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# EDUCATION IN FORESTRY

PROCEEDINGS OF THE SECOND NATIONAL  
CONFERENCE, NEW HAVEN, CONN.  
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# EDUCATION IN FORESTRY.

## PROCEEDINGS OF THE SECOND NATIONAL CONFERENCE.

### INTRODUCTION.

The Second National Conference on Education in Forestry, was held under the auspices of the School of Forestry of Yale University, at New Haven, Conn., on December 17 and 18, 1920. Its purpose was to discuss the question, To what extent and in what ways is it desirable to revise the standardized curriculum of instruction in forestry that for the past 10 years has been more or less closely followed by the leading forest schools of the United States? That curriculum was the outcome of the First National Conference on Education in Forestry, held in December, 1909, when was appointed a committee on standardization of instruction in forestry that published its final report in the Forestry Quarterly for September, 1912 (Vol. X, No. 3). The reasons that led to the conference of 1909 are set forth succinctly by Dean Toumey in his opening address (see p. 4).

The second conference on professional forestry education was called by Dean Toumey, of the Yale School of Forestry, after consultation with other foresters engaged in educational work. Those in attendance represented, personally or by proxy, all the forest schools in the country that offer courses leading to a forestry degree, or that otherwise train men for the practice of forestry as a profession. There were also present a considerable number of other persons interested in the topics under discussion.

At the time of calling the conference, during the summer of 1920, Dean Toumey named a series of committees, and requested them to be ready to report at the conference in December. In the appendix is given a list of these committees and also of those appointed by the conference, with their personnel. The committee reports, followed by discussions, made up the subject matter of the conference.

Through the courtesy of the United States Commissioner of Education the proceedings of the conference are made of permanent record in this bulletin, the conference having very gladly accepted the commissioner's offer to incorporate this material in a publication of the Bureau of Education.

### ADDRESS OF WELCOME.

By DR. ARTHUR TWINING HADLEY, President of Yale University.

It is a great pleasure to welcome you at the opening of this conference on education in forestry. Every convention on technical education, and in fact on education of every kind to-day, has an inestimable value, a value different from

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what it had in times past. Formerly educational conferences meant comparison of methods of teaching in different institutions. The result was an improvement in technique and an improvement in purpose and spirit. To-day we have a different problem and a greater one. With the changes the war has produced, the high cost of living, etc., the matter of conserving our powers and of economy has come into education. Economy can be viewed in two ways, by saving money or making it go as far as possible; adapting means to ends—determining which things must be done now, which things can be postponed, which things need to wait until the special interest can best be suited.

An educational conference is, therefore, no longer a comparison of methods of scientific results already obtained. It is the adapting of methods into an organization which must have as much division of labor as a manufacturing plant, which must view the problems of demand, whether urgent in the immediate future, or the kind that can be dealt with more as circumstances allow, which must adapt the education of the country not simply to the methods of the science but to their position in our educational system as a part of the economic system of the country.

In this, foresters are adapted to lead the way. Forestry above all else is animated by the spirit of public service. It will take the lead here because it is free from the danger of subordinating public welfare to private consideration. We should study the demand for different lines of education as well as the supply, but always from the standpoint of the consideration of national before private interest. We welcome you all most heartily to this conference.

### OPENING ADDRESS.

By JAMES W. TOMMEY, Dean, Yale School of Forestry.

The first national conference on education in forestry in the United States was held in Washington, D. C., on December 30, 1909. That conference was called through the initiative of Gifford Pinchot. The object of the conference was fully set forth by Prof. H. S. Graves, in an article in the March number of the Forestry Quarterly, published in 1910. At that time there were over 20 institutions in this country and Canada which gave instruction in forestry. Forestry was then first beginning to attain a recognized place in educational circles in this country. There was no recognized standard of professional training, as was shown in the wide difference in scope in the forest schools and the great diversity in attainments of those calling themselves professional foresters. As pointed out by Graves, the civil service examinations served in a measure as a professional standard, but as only a part of the men trained in the schools took the examinations it scarcely answered the purpose.

The real purpose of the conference was to take the first steps in an agreement among the schools as to the character and minimum technical training required of a forester of the different grades. It was emphasized at that conference that the pressure to emphasize the practical application of forestry without due attention to the theory endangered the best development of forestry education in this country. It was also recognized that the omission or restriction in time of study given to the essential preforestry subjects in science and language was disastrous to the best training of the forester. At that time practically all the forest schools had developed within the previous decade, and it was emphasized that they must provide a better training than in the past when they were in the period of organization and the adjustment

of their curricula, and when instructors of adequate background and experience were not available. Looking back over a period of 10 years it is clear that the Washington conference, attended by delegates from nearly all the forest schools then in existence in America, has had far-reaching effects on forestry education in this country during the past decade.

One of the important results of that conference was the appointment of a committee on forestry education in America, with H. S. Graves as chairman. The purpose of this committee was to prepare and report upon a plan looking forward to a better standardization of forestry education in the different grades in this country. The committee reported at a special conference in Washington, in December, 1911, attended by representatives from 16 forest schools and departments of forestry in American colleges and universities. The plan proposed by the committee was discussed in detail and action taken on matters relating to admittance to schools of different grades, curriculum, and the number of hours in each subject. The final report embodying action taken at this special conference was published in the *Forestry Quarterly* for September, 1912.

The majority of the committee and the representatives of the institutions present at the special conference recognized that there should be in America four different grades of instruction in forestry.

- (a) Advanced professional training, to include not only a substantial general education but also a well-rounded course in all branches of technical forestry.
- (b) Instruction for forest rangers, based upon a high-school education or its equivalent, and conducted mainly along thoroughly practical lines.
- (c) General instruction in forestry supplementary to a course in agriculture and designed to be of assistance to owners in the handling of woodlands.
- (d) General courses in conservation and forestry for those who desire it as a part of their general education.

Although the above grades were recognized by the conference, the work of the committee in the final report was confined to formulating standards and requirements for professional training leading to a degree. No action on secondary forestry education was taken by the conference. However, in 1913 a subcommittee on secondary forestry education, of which the writer was chairman, was appointed by the National Conservation Congress to present a report at the November meeting of that year. This report, published in the *Proceedings of the Fifth National Conservation Congress*, discusses the development of secondary forestry education in the United States and outlines curricula for various grades of schools and colleges that offer courses in forestry subjects below the grade of full technical training.

Since 1913 there have been no conferences on forestry education and no extended journal articles dealing with this important subject. Each school has been left to work out, extend, and reshape its curriculum without reference to other schools, at least without mutual discussion and helpfulness. As a consequence forestry training in this country in the various grades has tended to diverge more or less from the standard of 10 years ago. To considerable extent local needs have emphasized extended training in certain subjects to the elimination or almost total suppression of others essential in a well-rounded course. In not a few instances the stress for time has continued to restrict the attention that should be given to preforestry subjects, and foresters continue to leave our schools with insufficient background in general educational subjects.

For some time the speaker has recognized the need for a second national conference on forestry education and in the early summer of 1920 he was urged by many foresters engaged in educational work to call such a conference to convene at New Haven, Conn., on December 17 and 18, 1920. In order to facilitate the work of the conference and make it productive of the most good, a number of committees were appointed some months ago to prepare reports on the more important phases of forestry education in this country. We are here to-day to hear these reports and after full discussion to take such action as is deemed desirable.

## REPORT OF THE COMMITTEE ON THE UNDERGRADUATE COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN FORESTRY.

It is an axiom that no superstructure can long endure unless it rests on a firm foundation. Whatever opinion one may hold as to the length of time needed to train a man for the practice of forestry as a profession, we are all agreed that he should be well grounded in the fundamentals. The purpose of this report is to set forth what in the judgment of this committee constitutes the groundwork of a technical education in forestry, whether or not it is to be followed later by a more specialized study.

This report is based on the assumption that the normal undergraduate course in professional forestry will cover a period of four years. This the committee believes should hold as the absolute minimum. For easy comparison with existing curricula these years may be divided into eight terms of 15 or 16 weeks of actual instruction each, exclusive of vacations and term examination periods. The four-year period will thus include three summers of approximately three months each.

It is further assumed that upon the successful completion of course work aggregating 130 credit hours, more or less, in accordance with the regulations of each forest school, there shall be conferred on the candidate a bachelor's degree. The committee has not considered whether that degree should be styled Bachelor of Science or Bachelor of Science in Forestry, in that this is a matter that for the most part is regulated by the faculty, or other legislation governing individual institutions.

The committee was assigned the duty of outlining an undergraduate course. The question of whether such a course will give a man adequate and full preparation for the practice of the profession is the province of other committees of this conference. On this point the committee, as a body, expresses no opinion, although its members, as individuals, have very definite ideas thereon, ranging from the viewpoint of Prof. Bruce that four years is enough, to the opposite extreme, which would favor six or even seven years of college work as being none too much to permit the prospective forester to get all that he really ought to have. In this report, however, the committee deems its function to be to set forth how a student who desires to fit himself for professional work in forestry, and who has only four years to devote to college training, can use that time to the best advantage.

Before proceeding to the consideration of the curriculum which it presents for discussion, there are a few general points on which the committee desires to go on record.

Taken by and large, the committee is in substantial agreement, except perhaps as regards a foreign language, with the statement of "Requirements for a Degree in Forestry," announced by the committee that in 1912 reported on "Standardization of Instruction in Forestry," as set forth, on pages 344 to 347 of the *Forestry Quarterly*, Vol. X, No. 3, September, 1912 (pp. 4-7 of the separate of that report). But, on the basis of the experience of the past decade, the com-

mittee believes that the emphasis should be placed today somewhat differently from what it was in 1912. One member of the committee says of the 1912 program: "It treated forestry as a science rather than as a profession." The leaning then was toward botany and silviculture; the present trend is more toward utilization, management, and a wider knowledge of economics, although it is recognized that silviculture will always be the backbone of management.

Approaching the subject more in detail, the committee submits its judgment on several specific points, as follows:

1. Entrance requirements. While admitting the desirability, for several reasons, of pushing back into the preparatory schools certain subjects, especially solid geometry, algebra, and trigonometry, and perhaps physics as well, the feeling of the committee is that in general the forest schools had best not set up requirements for admission different from those of other departments of the universities of which they form a part. It is assumed, however, that entrance requirements shall be of high grade and that they shall cover such subjects as, for example, are now administered by the college entrance board. But there is no objection at all to including in the announcement of any school a strong recommendation to prospective forestry students that they come prepared to pass off certain subjects at entrance.

There is some difference of opinion in the committee on this point, but the fact remains that if a student has to take while in college elementary subjects that he might have got equally well in high school, time will be used up that might otherwise have been devoted to courses that can only be given to advantage in college. Most forest schools are trying to give in four years work that could advantageously be expanded into five. The fewer elementary subjects there are included, the more room there is for technical forestry subjects, or for such closely allied topics as economics.

As to language requirements, the majority opinion of the committee seems to be that French or German should be offered for entrance and not form a part of the college course. There is urgent need for a stronger course in English than is given in many colleges. For the forester, training in composition is more important than an acquaintance with English literature, desirable as that unquestionably is. The ability to speak and write vigorous, virile English is a great asset to any man. Courses that give him training in exposition and argument, through the preparation of themes and reports, seem to be what is needed. If it is impracticable to institute such courses, the forest school faculties should demand of their students that the written work in forestry courses conform to certain standards, even if to do so entails some drudgery on the part of the instructor in the correction of papers. Somehow forest-school men must be made to learn to use English with force and precision.

2. Saving time through the regulation of entrance requirements naturally leads to the question of how far certain advanced subjects, like management and administration that in some schools are now taught only to graduate students, should be incorporated, if at all in an undergraduate course. The committee feels that place should be made for them, leaving the fifth year for those who can go on to the master's degree, to be devoted primarily to specialization. But here again the members of the committee differ to some extent.

3. Based on the principle that it is the duty of the forest schools so to train their students that, following a period of apprenticeship after graduation, they will be equipped to handle large problems, including the framing of forest policies, the committee is in favor of introducing in the later years of the undergraduate course such subjects in the field of economics as business

law, accounting and cost accounting, industrial organization, and the like. Certain of these require as a prerequisite the general course in economics now required in most college curricula, as it certainly should be in all forest schools. While it is true that a knowledge of these subjects can be acquired through reading, the committee feels that enough work in them should be done at college to establish an interest that will result in subsequent study. Foresters have been prone to forget that forestry and economics go hand in glove.

4. The opinion of a majority of the committee appears to be that a more or less fixed curriculum is best for an undergraduate course. But nevertheless it should be so administered that in the junior, and particularly in the senior year, there may be opportunity for specialization, at least through election from a list of specified courses. The difficulty with too early specialization is that the student is liable to make an unwise choice and then, upon discovering his error, to be unable to readjust himself without considerable loss of time, and perhaps of interest as well. One member of the committee, Mr. Bruce, holds, however, that specialization should begin early, even before entrance to college. To this end he advocates the announcement of parallel curricula in general forestry and in utilization, with considerable flexibility in each, when approved by a faculty adviser.

Several forest schools publish, or at least bring to the attention of the forestry students, a list of courses recommended for election. The committee is agreed that the success of such an elective system depends to a considerable extent on how closely the student is directed by a faculty adviser *who really advises*. The experiment of unrestricted election at Harvard, under President Eliot, has led the pendulum to swing back in many colleges, and particularly in the technical schools, to a closer adherence to a fixed curriculum, at least by underclassmen.

5. The committee is unanimous that professional forestry students should be required to engage in forestry work during the summer vacation period, but opinions vary as to how much and just what should be demanded. The opinion of a majority of the committee seems to be in favor of one summer spent with a forestry party or in a position in a forest industry, plus another summer spent, in whole or in part, in a forestry camp under faculty guidance. Formal instruction need not necessarily be a part of such a camp, but the work in the field must be under strict direction. It should amplify the instruction given by lectures, laboratory exercises, and local field trips in the winter terms, in the essential branches of forestry.

If the forestry camp continues throughout the summer, field work in topographic mapping may be included. If the forestry camp is only of a few weeks' duration, attendance at a civil engineering camp may well also be required. Forestry students should be recommended to do additional work in the forest, in other summers, beyond the minimum requirements. Prof. Briscoe, however, holds that forestry students "get more practical work and more real experience in the woods than in a school camp, and that many students need this time for earning money enough to complete their college work during the remainder of the year."

6. The committee unanimously recommends that the forestry students at all forest schools heartily be encouraged to organize and maintain a vigorous forestry club. The activities of such an organization are a useful adjunct to the classroom and laboratory. The club campfire constantly rekindles the torch of professional esprit de corps, that the faculty of every forest school is endeavoring to have handed on from class to class. A live forestry club is a potent factor in the success of any forest school.

## RECOMMENDATIONS.

Specifically as to a four-year undergraduate curriculum the committee desires to emphasize:

1. That the first two years should be devoted primarily to fundamental subjects like English, chemistry, botany, geology, mathematics, and mechanical drawing and civil engineering.

2. That the technical forestry courses should come mainly in the junior and senior years.

3. That more courses in the field of economics should be included than is usual to-day in the curricula of most of the forest schools.

4. That while some specialization may be permitted, if indeed not encouraged, in the junior and senior years, deviation from the regular curriculum should be made only with the approval of a member of the faculty, and in any event that the courses should be selected from a recommended list. If a student desires a wider range of election, he should frankly be told that he must extend his period of residence at the university.

5. In most of the land grant colleges military training is required of all men during the freshman and sophomore years. In certain universities, additional work is required as well in physical training and in hygiene, outside of the regular curriculum. The committee has not made provision for such requirements in its recommendations, although, of course, work of this sort demands of the students a varying number of actual hours per week.

The difficulty of attempting through correspondence, and in the very limited time permitted, to work out a really satisfactory curriculum must be apparent to everyone. The committee frankly admits that the curriculum presented is only a suggestion, which should be followed up by careful and extended study. It hopes that this conference will authorize such a project.

It is, of course, not expected that the curriculum proposed by this or any other similar committee will be adopted by all forest schools offering an undergraduate course. Nor is it desirable that all schools should follow a uniform curriculum. Some schools can emphasize certain subjects better than can others. Perhaps the best results will follow if each school develops those features for which, owing to location or other factors, it is peculiarly adapted. Prof. Bruce accepts the curriculum proposed by this committee as a "general forestry" program, but he feels "that a man graduating therefrom is not to be considered as being adequately trained for forestry work on the utilization side." He thinks "we need a parallel course in forest utilization or forest engineering, based more on physics, mathematics, and mechanics, and less on the biological sciences." Prof. Bruce considers the recommendation "of such a curriculum to be within the scope of this committee, i. e., an undergraduate course leading to the degree B. S. (in forestry)." As indicating a different point of view Prof. Briscoe objects that some of the suggested courses in economics should give place to a larger number of hours in dendrology.

The important point to emphasize at this time is that it is very advisable that certain standard requirements for graduation be indorsed by all the representative forest schools of this country and Canada. If the leading schools can, after discussion, come to substantial agreement on fundamentals, this conference will have served its purpose, as did that of 1912.

## SUGGESTED CURRICULUM.

The committee submits as follows a four-year undergraduate curriculum in general forestry that meets with the approval of its several members.

The curriculum recommended by the committee is in three parts: (1) The subjects to which at least four members of the committee have agreed. These are set forth in schedule form. (2) Supplementary subjects which some members of the committee feel should be included somewhere in the forestry course, if not indeed in stated years. These are listed as recommended electives. (3) A longer list of subjects from which, depending on the desires of the individual student, selection could be made, under faculty supervision, in choosing electives. This list is called suggested electives.

Had the committee been able to meet in person and discuss this matter, the first list might have been more extended; also, further subjects might have been mentioned as suitable for election.

The recommended curriculum is as follows:

SUGGESTED CURRICULUM

For a Four-Year Undergraduate Course in Professional Forestry Leading to the Bachelor's Degree.

FRESHMAN YEAR.

First Term.		Second Term.	
	Credit hours.		Credit hours.
English (composition).....	3	English (composition).....	3
Chemistry.....	3	Chemistry.....	3
Botany.....	3	Botany.....	3
Geology.....	3	Mechanical drawing.....	3
Trigonometry <sup>1</sup> .....	3	Biology or zoology.....	3
		Field of forestry.....	2
	15		17

SOPHOMORE YEAR.

Civil engineering.....	3	Civil engineering.....	3
Physics <sup>2</sup> .....	5	Soils.....	4
Dendrology.....	3	Wood technology.....	3
Plant physiology.....	4	Organic chemistry.....	3
Economics (general).....	3	Economics (general).....	3
		English (composition).....	2
	18		18

Summer following sophomore year.

Three months' period of practical experience with a forestry party or in a forest industry. Required.

JUNIOR YEAR.

Forest mensuration.....	3	Forest engineering.....	3
Forest regions (timber trees, physiography).....	3	Silvics (forest ecology).....	3
Forest entomology.....	3	Forest pathology.....	3
Business law.....	2	Fire protection.....	2
Accounting.....	3	Timber treatment (seasoning and preservation).....	2
Electives.....	4	Electives.....	5
	18		18

Summer following junior year.

Forestry camp. Practice in forestry work under faculty supervision, 4-8 weeks. With this may be combined field practice in topographic mapping, or the forestry camp may be preceded by a civil engineering camp of from 4 to 6 weeks' duration.

<sup>1</sup> When not offered and passed at entrance.

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## SENIOR YEAR.

Silviculture.....	4	Seeding and planting.....	3
Utilization (logging, etc.).....	3	Management (including organization and finance).....	4
Forest history and forest policy (National and State).....	3	Electives.....	11
Mapping (data from civil engineer camp).....	2		
Electives.....	6		
	18		18

## ELECTIVES.

*Recommended.*

Credit hours.		Credit hours.	
Solid geometry (if not offered at entrance).....	3	Public speaking.....	2
Meteorology (for those offering trigonometry at entrance).....	3	The forest industries:	
Microscopic wood technology (laboratories with a few lectures).....	2	Lumber.....	2
		Pulp and paper.....	2
		Economics:	
		Cost accounting.....	3
		Industrial organization.....	2
		Labor problems.....	3

*Suggested.*

Credit hours.		Credit hours.	
Agronomy.....	3	Industrial hygiene.....	2
Analytic geometry.....	3	Lithology.....	1
Animal husbandry (general principles).....	3	Mineralogy.....	3
Commercial geography.....	2	Plant pathology (general).....	3
Economics (public and corporate finance, budgets, etc.).....	3	Psychology.....	3
Entomology (general).....	3	Shopwork (wood).....	1
Forest law (Kinney's text).....	2	Shopwork (iron).....	1
		Zoology (systematic mammals).....	3

*Subjects best taught in given regions.*

Logging engineering.  
Grazing.

The above report is submitted for the consideration of the conference.

R. S. HOSMER, *Chairman.*

J. M. BRISCOE.

DONALD BRUCE.

A. K. CHITTENDEN.

R. R. FENSKA.

J. S. HOLMES.

*Committee on Undergraduate Course.*

## DISCUSSION.

Following the Report of the Committee on a Four-Year Undergraduate Course

In answer to a question from Prof. Belyea, of Syracuse, as to the reason of the incorporation of inorganic chemistry in the sophomore year, Prof. Hosmer stated that this was a required subject in most colleges, and, further, that it was a prerequisite for organic chemistry. The chairman called for a show of hands as to whether organic chemistry should be included in a four-year undergraduate course in forestry; 17 ayes, 10 noes.

On the question of whether the preparation which the average student receives in the preparatory school in elementary mathematics, including solid geometry and trigonometry, and in physics, is sufficient, or whether college courses in these subjects should be required, a show of hands showed 7 in favor of a college requirement; 15 that passing off these subjects by entrance examinations was sufficient.

On a vote on the question of whether forest schools should set up a separate set of conditions governing entrance, or should accept students who had passed the equivalent of the requirements of the college entrance board, there was unanimous expression of opinion that the latter practice should in general be followed.

The question being raised whether a forest school should demand more credit hours for graduation than is demanded in other schools conferring a bachelor's degree, it seemed to be the opinion of the conference that, because a forest school is essentially on a professional basis, it could demand that courses aggregating a larger number of credit hours should be included in this curriculum. This is following the procedure already in force in a number of the colleges of engineering in this country.

Mr. Herbert A. Smith, of the Forest Service, emphasized the necessity of sufficient work in English so that the students should acquire the ability to express themselves with clearness and accuracy. He felt that too early specialization was undesirable and that the early part of the course should be devoted to laying proper foundations in which the study of English should have no small part.

In closing the discussion on this report, the chairman made it evident that to the committee had been assigned a task of working out on paper what it thought the best course in forestry for a man who could only spend four years in college. The report of the committee should be read in that light, rather than as constituting a fully rounded but curriculum for forestry instruction. The committee was assigned a definite task. The question of what work should be taken by students who desire fully to prepare themselves for the profession falls in the scope of another committee.

## REPORT OF THE COMMITTEE ON THE POSITION THAT FORESTRY COURSES SHOULD TAKE AS CULTURAL AND EDUCATIONAL DISCIPLINE.

Presented to the Conference by Dr. P. P. CLAXTON.

Statistics show that only about 2 per cent of our students of school age carry their education to the point of a college degree. Since most of the education in forestry to-day is confined to technical schools of college grade, agricultural colleges, and the like, it is obvious that, if the great mass of people are to know anything about forestry and its relation to human welfare, some courses of study in the subject must be introduced into the graded schools. Forest geography might be taught in the elementary schools, and if the Forest Service would prepare a leaflet on this subject, most State superintendents could be induced to include the work in their schools. In the schools of higher grade, forests in their relation to human welfare and the industries could be studied, so that in time there would be formed in the minds of the people an appreciation of the problem and a sympathetic interest in it. Education of the public in the field of forestry is the only way in which any constructive legislation can be accomplished.

The needs of the situation in the schools can be met if material already in existence is organized and assembled in such a way that it can be utilized by teachers; this should be supplemented by a series of questions and suggestions, so that teachers will be able to direct the attention of pupils in the right ways. A closer coordination between schools teaching forestry subjects would also be of great assistance.

### DISCUSSION.

In the absence of Dr. C. F. Jarvis, of the Bureau of Education, the foregoing informal statement was made by Dr. P. P. Claxton, United States Commissioner of Education. Commenting upon this statement Dr. Claxton said that it is the business of the Commissioner of Education to look forward into the future and see what kinds of education will be needed. The duty of schools is to train the citizens of the future. In time there will be need for a large number of scientifically trained foresters. There is, therefore, a place for education in forestry. From having so many ramifications in the field of economics, it is essential for the well-being of any country to have men trained not only for the technical practice of the profession, but also able to handle large questions of policy.

There is also need that the public should have some general information about what forestry is and what it seeks to accomplish. It is not necessary that the great mass of people should know forestry technically, but they should know enough about forestry and its relation to public welfare so that they can understand and have feeling and sympathy for it. It is, therefore, desirable that forestry be introduced as a subject of study in the elementary schools.

Dr. Claxton further suggested in connection with the technical aspect of forestry education, that in his judgment it would be a good thing were the committees of this conference continued, to give further study to this whole subject. A useful precedent has been set in this way by the committees appointed at a conference of highway and transportation engineers held in May.

1920. These committees have been making analyses of the different things necessary to be done and the several kinds of preparation requisite therefor. Is there not need for similar consideration of the problem of education in forestry?

In answer to a question as to what can be done at once to introduce forestry into the schools, Dr. Claxton suggested that lesson leaflets should be prepared and that a good place to begin was with the study of forest geography. If the Federal Government would get out such a leaflet he thought that he could induce most of the superintendents of State education to require its use.

Mr. S. T. Dana, of the Forest Service, suggested that in this connection it might be desirable to call a conference of superintendents of schools on forestry as a cultural and educational subject, in which might also be included the presidents of universities and the deans of colleges. Dr. Claxton said that he would be glad to consider this if the conference should ask for it.

The discussion closed with the suggestion that the committee might well, in its study of this question, recommend some form of cooperation between the Bureau of Education and the Forest Service that would lead to the preparation of a manual on forestry for use in the public schools.

## REPORT OF THE COMMITTEE ON THE COURSE LEADING TO THE DEGREE OF MASTER OF FORESTRY.

### THE FUNCTION OF A FIVE-YEAR COURSE IN FORESTRY.

Modern civilization rests upon the principle of cooperative effort in providing on a large scale and in advance of actual need the materials required for maintaining our standards of living. The three foundation stones are capital, cooperation, and Christian ethics. Forestry as a national policy embodies the highest development of the ideals of this civilization. The function of capital is to make possible the existence of individuals during the period required to organize an industry and produce the goods. Its destruction means starvation and savagery. Forestry requires by far the greatest period of time for production of any material, and is thus most closely dependent upon the ability to await returns, and upon the foresight and self-denial in the present, which this effort calls for. Cooperation means the development of specialists and technicians on the one hand, and on the other the harmonious working of this complicated organization for the common good, as opposed to class warfare. In forestry our progress will be measured to a far greater extent than in any other line by public activity, whether through direct ownership or cooperation with private effort. I need not emphasize the third factor—ethics—which alone protects property rights and makes any form of cooperative effort possible.

The material energies of organized society may be summed up as the organizing and conduct of enterprises which supply the consumer with what he needs when he needs it. The success of this effort is gauged by the abundance and cheapness of the goods supplied and the relative advance in average standards of comfort. This involves a threefold process fundamental to the consideration of forestry education: First, a study of the needs of wood consumers; second, the technique of wood production, harvesting, and utilization; and third, the business factors of adjusting the supply or production to the demand. It is possible to separate practically all forestry subjects into these three groups, except those applied sciences which are synthetic in character and whose function is to teach the principles of harmonizing the three elements into practical directions for operations.

The first group may be termed "economics." This deals with the demand, or the reaction of the forest on man. Its basis is the means of expression, language. Its fundamental sciences are history and economic relations, based on statistics. Its forest sciences are forest history and forest economies, while it finds its practical application in policies crystallized and expressed by laws.

The second group may be termed "technique" and deals with the physical environment altogether. Its basis lies in the sciences of physics and chemistry. Its fundamental sciences are geology, botany, zoology, mechanics. Its forest sciences are forest physiography, and soils, dendrology, and forest pathology, forest ecology or silvics, forest entomology and zoology, and wood technology. Its applied sciences are silviculture, forest engineering, forest utilization or

lumbering, uses and preservation of woods and wood-using industries, and forest protection in its technical aspects, including applied entomology, pathology, and engineering.

The third group, or business, is the one about which most confusion exists, and which is commonly divided between each of the others, some subjects being thrown with economics or demand, others with technique or supply. What constitutes the distinguishing character of this group? The function of a business being to supply demand, it is not limited to the technique of production. The business factors, distinct from these technical methods, deal with the three factors of quantities, location, and order or sequence—that is, the time factor. The basis of this group is mathematics and mechanical drawing. But when we come to the sciences, two sections appear, the one bearing upon economics, the others upon technique or the physical world. The fundamental science in this group belonging to the economic wing is accounting. That belonging to the physical wing is surveying. The one deals with man, the other altogether with the earth.

With surveying we encounter the classification termed engineering. This subject is commonly and correctly classed, under the term civil engineering, with dynamic engineering, for which it paves the way. But surveying and mapping, though forming this connecting link, belong absolutely in the business group, since they effect no dynamic change in the physical environment, but merely locate and measure areas, one of the three primary functions of business.

In the forest sciences the same two wings are in evidence. On the economics side is forest finance, which deals mathematically, through accounting methods, with the purely economic factors of forestry; hence is frequently confused with economics, with which it is the connecting link. On the physical side is forest mensuration, which deals mathematically with the living forces of nature, which it attempts to measure and interpret, thus forming the connecting link with ecology and silviculture. The greatest error in teaching either of these subjects is in viewing them from their purely mathematical aspect and striving to attain mathematical precision in results, when neither human nature nor plant life conforms to mathematical laws. Forest surveying and mensuration are combined under the term forest survey.

The applied science in this group is forest management, which includes organization and regulation of forests. This is a synthetic subject resting directly upon the three groups, based upon forest policy on the one hand and silviculture on the other, but based equally on the mathematical or business factors of finance and forest survey. It belongs in the business group because it is distinguished from each of the other groups by dealing, characteristically, with the purely business factors of quantity, location, and time, and with the organization and business or office methods by which to insure order and sequence of operations. Forest protection is a phase of forest management. Fire protection depends as much on economics, or public education and laws, and on business, or an efficient personnel well organized, as upon methods of fire prevention and fighting. This synthesis makes the subject difficult to classify. Lumbering when it treats of the lumber industry has the same threefold basis and can not be segregated as an engineering or technical subject, though the study of logging methods belongs there.

By temperament and training men tend to class themselves in one of three groups coordinated with this threefold division of forestry. To the economic group belong some of the great pioneers of forestry like Dr. J. T. Rothrock, of Pennsylvania, and many men prominent in the forestry movement whose work

has consisted in establishing the foundations of forestry in public policy, men not necessarily possessed of a technical forestry training. To the technical group belong the research specialists who are laying the foundations of forestry in the woods. These men as specialists are indispensable, but can we depend upon them alone to establish the practice of forestry? Until the advent of the trained forester, forest agitation got nowhere except as a land policy, which is pure economics. On the other hand, the purely technical side of a forester's training tends to make him contemptuous of the economic side, and to regard popular education as hot air because it does not teach him anything new, and speech making as an ordeal to be shunned. These ultratechnical foresters remind one of the text, "and like a lamb, dumb before his shearers, so opened he not his mouth." They are absolutely dependent for their livelihood as foresters upon the efforts of the economic group, or upon conditions created by these efforts, or else are forced to seek other employment; yet because of the defective specialization in their education these foresters are unable and unwilling in many cases to support this group. Of the two, the economist is bound to have the broader outlook, but he is often impractical. The fundamental defect of a too narrow specialist is intolerance and lack of comprehension of either one or both of the three phases or aspects of enterprise, which leads him to belittle instead of encouraging those engaged in these other rôles, thus operating not to build up the enterprise but to unscrew the bolts which hold it together.

Specialization without vision is not the result of education but of the lack of it. The laborer is a technician, usually excelling in some line, even if it is hod carrying, and with all the benighted insolence of superiority which his excellence gives when not accompanied by a comprehension of the functions of those who are not technicians. The utter disregard of practical affairs shown by the dreamer of utopian theories or narrow economist, when joined with this technical bigotry, is capable of consuming the world. The mathematical or business specialist, typified by the clerk, has no soul above figures. As the old Yale song has it, "now, which of these three persons would you most prefer to be?" The answer is, "The man behind," which, being interpreted, means the leader or organizer, the one who welds together these three elements which were never intended to be discordant or warring; the practical man who possesses not one but all three traits harmoniously developed; who is a thorough technician, understanding the art of successful forestry; who is a sound economist, understanding human nature and the relations of the industry to demand; but who above all is a practical business man, an administrator, who can successfully direct large undertakings and produce, in fact, the perfect cooperation required of forestry as of any other business.

Such men are possessed of the qualities of leadership, and they will become leaders as certainly as oil rises to the surface of water. It is not an accident that a very careful survey some three years ago of all the graduates of the Yale school of forestry showed that over 70 per cent had, in their career subsequent to graduation, demonstrated this ability for leadership.

But what is the rôle of a forest education in producing this type of person? Is he born that way? Can you make leaders by mere school training? There is not one of these three elements that is not better learned outside of college than in it. Economics means the study of human nature, not from books but at first hand, in the woods and factory, in public life. Technique means doing things, and the best way to learn how is to do them or be very close to them. Hence the scorn of the sophisticated laborer for the greenhorn with the education. And where else can a man learn the rules of business than in the

game itself? Haven't we a host of hard-headed, self-made men to emphasize this truth? Yes, we can all learn one, perhaps two, of these faculties in the school of experience, but it takes three legs to hold up a stool. One man in 100 may attain the power of coordination by his own efforts in the practical school of experience. Thinkers are not confined to the college bred. But more often such men have failed to attain the symmetry required of leaders. When they are given these responsibilities, what happens? They throw a monkey wrench into the machinery either by their failure to appreciate the vital relation of research to the health of the enterprise, or by lack of vision in dealing with personnel, or else they can not swing the administrative problems confronting them. The United States Forest Service has developed a few striking instances of this one-sided inefficiency. Its effects upon an organization are always serious and blighting. By contrast, the remarkable success of the Forest Service, far exceeding that of any administrative branch of the Government in the same period of time, is due directly to the predominance of the well-balanced type of leader, who can build constructively and inspire his subordinates.

In general this effect springs directly from the cause of the general training in forestry received by so many of these men employed by the Forest Service. Well-rounded college training is not a substitute for practical experience, but it is almost certain to give to the student the maximum chance of coordinating the three phases of his education and thus making out of him a leader as well as a specialist. Just as the origin of man from the lower animals came through coordinated development of all the senses leading to the power of thought, so narrow technical specialization must be accompanied by symmetrical development of practical business sense and full human sympathy, if the human race, or the profession of forestry, is to progress.

Does the four-year course in forestry supply this balanced training, or can it do so? This is not a question of technical training. It is not disputed either that technicians in logging, wood technology, silviculture, or other special lines can be given adequate preparation in four years, or that we need a much larger number of men in the ranks of forestry than in command. The question is, rather, What will the fifth year do for the forester who takes it? F. H. Newell says:

The human viewpoint is the most important part of education. Logic and reason are not the controlling factors. Emotions, sentiment, and ideals are more powerful.

In the report of President Hadley, of Yale University, for 1920, is the statement:

Especially is it necessary that men trained along lines of *applied science* should have a training not too narrow in extent or too highly specialized in character.

R. D. Forbes, in an article in the *Journal of Forestry* in April, 1920, on education says:

What forestry needs is not specialization, but generalization. Forestry more perhaps than most professions needs men of broad training rather than specialists. In the present state of development of forestry in America we need administrators (business men) and propagandists.

Prof. R. C. Bryant says:

It is one of the weak points in our profession that we have not developed forestry-economists who can speak authoritatively on the many vital problems affecting forests and forestry. We have neglected the broader economic phases of the subject.

Prof. S. N. Spring gives as his contribution to this report:

A course covering four years and comprising the fundamental sciences, engineering and forestry courses with a minimum of hours in English and economics, forms too narrow a training for the development of a professional forester. There is need of more economics, English, history, business courses, law, and the like. Youth and undergraduate activities, desirable as they both are, prevent as searching work as is found possible in a fifth year of graduate work, which, properly correlated with the former, should produce men who will raise the standards of forest practice and not be mere practitioners of forestry. There must be schools that can give adequate training to maintain the highest standards and to make sure of the best development in forestry in the United States. We must not have in mind the training of foresters solely under present day needs but give the breadth of training that will meet future conditions.

P. T. Coolidge writes:

We can not derive the best benefits from our wild lands as State or Federal administrators or as private foresters except from a point of view which includes a much wider knowledge than that comprised under the teaching of forestry as an art.

He cites the need for economics, history, English, and a modern language—in his case, French.

Our education in forestry during the last 20 years has proven weakest in the approaches to mechanical engineering. . . . Whatever essentials of engineering can be included in a forestry course will prove of greatest value. . . . A subject that for many years had received insufficient attention is accounting. . . . The instruction at Harvard, combining lumbering and business administration, has enabled graduates to do very distinctive work. The silvicultural twist in our education has unduly emphasized consideration of the trees to the detriment of consideration of the forest.

Dr. Roth says: "I believe in a five-year course for the real student who aims at work that is either big or deep," and the Michigan five-year course is planned to enable the student to introduce languages, economics, and other cultural subjects.

In considering what should constitute a well-balanced five-year course of training for a professional forester, and in comparing the courses now given both in four years and five years a common standard of credits is required. Practice differs somewhat between colleges. The standard which has been adopted in this discussion is, for lecture courses, 1 hour for a term of one-half year, consisting of 16 weeks of classroom work, exclusive of examinations and vacations. For laboratory work practice varies between 2 and 2½ hours as the equivalent of 1 hour of classroom, sometimes varying within the same college and department according to the course. For field work, practice varies from 2½ hours to 3 hours as the equivalent of 1 hour of classroom work. At the University of Minnesota one credit hour is equivalent to one lecture or recitation period requiring 2 hours of preparation, 2 hours of laboratory work requiring 1 hour of preparation, or 3 hours of laboratory work with no preparation, each week for one quarter. Three quarters give 32 weeks of work exclusive of examinations. In the four-year course 210 credit hours are required for graduation, which reduced to the minimum basis by the factor two-thirds gives 140 credit hours, or 35 per term, inclusive of the summer field work at Itasca Park, the omission of which lowers the term average to approximately 32 credits.

At the University of California, 130 units of study are required for a four-year course, which includes 6 units of summer field work, or 124 for the regular terms, an average of 32 per year.

The Yale course has been computed by using 2 hours as the equivalent for laboratory work, and 3 hours for field work. As there are 66 hours of labor

tory work, the use of 2½ hours as the equivalent would reduce the total credits by about 6 units, giving approximately 200 units. The variation between colleges as to length of term and equivalents used is apparently not sufficient to require the use of reduction factors to obtain a common standard or weight. The next factor is the size of the load per term or year. See Table 1.

TABLE 1.—Grouping of subjects in 4 and 5 year courses.

By group of subjects. <sup>1</sup>	Four years.				Five years.			
	Michi- gan.	Califor- nia.	Penn- sylv- ania.	Pro- posed.	Califor- nia.	Corn- ell.	Yale	Pro- posed.
Economics, including language.....	20	27	45	27	27	21	45	45
Business, including surveying.....	41	37	32	27	46	30	51	45
Technical, including mechanical en- gineering.....	71	64	92	70	91	84	104	90
Research.....		2	2		2	6	1	
Electives.....		3				10		
Seminary, advanced work.....						4	3	
Total.....	132	135	171	124	166	155	204	140

<sup>1</sup> In all courses except at Yale and 5-year proposed about 9 credits are omitted for military drill, hygiene and physical training.  
<sup>2</sup> Supplemented by electives; not listed in published outline of courses.  
<sup>3</sup> or more.  
<sup>4</sup> Credits for summer field work not included would add 10 to 15 credits.

Here there is considerable variation between colleges. Yale evidently requires a standard of about 20 hours or units per term, while Pennsylvania State even exceeds this. In each case the course permits of practically no electives; so these represent the maximum requirements and greatest rigidity. The standard set by Cornell, California, and Michigan is 16 to 18 hours per term, or a total of about 130 hours for four years. To this in each instance can be added the summer work or term, whether this be one or two seasons. These add from 10 to 20 hours. The additional year brings the total available units to 200 in case of Yale and 175 at California. Cornell, by crediting one term in individual field work with a reasonable number of hours (15), has a total of 150 credits. Pennsylvania State by crowding the load shows 170 credits for four years. To all but Yale 9 credits are added for military drill, hygiene, and personal health. Yale presumably devotes an equivalent time in extracurriculum activities along similar lines.

The effect of an overload is to deprive the student of time which should be devoted to reading and reference work, thoroughness of preparation, and initiative or original thinking, but which may of course in undergraduate work be wasted. Recreation is required, at least by the undergraduate, and for the postgraduate, research, and independent work require a light fixed schedule. There is serious danger, therefore, in endeavoring to crowd into four years a course which should require five years for its completion, or in overloading a five-year course with too great a specialization in any line, if its purpose be not distinctly to specialize.

Assuming a standard of 180 credits for a five-year course, which is 20 less than given by Yale (26 on basis of two hours laboratory for one hour class), how should such a course be balanced for a general professional training? No course can be proposed which will be acceptable to all institutions, even for the purpose outlined, but a standard will serve to call attention to overweight or deficiencies, as well as to emphasize the advantages of five years of training.

EDUCATION IN FORESTRY.

TABLE 2.—Credits or units per year, 4 and 5 year courses.

Years.	Four years.				Five years.				
	Michi-gan.	Calif-ornia.	Penn-syl-vania.	Pro-posed.	Calif-ornia.	Cor-nell.	Yale.	Pro-posed.	Unit extras.
Freshman.....	131	129	137	133	129	136	38	34	30
Sophomore.....	132	132	140	136	130	130	41	34	32
Junior.....	32	34	42	36	30	37	41	34	35
Senior.....	29	34	38	36	34	21	40	34	35
Postgraduate.....					34	13+	35	34	35
Summer fieldwork.....	8	6	14	10	9	7	10	10	13
Total.....	132	135	171	161	166	144	206	180	180
Extras.....	9	9	9	9	9	9			9

1 Plus 4 hours of military drill, hygiene, etc.  
 2 Plus 5 hours of military drill, hygiene, etc.  
 3 Plus 1 term of individual work, about 15 credits, and electives not listed in published outline of course.  
 4 Cornell also requires 3 months of practical experience and 1 month in forestry camp.

TABLE 3.—Subgroups of subjects, 4 and 5 year courses.

By group of subjects.	Four years.				Five years.			
	Michi-gan.	Calif-ornia.	Penn-syl-vania.	Pro-posed.	Calif-ornia.	Cor-nell.	Yale.	Pro-posed.
Electives.....		3				10		
Economics:								
Language.....	6	12	24	8	9	6	21	18
Science and arts.....	14	15	21	19	18	15	21	27
Total.....	20	27	45	27	27	21	42	45
Business:								
Mathematics and drawing.....	8	14	6	6	20	6	17	13
Science and arts.....	33	23	26	21	26	24	34	32
Total.....	41	37	32	27	46	30	51	45
Total for 2 groups.....	61	64	77	54	73	51	97	90
Technique:								
Physics and chemistry.....	12	18	13	14	27	12	22	15
Engineering.....	9	14	11	9	30	9	7	15
Site.....	10	7	11	10	7	15	12	10
Plants.....	32	17	39	28	17	31	45	35
Animals and insects.....	4	7	8	6	7	11	15	8
Wood.....	4	3	10	5	3	6	7	7
Total.....	71	66	92	70	91	84	108	90
Research.....		2	2		2	16	1	
Seminary.....						4		
Advanced work.....						4		
Recapitulation.....	132	135	171	124	166	159	206	180

1 Or more.  
 2 See electives.  
 3 Credits for field work not included.

The division proposed is shown in Table 2:

Economics ..... 45, or 25 per cent.  
 Business ..... 45, or 25 per cent.  
 Technique ..... 90, or 50 per cent.

The technical subjects are further divided into—

Basic sciences ..... 15-16 2/3 per cent.  
 Engineering and practice ..... 15-16 2/3 per cent.  
 Sciences and scientific practice ..... 60-66 2/3 per cent.

The sciences may be further divided into—

Factor of site.....	10-16½ per cent.
Plants.....	35-58 per cent.
Woods.....	7-11½ per cent.
Animals.....	8-13½ per cent.

It is in the economic and business group that the greatest deficiencies are ordinarily found. The suggested division of the 45 credits in economics is as follows:

TABLE 4.—Economics—Subjects arranged by groups, 4 and 5 year courses.

Group and subjects.	Four years.				Five years.			
	Michi- gan.	Calli- fornia.	Penn- syl- vania.	Propo- sed.	Calli- fornia.	Cor- nell.	Yale.	Propo- sed.
<b>Races:</b>								
English.....	6	12	12	8	9	6	12	12
Modern language.....			12				12	6
<b>Sciences:</b>								
History.....		9	12	11	12	6	3	6
Economics.....	3						4	9
Economic geography.....								
Forest economics.....	7	1	2	2	1	6	1	3
History of forestry.....	1	1	2	1	1	1	1½	1
<b>Applied sciences:</b>								
Business law.....				2				3
Lumber industry.....		3	2		3		1	1
Forest policy.....	3	1	3	2	1	2	3½	4

Of these, English has been the most neglected, so much so that most foresters are greatly handicapped by inability to express themselves, although at that the percentage of efficiency in the use of language is higher than is found in the engineering profession. A modern language should if possible be learned in high school—Spanish for practical use, French or German for research and literature. The need for a better basis in economics, including the history of the twentieth century, is going to increase constantly. One three-hour credit is totally inadequate in economics. In no other line does the forester's education need rounding out so badly. Of the nine credits suggested, three are elementary, permitting the student to take later courses in the principles of organization and management, employment, markets, and other subjects for six additional credits.

Business law has been generally omitted, but deserves a place in the curriculum. The remaining nine credits devoted to forest economics include the general courses usually given to beginners, the history of forestry, and State and National forest policy, with one hour for the economics of the lumber industry.

TABLE 5.—Business subjects arranged by groups.

Groups and subjects.	Four years.				Five years.			
	Michi- gan.	Calli- fornia.	Penn- sylva- nia.	Pro- posed.	Calli- fornia.	Cor- nell.	Yale.	Pro- posed.
<b>Basics:</b>								
Mathematics.....	8	12 <sup>a</sup>	4	3	15	3	10	10
Mechanical drawing.....		2	2	3	2 <sup>a</sup>	3	3	3
Descriptive geometry.....					3			4
<b>Sciences (economic):</b>								
Accounting.....				6	3		3	3
Forest finance (technical).....	2	2	2	1	2	2	1	2
Surveying and topographic map- ping.....	16	9	10	8	9	14	11	12
Mensuration.....	8	10	8	3	10	3	5 <sup>a</sup>	7
<b>Applied sciences:</b>								
Lumber business.....	3		12				4	2
Management (organization and regulation).....	4	2	6	3	2	5	10	4

<sup>a</sup> Alternative, not included in totals.

In the business group a minimum of 10 credits is indicated for mathematics. This covers trigonometry, analytical geometry, and differential and integral calculus. There may be some difference of opinion as to the necessity of mathematics above trigonometry, but the additional subjects are strongly recommended in a five-year course.

An elementary course in accounting is considered indispensable to a well-balanced forestry course and is the most serious omission in courses as at present arranged. A second course, making six hours, is advisable as a substitute, if necessary for a course in economics (with which this subject is commonly classed). Twelve hours for surveying is intended to thoroughly cover both plane and topographic surveying. This is adequate. Mensuration is best taught by combining lecture and field work in about equal credit weight, i. e., one hour class work to three hours in the field. If this is not possible, sufficient class work should precede the field work to clarify the subject. Seven credits is considered a minimum for effective instruction.

The eight credits allotted in the proposed course to applied subjects are less than are now given at Yale both in lumbering and management. Owing to the synthetic character of both subjects, an analysis of the time allotted by each university which should fall under economics or technique could not be made with certainty. A summary of all this group as proposed shows the following:

Subjects.	Four years.				Five years.			
	Michi- gan.	Calli- fornia.	Penn- sylva- nia.	Pro- posed.	Calli- fornia.	Cor- nell.	Yale.	Pro- posed.
Lumber industry.....	6	11	9	3	10	4	10	9
Policy and management.....	7	5	9	5	3	7	13 <sup>a</sup>	13

TABLE 6.—Technical subjects, arranged by groups.

Groups and subjects.	Four years.				Five-years.			
	Michi-gan.	Calif-ornia.	Penn-syl-vania.	Prop-osed.	Calif-ornia.	Corn-nell.	Yale.	Prop-osed.
<b>Basis:</b>								
Physics.....	4	3	3	5	12	6	12	15
Chemistry.....	8	10	10	9	10	6	10	
Agricultural chemistry.....		5			5			
<b>Engineering (applied science):</b>				1		1		
Forge work.....					6			3
Elementary mechanics.....					10			
Advanced mechanics.....					4	2	1	3
Forest engineering.....	3	4	2	3				
Lumbering.....	3	7	7	3	7	3	5	6
Forest protection.....	3	3	2	2	3	3	1	3
<i>Factors of site.</i>								
<b>Sciences:</b>								
Meteorology.....						3		1
Mineralogy.....	4		2			3	2	
Geology.....	6	3	3	3	3	4	4	3
Soils.....		4	3	4	4	5	2	3
Physiography.....			3	3			4	3
<i>Botany, including silviculture.</i>								
<b>Sciences:</b>								
Elementary botany.....	4	4	4	6	4	6	4	4
Morphology and anatomy.....	8		7		4		8	4
Ecology and physiology.....	2		2	4		4	8	4
Dendrology.....	2	6	7	3	6	4	4	5
Forest pathology.....	4		3	3		6	3	3
Forest ecology or silvics.....	4	2	3	3	2	3	6	4
<b>Applied sciences:</b>								
Silviculture, natural.....	4	2	9	4	2	3	7	7
Seeding and planting.....	4	2	4	3	2	3	4	4
<i>Zoology, including insects.</i>								
<b>Sciences:</b>								
Biology.....	4	4	3	3	4	3	4	6
Zoology.....						3	4	
Entomology.....						3	4	
Forest entomology.....		3	4	3	3	2	3	4
<b>Applied science:</b>								
Fish and game.....								
<i>Wood.</i>								
<b>Sciences:</b>								
Wood technology.....	2	3	4	3	3	3	3	
Identification, properties, pres- ervation.....	2		4	2		3	2	2
<b>Applied sciences:</b>								
Wood-using industries.....			2				2	2

For the technical subjects, including the two lines, engineering exclusive of surveying, and sciences, the allotment of one-half the total is a recognition of the fact that the forester is primarily a technician. The general forestry course as planned can not expect to equip a man as a full-fledged logging engineer unless this is done at the sacrifice of the economic, business, or scientific studies.

It will be observed that the five-year course at California permits a man to complete both the regular four years' work plus the engineering: but this is possible apparently because less foundation is given in some other subjects, as pathology, botany, and silviculture.

It is assumed that either physics or chemistry is a college entrance requirement, and that 15 credits will be sufficient to cover both of these subjects. Elementary mechanics is recommended on the same basis as accounting—as

necessary to take the raw edge off of the forester's ignorance without necessarily making him a logging engineer. The subject is basic in importance. If this is followed by a course in forest improvements and about 6 credits in lumbering, the forester should be able to get by as a superintendent or even manage small operations directly.

Three hours for forest protection are ample to cover the subject, outside of pathology and entomology.

If surveying is included with engineering, the comparison is as follows, exclusive of lumbering and protection:

Subjects.	Four years.				Five years.			
	Michi- gan.	Calli- fornia.	Penn- syl- vania.	Pro- posed.	Calli- fornia.	Corn- nell.	Yale.	Pro- posed.
Surveying.....	16	6	10	8	9	14	11	12
Mechanical engineering.....	3	3	2	4	19	1	1	6
Total.....	19	9	12	12	28	15	12	18

Nor is this general course intended to create specialists fitted for research in silviculture, technology, or forest protection. Such courses will show the same character of variation which California's five-year course shows for the specialized logging engineering training.

The object of the course as planned for the other branch of technique dealing with the forest as a living organism is not therefore to overload the student with botany, silvics, and ecology, but to cover these subjects adequately. They require greater weight than other sciences, since forestry is primarily the art of growing trees.

Under site factors one credit usually omitted can well be devoted to meteorology. Six may be divided between geology and soils. Mineralogy, on the other hand, may easily be overdone; we are not training economic geologists. It is doubtful whether more than 12 credits should be devoted to botany, exclusive of dendrology. The 8 additional credits required by the Yale course tend to develop specialists in ecology, and the time so spent is needed in economics.

Dendrology can utilize from five to six hours, since this course can be made a connecting link with silvics on the one hand and wood utilization and properties on the other, by discussing the habits, requirements, and properties of the different species.

Three hours each is adequate for forest pathology and forest entomology. The separation of forest ecology, under the term "silvics," from silviculture is proper, and requires three to four hours. Seeding and planting commonly takes four hours. The time devoted to silviculture varies with the amount of instructive field work possible, and in regions of second growth seven hours can be profitably devoted to this subject.

Even with these minimum requirements, scant time is left for the development of zoology leading to fish and game culture, a subject which Cornell has always retained. This is one of the specialties and may increase in importance with the growth of the need for game propagation and protection. Nor can we hope to devote much more than seven hours to wood, either in microscopic study, identification, or treatment.

No effort has been made to present a course giving these studies in sequence. This is a matter which each institution can work out on its own lines. The evidence based on existing courses seems to show unmistakably that a four-

year course unless heavily overloaded excludes not only a desirable proportion of the vitally necessary subjects of economics, English, history, and languages, but that elementary business subjects such as accounting and additional work in mathematics are impossible, while in engineering, mechanics is omitted. Conformity to a single standard is not desirable, but recognition of the general training of a forester as distinct from specialized training calls for a course based if possible on five years following closely the lines indicated.

H. H. CHAPMAN, *Chairman.*  
 FREDERICK ROTH.  
 S. N. SPRING.  
 C. D. HOWE.  
 P. T. COOLIDGE.

#### MEMORANDUM FROM REPRESENTATIVES OF WESTERN FOREST SCHOOLS.

Following the reading of the committee report by Prof. Chapman a memorandum from representatives of a number of the forest schools situated in the States west of the Mississippi, sent to this conference with the request that it be incorporated in its proceedings, was submitted. The memorandum follows:

DECEMBER 6, 1920.

At a meeting of representatives of western forest schools held here in Spokane to-day certain topics to be discussed at the proposed educational conference in New Haven were considered. We desire to forward to this conference the following statement of our position on certain specific questions:

1. While we believe that a better training in forestry can unquestionably be given in five or six years than can be compressed into four, yet on the basis of our experience and of that of parallel courses in similar fields which have come under our observation, we emphatically believe that the regular four-year course leading to the bachelor of science or bachelor of science in forestry degree must include all the essential subjects of a forestry curriculum, so that the graduates therefrom may be considered fitted to commence their professional career. A longer course will not attract the best type of man in the long run, and hence may even result in the turning out of an inferior product.

2. Modern forestry is a field with such variegated and specialized opportunities for work on the part of the forest school graduate that the training given in these schools should not be crystallized into any one fairly rigid curriculum. Instead, a system of controlled electives, commencing at least as early as the junior year, should permit a student to prepare himself specifically for positions in the United States or State forest services, or the lumber industry in any of its branches. The type of specialization to be developed at each school is of course largely a local matter.

DONALD BRUCE, *University of California.*

HUGO WINKENWERDER, *University of Washington.*

DAVID T. MASON, *University of California.*

FRANK G. MILLER, *University of Idaho.*

THORNTON T. MUNGER, *University of Montana.*

THOS. C. SPAULDING, *University of Montana.*

#### DISCUSSION

Following the Report of the Committee on a Course Leading to the Master's Degree in Forestry.

Prof. Toumey said that he thought the plan presented might be accepted by the conference as an ideal scheme, but that each school must necessarily deviate from it, depending on where that school is located and upon what the demands

upon its graduates are going to be. In this connection Prof. Morrell, of Colorado, felt that more work should be offered on grazing. Prof. Chapman agreed that this was important, but thought that the inclusion of grazing was a matter which had best be left to schools favorably located for teaching it.

Prof. Hosmer suggested that consideration be given to the question of the expense involved. With the present scale of salaries carried by positions to which forest school graduates are eligible, many students feel that they can not afford to spend more than four years at college. The men with a broader training are usually considerably ahead of the four-year men after the expiration of 10 or 15 years. The question is how to impress this fact on the undergraduate with sufficient force so that he will remain for the extra year at college.

In the discussion of the memorandum forwarded by men of the forest schools of the Western States, it appeared to be the opinion of many of those present at the conference that four years was an insufficient time in which to give a student a completely rounded training in forestry that would enable him to meet in full the demands of the profession. If only four years is spent at college the student tends to lack a proper grasp of the whole subject that will enable him to reach the higher places in the profession.

Several speakers expressed as their opinion that, where possible for an individual student to do so, six years of college training was better than five. The net result of the discussion on this point appeared to be that, while the men of the western schools felt that four years was sufficient, it was the opinion of some of the eastern schools that five years should be regarded as the minimum in professional forestry training.

**REPORT OF COMMITTEE ON SPECIALIZATION BY STUDENTS IN THEIR WORK FOR THE PROFESSIONAL DEGREES OF BACHELOR OF SCIENCE IN FORESTRY AND MASTER OF FORESTRY BEFORE THEY HAVE COMPLETED THE GENERAL COURSE COVERING THE FIELD OF FORESTRY.**

**Query:** Should specialization follow or precede conferring of the professional degree?

In accepting this assignment, certain doubts have arisen concerning the exact limit of the topic, since other phases of specialization are being handled by another committee.<sup>1</sup>

In an explanatory letter Dean Toumey interpreted the question as follows:

"To what extent should men be encouraged to specialize after their general science work and before they have had training covering the general field of forestry?"

It is a trite statement that all educational systems are now in a rapid state of evolution. This is particularly true of forestry education, dating back but 22 years in this country. Our profession is changing; new needs have arisen and are arising; new methods must be adopted to provide for them. Agriculture 30 years ago comprised merely field tillage. Now the leading agricultural college in the country trains men for 71 different lines connected with the utilization and conversion of these crops; and to agronomy has been added animal husbandry, and cheese and butter making; even experts in milk distribution are turned out by this institution, believing that the times demand efficient and economical distribution as well as scientific production.

Forestry, like its sister art, agriculture, deals with a land problem. As in the case of agriculture, it is now rapidly expanding, and we at Syracuse are firmly convinced that forest conservation must be practiced in the pulp and sawmill, and in the marts of trade, in order to reduce the drain upon our forests by eliminating waste and putting our manufacturers in a position to adopt the best methods of forestry practice. In short, forestry includes not only crop production—silviculture—but the utilization and distribution of manufactured products, like lumber, paper pulp, etc. So much for the background.

To return to the question asked, under no circumstances would we encourage men to specialize before receiving their professional degree. On the contrary, given time and money we would urge every man who wished to make the most of himself in the forestry profession to take a four years' liberal education—a classical course if you please. After receiving a thorough training in English, modern languages, history, literature, economics, and psychology, with

<sup>1</sup>In presenting the report the chairman of the committee said: "Before taking up the question it should be announced that the committee has not met, and while views have been exchanged to some degree, it is largely my own presentation. I have outlined the contents of this report to the other members of the committee and requested them to send in individual opinions by mail in case they could not be present."

the usual amount of mathematics and science, he should be thoroughly prepared to take a graduate course in forestry to the extent desired. Such men would not only have a breadth of vision and understanding of actions and reactions and acquaintance with economic laws; they would elevate the whole profession. In addition they would certainly become leaders of thought and molders of sentiment in their various communities along broader lines than forestry. They would possess a tolerance, a philosophy, resources of mind that would make them delightful companions, well-balanced as to soul, able to maintain forestry upon a high plane, which is the ambition of every member of the profession.

Such is the kind of preparation for our profession that should be encouraged in cases where time, funds, and necessary patience are present. The broad vision which characterized the early plans of the forestry movement in America is but a reflection of the liberal education of the leaders of forestry at that time. That the value of the broad cultural education is shared by others can be proven by experience of men teaching science<sup>3</sup> and men employing engineers in an executive capacity.<sup>4</sup>

We regret a change in the entrance requirements of the Yale School of Forestry making prerequisite some sciences and other subjects like mechanical drawing, which makes entrance difficult for B. A. men receiving diplomas from such colleges as Amherst, Williams, and Bowdoin. While it is true that most of these subjects—with the possible exception of mechanical drawing—can be obtained in our classical colleges, the preforestry course would have to be carefully planned.

To us at Syracuse the problem seems different. We do not give a professional degree at the end of four years. We award the straight bachelor of science degree. In addition we consider the men who go into the industries as mere four-year apprentices, and want it clearly understood that no graduate is considered a technical forester until he has received a master's degree.

The war changed many things. Not only did it stimulate educational activities, as the increased enrollment in all our colleges and technical schools prove, but it increased the impatience and the restlessness of the American student, never inclined to prolonged study and patient preparation evidenced by students at continental universities. Always eager, anxious to get into life as soon as possible, the average American student now demands all the short cuts possible. To such men, and probably they are in the majority, the four years of cultural study, plus two to three years of graduate work, is out of the question both from temperamental and financial reasons. Institutions of learning must plan to meet the situation which exists, all the while hoping and planning to change conditions and provide for more prolonged instruction men who are to be leaders in research. Another factor which enters into the educational

<sup>3</sup> A prominent botanist who for many years has carried on research along lines of forest pathology, himself a graduate of one of the leading State colleges and the recipient of a doctorate from a German university, told me that in his earlier years he had scoffed at the theory that a liberal education gave better mental discipline than science. After 15 years of graduate instruction, during which time he had opportunities to compare men from a near-by classical college specializing in botany and forest pathology, with holders of a B. S. degree whom he himself had taught, the conclusion was forced upon him that the men with liberal education made greater headway, had more poise, greater self-reliance and initiative in attacking new problems than the men trained in science alone.

<sup>4</sup> The president of one of the largest manufacturing concerns in central New York, employing in its many plants and departments engineers from practically every technical school of standing, was asked what he considered the best preliminary education for an engineer. His reply came back instantly, "One of the prerequisites for a broad-gauge engineer who will serve later as an executive is a thorough knowledge of Latin."

problem is the realization by industries of all sorts that the college trained men are, after two or three years of practical work, vastly superior to so-called graduates of the "school of experience." As a result of these conditions we have both the supply (incoming students) and the demand (forest industries) looking in the same direction. Our plan is to bring both supply and demand together to the improvement of the industries and the prolongation of our national timber supply by eliminating or reducing waste by better manufacture and more efficient distribution.

These are the conditions we are trying to meet. Those of us who were fortunate enough to attend the Madison conference realize that we are on the verge of tremendous expansion along technical lines. There is need for men who know about wood structure to take charge of timber preservation; to recommend the use of different kinds of wood to architect and consumer. Automobile, vehicle, and agricultural implement concerns need men who can handle a dry kiln. Paper and pulp concerns are now realizing that the technical men far surpass the rule of thumb paper maker after a year's practical training. It is axiomatic that, unless the industries drawing upon the forest for their raw product can manufacture and sell their products at a profit, we can not expect the practice of forestry by the private owner. Consequently, the introduction of technical men into the industries, increasing the efficiency of manufacture, adding to the effectiveness and economy of distribution, is part and parcel of the forest program and lays upon every school an obligation to meet that condition according to the needs of its own district.

This brings us to a further innovation which may seem heretical to some. We believe that the field of forestry not only includes (1) the production of the raw stock, (2) its utilization, or manufacture of the raw stock into its first stage, but also if the production and manufacture of forest products are to be carried on profitably, (3) they must be distributed with understanding and economy by men who know lumber, its structure, qualities, method of growth, distribution of species, etc. Consequently, we are looking forward to the time when we at Syracuse will prepare men for lumber salesmanship in order that such men, after an apprenticeship of 12 to 18 months with large manufacturing and selling concerns, will be able to recommend the use of wood which will best serve, and be able to distribute it against steel, concrete, beaver board, etc. If this be treason, make the most of it. Thus, to our minds, the field of forestry includes silviculture, lumbering, utilization, courses in paper and pulp manufacture, dry kiln engineering, etc., including courses in preparing men for lumber salesmanship; nor should recreational forestry and wild life specialization be omitted. In sum, any problem which pertains to the nonagricultural areas of our country must be handled by the forester, and adequate training should be provided along all lines. So much for our vision.

After much thought and counsel with wood users, we believe that there is, first, a need for as many men as we plan to turn out, and, secondly, that they should be trained in colleges of forestry rather than in engineering schools to serve as *apprentices* to forest industries at the end of four years. Their college training will enable them to learn the practical phases of paper making, lumber manufacture, seasoning or distribution of forest products, with far greater rapidity and thoroughness.

It is realized that four years is a short time in which to train men for a profession combining both engineering and economics, as forestry does. (However, Sheffield Scientific School has but recently increased its requirements from three to four years.) Our plan aims to give during the first two years a broad

scientific training, introducing as many cultural subjects as time will permit. If any man comes to us with advanced credits, he is by no means allowed to elect ahead of his class. Rather, he is urged to avail himself of the resources of the university, on whose campus we are located, and elect extra courses in English, history, economics, language, etc.

The subjects which might be considered a part of the forestry program during the first two years are silviculture, technology, and forest engineering. However, if a man finds during this time he has chosen the wrong profession or has misunderstood the demands which forestry makes upon him, the course is not too specialized to prevent his changing to engineering, agriculture, or a general science course in any university with practically no loss of time.

At the end of the second year men are compelled to spend three months in camp in the Adirondacks, surveying, cruising timber, making topographic maps, building trails and bridges. In short, a general course of training in field methods is given them by their instructors which is intended to round out the theoretical work they have been given during the first two years. It does more than that, it eliminates the weak vessels and gives the faculty a chance to size up each man, to know his possibilities and to determine what particular phase of the ever-broadening field of forestry each student is best suited for. At the end of this summer semester the men return to Syracuse, or in some cases drop out, having discovered that they are not the stuff that foresters are made of. If they come back they are then permitted to elect a group which will prepare them from a certain line of work. Certain subjects are common to every group, being the essentials of a general scientific and forestry education. In this selection the men are aided by instructors who have lived with them in camp for a period of three months and can assist in vocational guidance. This grouping of studies permits students to begin specialization during the third year in college, since they can elect, by choosing a certain group, three subjects in addition to the regular three subjects required. With the inauguration of our paper and pulp work it will probably be necessary to give extra work in chemistry and physics during the sophomore year which will cause a slight deviation from the above.

At the end of the junior year we have arranged a long vacation of five months. Every man is urged to secure a wood or mill job of some sort where he will work not under the eyes of his instructors, but under a regular boss who will demand full work for regular wages. As an instance of the increasing interest which forest industries are showing, it may be said that the placement committee last spring had over 600 positions open for 53 men, juniors and seniors, they were trying to locate. This list comprised only positions where some measure of technical forestry training was required. Seventeen different types of jobs were offered.

Upon his return to college at the end of the junior vacation, his general performance with his employer and his reputation as a technical man is ascertained. Increased opportunity is given for specialization during the senior year, the group which he has elected including only one subject common to all groups, the others varying according to the group selected.

Thus, at the end of the fourth year the men who have chosen to specialize are graduated with a degree indicating a training only in science—the B. S. degree. However, they may have received special training which will make them capable college-trained apprentices for the paper and pulp industries, dry kiln engineering, forest recreation experts, forest engineers, i. e., surveyors, topographic mappers, "growth sharks," etc., knowing something about wood, the basic raw material as an organic product, and having a scientific training

which will make future development certain. Those who have not chosen any particular group receive a training comparable to that which the silviculturalist received in most of our colleges during the past 10 years, and can either continue their studies, specializing during their graduate instruction, or shift for themselves after graduation, as many of our foresters have done in the past.

It goes without saying that after entering the employ of a forest industry additional study will be necessary. We point out to our men that if they wish to develop they should study while working, and that study along technical lines will be to their advantage. Men in the paper industry might take courses in mechanical or chemical engineering at a correspondence school, or even a return to college for a year or more of graduate work might be desirable after a couple of years' experience. Four years is too short a time to turn out the kind of apprentice forest industries are now demanding.

The type of men described above are what we call the four-year vocational men; they are the sergeants, corporals, and shavetail lieutenants of the forest industries—not research men. We appreciate the difficulty, yes, the impossibility, of turning out leaders of research in anything less than five to seven years. It seems that most of the men at the Madison conference failed to differentiate clearly between these two types of men. The four-year man, it goes without saying, is not adequately prepared to handle research as a general rule.

For the technical foresters of research temperament, again a maximum of cultural subjects if possible is recommended. This might necessitate for the holder of a B. A. degree two years' work for a master's degree in forestry and at least three years for a doctorate on account of the possible lack of fundamental sciences. Our largest steel plants and factories of all kinds are now seeing the need for research, and whether or not the Madison laboratories require many men of this type, development of forest industries, we believe, will make an ever larger demand for trained men who can solve the original problems which confront them.

#### SUMMARY OF RECOMMENDATIONS.

1. The ideal forester should possess the broadest fundamental training possible; a classical education if time and funds permit.
2. A condition and not a theory confronts us, since men of limited means, impatient to get to work, are each year entering our State institutions. As a State institution it is our problem to deal as justly by them as we can within the time at their disposal.
3. True forest conservation must provide for elimination or decrease of waste (utilization) as well as increased production (silviculture), and technically trained men are needed to effect these economies.
4. Industries owning and manufacturing forest products should be aided in the economical utilization and distribution of these products, since the practice of forestry by the private owner (four-fifths of our standing timber is privately owned) necessitates foregoing present profits, to be reinvested in timber crops for future harvests.
5. The forest schools have a duty to provide these industries with a better grade of employee, a man having a training in fundamental sciences with some specialization in order that improvements and economies in forest utilization may be effected, to the end that profits for future reinvestment in forestry properties, growing stock, etc., may be assured.

6. We should limit the group of technical foresters to men who have had at least one year of graduate instruction.

7. Leaders of research, men who add to the supply of knowledge which our growing profession requires, should be trained not less than five to seven years, and every school should always urge its best men to return for graduate work.

This is the goal toward which we are working, holding before us always the conception that the foresters of to-morrow, like those of yesterday, must not only be men of sound training but they must also be imbued with the lofty idealism and the spirit of service for which our profession is and always has been renowned.

F. F. MOON, *Chairman*

R. C. BRYANT.

J. A. FERGUSON.

W. B. HASTING.

#### DISCUSSION.

Several speakers emphasized the need for the forest schools to offer instruction to men who desired work along particular lines or in special subjects closely related to forestry which can be given better at a forest school than in a college of engineering. But it was clearly brought out that students taking only such work were not to be regarded as bona fide foresters. To be recognized as a forester, the student must satisfactorily pass at least the minimum amount of work that the school has set up.

It was further suggested that were the forest schools to be regarded more truly as professional schools than some now are, it would help to foster in the student the professional viewpoint. To this end the ideal forest school should be regarded not as a graduate school but rather as a school of applied science.

## REPORT OF THE COMMITTEE ON THE SCOPE AND CHARACTER OF TRAINING FOR SPECIALISTS IN FOREST PRODUCTS.<sup>1</sup>

A few words as to the origin of this committee may perhaps be helpful as an introduction to its report and recommendations. In January, 1920, Mr. Earle H. Clapp, assistant forester in charge of the branch of research of the Forest Service, raised with a number of forest schools the question as to the training of men planning to take up research or other work in the field of forest products. He pointed out that the experience of the Forest Service for the past 15 years, particularly at the Forest Products Laboratory at Madison, Wis., had shown that, while such men must be thoroughly trained in engineering or chemistry, their usefulness could be greatly increased by a thorough understanding of the fundamentals of forestry and their relation to the forest industries of the country, and suggested the possibility of working out cooperative courses for students in forestry and engineering which would provide a training of this sort. The interest manifested in this suggestion was so general that arrangements were made for the holding of an informal conference of foresters, engineers, and chemists at Madison on July 24, 1920, to discuss the entire question.

This conference endorsed the general principle that men desiring to specialize in forest products work should have, in addition to their basic training in engineering or the physical sciences, a thorough knowledge of wood as an organic product as well as a clear understanding of the fundamentals of forestry. It also arranged for the organization of a committee to go into the entire question in detail and to present a report with recommendations to this general conference on forest education. In order to cover the field as thoroughly as possible, the committee was composed of two professors of forestry, one from the East and one from the West, a professor of civil engineering, an engineer in industrial work, and a member of the Forest Service. While it has been impossible for the committee as a whole to hold any meetings, its members have secured suggestions bearing on its work from nearly a hundred individuals, including a wide representation of foresters, engineers, and chemists in the Forest Service, in educational circles, and in industrial life. These suggestions have proved most helpful and have been freely used in the preparation of this report.

Before taking up specifically the question of education the committee would like to express its emphatic belief in the need for technically trained men in the field of forest products. This applies not only to highly specialized research, whether conducted by public or private agencies, but to the wide variety of commercial operations involved in the handling of wood from the time it

<sup>1</sup>In connection with this report, attention is called to an article by Hugo Winkenwerder in the October, 1918, issue of the *Journal of Forestry*, entitled "Some Fundamental Problems in Forestry Education." Dean Winkenwerder is one of the first and most ardent advocates of the principle that it is as much the business of the forest schools to train men for work in forest and wood utilization as for work in forest production.

leaves the tree till it reaches the ultimate consumer. No one questions the need of technical knowledge in the production and use of steel or concrete; yet wood, being more complex, is more difficult to handle efficiently than either of these. It is inconceivable that the industries using wood, with their hundreds of millions of dollars of invested capital, will not turn more and more to technically trained men to handle the infinite number of problems connected with its most effective manufacture, utilization, and sale.

The industries themselves are just beginning to realize this need. Last fall, for example, Mr. Thomas D. Perry, vice president and general manager of the Grand Rapids Veneer Works, called attention to the need for technical information and technically trained men in a half dozen or more representative industries. Among other things he said:

It is doubtful whether any other major group of modern manufacturers gives evidence of less scientific knowledge of its products. \* \* \* A survey, no matter how superficial, would demonstrate that while the woodworker may not have needed the engineer in the past, he certainly needs him now. \* \* \* It follows, therefore, that if the woodworking industry and the engineering profession are to be of mutual benefit a broader aspect and a complete readjustment of attitude are necessary. \* \* \* The field for the engineer in woodworking is almost unlimited, but the development of such a new and untried line will take education, patience, and adaptability on the part of all who are vitally interested in the trades that employ so large a proportion of our citizens.

As a result of this address the American Society of Mechanical Engineers at its meeting in New York earlier this month, held a "forest products session" devoted to the woodworking phases of engineering.

Granting, then, the need for technically trained men in the wood-using industries, the question arises as to the particular form which this training should take. So far, both the Forest Service and the industries themselves have, perforce, turned to men trained primarily as engineers, chemists, or foresters, because no other type of man was available. These men have unquestionably rendered valuable service. In doing so, however, they have practically all been laboring under a distinct handicap, the engineers and chemists because they knew little or nothing of botany and forestry, the foresters because they knew too little of engineering and chemistry. In the judgment of this committee, what is needed is a technologist who knows trees and their products from the biological as well as from the engineering and chemical standpoint, and who is able to connect the industrial aspects of wood utilization with the fundamentals of forest practice and forest conservation.

Wood is an organic product. As such, a knowledge of its composition and structure, of the life processes by which it is produced and of the influence of environment on its physical, mechanical, and chemical properties is essential to its most efficient utilization. From an industrial standpoint, a knowledge of the commercial distribution of the important species of trees, of the effect of different methods of forest management on the character and quantity of material produced, and of the relation between the practice of forestry and the maintenance of an adequate supply of wood as a raw material is equally essential. From whatever angle one approaches the question he finds himself led sooner or later to the living tree and to the forest.

A few specific examples may help to make clearer this interrelation between the biological and physical sciences. Take, for example, timber seasoning. On the face of it this is an engineering problem involving simply the removal of water from the wood. The most elementary work, however, makes it apparent that the method by which this removal can be effected to best advantage depends to a very large degree on the structure of the wood, and this in turn

depends both on the kind of tree and the conditions under which it has been grown. Dendrology, plant physiology, and ecology are thus introduced as factors that can not be ignored. Why is it so much more difficult to dry the southern swamp oaks than the northern upland oaks? The answer is to be found in the field of biology fully as much as in physics or chemistry.

Or take the question of the mechanical properties of wood. We already know that these vary materially with the rate of growth of the tree. This rate of growth in turn depends on the forest conditions under which the tree has been grown, conditions which to a large extent can be controlled by human efforts. The engineer in timber mechanics is thus led at once into the field of silviculture.

Or take the question of decay in structural timbers, railroad ties, pulpwood, or wood pulp. How can one hope to understand or control this without a knowledge of plant physiology and pathology and of organic chemistry? Or take the production of naval stores. Is not a thorough understanding of the biological processes by which resin is produced, of the effect of chipping on these and other aspects of the tree's life, and of the relation between the character of the stand and the amount of resin flow fundamental to the development of efficient methods?

Even in so apparently remote a field as the production of ethyl alcohol from sawdust a knowledge of the processes by which that most wonderful of all laboratories, the living plant, converts one organic substance into another may play a more important part than we now think. The field is so vast and the possibilities so unlimited that we do not at present know enough even to ask intelligent questions regarding a thousand and one problems that will be formulated only by those trained in both the biological and physical sciences. And in whatever line such men may specialize they will find themselves materially helped by a general knowledge of the forest resources from which their raw material comes, of the methods by which these resources may be perpetuated, and of their place not only in individual industries but in the life of the nation as a whole. The point of view which embraces the forest as well as its products constitutes an asset not to be ignored.

The need for men of this type is as real in a wide variety of business positions as in public service. As one forester now in industrial work has expressed it:

The course should aim not only to prepare men for the forest products laboratory and other research but for lumber-sales engineers, creosote wood sales engineers, chemists in the employ of lumber associations, technical-service engineers, wood-using equipment installations and sales engineers, and the many other lines of work in which a technical knowledge of wood and forestry is of basic value. The field for such specialists has hardly been scratched. Hundreds of potential positions of this kind are simply waiting for the men to fill them.

The committee believes that this is by no means an exaggerated statement of the situation. The mere fact that the industries have not as yet demanded men whose technical training included both the biological and physical sciences and the broader aspects of forestry proves nothing but that they have not been available. It is only a question of time when the need, already felt by the Forest Service, will be recognized by the industries as well. How rapidly the present potential demand will develop into an actual demand is, of course, problematical. The committee believes, however, that if the training of such men is begun on a comparatively small scale, it will not be long before the demand for them will considerably exceed the supply. The conclusion seems inescapable that as soon as they prove their worth they will be preferred to those less well equipped for the work at equally good if not better salaries.

The point has been raised that it is already possible for any one who is willing to spend the time and money to obtain an education in practically any combination of subjects that he desires; in other words, that if a man wishes to become proficient in engineering, chemistry, botany, and forestry, the courses to enable him to do this are already in existence. To a considerable extent this is true. Theoretically, any man can, if he desires, take a complete course in mechanical or civil or electrical or chemical engineering, and follow this up by a complete course in forestry, or vice versa. Practically few men have the time or money to take any such combination, while those who have are usually unwilling to make an expenditure which will not apparently yield a corresponding increase in financial remuneration immediately upon graduation. A further difficulty is that many of the courses would not be presented in such an order or such a way as to give the student the best preparation for his subsequent work, and that comparatively little advanced instruction can now be obtained in such specific subjects as kiln drying, wood preservation, timber testing, wood distillation, etc. There appears, therefore, to be as ample justification for the introduction of special courses for the training of men to enter the field of forest products as there was for special courses in such fields as chemical engineering, sanitary engineering, and electrical-railway engineering, all of which are of comparatively recent origin.

The committee feels that the ideal training for any professional man is a four-year course in the liberal arts followed by as many years of specialization as may be needed to train him for work in his chosen field. Such a combination gives a breadth of view and a background for a man's professional work and other activities that can be obtained in no other way. The committee recognizes, however, that this ideal is impossible of general accomplishment, and that the demand both on the part of industry and of the students themselves for a preparation that will enable them to take up their professional work in the shortest possible time makes it necessary to offer opportunity for early specialization. The committee therefore recommends the inauguration of courses which will enable a man to complete the necessary foundation work in four years and to do a certain amount of specialization in the fifth year. In doing so, however, it wishes it clearly understood that it does not regard it as possible to turn out a thoroughly trained specialist in five years, and that it believes at least one or two years of additional graduate work to be necessary for this purpose.

The committee believes that the essential basis for an adequate course in forest products consists of a thorough training in the fundamental sciences of mathematics, physics, chemistry, and botany. With these as a foundation their practical application to specific problems is comparatively easy. Some training in the more directly applicable of the applied sciences is, of course, highly desirable and even essential. As a general rule, however, it is more important for the student to know why rather than merely how; principles are more valuable than isolated facts. On the other hand, these principles should not be taught in the abstract, but should be given life and interest by teaching them so far as possible with special reference to the student's future activities.

Fundamental work in the pure sciences should be concentrated in the first two years and largely completed by the end of the third year. It should be followed and to some extent accompanied in the third and fourth years by work in the applied sciences such as steam and gas power, electrical engineering, machine design, forest mensuration, chemical technology, wood distillation, timber testing, etc. Then in the fifth and subsequent years opportunity should be afforded for advanced work in the particular field which the student plans

to enter, as, for example, in the mechanical properties of wood, the seasoning of timber, the chemistry of cellulose compounds, etc.<sup>2</sup>

In accordance with this general outline, the committee presents tentative curricula of possible courses for the training of engineers and chemists in forest products, not because it anticipates that such curricula will be followed in toto by any institution but as indicative of the ground which it feels should be covered. It realizes perfectly that in the inauguration of work of this sort different institutions will go at it from different points of view, and will desire both to cover somewhat different ground and to cover the same ground in a different way from that suggested. The committee is under no illusion as to the perfection of the suggested courses and believes that in the formative stage of instruction along this particular line rigid standardization is neither desirable nor possible.

With this general statement as to the purpose of the curricula a brief explanation of the reasons for the inclusion or exclusion of certain subjects may be in order. Entrance requirements are included primarily to show the ground assumed to have been covered in the preparatory school as a basis for the college courses prescribed. Those indicated have been selected as representing approximately the present average in spite of the fact that the committee feels that they are rather low and could well be strengthened by the addition of from one to two extra units each in science and mathematics, particularly chemistry, biology, botany, advanced algebra, and trigonometry. If this were done, the two units of foreign language might perhaps be omitted, particularly in view of the fact that they are not to be followed up in college. On the other hand, the very fact that cultural subjects are practically excluded from the college course may make it desirable to require some preparatory school training in them.

Lack of available time has made it necessary to omit such subjects as English literature, logic, modern language, history, sociology, psychology, and philosophy in spite of their obvious cultural, and even professional, value. Acquaintance with the foreign literature pertaining to an individual's particular field will have to be maintained through abstracts and through general or special translations. The committee regards these omissions as a distinct weakness and suggests that students presenting advance credits be encouraged, if not required, to elect cultural subjects such as those mentioned, rather than additional technical work. It regrets very much that it was not able to find room for a third or fourth year course in report writing, including the analysis, preparation, and presentation of data, and urges that special attention be given to these subjects, in which most technical men are weak, in connection with other courses.

The introductory lectures are intended to acquaint the student with the broad fields of engineering, chemistry, and forestry, and to give some idea of

<sup>2</sup>In connection with this paragraph Dr. Hatt comments as follows: "While the traditional curriculum provides for the so-called fundamental subjects for the first two years, which are mathematics, physics, and chemistry, there is a growing belief on the part of educators that the student should be introduced to concrete engineering problems during his first two years, and that a greater power in the use of these fundamental sciences will be gained when they are associated with simple engineering projects. Such evidence as we have shows this device to be of value.

"There is a tendency also to distinguish between the training of the designer of bridges or machines and the constructor or operator. The first group will be given a wider and more thorough training in analysis and pure science. The latter will take less of abstract studies and more work in the college of commerce and business, in the study of shop management, etc."

the location, abundance, and importance of the raw materials on which these are based. Elementary surveying has been included in spite of the fact that the work of forest products technologists will ordinarily be indoors, because of the fact that some knowledge of the use of surveying instruments and surveying practice may be of direct value in connection with their regular work. Manual training in the form of wood work, forge, and machine shop is suggested both to train the students to use their hands and to give them through actual contact a first-hand knowledge of some of the more important tools of their profession. Enough of the practice of forestry has been included to enable the technologist to connect wood and other forest products with the growing forest and with the general principles of forest conservation. The principles of political economy and their practical application in industrial organization and management have been included to enable the technologist to correlate his technical specialty with economic conditions and to rise to administrative positions obviously requiring a knowledge of such matters. In the committee's judgment a clear understanding of the principles of economics and of their practical application in business life is almost as essential for the successful engineer or chemist in forest products as a thorough technical knowledge of his specialty.

The value of the other subjects included, because of their direct bearing in the field of forest products, is believed to be self-evident. The number of hours which should be devoted to each subject is, of course, a highly debatable point, and the committee's suggestions in this respect are decidedly tentative. It will be noted that the total number suggested (144 in four years) coincides very closely to that proposed by the committees on undergraduate and graduate courses in forestry.

The tremendous amount of ground to be covered has made it impossible to offer any opportunity for a choice of electives during the first four years. Beginning with the third year, however, two slightly divergent branches are suggested, depending on whether the individual desires to specialize in the engineering or the chemical end of the work. This specialization will naturally be still more marked in the fifth and subsequent years, during which the man should devote his time to advanced work in the particular field he plans to enter. It is also possible that those showing special aptitude early in the course might, with the consent of their faculty adviser, be allowed some choice of subjects prior to this time. The first two years are the same for both lines of work (engineering and chemical), and have been made to agree as nearly as practicable with the courses most commonly required of students in the various schools of engineering, science, and forestry. This will give the student a substantial foundation for almost any line of technical work, and at the same time will facilitate changing his course should he decide later that he prefers to enter some other line.

At this point the committee desires to emphasize again the importance of the fifth year for those who aspire to leadership in either the scientific or business world. This is particularly true in the field of research, for leadership in which the completion of work leading to the degree of doctor of philosophy is highly desirable. And for those who can spare the time, additional collegiate work in the liberal arts is decidedly worth while. The committee recommends as an excellent combination a four-year course leading to the degree of bachelor of arts, so arranged as to include at least the first two years of the special course suggested and followed by the remaining two years of technical work leading to the degree of bachelor of science.

One difficulty in the introduction of a special course in forest products will be the tendency to construct it out of a combination of the courses already in-

existence. To a certain extent this will undoubtedly be necessary. Most of the courses in pure science, for the present at least, will probably have to be taken in substantially their present form, although it would be highly desirable and in some cases may prove possible to give them with special reference to the student's future work. In the applied sciences this should prove still more feasible and the bulk of the work should have some direct bearing on the field of forest products. Thus in the study of engineering materials special attention should be paid to wood rather than to steel or concrete; in machine design to sawmill and woodworking machinery; in forest mensuration to the measurement of logs, cordwood, and standing trees rather than to stem analysis and the preparation of yield tables, etc. In some cases new courses will undoubtedly have to be introduced. An example of this is the so-called course in the "Practice of forestry," the aim of which is to give the engineer or chemist in forest products a bird's-eye view of the more essential features of silviculture, forest management, forest valuation, and forest regulation.

As education in the field of forest products develops and becomes more firmly established, the natural evolution will be toward modifications looking to the inclusion of essentials and the elimination of nonessentials. Short cuts will undoubtedly be devised, new courses will be added or substituted for old ones, and the weak spots in existing courses will be strengthened. The underlying principle should be to have each subject taught, not as an end in itself, but as an integral part of a homogeneous course aimed to give the student the best possible equipment in the time available for a specific field of work. To do this effectively the instructor should have not only a thorough technical knowledge of the fundamental and applied sciences pertaining to his particular subject, but at the same time the necessary point of view. Such men are at present comparatively rare, and it may be some time before any considerable number of thoroughly competent instructors will be available.

In this connection the committee would like to emphasize the desirability of enlisting the student's interest and giving him the right point of view from the very beginning of this course. To a considerable extent this can be done by extra curriculum activities, such as the organization of student clubs and the giving of special lectures by foresters, engineers, chemists, business men, and others of prominence and reputation in their respective fields. Such activities can well be made to play an important and helpful part in the student's training.

These suggestions constitute the broad outlines of the scope and character of special courses for the training of technologists in the field of forest products. Who should take the leadership in securing their introduction? In the judgment of the committee this is a duty which devolves primarily upon the foresters and forest schools of the country. Careful analysis of the proposed courses will show that they contain many subjects quite foreign to the curricula of the engineering schools, such as botany, plant physiology, tree diseases and injuries, and forest mensuration. Such subjects as silvics, wood technology, engineering mechanics, and practice of forestry are equally foreign to the colleges of science. On the other hand, hardly a subject is included which is not already required or might logically be required by some forest school. Practically all of the forest schools now give at least elementary instruction in such subjects as timber tests, kiln drying, wood distillation, and wood preservation. A good deal of engineering and chemistry is already required by those offering advanced work in these lines and in logging engineering. To require such additional instruction in these fields as might be necessary would be but a step, and would be wholly in line with the development of forest education.

From still another angle leadership in the matter falls upon the foresters. Forestry as a profession aims primarily at the conservation and perpetuation of our forest resources. In attaining this end it must take into account three distinct but closely related fields of activity—(1) raising the forest crop (silviculture and forest management), (2) harvesting the forest crop (lumbering and logging engineering), and (3) utilizing the forest crop (wood utilization). Underlying all three is forest economics. The way in which each of these fields is handled reacts directly upon the effectiveness with which our forests are used and must necessarily be a matter of concern to the forester. So far foresters have interested themselves in these activities in approximately the order named. The production of the forest crop for a time absorbed practically their entire attention. Then they became interested in its harvesting and turned to the technically trained logging engineer. Now their attention is being attracted more and more to its utilization, with an increasing realization that the way in which this is handled has a very direct bearing on forest conservation. Furthermore, the very fact that wood is an organic product and that its utilization is closely connected with its production and its harvesting make it highly desirable that men working in the field of forest products should have the forester's point of view, which can of course be secured to best advantage if the leadership in their training is taken by the forest schools.

Obviously this does not mean that all of the work must be given in departments or schools of forestry. Even those forest schools which go furthest in this direction do not attempt to give all of the required subjects. In the judgment of the committee the exact amount of work which should be given in the various departments or colleges is a matter to be worked out locally. In some cases a considerable number of subjects, such as mathematics, physics, chemistry, engineering, mechanics, machine design, steam and gas power, etc., can undoubtedly be given to best advantage in the colleges of engineering or science, while the work in wood identification and structure, tree diseases and injuries, forest mensuration, the practice of forestry, timber seasoning, wood preservation, wood distillation, etc., would naturally be given in the forest schools. In other cases the forest schools themselves may desire to go somewhat further than this. The important point is that the work should be developed under the leadership of the forest schools in as close cooperation with the other colleges as local conditions make desirable.

The committee feels that it is also important that the work should be undertaken at first at a comparatively small number of institutions having strong staffs in both forestry and engineering. It is obviously not within the province of the committee to suggest what institutions these should be. It does, however, wish to emphasize the fact that in its judgment there is danger in having the work undertaken too generally and by schools not thoroughly equipped to handle it. After it is once well under way at a few institutions and the best lines of development have been indicated by actual experience, it can be extended to others as rapidly as the need for additional men becomes apparent. This raises the entire question of promoting economy and efficiency in forest education by having different schools specialize along different lines.

The question as to the degree or degrees which should be granted men with this sort of training seems to the committee of comparatively minor importance at this time. At the end of four years the degree of B. S. would seem to be appropriate. At the end of five years there are several possibilities. Among these may be mentioned master of science in engineering, in chemistry, or in forestry, engineer in forest products, chemist in forest products, and master of

forestry. Some have suggested the advisability of granting no degree at the end of four years in order to provide an additional incentive for men to stay through the fifth year. The creation of new degrees has also been suggested, and the committee sees no objection to this if the institutions at which the work is given feel that at present they have no degree sufficiently descriptive of the training secured to be satisfactory.

Whatever degree may be decided on, the committee feels that men with such a training as it has suggested would be qualified to handle the great bulk of the problems encountered in the field of wood utilization, whether in private industry, in educational institutions, or in public service. At the same time it recognizes the fact that there will be occasional problems requiring the services of technical men in allied fields, such as mechanical engineering and organic chemistry. Such problems will, however, be the exception rather than the rule. In this connection the committee expresses the hope that the Forest Service will encourage the development of courses along the lines indicated by giving preference in civil-service examinations, through the rating of training and experience, to men with the combined training suggested.

Much hard work must be done before such courses can be satisfactorily formulated and effectively given. The committee realizes only too well that it has made little more than a beginning and that the suggestions which it has been able to offer are far from the last word on the subject. If they stimulate and point the way to further action, they will have served their purpose. Comprehensive and thoroughgoing studies must still be made of the precise duties and requisite qualifications of men in forest products work. The particular combination of subjects best suited for the preparation of such men must be determined. Innumerable practical details in the introduction of new courses, the modification of old ones, and the construction of new curricula must be worked out. This is primarily a task for the forest schools. It is, however, one in which the profession as a whole can be of material assistance. The committee, therefore, recommends the appointment by the Society of American Foresters of a committee to continue the work which it has begun. This committee, in which representatives of the forest schools should, of course, play a prominent part, could render a real service by conducting further investigations, making specific recommendations, and cooperating with educational institutions in formulating and securing the introduction of such curricula as may be deemed advisable.

In conclusion, the committee desires to emphasize the following points:

1. That there is a very large and as yet undeveloped field for the employment of technically trained men in the utilization of forest products.
2. That these men should have a thorough fundamental training in mathematics, physics, chemistry, and botany as a basis for later specialization in any given line, together with sufficient forestry to give them the forester's point of view.
3. That the special four-year curricula suggested should, if possible, be preceded by collegiate work in the liberal arts and followed by graduate work in the individual's chosen field.
4. That the forest schools, in cooperation with schools of engineering and science, should take the leadership in securing the introduction of such curricula.
5. That at the outset the work should be undertaken at comparatively few institutions and extended later as the opportunities and demand for such men become more apparent.

8. That the Society of American Foresters should appoint a committee to consider more fully such questions as the need and opportunities for men of this type, their precise duties and qualifications, the exact ground which should be covered in their training, and ways and means of providing adequate opportunities for such training.

S. T. DANA, *chairman*,  
W. K. HATT,  
R. S. HOSMER,  
C. E. PAUL,  
HUGO WINKENWERDER.

### SUGGESTED COURSES FOR THE TRAINING OF ENGINEERS AND CHEMISTS IN FOREST PRODUCTS.

#### Entrance Requirements for Engineers and Chemists.

Required:	Units.	Optional:	Units.
English.....	3	Advanced algebra.....	1
French or German (both units in same language).....	2	Biology, botany, or chemistry.....	1
History.....	1	Cities and American Govern- ment.....	1-1
Algebra.....	1	Drawing.....	1-1
Plane geometry.....	1	Economics.....	1-1
Solid geometry.....	1	English.....	1
Physics.....	1	French, German, Spanish, or Greek.....	1-3
Total.....	10	History.....	1-3
		Latin.....	1-4
		Physical geography, geology, zoology, or physiology.....	1-1
		Trigonometry.....	1-1
		Vocational, industrial, or com- mercial subjects.....	1-3
		In all.....	5

#### College Curriculum for Engineers.

##### FIRST YEAR.

FIRST SEMESTER.	Hours.	SECOND SEMESTER.	Hours.
English (1) <sup>1</sup> .....	3	English (1).....	3
Advanced algebra and trigonometry (3).....	4	Analytic geometry (4).....	3
Chemistry (10).....	3	Chemistry (10).....	3
Botany (29).....	3	Botany (29).....	3
Drawing (6).....	3	Drawing (6).....	3
Wood work (8).....	2	Forge shop (9).....	1
		Introductory lectures (2).....	2
	18		18

##### SECOND YEAR.

Differential calculus (5).....	3	Integral calculus (5).....	3
Physics (18).....	3	Physics (18).....	3
Physics laboratory (19).....	2	Physics laboratory (19).....	2
Qualitative analysis (11).....	4	Quantitative analysis (12).....	4
Plant physiology (30).....	3	Silvics (32).....	3
Dendrology and forest distribution (81).....	3	Elementary surveying (7).....	3
	18		18

<sup>1</sup> Numbers in parentheses refer to the accompanying description of courses.



## EDUCATION IN FORESTRY.

Between the second and the third year each student is required to spend at least 10 weeks in some kind of woods work, as, for example, at a logging operation, at a summer forestry camp, or in timber reconnaissance or similar work with the United States Forest Service or other forest organization.

## THIRD YEAR.

FIRST SEMESTER.		SECOND SEMESTER.	
	Hours.		Hours.
Engineering mechanics (21).....	4	Engineering mechanics (21).....	4
Mechanical laboratory (22).....	1	Mechanical laboratory (22).....	1
Organic chemistry (13).....	3	Organic chemistry (13).....	3
Organic synthesis and analysis (14).....	2	Organic synthesis and analysis (14).....	2
Plant pathology (33).....	3	Tree diseases and injuries (31).....	4
Wood technology (35).....	4	Wood technology (35).....	4
	17		18

Between the third and the fourth year each student is required to spend at least 10 weeks in connection with one or more wood-using industries employing chemical processes.

## FOURTH YEAR.

FIRST SEMESTER.		SECOND SEMESTER.	
	Hour.		Hour.
Economics (39).....	3	Economics (39).....	3
Practice of forestry (37).....	3	Industrial organization and administration (40).....	3
Physical chemistry (15).....	3	Physical chemistry (15).....	3
Chemical technology (16).....	4	Electrical engineering (26).....	3
Forest mensuration (36).....	2	Industrial analysis (17).....	3
Lumbering and wood-using industries (38).....	3	Wood-using industries (38).....	3
	18		18

## FIFTH YEAR.

Advanced work, chiefly elective, along such lines as—

- Derived products,
- Wood preservation,
- Cellulose chemistry,
- Biochemistry,
- Physical organic chemistry,
- Chemical industries,

and including regular seminar work and the preparation of a thesis.

## OTHER GRADUATE WORK.

To include research along the specific lines in which the individual student desires to specialize.

*Brief description of courses.*

1. *English*.—Composition, rhetoric, and general literature, with particular emphasis on the clear and logical presentation of facts and ideas. (E and C, I, 1 and 2.)
2. *Introductory lectures*.—A general survey of the fields of engineering, chemistry, and forestry, indicating briefly the character of work, opportunities open, kind, extent, and distribution of the principal raw materials used, etc. (E and C, I, 2.)
3. *Advanced algebra and trigonometry*.—College algebra beyond quadratics; plane trigonometry. (E and C, I, 1.)

\* Letters and numbers in parentheses following each course indicate whether it is for engineers or chemists (or both), and the year and semester in which it is given. Thus, E and C, I, 1 and 2 indicate that the course is for both engineers and chemists and that it is given in the first year, first and second semesters; C, IV, 1, that the course is for chemists and is given in the fourth year, first semester, etc.

4. *Analytic geometry*.—Plane and solid analytic geometry. (E and C, I, 2.)
5. *Calculus, differential and integral*.—Principles of differential and integral calculus applied to functions of one and several variables. (E and C, II, 1 and 2.)
6. *Drawing, lettering, mechanical drawing, free-hand drawing, and machine sketching*. (E and C, I, 1 and 2.)
7. *Elementary surveying*.—Use of surveying instruments; fundamental surveying methods; measurement of lines, angles, and areas. (E and C, II, 2.)
8. *Woodwork*.—Use and care of bench and lathe tools, and of woodworking machinery; preliminary exercises in pattern making, joinery, and cabinet work. (E and C, I, 1.)
9. *Iron shop*.—Forging, welding, tool dressing, tempering, etc. (E and C, I, 2.)
10. *Chemistry*.—General theory; classification and properties of nonmetals, metals, and their compounds. (E and C, I, 1 and 2.)
11. *Qualitative analysis*.—Principles and practice of qualitative analysis. (E and C, II, 1.)
12. *Quantitative analysis*.—Gravimetric and volumetric determinations, including electrolytic methods and the calibration of weights and volumetric apparatus. (E and C, II, 2.)
13. *Organic chemistry*.—Composition and characteristics of the principal classes of organic compounds, with emphasis upon class reactions and structural theory, and with special reference to wood and other forest products. (E and C, III, 1 and 2.)
14. *Organic synthesis and analysis*.—Preparation and analysis of typical organic compounds. (C, III, 1 and 2.)
15. *Physical chemistry*.—Constitution and structure of matter; general properties of gases, liquids, and solids; phenomena of solutions; colloids; electrochemistry; thermochemistry. (C, IV, 1 and 2.)
16. *Chemical technology*.—Application of chemical and physical principles to problems of chemical manufacture, together with the principles of standard types of machinery and apparatus used by the chemical industries. (C, IV, 1.)
17. *Industrial analysis*.—Analysis of a variety of materials in common industrial use, with emphasis on the significance of procedure and results. (C, IV, 2.)
18. *Physics*.—Fundamental principles of gravitation, heat, light, sound, mechanics, magnetism and electricity. (E and C, II, 1 and 2.)
19. *Physics laboratory*.—Physical measurements and experiments in the fields covered by Course 18. (E and C, II, 1 and 2.)
20. *Engineering mechanics*.—Theoretical and applied mechanics, including fundamental concepts and general principles of equilibrium and motion; statics, kinetics, and mechanics of materials; application of principles and methods to engineering problems. (E and C, III, 1 and 2.)
21. *Mechanical laboratory*.—Experiments on engines, turbines, pumps, boilers, and other machines; shop practice on the drill, lathe, planer, and other standard machine tools. (E and C, III, 1 and 2.)
22. *Steam and gas power*.—A general study of steam and gas power plants and equipment; relative costs and advantages of different types and sizes of machinery; combustion, handling, and storage of fuels used in power plants. (E, III, 1.)
23. *Machine design*.—Design of machines and machine parts, including advanced drawing, and with particular reference to sawmill and woodworking machinery. (E, IV, 1.)
24. *Hydraulics*.—Hydrostatics and hydrodynamics, including water pressure, water flow, friction, etc. (E, IV, 1.)
25. *Masonry construction*.—Principles and design of masonry structures, including the properties of concrete and reinforced concrete. (E, IV, 1.)
26. *Electrical engineering*.—Essentials of electrical engineering, including the generation, transmission, and application of electrical power. This and Course 22 together cover the subject of prime movers. (E and C, IV, 2.)
27. *Engineering materials*.—Properties and requirements for materials, particularly wood, used in engineering construction; effect of methods of manufacture upon the quality of the material; specifications and standard tests used to secure acceptable grades of material. (E, IV, 2.)
28. *Structural design*.—Computation of stresses; design of columns, beams, and girders; building laws and specifications. (E, IV, 2.)
29. *Botany*.—Studies of the form, structure, life processes, and (briefly) classification of the principal groups of plant life. (E and C, I, 1 and 2.)

30. *Plant physiology*.—Absorption, nutrition, growth, and reproduction, with special reference to woody plants. (E and C, II, 1.)
31. *Dendrology and forest distribution*.—Identification, classification, and distribution of trees and shrubs, with special reference to those of commercial importance. (E and C, II, 1.)
32. *Silvics*.—Relation between trees and forests and their environment; life history of the forest; silvical characteristics of the more important timber trees and types. (E and C, II, 2.)
33. *Plant pathology*.—Nature, cause, and control of plant diseases, with special reference to diseases of trees. (E and C, III, 1.)
34. *Tree diseases and injuries*.—Detection, prevention, and eradication of tree diseases and wood decay; relation between decay and such processes as air drying, kiln drying, gluing, painting, creosoting, etc.; effect of fire, insects, lightning, wind, frost, etc., on trees and their products. (E and C, III, 2.)
35. *Wood technology*.—Gross and microscopic structure and physical, chemical and mechanical properties of wood, with special reference to its identification and uses, and including a consideration of defects. (E and C, III, 1 and 2.)
36. *Forest mensuration*.—Form and content of trees and logs, with special reference to the measurement of standing timber and of logs, cordwood, and other forest products. (E, III, 2; C, IV, 1.)
37. *Practice of forestry*.—Place of forestry in the life of a nation; elementary principles and practice of fire protection, silviculture, forest management, forest organization, and forest administration. (E and C, IV, 1.)
38. *Lumbering and wood-using industries*.—Brief survey of the methods of logging and milling in the principal forest regions of the United States, including grading rules; consideration of the principal wood-using industries, with special reference to their economic importance, woods used, and methods of operation. (E and C, IV, 1 and 2.)
39. *Economics*.—General principles of economics, including production of wealth, business organization, value and price, money and banking, trade and commerce, distribution, labor problems, transportation, public finance, etc. (E and C, IV, 1 and 2.)
40. *Industrial organization and administration*.—Modern methods of industrial organization, administration, and production, including such factors as methods of planning work and insuring production, administrative reports, time-keeping and cost-finding systems, plant location and arrangement, etc. (E and C, IV, 2.)

## COMMENTS BY DEAN WINKENWERDER.

In connection with the curricula I want to go on record with reference to the following points:

(a) I believe the committee should make a distinction between the type of individual that will become primarily a research man (either in the Government service or in the industries) and the type that will enter the industrial field with a view to working into the administrative or business end of the industry. This distinction can readily be made by adopting the elective system. The demand for men trained in forest products will be many times greater in the latter than in the former field. The curricula as presented are, to my mind, arranged primarily for training research men.

(b) The Elective System. The modern method in education is the elective system. In technical courses such as these, a system that prescribes certain fundamentals and ends with advanced, highly specialized work, admission to which is guarded by carefully selected prerequisites, has many advantages. It opens up a wide field for specialization in that it can be adjusted to meet any specific needs; yet keeps the curriculum simple and makes it easy to administer. Fundamental courses will serve as general prerequisites and breadth of training. The prerequisites to the advanced courses will lend purpose and direction to the work of the student and prevent him from dissipating his energies over a large number of unrelated subjects. The final advanced courses, if properly organized, will tie in the theoretical work with the actual work the graduate will be called upon to do when he leaves the university. In courses acknowledged by the committee to be merely suggestive and which will need to be modified from time to time as we learn more specifically the nature of the

work to be done by the graduate, it would certainly seem that the elective system would lend itself far better to the conditions than a definitely prescribed curriculum.

(c) It is now quite generally conceded among educators that the five-year curriculum is not working out satisfactorily, because the majority of students will not stay five years. This means that much of the work will have to be complete in and of itself, i. e., we shall have to prepare the student to fit into some definite job at the end of his fourth year, and this will be possible for many of the industrial jobs. This will mean that a great deal of the work scheduled for the fifth year, particularly in the engineering course, will need to be given to the undergraduates.

#### DISCUSSION OF THE REPORT ON THE SCOPE AND CHARACTER OF TRAINING FOR SPECIALISTS IN FOREST PRODUCTS.

Prof. R. F. Brann, of the University of Maine, outlined the work done at that institution to train men for the pulp and paper industry; the graduate is a chemical engineer with a general knowledge of forestry.

Dean Toumey pointed out the danger that courses on specific details and technique tended to make the student an artisan and to get away from the ideal of what a fundamental education should be. Proper training should ground the student in fundamentals and develop in him the power of philosophical reasoning.

Mr. C. P. Winslow, of the Forest Products Laboratory, Madison, Wis., emphasized the point made by Dean Toumey. If a man specializes too intensively as an undergraduate, he may find later that his interests lie in a different direction; a broader and more fundamental training is of greater value. This has been proved to be true at the Forest Products Laboratory. There is an increasing demand and good field for men that might be called forest-products engineers. But to get the necessary training takes more than four years. One trouble at the laboratory has been to get men from college who have both the fundamental background, plus knowledge of some particular branch, like chemistry. Many men have had to get this after coming to Madison. The demand at the laboratory is not great enough to justify the forest schools in developing men for that work alone, but there is a demand for such men in the industries. The forest schools are in a position to meet this need. The important thing is to establish a good four-year undergraduate course on which those who wish to go on for further study can base specialized work in one or more particular lines. Such well-grounded men will be able to progress satisfactorily in a variety of wood-working industries.

In answer to a question as to what salary such a man might expect (with regard to its bearing on inducing him to remain longer at college), Mr. Winslow replied that generally the graduate is looked upon as an untried man and is paid accordingly. Men who have had training subsequent to college may get \$3,000 to \$4,000, with an arrangement for a bonus on the sales that they increase. If such men can develop the industry, they are apt to rise fast. One man of 28, five years out of college—two and a half at the laboratory and an equal time in educational work—went to a commercial company at a salary of \$5,000. The minimum salaries that are offered men who have been at the laboratory two or three years range around \$3,000 up to \$6,000 or \$7,000.

Profs. Moon and Hosmer both emphasize the point that there was need for two types of men: (1) The man who had had four or five years at college and begins as an apprentice, as it were, developing his vocation while learning the industry; and (2) the man of research type who, after five to seven years of college work, emerges as a highly trained specialist. The schools can provide definite courses for the first type; for the latter it is a question of individual graduate study.

## REPORT OF THE COMMITTEE ON THE FIELD AND SCOPE OF VOCATIONAL TRAINING IN FORESTRY.

This report is presented in two parts. The first, dealing with vocational education in forestry in a more general way, was prepared by the chairman of the committee, Prof. James B. Berry. The second part, dealing with ranger schools, was prepared by Prof. E. A. Ziegler.

### Part I. VOCATIONAL EDUCATION IN FORESTRY.

Vocational forestry is differentiated from professional forestry by extent of training rather than kind of subject matter. In general, the positions which are more intimately concerned with "doing"—with the carrying out of certain operations involving skills—are classed as vocational. In a broad sense, however, the term includes practically all of the so-called professional occupations. There is, then, no hard and fast line separating vocational from professional forestry.

The field of vocational education in forestry includes five lines of preparation, all of which may be promoted under the vocational education act (Smith-Hughes) of 1917. Briefly, these are as follows:

1. **Farm-woodlot manager.** Here forestry enters as an adjunct to farming and becomes one of several farm enterprises. Not infrequently the subject of woodland forestry will be handled as a phase of horticulture, especially as regards ornamental planting, windbreaks, care of shade trees, tree surgery, and nursery practices. The fact must be continually borne in mind that vocational training in agriculture is the object of this course of study, and the subject of forestry enters on the same basis as field crops, animal production, fruit growing, and farm shop. The course of training may extend over a period of four years or less. It should include six months of supervised farm practice.

2. **Forest ranger (Federal and State civil service).** This phase of vocational forestry involves training in many of the skills of civil engineering, silviculture, lumbering, live-stock growing, elementary law, fish and game protection and propagation, etc. In general, these positions are filled by graduates of professional and semiprofessional schools. Several hundred vacancies occur each year, and there is a growing demand for a limited number of vocational forestry departments in secondary schools for the preparation of rangers. The period of training may consist of four years or less. This course may be on a basis of four months of supervised work or alternate days or weeks devoted to supervised practice.

3. **Straw bosses for woods operations.** The course of training is quite similar to that offered for the preparation of foremen in industry. In addition to technical knowledge and skills there is involved ability to handle men. The subjects taught include certain skills in surveying, mechanics, lumbering, handling live stock, etc. On operation there are certain men who, with a short, intensive course of training, will develop into efficient foremen. In general, this course may be offered in evening classes.

4. **Skilled workers (sawyers, etc.) in sawmills, planing mills, handle factories, wood-pulp mills, tie pickling plants, and similar establishments.** In this

case the course of training is more concerned with technical knowledge; skills are acquired in the ordinary course of the day's work. The instruction is highly specialized and varies for each industry. In general, there is a place for evening classes in connection with every large wood-using industrial plant.

5. Skilled workers in tree surgery, forest nurseries, woodland and estate management, city forestry, and similar positions. The type of instruction varies for the position and covers both technical information and the acquiring of skills. Frequently indeed the question of skills will be important. Ordinarily such training does not involve the development of managerial ability, such as is required in a foreman. A short, intensive period of training, such as was developed by the War Department, will prove most successful. Alternate days or weeks should be devoted to supervised practice.

#### ORGANIZATION OF VOCATIONAL EDUCATION UNDER THE ACT OF 1917.

The administration of the Vocational Education Act (Smith-Hughes, 1917) is placed in the hands of a Federal Board of Vocational Education (which is composed of seven members—the Secretaries of Agriculture, Labor, and Commerce, the Commissioner of Education, and three lay members representing labor, agriculture, and industry) and State boards designated by the legislative bodies of the respective States. In general, the State board of education has been so designated and the State superintendent of education appointed executive official for vocational education. In many States an assistant to the State superintendent is designated director of vocational education and the responsibility for administering the act in the State is delegated to this official. The State director is assisted by assistant directors and supervisors in the various fields of vocational training.

The requirements of the vocational educational act are:

1. The instruction must be under public supervision and control.
2. It must be adapted to the needs of persons of 14 years of age and over.
3. It must be of less than college grade.
4. The instruction in agriculture must include six months of supervised practice.
5. The instruction in trades and industries must include one-half time devoted to practice work on a productive basis.

According to the 1920 report of the Federal board there are at present in the United States 3,155 vocational schools and departments taking advantage of the provisions of the vocational education act, of which 1,375 are in agriculture, 700 in home economics, 758 in trades and industries, and 322 continuation.

While the subject of forestry is not mentioned specifically in the act, the interpretation of the Federal board is that productive forestry (silviculture) is a part of agriculture, and forest utilization a part of the field of trades and industries. Much may be judged from the basis of apportionment: if the workers of the particular industry are numbered as "rural" by the United States Census, the presumption is that the industry is rural in nature and may be classified as agricultural. The fact that forestry appears in both fields necessitates a discussion of the possible development of vocational forestry in each field.

#### FORESTRY IN VOCATIONAL AGRICULTURAL SCHOOLS AND DEPARTMENTS.

In the field of vocational agriculture the high school has been universally selected as the institution best fitted for this purpose. Usually the work in agriculture is organized as a department, and it is optional with the student

which department he specializes in. In many States special vocational schools in agriculture have been established, and the students are required to pursue agricultural subjects during at least a portion of the course. In many States the curriculum of the vocational department in agriculture is outlined in the State plan in a general way. For the State of Pennsylvania the following course of study is required, although some latitude is allowed in adapting the instruction to local needs.

*Curriculum of the vocational department in agriculture in Pennsylvania.*

FIRST YEAR.

Vocational and related subjects— <i>one-half day.</i>	Periods per week.	Academic subjects— <i>one-half day.</i>	Periods per week.
General science .....		English .....	5
Poultry .....		Civics .....	3
Mechanical drawing .....		Etymology or foreign language .....	5
Vegetable gardening .....		Health inspection .....	2
Farm shop work .....			
Agricultural project .....			15
	15		

SECOND YEAR.

Farm crops .....		English .....	5
Ornamental gardening .....		Modern European history .....	3
Farm forestry .....		Economic geography or foreign language .....	5
Farm bookkeeping .....		Health instruction .....	2
Farm shop work .....			
Agricultural project .....			15
	15		

THIRD YEAR.

Dairying .....		Chemistry or physics .....	5
Animal husbandry .....		English .....	5
Fruit raising .....		History, American .....	3
Forging and farm shop work .....		Health instruction .....	2
Agricultural project .....			
	15		15

FOURTH YEAR.

Farm mechanics .....		Chemistry or physics .....	5
Farm management .....		English .....	5
Rural law .....		American economic history .....	3
Rural sociology .....		Health instruction .....	2
Agricultural project .....			
	15		15

The content of the course in woodland forestry, as a part of the four-year training period in vocational agriculture for high schools, is determined largely by the farm, community, and regional needs. Not alone the requirements of the present and immediate future must be given consideration, but also the probable developments of the more distant future. Wood differs from other crops chiefly in that a considerable period of time is required for the products to reach usable form. In the South, approximately 60 per cent of the total area is in woods, nearly every farm including a larger or smaller woodland. In the undeveloped sections it is not uncommon to find from 50 to 80 per cent of the individual farms in second-growth forest. Eventually an increasingly large part of the wooded areas will be required for the production of food crops to

satisfy the demands of a rapidly growing population. Agricultural development of the future must not be unduly stressed, however, since wood is as important a factor in our present-day civilization as is food material. The tendency in older countries is to provide for increasing populations through the introduction of more intensive methods of utilizing the soil. Germany maintains 26 per cent of her area in wood production.

#### THE COMMUNITY SURVEY.

The farm-to-farm survey, involving also a study of wood markets and farm requirements for wood, will indicate the relative importance of the wood crop and serve as a basis to determine the time, emphasis, and content of the course of study. Because of the bulky character of woodland products, the factors of transportation, involving the condition of country roads, distance to railroad, and railway rates, require special study, since these are often the controlling factors in marketing wood at a profit. Too often the farmer is at the mercy of the local dealer simply because he is unable to get his logs to market. The marketing of woodland products is frequently as difficult of solution as is the handling of perishable crops.

The farm requirements for repair and other wood products vary according to the intensiveness of agricultural practices, the demands upon the woodland being greatest in well-developed communities. Thus, the total area of woodland in a community is, in itself, not a true index to the relative importance of forestry in the course of study, market demands and farm needs demanding equal consideration. The coal situation during the recent war brought out the fact that many communities throughout the country used little or no coal for domestic heating.

Just where woodland forestry will be introduced into the four-year course of study depends upon its relative importance as a farm activity. In a community which is being developed along the line of diversified agriculture, and it is from this standpoint that the small woodland possesses the greatest possibilities in supplying the farm requirements for wood, the subject matter in forestry may well be introduced into the second or third year work, combining it with allied agricultural subjects to make a full year's work. Where farming practices are more specialized, the arrangement of the course of study must, of necessity, be modified. Thus, in a community where grazing is the principal agricultural interest, considerable time should be devoted to wood production as an adjunct to the growing of live stock. On the other hand, in a specialized market-gardening community where no woodlands occur, the work in forestry may be reduced to a minimum.

#### PROJECT WORK.

In general, the course of study in woodland forestry will be built up about the projects of possible interest to the pupils of a given community. Because of the run-down condition of the average woodland, the project of greatest interest to the boy will be along the line of reorganization on a profitable basis. Projects, both major and minor, of possible interest in certain communities are:

#### MAJOR PROJECTS.

Reorganization of the farm woodland on a profitable basis.  
 Management of the farm woodland in the production of wood.  
 Turpentine orcharding as an adjunct to wood production.  
 Basket willow production.  
 The production of nursery stock.  
 The management of the sugar bush.

## MINOR PROJECTS.

The treatment of fence posts.  
 The treatment of shingles and construction timbers.  
 Woodland planting in the reclamation of eroded fields.  
 Tree planting in the holding of stream banks.  
 Clearing land of stumps.  
 Establishment of a shelter belt.  
 The planting of roadside trees.  
 The pruning and care of shade trees.  
 The control of tree pests.  
 Trial planting of introduced trees.  
 Estimating the volume of standing timber.  
 Manufacturing wood with the farm-saw outfit.

A major project consists of a definite woodland problem involving a number of operations extending over a period of one or several years and offering opportunity for increased wood (of by-products) production. A minor project is a farm job involving woodland products and connected with, and a part of, a major project in field crops, animal production, woodland forestry, orcharding, or farm management. No considerable length of time is required in its execution, nor is there any question of seasonal sequence or cash returns. Often, indeed, the minor project is termed an "improvement" project, since the object is the betterment of farm conditions.

The size of the woodland is more or less fixed by farm conditions, varying from a few acres to 40 or more acres, and may not be modified to any great extent. An area of from 5 to 10 acres will usually be as much as the average boy can attend to, since his projects in field crops and animal production will, in all probability, be continued through this year also. In case the woodland is larger than is desired and, in addition, includes situations possessing agricultural value, the project should be limited to those portions which are adapted solely to the growing of wood. Accurate data are essential in the reorganization of the woodland, and this fact should limit the boy to an area consistent with thorough work. Other projects will vary with farm practices, market conditions, and trade customs. The project in turpentine orcharding should cover a crop, since this is in the recognized unit of the industry. The production of nursery stock may involve a very limited area (one-quarter to one-half acre) at the beginning, but provision should be made for an area of 15 or 20 acres to become available as needed. The same is true of the willow belt, the high cost of cuttings in the establishment of the belt limiting the boy to a small area.

Little can be said regarding the extent of the minor projects since much depends upon the requirements of the major projects and farm conditions. Particularly is this true of projects involving the clearing of land, the treatment of posts and farm timbers, the establishment of shelterbelts, the planting of roadside trees, and the pruning and care of shade trees.

Classroom instruction, as embodied in the course of study, is based upon a critical analysis of the projects of possible interest to the community and consists of a discussion of the scientific principles which underlie the practice of woodland forestry. General rules must be given a local application in the management of community woodlands; impracticable theories must be eliminated. In his project study the boy works out the further application of his technical knowledge to the specific needs of his woodland projects. It is essential, therefore, that the teacher, in the preparation of a course of study for a community, have definite knowledge of local conditions and keep clearly in mind the controllable factors of wood production. Unless he has had considerable experience in woodland management, he is in a position to derive as much benefit from the project as does the boy himself.

Because of the long life of the woodland project it is important that the annual reports be as detailed as possible, all data being included. As the reports for a particular subject accumulate from year to year the teacher will find in them a wealth of information which may be drawn upon for both classroom instruction and project study. The teaching in fact can not function as it should until these technical data have been assembled and put into usable form.

In a forest section where silvicultural activities constitute the principal occupation of the inhabitants, as is true of certain of the national forest areas, it could happen that 50 or even 75 per cent of the vocational course in agriculture might be devoted to the subject of forestry. In fact it needs but a decision by the Federal board to make possible the establishment of silvicultural vocational schools, similar to the Waldhauptschule of Germany. In the United States the policy has been to use college graduates in forestry for filling ranger positions in the Forest Service, yet it is generally admitted that the work of a ranger is vocational rather than professional in nature. The real difficulty lies in the absence of practice in the professional course, and it is in an endeavor to correct this deficiency that professional students are advised to accept ranger positions. While there are many so-called ranger schools in the country they all require a high-school diploma for entrance, thereby placing themselves in the semiprofessional class and making themselves ineligible to the benefit of the vocational education act.

If the ranger schools of the country are to comply with the requirements of the vocational education act, it will be necessary (1) to reach the vocational standing by eliminating the high-school diploma entrance requirement; (2) to offer preparation for useful employment (as a ranger, cruiser, woods foreman, forest superintendent, etc.) which is adapted to the needs of persons over the age of 14 years; and (3) to require supervised practice under field conditions.

In the inauguration of vocational education in forestry the problem of teacher training will be found to possess a significance similar to the place it occupied in vocational agriculture. Vocational education demands new teaching tools and materials; the traditional lecture method of instruction can not be used. Boys who require vocational education are "motor minded"; they learn best by doing. This means that teachers must be specially prepared to instruct vocational students. No doubt the requirements as to the training will be somewhat similar in forestry to those in agriculture. Under the Georgia State plan the vocational teacher in agriculture must have had two years of practical experience in farming since his fourteenth birthday, one year of which must have been continuous; he must have had technical training in agriculture equivalent to a four-year professional course; he must have had professional training in teaching and education; and he is required to have practical experience in teaching vocational agriculture. It is readily understood that the teacher training division carries a large share of the responsibility in making for the success of vocational education, since it is this division which recommends both the technical and professional subject to be required of the prospective teachers. Whether the teachers of vocational agriculture will give any time to woodland forestry will depend upon their own training, and this in turn upon the courses in forestry required for the prospective teachers under the State plan.

If the statement is true that the future crop of wood of the eastern United States will be produced by the farm woodlands of that region, is it not highly important that the teachers of vocational agriculture—the ideal builders of the coming generation of farmers—be given adequate training in forestry? Many of the men in charge of teacher training have had no training in forestry.

and can not realize its importance in the national economy, and the foresters in education must accept the responsibility to insure adequate preparation in forestry for the prospective teachers of vocational agriculture. Considerable care should be taken in outlining such a course, however, and the forester must make a critical survey of the field of activity of the vocational teachers to determine just what subject matter will be of value to them. He must realize that the teacher, in his particular community, makes a similar study to determine the subject matter needed by his pupils.

## Part II. RANGER SCHOOLS.

By Prof. E. A. ZIEGLER.

The purpose of the "ranger school" is to train men to fill positions in forestry below the grade of professional forester. For some time to come the special ranger school attached to some higher institution—agricultural college, professional forest school, special State ranger school, or private ranger school—will supply this demand. The following notes have to do with this field:

In the practice of forestry there must be a number of rangers (or men of similar grade) to each forester. Since there are upward of 22 schools giving professional forestry courses, one would expect several times that many schools training rangers. On the contrary we find very few schools training rangers. The conclusion, therefore, is that in the present stage of forest development in America the ranger, woods foreman, or under forester is not a school-trained man, and that the demand for such a training is not very strong.

This is not a condition peculiar to forestry. The engineer in carrying out his plans uses apprentice-trained foremen. Thus railroad track foremen and master mechanics carry out the instructions of the maintenance-of-way engineer and the civil engineer in charge of railroad construction. The mine engineer relies on the mine boss to carry out his plans. The architectural engineer relies on the boss mason, the boss bricklayer, and the boss carpenter. All these vocational men are apprentice-trained men, and the reason is not far to find.

The applications of architectural engineering and civil engineering are so varied and specialized that no one course for vocational engineers could cover the field. Further, the primary qualifications for these positions are manual dexterity and the ability to handle men. This is a training of "doing" and is very difficult to impart in a school, unless it is a shop school or "school on the job."

Physicians need trained nurses to carry out their prescribed treatment. They are not trained by studying the pharmacopola and learning rules in a classroom. They are trained in the hospital and learn the medical side while learning the manual side. This "learning in doing" is being applied more and more even to professional education. Mechanical and electrical engineering schools are giving credit for and often requiring a certain amount of practical shop experience or apprentice work. Civil engineers are doing likewise. Theological seminaries require students to occupy pulpits in their senior year. Agricultural colleges are requiring a certain amount of practical work on accredited farms, even though they themselves possess experimental farms and carry on farming operations.

The following conclusions may be accepted, then, with little fear of effective contradiction:

1. The forest ranger for some time, like the engineering foreman, will continue to be largely a practical field-trained man, and a somewhat locally field-trained man. For example, in some regions of the Southwest, national forest rangers administer more grazing business than forest business. They must

necessarily be thoroughly versed in stock and range management. The ranger here may be primarily a cattleman.

In the Northwest there is more timber, and shortly, if not now, the ranger will be in constant touch with logging work. Here the ranger should be primarily a woodsman. The conservative logging-boss stripe of man is an effective ranger.

In the cut-over and burned forests of Pennsylvania the more advanced mountain farmer makes the best ranger. He is often a logging trained woodsman in addition, for not many years ago farming a mountain farm in summer and being a lumber jack in the winter was a common and profitable combination of vocations.

2. Should, therefore, there be no ranger schools at all? Although the majority of rangers and lower forest officers of foreman grade will, for some time to come, be drawn from this practical work-trained class of men, yet among the younger and more ambitious of these men there is some demand for better training in a few special lines. It may be range-management for some, for others, lumber estimating and scaling, road and trail building, forest mapping, or nursery management. There is room for a limited number of ranger schools now. For strictly ranger work they should encourage mainly the ranch, woods, and farm boys.

As forestry conditions improve and the professional foresters are able to become real practicing woods foresters in place of propagandists and virgin timber sale administrators, there will be a demand for more training on the part of under foresters to carry out their share of forest development. As these vocational schools become more and more forest trade schools, the term "ranger school" will become a misnomer. They should be called "lower forest schools," or "forest high schools."

3. These schools should be carried on in connection with a real forest of commercial size and under forest management.

4. For the present, field-trained men of experience may need only short special courses of here six months, there three months, yonder a year. But the final vocational forest school for real forestry practice, taking the students from the public schools, must have at least two years in its course. In regions where there is demand for nursery superintendents, planting assistants, game preserve superintendents, and men of equivalent training, the time is now ripe for such a course.

5. For the present older practical, field-trained men the preparation required for the lower forestry (ranger) courses should be grammar school education. The course itself should be entirely "practice," with little or no basic science or mathematics, and should last up to one year. It is a passing phase and is not worth standardizing.

The vocational school, as real forestry begins to arrive, should require a two-year high-school training, and itself cover a period of two years, or should cover four years above the grammar school. It should give science and mathematics along with the strong field courses. In fact it should offer electives enough to permit the brighter and more ambitious to go into the professional course.

6. It is not thought that the curriculum for that ranger school that deals with the older field-trained man can or should be standardized. Cary's list in the 1911 Conservation Report covers the necessities, somewhat rearranged as follows:

- (a) Engineering and construction:  
Compass surveying and simple topographic mapping (plane table); leveling; road and trail building; cabins and bridges; telephones; trucks and mechanics.

**(b) Forestry:**

Silviculture (seed collection, seeding, planting).  
 Mensuration—timber estimating, scaling, calculation of increment.  
 Tree identification.  
 Forest protection—fire, insects, fungi.  
 Wood identification—local species.  
 Logging and utilization of wood.

**(c) Miscellaneous:**

Bookkeeping.  
 First aid.  
 Game and fish.  
 Constables' or wardens' law.

These older field-trained men will generally have the training in packing and riding, ax and saw, camping, etc.

For the forward-looking vocational forest school, looking to the public schools (second year high school) for its recruits, the course will be more comprehensive in that it will contain more basic mathematics and science, as well as more elementary outdoor training.

**FIRST YEAR.***First semester.*

English: Composition and rhetoric.  
 Mathematics: Geometry (elementary algebra assumed to have been taken in high school).  
 Botany: A brief view of plant structures and processes.  
 Tree identification.  
 Elementary forestry (general survey).  
 Silviculture: Seed collection and storage on a practical basis.  
 Shop: Woodworking and machine-shop tools.

*Second semester.*

English: Theme and report writing.  
 Mathematics: Elementary trigonometry, compass surveying.  
 Wood identification and uses of wood.  
 Drawing.  
 Silviculture: Seeding and planting (four weeks' nursery and outplanting work).  
 Mensuration: Log scaling, timber estimating.  
 Motor trucks and gas engines.

*Summer term.*

Nursery practices: Use of ax and saw in improvement cuttings.

**SECOND YEAR.***First term.*

Mathematics: Plane table surveying and topographic sketching; forest type mapping.  
 Forest protection: Field practice in fire fighting carried on throughout course of adjacent forest property; protection from fire, insects, and fungi.  
 Road and trail building: Bridges, cabins, telephone construction, fire towers.  
 Silviculture: Methods (simple).  
 Botany and soils (elementary).

*Second term.*

Forest law: Elementary business law.  
 Bookkeeping and use of forms.  
 Game and fish.  
 Forest recreation.  
 Ranger manuals (National Forest or State, or both).  
 Special regional features, as grazing business, camping, packing.  
 First aid.

*Summer term.*

Wood utilization; logging and milling in connection with commercial operation.

The above curriculum is mere outline. It is a little more theoretical than the previously-mentioned temporary ranger courses. Its graduates would start in as guard, assistant rangers, helpers, etc., and get practical field experience before being promoted to places of responsibility.

J. H. BERRY, *Chairman.*

E. A. ZIEGLER.

H. WINKENWIEDER.

R. S. MADDOX.

## SHOULD "PUBLIC RELATIONS" RECEIVE A PLACE IN THE PROFESSIONAL TRAINING OF FORESTERS?

By HERBERT A. SMITH,

*Assistant Forester, United States Forest Service.*

Throughout our program we have had before us the broad theme of what it is that we are trying to do when we undertake to make a forester. That is what we are bound to come back to, whether we are talking about entrance requirements or the length of the course or the subjects to be studied or specialization or meeting the demands of the industries or pleasing the men themselves.

The men themselves, as we have been told this morning, want a course that will let them begin to earn as soon as possible; and the industries which are ready to give them employment want them trained along specialized lines; and therefore we must, apparently, crowd pretty well out of the course those studies which are intended to give all-round development rather than preparation for specific classes of jobs. But, after all, must we? The spirit of youth is impatient, anxious to be done with preparing and to begin to do; and it is a wholesome spirit—for youth; but it is not necessarily wholesome for youth that it should altogether have its own way. Our professional schools have an obligation not merely to cater to the wishes of their clientele. If we are going to gauge our work on the basis of what the industries want, and so meet the desire of the bulk of forest-school students to get to the best-paying job with a minimum of expenditure of time and money, are we not in much the position of yellow journalism, which frankly undertakes to "give the public what it wants"? If we run our forest schools on this basis, we shall not prepare men for a career, for a lifetime of climbing the ladder; we shall prepare them for immediate jobs. The school that does that successfully will probably prosper greater, so far as numbers go; but the percentage of its graduates who eventually attain distinction will be unduly small.

It is important that a man should, in laying out the plan of his life, look far forward. He should prepare himself for middle age, for the period of fully ripened powers, for the true harvest time of his activity. You can not build high on thin foundations. The professional schools should recognize that their task is to give men the right start.

It is from this standpoint that I look at the question of preparing forestry students for what we have recently come to call, in the Forest Service, "public relations." The term designates for us, in the first place, a unit of organization. This unit conducts a group of specialized activities, having a common purpose. They are not merely activities conducted by specialists in the Washington and district offices; they are extended throughout the field organization to an increasing degree and with increasing emphasis on their necessity.

Take for example the forest supervisor. In the first years of the Forest Service our supervisors usually had to face a local public sentiment which was

not merely indifferent but actually hostile. Naturally the tendency was to fight back more or less; confronted by antagonism, men of spirit naturally felt the necessity of holding up their end. After this stage, and as the spirit of hostility died out, came a period of pressure from the Washington office for better standards of work. The forest supervisor had to be a combination of a good technical man and a good business man. The demands on him were constantly greater than he saw his way to meet, and compelled him to turn all his attention on the forest. A third stage came strikingly into view during the war. The forest officers had gradually gained a position in local esteem which caused them to be turned to as community leaders in all kinds of public activities. By and large, the forest supervisor has come to be not merely a Federal official, not merely a capable forester and business agent, but a public man. We are now entering on a fourth stage, in which the forest officer combines with the public relations viewpoint the assumption of definite and specialized public relations activities.

It was primarily due to our fire problem that we moved forward to this stage. Three or four years ago our District 5 office came to the conclusion that altogether too much money was spent in fighting fires which should never have started. A remedy was sought along the interrelated lines of law enforcement and education, each helping out the other. The educational task consisted of finding out and utilizing as many agencies as possible that would affect the ways of thinking of the public with regard to forest fires. Among these are the newspapers, the schools, the "movies," and public talks by local forest officers. The results had much to do with bringing us to our present recognition of public relations.

The question whether the men who come into the Forest Service from the forest schools should receive in connection with their technical training some specific preparation for work of this character can not be answered as an isolated question. It must be coordinated with the whole broad question of the type of man that the schools should seek to turn out, and the relative value of the different subjects needing to be taught, and the time that each should have given it. The dean of the school of journalism in the University of Montana instructs the forest school students in newspaper work. The reason, he told me, is because a forest officer who does not know how to furnish the press with the kind of information that it wants, who does not understand the function of the press in our national life and does not appreciate the importance of establishing good relations with his local newspaper editors, lacks proper equipment for his work. That is significant, but not to my mind conclusive. For the question is not what is important, but what is most important.

There has been an extraordinary broadening of the conception of the field of the engineer. The profession no longer concerns itself merely with mechanical and physical forces and problems, with machines and structures and energy. It deals with all that enters into production, including the human element—with questions of labor, of public welfare, of Government. Unless we are to consider all this as "without logical basis, there is need for recognizing that in the field of engineering we now have an entirely new set of concepts, and a necessity for a corresponding readjustment of education for the work of engineers. It must be broadened and humanized.

An undergraduate four-year course in forestry will closely approximate that of the engineering schools, if both are worked out along the right lines. It has been generally agreed here that in such a course for foresters the first two years should be the period of foundation laying, with emphasis on a broad

education rather than specialization. The aim is to give us a man of such breadth that he may be able to develop his full power in time, to grow as he goes on; to become a man of all-round capacity, of poise, sure judgment, of leadership and mastery. It will not do in planning for this to draw up a schedule of subjects and stop there. The important matter is not what subject you teach, but what your object is and what results you get. The place of English in the first two years' work has been spoken of this morning. To learn to think clearly and write accurately is certainly of great importance, but it does not follow that the burden of bringing this to pass should be laid solely on the English department. In a preparatory school I got my best training in English from my teacher of Latin. On the other hand, if we are considering how to develop an all-round man of power in his period of full maturity, possibly the English is needed in the course for other purposes. English studies must be co-ordinated with the study of other languages, of history, of science, of every part of the course, in short; and its definite educational object prescribed for it. When that has been done, call in the English department of the university, tell them what you want, and ask them if they can deliver the goods.

We can not settle this matter by my talking about it here for half an hour, or by everybody talking about it for two days. My hope is that this conference will proceed to create a committee the purpose of which shall be to make a study of the place of cultural education in the forestry course, the subjects most suitable to serve the purpose sought, and the objects to be aimed at in each case. This whole question is so broad, so complex, and so uninformal at the present time that a council engaged in its study will have before it a task of a magnitude almost as great as its solution is urgent.

## REPORT OF THE COMMITTEE ON FORESTRY AS A PART OF EXTENSION COURSES IN COLLEGES AND UNIVERSITIES.

### EXTENSION WORK IN FORESTRY.

*Object.*—To supplement the more formal instruction of the classroom and reach those who can not afford the time or money to attend regular courses.

*The need.*—In this way the salient points in forestry can be set before the small woodlot owner, the wood user, and the person whose interest has been stimulated to the point where he wishes to acquire a systematic view of the fields which are susceptible of presentation by extension methods. To make this more concrete there would be included the woodland owner whose holdings were too limited to justify the employment of an expert and who must, therefore, be his own forester; the manufacturer of wood in some form who wished accurate information about his raw material; and the general reader who wished to systematize his information.

*Methods.*—Extension work may be accomplished by (1) reading courses, (2) talks; (3) demonstrations; (4) permanent projects.

Reading courses can be developed in the following subjects:

1. General forestry.
2. Dendrology (including wood uses and identification).
3. Estimating and scaling.
4. Woodlot management (including protection, utilization, silviculture, and regulation).
5. Lumber grading.
6. Sawmill practice.
7. Kiln drying.
8. Wood preservation.
9. Economic aspects of the lumber industry.

The aim should be to cover well a few well-chosen phases of the subject. The "job sheet" method, as employed in the intensive training courses of the Army, may well serve as a model. The textbook should be carefully selected and may in some cases have to be specially prepared. Written reports should always be required. These should be carefully reviewed, suggestions made as to wrong or doubtful points and graded.

Talks or lectures should be concise and forceful appeals for action along definite lines. To be effective they must first clear the ground of obstacles, real and imagined, and then bring to bear upon the will of the audience such a flood of stimuli that their inherent inertia will be overcome. Merely to convey information is not enough. The audience must be moved to use the knowledge presented.

Talks may well be illustrated where the illustrations reinforce the argument. Merely showing pretty pictures is a waste of time.

Demonstrations are the natural result of the failure of talks to produce large results. Showing a man how to do a thing is much more effective than telling him how to do it. Hence, talks should, if possible, always be

followed up by concrete, living illustrations. This is particularly the case in forestry. A demonstration talks all the time.

Projects are in turn a higher development than isolated demonstrations. In the former a carefully thought-out plan of action is followed up until results are secured. For example, thinning might be demonstrated in a single woodlot of pure, evenaged composition, but a thinning project covering all the phases of thinning in a certain type would be much more effective. It would include not only marking for thinning, but actually making the cutting and marketing the product.

#### SUMMARY OF RECOMMENDATIONS.

In view of the need of making extensive work in forestry more effective. It is recommended—

1. That all agricultural colleges and agricultural high schools be urged to give thorough courses in forestry to the end that woodland owners may be better prepared to care for their holdings, that the general public may better understand our problems, and in particular, that county agents and others charged with rural leadership may appreciate the important rôle of the forest in our national economy. At the present time rural leadership is almost wholly in the hands of tillage land experts who think the land should only be used for two purposes, cultivation or pasture.
2. Every woodland State should have at least one extension specialist to advise with the county agents. Ultimately there should be a forester in each wooded county.
3. A special committee of this conference or the Society of American Foresters should be appointed to—(a) outline reading courses; (b) secure a wider hearing in rural leadership circles for forestry; (c) report progress annually in the Journal of Forestry.

O. M. BUTLER,  
A. K. CHITTENDEN,  
E. O. SIEKE,  
K. W. WOODWARD, *chairman*.

#### DISCUSSION.

Prof. Woodward said that he was impressed by the fact that certain fundamental ideas have not yet been sufficiently impressed upon the general public. The average man does not realize that wood is a necessity, and further that it is a comparatively restricted crop and that the supply is limited. The question is how to create a recognition of the facts that will constitute a basis for action.

Mr. T. S. Woolsey, jr., thought that to get forestry understood by the public generally we must go deeper and begin in the schools. In France forestry is understood much better than it is here. They have reached the conclusion that to have it understood by all the citizens, the study of forestry must start in the schools. Can we not profit by their example?

The possibility of forwarding forestry through the agency of the farm bureau was discussed by several speakers, who all agreed that in this way points of contact could be established with the woodland owner and the wood user better perhaps than in any other way. But it requires trained men to do this work. What is needed is personal contact by the right sort of man, working in conjunction with the county agent, and backed in his work by the culminative effect of rightly directed publicity. It seemed to be the consensus of opinion that in many States the farm bureau organization, working in cooperation with the State college, and preferably having a forester on the staff, could accomplish more in this way than if the extension work were to be undertaken by the State forester, whose attention is more likely to be centered on administrative and protective duties. An alternative plan that has promise is the method of appointing foresters in charge of local districts.

## REPORT OF THE COMMITTEE ON THE CHARACTER AND EXTENT OF RESEARCH BY SCHOOLS OF FORESTRY AND DEPARTMENTS OF FORESTRY IN COLLEGES AND UNIVERSITIES.

The agencies engaged in research contributory to forestry have recently been clearly defined by John C. Merriam,<sup>1</sup> of the National Research Council. His classification is as follows: (1) Research of practical application in engineering laboratories; (2) governmental bureaus and laboratories; (3) research foundations; (4) museums and allied institutions; (5) educational institutions.

In this collective development of research, schools and departments of forestry should bear a substantial part. Where the scope of the curriculum and the extent of equipment will permit, forest schools are especially fitted for this kind of work. Their administration is permanent, comparatively unchanging, and favorable to the necessary initiative and freedom in investigators. Moreover, the training of professional foresters, particularly in postgraduate grades, will profit by the inclusion of opportunity for research, both as an educational influence and a means to specialization.

It is important, however, to correlate the functions of the forest schools with those of the other agencies in the same or similar fields, particularly the Forest Service. The Forest Service is probably best qualified to undertake problems having a general or interstate bearing, while the schools are often better fitted to solve questions of a local or comparatively specific nature.

Fundamental problems, such as those dealing with the laws of growth, are best handled where the qualified men and a favorable directing policy exist. This combination may be found either in a Federal bureau or in educational institutions. The development of general science indicates that universities on the whole are the more favorable places for successful research.<sup>2</sup> Exact division of the field, however, is not possible or wise.

To develop the necessary correlation of work, both exchange of information on projects proposed or under way and actual cooperation are desirable. The basis of cooperation may well include the following items: Agreement upon a particular project and the working plan for carrying it out; control of execution; division of financial responsibility; and understanding as to rights and manner of publication.

It should be the function of some central body such as the Forest Service or the National Research Council to advise and consult frequently with the schools so as to avoid duplication and with the definite purpose of strengthening the hands of competent men who are working under difficulties. Such action would

<sup>1</sup>The Function of Educational Institutions in Development of Research. John C. Merriam. Reprint from University of California Chronicle, April, 1920.

<sup>2</sup>Mr. E. H. Clapp of the committee, desires it to be recorded that his experience "leads to the belief that, other things equal, most favorable conditions for research permit investigators to devote their entire time to it, and that investigators in any institution where this is not possible labor under a corresponding handicap."

help to stimulate investigative work in general and make for unity in securing legislation. Any further attempt to standardize forest research by division of the field would be fruitless and inexpedient.

Respectfully submitted.

R. T. FISHER, *Chairman.*

R. C. HAWLEY.

J. S. ILLICK.

J. H. FOSTER.

E. H. CLAPP.

#### DISCUSSION.

The discussion developed the idea that in this country research in forestry is really only just beginning, and that now that the machinery for carrying on the work of education in forestry is coming to be perfected, an important opportunity for the forest schools lies in fostering research. Various opinions exist as to how research in forestry should be divided. One argument is for the Federal Government to investigate National problems; the State, State problems; and the schools, local problems. Opposed to this is the method commonly followed in other lines of scientific research, where problems of fundamental interest are considered to be quite as much the function of the colleges as of the Government.

The consensus of opinion of the conference appeared to be that as research in forestry is so comprehensive in its scope, it would be better not to attempt an arbitrary division of the field, but rather to encourage in every way possible all the agencies prepared to engage in it. In the last analysis it is the investigator that counts; the man rather than the agency through which he works. The important point is that research is fostered by a congenial atmosphere. Such surroundings are more likely to be found at educational institutions than under Government bureaus, even though the Government may have better facilities for providing physical equipment. In the course of time the universities will get the money so that investigators may have equipment and time for their studies and be able to conduct them in an unhampered way.

The opinion was expressed that a limited amount of teaching, particularly of advanced students, was in many cases an advantage rather than a detriment to the investigator, particularly where as in a school of applied science the subjects being studied can be made to link up with the problems of industry. From another standpoint the study of such problems is advantageous in that it may lead to financial support being given to research work by commercial interests which, so long as the grants are made without improper restrictions, is an effective aid in the advancement of knowledge.

## RECOMMENDATIONS OF THE CONFERENCE.

Throughout the meeting the sentiment was repeatedly expressed that the reports submitted were but starting points for the problems under consideration. Because of this feeling, and also in view of the report of the committee on permanent organization, the conference at its final session expressed its belief that the purpose for which the New Haven meeting was called would best be served were the work there begun continued by a permanent organization. It was the sense of the conference that the most satisfactory agency through which to accomplish this was the Society of American Foresters. Accordingly, the conference unanimously adopted the following:

### RESOLUTION.

*Resolved*, That this conference recommends to the Society of American Foresters (1) that it appoint, through its president, a committee on forest education to consider all suggestions made to this conference, whether in formal reports or otherwise, together with such other phases of forest education as it deems advisable; (2) that this committee consist of (a) the chairman of this conference, as chairman, (b) the chairmen of the eight committees reporting to this conference in those cases where they were senior members of the society, and in cases where they are not, of some other member of the committee who is a senior member of the society, and (c) of three other members; (3) that this committee be authorized to appoint subcommittees, which may include persons to be appointed by the chairman who are not and do not by virtue of such appointment become members of the main committee; and (4) that it report the results of its investigations, with recommendations, to the society from time to time.

At the annual meeting of the Society of American Foresters, held in New York City on December 19, 1920, the above resolution was presented and adopted. Shortly thereafter the president of the society appointed as the committee on forestry education the following persons:

J. W. Toumey, New Haven, Conn., chairman.  
R. S. Hosmer, Ithaca, N. Y.  
H. H. Chapman, New Haven, Conn.  
F. F. Moon, Syracuse, N. Y.  
S. T. Dana, Washington, D. C.  
E. A. Ziegler, Mont Alto, Pa.  
E. G. Cheyney, St. Anthonys Park, Minn.  
K. W. Woodward, Durham, N. H.  
R. T. Fisher, Cambridge, Mass.  
H. P. Baker, New York, N. Y.  
P. S. Lovejoy, Ann Arbor, Mich.  
R. D. Forbes, New Orleans, La.

To cover the wide field and to endeavor to advance forestry education in this country in the largest measure, the main committee has been organized into 10 subcommittees to study and report upon specific topics within the limits of the general committee's field of activity. These reports will be made to the Society of American Foresters and doubtless in due course will be made public through the official organ of the society, *The Journal of Forestry*.

## APPENDIX.

### LIST OF COMMITTEES OF SECOND NATIONAL CONFERENCE ON EDUCATION IN FORESTRY.

New Haven, Conn., December 17 and 18, 1920.

#### OFFICERS OF THE CONFERENCE.

*Chairman:* Dean James W. Toumey, Yale School of Forestry.  
*Secretary:* Mr. T. S. Woolsey, jr., New Haven, Conn.

#### COMMITTEES APPOINTED BY DEAN TOUMHEY TO REPORT AT THE CONFERENCE.

##### *Committee on undergraduate course:*

Dean R. S. Hosmer, Cornell University, chairman.  
Professor J. M. Briscoe, University of Maine.  
Professor A. K. Chittenden, Michigan Agricultural College.  
Professor R. R. Fenska, University of Montana.  
Professor Donald Bruce, University of California.  
Mr. J. S. Holmes, State Forester of North Carolina.

##### *Committee on course leading to the degree of Master of Forestry:*

Professor H. H. Chapman, Yale University, chairman.  
Dean Filibert Roth, University of Michigan.  
Professor S. N. Spring, Cornell University.  
Professor C. D. Howe, University of Toronto.  
Mr. P. T. Coolidge, Consulting Forester, Bangor, Me.

##### *Committee on specialization:*

Dean F. F. Moon, New York State College of Forestry, chairman.  
Professor R. C. Bryant, Yale University.  
Professor J. A. Ferguson, State College of Pennsylvania.  
Mr. W. B. Hastings, State Forester of Vermont.

##### *Committee on training of specialists in forest products:*

Mr. S. T. Dana, U. S. Forest Service, chairman.  
Dean R. S. Hosmer, Cornell University.  
Dean H. Winkenwerder, University of Washington.  
Dr. W. K. Hatt, Purdue University.  
Dr. C. E. Paul, National Lumber Manufacturers' Association.

##### *Committee on vocational training in forestry:*

Professor J. B. Berry, Meadville, Pa., chairman.  
Professor E. A. Ziegler, Pennsylvania State Forest Academy.  
Dean H. Winkenwerder, University of Washington.  
Mr. R. S. Muddox, State Forester of Tennessee.

##### *Committee on forestry in cultural and general educational discipline:*

Dr. C. D. Jarvis, Bureau of Education, Washington, D. C., chairman.  
Dr. John Ise, University of Kansas.  
Professor E. G. Cheyney, University of Minnesota.  
Mr. H. O. Cook, Forester, Conservation Commission of Massachusetts.  
Mr. R. D. Forbes, State Forester of Louisiana.

*Committee on extension courses in forestry:*

Professor K. W. Woodward, New Hampshire Agricultural College, chairman.

Professor A. K. Chittenden, Michigan Agricultural College.

Mr. E. G. Sleske, State Forester of Texas.

Mr. O. M. Butler, Forest Products Laboratory, Madison, Wis.

*Committee on research in forestry:*

Professor R. T. Fisher, Harvard University, chairman.

Professor J. S. Illick, Department of Forestry of Pennsylvania.

Professor R. C. Hawley, Yale University.

Mr. J. H. Foster, State Forester of New Hampshire.

Mr. E. H. Clapp, U. S. Forest Service.

## COMMITTEES APPOINTED BY THE CONFERENCE

*Committee on permanent organization:* R. C. Bryant (chairman), J. A. Ferguson, J. M. Briscoe.

*Committee on resolutions:* H. H. Chapman (chairman), F. F. Hoon, S. T. Dana.

*Committee to edit and publish the proceedings:* R. S. Hosmer (chairman), E. A. Ziegler, K. W. Woodward.

## FOREST SCHOOLS HAVING 4-YEAR CURRICULA.

Economy in publication demanded the omitting of the detailed courses of study for 20 American forest schools offering courses covering a four-year period. Certain of the schools offer only a four-year curriculum; others also give graduate work, leading after one additional year to the master's degree. In the following list the schools offering graduate work are indicated by an asterisk.

Interested persons may secure the curricula of the schools from their respective catalogs in greater detail than could be here published. The similarity of many of the courses would have made of their inclusion unnecessary repetition.

The following list shows the principal forest schools giving 4-year courses or more and granting a forestry degree:

Bates College, Lewistown, Me.

\*University of California, Berkeley, Calif.

\*Colorado College, Colorado Springs, Colo.

Colorado Agricultural College, Boulder, Colo.

\*Cornell University, department of forestry, New York State College of Agriculture, Ithaca, N. Y.

Georgia State College of Agriculture, Athens, Ga.

University of Idaho, Moscow, Idaho.

\*Iowa State College of Agriculture, Ames, Iowa.

University of Maine, Orono, Me.

\*Michigan Agricultural College, Lansing, Mich.

University of Michigan, Ann Arbor, Mich.

\*University of Minnesota, St. Paul, Minn.

University of Montana, Missoula, Mont.

University of Oregon, Eugene, Oreg.

Pennsylvania State College, State College, Pa.

Pennsylvania State Forest Academy, Mont Alto, Pa.

\*Syracuse University, New York State College of Forestry, Syracuse, N. Y.

\*University of Toronto, Toronto, Canada.

University of Washington, Seattle, Wash.

\*Yale University, New Haven, Conn.

\*This school also gives a short course for forest rangers.

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