

OFFICIAL PUBLICATIONS
OF CORNELL UNIVERSITY

VOLUME IV

NUMBER 15

NEW YORK STATE
COLLEGE OF AGRICULTURE

ANNOUNCEMENT OF THE
DEPARTMENT OF FORESTRY

1913-14

JULY 15, 1913
PUBLISHED BY CORNELL UNIVERSITY
ITHACA, NEW YORK

CALENDAR

First Term, 1913-14

Sept. 12,	Friday,	University entrance examinations begin.
Sept. 22,	Monday,	Academic year begins. Registration of new students.
		All special students in the College of Agriculture must first present themselves at the Office of the Secretary, Main Building 122, unless permission to register has previously been sent to them by the Registrar.
Sept. 23,	Tuesday,	Registration of new students.
Sept. 24,	Wednesday,	Registration of old students.
Sept. 25,	Thursday,	Instruction begins. President's annual address to the students.
Oct. 14,	Tuesday,	Last day for payment of tuition.
Nov. 11,	Tuesday,	Registration of Winter Course students.
Nov.	Thursday-Friday,	Thanksgiving recess.
Dec. 20,	Saturday,	Instruction ends in all courses. Christmas recess.
Dec. 30,	Tuesday,	Instruction resumed in Winter Courses.
Jan. 5,	Monday,	Instruction resumed in regular and special courses.
Jan. 11,	Sunday,	Founder's Day.
Jan. 26,	Monday,	Term examinations begin.

Second Term, 1913-14

Feb. 7,	Saturday,	Registration, undergraduates.
Feb. 9,	Monday,	Instruction begins.
Feb. 12,	(week of)	Farmers' Week.
Feb. 13,	Friday,	Instruction ends in Winter Courses.
Feb. 27,	Friday,	Last day for payment of tuition.
April 1,	Wednesday,	Instruction ends
April 9,	Thursday,	Instruction resumed } Spring recess.
May 23,	Saturday,	Navy Day.
June 3,	Wednesday,	Term examinations begin.
June 17,	Wednesday,	Forty-sixth Annual Commencement.

Summer School in Agriculture, 1914

July 6,	Monday,	Summer School begins.
Aug. 14,	Friday,	Summer School ends.

First Term, 1914-15

Sept. 11,	Friday,	Entrance examinations begin.
Sept. 21-22,	Monday-Tuesday,	Registration of new students.
Sept. 23,	Wednesday,	Registration of old students.
Sept. 24,	Thursday,	Instruction begins.

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THE DEPARTMENT OF FORESTRY

OFFICERS AND STAFF

Jacob Gould Schurman, A.M., D.Sc., LL.D., President of the University.

Ernest George Merritt, M.E., Dean of the Graduate School.

William Alonzo Stocking, jr., M.S.A., Acting Director of the College of Agriculture and Professor of Dairy Industry.

David Fletcher Hoy, M.S., Registrar of the University.

Albert Russell Mann, B.S.A., Secretary to the College of Agriculture.

Walter Mulford, B.S.A., F.E., Professor of Forestry.

Samuel Newton Spring, B.A., M.F., Professor of Forestry.

Arthur Bernhard Recknagel, B.A., M.F., Professor of Forestry.

Frank B. Moody, A.B., M.S.F., Professor of Forestry.

John Bentley, jr., B.S., M.F., Assistant Professor of Forestry.

Students in the Department of Forestry receive instruction also from a corps of professors and instructors in the colleges of Agriculture, Arts and Sciences and Civil Engineering.

THE DEPARTMENT OF FORESTRY

The Department of Forestry is a department of the New York State College of Agriculture, a college of Cornell University.

The Department has three principal aims: to give instruction at the University; to conduct research; and to give direct help to the owners of forest lands in New York State.

The instruction in forestry at the University is designed to meet the needs of several classes of students: (1) students of general agriculture who wish elementary education in the care of woodlands and in forest planting and forest nursery work; (2) prospective teachers, business men, lawyers, and others who desire an understanding of the place of forestry in the life of a nation; (3) technical students in other lines who wish one or more technical forestry courses, for example, wood technology; (4) professional forestry students.

Research work is conducted under the supervision of the Department.

An important part of the work of the Department is its effort to be of direct help to owners of forest lands in New York State. This is accomplished by correspondence, publications, lectures, and personal inspection of woodland or of land to be planted.

GENERAL INSTRUCTION IN FORESTRY

For students who wish general instruction in forestry but do not wish to take the professional course in forestry, courses 1, 2, 3, and 6 (see page 12) are recommended. The other courses in the Department, except course 18, are also open to such students if they have the necessary prerequisites.

PROFESSIONAL COURSE IN FORESTRY

Aims

The professional forestry course is designed to prepare students for a professional career in general forestry, and also to provide opportunity for advanced study and research in silviculture, forest management, forest mensuration, forest entomology, forest pathology, and other lines in which specialists will be useful. The professional forestry course is also suitable as a means of general education.

Degrees, and Length of Course

The full course requires five years, and leads to the degree of Bachelor of Science at the end of the fourth year and to the degree of Master in Forestry at the end of the fifth year. Students who enter as graduates without having had undergraduate instruction in forestry should be able to complete the work for the Master's degree in two years if they have had substantially the equivalent of most of the courses, other than forestry, listed in the sequence of courses on pages 9-10; if they lack much of the fundamental science work there listed it will require a correspondingly longer time to qualify for the Master's degree. Work for the degree of Doctor of Philosophy may also be done in the Department of Forestry.

Admission and Classification

The following four classes of students are admitted to the work of the Department of Forestry of the New York State College of Agriculture:

1. Persons who desire to begin, as freshmen, the regular undergraduate course leading to the degree of Bachelor of Science.
2. Persons who have already attended some college or university and desire to enter with advanced standing.
3. Graduate students who are candidates for the degree of Master in Forestry.
4. Graduate students who are not candidates for a degree.

1. **Admission to Freshman Class.** An undergraduate student registers in the College of Agriculture and is a candidate for the degree of Bachelor of Science. An applicant for admission as a freshman to the Department of Forestry of the New York State College of Agriculture must offer fifteen units arranged as follows: English (3), history (1), elementary algebra (1), plane geometry (1), a foreign language (3), elective (6).

It is strongly recommended that, when possible, prospective students shall include solid geometry and plane trigonometry among the elective subjects offered for admission.

The required and elective subjects that may be offered for admission are named in the following list; the figures in parenthesis following each subject indicates its value in units and shows the maximum and minimum amount of credit allowed in the subject. A unit represents five prepared recitations a week for one year in a study.

1a. English A	(2)	8a. Ancient History	($\frac{1}{2}$ -1)
1b. English B	(1)	8b. Modern History	($\frac{1}{2}$ -1)
2a. First Year Greek	(1)	8c. Am. History and Civics	($\frac{1}{2}$ -1)
2b. Second Year Greek	(1)	8d. English History	($\frac{1}{2}$ -1)
2c. Third Year Greek	(1)	9a. Elementary Algebra	(1)
3a. First Year Latin	(1)	9b. Intermediate Algebra	($\frac{1}{2}$)
3b. Second Year Latin	(1)	9c. Advanced Algebra	($\frac{1}{2}$)
3c. Third Year Latin	(1)	9d. Plane Geometry	(1)
3d. Fourth Year Latin	(1)	9e. Solid Geometry	($\frac{1}{2}$)
4a. First Year German	(1)	9f. Plane Trigonometry	($\frac{1}{2}$)
4b. Second Year German	(1)	9g. Spher. Trigonometry	($\frac{1}{2}$)
4c. Third Year German	(1)	10. Physics	(1)
5a. First Year French	(1)	11. Chemistry	(1)
5b. Second Year French	(1)	12. Physical Geography	(1)
5c. Third Year French	(1)	13. Biology*	(1)
6a. First Year Spanish	(1)	14. Botany*	($\frac{1}{2}$ -1)
6b. Second Year Spanish	(1)	15. Zoology*	($\frac{1}{2}$ -1)
6c. Third Year Spanish	(1)	16. Agriculture	($\frac{1}{2}$ -1)
7a. First Year Italian	(1)	17. Drawing	($\frac{1}{2}$ -1)
7b. Second Year Italian	(1)	18. Manual Training	(1)
7c. Third Year Italian	(1)		

Applicants must present certificates of good moral character. Students are admitted on examination, or on presenting credentials of the Department of Education of the State of New York, or on acceptable school certificates.

Candidates for admission must file their credentials and obtain permits for examination at the University Registrar's Office, Morrill 10. Results of examinations may be ascertained from the Registrar.

For other details as to subjects and methods of admission, see the General Circular of Information, which may be obtained on application to the Secretary, Cornell University, Ithaca, New York.

2. Admission to Advanced Standing. A student who, having already attended some college or university, desires advanced undergraduate standing, should file with the Registrar of Cornell University, on an official blank to be obtained from him, a formal application for admission to advanced standing in the College of Agriculture, together with an official certificate, from the college or university already attended, of his honorable dismissal, his entrance examinations in detail, his terms of attendance, and the amount of work that he has completed, and a detailed statement of the courses pursued for which he desires credit at Cornell. He should send also a catalogue of the institution, writing on it his name and marking the entrance requirements that he has satisfied and each subject that he has completed.

A student admitted to the College of Agriculture from another college in Cornell University, or from any other institution of collegiate rank, will be regarded as having completed the number of terms and hours to which his records entitle him, and will receive all the privileges of students who have completed

*If an applicant has counted Biology (1) he may not offer also Botany ($\frac{1}{2}$) or Zoology ($\frac{1}{2}$).

the same number of terms and hours by residence in the College. In order, however, to obtain the degree of Bachelor of Science, he must have completed the subjects listed in black faced type in the recommended sequence of studies on pages 9-10, and all but twenty hours of his elective work must have been taken in courses allowed as agricultural electives. He must also have been in residence in the College of Agriculture at least two consecutive terms and have completed not less than fifteen hours a term, of which two-thirds, at least, must be subjects taught by the staff of the College of Agriculture. He will not be required to take all the subjects not in black faced type on pages 9-10, the Department of Forestry arranging his course of study to suit his needs.

3. Admission as a Graduate Student, Candidate for the Degree of Master in Forestry. A graduate student registers in the Graduate School as a candidate for the degree of Master in Forestry, if the following entrance requirements have been fulfilled:

(1) The candidate's training must be accepted as substantially equivalent to the first four years of the professional forestry course given at Cornell University (see pages 9-10).

(2) The candidate must have had at least three months experience in forestry work or in a logging camp, proof of which is to be by a signed statement or an examination in woodmanship, or by both.

A student entering the Graduate School as a candidate for the degree of Master in Forestry should not enter at the beginning of the second term. It will be impossible to arrange his work unless he enters at the beginning of the first term.

4. Admission as a Graduate Student, not a Candidate for a Degree. A student who is a graduate of an institution in which the amount of work required is substantially equivalent to that required for the first degree in one of the four-years courses at Cornell University, but who cannot meet the technical requirements listed under (3), may register in the Graduate School, but not as a candidate for a degree. Or such a student may register in the College of Agriculture as a candidate for the degree of Bachelor of Science. In either case, as soon as the requirements listed under (3) are fulfilled, the student registers in the Graduate School as a candidate for the degree of Master in Forestry.

REQUIREMENTS FOR DEGREES

Undergraduate Work Leading to the Degree of Bachelor of Science

The requirements for the degree of Bachelor of Science shall be residence for eight terms, and, in addition to the prescribed work in the Department of Physical Culture and of Military Science and Tactics, the completion of one hundred and twenty hours of required and elective work. The required and elective work must include all the courses listed in black faced type in the sequence of studies given below, and such other courses as the Department of Forestry believes to be best adapted to meet the needs of the individual student, subject to the regulations of the College of Agriculture. The sequence of studies given below is recommended and will prove desirable for most students. It is to be understood, however, that this is not a curriculum required of all students. Devia-

tions from it will be made for students entering the course with advanced standing, and for other students whenever advisable. In choosing the subjects to be elected, each forestry student must obtain the advice and approval of a professor or an assistant professor in the Department of Forestry, who shall be chosen by the student at the beginning of the sophomore year. Admission to candidacy for the degree of Master in Forestry may be conditioned on compliance with this regulation. Freshmen who are planning to take the professional forestry course are urged to call at the office of the Department of Forestry at the beginning of the college year.

Graduate Work Leading to the Degree of Master in Forestry

In the fifth year the student selects one major and one minor subject and pursues either advanced study or research along those lines. Graduate students do not devote this year to undergraduate class work, although in special cases a part of the student's time may be spent in such work. The work of each candidate for an advanced degree is in charge of a committee consisting of two or more professors under whom his major and minor subjects are pursued, the professor of his major subject being the chairman. A candidate for the Master's degree must spend at least one year in residence at this University. He must present a satisfactory thesis, or essay, and must pass an examination.

The course of study for students who enter as graduates but are not yet candidates for the Master's degree, will be arranged to suit the needs of each student.

Attention is called to the fact that the departments of Entomology and Plant Pathology offer facilities for advanced study of forest insects and tree diseases. Details regarding advanced work along these and other allied lines are to be found in the Announcement of the Graduate School.

Graduate Work Leading to the Degree of Doctor of Philosophy

Candidates for the degree of Doctor of Philosophy may elect either major or minor subjects in the Department of Forestry. Details regarding work for the doctorate may be obtained on application to the Dean of the Graduate School.

RECOMMENDED SEQUENCE OF STUDIES FOR PROFESSIONAL FORESTRY STUDENTS

The subjects in black faced type are required of all students in the College of Agriculture. The subjects given in the freshman year which are not in black faced type must be taken by all freshmen who plan to take the professional forestry course; the failure of a student to do this will complicate the remainder of his course.

		Freshman year			
		Hours 1st term	Hours 2d term		
English 1	4	English 1	.....	4
Chemistry 1	6	Chemistry 85	.....	4
Biology 1	3	Biology 1	.....	3
The Farm 1	2	Drawing 1	.....	3
Mathematics 1*	3	Mathematics 3*	.....	2

*If Mathematics 1 (solid geometry) has been offered for entrance, Mathematics 3 (plane trigonometry) should be taken in the first term, and Meteorology 1 should then be taken in the second term. If not taken in the freshman year meteorology should be taken later if possible.

COLLEGE OF AGRICULTURE

Sophomore year

	Hours 1st term		Hours 2d term
Botany 1	3	Botany 1	3
Geology 1	3	Botany 20 (General Plant Physiology)	4
Physics 1	4	Geology II	3
Civil Engineering 10 (Elementary Surveying)	3	Civil Engineering 11a (Advanced Surveying)	4
Entomology 3	3	Entomology 3I	1
		Soil Technology I	3

Summer following sophomore year

Summer camp for six weeks, beginning in June. **Civil Engineering 13 (Surveying)**, six hours credit.

Junior year

	Hours 1st term		Hours 2d term
Political Science 51	3	Political Science 51	3
Forestry 6	2	Forestry 8	2
Plant Pathology 1	3	Plant Pathology 8	2
Botany 2	3	Zoology 5	6
Sibley S4 (Forge Work)	1	Rural Economy 7	3
Geology 15	1	Entomology 30	2
Civil Engineering 14 (Surveying) ..	2		

Senior year

Forestry 9	4	Forestry 11	5
Forestry 13	3	Forestry 15	3
Forestry 14	3	Forestry 16	3
Forestry 18	1	Landscape Art 2	1
Forestry 19	3	Rural Engineering 3	3
Forestry 10	2		

The remaining work of the undergraduate years should be chosen with reference to the tastes and needs of the individual student.

Fifth year

Forest management (**Forestry 20**); forest administration (**Forestry 21**); seminar (**Forestry 22**); and either advanced work (**Forestry 23**) or research (**Forestry 24**). During the six or eight weeks preceding Commencement, students taking course 23, except those who are specializing in lines not requiring a field trip, will be engaged in working-plan and other forestry work on a large forest tract in New York or Pennsylvania.

EQUIPMENT

The Department of Forestry has temporary use of a laboratory, a classroom, and offices in the new Home Economics Building. The State has appropriated \$120,000 for a forestry building, which is now in process of construction and should be ready for occupancy sometime during the year 1913-14. The Department has a tract of about one hundred and seventy-five acres of open land which is being used for forest planting; another tract of thirty-eight acres, partly open land and partly wooded; and eight other woodlots, including stands of white pine, hardwoods, and hemlock. All these lands are within three miles of the University Campus. The Department has planted more than fifty acres of its land with experimental and demonstrational plantations. There is also a forest nursery. A forestry library of over twelve hundred bound volumes, including extensive files of forestry periodicals, is housed in the University Library. There is an ample collection of forestry instruments and lantern slides.

EXPENSES

Tuition for Undergraduate Students. Tuition in the College of Agriculture is free to both graduate and undergraduate students who for a year or more immediately preceding admission have been residents of the State of New York. The annual tuition fee of regular students from outside the State is \$100, and of special students from outside the State \$125. After July 1, 1914, the annual tuition fee of regular students from outside the State will be \$125.

Tuition for Graduate Students. Tuition is free to graduate students for work in the New York State College of Agriculture. For Graduate School minor subjects taken outside the College of Agriculture, pro rata tuition (one-sixth for each minor) of the college in which the minors are taken will be charged. For Graduate School minors taken in the College of Agriculture by students whose major subject is in another college, pro rata tuition (one-sixth for each minor) will be deducted. For Graduate School students not candidates for a degree, tuition will be pro rata as of the college or colleges in which the work is taken.

A graduate student taking the regular professional forestry course will have no minors outside the College of Agriculture.

Other fees and expenses. Other fees are as follows: matriculation fee, paid when entering the University, \$5; fee for baccalaureate degree, \$10; fee for advanced degree, \$20; infirmary fee, \$3 a term. Laboratory fees are required in various courses. The fee for the summer camp in surveying is \$35, which includes board and lodging for six weeks. The expense for textbooks, instruments, and the like, varies from \$10 to \$75 a year. The cost of living in Ithaca, including board, room, heat, and light, varies from \$5.50 to \$10 a week.

CORRESPONDENCE

Correspondence regarding entrance as a freshman and admission to advanced undergraduate standing should be addressed to The Registrar, Cornell University; requests for the General Circular of Information (containing details regarding entrance requirements and other information for prospective students) should be addressed to The Secretary, Cornell University.

Correspondence regarding admission as a graduate student, and requests for copies of the Announcement of the Graduate School, should be sent to the Dean of the Graduate School, Cornell University.

Copies of the general announcement of the College of Agriculture, and of the forestry announcement, may be obtained from the Secretary, College of Agriculture.

Information regarding opportunities for self-support may be obtained from the Cornell University Christian Association and from the Secretary of the University.

Prospective forestry students who plan to enter as graduates, or as undergraduates with advanced standing, are urged to write to the Department of Forestry for general information regarding the course of study which they would need to pursue.

COURSES OF INSTRUCTION OFFERED BY THE DEPARTMENT OF FORESTRY

Courses intended primarily for students who do not expect to make forestry their major work

1. **The Farm Woodlot.** Either term, credit two hours. Professor MOODY. Lectures, M, 9. Home Economics Building 100. Practice, M or T, 2-4.30. First term, Home Economics Building 370; second term, Home Economics Building 100.

The management of the farm woodlot, and the starting of new woodlots by planting or sowing. A course dealing with the woodlot as deserving and repaying proper care, such as is given the other crops on the farm. Laboratory fee, 50 cents.

Students expecting to take courses 2 and 3 should not elect course 1, as the ground covered in course 1 is gone over in courses 2 and 3.

2. **Elements of Forestry: Mensuration, Utilization, and Management.** First term, credit three hours. Assistant Professor BENTLEY. Lectures, T Th, 9. Home Economics Building 100. Practice, W or Th, 2-4.30. Home Economics Building 370.

An elementary course including estimating and measuring the amount of standing timber and its value; measurement of logs and of other forest products; the rate of growth of timber in diameter, height, volume, and value; the best uses to which various forest products can be put; methods of logging, milling, and sale of timber; identification of common woods; age at which timber should be harvested; methods of regulating the amount of timber cut so as to insure a permanent income. (See course 3.) Laboratory fee, \$1.

3. **Elements of Forestry: Silviculture.** Second term, credit three hours. Professor SPRING. Lectures, T Th, 9. Home Economics Building 100. Practice, W or Th, 2-4.30. Home Economics Building 370.

An elementary course including the life history of the forest; the influence of soil and climate on forests; the influence of forests on stream flow, climate, and soil; forest planting, sowing, and nursery work; reproducing the forest without planting or sowing; care of the crop during its growth, including thinning; protection from fire and other enemies; identification of a few of the principal timber trees of this region. Laboratory fee, \$1.

Courses 2 and 3 may be taken independently. If both courses are taken, they should meet the needs of students who wish a more detailed knowledge of timberland management than is given in course 1 but who do not wish the professional courses.

Courses intended for both professional forestry students and students in other lines

6. **The Field of Forestry.** First term, credit two hours. Professor SPRING. Lectures, W F, 9. Home Economics Building 100.

The place of forestry in the life of a nation; its aims and importance; national, state, communal, and private forestry enterprises; the day's work of a forester.

8. **Wood Technology.** Second term, credit two hours. Professor RECK-NAGEL. (The entire course will be completed in the first ten weeks of the term, during which time there will be two lectures and one practice period each week.) Lectures, M W, 10. Home Economics Building 100. Practice, T, 2-4.30. Home Economics Building 370.

Structure of wood; physical, chemical, and mechanical properties of wood; technical uses of wood (paper pulp, destructive distillates, and the like); wood conditioning (drying and seasoning); wood preservation. Laboratory fee, \$1.

Courses intended primarily for professional forestry students

Professional forestry students should not elect courses 1, 2, and 3, as the following required professional courses will cover the same ground in greater detail.

9. Forest Utilization. First term, credit four hours. Professor RECKNAGEL. Lectures, M T W Th, 10. Home Economics Building 100. Field trip, one week (spring vacation), study of a lumbering operation in the Adirondacks or in northern Pennsylvania; cost not to exceed \$15. (The field trip is required of professional students, optional with others; credit for the course is given at the close of the first term.)

The principal industrial uses of timber; logging methods and equipment; logging in representative regions; manufacture of lumber; determination of stumpage values; timber sale contracts; timber sale administration, including marking, brush disposal, and scaling in practice; minor industries; utilization of forest products other than wood, as grazing range, fish and game, and the like.

10. Forest Engineering. Second term, credit two hours. Assistant Professor BENTLEY. Lectures, T Th, 11. Home Economics Building 100.

The construction of trails, roads, telephone lines, and the like. Field work in forest engineering is given in the field trip included in course 23.

11. Forest Mensuration. Second term, credit five hours. Assistant Professor BENTLEY. Lectures, M W, 8. Home Economics Building 100. Practice, F, 8-1 and 2-4.30. Home Economics Building 370.

Measurement of logs and standing timber; timber cruising; study of the rate of growth of timber; volume and yield tables. Laboratory fee, \$1.50.

13. Timber Trees and Forest Regions. First term, credit three hours. Assistant Professor BENTLEY. Lectures, M W, 12. Home Economics Building 100. Practice, F, 2-4.30. Home Economics Building 370.

Brief account of the forest regions of the world; detailed description of the forest regions of the United States and Canada; the distribution, importance, and silvical characteristics of a large number of the leading timber trees of the United States and Canada, and the identification of such of these as do not grow near Ithaca. (The identification of trees growing near Ithaca is included in Botany 2.) Laboratory fee, \$1.

14. Silviculture: Forest Ecology. First term, credit three hours. Prerequisite Botany 1 or the equivalent. Professor MULFORD. Lectures, W F, 8. Practice, W, 2-4.30. Home Economics Building 100.

The influence of site on the forest and of the forest on site; the behavior of trees as members of a forest community. Laboratory fee, 50 cents.

15. Silviculture: Natural Reproduction and Care of the Forest. Second term, credit three hours. Prerequisite courses 13 and 14. Professor MULFORD. Lectures, T Th, 8. Practice, Th, 2-4.30. Home Economics Building 100.

A technical discussion of the silvicultural systems as practiced in Europe, and the possibility of using them in each of the forest regions of the United States and Canada; improvement cuttings, thinning, and underplanting; marking timber for cutting. Laboratory fee, 50 cents.

16. Silviculture: Forest Planting and the Forest Nursery. Second term, credit three hours. Professor SPRING. Lectures, W, 9. Home Economics Building 100. Practice, S, 8-1. Home Economics Building 370.

Collection, care, and testing of tree seeds; identification of tree seeds and seedlings; raising trees in a forest nursery; starting forests by planting trees and by direct seeding; fixation of sand dunes; forestation on the prairies and under semi-arid conditions; great forestation enterprises of the world. Laboratory fee, \$1.50.

18. Forest Protection. First term, credit one hour. Open only to professional forestry students. Professor SPRING. Lectures, Th, 11. Home Economics Building 100.

Protection of forests from fire and other enemies. Protection from injury by insects and fungi is given in Entomology 31 and Plant Pathology 1 and 8, respectively.

19. Forest Policy, Forest Law, and History of Forestry. First term, credit three hours. Professor SPRING. Lectures, M T W, 11. Home Economics Building 100.

The historical development and present status of the relations of state and individual to forestry; the elements of forest law.

20. **Forest Management.** First term, five hours. Open only to graduate students. Professor RECKNAGEL. Lectures, M T W Th, 9. Practice, S, 9-11.30. Home Economics Building 370.

Forest organization, including foundations of working plans, regulation of yields, and the formulating of working plans; forest finance, including forest valuation (the ascertainment of values) and forest statics (the comparison of values). Field work in forest management is given in the field trip included in course 23.

21. **Forest Administration.** Second term, credit two hours. Professor RECKNAGEL. (The entire course will be completed in the first ten weeks of the term, during which time there will be two lectures and one practice period each week.) Prerequisite course 20. Lectures, W Th, 9. Home Economics Building 370. Practice, S, 9-11.30. Home Economics Building 100.

Personnel and organization, exemplified by various actual organizations; business practice. Field work in forest administration is given in the field trip included in course 23.

22. **Seminar.** Throughout the year. Two hours a term. Open only to graduate students. Professors MULFORD, SPRING, RECKNAGEL, and MOODY, and Assistant Professor BENTLEY. Hours to be arranged. Home Economics Building 100.

23. **Advanced Work.** Throughout the year, two or more hours a term. Open to undergraduate and graduate students who have had the necessary training. Professors MULFORD, SPRING, RECKNAGEL, and MOODY, and Assistant Professor BENTLEY. Hours by appointment.

Individual advanced study of designated topics. During the six or eight weeks preceding Commencement, all graduate students taking course 23, except those who are specializing in lines not requiring a field trip, will be engaged in working-plan and other forestry work on a large forest tract in New York or Pennsylvania. The field trip will be in charge of Professor RECKNAGEL.

24. **Research.** Throughout the year, three or more hours a term. Open only to graduate students who have had the necessary training. Professors MULFORD, SPRING, RECKNAGEL, and MOODY, and Assistant Professor BENTLEY. Hours by appointment.

COURSES OF INSTRUCTION GIVEN BY OTHER DEPARTMENTS AND LISTED IN THE RECOMMENDED SEQUENCE OF STUDIES

Biology

1. **General Biology.** Throughout the year, credit three hours a term. Professor NEEDHAM, Assistant Professor JOHANNSEN, and assistants. Lectures, M W, 9. New Auditorium. Practice, M, T, W, Th, or F, 2-4.30; T, Th, F, or S, 8-10.30; or M, T, W, Th, or S, 10.30-1. Main Building 302.

This is an elementary course designed to acquaint the general student with the main ideas of biology through selected practical studies of the phenomena on which biological principles are based. Both lectures and laboratory work will deal with such topics as the interdependence of organisms, the simpler organisms, organization and phylogeny, oogenesis and ontogeny, heredity and variation, natural selection and adaptation, segregation and mutation, the life cycle, metamorphosis and regeneration, and the responsive life of organisms. Laboratory fee, \$2.50 a term.

Botany

1. **General Botany.** Throughout the year, credit three hours a term. Professor WIEGAND and assistants. Lectures, M, 9 or 11. Main Building, Assembly Hall. Laboratory and field work, two periods of two and one-half hours each,

by appointment. Students must consult the Department in regard to laboratory appointment before registering for the course.

This course is designed to furnish a general knowledge of the fundamental facts and principles of plant life. The plant as a living organism will be considered from the point of view of general structure, variability, adaptation, function of parts, life processes, evolution, and distribution. A part of the time will be spent in becoming acquainted with the commoner wild and cultivated species and with the larger natural groups of plants. As much field work as is practicable will be introduced. Laboratory fee, \$2.50 a term.

2. **Forest Botany.** First term, credit three hours. Prerequisite course I or its equivalent. Professor WIEGAND and ———. Designed especially for juniors in forestry. Lectures or conferences, T, 8. Home Economics Building 100. Laboratory or field work, W Th, 2-4.30. Agronomy Building, Botanical Laboratories.

A course dealing with the identification of trees and shrubs, both in summer and in winter, and with other problems relating to forest plants.

20. **General Plant Physiology.** Either term, credit four hours. Prerequisite all freshman work or its equivalent, and course I. Assistant Professor KNUDSON, and Messrs. WILSON, ROBBINS, NANZ, and ———. This course may be taken to satisfy the requirement in physiology.

First term, lectures, T, 10. Main Building 292. Recitations, three sections, Th, 10. Main Building 292, Agronomy Building 21, Landscape Art Building. Laboratory, sec. I, M, 2-5, Th, 11-1; sec. II, T Th, 2-4.30. Agronomy Building 21.

Second term, lectures, T, 10. Main Building 292. Recitations, five sections, Th, 10. Main Building 292, Agronomy Building 21, Agronomy Building 192 Main Building 232, Landscape Art Building. Laboratory, sec. I, M, 8-10, F, 8-11; sec. II, M, 11-1, W, 10-1; sec. III, M, 2-5, S, 11-1; sec. IV, T Th, 2-4.30; sec. V, Th, 11-1, S, 8-11. Agronomy Building 21.

The topics include absorption, nutrition, relations to environment, growth, reproduction, and propagative processes. Laboratory fee, \$5.

Chemistry

1. **Introductory Inorganic Chemistry.** Either term, credit six hours. Lectures, recitations, and laboratory.

1a. Lectures. First term, M W F, 11, Professor DENNIS and Mr. DAVIS; T Th S, 11, Professor BROWNE and Mr. DAVIS. Second term, M W F, 11, Professor DENNIS and Mr. DAVIS. Morse Hall, Lecture Room 1.

1b. Recitations (one hour a week to be arranged), and laboratory, M F, 2-4.30; T Th, 2-4.30; W, 2-4.30, S, 8-10.30. Professors DENNIS and BROWNE, Doctor WELSH, and Messrs. OVERMAN, GULICK, PARMELEE, WEISER, MACK, NORTON, and ———.

85. **Agricultural Chemistry.** Second term, credit four hours. Prerequisite Chemistry I. Professor CAVANAUGH, and Messrs. RICE and CONLIN. Lectures, T Th S, 11. One recitation, M or F, 8 or 9. Morse L. R. 1.

A general course treating of the relations of chemistry to agriculture and dealing with the composition and chemical properties of plants, soils, fertilizers, feeding stuffs, insecticides, and fungicides.

Civil Engineering

10. **Elementary Surveying.** First term, credit three hours. Assistant Professor LELAND, and Messrs. LAWRENCE, McCURDY, BAKER, and TEETER. One recitation and two field or computation periods a week. Eight sections.

Use of steel tape, level, and transit; fundamental surveying methods; measurement of lines, angles, and differences of elevation; land surveying—areas and plotting. Recitations, field work, computations, and mapping. Text-books: Breed and Hosmer's Elementary Surveying, and Leland and Boothroyd's Area of Land.

11a. **Advanced Surveying.** Primarily for students in forestry and landscape art. Second term, credit four hours. Assistant Professor LELAND and

Mr. LAWRENCE. Prerequisite course 10. Four periods a week; field work after Easter.

Topographic, hydrographic, and geodetic surveying and field astronomy; United States Public Land Surveys; precise measurements; transit and stadia, plane table, sextant; stream measurement; topographic reconnaissance; road location, circular curves; triangulation for the control of local surveys, base lines; field determinations of time, latitude, and azimuth. Recitations, field work, and plotting. Textbooks: Breed and Hosmer's Higher Surveying, and Campbell's Practical Astronomy.

13. **Summer Survey; Topographic, Hydrographic, and Geodetic Survey; Camp.** Six weeks in June and July. Six hours. Assistant Professors LELAND, UNDERWOOD, TURNER, WALKER, and GEORGE, and Messrs. LAWRENCE, MCCURDY, BAKER, TEETER, ———, and ———. Date of beginning to be announced in second term. Prerequisite course 11; also open to students in forestry who have had course 11a, for whom the work is modified to meet their special needs.

Practical experience in surveying under field conditions. An extensive topographic survey with the transit and stadia and the plane table, and a hydrographic survey of a portion of Cayuga Lake, are executed, and field maps are made. Triangulation and precise leveling control the topographic and hydrographic work. A base line is measured with invar tapes. Astronomic observations for azimuth, latitude, and time are made, and results computed. Each party also performs a number of field exercises in city surveying. Each student takes part in all branches of the work. Field and office work six days and evenings a week.

14. **Survey Computations and Mapping.** First term, credit four hours. Assistant Professors LELAND and UNDERWOOD, and Messrs. LAWRENCE and ———. Forestry students register for only two hours in this course. Prerequisite course 13.

Drawing

1. **Mechanical Drawing.** Either term, credit three hours. Mr. REYNA. Lectures during practice. Practice, M W, 2-4.30, or T Th, 2-4.30. Third hour by appointment. Dairy Building 341.

Students may not register for less than three hours. As the drafting room will accommodate but thirty students in each section, those registering in the course will be assigned to desks as they report to the Department. Therefore, in order to secure a place it will be necessary to report promptly. A small amount of outside reading is required.

English

1. **English. Introductory Course.** Throughout the year, credit four hours a term. Students who have not taken the course in the first term may enter in the second term in sections provided for them. Open only to underclassmen who have satisfied the entrance requirement in English. Assistant Professors ADAMS and MONROE, Doctors BAILEY, BROUGHTON, STELTER, GILBERT, and JENSEN, and Messrs. BALDWIN, CROWELL, and TOWNLEY. Twenty-one sections, at the following hours: T W Th F, 8, 9, 10, 11, 12. Rooms to be announced.

A study of representative works in English literature, including four plays of Shakespeare, four modern novels, selected essays, and poems of Milton, Tennyson, and Browning. Practice in composition in connection with the reading, with incidental study of the principles of writing. Registration in the course is in charge of Doctor BAILEY.

Students who elect English 1 must apply at Goldwin Smith A on Monday, Tuesday, or Wednesday of registration week for assignment to sections.

Entomology

3. **General Entomology.** Throughout the year, credit three hours a term. Prerequisite Biology 1 or Zoology 1. Lectures, W F, 9. First term, Dairy Building 222. Professor COMSTOCK. Second term, Main Building 392. Profes-

sor HERRICK. Practical exercises, W, Th, or F, 2-4.30, or S, 8-10.30. Main Building 392. First term, Professor COMSTOCK and Miss STRYKE; second term, Professor HERRICK.

First term, lectures on the characteristics of orders, suborders, and the more important families, and on the habits of representative species. The practical exercises include a study of the structure of insects and practice in their classification. The lectures only (credit two hours) are taken by those who have had courses 4 and 5. Second term, lectures on the more important insect pests and on methods of controlling them. The practical exercises will include a study of the different stages of as many of the forms as time will permit, together with observations in the field on the habits of the pests. Laboratory fee, \$3 a term.

30. **Aquiculture.** Second term, credit two hours. Assistant Professor EMBODY. Lectures, T, 12. Main Building 392. Laboratory and field work, Th, 2-5. Biological Field Station and Experimental Hatching Station.

A course on the utilization of the resources of inland waters. Laboratory fee, \$2.50.

31. **Forest Insects.** Second term, credit one hour. Prerequisite first term of course 3. Professor HERRICK. Lectures, Th, 11. Main Building 392.

A course of lectures dealing with insects injurious to forest and shade trees, together with a consideration of the best methods of controlling their ravages.

The Farm

1. **The Farm.** First term, credit two hours. Professor NEEDHAM, Assistant Professors COMSTOCK and EMBODY, and assistants. Lectures, M, 8. New Auditorium. Practice, T, Th, F, or S, 8-10.30, daily except S, 10.30-1 or 2-4.30, or S, 10.30-1, at appointed places on the farm.

This is a course in the study of our agricultural environment. The Cornell University farm will be explored. Its history, its topography, its population, and its chief crops, wild and cultivated, will be studied. Its fields, hills, woods, and streams will be explored, and records will be made of the things observed.

The course deals with the sources of agriculture. It considers crops from the naturalist's viewpoint—Nature's cereals and fruits and roots and fowls that were all present before agriculture developed. Wild products will be compared with cultivated varieties, and the related forms that have not been brought into cultivation will not be overlooked. Finally, these things will be viewed collectively, as conditioning the human affairs of the country community. They will be considered as elements that may be contributory to the beauty, the healthfulness, and the intellectual interest and enjoyment of the farm home. Laboratory fee, \$2.

Geology

1. **Dynamic Geology.** First term, credit three hours. Assistant Professor VON ENGELN, and Messrs. STORRER, VERWIEBE, ELSTON, and ———. Lectures, T Th, 11; repeated second term, T Th, 9. McGraw Hall, Geological Lecture Room. One laboratory period a week, sections M T W Th F. Recitations to be arranged. One all-day excursion required.

Planned to give beginners a knowledge of the fundamental principles and facts of dynamic geology by means of lectures, maps, lantern slides, specimens, and textbook and field study. For those who desire to continue in geology this course may be followed in the second term by the elementary course 2, 11, 21, or 40.

11. **Elementary Mineralogy.** Second term. Three hours; if taken after course 12, two hours. Professor GILL and Mr. WILBER. Lectures, M W, 8, McGraw Geological Lecture Room. Laboratory sections to be arranged.

For beginners who desire a general knowledge of the commoner minerals and their uses, the properties by which they are recognized, and their significance as constituents of the earth's crust, or as sources of useful substances.

15. **General Lithology.** First term, credit one hour. Prerequisite courses I and 11. Professor GILL. Lectures or recitations, alternate S, 9; laboratory, alternate S, 8.30-11; McGraw Mineralogical Laboratory.

An elementary course designed to teach recognition of the various kinds of rocks, their mineral composition, mode of origin, and the like.

Landscape Art

2. **Lectures Introductory to Work in Landscape Art.** Second term, credit one hour. Assistant Professor DAVIS. Lectures, W, 10.

A general course introductory to an appreciation of landscape. Prerequisite to course 4, and suggested as of cultural value to the general student. Those intending to specialize in landscape art should elect this course in their freshman year.

Mathematics

1. **Solid Geometry.** Either term, credit three hours. First term, T Th S, 11. White 9. Assistant Professor RANUM. Second term, T Th S, 11. White 27. Assistant Professor SHARPE.

Open to all students, but designed especially for those who have entered with the minor requirements in mathematics and are preparing: (a) to teach mathematics in the secondary schools; (b) to take up engineering work later in the course; (c) to specialize in chemistry, physics, or forestry.

3. **Plane and Spherical Trigonometry.** Either term, credit three hours. First term, M W F, 11. White 21. Doctor MCKELVEY. Second term, M W F, 11. White 27. Assistant Professor SHARPE.

Open to all students, but designed especially for those mentioned under course 1. Forestry students will register for only two hours credit and will discontinue the course when the instruction in plane trigonometry is completed.

Meteorology

1. **Meteorology and Climatology.** Second term, credit three hours. Professor WILFORD M. WILSON. Lectures, M W F, 10. Dairy Building 222.

Lectures and weather observations. Designed to acquaint the student with the general circulation of the atmosphere; development, movement, and conditions that attend cyclones, tornadoes, and special storms; practical weather forecasting from weather maps and local observations; the use of meteorological instruments; general and special climatology and its relation to agriculture.

Physics

1. **Introductory Experimental Physics.** Either term, credit four hours. Professors NICHOLS, MERRITT, and SHEARER, and Assistant Professor GIBBS. Lectures, M T W Th, 9 or 12. Rockefeller A.

Entrance physics is not accepted as an equivalent of this course.

Plant Pathology

1. **Plant Pathology.** First term, credit three hours. Prerequisite Botany I or its equivalent. Professor WHETZEL, and Messrs. GREGORY, HESLER, RANKIN, CHUPP, and KEEFER. Recitations, F, 12. New Auditorium. Practice by sections, as follows: general agriculture, W F, 2-4.30; horticulture, Th, 2-4.30, S, 10.30-1; forestry, M T, 2-4.30. Auditorium, East Basement.

A fundamental course treating of the common diseases of cultivated crops, their nature, cause, and control. A prerequisite for all other courses in plant pathology. Students specializing in those lines indicated by the names of the sections will be expected to schedule this work accordingly. The practice work must be taken in the couplets announced above. Laboratory fee, \$4.50; breakage deposit, \$2.

8. **Dendropathology.** Second term, credit two hours. Prerequisite course 1. Messrs. RANKIN and KEEFER. Lecture and laboratory hours to be arranged. *Designed especially for students in forestry and rural art. Laboratory fee, \$2; breakage deposit, \$2.

Political Science

51. **Elementary Economics.** Throughout the year, credit three hours a term. One lecture and two recitations each week. Lectures, M, 9 or 11. Sibley Dome. Assistant Professor BAUER. Recitations, T Th, 8, 9, 10, 11, 12; W F, 8, 9, 10, 11, 12. Assistant Professor BLAKEY, Doctors USHER and SMITH, and Mr. GILMAN.

A general introduction to economics. This course is a prerequisite for most of the other courses in the field of political science. For section assignments and other information apply at the Library, Political Science Seminary.

Rural Economy

7. **Conservation.** Second term, credit three hours. Open to juniors and seniors in all colleges. Professor LAUMAN. Lectures, M W F, 11. Main Building 392.

Rural Engineering

3. **Farm Mechanics.** Either term, credit three hours. Students are urged to take Drawing 1 in preparation for this course. Professor H. W. RILEY, and Messrs. HAZEN, STRAHAN, PHILLIPS, ARTMAN, WEATHERBY, and ———. Lectures, T Th, 10. Dairy Building 222. Practice, M, T, or W, 2-4.30. Rural Engineering Building.

A study of the principles of operation, the details of construction, and the practical operation and care of: A—Machinery, including gasoline engines, water wheels, devices for transmitting power, hydraulic rams, pumps, spray nozzles, spraying outfits, water supply outfits. B—Implements, including plows and binder attachments, with a discussion of the special mechanical features of some of these implements now on the market. Laboratory fee, \$2.

Forge Work. (A non-agricultural elective. Sibley course S4.) Either term, one or more hours. Mr. HEAD. Practice, daily, 8-11 or 11-2, or daily except S, 2-5, as assigned by Assistant Professor WELLS. East Sibley.

A course given in Sibley College especially for agricultural students, covering the construction of the forge, selection of coal, care of the fire, practice in forging to shape and size, welding iron and steel, and tempering steel. By paying for material used, the student will have opportunity as far as time permits to make for himself a set of tongs, punches, chisels, and other tools. A laboratory fee will be charged.

Soil Technology

1. **Principles of Soil Management.** Either term, credit three hours. Prerequisite Chemistry 1 and Geology 1. Assistant Professor BUCKMAN. Lectures, T Th, 9. Main Building, Assembly Hall. Laboratory, M, T, W, Th, or F, 2-4.30. Agronomy Building 42. Students must consult Assistant Professor Buckman before choosing laboratory period.

A comprehensive course dealing with the origin, composition, and properties of soils, with particular reference to their management in crop production. The laboratories will consist in practice designed to demonstrate fundamental physical relations, and will be supplemented by laboratory lectures. Laboratory deposit, \$3.

Zoology

1. **General Zoology.** First term, credit five hours. Assistant Professor REED, Doctors WRIGHT and ALLEN, and Mr. DENNEY. Lectures, M W F, 10. McGraw Hall 5. Laboratory, sec. 1, M, 2-4.30, S, 8-10.30; sec. 2, T Th, 2-4.30; sec. 3, W F, 2-4.30.

A general survey of the animal phyla, the life processes, adaptations, and relationships of animals, and the principles of zoology, and an introduction to morphology and development. As far as possible each phase of the subject will be illustrated with living material.

OFFICIAL PUBLICATIONS OF CORNELL UNIVERSITY

Issued at Ithaca, New York, monthly from July to November inclusive, and semi-monthly from December to June inclusive.

[Entered as second class matter, August 31, 1910, at the post office at Ithaca, New York, under the Act of July 16, 1894.]

These publications include

Catalogue Number (containing lists of officers and students), price 25 cents,
Book of Views, price 25 cents,

Directory of Faculty and Students, First term, 1912-13, price 10 cents,
and the following informational publications, any one of which will be sent gratis and post-free on request. The date of the last edition of each publication is given after the title.

General Circular of Information for prospective students, December 15, 1912.

Announcement of the College of Arts and Sciences, May 15, 1913.

Announcement of Sibley College of Mechanical Engineering and the
Mechanic Arts, January 1, 1913.

Announcement of the College of Civil Engineering, February 15, 1913.

Announcement of the College of Law, April 15, 1913.

Announcement of the College of Architecture, June 1, 1913.

Announcement of the New York State College of Agriculture, June 15, 1913.

Announcement of the Winter Courses in the College of Agriculture, July 1,
1913.

Announcement of the Summer School in Agriculture, April 1, 1913.

Announcement of the New York State Veterinary College, March 1, 1913.

Announcement of the Graduate School, January 15, 1913.

Announcement of the Summer Session, March 15, 1913.

Annual Report of the President, December 1, 1912.

Pamphlets on prizes, samples of entrance and scholarship examination papers, special departmental announcements, etc.

Correspondence concerning the publications of the University should be addressed to

The Secretary of Cornell University,
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