. Bretz (1966), professor of forestry 1954 to 1968.

Funds from several sources—advertising, the Forestry Club, the Forestry Alumni Association, and the School of Forestry—finance the Missouri Log.

The Forestry Club has given honorary memberships to four persons. These are the late George O. White, former state forester, in 1960; the late W. J. O'Neil, associate professor of Forestry at the University of Missouri, in 1964; R. H. Westveld, retired director of the School of Forestry, in 1965; and Osal Capps, state forester of Missouri in 1968.

### **Xi Sigma Pi**

During the school year 1948-49 a group of forestry students with high scholastic standing requested the University administration permission to establish Phi Theta Gamma as an honorary fraternity for foresters. The University administration granted permission in the spring of 1949. The objective of the group was to recognize high scholarship and leadership among forestry students. Its goal was ultimately to become a chapter of Xi Sigma Pi, National Honorary Fraternity. Their petition was approved by the national organization and on May 10, 1952,

Tau Chapter of Xi Sigma Pi was established at the University of Missouri by Daniel Den Uyl a member of the Kappa Chapter who represented the national officers.

Forestry students who rank in the upper 25 percent of their class either during their junior or senior years are eligible for membership in the fraternity. Graduate students are also eligible. In addition to the scholarship qualifications, candidates must be of good character and be potential leaders in their profession.

One of its first activities was to recognize the freshman and senior with the highest scholastic standing in their respective classes. The first awards, which consisted of having the names of the students engraved on a plaque, were made during the school year 1951-52.

Another important activity of Xi Sigma Pi is the maintenance of a map located in the hallway near the administrative offices of the School of Forestry which shows the identity and location of each alumnus of the School of Forestry.

In the spring of 1950 the members of the class of 1950, under the sponsorship of Xi Sigma Pi, established a memorial plantation of eastern redcedar at the Weldon Spring Experimental Farm. During the school year 1952-53 the Rudolf Bennitt Forest was dedicated at the Ashland Arboretum and Wildlife Area. On several occasions the members of Xi Sigma Pi have carried out stand improvement work in this forest.

Annually, the members of Xi Sigma Pi sponsor a luncheon for alumni following the annual meeting of the Forestry Alumni Association in the fall. This is done as a convenience for the alumni. The meeting is held on a Saturday preceding one of the important football games.

During the biennium 1966-1968 the Tau Chapter of Xi Sigma Pi held the national offices of the organization. Gene S. Cox was elected forester, the late W. J. O'Neil, assistant forester, and R. H. Westveld, secretary-fiscal agent by the Executive Council of the national organization. Upon the death of W. J. O'Neil in the spring of 1967 R. C. Smith was elected to the position of Assistant Forester. Upon the recommendation of the secretary-fiscal agent, the national convention in 1967 approved the issuing of an annual newsletter on experimental two-year basis. The first issue of this publication was released in the spring of 1968.

### **Student Council**

As student unrest developed on some campuses and became acute on a few campuses in 1968 and 1969 (not at the University of Missouri-Columbia), the Chancellor of the University of Missouri-Columbia and student leaders sought ways of improving communications between students and the administration. Agreement was reached for Student Councils to be organized in each division of the University, the membership of each Council to be determined by an election in April of each year. Two members are elected from sophomore, junior, and senior classes. These elected members then appoint a member of the freshman class in October to represent that class. The Council appoints a faculty advisor and nominates members to serve on eight of the School of Forestry Committees. The Council must meet at least once each month. It has the responsibility of considering any matters brought to it by students and to keep students and faculty informed of its actions.

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## Chapter VII

### THE ALUMNI

The alumni of the School of Forestry through 1969 consist of 576 persons who earned their bachelor's degrees at the University of Missouri-Columbia (17 from 1912 through 1921 and 559 from 1949 through 1969), 16 persons who earned bachelor's degrees at other institutions and earned only their advanced degrees from the University of Missouri. In this first group, 36 alumni also earned the master's degree from the University of Missouri and two persons in the latter group also earned the Ph.D. degree from the University of Missouri. Of the 16 persons who earned only advanced degrees from the University of Missouri, two earned the Ph.D. degree.

#### **Forestry Alumni Association**

The alumni have always been interested in and loyal to the School of Forestry. This is evidenced by the fact that in 1953, only two years after the first degrees in forestry were conferred by the new department a small group of alumni met for the purpose of organizing the Forestry Alumni Association. A constitution was adopted which, among other things, provided for the publication of a quarterly newsletter. Following a contest to select a name, it was initiated as the *Missouri Forestry Alumni News*.

The first meeting of the Forestry Alumni Association was held in Columbia March 10, 1953, with seven members present. The group decided to hold future meetings in the fall on a Saturday when a football game was being played in Columbia. This has been the practice since that first fall meeting.

At the first meeting three committees were established: (1) Advisory Committee to the Forestry Department, (2) Placement of Graduates, and (3) Financial Committee. The Advisory Committee in the mid 1950's solicited the views of the alumni on improvements in the forestry curriculum. The Financial Committee, which at first concerned itself with scholarships, later became the Development Committee and added all types of financial aid to the School of Forestry as its function. The constitution of the Forestry Alumni Association has been revised three times, in 1954, 1959, and 1967. The 1959 revision made



provision for an associate membership created for those members of the faculty who are not graduates of the University of Missouri.

Because of relatively small attendance at the annual meetings—37 was the largest number in 1960—due in part to the fact that the members are widely dispersed throughout the United States, the Association has been limited in the kinds of activities it can undertake. In recent years it has been concerned with strengthening itself and supporting the activities of the Development Committee in securing funds for the School from private sources.

In 1957 the Forestry Alumni Association established the Rodney Ward Scholarship in memory of Rodney L. Ward, a member of the class of 1953, who was killed in an accident. The Scholarship was financed by contributions from alumni and members of the faculty of the School of Forestry. In 1926 the Rodney Ward Scholarship was renamed the Forestry Alumni Scholarship because Alumni Association wanted to honor the memory of other alumni who were deceased. Subsequently, the members of the Association decided that they preferred to support a loan fund to replace the Forestry Alumni Scholarship. The Board of Curators accepted the School of Forestry Memorial Loan Fund July 7, 1960. By the Spring of 1969 the School of Forestry Memorial Loan Fund had accumulated approximately \$2,700 which was available as loans for forestry students.

At two of its annual meetings the Forestry Alumni Association voted to make contributions from its reserves to the School of Forestry Development fund. At the November 11, 1961, meeting it voted to contribute \$200 and at its November 30, 1965, meeting it voted \$250 more to the School of Forestry Development Fund.

At the November 7, 1964, meeting of the Association, the members voted to establish a Citation of Merit and recommended that a committee be appointed to establish criteria for awarding the citation. The committee established the following guide lines for awarding the citation.

1. The selection should be made from persons who are not alumni of the School Forestry.
2. Award to be made whenever there are suitable candidates for consideration, but no more than one award a year.
3. Selection should be based on service to the School of Forestry, taking into account the following: contribution of time to the development and improvement of the school (for example, membership on School of Forestry Advisory Council); assumption of leadership of school improvement activities (for example, as an officer, chairman of a working group or committee of the School of Forestry Advisory Council); active support of state or federal legislation contributing to the betterment of the School; and gaining financial support for the School.

The committee decided that the most appropriate time for awarding Citations of Merit would be at the annual meeting of the School of Forestry Advisory Council.

The first award was made in the fall of 1966 to D. B. Mabry, an officer of Moss-American, Inc., of St. Louis. Mabry was the first chairman of the School of Forestry Advisory Council and have been very active in the council for seven years. The second award was presented in 1967 to Leo Drey, the owner of Pioneer Forest, who, at the time of receiving the award was chairman of the School of Forestry

Advisory Council. He, like Mabry was a very active member of the School of Forestry Advisory Council. The third award was made in the fall of 1968 to John Powell, owner of a tract of forest land and of a retail lumber business. He had served in various offices, including the chairmanship of the School of Forestry Advisory Council. The fourth award was made in 1969 to Roger Shaw, owner of several thousand acres of land in the Ozarks managed for timber and livestock. He has been a member of the School of Forestry Advisory Council since 1958 and was its second chairman.

To acquaint seniors with the Forestry Alumni Association, they are given copies of the Forestry Alumni News during their senior year and at the time of their graduation they are the guests at a luncheon sponsored by the Association.

While the members of the Association have attended the annual meeting, the wife of the Director of the School of Forestry has entertained the wives of the members and wives of the faculty at a morning coffee. Alumni and wives and faculty and wives then joined together for a luncheon handled by Xi Sigma Pi. In 1967, the first dinner for association members and their wives and faculty and their wives was held following the football game.

On July 1, 1969, the membership in the Forestry Alumni Association was 344.

### **Occupations of Alumni**

One hundred ninety-six of the 549 alumni who received undergraduate degrees from the University of Missouri-Columbia fall into categories which would be described as non-forestry employment, deceased, retired and unknown. Seventy-four of the alumni are known to be in types of work that would be classified as non-forestry, although a number of persons in this category are engaged in work for which their training provides excellent background. Fourteen alumni are deceased, four are retired and the occupations of 35 alumni are unknown. Eighteen are classified as having made the military service their career (these individuals have been in the military service more than five years, some of them for as long as 15 years). Fifty-one alumni are classified as being temporarily in the military service. Many of these will undoubtedly accept forestry positions when they are released from their military obligation.

Two-hundred fifty-three of the alumni who earned undergraduate degrees are engaged in some type of forest land management work. The largest number in this category is employed by the Forest Service of the U. S. Department of Agriculture. They occupy virtually every type of position recognized by the Forest Service.

Five alumni are supervisors of national forests. They are Walter B. Metcalf, '50, A. Claude Ferguson, '52, James S. Berlin '57, Alfred H. Troutt '57, and Donald C. Rollens '59. One alumnus is a deputy supervisor and another is an assistant forest supervisor.

Robert D. Raisch '50, is director, Division of Cooperative Forest Management, U. S. Forest Service in Washington, D. C. Nine alumni are timber management assistants, 20 are district rangers, six are assistant district rangers, four are Job Corps assistants, three are Job Corps supervisors and 27 are unclassified since it is impossible from the title of their positions to determine definitely the position they occupy. Ten alumni are in research, three of whom are project leaders. Thirty alumni are specialists or staff officers, other than timber management assistants,

either in the Forest Supervisor's office or on a ranger district.

Seventy-eight alumni who received undergraduate degrees are employed in the various state forest services. Two occupy the position of state forester, Harold G. Gallaher, '49, who also occupies the position of Extension Forester in Kansas and David M. Click, '55, who is state forester of Indiana and serves also as acting deputy director of the Indiana Department of Natural Resources. Alumni employed by state forest services also include three assistant state foresters, one associate state forester, 22 farm foresters, 20 district foresters, eight assistant district foresters, 17 specialists and five who occupy miscellaneous types of jobs.

Four alumni occupy the position of extension forester and a similar number occupy the position of district extension forester while one is an assistant extension forester. All of these are associated with the Land Grant colleges of the states where they are employed. One alumnus is a research scientist with a state agricultural experiment station.

Thirty-eight alumni who earned undergraduate degrees are employed in some type of forest land management work with private industry. Five are chief foresters for the companies by which they are employed. Of these five, David D. Schores, '53, woodlands manager, Buckeye Cellulose Corporation, probably occupies the most responsible position. Twenty-one persons occupy positions which are classified as unit forester, district forester, or assistant district forester. Seven alumni are classified as specialists, three are engaged in research, one is a logging manager and one is in an unclassified position.

Thirty-nine alumni who received undergraduate degrees are employed by business and industry. The greatest number in this group, 22, are either salesmen or sales managers. Most alumni in these categories are employed by the larger corporations such as Weyerhaeuser Company, Longbell Division International Paper Company, Georgia-Pacific Corporation, U. S. Plywood-Champion Papers, and Olinkraft. Three alumni are presidents of companies that sell and distribute wood products and one is a vice-president. The remainder are engaged in a wide variety of occupations including manufacture of wood products.

Fifteen alumni occupy positions on the staffs of colleges and universities. Most of them are associated either with forestry departments or forestry schools. One, however, Richard Hawkins, '57, occupies the position of assistant director, State University of New York Water Resources Center, State University College of Forestry. Of those engaged in teaching or research at colleges and universities four are associate professors, six are assistant professors, three are instructors, and one is a post-doctoral fellow. Twenty-five alumni were pursuing graduate work in the spring of 1969. Several of these will undoubtedly complete their graduate study by the end of the school year.

Nine alumni are engaged in tree service or municipal forestry work. Representative of this group are Raymond R. Bruns, '55, who is forester for Union Electric Company, David S. De Voto, '59, who is park forester, Board of Park Commissioners, Minneapolis, Minn., Paul R. Naland '61, who is city forester, Iowa City, Ia, and William Payne, '65, who is city forester, University City, Mo.

Five alumni are in consulting work. The best known in this group are Murrell W. Talbot, '13, and Jerry T. Davis, '54, who is the owner of Davis Forestry Services.

Fifteen alumni are employed by federal departments other than the Forest Service of the Department of Agriculture. Eleven of these are employed by various divisions of the Department of Interior, including the National Park Service; the Bureau of Outdoor Recreation; Bureau of Sports Fisheries, and Wildlife; Bureau of Indian Affairs; and Bureau of Land Management. One alumnus is a recreation planner for the Corps of Engineers and another is a research forester for Soil Conservation Service. Two alumni were serving in the Peace Corps in the spring of 1969.

Figure 1 shows the geographic location of the 353 alumni engaged in forestry work who earned undergraduate degrees at the University of Missouri-Columbia. Missouri leads all other states by a wide margin in the number of alumni foresters employed within the state, with the number totaling 87. Other states that have 10 or more alumni are Arkansas with 14, California with 25, Oregon with 24, Washington with 15, Colorado with 11 and Wisconsin with 10.

The 16 alumni who earned only graduate degrees in forestry from the University of Missouri-Columbia are classified as follows: Assistant director of federal forest experiment station, 2; research project leaders for federal forest experiment stations, 5; district ranger, U. S. Forest Service, 1; staff officer, U. S. Forest Service, 1; unclassified, U. S. Forest Service, 1; education (assistant professor), 1; research, foreign country, 1; non-forestry, 1; unknown, 3.



Figure 1. Distribution by states of 353 alumni engaged in forestry work - May 1969.

## Appendix A

FOREST FACULTY - PAST AND PRESENT

| Name                       | Degrees              | Date of First Appointment | Rank When Appointed | Promotions   | Date of Separation | Resigned, Retired, Died  |
|----------------------------|----------------------|---------------------------|---------------------|--------------|--------------------|--|
| John Arden<br>Ferguson     | B.S., M.F.           | 9-1-11                    | Professor           |              | 12-31-12           | Resigned   |
| Ernest C. Pegg             | M.F.                 | 9-1-12                    | Instructor          | Asst. Prof.  | 8-31-19            | Resigned   |
| Howard DeForest            | M.F.                 | 1-13-13                   | Asst. Prof.         |              | No record          | Resigned   |
| Frederick Dunlap           | B.S., M.F.           | 9-1-13                    | Professor           |              | 9-1-21             | Terminated<br>with abol-<br>ishment of<br>Forestry<br>Department |
|                            |                      | Reappointed<br>7-1-26     | Ext. For.           |              | 6-30-27            | Terminated   |
| Ruthford Henry<br>Westveld | B.S., M.F.,<br>Ph.D. | 1-1-36                    | Asst. Prof.         |              | 8-31-38            | Resigned   |
|                            |                      | Reappointed<br>8-15-47    | Professor           | Director     | 12-31-69           | Retired  |
| Ralph H. Peck              | B.S., M.F.           | 7-1-36                    | Ext. Asst. Prof.    | Assoc. Prof. | 4-14-47            | Died   |
| Elliott W.<br>Zimmerman    | B.S.                 | 10-1-38                   | Ext. Asst. Prof.    |              | 1-31-39            | Resigned   |
| Leighton E.<br>McCormick   | B.S.F.               | 2-10-39                   | Ext. Asst. Prof.    | Professor    | 6-29-68            | Died   |
| Calvin Bowen               | B.S., M.S.           | 11-16-39                  | Ext. Asst. Prof.    |              | 7-31-47            | Resigned   |
| W. C. Sechrist             | B.S.                 | 10-1-40                   | Research Ast.       |              | 6-30-42            | Resigned   |
| C. Willard Leach           | B.S.A.               | 3-1-42                    | Research Asst.      | Instructor   | 2-28-46            | Resigned   |

| Name                      | Degrees                | Date of First Appointment | Rank When Appointed | Promotions                  | Date of Separation | Resigned, Retired, Died |
|---------------------------|------------------------|---------------------------|---------------------|-----------------------------|--------------------|-------------------------|
| Robert L. Curtis          | B.S.                   | 9-23-42                   | Ext. Asst. Prof.    |                             | 10-13-43           | Resigned                |
| Richard Chandler<br>Smith | B.S., M.F.,<br>D.F.    | 2-1-47                    | Asst. Prof.         | Assoc. Prof.<br>Professor   |                    |                         |
| Kenneth C.<br>Compton     | B.S., M.S.             | 9-15-47                   | Asst. Prof.         |                             | 9-10-51            | Resigned                |
| Robert E.<br>McDermott    | B.S.F.,<br>M.S., Ph.D. | 2-1-48                    | Instructor          | Asst. Prof.<br>Assoc. Prof. | 9-30-59            | Resigned                |
| J. Milford Nichols        | B.S., M.S.             | 5-1-48                    | Instructor          | Asst. Prof.<br>Assoc. Prof. |                    |                         |
| Paul Y. Burns             | B.S., M.F.,<br>Ph.D.   | 7-1-48                    | Asst. Prof.         | Assoc. Prof.                | 1-31-55            | Resigned                |
| Richard W. Dingle         | B.S., M.F.,<br>Ph.D.   | 8-1-48                    | Instructor          |                             | 8-31-53            | Resigned                |
| Peter W. Fletcher         | B.S., M.F.,<br>Ph.D.   | 9-20-48                   | Instructor          | Assoc. Prof.<br>Professor   | 6-30-59            | Resigned                |
| Ross Hortin               | B.A., B.S.,<br>M.F.    | 9-1-49                    | Instructor          |                             | 6-30-52            | Resigned                |
| R. Brooks Polk            | B.S.F.,<br>M.S.        | 9-1-49                    | Instructor          | Asst. Prof.<br>Assoc. Prof. |                    |                         |

| Name                    | Degrees                      | Date of First Appointment | Rank When Appointed | Promotions                  | Date of Separation | Resigned, Retired, Died      |
|-------------------------|------------------------------|---------------------------|---------------------|-----------------------------|--------------------|------------------------------|
| Lee Kent Paulsell       | B.S.F., M.S.                 | 6-1-49                    | Instructor          |                             | 9-15-49            | Resigned                     |
|                         |                              | Reappointed<br>9-1-50     | Instructor          |                             | 6-8-51             | Resigned                     |
|                         |                              | Reappointed<br>9-1-53     |                     | Asst Prof.<br>Assoc. Prof.  |                    |                              |
| William James<br>O'Neil | B.S.                         | 10-10-51                  | Assoc. Prof.        |                             | 9-1-64             | Retired, Died<br>May 7, 1967 |
| Lawrence Leney          | B.S., M.S.,<br>Ph.D.         | 12-1-52                   | Asst. Prof.         |                             | 8-31-60            | Resigned                     |
| Theodore W. Bretz       | B.S., M.S.<br>Ph.D.          | 9-15-54                   | Professor           |                             | 12-31-67           | Died                         |
| Andrew J. Nash          | B.A., B.S.F.,<br>M.S., Ph.D. | 7-1-55                    | Asst. Prof.         | Assoc. Prof.<br>Professor   |                    |                              |
| Ralph A. Musbach        | B.S.F.                       | 9-1-56                    | Instructor          | Asst. Prof.                 |                    |                              |
| Kenneth E. Moore        | B.S.F., M.F.                 | 7-22-57                   | Instructor          | Asst. Prof.<br>Assoc. Prof. |                    |                              |
| Donald J. Janes         | B.S.F., M.S.                 | 9-17-57                   | Assistant           | Instructor                  | 2-14-67            | Resigned                     |
| Carl D. Settergren      | B.S.F., M.S.<br>Ph.D.        | 6-9-58                    | Assistant           | Instructor<br>Asst. Prof.   |                    |                              |
| Oscar J. Dooling        | B.S.F.                       | 7-1-59                    | Technician          | Instructor                  | 9-15-61            | Resigned                     |
| Edwin P. Allen          | B.S.F.                       | 7-10-59                   | Instructor          |                             | 11-30-60           | Resigned                     |
| Gilbert Begeman         | B.S.F.                       | 7-10-59                   | Instructor          |                             | 6-30-61            | Resigned                     |
| Roy S. Brundage         | B.S.F., M.S.                 | 7-10-59                   | Instructor          |                             | 5-2-61             | Resigned                     |



| Name                   | Degrees               | Date of First Appointment | Rank When Appointed       | Promotions   | Date of Separation | Resigned, Retired, Died, |
|------------------------|-----------------------|---------------------------|---------------------------|--------------|--------------------|--------------------------|
| Hugh T. Hambrick       | B.S.                  | 7-10-59                   | Instructor                |              | 9-30-60            | Resigned                 |
| Thomas E. Jordan       | B.S.F.                | 7-10-59                   | Instructor                |              | 11-30-60           | Resigned                 |
| John E. Lowe           | B.S.F.                | 7-10-59                   | Instructor                |              | 11-4-60            | Resigned                 |
| Gene S. Cox            | B.S., M.F.,<br>Ph.D.  | 3-15-60                   | Assoc. Prof.              | Professor    |                    |                          |
| E. A. McGinnes,<br>Jr. | B.S., M.F.,<br>Ph.D.  | 4-1-60                    | Assoc. Prof.              | Professor    |                    |                          |
| James P. Pastoret      | B.S., M.S.            | 2-1-61                    | Asst. Prof.               |              |                    |                          |
| Albert R. Vogt         | B.S.F., M.S.<br>Ph.D. | 6-5-61                    | Assistant                 | Instructor   | 6-30-66            | Resigned                 |
| Fred Taylor            | B.S.F.,<br>M.W.T.     | 12-1-62                   | Asst. Prof.               |              | 5-31-65            | Resigned                 |
| J. Howard Smith        | B.S., M.S.            | 9-1-64                    | Asst. Prof.               |              | 6-30-66            | Resigned                 |
| Donald P. Duncan       | B.S., M.S.,<br>Ph.D.  | 9-1-65                    | Professor and<br>Director |              |                    |                          |
| Gregory N. Brown       | B.S., M.F.,<br>D.F.   | 6-1-66                    | Asst. Prof.               |              |                    |                          |
| Miles Brown            | B.S.F., M.S.          | 4-18-66                   | Asst. Prof.               |              |                    |                          |
| Kent Adair             | B.S., M.F.<br>Ph.D.   | 1-1-67                    | Asst. Prof.               | Assoc. Prof. |                    |                          |
| J. Gordon Powell       | B.S.F.                | 8-1-67                    | Adm. Assistant            |              |                    |                          |
| F. Glenn Goff          | B.S., M.S.,<br>Ph.D.  | 9-1-67                    | Asst. Prof.               |              |                    |                          |
| Kent B. Downing        | B.S., M.S.            | 9-1-67                    | Instructor                |              |                    |                          |

| Name              | Degrees              | Date of First Appointment | Rank When Appointed                | Promotions | Date of Separation | Resigned Retired Died        |
|-------------------|----------------------|---------------------------|------------------------------------|------------|--------------------|------------------------------|
| Edwin Wheeler     | B.S., M.S.           | 9-1-67                    | Asst. Prof. and<br>Ext. Wood Tech. |            |                    |                              |
| Kenneth Chilman   | B.S.F., M.F.         | 1-1-68                    | Asst. Prof.                        |            |                    |                              |
| Merton F. Brown   | B.S., M.S.<br>Ph.D.  | 9-1-68                    | Asst. Prof.                        |            |                    |                              |
| El Sayed Kandeel  | B.S., Ph.D.          | 9-1-68                    | Visiting Prof.                     |            | 6-30-69            | Terminal<br>Appoint-<br>ment |
| John P. Slusher   | B.S., M.S.           | 7-1-69                    | Asst. Prof.                        |            |                    |                              |
| William H. Kearby | B.S., M.S.,<br>Ph.D. | 9-1-60                    | Asst. Prof.                        |            |                    |                              |

Appendix B  
 BIOGRAPHICAL INFORMATION ON FORESTRY FACULTY  
 1969

KENT T. ADAIR

Academic Rank: Associate Professor

Education:

B.S. Colorado State University 1958  
 M.F. Oregon State University 1961  
 Ph.D. Colorado State University 1968

Field of Specialization: Forest Economics--Management and Marketing

Professional Experience:

1958-59 U.S. Forest Service, Timber management.  
 1959-60 Bigley & Feiss, Foresters, Inc. Consultant  
 1961-63 Research Forester, Colorado State University  
 1963-66 Assistant Professor, University of Montana  
 1967- Assistant and Associate Professor, University of Missouri-  
 Columbia

Service in Professional or Scientific Societies:

Society of American Foresters  
 Northern Rocky Mountain Section  
 Chairman, Taxation Committee 1964-65

GREGORY NEIL BROWN

Academic Rank: Assistant Professor

Education:

B.S. Iowa State University 1959  
 M.F. Yale University 1960  
 D.F. Duke University 1963

Field of Specialization: Forest Physiology

Professional Experience:

1963-66 Plant Physiologist, Radiation Ecology Section, Oak Ridge  
 National Laboratory  
 1966- Assistant Professor, University of Missouri-Columbia

Service in Professional or Scientific Societies:

American Society of Plant Physiologists  
Midwestern Region  
Co-chairman 1970 meeting  
Society of American Foresters  
National  
Member, Committee on Tree Physiology 1968-  
Missouri Academy of Science  
Chairman, Membership Committee

MERTON FRED BROWN

Academic Rank: Assistant Professor

Education:

---

B.S.F. University of Maine 1961  
M.S. University of Maine 1963  
Ph.D. University of Iowa 1966

Field of Specialization: Mycology

Professional Experience:

1966-68 Assistant Professor of Biology, Wisconsin State University,  
Superior  
1968- Assistant Professor of Plant Pathology and Forestry

Service in Professional and Scientific Societies:

Xi Sigma Pi, Wisconsin State University, Superior President, 1968

MILES COURTNEY BROWN

Academic Rank: Assistant Professor

Education:

B.S.F. Colorado State University 1952  
M.F. Colorado State University 1966

Field of Specialization: Wood Utilization (Extension)

Professional Experience:

1952-53 Service Forester, Colorado State Board of Forestry, Denver  
1953-56 District Forester, Bureau of Land Management, Denver,  
Colorado

- 1956-59 Forester, Chama Lumber Co., Chama, New Mexico  
 1959-66 Forester, East Side Lumber Co., Fort Collins, Colorado  
 1966 Industrial Specialist, Small Business Administration, Denver  
 Colorado  
 1967 Extension Wood Products Specialist, University of Missouri-  
 Columbia

KENNETH CLAUS CHILMAN

Academic Rank: Assistant Professor

Education:

- B. S. F. Purdue University 1956  
 M. F. University of Michigan 1959  
 Ph. C. University of Michigan 1967

Field of Specialization: Administration and Forest Recreation

Professional Experience:

- 1956-65 U. S. Forest Service, California (administration)  
 1965-67 Teaching Assistant, Teaching Fellow and Instructor,  
 University of Michigan  
 1967- Assistant Professor, University of Missouri-Columbia

GENE SPRACHER COX

Academic Rank: Professor

Education:

- B. S. Duke University 1947  
 M. F. Duke University 1948  
 Ph. D. Duke University 1953

Field of Specialization: Ecology and Forest Soils

Professional Experience:

- 1948-49 Research Forester, Duke University  
 1951-53 Assistant Professor, Stephen F. Austin College  
 1953-69 Assistant and Associate Professor, Montana State University  
 1960- Associate Professor and Professor, University of Missouri-  
 Columbia

Service in Professional and Scientific Societies:

- Xi Sigma Pi  
 National Forester 1966-68

Gamma Sigma Delta  
Missouri Chapter, Secretary 1969-70  
Society of American Foresters  
Missouri Chapter, Chairman, Membership Committee 1965-66

KENTON BENSON DOWNING

Academic Rank: Instructor

Education:

B.S. Colorado State University 1962  
M.S. Colorado State University 1966  
Some residence work toward Ph.D., University of Missouri,  
1967-69

Field of Specialization:

Outdoor Recreation and Land Planning

Professional Experience:

1964-67 State District Forester, Colorado

Service in Professional or Scientific Societies:

Society of American Foresters  
Central Rocky Mountain Section  
Journal Reporter 1966-67

Xi Sigma Pi  
Tau Chapter, Faculty Advisor

DONALD PENDLETON DUNCAN

Academic Rank: Director and Professor

Education:

B.S.F. University of Michigan 1937  
M.S. University of Michigan 1939  
Ph.D. University of Minnesota 1951

Professional Experience:

1937-39 Teaching and Research Assistant in Forestry and Zoology,  
University of Michigan  
1939-41 Shelterbelt Forester, Junior Forester, U.S. Forest Service  
1941-42 Instructor, Department of Horticulture, Kansas State College  
1945 Instructor, Army University, Florence, Italy  
1946-47 Extension Forester and State Forester, Kansas State College

- 1947-65 Instructor to Professor and Assistant Director, School of Forestry, University of Minnesota  
 1965 Director and Professor of Forestry, University of Missouri-Columbia

Field of Specialization: Administration

Service in Professional and Scientific Societies:

- Society of American Foresters  
 Division of Recreation  
 Secretary, 1954; Vice-Chairman, 1955; Chairman, 1956  
 Division of Education  
 Secretary, 1963; Vice-Chairman, 1964; Chairman, 1965  
 Committee on Accreditation  
 Member, 1968-70  
 Committee on Civil Service  
 Member, 1968-69  
 Upper Mississippi Valley Section  
 Southern Minnesota Chapter, Chairman, 1949-50  
 Chairman, Minnesota Legislative Committee, 1957-58  
 Secretary - Treasurer 1959-61  
 Chairman, 1961-63  
 Ozark Section  
 Chairman, Planning and Policy Committee, 1968-70  
 Forest Products Research Society  
 Board of Trustees, Midwest Section, 1967-68.  
 Xi Sigma Pi  
 Delta Chapter Faculty Advisor, 1959  
 Sigma Xi  
 Minnesota Chapter Membership Committee, 1961

Other Service:

- Minnesota Natural Resources Council  
 Consultant, 1961-63  
 National Science Foundation - Society of American Foresters  
 Visiting Scientist, 1964-65, 1968, 1969  
 McIntire - Stennis Cooperative Forestry Research Advisory Board  
 Member 1967-70  
 Association of State College and University Forest Research Organizations  
 Executive Board Member, 1967-68  
 North Central Regional Forestry Research Committee  
 Chairman, 1967-68  
 Heads of Midwest Forestry Educational and Research Programs  
 Chairman 1967-68  
 Council of Forestry School Executives  
 Secretary, 1969; Vice-Chairman, 1970

Foreign Area Fellowship Program  
Consultant, 1968, 1969  
Cooperative State Research Service  
Comprehensive Forestry Research Review Team, 1969

F. GLENN GOFF

Academic Rank: Assistant Professor

Education:

B.S. Central Michigan University 1962  
M.S. University of Wisconsin 1964  
Ph.D. University of Wisconsin 1966

Field of Specialization: Plant Ecology

Professional Experience:

1961-62 Teaching Assistant, Central Michigan University  
1962-64 Botanist, University of Wisconsin Arboretum  
1965 Teaching Assistant, University of Wisconsin  
1966 Visiting Assistant Professor of Botany, University of  
Wisconsin  
1966-67 Assistant Professor, Central Michigan University  
1967 Assistant Professor, University of Missouri-Columbia

Service in Professional and Scientific Societies:

Member, Advisory Committee on Analysis of Ecosystems (Deciduous  
Biome), International Biological Program. 1968-  
Associate Editor, Ecology

EL-SAYED A. EZZAT KANDEEL

Academic Rank: Visiting Professor

Education:

B.S. Alexandria University 1960  
Ph.D. Iowa State University 1968

Field of Specialization: Wood Science

Professional Experience:

1961-64 Laboratory Lecturer, Alexandria University  
1966-67 Graduate Assistant, Iowa State University  
1968-69 Visiting Professor, University of Missouri-Columbia



## WILLIAM HAROLD KEARBY

Academic Rank: Assistant Professor

Education:

|       |  |      |
|-------|--|------|
| B.S.  | Wisconsin State University, Stevens Point, | 1960 |
| M.S.  | University of Wisconsin                    | 1962 |
| Ph.D. | University of Wisconsin                    | 1965 |

Field of Specialization: Forest Entomology

Professional Experience:

|         |  |
|---------|--|
| 1960-64 | Research Assistant, University of Wisconsin                                      |
| 1964-69 | Assistant Professor of Entomology, Pennsylvania State University                 |
| 1969    | Assistant Professor of Entomology and Forestry, University of Missouri-Columbia. |

## EDGAR ALLEN MCGINNES JR.

Academic Rank: Professor

Education:

|       |                                    |      |
|-------|------------------------------------|------|
| B.S.  | Pennsylvania State University      | 1950 |
| M.F.  | Pennsylvania State University      | 1951 |
| Ph.D. | New York State College of Forestry | 1955 |

Field of Specialization: Wood Science

Professional Experience:

|                      |  |
|----------------------|--|
| 1951-52 and 1955-60, | Research chemist, American Viscose Corporation                     |
| 1960-                | Associate Professor and Professor, University of Missouri-Columbia |

Service in Professional or Scientific Societies:

|   |
|---|
| Forest Products Research Society        |
| Membership Committee, 1966-67           |
| Missouri Academy of Science             |
| Secretary 1968-                         |
| Society of Wood Science and Technology, |
| Undergraduate Committee 1968-           |
| Membership Committee 1968-              |

KENNETH EDWARD MOORE

Academic Rank: Associate Professor

Education:

- B.S. University of Connecticut 1934
- M.F. Yale University 1946

Field of Specialization: Forest Products, Forest Engineering

Professional Experience:

- 1934-41 Technical Forester, Project Forester, and Farm Forester, Soil Conservation Service.
- 1941-42 Forest Soils Technician, Conn. Agr. Exp. Sta.
- 1942-45 Aircraft Inspector (Wood Program), Bureau of Aeronautics, Navy Dept.
- 1945-46 Forest Products Technician, Conn. Agr. Exp. Sta.
- 1947-53 Instructor, School of Forestry, Montana State University
- 1955-57 Cartographic Engineer, Engineering Services, Inc.
- 1957- Instructor, Assistant Professor and Associate Professor University of Missouri-Columbia

Service in Professional and Scientific Societies:

- Society of American Foresters
  - Northern Rocky Mountain Section
  - Membership Committee 1951-53
- Missouri Chapter
  - Recognition Committee 1966

RALPH ARTHUR MUSBACH

Academic Rank: Assistant Professor

Education:

- B.S.F. University of Missouri-Columbia 1950
- One year residence work toward master's degree, University of Missouri-Columbia, 1962-63

Field of Specialization: Forest Ecology

Professional Experience:

- 1950-55 Assistant District Forester, Missouri Department of Conservation
- 1955-56 District Forester, Missouri Department of Conservation
- 1956- Assistant Professor of Forestry, University of Missouri-Columbia

Sabbatical Leave:

9 months residence work toward master's degree, University of Missouri-Columbia, 1962-63

Service in Professional of Scientific Societies:

Society of American Foresters

Ozark Section

Member, Tellers Committee, 1969

Missouri Chapter

Member, Nominating Committee, 1969.

## ANDREW JOSEPH NASH

Academic Rank: Professor

Education:

|        |                                    |      |
|--------|------------------------------------|------|
| B.A.   | University of British Columbia     | 1941 |
| B.S.F. | University of British Columbia     | 1946 |
| M.F.   | New York State College of Forestry | 1952 |
| Ph.D.  | New York State College of Forestry | 1962 |

Field of Specialization: Mensuration and Photogrammetry

Professional Experience:

|         |   |
|---------|---|
| 1946    | Ranger, British Columbia Forest Service.  |
| 1946-55 | Forest Research Officer, Canadian Government  |
| 1955-   | Assistant Professor, Associate Professor and Professor, University of Missouri-Columbia   |
| 1966-68 | On leave from University of Missouri. In charge of all forestry inventory training and work on 20,000 square miles of Government forest land on the Pre-Investment Survey of Forest Resources Project in India under UN/FAO supervision |

Sabbatical Leave:

1961-62 work on Ph.D. at New York State College of Forestry

Service in Professional or Scientific Societies:

Section 25, International Union of Forest Research Organizations  
Secretary 1969-71

## J. MILFORD NICHOLS

Academic Rank: Associate Professor

Education:

B.S.F. Michigan State University 1940  
M.S. University of Missouri-Columbia 1952  
One year work toward Ph.D., University of Michigan. 1960-61

Field of Specialization: Forest Management

Professional Experience:

1940-48 District Forester, Missouri Department of Conservation  
1948- Instructor, Assistant and Associate Professor, University  
of Missouri-Columbia.

Sabbatical Leave:

1960-61 Study toward Ph.D. University of Michigan

Service in Professional or Scientific Societies:

Society of American Foresters  
Missouri Chapter  
Chairman, 1967-68

JAMES PETER PASTORET

Academic Rank: Assistant Professor

Education:

B.S. University of Michigan 1949  
M.W.T. University of Michigan 1951  
1959-60 2 years of residence on work toward Ph.D. North Carolina  
State College

Field of Specialization: Wood Technology

Professional Experience:

1949-50 and 1952-53 Project Engineer, Singer Manufacturing Co.  
1954-58 Production Engineer, Kaiser Aluminum and Chemical  
Corporation  
1959-60 Research and Teaching Assistant, North Carolina State  
College  
1961- Assistant Professor, University of Missouri-Columbia

Sabbatical Leave:

1968-69 Working on College Seminar Series for Southern Pine  
Association

LEE KENT PAULSELL

Academic Rank: Associate Professor

Education:

- B.S.F. University of Missouri-Columbia 1949  
 M.S. University of Missouri-Columbia 1950  
 1 year of residence work toward Ph.D., University of Minnesota  
 1959-60

Field of Specialization: Silviculture, Ecology, Fire

Professional Experience:

- 1949-51 Resident Forester, Weldon Spring Experimental Farm  
 1951-53 Forest Manager, Pioneer Forest, (Leo A. Drey) St. Louis,  
 Mo.  
 1953-56 Resident Forester, University Forest  
 1956- Assistant and Associate Professor, University of Missouri-  
 Columbia

Sabbatical Leave:

- 1959-60 One year work toward Ph.D. University of Minnesota

Service in Professional and Scientific Societies:

- Society of American Foresters  
 Ozark Section  
 Secretary-Treasurer, 1968-69  
 Vice Chairman, 1969-70  
 Chairman, Membership Committee, 1969-70  
 Division of Education  
 Secretary, 1969-70

R. BROOKS POLK

Academic Rank: Associate Professor

Education:

- Associate of Arts, University of Florida 1946  
 B.S.F. University of Florida 1947  
 M.S.F. Montana State University 1949  
 Additional graduate study, University of Missouri-Columbia, 1957-58,  
 1959-60, 1960-61, and course work and residence toward Ph.D. at  
 North Carolina State University 1958-59

Fields of Specialization: Silviculture, genetics, dendrology

Professional Experience:

- 1947-48 Instructor in Forestry, Auburn University  
 1949- Instructor, Assistant and Associate Professor  
 University of Missouri-Columbia

Sabbatical Leave:

- 1958-59 North Carolina State University, Graduate study toward Ph.D.

CARL DAVID SETTERGREN

Academic Rank: Assistant Professor

Education:

B.S.F. University of Missouri 1958  
M.S. University of Missouri 1960  
Ph.D. Colorado State University 1967

Field of Specialization: Watershed Management-Forest Hydrology

Professional Experience:

1960- Instructor and Assistant Professor, University of Missouri-  
Columbia

Sabbatical Leave:

1965-66 Colorado State University, study toward Ph.D.

Service in Professional and Scientific Societies:

Society of American Foresters  
Missouri Chapter, Secretary-Treasurer, 1968-69  
Vice-Chairman 1969-70

JOHN PAUL SLUSHER

Academic Rank: Assistant Professor

Education:

B.S.F. University of Missouri-Columbia 1957  
M.S. Kansas State University 1969

Field of Specialization: Forest Management (Extension)

Professional Experience:

1957-61 Farm Forester, Missouri Conservation Commission  
1961-69 District Forester, Area Forester (Extension)  
Kansas State University

Other Service:

Kansas Christmas Tree Association  
Secretary-Treasurer 1964-69  
National Christmas Tree Growers Association  
Trustee from Kansas 1965-69  
University of Missouri Forestry Alumni Association  
Second Vice President 1968-70  
Missouri Wood Industry Show Inc.  
Secretary-Treasurer 1969-70

## RICHARD CHANDLER SMITH

Academic Rank: Professor

Education:

|   |      |
|---|------|
| B.S. in Forestry, University of Minnesota | 1937 |
| Master of Forestry, Duke University       | 1947 |
| Doctor of Forestry, Duke University       | 1950 |

Field of Specialization: Forestry Economics

Professional Experience:

|         |  |
|---------|--|
| 1937-40 | Field Assistant, U.S. Forest Service   |
| 1940    | Research Assistant, American Creosoting Co.  |
| 1941-42 | Chief Forester, American Creosoting Co.  |
| 1947-   | Assistant Professor, Associate Professor, and Professor, University of Missouri-Columbia |

Sabbatical Leave:

|         |   |
|---------|---|
| 1962-63 | Pacific Northwest Forest and Range Experiment Station. Research on employment and trends in manpower requirements in the forest products industries of Oregon and Washington. Reasons for change in the industries caused by automation, mechanization, changing timber specifications, mix of products, and transportation were studied. |
|---------|---|

Service in Professional and Scientific Societies:

|                                 |  |
|---------------------------------|--|
| Society of American Foresters   |  |
|                                 | Member of national committee on election procedures 1966 |
| Ozark Section                   |  |
|                                 | Membership committee chairman 1956-57                    |
|                                 | Secretary-Treasurer 1957-59                              |
|                                 | Vice Chairman 1958-59                                    |
|                                 | Chairman 1959-60   |
|                                 | Editor, Ozark Reporter 1964-67                           |
|                                 | Natural Areas Committee 1955-69                          |
|                                 | Chairman, Foresters' (endowment) Fund, 1969-             |
| Gamma Sigma Delta (agriculture) |  |
|                                 | Member, elections committee 1968-70                      |

## RUTHFORD HENRY WESTVELD

Academic Rank: Director Emeritus and Professor

Education:

|      |                           |      |
|------|---------------------------|------|
| B.S. | Michigan State University | 1922 |
| M.F. | Yale University           | 1925 |

Ph.D. Michigan State University 1946

Field of Specialization: Silviculture

Professional Experience:

- 1922-24 Junior Forester, U.S. Forest Service
- 1925-28 Assistant Silviculturist, U.S. Forest Service
- 1928-36 Assistant and Associate Professor, Michigan State University
- 1936-38 Assistant Professor, University of Missouri-Columbia
- 1938-46 Professor of Silviculture, University of Florida
- 1946-47 Professor and Head, Forestry Department Auburn University
- 1947-57 Professor and Chairman, Department of Forestry,  
University of Missouri-Columbia
- 1957-65 Professor and Director, School of Forestry, University  
of Missouri-Columbia
- 1965-69 Director Emeritus and Professor, University of Missouri-  
Columbia

Service in Professional and Scientific Societies:

Society of American Foresters

National

Chairman, Committee on Farm Forestry Education in the  
Agricultural Colleges 1937-39

Chairman, Program Committee for Annual Meeting 1941,  
Member, Council, 1952-55

Member, Research Committee 1958-65

Representative, Division of Biology and Agriculture,  
National Academy of Science-National Research Council  
1964-66

Division of Education

Chairman, Committee on Farm Forestry Education  
1964-66

Central States Section

Chairman, Membership Committee 1934-35

Ozark Section

Member, Membership Committee 1937-38

Southeastern Section

Member, Forestry Education Committee 1941-42

Other Service:

Council of Forestry School Executives

Secretary 1955-56

Chairman 1956-57

Chairman, Research Committee 1957-58

Agricultural Board, Division of Biology and Agriculture,  
National Academy of Science-National Research Council

Member 1961-67



Chairman, Committee on Forestry Research 1964-66  
 Working Committee on Forestry at Land-Grant Colleges  
 Chairman 1958-60  
 Commission on Forestry at Land-Grant Institutions Chairman  
 1960-61  
 Commission on Forestry at Land-Grant and Other State Institutions  
 Chairman 1961-64  
 McIntire-Stennis Cooperative Forestry Research Advisory Board  
 Chairman, 1963-65  
 Research Facilities Review Team, U.S. Department of Agriculture  
 Member 1963

EDWIN Y. WHEELER

Academic Rank: Assistant Professor

Education:

B.S. Oklahoma State University 1951  
 M.S. New York State College of Forestry 1953  
 One year graduate work toward Ph.D., Michigan State University,  
 1966-67

Field of Specialization: Wood Utilization (Extension)

Professional Experience:

1953-57 Cost Department Manager, Setter Bros., Inc.  
 1957-58 Division Sales Manager, the W and F Manufacturing Co., Inc.  
 1958-67 Assistant Professor, Oklahoma State University  
 1967- Assistant Professor, University of Missouri-Columbia

Service in Professional and Scientific Societies:

Forest Products Research Society  
 Mid-South Section, Trustee 6 years  
 Mid-South Section-Newsletter Editor 2 years  
 Midland Empire Hardwood Association  
 Secretary, 1969-70  
 Missouri Forest Products Association  
 Executive Secretary, 1970

Appendix C

FORESTRY CURRICULUMS FOR SELECTED YEARS

1946-47    1948-49    1953-54    1958-59    1965-66    1968-69

FORESTRY CURRICULUM 1946-1947FRESHMAN

| <u>First semester</u>        |           | <u>Second semester</u>   |           |
|------------------------------|-----------|--------------------------|-----------|
| Introductory College Algebra | 3         | Trigonometry             | 2         |
| General Botany               | 5         | Forest Cartography       | 2         |
| General Forestry             | 3         | General Zoology          | 5         |
| Composition and Rhetoric     | 3         | Agricultural Economics   | 3         |
| Physical Education           | 1         | Composition and Rhetoric | 3         |
| Military Science             | 1         | Physical Education       | 1         |
|                              | <u>16</u> | Military Science         | <u>1</u>  |
|                              |           |                          | <u>17</u> |

SOPHOMORE

| <u>First Semester</u>       |           | <u>Second Semester</u> |           |
|-----------------------------|-----------|------------------------|-----------|
| General Inorganic Chemistry | 5         | Soils                  | 5         |
| Land Surveying              | 3         | Elementary Organic     |           |
| Physical Geology            | 3         | Chemistry              | 3         |
| Dendrology (softwoods)      | 2         | Dendrology (hardwood)  | 3         |
| Applied Entomology          | 3         | Elementary Taxonomy    | 3         |
| Physical Education          | 1         | Physical Education     | 1         |
| Military Science            | 1         | Military Science       | 1         |
|                             | <u>18</u> |                        | <u>16</u> |

SUMMER FIELD CAMP (9 weeks)

|                  |          |
|------------------|----------|
| Forest Survey    | 3        |
| Silvics          | 3        |
| Field Dendrology | 1        |
| Camp Management  | <u>1</u> |
|                  | 8        |

JUNIOR

| <u>First semester</u>     |          | <u>Second semester</u> |          |
|---------------------------|----------|------------------------|----------|
| Silviculture-planting     | 3        | Land Economics         | 2        |
| Forest Meusuration        | 3        | Wood Technology        | 3        |
| Forest Protection         | 3        | Forest Insects         | 3        |
| Forest History and Policy | 2        | Public Speaking        | 3        |
| Principles of Wildlife    |          | Rural Sociology        | <u>3</u> |
| Conservation              | 3        |                        | 14       |
| Elective                  | <u>2</u> |                        |          |
|                           | 16       |                        |          |

SENIOR

| <u>First semester</u>              |           | <u>Second semester (1)</u>              |    |
|------------------------------------|-----------|---|----|
| Forest economics                   | 2         | Applied Forest Management               | 5  |
| Forest Management                  | 3         | Forest Improvements                     | 3  |
| Harvesting of Products             | 3         | Forest Range and<br>Wildlife Management | 3  |
| Wood Preservation and<br>Seasoning | 3         | Applied Silviculture                    | 4  |
| Silviculture-cutting               | 3         | Seminar                                 | 1  |
| Seminar                            | 1         |   | 16 |
|                                    | <u>15</u> |   |    |

FORESTRY CURRICULUM 1948-1949FRESHMAN

| <u>First semester</u>        |           | <u>Second semester</u>   |           |
|------------------------------|-----------|--------------------------|-----------|
| Introductory college algebra | 3         | Trigonometry             | 2         |
| General botany               | 5         | Cartography              | 2         |
| General forestry             | 3         | General zoology          | 5         |
| Composition and Rhetoric     | 3         | Composition and Rhetoric | 3         |
| Military                     | 1         | Plant Taxonomy           | 3         |
| Physical education           | 1         | Military                 | 1         |
|                              | <u>16</u> | Physical Education       | 1         |
|                              |           |                          | <u>17</u> |

SOPHOMORE

| <u>First semester</u>                          |           | <u>Second semester</u>      |           |
|--|-----------|-----------------------------|-----------|
| General chemistry                              | 5         | Dendrology                  | 2         |
| General economics or<br>Agricultural economics | 5         | Land surveying              | 3         |
| Dendrology                                     | 2         | Organic chemistry           | 3         |
| Forestry reports                               | 1         | Soils                       | 5         |
| Physical geology                               | 3         | Foundations of silviculture | 2         |
| Military                                       | 1         | Military                    | 1         |
| Physical Education                             | 1         | Physical education          | 1         |
|  | <u>18</u> |                             | <u>17</u> |

SUMMER CAMP

|                     |           |
|---------------------|-----------|
| Forest measurements | 4         |
| Silvics             | 2         |
| Field dendrology    | 1         |
| Silviculture        | 2         |
| Forest Utilization  | 2         |
| Forest Improvements | 1         |
|                     | <u>12</u> |

- (1) Lectures on Columbia campus through February 28 followed by field camp in Ozarks from March 1 to June 1.

JUNIOR

| <u>First semester</u>    |           | <u>Second semester</u> |           |
|--------------------------|-----------|------------------------|-----------|
| Forest mensuration       | 3         | Wood technology        | 3         |
| Practice of silviculture | 3         | Forest economics       | 3         |
| Rural sociology          | 3         | Forest insects         | 3         |
| Logging and milling      | 3         | Public speaking        | 3         |
| Elective                 | 3         | Elective               | 3         |
|                          | <u>15</u> |                        | <u>15</u> |

SENIOR

| <u>First semester</u> |           | <u>Second semester</u> |           |
|-----------------------|-----------|------------------------|-----------|
| Forest management     | 3         | Forest policy          | 2         |
| Forest protection     | 3         | Forest products        | 3         |
| Forest pathology      | 3         | Elective               | 8         |
| American government   | 5         |                        | <u>13</u> |
| Elective              | 3         |                        |           |
|                       | <u>17</u> |                        |           |

FORESTRY CURRICULUM 1953-1954FRESHMAN

| <u>First semester</u>        |           | <u>Second semester</u>   |           |
|------------------------------|-----------|--------------------------|-----------|
| Introductory college algebra | 3         | Trigonometry             | 2         |
| General botany               | 5         | Cartography              | 2         |
| General forestry             | 3         | Composition and rhetoric | 3         |
| Composition and rhetoric     | 3         | Plant taxonomy           | 3         |
| Military                     | 1         | American government      | 5         |
| Physical education           | 1         | Military                 | 1         |
|                              | <u>16</u> | Physical education       | 1         |
|                              |           |                          | <u>17</u> |

SOPHOMORE

| <u>First semester</u>                  |           | <u>Second semester</u>      |           |
|--|-----------|-----------------------------|-----------|
| General chemistry                      | 5         | Forest soils                | 3         |
| Dendrology                             | 2         | Dendrology                  | 2         |
| Principles of wildlife<br>conservation | 3         | Elementary college physics  | 5         |
| Land surveying                         | 3         | Foundations of silviculture | 2         |
| Physical geology                       | 3         | Exposition                  | 3         |
| Military                               | 1         | Military                    | 1         |
| Physical education                     | 1         | Physical education          | 1         |
|  | <u>18</u> |                             | <u>17</u> |

SUMMER CAMP

|                     |           |
|---------------------|-----------|
| Forest measurements | 4         |
| Silvics             | 2         |
| Field dendrology    | 1         |
| Silviculture        | 2         |
| Forest utilization  | 2         |
| Forest improvements | 1         |
|                     | <u>12</u> |

JUNIOR

| <u>First semester</u>                          |           | <u>Second semester</u>                  |           |
|--|-----------|---|-----------|
| Forest mensuration                             | 3         | Forest protection                       | 3         |
| Logging and milling                            | 3         | Wood technology                         | 3         |
| Practice of silviculture                       | 3         | Forest economics                        | 3         |
| General economics or<br>Agricultural economics | 5         | Rural sociology or General<br>sociology | 3         |
| Elective                                       | 3         | Elective                                | 5         |
|  | <u>17</u> |   | <u>17</u> |

SENIOR

| <u>First semester</u> |           | <u>Second semester</u> |           |
|-----------------------|-----------|------------------------|-----------|
| Forest management     | 3         | Forest policy          | 2         |
| Forest pathology      | 3         | Forest products        | 3         |
| Public speaking       | 3         | Forest insects         | 3         |
| Elective              | 5         | Elective               | 8         |
|                       | <u>14</u> |                        | <u>16</u> |

FORESTRY CURRICULUM 1958-1959FRESHMAN

| <u>First semester</u>         |           | <u>Second semester</u> |           |
|-------------------------------|-----------|------------------------|-----------|
| *Introductory college algebra | 3         | *Trigonometry          | 2         |
| General botany                | 5         | American government    | 5         |
| English composition           | 3         | English composition    | 3         |
| General forestry              | 3         | Forest cartography     | 2         |
| Physical education            | 1         | Dendrology             | 3         |
| Military science              | 1         | Physical Education     | 1         |
|                               | <u>16</u> | Military science       | 1         |
|                               |           |                        | <u>17</u> |

\*Analytical geometry and calculus (5 cr.) may be substituted for algebra and trigonometry if a student has completed 4 units of mathematics in high school with better - than - average grades.

SOPHOMORE

| <u>First semester</u> |           | <u>Second semester</u>      |           |
|-----------------------|-----------|-----------------------------|-----------|
| Inorganic chemistry   | 5         | Forest soils                | 3         |
| Public speaking       | 3         | General economics           | 5         |
| Land surveying        | 3         | Elementary college physics  | 3         |
| Physical geology      | 3         | Technical writing           | 3         |
| Dendrology            | 2         | Foundations of silviculture | 2         |
| Physical education    | 1         | Physical education          | 1         |
| Military science      | 1         | Military science            | 1         |
|                       | <u>18</u> |                             | <u>18</u> |

SUMMER CAMP

|                     |           |
|---------------------|-----------|
| Forest measurements | 3         |
| Silvics             | 2         |
| Field dendrology    | 1         |
| Silviculture        | 2         |
| Forest Utilization  | 2         |
| Forest engineering  | 2         |
|                     | <u>12</u> |

JUNIOR

| <u>First semester</u>      |           | <u>Second semester</u> |           |
|----------------------------|-----------|------------------------|-----------|
| Elementary college physics | 3         | Forest policy          | 1         |
| Forest mensuration         | 4         | Wood technology        | 3         |
| Logging and milling        | 3         | Forest economics       | 5         |
| Practice of silviculture   | 3         | Forest management      | 3         |
| *Cultural course           | 3         | Elective               | 3         |
|                            | <u>16</u> |                        | <u>15</u> |

\*Social Science or humanities

SENIOR

| <u>First semester</u>       |           | <u>Second semester</u> |           |
|-----------------------------|-----------|------------------------|-----------|
| Forest resources management | 3         | Forest insects         | 3         |
| Forest pathology            | 3         | Forest fire control    | 2         |
| Forest photogrammetry       | 3         | Forest products        | 3         |
| Elective                    | 6         | Elective               | 7         |
|                             | <u>15</u> |                        | <u>15</u> |

FORESTRY CURRICULUM - 1965-1966FRESHMAN

| <u>First semester</u>    |           | <u>Second semester</u> |           |
|--------------------------|-----------|------------------------|-----------|
| *College algebra         | 3         | Trigonometry           | 2         |
| English composition      | 3         | English composition    | 3         |
| Introduction to forestry | 2         | American government    | 5         |
| General botany           | 5         | General chemistry      | 5         |
| Physical geology         | 3         | Military               | 0         |
| Military                 | 0         | Physical education     | 0         |
| Physical education       | 0         |                        | <u>15</u> |
|                          | <u>16</u> |                        |           |

SOPHOMORE

| <u>First semester</u>                             |           | <u>Second semester</u>     |           |
|---|-----------|----------------------------|-----------|
| Elementary organic chemistry or general chemistry | 3         | Elementary college physics | 5         |
| Public speaking                                   | 3         | Forest soils               | 3         |
| General economics                                 | 4         | Forest entomology          | 3         |
| Dendrology  | 4         | Forest graphics            | 2         |
| Statistical techniques                            | 2         | Social science elective    | 3         |
| Military  | 0         | Military                   | 0         |
| Physical education                                | 0         | Physical education         | 0         |
|   | <u>16</u> |                            | <u>16</u> |

JUNIOR

| <u>First semester</u> |           | <u>Second semester</u>          |           |
|-----------------------|-----------|---------------------------------|-----------|
| Plant Physiology      | 3         | Practice of silviculture        | 3         |
| Silvics               | 5         | Wood anatomy and identification | 3         |
| Forest management I   | 5         | Forest management II            | 5         |
| Surveying             | 3         | Technical writing               | 3         |
|                       | <u>16</u> | Forest Photogrammetry           | 2         |
|                       |           |                                 | <u>16</u> |

SUMMER CAMP

|                               |           |
|-------------------------------|-----------|
| Forest inventory              | 3         |
| Forest ecology                | 2         |
| Silviculture                  | 2         |
| Utilization                   | 1         |
| Engineering                   | 2         |
| Management - utilization trip | 2         |
|                               | <u>12</u> |

\*Analytical geometry and calculus (5 cr.) may be substituted for algebra and trigonometry if a student has completed 4 units of mathematics in high school with better - than - average grades.



SENIOR

| <u>First semester</u>              |          | <u>Second semester</u>          |          |
|------------------------------------|----------|---------------------------------|----------|
| Range and watershed management     | 3        | Forest pathology                | 3        |
| Recreation and wildlife management | 3        | Forest fire control and use     | 2        |
| Social science elective            | 3        | Harvesting and wood utilization | 4        |
| Humanities elective                | 3        | Forest Management III           | 5        |
| Elective                           | <u>3</u> | Humanities elective             | <u>3</u> |
|                                    | 15       |                                 | 17       |

OPTIONAL PROGRAM IN FORESTRY CURRICULUM

Students desiring to meet specific educational objectives may choose an optional program. The objective could be (1) to prepare adequately for graduate study in a specialized field or (2) to prepare for a specific phase of forestry work such as shade tree service, municipal forestry, outdoor recreation, etc.

The following rules apply to the optional program:

1. Students must have junior standing and a grade-point average of 2.50 or higher.
2. Courses required during the freshman and sophomore years, with the possible exception of Forest Entomology are required of all students.
3. Students must make application to the curriculum committee, stating their educational objectives.
4. Upon approval, the curriculum committee, in consultation with the student, will determine which of the required courses he will not be required to take, and will determine the substitute courses.
5. The committee will submit its recommendations to the School of Forestry faculty for approval.
6. Upon approval the statement of educational objectives and the changes in course requirements will be made a part of the students' record.
7. Substitutions may be made for the following courses; wood anatomy and identification, harvesting and wood utilization, watershed and range management, recreation and wildlife management, fire control and use, forest pathology, and forest entomology (two of last three).

FORESTRY CURRICULUM 1968-1969FRESHMAN

| <u>*First semester</u> |           | <u>Second semester</u>                         |    |
|------------------------|-----------|--|----|
| College algebra        | 3         | Trigonometry                                   | 2  |
| English composition    | 3         | Introduction to political<br>science           | 3  |
| General botany         | 5         | General chemistry or<br>Introductory chemistry | 5  |
| Physical geology       | 3         | Elementary statistics                          | 3  |
| Forestry orientation   | 0         | ** Elective                                    | 3  |
| ** Elective            | 3         | Physical education                             | 0  |
| Physical education     | 0         |  | 16 |
|                        | <u>17</u> |  |    |

SOPHOMORE

| <u>First semester</u> |           | <u>Second semester</u>     |    |
|-----------------------|-----------|----------------------------|----|
| General economics     | 5         | Forest soils               | 3  |
| Dendrology            | 4         | Elementary college physics | 5  |
| Surveying             | 3         | Forest entomology          | 3  |
| ** Elective           | 3         | Exposition                 | 3  |
| Physical education    | 0         | Forest Graphics            | 2  |
|                       | <u>15</u> | Physical education         | 0  |
|                       |           |                            | 16 |

JUNIOR

| <u>First semester</u>              |           | <u>Second semester</u>   |    |
|------------------------------------|-----------|--------------------------|----|
| Silvics                            | 5         | Practice of silviculture | 3  |
| Forest management I                | 5         | Forest management II     | 5  |
| Wood anatomy and<br>identification | 3         | Technical writing        | 3  |
| Forest photogrammetry              | 2         | Plant Physiology         | 3  |
|                                    | <u>15</u> | Elective                 | 3  |
|                                    |           |                          | 17 |

SUMMER CAMP

|                             |           |
|-----------------------------|-----------|
| Forest inventory            | 3         |
| Forest ecology              | 2         |
| Silviculture                | 2         |
| Utilization                 | 1         |
| Engineering                 | 2         |
| Management-Utilization trip | 2         |
|                             | <u>12</u> |

\*Analytical geometry and calculus (5 credits) shall be substituted for college algebra and trigonometry if a student obtains a score of 18 or better on the mathematics placement test and has better than average grades in four units of high school mathematics courses.

\*\*A total of 9 elective hours is restricted to the Humanities and Social Sciences with a minimum of 3 credits in each area.

| <u>SENIOR</u>                      |          |                             |           |
|------------------------------------|----------|-----------------------------|-----------|
| <u>First semester</u>              |          | <u>Second semester</u>      |           |
| Range & watershed management       | 3        | Forest pathology            | 3         |
| Recreation and wildlife management | 3        | Forest fire control and use | 2         |
| Wood Industries III                | 4        | Forest management III       | 5         |
| Public speaking                    | 3        | Elective                    | 5         |
| Elective                           | <u>3</u> |                             | <u>15</u> |
|                                    | 16       |                             |           |

#### FOREST SCIENCE AND SPECIALIZATION OPTIONAL PROGRAM

Students desiring to meet specific educational objectives in biological, physical, or social sciences related to forestry may choose an optional program. The objective could be (1) to prepare adequately for graduate study in a specialized field, or (2) to prepare for a specific aspect of forest land management.

The following rules apply to the optional program:

1. Students must have at least sophomore standing (freshman-year courses, except for the 6 hrs. elective, are required of all students).
2. Students must have a grade-point average of 2.50 or higher.
3. Students must make application to the Curriculum Committee handling the curriculum of their interest, stating their educational objectives.
4. Upon approval, the student, in consultation with the Curriculum Committee, will determine an appropriate advisor in the specialized field of his interest.
5. The student and the new advisor will determine the appropriate program within the limits of program flexibility and submit this program through the Curriculum Committee to the School of Forestry faculty for approval.
6. Upon approval the statement of educational objectives and new program will be a part of the student's record.

#### Limits of Program Flexibility

(a) Eleven (11) semester hours of free electives are available. (b) Additional elective hours may be recommended by the advisor since students in the Forest Science and Specialization Optional Program will be in good standing with regard to grade-point average. (c) Substitution may be made for the following courses: Wood anatomy and identification, Forest products III, Watershed and range management, Recreation and wildlife management, Forest management III, Fire control and use, Forest pathology, Forest entomology, (two of the last three courses.) The total course semester hours available for a Forest Science and Specialization Program is 34 or 35 credit hours plus additional elective hours (b).

Appendix D  
 FOREST PRODUCTS MARKETING CURRICULUM  
1951-1952  
FRESHMAN

| <u>First semester</u>        |           | <u>Second semester</u>   |           |
|------------------------------|-----------|--------------------------|-----------|
| Introductory college algebra | 3         | Trigonometry             | 2         |
| General botany               | 5         | Engineering Drawing      | 3         |
| General forestry             | 3         | General Zoology          | 5         |
| Composition and rhetoric     | 3         | Composition and rhetoric | 3         |
| Military                     | 1         | Plant taxonomy           | 3         |
| Physical education           | 1         | Military                 | 1         |
|                              | <u>16</u> | Physical education       | <u>1</u>  |
|                              |           |                          | <u>18</u> |

SOPHOMORE

| <u>First semester</u> |           | <u>Second semester</u>     |           |
|-----------------------|-----------|----------------------------|-----------|
| Inorganic chemistry   | 5         | Dendrology                 | 2         |
| General economics     | 5         | Land surveying             | 3         |
| Dendrology            | 2         | Organic chemistry          | 3         |
| Forestry reports      | 1         | Elementary college physics | 5         |
| Public speaking       | 3         | Engineering materials      | 2         |
| Military              | 1         | Military                   | 1         |
| Physical education    | 1         | Physical education         | 1         |
|                       | <u>18</u> |                            | <u>17</u> |

SUMMER SCHOOL (Columbia)

|                       |   |
|-----------------------|---|
| General psychology    | 3 |
| Elementary accounting | 4 |

SUMMER CAMP

|                            |   |
|----------------------------|---|
| Forest utilization         | 2 |
| Wood in light construction | 2 |

JUNIOR

| <u>First semester</u>      |           | <u>Second semester</u>     |           |
|----------------------------|-----------|----------------------------|-----------|
| Logging and milling        | 3         | Wood technology            | 3         |
| Introduction to rural life | 3         | Retailing                  | 4         |
| Business law A             | 3         | American government        | 5         |
| Principles of marketing    | 3         | Advertising principles and |           |
| Elective                   | 3         | practices                  | 3         |
|                            | <u>15</u> | Elective                   | <u>2</u>  |
|                            |           |                            | <u>17</u> |

SENIOR

| <u>First semester</u>             |           | <u>Second semester</u>  |           |
|-----------------------------------|-----------|-------------------------|-----------|
| Timber seasoning and preservation | 2         | Forest products         | 3         |
| Forest products marketing         | 2         | Wood deterioration      | 2         |
| Farm buildings                    | 3         | Credits and collections | 2         |
| Applied psychology                | 3         | Elective                | 6         |
| Elective                          | 5         |                         | <u>13</u> |
|                                   | <u>15</u> |                         |           |

Appendix E

WOOD PRODUCTS MERCHANDISING CURRICULUM 1958-1959

FRESHMAN

| <u>First semester</u>        |           | <u>Second semester</u> |           |
|------------------------------|-----------|------------------------|-----------|
| Introductory college algebra | 3         | Trigonometry           | 2         |
| General botany               | 5         | Engineering drawing    | 3         |
| General forestry             | 3         | American government    | 5         |
| English composition          | 3         | English composition    | 3         |
| Military                     | 1         | Dendrology             | 3         |
| Physical education           | 1         | Military               | 1         |
|                              | <u>16</u> | Physical education     | 1         |
|                              |           |                        | <u>18</u> |

SOPHOMORE

| <u>First semester</u> |           | <u>Second semester</u>     |           |
|-----------------------|-----------|----------------------------|-----------|
| Inorganic chemistry   | 5         | Elementary accounting I    | 3         |
| General economics     | 5         | Business law A             | 3         |
| Dendrology            | 2         | Public speaking            | 3         |
| General psychology    | 3         | Elementary college physics | 3         |
| Military              | 1         | Applied psychology         | 3         |
| Physical education    | 1         | Military                   | 1         |
|                       | <u>17</u> | Physical education         | 1         |
|                       |           |                            | <u>17</u> |

JUNIOR

| <u>First semester</u>      |           | <u>Second semester</u> |           |
|----------------------------|-----------|------------------------|-----------|
| Elementary college physics | 3         | Corporation finance    | 3         |
| Logging and milling        | 3         | Marketing management   | 4         |
| Elementary accounting II   | 3         | Wood technology        | 3         |
| Principles of marketing    | 3         | Persuasive speaking    | 3         |
| Technical writing          | 3         | Elective               | 5         |
| Elective                   | 3         |                        | <u>18</u> |
|                            | <u>18</u> |                        |           |

SENIOR

| <u>First semester</u>                |           | <u>Second semester</u>            |          |
|--------------------------------------|-----------|-----------------------------------|----------|
| Sales control                        | 2         | Timber seasoning and preservation | 2        |
| Forest products marketing            | 2         | Forest products                   | 3        |
| Advertising principles and practices | 3         | Credits and collections           | 2        |
| Elective                             | <u>11</u> | Principles of selling             | 2        |
|                                      | 18        | Elective                          | <u>9</u> |
|                                      |           |                                   | 18       |

## Appendix F

WOOD PRODUCTS MERCHANDISING AND RESIDENTIAL AND LIGHT CONSTRUCTION CURRICULUM, 1963-1964FRESHMAN

| <u>First semester</u> |           | <u>Second semester</u>      |          |
|-----------------------|-----------|-----------------------------|----------|
| College algebra       | 3         | Trigonometry                | 3        |
| General botany        | 5         | Engineering drawing         | 3        |
| General forestry      | 3         | General inorganic chemistry | 5        |
| English composition   | 3         | English composition         | 3        |
| Military              | 0         | General psychology          | 3        |
| Physical education    | 0         | Military                    | 0        |
|                       | <u>14</u> | Physical education          | <u>0</u> |
|                       |           |                             | 17       |

ADDITIONAL REQUIRED COURSES - BOTH OPTIONS

|                                      |   |
|--------------------------------------|---|
| Elementary accounting I              | 3 |
| Elementary accounting II             | 3 |
| Principles of selling                | 2 |
| Business law A                       | 3 |
| Technical writing                    | 3 |
| Wood technology                      | 3 |
| Forest products                      | 3 |
| Advertising principles and practices | 3 |
| Elementary college physics           | 5 |
| American government                  | 5 |
| Applied psychology                   | 3 |
| Public speaking                      | 3 |
| Persuasive speaking                  | 3 |

ADDITIONAL REQUIRED COURSES - WOOD PRODUCTS MERCHANDISING OPTION

|                         |   |
|-------------------------|---|
| Principles of marketing | 3 |
| Corporation finance     | 4 |
| Transportation          | 3 |
| Marketing management    | 3 |

|                                   |    |
|-----------------------------------|----|
| Credits and collections           | 3  |
| Sales control                     | 3  |
| Dendrology                        | 5  |
| Logging and milling               | 3  |
| Timber seasoning and preservation | 2  |
| Forest products marketing         | 2  |
| Electives                         | 30 |

ADDITIONAL REQUIRED COURSES - RESIDENTIAL AND LIGHT CONSTRUCTION OPTION

|                                       |    |
|---------------------------------------|----|
| Fundamentals of architecture          | 3  |
| Principles of architecture design I   | 3  |
| Business law B                        | 3  |
| Principles of real estate             | 3  |
| Surveying                             | 3  |
| Construction and contracting          | 3  |
| Labor problems                        | 3  |
| Architectural drawing and home design | 3  |
| Wood in light construction            | 2  |
| Estimating                            | 2  |
| Design fundamentals                   | 3  |
| Landscape design                      | 3  |
| General sociology                     | 3  |
| Elective                              | 24 |

Appendix G

WOOD PRODUCTS CURRICULUM 1968-1969

FRESHMAN

| <u>First semester</u>  |           | <u>Second semester</u>            |           |
|------------------------|-----------|-----------------------------------|-----------|
| *College algebra       | 3         | *Trigonometry                     | 2         |
| English composition    | 3         | Elementary statistics             | 3         |
| Introductory chemistry |           | Elementary college physics or     | 5         |
| or **General chemistry | 5         | **General physics                 |           |
| General psychology     | 3         | Introduction to political science | 3         |
| Physical education     | 0         | Forest products I                 | 1         |
|                        | <u>14</u> | Physical education                | 0         |
|                        |           |                                   | <u>14</u> |

\*Analytical geometry and calculus shall be substituted for College algebra and Trigonometry if a student obtains a score of 18 or better on the mathematics placement test and has better-than-average grades in four units of high school mathematics courses.

\*\*Students desiring advanced work in physics or chemistry should take the higher numbered courses.

SOPHOMORE

| <u>First semester</u>  |           | <u>Second semester</u> |           |
|------------------------|-----------|------------------------|-----------|
| Wood Technology I      | 3         | Wood science I         | 4         |
| Wood Industries I      | 3         | Wood processes I       | 3         |
| Public speaking        | 3         | Wood Industries II     | 3         |
| General economics or   |           | Technical writing      | 3         |
| Agricultural economics | 5         | ***Elective            | 3         |
| Physical education     | 0         | Physical education     | 0         |
|                        | <u>14</u> |                        | <u>16</u> |

JUNIOR

| <u>First semester</u> |           | <u>Second semester</u> |           |
|-----------------------|-----------|------------------------|-----------|
| Wood technology II    | 3         | Wood processes II      | 3         |
| ****Specialization    | 9         | ****Specialization     | 9         |
| ***Electives          | 3         | ***Electives           | 3         |
|                       | <u>16</u> |                        | <u>15</u> |

SENIOR

| <u>First semester</u> |    | <u>Second semester</u> |    |
|-----------------------|----|------------------------|----|
| Wood industries III   | 4  | Forest Products II     | 3  |
| ****Specialization    | 9  | ****Specialization     | 3  |
| ***Electives          | 3  | ***Electives           | 9  |
|                       | 16 |                        | 15 |

\*\*\*At least 9 hours of free electives must be in courses numbered 200 or above and will normally be taken in subjects other than those specified in the student's major area of specialization.

\*\*\*\*See paragraph "Specialization"

SPECIALIZATION

All students will be required to complete at least 30 hours in courses providing specialization within a selected area of interest. By the beginning of the last month of the students' freshman year, each student must notify by letter, The Wood Products Curriculum Committee, of his educational objectives. Upon receiving the letter, the committee will appoint an advisor who will work with the student to develop a program of study to be submitted to the committee for approval during the first semester of the sophomore year. At least 15 hours of the specialization program must be in courses numbered 200 or above. This credit is to include course work in each of the fields listed under the indicated area of specialization, as follows:

| <u>Wood Science</u> | <u>Utilization</u>     | <u>Management</u> |
|---------------------|------------------------|-------------------|
| Botany              | Industrial Engineering | Economics         |
| Chemistry           | Mechanical Engineering | Marketing         |
| Physics             | Industrial Arts        | Management        |
| Mathematics         |                        | Accounting        |
| Statistics          |                        |                   |



Appendix H  
MASTER OF SCIENCE THESES

1950

- Glaser, Edwin H. Income possibilities from small woodlands in Missouri.  
Paulsell, Lee K. Management plan for the Weldon Spring Experimental Forest.

1952

- Hunt, Ellis V., Jr. Sawmilling cost in central Missouri.  
Nichols, J. Milford. Effect of chemicals on tree species.  
Ochrymowych, Julian. Mineral nutrition and growth of eastern redcedar.  
Shaw, Dale L. Defects in Missouri oaks.

1953

- Sander, Ivan L. Defects in oak sawtimber in Missouri.

1954

- Clark, F. Bryan. Pruning black walnut.

1956

- Neebe, David J. Thinning of eastern cottonwood in Missouri.  
Puchbauer, Truman C. Timber management plan--Mingo National Wildlife Refuge.

1958

- Whipkey, Ronald Z. Hydrologic relationships in Missouri Ozarks.

1959

- Plass, William T. A silvical analysis of a virgin hardwood forest.

1960

- Ali, Sayed S. N. Acorn production in Missouri.  
Cole, Alex B. Forest resources of rural householders in Dent County, Missouri.  
Semago, William T. Interception of precipitation by hardwood litter.  
Settergren, Carl D. Initial survival of oak in river hills.

1961

- Koelling, Melvin R. An exploratory study of the foliar nutrient content of shortleaf pine in Missouri.  
Quaynor, Solomon O-A. Site preparation as a cultural measure in establishing pine plantations in central Missouri.

1962

- Dooling, Oscar J. Morphological and cultural variation in Ceratocystis fagacearum (Bretz) Hunt.
- Janes, Donald J. Radial growth rate and sprouting characteristics of silver maple as affected by competing forest trees.
- Meredith, Theodore H. Marketing forest products in the eastern Ozark region.
- Ryker, R. Allen. Artificial extraction effects on pine pollen vigor.
- Siedel, Kenneth. Effect of stratification, repellent treatment, and storage on the germination of shortleaf pine seed.
- Vogt, Albert R. The influences of auxin on basal sprouting of oak seedlings.

1963

- Holt, Francis T. An analysis of growth rates of oak in Missouri.
- Mischon, Raymond M. Sawmill efficiency in the eastern Ozark region.

1964

- Cole, Dennis M. Recreational impact on forest sites in the Missouri Ozarks.
- Myers, John K. Marketing activities of the sawmill industry in the eastern Ozark region.

1965

- Floto, Loren R. An evaluation of a southeast Missouri cottonwood plantation.
- Loomis, Robert M. Seasonal interpretation of certain fire danger factors in Missouri.
- Lowe, John E. The construction of aerial photo volume tables for central Missouri hardwoods.
- Scowcroft, Paul G. The effects of fire on the hardwood forests of the Missouri Ozarks.

1966

- Ammon, Vernon D. The importance of the small oak barkbeetle Pseudopityophthorus minutissimus (Zimm.) as a vector of the oak wilt fungus Ceratocystis fagacearum (Bretz) Hunt.
- Biswell, Clifford R. Nurse seed grafting of selected varieties of chestnut, pecan and walnut.
- Chesebro, John W. Fomes annosus on shortleaf pine in Missouri: Studies concerning duration of stump susceptibility of infection, stump protection, and height of bole invasion.
- Christoff, Gary T. The role of indoleacetonitrile and indoleacetic acid in the germination of black oak and white oak acorns.

- De Walle, David R. The hydrologic budget of an Ozark watershed.
- Drummond, David B. Fluctuation in Fomes annosus inoculum levels and infection rates in Missouri.
- Speckhart, Aaron K. Forest taxation with special reference to the Missouri State Forestry Act.

1967

- Miller, David R. Water balance in an oak-hickory stand in central Missouri.
- Valiunas, Algrid J. Crop tree release thinning of immature oak in Missouri.
- Walters, Don A. A study of reproduction on two tracts of mature oak in the Missouri Ozarks.
- Wuenscher, James E. A vegetational analysis of a virgin hardwood stand in east-central Missouri.

1968

- Lowery, Robert E. The effect of initial stem temperature on time required to kill cambium of shortleaf pine.
- Thompson, Gordon L. A comparative study of homebuilder attitudes toward selected structural and millwork wood components.
- Vogt, William K. Investigations of methods for vegetative propagation of oak.
- Voyles, William J. Visitor characteristics at selected state parks.

1969

- Bielefeld, David R. The quantitative and qualitative changes in the soluble ribonucleic acid distribution due to the effect of high temperatures upon mimosa epicotyl tissue.
- Monterastelli, Julius J. Market value of forest land in southeast Missouri and its relationship to intended land-use and owner characteristics.
- Naughton, Gary G. Some characteristics of walnut coppice sprouts.
- Powell, John L. Harvesting optimum shortleaf pine products for an integrated market.
- Rochow, John J. Gradient analysis in mid-Missouri forests.
- Schnare, Paul D. A provenance study of jack pine in central Missouri.
- Weigel, Richard D. Open space inventory for regional recreation: An initial application in St. Louis County, Missouri.
- Yoder, William G. A study of the Nantucket pine tip moth in Missouri: Its life cycle and the influence of predators and precipitation deficits upon its infestation levels.

Appendix I  
DOCTOR OF PHILOSOPHY DISSERTATIONS

1965

Ralston, Robert A. An economic evaluation of land use alternatives in Dent County, Missouri.

1966

Vogt, Albert R. Physiological factors controlling sprouting of oak.

1967

Crawford, Hewelette S. Jr. Stand stocking and effects on understory vegetation in even-aged black oak stands.

1968

Holt, Francis T. The energy budget and water balance of an oak-hickory timber stand in central Missouri.

1969

Seidel, Kenneth W. The drought resistance and internal water balance of oak seedlings.

Appendix J  
FORESTRY PUBLICATIONS

FORESTRY PUBLICATIONS OF THE MISSOURI AGRICULTURAL EXPERIMENT STATION

Bulletins

- Record, Samuel J. Forest Conditions of the Ozark Region of Missouri. Bulletin 89, November 1910.
- Wooley, J. C. Effect of Treatment on Fence Posts. Bulletin 374, January 1937.
- Westveld, R. H. and Conrad H. Hammar. Forest Restoration in Missouri. Bulletin 392, November 1937.
- Sechrist, Wm. C. and Ralph H. Peck. Missouri Woods and Wood-Using Industries. Bulletin 442, March 1942.
- Peck, Ralph H., Wm. C. Sechrist, and C. Willard Leach. Marketing Missouri Farm Timber Crops. Bulletin 460, January 1943.
- Burns, Paul Y. and J. Milford Nichols. Oak Pruning in the Missouri Ozarks. Bulletin 581, April, 1952 (out of print).
- Nichols, J. Milford, Direct Seeding of Oak in Missouri. Bulletin 609, January 1954 (out of print).
- Nichols, J. M., Paul Y. Burns and Donald M. Christisen. Acorn Production in the Missouri Ozarks. Bulletin 611, January 1954.
- O'Neil, W. J. Tests on Treated Fence Posts. Bulletin 612, January, 1954 (superseded by Bulletin 808).
- Martin, S. Clark, J. M. Nichols and Dayton L. Klingman. Controlling Woody Plants with 2, 4, 5 -T; 2, 4-D and Ammate. Bulletin 615, January 1954.
- Smith, Richard C. Marketing Farm Woodlot Products. Bulletin 623, May 1954
- Dingle, Richard W. and Peter W. Fletcher. A Survey of Forest Tree Plantings in Missouri. Bulletin 640, January 1955.
- Burns, Paul Y. Fire Scars and Decay in Missouri Oaks. Bulletin 642, January 1955.
- McDermott, R. C. Poison Ivy. Bulletin 680, January 1957.
- Staff of the University of Missouri School of Forestry (10 authors). Research in Forestry and Wood Products. Bulletin 709, June 1958.
- Paulsell, Lee K. and J. Milford Nichols. Marketing Christmas Trees in Missouri. Bulletin 719, December, 1958.
- Paulsell, Lee K. Missouri's Forest Laboratory. September 1959, Bulletin 724.
- Nichols, J. Milford and Lee K. Paulsell. A New Idea in Fire Fighting--Air Blast Line Building. Bulletin 725, February 1959.

- Smith, Richard C., Lee K. Paulsell and Lawrence Leney. Oak Panelling--its processing and marketing. Bulletin 737, July 1959.
- Brohn, Allen and Thomas S. Baskett. Free Livestock Range in Missouri. Bulletin 761, January 1961.
- Settergren, Carl and R. C. McDermott. Trees of Missouri. Bulletin 767, January 1962 (for sale: \$1.00).
- Mendel, Joseph J. Timber Resources of the Eastern Ozarks. Bulletin 779, June 1961.
- School of Forestry and Columbia Forest Research Center (15 authors). Research--The Key to the Development of Missouri's Forest Resources and Wood-Using Industries. Bulletin 792, January 1963 (out of print).
- Gansner, David A. and Clarence D. Chase. Timber Resources of the Missouri Prairie Region. Bulletin 797, July 1963.
- O'Neil, W. J. Tests on Treated Fence Posts. Bulletin 808, July 1963.
- Polk, R. Brooks, Christmas Trees--a Missouri Crop. Bulletin 820, June 1964.
- McGinnes, E. A. Jr. A Survey of Wood-Using Industries of Missouri. Bulletin 824, January 1965.
- Gansner, David A. Timber Resources of Missouri's Southwestern Ozarks. Bulletin 845, January 1966.
- Gansner, David A. and Burton L. Essex. Timber Resources of Missouri's Riverborder Region. Bulletin 846, March 1966.
- Gansner, David A. Timber Resources of Missouri's Northwestern Ozarks. Bulletin 847, March 1966.

#### Research Bulletins

- Dunlap, Frederick. Growth of Oak in the Ozarks. Research Bulletin 41, March 1921.
- King, D. B., E. V. Roberts and R. K. Winters. Forest Resources and Industries of Missouri. Research Bulletin 452, December 1949.
- Rogers, Nelson F. Strip-mined lands of the Western Interior Coal Province. Research Bulletin 475, May 1951.
- Dingle, R. W. Relationship of Shortleaf Pine Growth to Soil Properties. Research Bulletin 541, February, 1954 (out of print).
- McDermott, R. E. Seedling Tolerance as a Factor in Bottomland Timber Succession. Research Bulletin 557, July, 1954.
- Fletcher, Peter W. and Julian Ochrymowych. Mineral Nutrition and Growth of Eastern Redcedar in Missouri. Research Bulletin 577, February, 1955.

- McDermott, R. E. and P. W. Fletcher. Influence of Light and Nutrition on Color and Growth of Redcedar Seedlings. Research Bulletin 587, June, 1955.
- Smith, Richard C. Taxation of Forest Land in South Missouri. Research Bulletin 624, March, 1957.
- Fletcher, P. W. and R. E. McDermott. Influence of Geologic Parent Material and Climate on Distribution of Shortleaf Pine in Missouri. Research Bulletin 625, April, 1957.
- Nichols, J. Milford. Control of Woody Vegetation. Research Bulletin 638, August, 1957.
- Paulsell, Lee K. Effects of Burning on Ozark Hardwood Timberlands. Research Bulletin 640, September, 1957.
- Jones, T. W. and T. W. Bretz. Experimental Oak Wilt Control in Missouri. Research Bulletin 657, February, 1958.
- O'Neil, W. J. Selling Mill-Run and Graded Oak Lumber. Research Bulletin 685, January, 1959.
- Whipkey, R. Z. and P. W. Fletcher. Precipitation and Runoff From Three Small Watersheds in the Missouri Ozarks. Research Bulletin 692, April, 1959.
- Nash, Andrew J. Growth in Well-Stocked Natural Oak Stands in Missouri. Research Bulletin 700, October, 1959.
- Neebe, David J. and Peter W. Fletcher. Thinning of Eastern Cottonwood in Missouri. Research Bulletin 733, April, 1960.
- Cole, Alex B. and Richard C. Smith. The Forest Resources of Rural Householders in Dent County, Missouri. Research Bulletin 740, June, 1960.
- Leney, Lawrence. Mechanism of Veneer Formation at the Cellular Level. Research Bulletin 744, July, 1960.
- Minckler, Leon S. and Robert E. McDermott. Pin Oak Acorn Production and Regeneration as Affected by Stand Density, Structure and Flooding. Research Bulletin 750, September 1960.
- Semago, William T. and Andrew J. Nash. Interception of Precipitation by a Hardwood Forest Floor in the Missouri Ozarks. Research Bulletin 796, February 1962.
- Lull, Howard W. and Peter W. Fletcher. Comparative Influence of Hardwood Trees, Litter, and Bare Area on Soil-Moisture Regimen. Research Bulletin 800, March 1962.
- Krusekopf, H. H. Forest Soil Areas of the Ozark Region in Missouri. Research Bulletin 824, April 1963.

- McGinnes, E. A. Jr. Growth-Quality Evaluation of Missouri-Grown Short-leaf Pine (*Pinus echinata*, Mill.). Research Bulletin 841, September 1963.
- Mischon, Raymond M. and Richard C. Smith. Sawmill Efficiency in the Eastern Ozark Region. Research Bulletin 860, April 1964.
- Smith, Richard C. and Raymond M. Mischon. Trends in Forest Taxes in South Missouri. Research Bulletin 883, March 1965.
- Minckler, Leon S. and Donald D. Janes. Pin Oak Acorn Production on Normal and Flooded Areas. Research Bulletin, December 1965.
- McGinnes, E. A. Jr. and R. A. Ralston. Growth-Quality Evaluation of Black and Scarlet Oak Grown in Missouri. Bulletin 921 March 1967.
- DeWalle, David R. and Lee K. Paulsell. Canopy Interception, Stemflow, and Streamflow on a Small Drainage in the Missouri Ozarks. Research Bulletin 951. April 1969.

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- Burns, Paul Y. Value of Farm Woodlot Management. Circular 349, July 1950.

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- Westveld, R. H. The Background of the McIntire-Stennis Act for Cooperative Forestry Research. Special Report 31, June 1963.

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#### Circulars

- Westveld, R. H., 1936 "How to Plant Small Trees," Circular 342.
- Westveld, R. H., 1936 "Tree Windbreaks for Missouri Farms," Circular 343.
- Westveld, R. H., 1936 "Tree Planting for Erosion Control," Circular 345.
- Westveld, R. H. and Rudolf Bennitt, 1936 "Improving Food and Cover for Wildlife on Missouri Farms I Trees and Shrubs," Circular 348.
- Westveld, R. H. and Rudolf Bennitt, 1938 "Improving Food and Cover for Wildlife on Missouri Farms I Trees and Shrubs," Circular 393, (Revision of Circular 348).
- McCormick, L. E., 1939 "The Planting and Care of Forest Trees on Missouri Farms," Circular 409.
- McCormick, L. E. and Calvin Bowen, 1940 "Answers to Some Common Questions on Clearing Timbered Land," Circular 425.



- McCormick, L. E. and Calvin Bowen, 1946 "Processing and Use of Native Lumber on Farms," Circular 528.
- McCormick, L. E. and Calvin Bowen, 1947 "Answers to Some Common Questions on Clearing Timbered Land," Circular 546, (Revision of Circular 425).
- McCormick, L. E., 1948 "Planting and Care of Forest Trees," Circular 563, (Revision of Circular 409).
- McCormick, L. E., 1949 "Farm Woodland Management," Circular 576.
- McCormick, L. E., 1950 "Processing and Using Native Lumber," Circular 579.
- Curtis, Robert L., 1943 "Planting Methods for Farm Woodlands," Circular 497.
- Smith, Richard C. and L. E. McCormick, 1952, "Directory of Wood Using Industries in Missouri," Circular 626.
- McCormick, L. E., 1955, "Farm Windbreaks," Circular 656.
- McCormick, L. E., 1957 "Farm Woodland Management," Circular 671, (Revision of Circular 576).
- McCormick, L. E. and Richard C. Smith, 1961 "Directory of Sawmills and Other Wood-Using Industries in Missouri," Circular 733.
- Taylor, Fred W., 1963 "Air Seasoning of Wood," Circular 800.
- Taylor, Fred W., 1963 "Log Sawing Procedures," Circular 801.
- McCormick, L. E., Fred W. Taylor, Richard C. Smith, and Robert Massengale, 1965 "Sawmills and Other Wood-Using Plants in Missouri," Circular 834.

#### Folders

- McCormick, L. E., 1957 "How to Use Your Cruising Stick," Folder 56.
- McCormick, L. E., 1960 "Before You Order Seedlings," Folder 90.

#### Leaflets

- McCormick, L. E., 1957 "Tree Planting Guide," Leaflet 54.
- McCormick, L. E., 1961 "How to Plant Trees and Shrubs," Leaflet 55.

#### Manuals

- McCormick, L. E., Calvin Bowen, and Marion W. Clark, 1949 "Tree Planting for Erosion Control," Manual 13.

#### 4-H Circulars

- McCormick, L. E., 1953 "Forestry for Boys and Girls," 4-H Circular 111.

Science and Technology Guides

- McCormick, L. E. and Edwin H. Glaser, 1963 "Before You Order Seedlings," Guide 5006.
- McCormick, L. E., 1964 "Shaping Christmas Trees for Quality," Guide 5706.
- McCormick, L. E. and John Wylie, 1963 "Increase Timber Profits Through Stand Improvement," Guide 5150.
- McCormick, L. E. 1964 "How to Plant Forest Trees," Guide 5008.
- Taylor, Fred W., 1964 "Use of Treated Posts for Fence Building," Guide 5500.
- Taylor, Fred W. and L. E. McCormick, 1964 "A Farm Method for Treating Fence Posts," Guide 5502.
- Taylor, Fred W., 1965 "Sawmill Alignment," Guide 5600.
- McCormick, L. E., 1967 "Essentials of Christmas Tree Production," Guide 5700.
- McCormick, L. E., 1967 "How to Measure Trees and Logs," Guide 5050.
- McCormick, L. E., 1967 "Farmstead Windbreak," Guide 5900.
- School of Forestry, Department of Agronomy and Department of Agricultural Economics, 1968, "Conversion of Brush and Low Quality Timber with Aerial Spray," Guide 4690.

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- Adair, Kent T., E. A. McGinnes, Jr., and J. P. Pastoret, 1968. Wood products instruction at the University of Missouri. Wood and Fibre 1 (1) 76-78.
- Brown, M. C. and E. A. McGinnes, Jr., 1968. Research for Missouri forest products industries. Forest Products Journ. 18 (10) 21-22.
- Brown, G. N. and F. G. Taylor, Jr. 1966. Zinc-65 distribution and radio-sensitivity of growth and Zn<sup>65</sup> uptake in red oak seedlings. Radiation Botany 6:519-524.
- \_\_\_\_\_. 1967. Interaction of radiation and photoperiodism in Xanthium Pennsylvanicum: Effects of radiation during the light and dark periods of photoinduction. Radiation Botany 7:67-72.
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- Cox, G. S. and F. T. Holt. 1965. Instrumentation for micrometeorological studies in hardwood forest stands. *Proc. Missouri Acad. Sci.* 2:33.
- Cox, G. S. and A. R. Vogt. 1969. Evidence for the hormonal control of stump sprouting by oak. *Forest Science* (in press)
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- \_\_\_\_\_ 1967. Classification and quantity of fiber types in a Western hemlock and Sitka spruce dissolving-grade pulp. *Forest Products Journal* 17 (5) 33-39.
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- \_\_\_\_\_ 1959. University Forest notes 7: (3) 11.
- \_\_\_\_\_ 1959. University Forest notes 7: (4) 7.
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- \_\_\_\_\_ 1959. Weldon Spring notes 7: (2) 9.
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Appendix K  
SCHOLARSHIPS IN SCHOOL OF FORESTRY

Rodney Ward Memorial Scholarships

Sponsor--Forestry Alumni Association  
Year Established--1957  
Stipend--Approximately \$200 annually  
Year Terminated--1963 when School of Forestry Memorial Loan Fund was established.

Federated Garden Clubs of Missouri

Sponsor--Federated Garden Clubs of Missouri  
Year Established--1957  
Stipend--Approximately \$300  
Year Terminated--1959 when scholarship was transferred to Department of Horticulture for students in floriculture.

Kansas City Hoo-Hoo Club Scholarships

Sponsor--Kansas City Hoo-Hoo Club  
Year Established--1959  
Stipend--\$200 to \$400 annually for each of one or more scholarships  
Restrictions--Limited to students involved in wood products merchandising curriculum.

Missouri Federation of Women's Clubs, Inc.

Sponsor--Missouri Federation of Women's Clubs  
Year Established--1959  
Stipend--\$300 annually for each of one or more scholarships

Lumber Dealers' Scholarship

Sponsor--Lumber dealers associations in Missouri  
Year Established--1960  
Stipend--Varied from \$200 to \$260 annually for each of two scholarships  
Restrictions--Limited to students enrolled in the wood products merchandising curriculum.

Marguerite Krueger Conservation Club Forestry Summer Camp Scholarship

Sponsor--Marguerite Krueger  
 Conservation Club of St. Louis  
 Year Established--1961  
 Stipend--Has varied from \$150 to \$225 annually  
 Restrictions--Used for student attending forestry summer camp.

St. Louis Hoo-Hoo Club Scholarship

Sponsor--Hoo-Hoo Club of St. Louis  
 Year Established--1963  
 Stipend--Has varied from \$215 to \$250 annually  
 Restrictions--Limited to students in wood products merchandising curriculum

Homes Builders Association of Greater Kansas City Scholarships

Sponsor--Home Builders Association of Greater Kansas City  
 Year Established--1963  
 Stipend--\$250 to Missouri residents or \$500 to Kansas resident to each of four individuals annually  
 Restrictions--Limited to residents of Platte, Jackson, Clay or Cass counties in Missouri or to residents of Johnson or Wyandotte counties in Kansas interested in the home building industry and/or its allied fields

Home Builders Association of Springfield

Sponsor--Home Builders Association of Springfield, Missouri  
 Year Established--1964  
 Stipend--\$100  
 Restrictions--Limited to student enrolled in residential and light construction curriculum

National Association of Home Builders Scholarships

Sponsor--National Association of Home Builders  
 Year Established--1965  
 Stipend--\$250 to \$500 annually for one or more persons  
 Restrictions--Limited to students enrolled in residential and light construction curriculum  
 Year Terminated--1969

David and Gertrude Gwinner Scholarships

Sponsor--Mr. and Mrs. T. Myron Gwinner  
Year Established--1966  
Stipend--\$250 annually to provide one or more scholarships

Home Builders Association of Greater St. Louis

Sponsor--Home Builders Association of Greater St. Louis  
Year Established--1966  
Stipend--\$250 periodically  
Restrictions--Limited to students interested in the home building industry and/or its allied fields

Oliver J. Ferguson Scholarship

Sponsor--Oliver B. Ferguson  
Year Established--1967  
Stipend--\$100 annually

Ladies Auxiliary of the Columbia Home Builders Association

Sponsor--Ladies Auxillary of the Columbia Home Builders Association  
Year Established--1967  
Stipend--\$400 made available at discretion of Scholarship Committee  
Restrictions--Limited to students interested in residential and light construction

William T. Kohner Scholarships

Sponsor--the late William T. Kohner  
Year Established--1968  
Stipend--the income (approximately \$300 annually) from invested principal

## Appendix L

### THE WESTVELD AWARDS

The Freshman Award goes to the freshman who attains the highest scholastic average during the first semester.

The Sophomore Award goes to the sophomore, who, during his freshman and sophomore years has been most active in the Forestry Club. The Junior Award goes to the junior who has had the highest scholastic average in courses other than forestry during his freshman and sophomore years.

The Senior Award goes to the senior who has mostly effectively combined high scholarship and leadership for and service to his fellow students.

Fifty - nine persons had been the recipients of these awards through 1969. Seven persons received awards twice and three persons received awards three times.

The names of the award winners are shown in the following tabulation.

| Year | Freshman             | Sophomore             |
|------|----------------------|-----------------------|
| 1952 | Richard Garner       | George Oonk           |
| 1953 | Richard Hines        | David M. Click        |
| 1954 | John K. Strickler    | Howard L. Wolf        |
| 1955 | Carl D. Settergren   | Ronald J. Strauss     |
| 1956 | Eugene L. Brunk      | Alfred M. Rivas       |
| 1957 | Ronald G. Cockrel    | Hugh Speight          |
| 1958 | Donald Percival      | Frederick W. Bergman  |
| 1959 | John J. Wilczynski   | William J. Nelson     |
| 1960 | Harry Lee            | John J. Wilczynski    |
| 1961 | Walter G. Thies      | Robert G. Stryker     |
| 1962 | Roger W. Leonard     | Walter G. Thies       |
| 1963 | James R. Willis      | Tim R. Schweigart     |
| 1964 | David R. Barber      | Marshall S. Odell     |
| 1965 | Richard A. Sirken    | Ronald E. Lumb        |
| 1966 | Dennis R. Knapp      | Frank L. Gordon       |
| 1967 | William G. Eickmeier | Orland Baltz          |
| 1968 | Phillip A. Hein      | Thomas P. Ronk        |
| 1969 | Gregory S. Hodgins   | James K. Stevens, Jr. |

|      | Junior               | Senior             |
|------|----------------------|--------------------|
| 1952 | Edward H. Oechsle    | A. Claude Ferguson |
| 1953 | R. Allen Ryker       | David D. Schores   |
| 1954 | Stanley L. Krugman   | R. Allen Ryker     |
| 1955 | Daniel A. Rascher    | Stanley L. Krugman |
| 1956 | Alex B. Cole         | Howard L. Wolf     |
| 1957 | Carl D. Settergren   | Ronald J. Strauss  |
| 1958 | Richard R. Kilbury   | Carl D. Settergren |
| 1959 | Victor H. Gaines     | Hugh Speight       |
| 1960 | David Kline          | Ted H. Meredith    |
| 1961 | Raymond M. Mischon   | Albert R. Vogt     |
| 1962 | Melvin J. Weiss      | John J. Wilczynski |
| 1963 | Walter G. Thies      | Melvin J. Weiss    |
| 1964 | Walter L. Dowd       | Loren R. Floto     |
| 1965 | James R. Willis      | James E. Wuenscher |
| 1966 | Wallace W. Chandler  | James R. Willis    |
| 1967 | David H. Helton      | William R. Houston |
| 1968 | Dennis R. Knapp      | Steven E. Lindsey  |
| 1969 | William G. Eickmeier | Michael E. Warden  |

## Appendix M

### RECIPIENTS OF WESTVELD PRIZE IN FORESTRY

The prize was established by friends and associates of R. H. Westveld at the time of his retirement as Director in 1965. The income earned by the fund--approximately \$100 per year--is awarded annually to a junior or senior preparing the best technical or popular article on a topic in silviculture.

Recipients of the prize and the titles of their papers are:

1968. Guy Bottom, Management of black walnut.

1969. John M. Elliott, Regeneration of ponderosa pine.



Appendix N  
RECIPIENTS OF B.S.F., M.S. AND PH.D. DEGREES

Recipients of B. S. F.

1913

Fallenius, Victor C.  
Talbot, Murrell W.

1914

Clay, Robert B.  
Gibson, Maurice S.

1915

Miller, Max E.  
Youmans, John P.

1916

Kraft, Felix G.

1917

Bremicker, Joel H.  
Herald, Charles W. Jr.  
Ladensohn, Samuel H.

1918

Hotze, Bent  
Kohner, William G.

1919

Bruto, Fred R.

1920

Fritschle, Charles R.

1921

Broadbent, Sam R.  
Green, Burdett  
Simmons, Charles W.

1949

Barnhart, Charles E.  
Canter, Edward H.  
Church, Joseph B.  
Erwin, Harry K. Jr.

1949 (cont.)

Gallaher, Harold G.  
Glaser, Edwin H.  
Hamilton, George W.  
Kullman, John R.  
Metcalf, Walter B.  
Paulsell, Lee K.  
Piepenbring, Richard L.  
Pittenger, Donald  
Shields, Albert J.  
Wehking, Erhardt F.  
Wilder, David L. Jr.

1950

Ball, Gilmore  
Berkley, Raymond L.  
Creasy, R. C.  
Deed, Richard N.  
Dressel, Armin T.  
Edscorn, Kenneth C.  
Faulkenberry, V. T.  
Hafner, Kerwin F.  
Hunt, Ellis V. Jr.  
Kunze, Ernest W.  
Liechti, Wallace M.  
Lodge, George W.  
Matt, Lester E.  
Metcalf, Woodford P.  
Mobley, Noah R.  
Moeller, Carl A. Jr.  
Moran, Harry B.  
Musbach, Ralph A.  
Purcell, William W.  
Raisch, Robert D.  
Schildknecht, John R.  
Schweitzer, F. J. Jr.  
Sendt, Harold  
Sendt, William B.  
Stevenson, Robert L.  
Todd, William J.

1950 (cont.)

Tschannen, Lester E.  
Walker, James W.  
Wilson, Orville E.  
Wolfel, George W.  
Wood, Edison B.

1951

Bammert, Robert F.  
Brodhage, Jack A.  
Bruns, Raymond R.  
Buck, Frederick  
Chandler, Rolla E.  
Cochrane, James R.  
Duesing, Richard C.  
Duncan, Daniel W.  
Ferris, Earl F.  
Hawkins, Wharton Z.  
Lashley, Owen L.  
Mabry, James D.  
Robine, Carl L.  
Sander, Gerhard H.  
Shaw, Dale L.  
Smith, Donald W.  
Smith, James C.  
Stevenin, Howard L.  
Todd, William G.  
Vogler, James E.  
Ward, John T.  
Welch, Hugh D. Jr.  
Williams, Ralph J.

1952

Aikins, Robert E.  
Coplen, William C.  
Eggers, Kenneth W.  
Ferguson, A. Claude  
Fric, Jerry  
Gibson, William J.  
Grote, Donald A.  
Groeppe, Richard C.  
Hembree, Jack E.  
Herzwurm, Ernest J.  
Illinik, Richard H.  
Kerr, Russell S.  
Klonowski, Floyd

1952 (cont.)

Kunz, Ralph H.  
Neebe, D. J.  
Ottomeyer, Donald J.  
Pallo, Frank B.  
Plummer, John L.  
Robinson, John H.  
Sander, Ivan L.  
Steger, Peter J. Jr.  
Taylor, Richard  
Vandeven, James A.  
Wallace, Joseph P.

1953

Beck, Paul L.  
DeMoor, James F.  
Gould, Thomas L.  
Green, James W.  
Grisham, Edward W.  
Hankins, Robert T.  
McDonald, N. A.  
Oechsle, Edward H.  
Schores, David D.  
Smith, Harold W.  
Ward, Rodney L.

1954

Biswell, Clifford R.  
Carnell, Bill M.  
Cowley, Arthur P.  
Davis, Jerry T.  
Gann, Alvin L.  
Gass, Ramon D.  
Hepting, William C.  
Hubbs, Oliver W.  
Ross, Roy D.  
Ryker, Russell A.  
Scharpf, Robert F.  
Statler, Luther D.  
Wooley, Bill

1955

Barnhart, Franklin T.  
Beilmann, August F.  
Boeckstiegel, Lee L.  
Breeding, Leslie E.

1955 (cont.)

Burkel, Donald  
 Click, David  
 Hunt, Joseph W.  
 Janes, Donald J.  
 Krugman, Stanley L.  
 Mason, Douglas  
 Oonk, George B.  
 Puchbauer, Truman C.  
 Quinlin, Gerald J.  
 Rapp, Robert D.  
 Sams, John P.  
 Shearer, Warren  
 Smithson, Royce M.  
 Stinson, Douglas J.  
 Wheeler, Jerry  
 Wood, Francis A.  
 Woodland, Ron

1956

Coates, John Jr.  
 Flittner, Robert J.  
 French, Harold S.  
 Grey, Gene W.  
 Hilliard, Robert E.  
 Lamar, Andrew J.  
 Lowery, John W.  
 Massengale, Robert A.  
 Rascher, Daniel A.  
 Roloff, Glenn A.  
 Sackett, Allen H.  
 Wilson, John E.  
 Wolf, Howard L.  
 Wood, George W.

1957

Allen, Jerry G.  
 Arter, Jerome S.  
 Bell, L. Wayne  
 Berlin, James S.  
 Carron, S. T.  
 Cole, Alex B.  
 Eckles, Wayne  
 Ferell, Raymond S.  
 Ferrill, Mitchell D.  
 Fisher, Harold E.

1957 (cont.)

Foley, James N.  
 Gwinner, Myron W.  
 Hawkins, Richard H.  
 Jennings, Harry L.  
 Keyth, William A.  
 Nelson, Nathan C.  
 Poat, Austin J.  
 Prante, Howard J.  
 Rivas, Alfred M.  
 Schaller, George T.  
 Seabaugh, James T.  
 Slusher, John P.  
 Strauss, Ronald J.  
 Strickler, John K.  
 Tamm, Jerry N.  
 Troutt, Alfred H.

1958

Allmon, Arlen D.  
 Alt, Lowell  
 Austin, Stanley B.  
 Berkholz, Richard C.  
 Bookholtz, Cletus P.  
 Booth, Jack  
 Bunch, Stanley R.  
 Collett, Loyd M.  
 Cottingham, Robert I.  
 Crisan, J. R.  
 Draper, G. M.  
 Ferguson, Allan J.  
 Ford, Robert D.  
 Gansner, David A.  
 Gritman, James C.  
 Heflin, Eldon L.  
 Hurlbut, Donald B.  
 Krull, Edward  
 Laval, Robert M.  
 Martin, James W.  
 Maynard, Arthur S.  
 Minor, Robert M.  
 Moose, Robert  
 Onstott, Bill  
 Presley, Jerry J.  
 Settergren, Carl D.  
 Sitzes, Mason W.

1958 (cont.)

Smith, Timothy M.  
Soehlig, Larry A.  
Solomon, Clell A.  
Venegoni, Richard A.  
Ward, John R.  
Woerheide, John D.  
Zeugin, Roland

1959

Ali, Syed S. N.  
Ashton, Allan W.  
Begeman, Gilbert F. Jr.  
Benton, Raymond O.  
Bolm, Ralph C.  
Brunk, Eugene  
Capps, John S.  
Carter, William B.  
Cochran, Robert B.  
Colvin, Paul F.  
DeVoto, David F.  
Dooling, Oscar J.  
Gann, Larry  
Harris, Jack D.  
Hart, Glenn  
Hildebrand, Ronald R.  
Hilgemann, Warren  
Huggans, Jim  
Hulse, Floyd G.  
Jordan, Thomas E.  
Jourden, Richard  
Kilbury, Richard R.  
Koelling, Melvin R.  
Lackey, Thomas D.  
Lawson, Robert P.  
Lichterman, Leon L.  
Lohmeyer, Edgar J. Jr.  
Luebchow, Kaye R.  
Miller, Harold N.  
Mokry, Theodore J.  
Niewald, Albert E.  
Rice, Howard  
Rollens, Donald L.  
Runyon, Norman  
Speight, Hugh  
Turley, Donald  
Vaughn, James D.  
Vinson, Joe A.

1960

Aubin, Gene F.  
Barney, James M.  
Bergman, Frederick W.  
Cockrel, Ronald G.  
Culbertson, David H.  
Dietzel, Wilbur D.  
Ewing, Floyd E.  
Gaines, Victor H.  
Gardner, Jack N.  
Grigery, Thomas E.  
Grunwald, Claus  
Hall, Randall R.  
Hurlbut, David D.  
Joiner, Gordon W.  
Lester, John E.  
Manor, George A.  
Meredith, Ted H.  
Nelson, William J.  
Nielsen, Rodney R.  
Palone, Woodrow L.  
Percival, Donald  
Rast, Everette D.  
Rogge, Frederick C.  
Runge, Norman W.  
Sanders, Carl C.  
Schuhmann, Marvin H.  
Schweer, William R.  
Shelby, William E.  
Taylor, Lawrence A.  
Thompson, John M.  
Whitaker, Eugene C.

1961

Backler, William E.  
Casteel, Charles A.  
Coose, Richard L.  
Crozier, Robert  
Deutsch, Henry A.  
Fallert, Robert A.  
Gibbs, Jim Bob  
Hagemeister, Jerry  
Johnsey, Richard L.  
Jones, Bill  
Kline, David E.  
Loewenberg, Bruce  
McGuigan, Don  
Naland, Paul R.

1961 (cont.)

Null, William S.  
 Parnell, Robert G.  
 Pribble, Jimmie L.  
 Price, James K.  
 Railey, John R.  
 Reid, Charles P. P.  
 Richmond, George B.  
 Schaberg, Ronald W.  
 Shamin, Mohammed  
 Sharma, Gopal K.  
 Speckhart, Aaron K.  
 Spellman, David L.  
 Vogt, Albert R.  
 Wilkins, Leland F.  
 Williams, Frank R.

1962

Allen, Richard P.  
 Bay, Phillip  
 Cole, Dennis M.  
 Gourley, Eldon L.  
 Henson, Roy L.  
 Holt, Francis T.  
 Johnson, Murray M. III  
 Laacke, Robert J.  
 Lange, Harold P.  
 Miller, David R.  
 Mischon, Raymond M.  
 Myers, John K.  
 Patterson, E. Lane  
 Reaver, Russel J.  
 Staples, Donald L.  
 Wakefield, W. C. Jr.  
 Watson, Keith  
 Wilczynski, John J.  
 Woodley, Charles S.  
 Worthington, George R.  
 Yost, Carl

1963

Adam, Earl V.  
 Alley, James A.  
 Brush, Lewis L.  
 Coonce, Leland F.  
 Dubrouillet, David

1963 (cont.)

Hodgeboom, Fred D.  
 Hutchison, Pat  
 Jensen, Helmer N. Jr.  
 Lapidakis, Jerry A.  
 Lindecke, Robert W.  
 Nash, Thomas C.  
 Pelly, Jerome  
 Pennell, Marvin J.  
 Rassfeld, Richard S.  
 Salmons, Joe  
 Shaw, Joseph A.  
 Stryker, Robert G.  
 Townsend, L. McGill  
 Underwood, Ellsworth C.  
 Vieth, Philip W.  
 Weiss, Melvyn J.  
 Wood, John M.  
 Zeorlin, Charles P.

1964

Brown, Edward A.  
 Cahill, Leslie V. II  
 Chesebro, John  
 DeWalle, David R.  
 Drummond, David B.  
 Fick, Thomas  
 Floto, Loren R.  
 Foster, James W.  
 Geisler, James C.  
 Gottschall, Glenn J.  
 Greenstein, Robert M.  
 Greer, Jerry D.  
 Hawkins, William L.  
 Hutchings, Bryan K.  
 Johnson, James F.  
 Kwader, John P.  
 Miley, Robert L.  
 Nay, Robert P.  
 Nelson, Robert E.  
 Newby, Loy C.  
 Orr, Curt M.  
 Ozanic, Carl F.  
 Sampson, Richard K.  
 Scobie, Walter R.  
 Scowcroft, Paul

1964 (cont.)

Summers, Glenn  
Temple, Clyde K.  
Thies, Walter G.  
Thomas, Harley  
Thompson, Gordon L.  
Williams, Lonnie H.

1965

Alley, Norman L.  
Allmon, Charles  
Ammon, Vernon D.  
Barney, Howard S.  
Christoff, Gary T.  
Davenport, Cledith  
Decker, Jerry A.  
Denney, Charles H.  
Dowd, Walter T.  
Dyer, James W.  
Eisele, William J. Jr.  
Evans, Richard S.  
Flowers, Royce W.  
Joiner, Phillip  
Leonard, Roger W.  
McAdams, Eugene A.  
Moser, John  
Owen, Allen D.  
Payne, William  
Roll, Robert A.  
Ross, Gerald  
Savage, William K.  
Schweighart, Tim R.  
Slayton, J. Richard  
Stephenson, William L. Jr.  
Stoewe, Russell J. Jr.  
Suchland, Arthur R.  
Teague, Neal  
Vogt, William K.  
Walters, Gerald A.  
Wells, John F.  
Wuenschler, James E.

1966

Backus, Barton L.  
Baer, James R.  
Bredfeldt, Harry J. Jr.

1966 (cont.)

Cutler, Robert R.  
Davis, Thomas A.  
Dexter, Richard A.  
Gibson, Mark C.  
Gisi, Donald V.  
Glock, Robert W.  
Grecco, Gary J.  
Haley, William J.  
Jones, Shelby G.  
Kellman, Harry J.  
King, Clyde W.  
Kocar, Guy C.  
Koelling, Otto W.  
Landes, Wallace H.  
Lowery, Robert  
Logan, Ralph B.  
Long, Rodney  
McHardy, David  
Marley, Robert  
Millikan, Billee C.  
Napier, Daniel A.  
Nash, Gary T.  
Odell, Marshall S.  
Paulsmeyer, John D.  
Rehagen, Conrad C.  
Riggs, David A.  
Sadowski, Frank G.  
Santhuff, Charles L.  
Schnurbusch, Willard J.  
Shambo, William  
Taliaferro, Carl E. Jr.  
Teverbaugh, John R.  
Walker, Nelson  
Walterscheidt, Michael J.  
Willis, James R.  
Wrobley, Ray  
Yoder, William G.  
Zolk, Toms C.

1967

Biles, Larry E.  
Bing, Gary C.  
Boarman, Daniel L.  
Brunk, Gary E.  
Caughlan, Charles A.

1967 (cont.)

Chandler, Wallace W.  
 Clark, Lawrence E.  
 Crouse, Freddie J.  
 Gonzalez, Claudio A.  
 Greenstreet, Milton E.  
 Griffith, Daniel T.  
 Harland, James R.  
 Hensler, Lawrence S.  
 Houston, William R.  
 Joines, James R.  
 Kohler, William K.  
 Kirby, Lonnie R.  
 Lumar, Leonard V.  
 Lyons, Gordon E. Jr.  
 McDaniel, Garold S.  
 Murray, Bruce L.  
 O'Brien, Larry C.  
 Pannell, Ray E.  
 Pennock, Allen J.  
 Potter, James A. II  
 Rice, Paul D.  
 Schnare, Paul D.  
 Teeter, Robert G.  
 Thornhill, Wayne A.  
 Westfall, Steven P.

1968

Allen, Ronald W.  
 Anderson, Robert L.  
 Davis, Walter M.  
 Fairchild, Jim  
 Fisher, Jerry  
 Fitzpatrick, William E.  
 Foersterling, Milton  
 Gordon, Frank L.  
 Halliwell, Douglas E.  
 Helton, David H.  
 Israel, David L.  
 Jacks, Gary S.  
 Juttner, Adrian S.  
 Kopf, Darrell E.  
 Lackamp, Larry  
 LeFever, Jerry G.  
 Leforegee, Gary M.  
 Lidholm, Gary V.  
 Lindsey, Steven E.

1968 (cont.)

Lumb, Ronald E.  
 Mackler, Leonard  
 Melton, James  
 Menke, William R.  
 Michaud, John J.  
 Moe, Gregor P.  
 Peterein, Kenneth  
 Rhode, Philip J.  
 Richardson, Dennis  
 Robinson, Lee  
 Rowland, Jack J.  
 Ruppert, David  
 Sailor, Paul S.  
 Schultz, Robert P.  
 Selle, Richard E.  
 Shafer, John  
 Shirley, Paul Jr.  
 Trammel, Clinton E.  
 Wallace, Earl E. Jr.  
 Wetzel, Ralph  
 Whiteaker, Richard  
 Windes, William E.  
 Yelton, Dale W.  
 Zorsch, Timothy A.

1969

Anderson, Gerald L.  
 Baer, Lawrence E.  
 Curtis, Scott  
 Day, Claude M.  
 Dietrich, Dennis R.  
 Dunehew, Johnny R.  
 Gabelman, Roger D.  
 Green, Stephen A.  
 Heyn, Eric C.  
 Holland, Harold M.  
 Jenn, Theodore R.  
 Jones, Peter A.  
 Mallams, Gary D.  
 Ogden, William A.  
 Pearson, David J.  
 Prochazka, John A. Jr.  
 Schelp, Lonnie E.  
 Schroeder, Michael O.  
 Stanosheck, Patrick T.  
 Strawn, Ronald

1969 (cont.)

Sweet, Perry S.  
Tamerius, Edward L.  
Tinsley, Richard E.  
Wallace, Joseph M.

1969 (cont.)

Warden, Michael E.  
Wellenkoetter, Carl R.  
Wilson, Floyd S.

Recipients of Master of Science

1950

Glaser, Edwin H.  
Paulsell, Lee K.

1952

Hunt, Ellis V. Jr.  
Nichols, J. Milford  
Ochrymowych, Julian  
Shaw, Dale L.

1953

Sander, Ivan L.

1954

Clark, F. Bryan

1956

Neebe, David J.  
Puchbauer, Truman C.

1958

Whipkey, Ronald C.

1959

Plass, William T.

1960

Ali, Sayed S. N.  
Cole, Alex B.  
Semago, William T.  
Settergren, Carl D.

1961

Koelling, Melvin R.  
Quaynor, Solomon O-A

1962

Dooling, Oscar J.  
Janes, Donald J.  
Meredith, Theodore H.  
Ryker, R. Allen  
Shamin, Mohammed  
Sharma, Gopal K.  
Siedel, Kenneth  
Vogt, Albert

1963

Holt, Francis T.  
Mischon, Raymond M.

1964

Cole, Dennis M.  
Deutsch, Henry A.  
Myers, John K.

1965

Floto, Loren R.  
Loomis, Robert M.  
Lowe, John E.  
Scowcroft, Paul G.

1966

Ammon, Vernon D.  
Biswell, Clifford R.  
Cheseboro, John W.  
Christoff, Gary T.  
De Walle, David R.  
Drummond, David B.  
Speckhart, Aaron K.



1967

Miller, David R.  
 Valiunas, Algrid J.  
 Walters, Don A.  
 Wuenscher, James E.

1968

Aranas, Armando  
 Lowery, Robert E.  
 Thompson, Gordon L.  
 Vogt, William K.  
 Voyles, William J.

1969

Bielefeld, David R.  
 Monterastelli, Julius J.  
 Naughton, Gary G.  
 Powell, John L.  
 Rochow, John J.  
 Schnare, Paul D.  
 Weigel, Richard D.  
 Yoder, William G.

Recipients of Doctor of Philosophy1965

Ralston, Robert A.

1966

Vogt, Albert

1967

Crawford, Hewelette S. Jr.

1968

Holt, Francis T.

1969

Siedel, Kenneth