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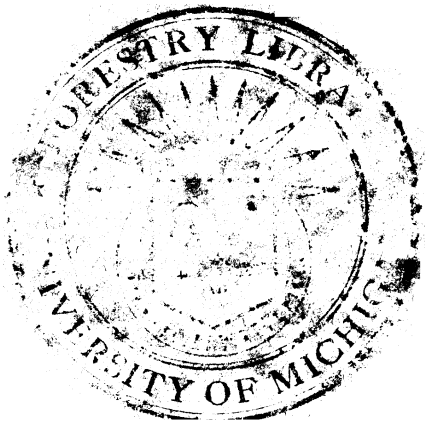

A Survey of Forestry Education in the United States with Particular Reference to Courses and Curricula

by

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PREFACE

This study seeks to supplement a similar one conducted by the writer a year ago at Oregon State College. The earlier report was based largely on questionnaire data obtained from nearly all the forestry schools in the United States. An effort has been made to bring this information up-to-date, and some changes in the organization and presentation of the material have also been effected, although many portions have been copied verbatim.

In addition, however, a considerable amount of new information pertaining to forestry courses and curricula, together with some other miscellaneous material, has been incorporated into this subsequent study. It is hoped that the material herein presented, and particularly the analyses of forestry curricula, will be a worthwhile contribution to the literature pertaining to forestry education.

Deans of nearly all the forestry schools in the country cooperated very well in replying to specific queries regarding their respective schools and in returning the questionnaires filled out as requested. Particular thanks are due to Dean S. T. Dana for his helpful criticism and suggestions and for his liberal donations of time whenever requested; thanks are also due Professor E. G. Mason, who helped outline the original problem and reviewed the first report, as well as to a number of other people who aided the work by their constructive criticism.

R.C.E.

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INTRODUCTION

The practitioner of forestry in the United States is confronted with a task as formidable as it is varied. Unlike the forestry situation in European countries, where relatively few timber types are found, forestry in the United States is fraught with numerous obstacles. A wide range of timber types, distinct and varied soil types, great variations in weather, difficult transportational problems, devastating attacks by diseases and insects - all combine to make the practice of forestry a task of many problems in the United States.

Each timber type is a biological unit in itself, and requires specific treatment for best results. At the present time twenty-five institutions in the country are training men to minister to the needs of this myriad of timber types throughout the land. For the most part this training is given the student in a period of four years, although some do return for additional training as graduate students.

In contrast to this system of forestry training, Germany with its comparatively simple forestry problems trains foresters more intensively over a period of approximately nine years. Following his application to the government for forestry training, the student works six months in the field. He then studies four years in a university and is subjected to an oral examination. If he passes this successfully, another two

years of study are completed followed by still another state examination. He then must engage in practical forestry work for another three years after which time he becomes eligible to take a final examination which determines whether he will be permitted to practice forestry in Germany.

This discussion pertaining to the training of the German forester is merely cited as an indication that perhaps our present system of forestry education in the United States will undergo changes in the future, although whether these changes will lengthen the present curriculum or not matters not greatly. The important question is that our institutions should keep their objectives clearly before them so that the graduate will be satisfactorily trained to take his place in current forestry work. It likewise behooves the young man choosing a life's work to think "wisely and well" before finally electing to study forestry; in order to achieve success he will have to study constantly throughout his life since forest practice changes just as certain phases of any other profession change.

With these views in mind, this study has been made of certain portions of forestry education as they exist today in the United States. In order that a clearer perspective of the entire picture might be had, the report begins with a brief survey of the early history of forestry education in the United States.

EARLY HISTORY OF FORESTRY EDUCATION

For nearly three hundred years America was lacking in forestry education. Near the close of the nineteenth century, however, "provisions were made for the introduction of technical instruction in forestry into the curricula of several of the larger universities." (18) In 1881, Professor Spalding of the University of Michigan "inaugurated a series of forestry lectures which dealt in broad terms with forest products, early laws and customs, the necessity of suitable forest legislation and the influence of forests on human affairs." (41) These talks were a means of promoting intelligence on the subject of forestry and were instrumental in "fostering cooperation between the University and the State on the problems of forestry." (15)

Isolated courses had been given in several other colleges prior to nineteen hundred, but they "failed to touch the vital economic problems of forests and their protection, management and perpetuation by natural means." (41) However, evidence at least points to the fact that some elements of forestry were being given at this early date; Illick states that "at least 32 land grant colleges gave some instruction in forestry prior to 1897." (22) Although they had a difficult time to convince the American people that trained foresters were needed, early educators (most of whom had been educated in Europe) such as Fernow, Roth, Graves and Schenck witnessed a steady improvement

in forestry education after the close of the century. In 1898 the initial step was taken in establishing a system of professional forestry schools, for in that year Cornell University in New York under the direction of Dr. B. E. Fernow launched a four year professional course in forestry. (15) In the same year the Biltmore Forest School was organized by Dr. C. A. Schenck in which students were given a year of practical and theoretical forestry instruction. Since that time the country has witnessed a rapid growth in the number of forestry schools.

SUBSEQUENT GROWTH OF FORESTRY SCHOOLS

Numbers:

Shortly after the close of the century, under the aggressive leadership of President Roosevelt and Gifford Pinchot, the federal government launched itself into the business of managing government-owned forestry lands. It was at this time, in 1905, that the administration of federal forests was shifted from the Department of Interior to the Department of Agriculture, and the change resulted almost immediately in improved forest management. Although compelled to administer sixty-three million acres of forest land with a force of eight hundred and twenty-one men, Pinchot rapidly improved conditions, and undoubtedly the change served to hasten the establishment of several forestry schools which were soon to appear. (24)

Three schools of forestry were established between 1898 and 1900, while the Roosevelt period witnessed the establishment of fifteen more by the year 1910; eight more were added during the decade 1911-1920 and since that time an additional nine have

been established. (22)

At the present time twenty-four different institutions offer training in forestry leading to a degree (three give professional instruction at a graduate level only), and these schools are now graduating large numbers of trained men each year.(18) In 1938 approximately 969 undergraduate degrees were granted and this figure will rise to more than 1000 in 1939. (19) Enrollment in forestry schools reached an all time high in 1937 with a total number of 6,067; however, the 1938 and 1939 freshman classes showed a slight decline and indications point to a gradual decline in the number of graduates in the next few years. (17) Forestry training has grown from a not-too-distant day of impotency to a position which has prompted some men to advocate that measures be taken to curtail either the number of forestry schools in the country or the number of students enrolled in these schools.

And so, having thus briefly surveyed the history of our forestry schools, let us move on to a consideration of the individual schools with particular reference to their faculties and facilities. It is very difficult to attempt to judge the qualifications of the schools, since the prevalent conditions vary so much in different institutions. Smaller and less wealthy schools, if judged on their equipment and facilities alone, would necessarily receive a poor rating. If, however, the basis of comparison were to be on the records made by graduates following their emergence from college, the results might present an entirely different picture.

Therefore, no attempt will be made here to rate schools on the basis of either of the two above comparisons; rather these questions will be discussed and an attempt will be made to present advantages and disadvantages of the contrasting elements found in the schools. Much of the information presented was secured by questionnaire and the remainder through a perusal of pamphlets, bulletins and articles pertaining to forestry schools and forestry education.

Library Facilities:

To function satisfactorily the forestry school should be amply supplied with all essential reading matter; at present, all possible extremes varying from the inadequate to the superfluous exist in the various school library facilities extended to the student. Naturally, such richly endowed schools as Yale, Syracuse, Michigan, Harvard and Duke Universities excel greatly in quantity of forestry reading matter available. Since these schools offer highly specialized graduate work requiring more research and wider reading, it is perhaps fitting that the schools should possess such complete forest libraries. (8) Yale, with a present endowment of "more than $1,750,000," possesses a large forestry library containing forty-five thousand volumes written in English and foreign languages. In addition the school receives more than "two hundred periodicals and other serial publications of importance in forestry." (54) Likewise, Harvard possesses a library of some 30,000 volumes and Duke also has a fairly complete and growing library. Offering sharp contrast to these extensive facilities are those maintained by

many of the smaller colleges; some schools reported approximately 1500 to 2000 books as their total library resources with fifteen or less periodicals on their subscription list. (23)

The character of the school is reflected to some extent by the nature and size of its library facilities. Wealthy institutions, training men in graduate research work, as typified by Yale, Harvard, Duke and possibly Michigan and California, appropriately enough have the large libraries and train a different type of student than do the smaller and less wealthy colleges in other parts of the country. Here the graduate student is thrown more upon his own resources; he is often engaged in individual study and spends much of his time browsing in the library in search of knowledge. He is an older person, more mature in taste and judgement; and the very fact that he is engaged in graduate work would indicate that he is a person of more than average ability--one able to choose meaty articles of value to him from the vast collection of information available.

On the other hand, smaller colleges, concerned primarily with the problems of the undergraduate, have no need for such voluminous facilities. During his first two years in college the student is ordinarily altogether too busy studying either the fundamentals of forestry or courses in fields apart from forestry to find the time, or the need, for reference to books other than just his textbooks. He is usually lacking in foresight and purpose so that the reading of technical forestry articles, outside of the few he might be compelled to read in his courses, is merely drudgery to him which he fortunately does

not have to undergo at the present time. Advancing to the position of a junior or senior usually serves to stimulate the student's interest in such widely read publications as the Journal of Forestry and American Forests; and during his senior year, particularly, the student follows these periodicals fairly closely, not because he has to, but because it is there that his interests lie.

However, it is only on rare occasions that the student seeks out books on forestry in the library of his own initiative, since many of them are highly technical in content; many are quite old publications; and, finally, the student finds it difficult to spare the time for such pursuits. The severity of the forestry curricula limits the spare time of the student and he finds it more profitable to read of the more modern phases of forestry in the Journal of Forestry or some other current magazine.

Unless under the efficient administration of a librarian, and unless the books are so arranged that the more important volumes may be found readily, the large library handicaps the student in that he spends a considerable portion of his time looking for the material he desires. He may have to thumb through several books pertaining to his subject before he finally strikes upon the one which serves his purpose best. In all probability the smaller library would contain an outstanding book in each field together with possibly a few others, and the searcher would have little trouble finding the book he wanted under such an arrangement. There is, moreover, little need for

numerous volumes written in foreign languages at the undergraduate schools. Exceptional, indeed, is the student who has a good reading knowledge of French or German; and, even should he be so talented, there would be no call for him to read extensively in such literature.

Such reading may be of some importance to the research forester, but in many cases is inconsequential even to him. Professor P. A. Herbert, speaking before a committee on forestry degrees, in 1937, stated: "I challenge the need of foreign languages to be cultured in every case. I maintain you can do the work of doctorate without having any foreign language whatsoever." (29) Dr. J. A. Larsen, attending the same conference, went on to say that "the foreign language requirement of the master's and doctor's degree is largely a joke." (29) Nevertheless, complete libraries are an integral part of any good forest school, and those institutions equipped with inadequate library facilities should endeavor to build them up to a satisfactory point.

Faculties:

But now let us move from a consideration of library facilities to a question of even greater importance--that of forestry school faculties. More than any other one thing the caliber of teacher in a school serves to make or break the reputation and efficacy of the school. Fortunate, indeed, is the school which has a staff of able teachers, who are genuinely interested in the welfare of the student. As Spaulding remarks, the student "can learn mensuration and silviculture from the textbook, but he

cannot learn vision and imagination, except as it is taught him by the real teacher." (16)

As might be expected, the ratio of student to teacher has increased to an appreciable extent since the beginning of the Roosevelt administration. (See Table I) Professors in many schools have been given additional duties--they are worked hard and have little opportunity for personal reading or research in forestry. It would almost seem that, burdened as he is, the professor cannot train his charges as efficiently as he formerly did in smaller classes. He has lost the personal touch with his students; and little can be done about it, since it is well-nigh impossible to come to know fifty or sixty students intimately.

However, as yet it has not been definitely proven that the teacher is less effective when teaching large groups, although the supposition does seem probable. (23) Graves, in discussing this question, says that he would "be interested to know whether the increase in size of classes has impaired to a noticeable degree the effectiveness of teaching." (16)

Not so long ago when five or ten students comprised the average class, it was a simple matter for the instructor to deal with them individually. He was not hampered by limited time, and encouraged sessions of discussion after class. But now with lecture classes in some schools ranging in size from twenty up to as many as seventy students, the professor has more than enough to keep him busy without being bothered by each student's individual cares and troubles. As a result of figures turned

in on the questionnaire, it was found that the average class for all schools was comprised of a little more than twenty-six students, but that the average size of classes varied from a low of nine at Colorado to a high of approximately seventy at Montana State College. (23) Graduate schools, that is Yale and Harvard, have maintained a low ratio of student to professor, rightfully enough. For example, at Yale University ten competent instructors concentrate their efforts on ~~forty-nine~~ sixty students, although it is perhaps true that here a somewhat greater proportion of the student's time is spent in individual research with only occasional assistance from the instructor. (54)

It was found in a survey of forestry school faculties that their average age did not vary greatly, and almost without exception they might be classed as middle-aged. (See Table I) The average for most schools was found to be in the late thirties or early forties, the Colorado faculty averaging the oldest with an age of forty-five and the University of Florida the youngest with an average age of but thirty years. (47) An average faculty age lying between thirty-five and forty is desirable for two reasons. If the faculty ages of a school averaged fifty or over, this would mean that several professors would be in their sixties or possibly even older. Although it does not necessarily follow that an older man makes a poorer teacher, yet at times they lack forcefulness and are hindered by their age in the field.

On the other hand when the average faculty age totals only thirty years, difficulties might very well arise unless the men

are exceptionally shrewd and experienced for their age. Any instructor whose age is under thirty, if he has occasion to teach upperclassmen, may often find himself in hot water because some of his students will be older than he is--men often with years of experience in the field. These older students with a mature outlook on life do not always find educational methods to their liking, and do not believe everything they see in print. Consequently, unless the instructor has a good personality, is shrewd and well-informed on his subject, he stands an excellent chance of losing the respect of the class. Although it doubtless is not always the case, there is a definite correlation between the age of the faculty and their efficacy in teaching.

In considering forest school faculties, the discussion is hardly complete unless one examines the institution from which the teacher has been graduated; that is, are they a product of the school in which they are teaching or have they been educated on some other campus? Oddly enough, the figures received indicate that in nearly all schools, most of the faculty graduated from some other institutions. (See Table I) This is easily explained in the case of West Virginia, Louisiana, Florida and Purdue, since these schools have not been functioning long enough to draw upon their own graduates for teaching duties.

Older schools such as the University of Michigan, Oregon State College and the University of Maine show a larger percentage of alumni on their teaching staffs. Of the three above-mentioned schools Oregon State has the largest percentage of alumni on its staff, followed by the University of Maine with 65% and the

University of Michigan with 36%. As the years go by, the newer schools will call upon their own alumni to return and take up teaching work, but for some of the newer forest schools this time may still be several years hence.

Staffs composed largely of former graduates have their advantages and also their disadvantages. Basic courses such as mensuration and forest engineering can be taught more efficiently by a former graduate, since he is familiar with the local conditions that will be encountered and he will know the points to stress and those not to stress. (23) It would preclude any such possibility as, for example, an easterner being employed to teach mensuration at Oregon State College without previous experience in the region. Unfamiliar with scaling and cruising problems in the west and trained under a system differing considerably from that existant at Oregon State, even though he were a very keen man, he would be unable to teach the course as efficiently as an Oregon State graduate of no more than average ability.

In the case of silviculture, dendrology or possibly forest management, however, the argument shifts; for here experience, travel and first-hand knowledge in the possession of the professor make the course more interesting and valuable to the student. Points of discussion are more vital if the teacher is able to call upon personal experience to furnish him definite examples. In silviculture the student reads of model white pine forests in the east, of the pernicious chestnut blight which has doomed the eastern chestnut forests, of naval stores operations--of a

hundred and one different things. If, after having read about such things, he is able to clear up any points and have others elaborated upon by a professor who has actually witnessed the things he has read about, then he will find the course more enjoyable and will also have a broader and truer conception of that phase of forestry.

TABLE I.--SHOWING APPROXIMATE STUDENT-PROFESSOR RATIOS, AVERAGE FACULTY AGES AND PER CENT OF SCHOOL STAFF HOME-TRAINED FOR SCHOOLS OF FORESTRY IN THE UNITED STATES.

Forest School	Ratios	Ages	Home-trained
California	40	45	20%
Colorado State	28	42	20%
Connecticut	10	45	20%
Duke	4	--	0%
Florida	15	33	0%
Georgia	28	40	60%
Harvard	4	--	--
Idaho	56	32	0%
Iowa	44	45	--
Louisiana	18	36	11%
Maine	27	38	65%
Michigan State	39	34	20%
Michigan University	15	40	36%
Minnesota	47	45	--
Montana	70	--	--
New Hampshire	32	--	--
North Carolina	--	--	--
Oregon State	50	40	90%
Pennsylvania State	51	--	--

TABLE I - (Continued)

Forest School	Ratios	Ages	Home-trained
Purdue	--	37	0%
Syracuse	10	--	--
Utah	53	--	--
Washington	50	--	--
West Virginia	12	38	0%
Yale	4	50	--

Experimental Forest Areas:

Just as the student may obtain vastly more from written material with a capable professor to guide him--so may he receive similar benefits through field work in the school forest area. Of prime importance to the forestry school is such an area of land that may be used for instruction and experimental purposes, since theories are not worth much as such unless they are tried in the field. To be of greatest value to the students the area should be near the school so that it is possible for them to attend classes here during the week. In the case of Oregon State College the school is fortunate in having an excellent site located less than ten miles away, and it is therefore possible to schedule outdoor classes here for the student one or more times a week. Some schools are not so fortunate in that their forests lie some distance away from the campus, and they are compelled to concentrate their field work in more sporadic but longer visits to their forest areas. This is true of the University of Minnesota where the nearest accessible

forest area lies sixty miles away from the campus.

The acreage owned or managed by all forest schools in the country is amply large to permit the conducting of any needed experiments, although the stocking on some areas is perhaps not all that it might be. Some of the schools are fortunate in having a forest which has been under their control for a good many years; and which, therefore, contains a desirable condition of stocking and a wise selection of species, as well as a number of worth-while experimental projects which are beginning to be of practical benefit. Such an area is well exemplified by the Harvard Forest at Petersham, Massachusetts, which was established in 1907 and managed by R. T. Fisher until his death in 1934. Until recent years the Forest has shown a profit on its operations and has set up as a goal "the production of high-grade timber", but at the same time never have attempts been made to "work counter to nature, but rather to harmonize man's efforts with natural tendencies." (45) Unfortunately much of the mature timber on this forest was blown over by the hurricane which ravaged the New England states in September of 1938.

Much of the success of the school forest hinges on the man (or men) in charge. The proper development of such a place requires that the director give unstintingly of his time and effort; successful management of an area does not mean that one can sit back and just watch things grow. If at all practical--that is, if permitted by size of area and accessibility--the management of school forests should work toward a self-sustaining basis. To do this, many problems, varying with each school, will

have to be overcome; undesirable species will have to be removed, rapid increment encouraged, proper stocking attained, road systems established, silvicultural operations practiced--these are some of the obstacles which must be met and they will require planning, attention, foresight and interest on the part of those managing the area. (45) Proper supervision cannot be exercised if the man in charge of the experimental forest has also to carry a full teaching load. The University of Michigan is one of the more progressive eastern schools which employs such a forest manager who devotes his time to the care and development of school forest properties.

Summer Camps:

With but very few exceptions the forestry schools of the country require that their students spend a session lasting from eight to twelve weeks in summer camp studying and applying practical forestry. The University of Maine forestry school requires its students to spend six weeks in summer camp during their sophomore year followed by "eight weeks from the middle of November to the middle of January in permanent camps on a 17,000 acre tract owned by the state" during their senior year. (23) Although western schools require this training almost as universally as those of the East do, the need is not so great because in many cases the student has an opportunity to find employment in the woods during the summer months, which enables him to gain just as much profitable experience as any he might gain through a summer spent in camp.

The above practice is a sound one, desirable in the West

as well as in the East, and is particularly helpful to the eastern student who has small opportunity for getting a summer's work in the woods. If this were not a mandatory policy, students might find themselves, ironically enough, the proud possessors of a degree in forestry and yet unable to apply their knowledge in the field in creditable fashion. Such a carefree experience is a good thing for the students not only from the standpoint of practical knowledge gained, but also in that it tends to produce a spirit of camaraderie among them and forms a more closely knit group. The only objection that might be raised against such requirements would be that of the cost to the poor student--unfortunate in his case, but still a necessity.

Changes and Additions Within Schools:

In compliance to recent developments in forestry education, it is interesting to note the actions of certain schools as to the alteration of present policies. Noteworthy among these changes is the action of Cornell University in its decision to discontinue the instruction given in professional forestry. The "last undergraduate degrees in forestry were conferred in June and September 1936, with one (a man who had been ill) in December of 1937." (23) The final M.F. degrees were conferred in September of 1937. Under the arrangement, as can be seen, the teaching of forestry in New York has been radically changed.

All instruction in professional forestry, both graduate and undergraduate, offered under state auspices is to be concentrated in the New York State College of Forestry at Syracuse, and theoretically at least, all professional instruction in wild

life conservation and management goes to the New York State College of Agriculture at Cornell. A few courses in forestry of general, non-technical nature such as woodlot management will be continued, but Syracuse will assume all cares and responsibilities connected with the task of training professional foresters (under the friendly gaze of certain members of the Society of American Foresters).

Of interest also is the conversion of the Colorado School of Forestry to a Department of Field and Forest Science. In Colorado, as was the case in New York, there existed until recently two forest schools--one at Colorado Springs and the other at Fort Collins. Under the new system the Colorado Springs school has been changed to a "Department of Field and Forest Science where the emphasis is to be on the recreational rather than the commercial aspects of forestry." (23) The status of forestry at the Fort Collins institution has been elevated to that of a forestry division complete even to its own dean. Thus, a stronger and more centralized system of professional forestry education in one case and a new field of forest recreation training in the other has been made available.

New Schools:

During the past six years three new forest schools have added their names to the United States roster. Oldest of the three is that established at richly-endowed Duke University in 1932. With ample facilities and a competent staff of instructors, Duke has become firmly established in its few short years of existence. Next to be founded was that located in West Virginia University

during the fall of 1935. Through the strong and generous assistance of the state, the new school has been able to expand as rapidly as the need arises without being retarded through lack of funds. (23) Although the first class of the school does not graduate until 1938, the students have already developed into a strong unit. Their forestry club is unusually active; social functions are well attended; a year-book is being published; and prominent foresters of the state are already showing an interest in the school.

Newest of the forest schools in the United States is that harbored on the campus of the University of Florida. Founded in the fall of 1937, the recent addition is an outgrowth of the old department of forestry in the agriculture college. Dr. E. A. Ziegler, former director of the Pennsylvania Forest Research Institution and for twenty years director of the Mont Alto School of Forestry, recently with the Southern Forest Experiment Station, was added to the staff during 1938. Such changes and additions should be carefully considered by the student endeavoring to select a suitable forestry school.

AN ANALYSIS OF REQUIRED AND RECOMMENDED COURSES

That forestry schools tend to provide specialty training in various phases of forestry is in many instances true. Ordinarily this specialized department of the school reflects the demands of local or regional industries for trained men, and consequently the training may be provincial in character, although this is, of course, not necessarily true.

In all fairness to the students themselves and to society, which is benefited, this sort of training should be given by certain forestry schools, despite the fact that some will say the profession of forestry is injured by graduating as professional foresters men who have received such training. These opponents maintain that young men do not merit the appellation professional forester, unless their four years of college work has been devoted to orthodox forestry without the distractive influence of specialized courses.

Generally speaking, forestry schools offer the following specialty divisions within their schools: forest management, wood products and wood utilization, training in some phase of recreation, landscaping or range management and logging engineering. Forestry and the lumber industry in the United States have demanded men skilled in one or more of the above fields of forestry, and it is with this fact in mind that forestry schools have set up specialized fields of training.

As mentioned above, the fields of study are often organized to appease local needs in the way of skilled men. For example, many of the features of the Wood Products courses given in forestry schools on the Pacific Coast will differ from those of the Lake States, the Atlantic States or the Gulf States, since woods and sawmill practices vary throughout the country. Information that would be applicable to conditions in California might be of little value to the industry in Wisconsin.

Reflecting the demand for specialty men of various kinds, schools in Oregon and Washington train an appreciable number as

logging engineers, many eastern schools develop their utilization specialists, and southern schools train their quota of naval stores men. It is evident that the schools, by these practices, are filling a need of the forest industries, and their breaking away from the regimented curricula of the traditional forestry school is justified by societies' needs.

The curricula as outlined for the unspecialized forestry divisions of the various forestry schools compare quite closely between schools. Generally speaking it might be said that the average curriculum contains the following courses, or at least most of them, and that knowledge gained from such courses is required by any practicing forester: (22)

Preparatory Subjects

Botany
Zoology
Geology
Chemistry
Physics
Mathematics (Algebra, Trigonometry)
English Composition
History
Government
Economics

Pre-technical Subjects

Forest Soils
Plant Ecology
Taxonomy
Dendrology
Accounting
Wood Technology
Drawing
Surveying
Mapping
Timber Physics
Statistics

Technical Subjects

Forest Protection
Silvics and Silviculture
Forest Pathology
Forest Entomology
Forest Mensuration
Forest Finance
Forest Regulation
Forest Management
Forest Administration
Range Management
Wildlife Management
Forest Recreation
Forest Utilization
Forest Economics
Forest Policy
Forest History

Recommended Subjects

Geography	Agronomy
German	Analytic Geometry
Meteorology	Animal Husbandry
Psychology	Minerology
Photography	Plant Pathology
Business Courses	Wood and Metal Shopwork
Landscape Design	Cost Accounting
Public Speaking	Labor Problems
English Literature	Tree Pruning

Preparatory Subjects:

Botany: Perhaps it might be wise to analyze the courses individually, and to consider why they are essential to the trained forester. Botany is without question a basic subject to forestry, and a knowledge of plant structure and growth must precede further more involved courses in forestry. Most schools require not less than a year of botany and some ask that the student complete 1½ years of such study.* Furthermore, botany may be rather an inclusive term, which may encompass related subjects such as taxonomy and ecology; these last-named courses are frequently required under the forestry curricula so that, all in all, as much or more time is devoted to botany than to any other one subject.

Training in botany is usually begun when the student first enters college, in order to give him some knowledge of basic forestry principles. Many subsequent courses demand a knowledge of botany, and the course adapts itself well to freshmen teaching. First-year botany includes a thorough study of plants and their functions, and is usually studied out of one text. Laboratory

*Georgia, California, Colorado State College.

work with considerable microscope study supplements the book and gives the student a practical working knowledge of the subjects.

Zoology: Similarly, zoology is listed as one of the courses that must be taken by the student in many forestry schools. Although perhaps not quite so important as a study of botany, this biological science dealing with the animal kingdom dovetails in with many types of work in the field. With increasing stress being placed on wildlife management both on private and public lands, the forester is often confronted with a type of work that lies within the realm of zoology.

The course is usually given in the second or third year, and the methods of study are comparable to those in botany. Numerous texts have been written on the subject, many of them redundant with scientific terms and classifications. Although the course may become unnecessarily scientific, at least from the standpoint of the forester, in some institutions, much of the knowledge is valuable per se, whether it applies to forestry or not. There might be some question, however, regarding the advisability of retaining zoology as a required course under the forestry curricula; it is possible that some of the social sciences or other cultural courses might be equally as beneficial to the student.

William L. Taylor in discussing the matter says: "It is a rule of good forestry, particularly where new forests are being created, that the forester shall be acquainted with the fauna of the locality and of his forest. Without intimate knowledge of the animal populations and their changes, it is impossible to

take steps that are bound to become necessary following any major alteration in the utilization of land to induce a balance of nature suited to the circumstances." (43)

Geology: Any well-rounded forestry curriculum must needs include some geology in his course of training; a practical correlation exists between geology and forestry. One whose work draws him constantly into the field need not ponder the question long before realizing the advisability of attaining some geology education. Personal satisfaction and enjoyment, a more thorough knowledge of tree growth and soil behavior, efficiency in road and trail construction--all justify the study of geology. E. W. Kelley of the U.S.Forest Service states that the government "requires men with a sound working knowledge of how the world came into being, versed in the elements of geology." (26)

Many state colleges and universities include excellent geology departments, as well as forestry schools, within their educational system; and the forestry student is thus in a position to obtain some very good training in geology. Often the scope of courses taken not only includes the conventional studies of geology dealing with the more prominent features of the land, but also serves to familiarize the student with the more common minerals and rocks to be found in the field. A year's study in geology should suffice to give one a good basic knowledge of land structure; probably half a year is all that the student should be required to spend in the study of geology, but advanced study in this field might well be listed as one of the more desirable elective courses open to the student.

Graves and Guise, in speaking of geology, say: "Its educational value alone in developing an appreciation of the world in which we live is cogent reason for including it among the basic subjects in the preparatory group." (15)

Chemistry: Varying amounts of chemistry, in several instances one year, are included as part of the course of study. A knowledge of chemistry is a valuable asset to the forester, and to the wood technologist it is indispensible. For those majoring in Wood Products, chemistry is among the most necessary of courses. Chemistry courses are scheduled for the student's freshman or sophomore year; thus, if he desires to follow up these courses later with additional work in chemistry, he may utilize some of his elective credits in this way. It is quite probable that more attention will be devoted in the near future to the wood products divisions of many of the countries' forestry schools. In order to keep pace with wood-substitute industries, the lumber people are going to have to devote their attention to wood plastics--to new uses for wood. Such development requires trained men; more particularly, it requires men trained in chemistry. Consequently, it can be seen that chemistry instruction will take on added importance in the curriculum of the wood products man; new courses in chemistry will be required and more time will be devoted to the subject.

Physics: Physics represents another of the basic technical courses included in the course of study at all but four forestry schools. Just as with chemistry, physics is of particular value and importance to the person specializing in logging engineering

or wood products, where the application of such knowledge is frequently called into play.

However, in the case of physics the general knowledge of the science, whether it ties in directly with forestry or not, becomes a valuable component of a person's education and for this reason makes the course a desirable one. To be of the greatest value physics should be presented with a thorough laboratory course to supplement the lecture material. Timber physics, which is often treated as a separate course, will be discussed later.

Mathematics: Although forestry is not founded so largely on mathematics as are the engineering schools, it is a profession which does make use of certain branches of mathematics to a large extent. Most schools offer training in algebra, trigonometry and statistics, and ordinarily one year is devoted to a study of mathematics. Mr. Kelley believes that "men with a good mathematical background are helped to think more clearly and reason along straighter lines between given starting points and ultimate objectives." (26)

Algebra courses offered to forestry students carry over the subject from high school and perhaps offer some worthwhile additional work in the field. An extensive grasp of the whole is not needed; algebra is sometimes used in cost computations in the field and in forest finance computations, but a general knowledge of algebra is sufficient to care for these needs. Often the classes are composed solely of foresters, although in some schools students take mathematics in mixed groups.

Trigonometry is a more practical course than is algebra to the forester; surveying, road and trail construction, railroad survey and construction, mapping--all tie in closely to trigonometry. Basic trigonometry is one of the more easily understood fields of mathematics, is thoroughly practical and does not require constant study in numerous courses of mathematics to master. The forestry student is taught an excellent working understanding of practical trigonometry in one semester, certain elements of which he is constantly called on to apply in succeeding engineering and mapping courses. Trigonometry might well be considered one of the most practical and worthwhile of all courses given the forestry student.

Statistics: Statistics is also a course that may be definitely applied in the field; its application is not so universal as that of trigonometry, but a knowledge of statistics is absolutely necessary in certain phases of forestry. In sampling work, in volume computation, in constructing yield tables and in cruising work, statistical methods are used. A comprehensive knowledge of statistics is not needed; and, for that matter, cannot be obtained in one semester. Understanding of sampling principles, averaging practices and ways of making accurate approximations from large bodies of data are the information that the forester wants.

Gevorkiantz says: "Whether he deals with the question of land use, germination of seed, or with a mere count of annual rings in a living tree, the investigator invariably needs the cautious rules of the statistical method to guide him in doing

justice to his problem." (14)

English: Much has been said of the pressing need for comprehensive training in English composition, and the forester's shortcomings in English are often more fact than fiction. Handicapped particularly are those students who received their high school education in small schools, where the English instruction is often of low caliber. It is of prime importance that the forester be able to express himself not only in writing, but also orally. Jeffers and Martell state that "the most widespread criticism by the industry is the lack of training in the use of the English language on the part of forest school graduates." (25)

The minds of the public are plastic, or so it is presumed, with regard to forestry needs, and it is the problem of the forester to mold public opinion so that it will appreciate the problems of, and cooperate with, the various forestry units of the country. In order to be influential the forester must be lucid, must have a knowledge of grammar and vocabulary to back up his statements.

It can be seen, then, that training in English should be stressed. Most schools require that the student carry on study in English for one year; the course includes composition writing, grammar studies, vocabulary improvements and supervised reading. It is customary to segregate the students on the basis of a general examination in English given all students on entering college. In this way students with a weak background of English are given a chance to devote more time to the subject so that when they finish their course of study they have a more suitable

foundation in English.

Perhaps this first year of English does not produce startling results; but at least it should serve to make the student more "English-conscious." As he finishes college he will read more widely, will write more reports and gradually, through use, will improve his English. At any event, it would seem that one full year of English is a just allotment on the part of the school. A subsequent course in report writing is often valuable to the professional student, and many foresters include such a course in their curriculum.

History: Most schools require that the student complete a specified amount of work in social science courses. These subjects are quite varied and might include history, economics and several courses in government and current affairs. All of these courses are of value, not only to the forester, but to anyone.

A history course, which is sometimes required of the forestry student, if it does not duplicate work already had in high school, can be very educational. Courses of all descriptions are offered in history, and the general knowledge to be derived from such a study makes one a better citizen and a more interesting person. Such courses have one big advantage over similar ones given in high school. The student is older and more mature in his outlook--he sees the importance of such study more fully and takes the course to add to his knowledge rather than merely because it is required.

It has been said rightfully that the "study of history is one of the most potent influences in education for developing

the spirit of inquiry, tolerance and breadth of view, which we are seeking to stimulate in the student." (15)

Government: Since forestry is so closely tied in with society and the public welfare, whether the forester works for some government unit or whether he is employed by a private concern, it seems particularly fitting that forestry students be required to study one or more courses in government.

Most institutions offer courses in national government, state and local government and government of local communities. Perhaps of the above courses mentioned, the former two would be better suited to the needs of the forester, or, for that matter, to the needs of the average citizen. In a study of this sort one learns of the workings of our governments--their failings and needs and their strong points--and in so learning, becomes a more interesting person when among other people and likewise a better citizen.

At present only four forestry schools require courses in government; perhaps the remaining schools are standing on firm ground in that their students have a fair knowledge of government gained in high school studies. It would seem, however, that such a study would be helpful to the average student, and on the basis of this assumption should be included as one of the recommendations for elective courses.

Economics: Needless to say, it is not sound to train the forester exclusively in the tenets of forestry; not only should he receive knowledge of a general or scientific nature, but also he should study some in the sphere of business. Economics is helpful to all,

whether the person be a housewife or a business executive. To the forester, especially to him who chooses to enter private industry, economics may well be indispensible. Often he will be operating on a close margin and may break himself through one or two unwise ventures. An understanding of economic principles helps to circumvent unfortunate mistakes in business.

Economics courses are given many foresters usually of one-term duration. Ordinarily they are straight lecture courses based on textbook material promulgated by classical economists. Consequently, these courses are often classed as "dry" by the student; little inspiration is offered for additional investigative work in economics and knowledge gained is often fragmentary.

The difficulty here may possibly be that too little time is devoted to the subject; it is rather difficult to grasp even many of the broader principles of economics in one semester's work; and, when it comes to applying these principles to specific cases, confusion may frequently result.

It is interesting to note past developments in Germany hinging on an application of economic principles in forest management. Private forest land owners, who were compelled either to make income more than balance expenditure or retire from business, managed to profitably operate their stands. Public foresters, on the other hand, indulging in the most intensified methods of silviculture, threw economic principles behind them and operated state lands on a losing basis. (37)

Pre-technical Subjects:

The subjects thus far discussed have been so constituted that the tie-up with forestry is not directly discernible; subject matter covered is of general value to the student and would aid the farmer, the soil expert, the botanist or the county agent probably just as much as the forester. This state of affairs sometimes makes the entering freshman strain at the tether; he wonders when he is really going to start training in "forestry", not realizing such preliminary knowledge is an absolute necessity before further progress can be made in his education.

But as he moves along into the second year of school, the freshman meets certain so-called "pre-technical subjects" which tie into forestry directly. Such courses must needs be taken by anyone aspiring toward professional forestry--they offer information pertaining more or less directly to the forest.

Soils: The relationship of the forester to the forest soils he works with is a close one; just as in the case of geology, such knowledge is of importance to the forester and is also good general material that is applicable to things apart from forestry. A knowledge of soils enables him to gauge deficiencies, to discern ailments, to choose the right tree for a particular spot, to classify land as to tree-raising ability, etc. Just as Mr. Kelley says, "the forester should have a definite working knowledge of the relationships between the various features which comprise the sum total life of that part of the world in which they live." (26)

He is able to read soil bulletins and soil maps more intelligently, and thereby can classify land as to soil type and soil series--exceedingly important considerations in many localities. Laboratory periods are a big help to the student, and work in nicely from a practical standpoint since soil differences can usually be readily obtained by core studies of surface soils.

During the past few years conservation policies have come to include soil conservation within their realm. Soil erosion work has brought home the valuable role of trees in checking erosion; often the forester is engaged in planting trees to control erosion and a knowledge of soils is helpful in this work. At other times he may have an acid soil, a porous soil, a poorly-drained soil or a hard-pan soil to cope with. Although he is far from being a skilled soil scientist, his training coupled with common sense will light the way to a sensible method of handling the problem.

Plant Ecology: Particularly for one entering experimental research work in forestry a course such as plant ecology would be helpful. An understanding of the relationship of plants to their environments is required in a general sense of the forester, but such a course as that mentioned above would, of course, disclose many new and unusual angles bearing on the question.

Taxonomy: Taxonomy is another course that falls into the same category as ecology--a very interesting and valuable course to one following botany in its many ramifications. To one not so interested, a detailed study of plant classification based on

relationships would be unnecessarily detailed. Because of their rather limited appeal, it might be advisable to keep both ecology and taxonomy on an optional basis with the student, although it might be argued that the training is valuable and will serve to stimulate one to indulge in personal study in later years in such work. Only a very few schools have it mandatory that either of these two courses be taken in the forestry curricula.

Dendrology: Rightfully enough dendrology in some form is included in the curricula of all forestry schools in the United States. As ordinarily presented, the course is very complete and is excellent training for the embryonic forester. All pertinent characteristics of some 100 important tree species are treated with, and a thorough knowledge of tree ranges is required. Trees native to the region in which the school is located receives somewhat more attention, since they are available for laboratory study.

This might well be considered as one of the best of all forestry courses taught; a forester does not merit the name until he has at least more than a layman's knowledge of the more important trees and shrubs native to his country generally and to his locality specifically. In learning the trees of his region thoroughly by means of actual field identification, the student often is in a position to observe family and genus characteristics that enable him to recognize strange trees and shrubs of other regions.

Also the large amount of reference work required in such a

course familiarizes the person with a large number of plant and tree books. At times various students will suddenly come to realize that it is enjoyable to browse in books of value--that it is a pleasure to accumulate knowledge about trees. They come to know the various species more as living beings with human qualities, than merely as trees. One may be sturdy, another hardy, another persistant, another god-like, another majestic, another garrulous, another soldierly, and so on through many of the tree species, each characterized by some peculiar trait or quality. Such enthusiasm is much to be desired, and here again the success of the class depends much upon the qualifications and attitude of the instructor.

Accounting: Though not yet required by most forestry schools, accounting principles are often applied in the field; whether one works in the federal or state forest service in an administrative capacity or whether he is employed in private forest industry, the need for accounting is often forcibly experienced. Many forestry school graduates now employed as rangers report a need for accounting in their work.

It would be entirely possible to cover the necessary material in one term; just as with almost any business it is only the fundamental knowledge of accounting that is applied in forest practice. Accounting principles also help one to become more neat and systematic in work habits and aid a person to set up thorough records of accounts and activities.

A practical arrangement, which is in effect in at least one forestry school, requires that all foresters take a special

accounting course for engineers and foresters in conjunction with engineering students in the college.* Practical problems likely to be encountered in keeping accounts for any business are solved in the course, and graduates state that this training often proves invaluable to them in the forestry work which they take up on graduating.

Wood Technology: Wood technology is rather a broad term in that it may be comprised of several courses including identification of woods, wood uses, chemistry of wood, etc. Nomenclature varies with schools, but ordinarily the same material is covered in each institution. Specialization in this phase of forestry has been undertaken by a few schools; Michigan and Syracuse, for example, offer excellent technology training in separate divisions of their forestry schools. A more detailed analysis of these and other wood-technology curricula is included elsewhere in this report. (See page 90.)

In such a field of study laboratory equipment must be ample, if satisfactory work is to be performed. Wood samples, microscopic slides and microscopes, strength-testing machines and other facilities must be available in order that laboratory work may be conducted satisfactorily. The course in timber physics might be included within the group of wood technology subjects, and it is here that the larger wood-testing machines are needed.

To one working in conjunction with wood-demanding or wood-supplying industries, a knowledge of wood technology becomes

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*School of Forestry--Oregon State College

everyday working material. He must be able to recognize woods, must be familiar with their inherent characteristics, must appreciate their relative value and suitability for certain uses. Of course, such a man is a specialist, and such extensive training must be passed up by the average student. For all practical purposes, a knowledge of the more important woods, and an ability to identify these woods is the information needed by most individuals.

Surveying: Much of the forester's work must be done in the field; any young person who works up through the ranks almost invariably will spend his first years in the forest. Here his work may be mapping, locating roads and trails, laying out railroads, constructing bridges and lookout towers or laying out picnic and camping spots. Obviously much of this work is based principally on surveying.

Surveying and drawing are taught in eighteen of the forestry schools in the United States, and it would seem that comprehensive courses are given at most of these schools. (37) Much of the study is carried on in the field; those schools which hold summer camps give their field work in surveying at this time. Irregular areas are surveyed by transit and compass; distances are determined by pacing and chaining and stadia; contours are taken by abney, transit and barometer.

It is customary to enroll the students for one year in surveying and drawing work, with a heavy allotment of hours to the course, since so much time is spent in the field. Such training is exceedingly important to the forester. As has been mentioned,

his first jobs often will be in some phase of surveying, and with a good background in the work he will be able to handle problems nicely.

Drawing: Drawing works hand in hand with surveying, and is taught in conjunction with it. The ability to turn out neat, well-balanced charts, diagrams and maps is a valuable asset; and, just as is the case with engineers, foresters are constantly engaged in such work. Drawing ability may be inherent within some people, but almost any person can become adept with practice. However, proper training entails about a year of constant drawing work. This fact some schools have overlooked; they attempt to cover the training in half a year or less and as a result the student's work often is slovenly.

Technical Subjects:

The last main grouping of courses includes those which are "of professional character and scope"; i.e., the technical subjects. Most of the classes in this category are compulsory with the student; and there are quite a large number of such courses, most of them taught in the last two years of a student's curriculum. The Second National Conference on Forestry Education advocated that such technical courses should be given "mainly in junior and senior years" and most forestry schools have wittingly or unwittingly taken their advice. (39)

Protection: An exception to this practice arises in the case of forest protection some of which may be, and often is, given in the sophomore year. Forest protection is rather a broad term, and may include all phases of forestry dealing with the

protection of forests. Under such terminology it would include fire protection, pathology and entomology.

On the other hand some schools include a so-called course in "forest protection"; this subject is primarily concerned with fire problems. Such a course attempts, in a decidedly limited time, to familiarize the individual with fire-fighting, and fire-detecting technique. Methods of attacking a fire, organization and handling of crews, operation of tools and equipment, measurement and recording of weather data--these represent a few of the particulars discussed.

A course of this type covers important material, but for best results it must be taught with a certain amount of field demonstration work. Fire experience and knowledge can be gained only by actual work on the fireline; lectures on the subject are valuable, but only if supplemented by work in the field. The same applies to weather observations. The class derives little benefit from a mere discussion of how a duff hygrometer, a sling psychrometer or a hazard indicator operates; they must see these things to appreciate them.

Silvics and Silviculture: Silvics and silviculture may well be placed in the above grouping of technical subjects. Silvics, the science, constitutes the foundation for silviculture, the art; the curricula of all forestry schools include silviculture as one of the required courses. Although a thorough concept of the art comes only after long years of experience with the forest, a large amount of valuable information is given the student in the year or more devoted to the subjects.

Thirty years ago, when forestry was first beginning to show signs of a vigorous future existence in America, silvicultural training in forestry schools presented a real problem. Although we had inhabited our continent for some 400 years and in that time managed to devastate more than half of the original timber of the land, little was known in the field of silviculture. Textbook material applied to European conditions, and for this reason was not readily usable.

But at this time a handful of outstanding foresters began studies and experiments which are today beginning to bear fruit. For many of our timber types we now have reliable information as to growth, seed, soil and site, pathological and entomological enemies and values. American texts have been written so that teachers of today are able to apply rules to localities and to illustrate rules with existing experiments.

Often the art of silviculture is taught in three steps: a general consideration of the forest and forest influences, a study of the application of silviculture to various species and timber types and finally an investigation of nursery practice, seeding and planting policy and forest reproduction in general. Classes, on their laboratory trips, may plant trees, visit nurseries, perform various types of silvicultural cuttings, make soil tests, correlate tree growth with site and climatic factors; the study can be made intensely interesting under proper direction and with the inspirational leadership of a good teacher.

Moving to the other side of the fence, the instructor who

is content to rely on text material solely, who is not personally interested in various experiments, who does not imbue the class with enthusiasm and instill in them an alert, questioning attitude, is not doing justice to his subject. Austin Cary says that personality and sympathy are the main attributes of a good teacher and goes on to say that "silviculture is the central part of forestry and ought to be strongly developed." (11)

Forest Pathology: That forest pathology is an important division of forestry cannot be denied; when one reads that damage amounting to approximately $250,000,000 occurs annually to wood products in the United States as a result of the attack of disease organisms, he has tangible evidence of the fact. (3) By means of a course in pathology the student becomes familiar with the more common fungi found on living and dead trees, on slash, on lumber, on seedlings, on bark, etc. These various diseases are of vital concern to one associated with forestry work, since one of the primary objectives of forestry is to produce healthy and merchantable trees.

It is absolutely imperative that the class be given frequent opportunities to visit the field in order to collect and observe specimens. Such a course cannot be taught in the classroom alone; field observation is more than just a supplement to lecture work in this course--it assumes just as much importance as the lecture work itself.

Under proper instruction a good knowledge of fungi diseases, parasitic diseases and physical injuries found commonly in the

forest can be accumulated. Since many diseases are particularly virulent in certain localities, it would be wise to stress such diseases native to the immediate region more than diseases not likely to be encountered in the course of work in that region. Should the man find employment in distant parts, he will be familiar with literature on pathology and will be able to refer to it for further information.

Forest Entomology: Forest entomology, the study of insects affecting forest growth, is important, just as is pathology, because of the millions of dollars of timber and wood products that are destroyed annually by insects. While the pathologist may have white pine blister rust and the chestnut blight to contend with, the entomologist has the equally destructive spruce budworm, larch sawfly and pine beetles on which to devote his attention.

Various insect epidemics have destroyed thousands of square miles of valuable timber, and man has found himself helpless in the face of the myriads of insects which appear periodically. But the entomologist, by intensive study, has come to know the life habits of many insects and in many cases has discovered control methods which are feasible. It lies within the realm of entomology, then, to devise new means of combating destructive forest insects; if the forester knows the habits of the most injurious of the insects, he has enough knowledge to make a correct diagnosis in cases which he is most likely to meet in the field.

Consequently, in presenting a course in forest entomology,

the instructor should concentrate on only the most important insects. Entomology is such a vast field that it is impossible to cover even a small percentage of the existing insect families in one semester and it is wasted effort to try to do so. The student can only assimilate just so much knowledge in a given time, and to attempt to cover the entire subject even in a general fashion is folly. Graves suggests that "special emphasis should be placed on the economic aspects of forest entomology and practical methods of control of the injurious insects." (15)

Forest Mensuration: Forest mensuration provides more working tools for the professional forester than any other course included in the field of forest management. A full year of study should be devoted to mensuration, since this subject must cover such a diversity of work that it cannot be successfully taught in a shorter period of time.

This, likewise, is another course which cannot be presented in the classroom alone. The principles driven home in the lecture periods do not remain with the student long, if he is not given a chance to apply them in the field. All phases of mensuration work are closely allied with the forest. This is true of log scaling, volume estimation, volume table construction, increment studies, yield table application and cost estimations of field work. The student may understand the material sufficiently well to pass examinations on the subject during the term; but such an approach to a practical subject is not itself practical and is unsound teaching technique.

If at all possible classes should be so arranged that classwork will correlate directly with field work. At the time a study is being made of log scaling practices, the class should have an opportunity to repair to the woods where down logs are available and where they can actually apply the rules learned in class. Similarly, when timber cruising methods are being studied, the class should be assigned an area of timbered land to cruise by one of the accepted methods. Such practices give the student a working knowledge of the subject; and later on when some future employer instructs him to cruise an area or to scale a deck of logs, he will be more competent in handling the job.

Many eastern schools are hampered in that their experimental forests are either inadequate or too distant for ordinary usage. To circumvent this difficulty such schools concentrate their field work in mensuration and present it at their summer camps. Here the subject is studied intensively--that is, a large portion of each week's study is devoted to mensuration practices, so that the total time devoted to the subject compares with that of western schools.

Mensuration is taught at all forestry schools in the United States, and the average period of time devoted to the subject is one year or 7.5 hours of study. As Graves points out "the subject is fundamental to forest management and essential to many phases of utilization, engineering and silviculture." (15) Graves goes on further to say "principles" should be stressed in the course, which is sound logic, but these "principles" necessarily

bring field practice into the picture, and one should not construe such advice as to mean the relinquishment of field work.

Finance: Forest finance, though it may seem "dry" and involved to the student at times, is really a valuable and applicable study of certain forest practices such as stumpage valuation, tax studies and insurance ratings. The practice of forestry always involves a comparatively long-time investment, and the returns are ordinarily negligible until the stand matures and is cut. In a selection system of forestry there is a fairly constant annual income, but the investment still remains a lengthy one. Furthermore, with the exception of the South, selective logging is still almost a nonentity, so that anyone entering the practice of forestry must consider investments carefully. High initial investments, whether they be in planting or subsequent silvicultural treatment, exist for such a long period of time that marketing of the mature timber years later may bring a net loss as a result of the compound interest factor operating on the initial investment.

It can be seen, therefore, that an understanding of the more basic principles of finance can mean a great deal to the forest owner. As mentioned previously, the German state foresters learned this to their chagrin, when they invested too much money in silvicultural treatment of young stands. The U. S. Forest Service is studying the problem constantly through its expert economists; the federal forest holdings and investments are so large that this intensive study is often helpful. But to the private holder of timber, whose possessions do not

ordinarily total more than a few thousands of acres, a general knowledge of compound interest and stumpage values is sufficient.

Such information is given in most forestry school finance courses, and often studies are also made of Forest Service practices in connection with stumpage appraisal, damage appraisals, and cost computations. Fifteen forestry schools offer courses in Finance, and most of them condense the subject into a one-semester course.

Forest Management: Forest management is ordinarily said to include all courses dealing with the handling of forestry property. Such a consideration of the term would place mensuration, finance, administration and various kinds of management within its bounds. However, many schools offer individual courses in forest management that are concerned actually with management practices and problems of forests. Students learn management techniques applicable to various types of stands including those which are even-aged, all-aged, virgin, over-mature, understocked, etc. The course is a practical one that smacks of forestry from beginning to end; it helps the student to understand the principles involved in selective logging, economic selection and sustained yield--terms commonly encountered in forestry literature and discussion of today.

Such a course may be taught very nicely within the classroom to students who have had field work in mensuration, engineering and silviculture. Such students have a background of field experience which permits them to visualize the various kinds of

forest practice under discussion. Furthermore, they can appreciate more fully the problems of logging managed timberlands, such as road costs, costs of road and equipment maintenance, depreciation charges on equipment, etc. Such considerations are of importance in forest management, since they often determine the "break-even" point on an operation.

Some schools, such as Oregon State College, for example, include a requirement within their management course that the students prepare a mangement plan for an actual forest area. Such a study helps to impress the somewhat involved tenets of management upon the student's mind, and may prove invaluable to him later in life should he be called upon to set up an actual working plan for an area. In the case cited students prepare a management plan for the 4500 acre school forest lying seven miles from the campus. Practically all of this forest is stocked, most of it with good quality standards. The area possesses two excellent potential markets, Albany and Corvallis, located less than ten miles away. In the problem, the student must first decide whether to use the timber as fuelwood or lumber; then, he must determine his rotation after which he arranges his cutting blocks, provides for reseeding, locates roads, computes costs and future incomes. Since much the same technique is followed in government management work, the knowledge derived from the study is practical and the report itself may at some later date serve as an excellent source of information.

Forest Administration: Ten schools offer work in forest administration, but the nature of the administration courses varies

with the institution. The course should logically embrace "the various activities of business management of a forest", but these activities are "roguish things" that some may hold important and others not. (15) The course is a three-hour one, usually given for only one semester. Among the things discussed by most instructors are problems of personnel management, business management, labor organization, labor efficiency, objectives of business, etc. In some institutions such a course as this presents a welcome change to the student in that thought-provoking questions, some of them of a philosophical nature, are discussed in class. Thus, the students have an opportunity to express their own thoughts and convictions, and are enabled to break away from technical and problem courses which sometimes comprise nearly their entire schedule.

Range Management: On certain national forests in the West, the handling of grazing permits has become the principle duty of Forest Service officials. In the higher mountains it is often true that timber values are negligible, whereas thousands upon thousands of vast mountain meadows constitute the best kind of grazing land. In accordance with the policy of the government, which strives to give the greatest amount of good to the greatest number of people for the longest period of time, this grazing land is made available to western stock owners.

Such use of government range involves a great deal of supervision, and it is, of course, desirable to have men available who are familiar with range practice. Such training is given in at least seven colleges--California, Oregon State, Washington

State, Idaho, Utah, Montana and Iowa, and in addition more limited training can be obtained at still other institutions in the form of individual courses in range management. Students intending to work on western national forests after graduating should be encouraged to seek at least a basic understanding of range management, involving a general knowledge of grasses, stock, stock poisons and diseases, etc. (See page 67)

Wildlife Management: Wildlife has received a tremendous boost during recent years; dwindling resources have been stabilized in many cases and in others they have even been increased beyond the numbers which inhabited the land at the time of the discovery of America. For example, it has been estimated that deer populations to be found east of the Mississippi river are at the present time larger than those living here before the time of Columbus. (2)

However, such is not universally the case with all our wild life; mountain sheep, mountain goats, grizzly bear, moose and caribou appear to be gradually diminishing throughout much of their range. (35) The national forests have a large responsibility in this connection, since so many wildlife species live within their bounds. It is estimated that 75% of the big game in the West are dependant on the national forests for summer forage.

Wildlife administration has come to be one of the very important divisions in the Forest Service; by the close of 1938 some 58 expert wildlife technicians had been taken into the ranks of the Service, while many rangers also devote much of

their time to the problems brought on by wild creatures inhabiting their districts. This being the case, it can readily be seen that there is a need for men who have had some training in wildlife administration. Unless specialization is intended by the person, it is not necessary that more than one or two courses be taken, since this should give him sufficient knowledge to meet the general run of difficulties he is likely to encounter. (See page 84)

Forest Recreation: Just as with wildlife, forest recreation has experienced a sharp rise in popularity within recent years. People have found themselves with free time, fast automobiles, good roads and have turned an eye toward wholesome recreation. This they have found in the various national parks and national forests of the country. Vast numbers of recreationists totalling as many as 30,000,000 in a single year visit our national forests. (31)

With this new development occurring, a new type of specialist has come into being--the recreation specialist or engineer. He must be a man with vision, have a flair for landscape design, must appreciate the value of simple and natural features of beauty. Although individual courses in the field of forest recreation are much to be recommended, it is, nevertheless, certainly not possible to really become trained in such work without studying landscape and cultural courses at some length.

Forest Policy and History: In order to really impart the proper background to the training of a forester, it is necessary to include courses considering the past developments in forestry.

Although United States forest history does not date back so very far, this history is replete with stories of fortunes made, of resources squandered, of governmental mistakes and of logging procedures.

It seems strange to realize that more than 2/3 of our original timber resources have been removed. Such facts as this obtained from a course in forest history do much to give the student a true understanding of what lies behind our present-day forestry picture. He will find a great deal of very interesting reading as he studies the course, although some of this information may make him writhe at the corruption and waste which has occurred during the exploitation of our timber resources.

Recommended Subjects:

Photography: Although all of the courses listed previously as desirable to the student are certainly well worth considering, no attempt will here be made to consider each one of them individually. However, of the list two seem especially worthy of mention--photography and tree pruning. With so much of his time devoted to the out-of-doors, the forester should be familiar with at least the rudiments of photography. This can be a source of great satisfaction to him, particularly since he has such a fine opportunity to behold beauty so often. A course in photography of average college caliber should suffice very nicely to give him an excellent background in photography which he can expand later with added reading and personal experience.

Tree Pruning: Although not at all widely offered in forestry

schools, tree pruning is a practical course of which every forester should have some knowledge. In portions of the East, where ice and wind storms occasionally occur, a trained man in this field should find plenty of work, particularly if the public can be made to realize that such men exist and are available. Eastern forestry schools in particular should endeavor to include some of this work in their forestry curricula. With employment opportunities in pure Forestry now becoming manifestly inadequate to take care of the hundreds of trained foresters emerging from forestry schools, an obligation rests squarely upon these schools. It is their duty to investigate all allied fields close to forestry in order that their graduates may have an opportunity to realize some tangible benefits from their training. Tree pruning offers such a supplemental field, and it would seem desirable that every forest school graduate should have some practical training, as well as classroom instruction, on the subject.

COMPARATIVE ANALYSES OF FORESTRY SCHOOL CURRICULA

As has been mentioned previously, nearly all forestry schools in the country tend to develop specialty departments in some phase of forestry. An attempt has been made to compare the curricula offered in such specialty divisions and in each case an effort has been made to include the better known schools in each comparison. Since much of the work has been based to a very large extent merely upon a careful consideration of the curriculum for each school as it is presented in the school's forestry

bulletin or catalogue, the value of each rating is directly proportional to the exactness and veracity of the information contained within the bulletin in question. For example, two schools may each list ten hours of required chemistry courses within their curricula. Yet this does not necessarily mean that the training will be equally as comprehensive in both cases. One institution may have better equipment or more capable instructors, and as a result, the student receives more complete training.

Although the accuracy of the comparisons are limited by the above-mentioned items, it is believed that, by and large, the analysis presents a true picture. The curricula in logging engineering is considered first.

Logging Engineering:

Logging engineering, the application of which is now pretty largely centralized in Canada and the Pacific Northwest, has undergone some interesting evolutionary changes. For many years the hard-living loggers found their transportation problems relatively simple, since they confined their logging activities to areas immediately adjacent to streams or other transportational facilities.

As time went on, however, they were compelled to move further away from streams and roads and into the virgin timber of the West in order to reach the timber. Their oxen worked slowly and log production slowed up. To meet these changing conditions in the 80's and 90's the steam donkey engine was improved and adapted to logging on the Pacific Coast. (27)

Early application of the "donkey" consisted solely of skidding the logs over skidroads to water or railroad landings, the individual logs being hauled out of the woods to the skidroad by means of bull teams. Later the bull teams were supplanted entirely by donkey engines, and engineering began to play a more important part in the business of logging.

Production increased greatly, and it became necessary to move back further into the hills. Unlike the eastern forests, transportation by water was commonly impossible, and it became necessary for trained men to determine grades, lay out curves, study yarding distances and construct railroads, flumes and roads.

During the early days of the World War further revolutionary changes were made in the "fir region" when the high lead system of logging was introduced. (27) At the same time various skyline systems were devised in order to increase production. Small fortunes were invested in railroads, engines, expensive logging equipment and bridges; such high capital investment required high outputs of logs and mass production followed. "Hi-Ball" became the slogan of all successful operations.

It was at about this time, during the years of 1910-12, that forestry schools began to add departments of Logging Engineering to their curricula. Logging had become an involved business with engineering problems to be solved, and trained men were needed.

The need for college-trained logging engineers exists in the Pacific Northwest and Canada (in the Northwest and Northeast) today just as much as it did twenty years ago. Four schools offer

work in this branch of forestry--Idaho, Montana, Washington, and Oregon State--but only the latter two institutions have separate departments of logging engineering. In Canada, the University of Toronto, University of British Columbia and Quebec Forest School offer degrees in Forest Engineering; students receiving these degrees at the Toronto and Quebec institutions are so trained as to fit into the woods operations of the large pulp and paper companies, while graduates of the University of British Columbia receive training more comparable to that given at the University of Washington and Oregon State College. (12)

The University of Idaho and Montana State University do not offer any specialized curriculum in logging engineering, but merely provide certain courses which the student may or may not take, as he chooses. For this reason, these two schools are not on a comparable basis with Oregon State and Washington. Similarly the University of Michigan offers an excellent course of logging costs, which would be a valuable addition to the curriculum of any logging engineering school.

It is interesting to compare the curricula of the two above schools. Both institutions admittedly produce capable logging engineers, and these men work in the same general timber type, Douglas fir, so that their problems are the same. Furthermore, both schools have had excellent success at placing their graduates with logging operations. Oregon State has graduated about ninety logging engineers, and of this total some 66% are now employed in branches of forestry, for the most part as logging engineers on woods operation.

Notwithstanding these facts, the two schools do have curricula which show some marked differences. (See Tables II and III) Washington seems to stress utilization, silviculture and the supposed need for chemistry and physics. 12.6 hours are devoted to utilization or wood technology courses and a total of 13.3 hours is applied to physics, if one counts the 3-hour unit course in timber physics. Likewise, 6.7 hours are given over to chemistry and 10 hours are spent on different phases of silviculture.

It seems questionable that practicing logging engineers will find need for such intense training in these subjects, possibly excepting the work in silviculture. A year's study of physics should suffice to give the person sufficient knowledge of the subject, and ordinarily he will find little need for chemistry if he engages in orthodox logging engineering. Mr. A. Koroleff, forester for the Canadian Pulp & Paper Association, speaking of the need for silviculture says that it is "most important to establish a chair on logging as related to silviculture, or vice versa; and care should be taken to stress the inter-relation between the two courses in dealing with each of them." (28) However, the 10 hours of silviculture seem more than ample; 5 hours of silviculture, if properly correlated with field logging, should be sufficient.

It seems strange that Washington offers no courses in business or social science to the logging engineering students. Mr. W. A. Delabey with the Canadian International Paper Co. says: "I do not think any forestry graduate should go into operations without at least having had some training in accountancy. Every

day it is necessary for us to watch costs and to know how to study cost statements as worked out by our accountants. A brief course of study on this subject will be of great value to every graduate entering operations." (7)

TABLE II. AN ANALYSIS OF LOGGING ENGINEERING CURRICULA OFFERED IN THE UNITED STATES TODAY, SHOWING NUMBER OF HOURS REQUIRED IN COURSE GROUPINGS AT EACH INSTITUTION

Courses	Oregon State College	University of Washington
Botany	4	5.3
Business Administration	11.3	0
Chemistry	2	6.7
Design	4	2
Economics	2	2
Electives	14.7	12
Engineering	12	8
English	6	3.3
Forestry	26	38
Geology	2	0
Logging	24.7	8
Mathematics	8.1	6.6
Physics	4	13.3
Seminar	2	0
Silviculture	2	10
Social Science	5.3	0
Wood Technology	2	12.6

TABLE III. A TABULATION INDICATING NUMBER OF HOURS REQUIRED IN INDIVIDUAL COURSES IN LOGGING ENGINEERING CURRICULA

Courses	Oregon State College	University of Washington
Accounting	6	-
Algebra	2.7	-
Botany	4	5.3
Bridge Design	2	-
Business Law	5.3	-
Chemistry	2	6.7
Commercial Woods	2	-
Dendrology	2.7	4
Drawing	-	2
Economics	2	2
Electives	14.7	12
Engineering	12	8
English	6	3.3
Field Trip	-*	10.7
Forestry (General)	2.7	2.7
Forest Administration	-	2
Forest Economics	2.7	-
Forest Finance	5.3	5.3
Forest Pathology	-	3.3
Forest Protection	2.7	4
Geology	2	-
Government	5.3	-
Lumbering	-	3.3
Logging Design	2	-
Logging Methods	2	-
Logging Plans	10	8

*Oregon State students take a three week trip annually, but receive no credit for this work.

TABLE III (Continued)

Courses	Oregon State College	University of Washington
Mensuration	8	6.7
Physics	4	10
Preservation	-	2
Seminar	2	-
Silviculture	2	10
Statistics	2.7	3.3
Timber Physics	-	3.3
Timber Transportation	10.7	-
Trigonometry	2.7	3.3
Wood Structure	-	2
Wood Technology	-	2
Wood Utilization	-	3.3

Another probable weakness existent at Washington, just as it also exists at many other schools, is an insufficient amount of training in English. Only 3.3 hours are required, and this is certainly not sufficient time to train a person in the fundamentals of good English, particularly if he comes to college handicapped by poor training in a small high school. Forestry officials and logging companies have observed this deficiency in English training and some have commented on the need for improvement here.

Mr. H. W. Eades with The Forest Products Laboratories in Vancouver says: "it has been my experience that many forestry graduates, individually clever and earnest workers carry little weight in the communities where they live and suffer from the

point of view of efficiency in their work, simply because they are quite inarticulate and cannot express themselves adequately either on paper or by word of mouth. A sound knowledge of the English language, written and spoken, is essential to a man nowadays who expects to become a leader. I have found this a weak point in the training of graduates from Canadian universities, and particularly in the training of those from American universities. Foresters who cannot speak well, nor write a good report or business letter can never expect to carry much weight." (9)

Logging engineering seniors at Washington spend all of the spring term on a field trip, which brings them in contact with typical work and enables them to meet future employers. Five to six weeks are utilized in camp to work up the field work data, and one week is spent visiting representative mills and logging operations. This sort of work is excellent training for the graduate, and is an essential part of any logging engineering school.

And now, having discussed Washington's strong and weak points, let us consider the curriculum at Oregon State College. Here the emphasis is placed largely on preparation of logging plans, the transportation of timber from the woods to the mills, on accounting and business law, and on design courses applying particularly to logging engineering.

Considering the subject purely from the standpoint of suitability to produce a qualified logging engineer, it seems that Oregon State possesses the more balanced course. Basic training

is given in general forestry, dendrology, botany, English, mathematics, mensuration, surveying, drafting, physics, chemistry, business and social science courses. Each of these subjects is evaluated from the standpoint of the needs of a practicing logging engineer, and the time devoted to each course is allotted accordingly.

Forest engineering has the most hours of study assigned to it; 12 hours are required here, but this is after all probably the most used of all training the engineer has in his possession. Delahey says that "many will claim that good courses in forest engineering are given in all forest schools, but I am of the opinion that even more attention should be paid to this subject." (7)

After grounding the student with this training his first two years, the junior and senior years are spent with logging engineering courses almost exclusively. At this time the student also is given 6 hours of study in accounting--3 hours are devoted to two special courses in accounting for engineers and foresters and 3 hours are given over to cost accounting. Thus it can be seen that the students have an excellent background in accounting. At the same time they also are given 5.3 hours of business law, and this is also very desirable from the standpoint of business.

With the exception of these studies in business courses, the logging engineers spend most of their time within the forestry school and in the field. Two courses deal with bridge design and logging machinery design. True-to-scale models are used in

these courses. Another course requires that each man draw up plans for a modern logging camp, based on a given number of men, and that they also make scaled drawings for their plans.

As to field work the student has four different courses his junior and senior years which draw him into the field. 10 hours are provided for studies in logging plans; here the men spend one day each week in the field, where they survey a merchantable Douglas fir stand, prepare topographic and relief maps and cruise the timber. This data they then take into the classroom, where they prepare complete logging plans for the area.

Relatively a large amount of study is directed toward railroad construction in connection with logging. The bridge design course is primarily related to railroad trestle construction and design. Then, in the senior year 10.7 hours are spent studying timber transportation methods and logging railroads are studied at length here. In connection with this course, for some years now the senior logging engineers have spent one full day of each week all year long in the field locating a logging railroad which will probably be constructed and used at some future date. The railroad will be used to tap a large body of timber, and the location being laid out by classes of senior logging engineers is the result of intensive reconnaissance surveys and accurate field work so that the work completed is thoroughly reliable and practical.

The school of logging engineering at Oregon State operates under a numerical advantage in that the enrollments are small

(ordinarily there are about fifteen students in the junior and senior classes combined), so that much individual attention from the instructor is possible. Most men enrolled in this course have a wide background of woods experience; this is perhaps to be expected since "candidates for degrees in logging engineering are required to have at least six months experience in logging operations." (42)

From the above discussion, it can be seen that Washington students receive all of their work in the field at the Charles Lathrop Pack Forest during the last three months of their senior year, whereas Oregon State men work considerably, but not exclusively, on outdoor problems the year around during their junior and senior years. The Oregon institution has the advantage of having a 4500 acre tract of school-owned timber, much of which is merchantable, just seven miles from the campus. Furthermore, there are many thousands of acres of forest land in the nearby Coast Range mountains which are available to the logging students, and one such tract is being used constantly at the present time.

During the spring of their last year, Oregon State logging engineers engage in a three-week tour of loggingand milling operations. On this trip students visit fir logging operations, large fir mills, Port Orford cedar woods operations, redwood and sugar pine cutting operations in California and ponderosa pine mills and logging operations in the Klamath region of Oregon. Operators are very cooperative, and permit the boys to examine their work thoroughly. It is not uncommon for the students

to make contacts at this time which produce jobs three months later when they graduate.

Unlike the condition existing with respect to logging engineering curricula in the United States, range management is offered at a number of institutions. A discussion of this course of study, as presented in some of the better schools, follows.

Range Management:

Recent developments that have taken place on federally-owned grazing lands in the West point out particularly well that there is a need for men trained in range management activities. The Taylor Grazing Act of 1934 is expected to correct many existent evils on 142,000,000 acres of Public Domain grazing land, and administration of the grazing on these lands is to be placed largely in the hands of college-trained men.

The Department of Interior intends to organize this land under a system much like that in effect on the National Forest lands. Large areas are being laid out into districts, and these in turn are broken down into smaller units similar to the ranger districts of the Forest Service. As yet the government has not fully manned all of these areas, and it has been said that a dearth of experienced men exists so that it is particularly difficult to fill the higher personnel positions.

Several schools are offering training in range management, and hope to place their graduates in government work, since this is the only extensive field of employment open to a person with such training, although the private livestock

industry will in time supplement this. University of California, Oregon State College, Washington State College, University of Idaho, Utah State Agricultural College, Montana State University and Iowa State College have special courses in range management. A thorough survey of all agricultural colleges has not been made, but the above list of schools includes all forestry schools which offer range management work.

All but the Oregon institution include range management instruction within the forestry school itself, so that fairly thorough training in forestry is also obtained. At Oregon State College the course is given in the school of agriculture so that farm practices, rather than forestry, supplement the range management work. However, many forestry students here take the more important range courses, so that their training is comparable to that of range management students in the other institutions.

A comparison of the curricula outlined by each of the schools shows that they are all quite similar. (See Tables IV and V) In the case of Iowa, those students majoring in range management must complete five years of college work, and this fact should be remembered when this curriculum is compared to those of other schools in the subsequent discussion.

The University of California offers a course in range management which, at least from outward appearances, contains several probable weaknesses. A. W. Sampson, who is a member of the faculty there, is one of the school's strongest assets. He is a well-known authority on range work; and it is he who conducts the courses dealing directly with range management. Fortunately

TABLE IV. AN ANALYSIS OF RANGE MANAGEMENT CURRICULA OFFERED IN THE UNITED STATES TODAY SHOWING NUMBER OF HOURS REQUIRED IN COURSE GROUPINGS AT EACH INSTITUTION

Courses	Calif- ornia	Idaho	Iowa	Mont- ana	Oregon State	Utah	Washing- ton State
Agriculture	0	0	2	0	6	8	2
Animal Husbandry	0	0	2.7	0	36	4	8
Bacteriology	0	0	2.7	0	2	0	4
Biology	0	0	4	6.6	0	0	0
Botany	19	25	14	22.3	11.3	15.3	17
Business Admin.	0	0	0	0	2	0	0
Chemistry	13	11	9.3	10	9.3	10	11
Ecology	3	3	6	2	2.7	6.7	3
Economics	9	6	0	2.7	6	3.3	4
Electives	--	11	--	11.3	8	26	6
Engineering	6	9	6.7	4.7	2	8.7	7
English	6	6	6	4	6	5.3	8
Erosion	0	3	4	0	0	6	0
Forestry	12	18	42	29.3	0	10.7	29
Genetics	0	0	2	0	0	0	0
Geology	3	8	2	0	0	3.3	0
Hydrology	0	0	0	0	0	3.3	0
Journalism	0	0	4	0	4	0	0
Mathematics	6	8	6.7	10.7	0	7.3	3
Physics	8	4	2	0	0	3.3	0
Public Speaking	0	0	2	0	2	2	0
Rangemanagement	6	8	13.3	12.7	15.3	11.3	11
Social Science	0	0	2	0	4.7	0	4
Soils	4	4	4	2	4	3.3	2
Wildlife	0	0	8	8	6	6.7	6
Zoology	3	4	0	0	2	0	0

TABLE V. TABULATION INDICATING NUMBER OF HOURS REQUIRED IN INDIVIDUAL COURSES IN RANGE MANAGEMENT CURRICULA

Courses	California	Idaho	Iowa	Montana	Oregon State	Utah	Washington State
Accounting	0	0	0	0	2	0	0
Agronomy	0	0	0	0	2	4.7	0
Animal Breeding	0	0	0	0	4	0	0
Animal Nutrition	0	0	0	0	2.7	0	0
Bacteriology	0	0	2.7	0	2	0	4
Biology	0	0	4	6.7	0	0	0
Birds & Mammals	0	0	0	0	0	0	3
Botany	16	25	14	19.7	11.3	12.7	11
Chemistry	13	11	9.3	10	9.3	10	11
Drawing	0	3	0	0	0	3.3	2
Ecology	3	3	6	2	2.7	6.7	3
Economics	9	6	0	2.7	6	3.3	4
English	6	6	6	4	6	5.3	8
Erosion	0	3	4	0	0	6	0
Farm Animals	0	3	0	0	10	0	3
Forage Crops	0	0	2	0	2	0	2
Forest Admin.	0	3	0	0	0	2	0
Forest Econ.	0	3	6.7	2.7	0	0	2
Forest Insects	0	0	2	0	0	0	0
Forest Management	3	0	2.7	10	0	0	3
Forest Mapping	0	0	2	.7	0	0	0
Forest Operations	0	0	2.7	0	0	0	0
Forest Planting	0	0	3.3	0	0	0	2
Forest Products	0	0	0	6.7	0	0	3
Forest Protection	0	3	2	2	0	2	2
General Forestry	3	4	6	4	0	2	3
Genetics	0	0	2	0	0	0	0
Geology	3	8	2	0	0	3.3	0

TABLE V. (Continued)

Courses	Calif-ornia	Idaho	Iowa	Mont-ana	Oregon State	Utah	Washing-ton State
Horticulture	0	0	0	0	2	0	0
Hydrology	0	0	0	0	0	3.3	0
Journalism	0	0	4	0	4	0	0
Land Utilization	0	0	0	0	0	3.3	0
Logging	0	0	0	0	0	0	4
Livestock Diseases	0	0	2.7	0	8	0	0
Lumbering	0	0	6	0	0	0	0
Mathematics	6	8	6.7	10.7	0	7.3	3
Mensuration	3	3	7.3	3.3	0	2.7	4
Physics	8	4	2	0	0	3.3	0
Poisonous Plants	0	0	2	0	0	0	0
Range Economics	0	0	0	0	3.3	2	0
Range Law	0	0	2.7	2.7	4	0	3
Range Management	6	6	4	10	0	5.3	5
Range Problems	0	0	2.7	0	2	4	0
Sheep Husbandry	0	0	0	0	2	4	2
Silviculture	3	2	9.3	0	0	2	6
Soils	4	4	4	2	4	3.3	2
Speech	0	0	2	0	2	2	0
Stock Judging	0	0	0	0	4	0	0
Stock Management	0	2	2	0	6	0	3
Social Science	0	0	2	0	4.7	0	4
Surveying	6	6	6.7	4.7	2	5.3	5
Taxonomy	3	0	0	2.7	0	2.7	6
Wildlife	0	0	8	8	6	6.7	3
Zoology	3	4	0	0	2	0	0

enough, also, the headquarters of the California Forest and Range Experiment Station are located on the campus, so that equipment and data are readily available.

An examination of the courses included in the curriculum at California shows that no agricultural and very few range management courses are offered. A relatively large amount of chemistry, botany and physics is required of the student instead. However, if a person intends to center his activities on range management, he will hardly find sufficient courses to gain an acquaintance with the work. For example, he gets no training whatsoever in farm animals, feeding, sheep or animal husbandry, forage crops or range economics.

Assuming that the other schools are right in including these courses within their range management curricula, California could better this division of their forestry school by bringing in additional courses which are agricultural in nature.

Oregon State College has a curriculum in range management that is much more complete. The chief weakness that one observes in examining the course is that no training is given in forestry or mathematics, while very little surveying work is included. The school would do well to include some forestry courses such as silviculture, forest protection and forest management, because much government range work overlaps with forestry. In view of recent events, it seems probable that all schools could add to the number of required forestry credits, since it is believed that in the future the Junior Range Examiner will be abandoned and range management questions will be included in the Junior

Forester examination.

Likewise some basic instruction in mathematics is quite likely to prove valuable in the field. Surveying work requires a knowledge of trigonometry and algebra, and much of the sampling work could be facilitated by an application of statistical methods. Oregon State could probably drop two or three agricultural courses and substitute some mathematics instead. It also seems strange that so little time is devoted to surveying; students are given only one two-hour course, whereas it would seem that they could do very nicely with eight or ten hours of study in this subject.

Oregon State is not alone in this weakness; none of the schools offer more than 6.7 hours of surveying and most of them offer less. In government service the range manager must have a thorough knowledge of land subdivision, map formation and surveying technique--this sort of thing will occupy much of his time. And a good working grasp of these subjects requires considerable study. Perhaps the schools will add to their engineering courses in the future.

Washington State College, located in the open land of eastern Washington, offers a course in range management that compares closely to that given in Oregon. Many short courses are included, dealing largely with farming subjects such as farm animals, stock management, sheep husbandry and forage crops. Sound basic training is also given in forestry, so that a weakness does not exist here.

No geology is given range management students at Washington

State, and only very limited training in soils and economics is included. In common with most of the other schools, no attention is given to economics, livestock diseases and animal breeding; these courses have much to recommend them. Geology and soils are of paramount importance to one interested in soil condition and capacity. Range management obviously requires constant attention to soils and soil cover. It requires that suitable plant cover be introduced and maintained on grazing areas, which in turn demands a knowledge of soil and ground formations.

Only four hours of economics are required of the student following range work at Washington State College; it seems probable that more economics would be an advantage to him, particularly if he should go into the livestock business himself. The raising of cattle is a business of sudden changes--prices vary, feed costs fluctuate, weather conditions create sudden emergencies. Such situations demand quick action on the part of the stock raiser, and his decisions must be based largely on economic principles.

University of Idaho is another northwestern institution that has a curriculum in range management. This is given in the school of forestry, but after the first year range management students break away from forestry courses pretty largely. Range management here "is designed to prepare students for all lines of research and administrative grazing work with the U.S.Forest Service, Soil Conservation Service, Taylor Act Administration and livestock companies." (48)

The outstanding feature of the Idaho curriculum is the large

amount of botany included in the course of study. 25 hours of botany are required for graduation, so there can be no doubt but that graduates here are well versed in things botanical. Despite the fact that so much time is given over to botany, Idaho has a well-balanced curriculum. Considerable time is devoted to chemistry, economics, mathematics and geology, and quite a few range courses are also included.

Utah State College lays considerable stress on its range management course, which is one of the option courses within the forestry school. The course of study "acquaints the student with proper methods of maintaining the production of native range lands and the proper methods of managing range livestock." (50) Graduates are in a position to take civil service examinations in range management and soil conservation.

An interesting thing about the Utah curriculum is the large number of elective hours open to the student. He has a total of 26 hours to devote to subjects of his own choosing, whereas most schools have ten or less elective hours. However, students ordinarily utilize these free hours by taking additional courses in range studies, so that the situation is not so significant as it might seem.

Considerable time at Utah is devoted to soil and erosion study, and such training is timely when one considers all of the work being done in the West on erosion control, soil conservation and water conservation. 9.3 hours of such study are stipulated, and additional elective hours are ordinarily utilized here to obtain more work in this field of study. This is the only school

which offers a course in hydrology, which ties in very closely with erosion work.

Montana State University also attracts range management students to its campus by its range curriculum, which includes a liberal mixture of forestry and range courses. Strong points here are studies in the fields of botany, wild animal management, mathematics, forestry and biology. Particularly complete are the studies in botany, since 22.3 hours are required for graduation in range management. (49)

The courses in wild animal management work in particular is well for the graduate who secures employment with the Forest Service. During recent years the Forest Service has been taking more and more interest in the wild animals that inhabit the forests. Management plans, game counts and studies are being made constantly in the national forests. Any person connected with grazing on national forests must be aware of the problems that arise from heavy populations of deer and elk and how to deal with them. Problems in connection with wild grazing animals such as antelope and buffalo and elk also occur on much public domain land and grazing reserves, and a knowledge of remedial measures is of value here.

Approximately 11 hours are given over to mathematics, and seven hours to biology; this is considerably more than is required in most schools and gives the student ample training in these two important subjects.

The school offers fewer range courses than do most of the other schools, and is noticeable weak in economics and soils

courses. Only 2.7 hours are devoted to economics and no business courses are listed, while but 2 hours of soils study are manifestly insufficient to teach the subject properly.

Iowa State College provides training in range management for young men living in the Middle West. The course compares to those at Oregon State College and Washington State College, and seems quite well-balanced throughout. It is noticeably strong in forestry courses such as silviculture, mensuration and forest economics, and it is possible that these courses are stressed too much, to the detriment of training in range courses. Forestry courses consume a total of 42 hours--much more than at any other institution.

However, the school also has a considerable number of range and agricultural courses within its curriculum, and judging from the number and character of these, the range course as a whole is well-rounded. The fact that so many forestry and range courses are completed by the student is explained by the fact that very few elective hours are listed and also because the curriculum here considered is on a five year basis.

Summary: To summarize the good and bad points of each of the schools, it might be said that California has the weakest of the range management curricula. Too few courses are offered in the major field of range management. Oregon State College offers a complete course in range work, and the only criticism of any note is that no heed is paid to forestry training. Washington State College also gives very complete training in range and agricultural work; it is weak in its soils and economics courses.

Judging only on the basis of required courses, Idaho has one of the strongest range management courses in the country, although this might readily be questioned because of the paucity of agriculture and animal husbandry courses. Utah has a very good course, probably the most well-rounded in the United States, but might add more business and forestry required courses with benefit. The same thing holds true for the course at Montana State University, although other deficiencies exist here also. Iowa ranks well toward the top with its numerous forestry and range courses required for graduation combining to produce well-trained men.

The United States Civil Service Commission has recently questioned the adequacy of the range management courses in the majority of the institutions discussed. It is apparently believed that too little training in the agricultural phases of range management, such as agronomy and animal husbandry courses, are offered in the schools. Further investigation may reveal that specific training of the type desired is offered, but that it is classified under general terms not indicative of the true nature of the courses. Nevertheless, this action on the part of the federal government may well lead some of the schools to make alterations within their curricula, since they cannot afford to ignore such a large potential employer of their graduates.

Although constructive range management practice is of relatively recent origin, many of the courses have been in existence for some time. In the case of wildlife education this is not true. Very little work has been done in most phases of wildlife, and few trained wildlife experts are available today.

With this sort of a situation existing, it is interesting to analyze what is being done in this field of education.

Wildlife:

Although some might possibly object that a discussion of wild life curricula does not properly come within the scope of this analysis of forestry curricula, an examination of courses at several of the schools outstanding in wild life work has been included. Actually wildlife management and forestry are alike in many respects; the well-rounded forester must know something of wildlife problems and vice versa. This fact is becoming increasingly appreciated as time goes on, and "the U.S.Forest Service has formally recognized wildlife management as an integral part of the administration of its various forests." (52)

Some leaders in the field of wildlife feel that the man who has a degree in forestry and later takes up graduate work in wildlife management has "a distinct advantage over the man who picks up his graduate work in forestry and wildlife management after first receiving his degree in zoology" (51) In other words some wildlife educators actually place wildlife management within the realm of forestry; in fact twelve of the twenty-three institutions offering wildlife training give sufficient undergraduate training in forestry courses to the wildlife student so as to make him eligible for membership as a Junior member of the Society of American Foresters. (38) However, despite the attitude of various schools on the relationship of forestry to wild life, it is certainly true that both are encompassed within the broad field of land use.

With the exception of a few instances in which colleges offered isolated courses in wildlife, very little real progress in wildlife training occurred until fifteen years ago when the first undergraduate course in game management was begun. (38) Probably the rapid expansion of education in this field can be traced directly back to the beginning of the first Roosevelt administration in 1932 and shortly thereafter. With a government definitely sympathetic toward conservation proposals, protagonists of wildlife measures were able to accomplish more in four years than during any other period in the country's history. As the government began to cast a favorable eye upon many projects, it was only natural that young men became attracted to such work. This, in turn, led to the establishment of many courses in wildlife management. "The greatest increase in the number of colleges offering game management occurred four years ago, when six colleges started courses. The following year six more colleges offered courses, but only two new ones started the next year." (38)

Since many of the schools have been established but a short time, it is true that some of them are not too firmly organized as yet. New courses will have to be added and others dropped; facilities and equipment must be augmented; additional competent instructors must be secured. As yet "there is little . . . agreement among the various schools regarding the essential training for a wildlife specialist, indicating a marked variation in the various schools' concepts of the meaning of wildlife management." Of the twenty-three institutions offering some courses in wildlife

fourteen place it under the department of forestry, five under zoology, three under agriculture and one under a combination of agriculture and forestry.

To a certain extent the schools have been influenced by the recommendations of the Bureau of Biological Survey pertaining to a suitable course in wildlife management. As Professor Wight points out "the outline of requirements as presented by the Bureau cannot but indicate the desirability of setting aside the field of wildlife management apart from zoology." Listed below are some of the statements pertaining to wildlife education included in the bulletin published by the Bureau in 1937. (53)

"Many institutions offer specialized courses that may be regarded as fitting into a wildlife management curriculum. Helpful and often basic as such courses are, however, few institutions are as yet offering a full-four year course leading to a degree in wildlife management. Ordinarily little attempt is made in the basic biology courses to point out or interpret for the student practical applications in wildlife conservation and management." The Biological Survey thus does not approve of scientific courses alone unless they are supported by field work in wildlife management, and it also apparently favors training which includes four years of study leading to a college degree.

Commenting as to specific knowledge required in various fields of research and management, the bulletin contains further advice: "In the field of research, workers are needed who are trained in the distribution and taxonomy of birds, mammals, and other vertebrates, and in aquatic biology, ecology, food habits,

fur-animal production, and control of wildlife diseases and parasites."

"In the field of mammal and bird taxonomy, well-grounded schooling is essential in general biology, zoology, physiology and anatomy, histology, genetics, aquatic and marine biology, and museum technique. Food-habits research requires training in a varied field, to identify in animal stomachs the fragments of plant seeds, mammals, birds, fishes, reptiles, amphibians, insects, and aquatic life, in all stages of maturity; it includes also experience in the field and knowledge and skill in laboratory technique."

"Research in the life history and habits of bird and mammal species calls for persons familiar with a wide range of animal and plant identifications; having a knowledge of forestry, agricultural crops, and soils, of breeding, feeding, and nesting habits, and of predation, diseases and parasites; and acquainted with physical factors and the daily and seasonal movements peculiar to the various species of birds and mammals."

Specialists in game and fur farming should be familiar with still further scientific technique and knowledge. "To evolve practical methods for the prevention, arresting, and cure of animal maladies on game and fur farms and under natural field conditions, laboratory and field workers in the realm of wildlife diseases and parasites must have a thorough knowledge of laboratory technique; thorough training in diagnosis; and be familiar with the identification of endemic diseases, ecto- and endoparasites, tumors, and morbid tissues. Fur and game farms

and wildlife experiment stations require personnel trained in wildlife production. This includes a knowledge of the principles of breeding, feeding and management as well as of diseases and their control."

For those relatively few specialists concentrating their efforts on research dealing with the control of predators and other harmful wildlife, a knowledge not only of life histories, habits and distribution of wildlife species, but also a familiarity with biochemistry and laboratory technique, field methods used to combat such populations, and the use of mechanical and poisonous weapons commonly used against unwanted and harmful wild creatures should exist.

Many young men are attracted to the specific field of game management as it is administered by various governmental agencies. Knowledge required for such work is not so scientific as that demanded by research, but a wide training is nevertheless necessary. "In the field of game management, the protection of favored species demands men familiar with wildlife, its habits, habitats, and ranges, and trained in the technique of law enforcement, men who have a working knowledge of Federal and State protective laws and regulations and know how to develop and manage wildlife refuges. Personnel for the control of species harmful to agricultural crops, livestock, forestry, and grazing and destructive to desirable forms of wildlife, must be familiar with the habits of all the major species in the area involved, have a perspective of those that are injurious in the general wildlife picture, a knowledge of control

technique, with experience in field application and ability to recognize wildlife values from esthetic and recreational points of view."

Training given the person who intends to enter government service in an administrative capacity should in certain phases parallel that given forestry students to a marked degree. "Field workers dealing with wildlife in relation to forestry, soil conservation, flood control, reclamation, drainage, grazing control, in fact, all phases in the forest-wildlife, farm-wildlife, and aquatic-wildlife relationships, from an administrative standpoint, should have training in the basic science courses, a technical knowledge to interpret and apply known and recorded facts, a good background of animal and plant ecology, some training in business administration and economics, an understanding of silvicultural methods, forest administration, agriculture, animal husbandry, and soils, and some engineering training involving dam construction, drainage, and navigation."

Migratory bird refuges require men with still a different type of training; much of this centers, of course, around the birds themselves, their foods and their predators. "Migratory-bird refuge administration requires personnel familiar with life histories and habits of waterfowl, fur animals and upland birds; with aquatic vegetation suitable for food, cover, and nesting sites, and technique in improving food and cover; and with desirable water levels and their engineering phases. Refuge managers must be informed on protective laws and regulations, and trained in business administration and in handling

personnel and equipment."

It would seem in the first place that, if an educational institution follows the Survey's suggestions to the letter, the wildlife students will more likely than not be rather narrowly trained. Too heavy a list of scientific courses is outlined; if most of them are required, the student will be deficient in general knowledge and training. The case is comparable to that of the U.S.Forest Service and forestry schools. By means of its civil service examinations, the Forest Service has done much to determine just what courses are included in a forestry curriculum.

Professor Wight feels that it would be most advisable to require a fifth year to round out the wildlife student's training and he further believes that a man with a degree in forestry is best equipped to continue his studies a fifth year in the field of wildlife.

It is interesting to note how comprehensive, according to Biological Survey standards, the curricula of the wildlife schools are at present. (See Table VI) Wildlife curricula at Iowa State College, Utah State College, Connecticut State College, University of Maine, Ohio State College, Pennsylvania State College, University of Missouri, Virginia Polytechnic Institute, Oregon State College and University of Michigan are those which are included in this study. This list does not comprise all of the schools offering training in wildlife, but it is a fairly comprehensive canvass of institutions offering such work.

TABLE VI. AN ANALYSIS OF WILDLIFE CURRICULA OFFERED IN THE UNITED STATES TODAY SHOWING NUMBER OF HOURS REQUIRED IN COURSE GROUPINGS AT EACH INSTITUTION.

Courses	Iowa	Utah	Connecticut	Maine	Ohio	Pennsylvania	Missouri	Oregon State	U. of Michigan	Virginia
Agriculture	0	0	0	0	0	0	0	8	0	0
Bacteriology	0	0	5	5	0	0	3	4	0	0
Botany	15.3	15.3	4	18	16.7	18	13	6	12	30.5
Chemistry	8	10	11	16	10.7	11	10	6	8	28
Economics	4	3.3	12	8	11	6	5	10	6	3
Electives	28.7	24	--	15	36.7	10	--	13.3	21	--
English	8	8.7	9	8	6	14	6	9	6	18
Forestry	44	12	30	34	2	50	6	4	38	36
Geology	6	6.7	0	0	3.3	7	11	0	4	4
Mathematics	16	15.3	8	14	4	23	5	0	8	33
Physics	2	3.3	3	0	0	4	0	0	0	12
Wildlife	0	10.7	19	0	5.3	0	0	22.7	30	14
Zoology	12	15.3	9	30	15.3	25	21	35.3	20	7.5
Range Mgt.	0	8	0	0	0	0	0	0	0	0
Political Sci.	0	0	0	0	0	0	5	3	0	0
Sociology	0	0	0	0	0	0	3	0	0	0
Poultry Husb.	0	0	0	2	0	0	0	0	0	0
Horticulture	0	0	3	0	0	0	0	0	0	0

Iowa has a course arrangement which is definitely dominated by forestry; 44 hours in forestry are required. Botany, mathematics and zoology also comprise a high proportion of total hours. The zoology courses supplant the wildlife courses given in several of the other schools. However, this lack of wildlife courses is rather odd, and a readjustment of zoology and forestry courses in order to admit more wildlife might be advisable. The committee on game management of the Society of American Foresters believes "that either the basic zoology courses must be changed to meet the demands of the already overloaded wildlife curriculum, or the wildlife curriculum must provide its own basic courses to better meet the needs of the students." (38)

Utah offers a curriculum which seems very well balanced; each of the listed courses receives a reasonable allocation of hours. This is also the only university to offer training in range management along with the wildlife curriculum; 12 hours are included as required in the course. Since Utah is located in a region where there is much joint use of range by wildlife and domestic cattle and sheep, this training in range management is no doubt of unquestioned value to the wildlife administrator.

Connecticut is particularly strong in forestry and wildlife courses with 30 and 19 hours respectively required. Weaknesses appear to exist in botany and zoology requirements; both fields are rather important to the wildlife manager. Likewise, no training is given in geology; this should be given if for no other reason than to place the student in possession of

general personal knowledge and information.

Maine requires 34 hours of forestry and 30 hours of zoology so that graduates here are given plenty of instruction in these subjects. No training in geology, physics or wildlife is given, and in this respect it is comparatively weak. Although many of the institutions require four or more hours of physics, it is possible that this after all may not be needed.

Ohio's curriculum is conspicuous by its lack of forestry courses; only two hours are required and this is manifestly insufficient. Botany and zoology subjects are stressed, together with chemistry and economics. But for the fact that so little training is given in forestry, Ohio has a well-balanced course. However, the relatively large group of elective hours also appears to be in need of some adjustment.

Pennsylvania offers relatively large amounts of forestry and mathematics; no wildlife courses are listed as such but are included within the zoology requirements. A greater-than-average amount of English is also included within the curriculum, and this is certainly anadvantage. But for the lack of balance between forestry and wildlife courses, Pennsylvania would present an excellent curriculum in wildlife. An interesting situation has existed for some time in the state in that the game department has been compelled to secure its skilled men from other states. Since this agency is the largest and most efficient of its kind in the United States, the situation has resulted in a personnel which is largely comprised of out-of-state men. With the recent addition of the wildlife school to the State

College it should not be long before an ample supply of skilled game technicians will be obtainable within state bounds.

Missouri, likewise, includes all wildlife courses within the zoology department, although an examination of credit requirements reveals that fewer hours of zoology are demanded than at most schools. This would seem to be a definite weakness, because wildlife training necessarily requires a goodly number of courses dealing principally with this alone. Forestry courses are also surprisingly low in number, whereas training in political science, botany and chemistry is quite ample. Generally speaking, the curriculum at Missouri seems to be weak and insufficient in that not enough required courses, particularly those dealing with forestry and wildlife, are provided.

The course given at Virginia Polytechnic Institute has both some fine and some poor characteristics. Excellent and extensive training in botany, chemistry and mathematics is required, but wildlife courses are not sufficient in number to impart the necessary training. More hours of study in each of the fields of botany, chemistry, forestry and mathematics are asked than in the fields of zoology and wildlife combined. This does not appear to be a singularly healthy and well-balanced state of affairs, if basic objectives in this school correspond to those in effect at the other institutions herein discussed.

In the fields of zoology and wildlife, Oregon State stands unchallenged so far as hour requirements are concerned. This institution gives its students more than twice as much training in wildlife and zoology as any other school considered in this

discussion. Utah, which ranks third to Oregon State in the amount of zoology and wildlife included in the curriculum, has approximately half as many credit requirements in these two basic fields as has Oregon State, while Michigan has nearly as many. Strong though it may be in this phase of its curriculum, Oregon shows weaknesses in that no mathematics or geology are given; and, furthermore, in that only two rudimentary forestry courses are offered. It would seem that in view of its favorable location, both from the standpoint of forestry instruction and wildlife facilities, Oregon State could develop an excellent wildlife course of instruction. To do this, however, an effort should be made to strike a more equitable balance between wildlife and forestry courses. (32)

The University of Michigan in 1927 revised its wildlife department and as it now stands, the student is encouraged to obtain a Master's degree which involves a fifth year in college. This procedure the school recommends to all who plan to enter the field of wildlife. It is interesting to note that the school has enjoyed excellent success in placing the men with a fifth year of training in wildlife positions, whereas the opposite is true for the four-year group. Much of the instruction, particularly in the first three years, comes within the scope of forestry and cultural training, whereas the fourth and fifth years include more concentration on wildlife subjects. As the course now stands, there is an excellent balance existing between all courses. The only factor which enters into the discussion is the fact that since Michigan requirements, as

here analyzed, are on the basis of a five year course of study, it is hardly a true picture to compare this curriculum to those of other schools based only on a four year period of training. With the added advantage of one year's additional study, the Michigan graduate appears to have the best background and training in wildlife when he emerges from school.

Dr. W. S. McAtee of the U.S.Bureau of Biological Survey in speaking of the Michigan curriculum, remarks: "In the past, this University has been very productive of wildlife research and at present, a marvelous program of such investigation is in progress. The importance of inventories is recognized, illustrative studies being an inventory of the wildlife resources of Washtenaw County; a method of evaluating a forest wildlife environment quantitatively; a quantitative study of the effects of wildlife management on song birds . . .; and experiments on methods of taking censuses of small mammals." (52)

Although not compulsory upon the student, graduate work in other wildlife institutions is becoming increasingly popular; it is possible that some of the other schools may institute a compulsory five year course in wildlife, although if this is done other revisions concerning the organization of courses should be completed first, as has been suggested above.

It is quite generally believed that there is little place in the wildlife picture for the man who has only undergraduate training. It has been pointed out that there are very few state or federal jobs available to the four-year man excepting a few, such as game management agent and sub-professional positions

of the biological aide class. (38) The wildlife management profession has in fact suffered serious damage through the incapable performance of improperly or inadequately trained wildlife men placed in responsible positions during the past six years.

Mr. Hosley and the remainder of the Society game management committee consider "graduate work essential for those holding responsible game management positions. Most of the time of students coming up through undergraduate forestry is spent on their basic courses. The wildlife management courses and the contributing lines of zoology, must be gotten later. In other words, this fifth year, which is apt to be more productive than any previous one, can be used to round out the man's training in environments, animal biology and land use." (38)

Wood technology curricula offer a sharp contrast to those branches of forestry heretofore discussed, in that much more chemistry, lumbering and engineering are included within the course of study. A few schools are noteworthy for their wood technology curricula, and an effort has been made to consider their course organizations in order that their good and bad points might be brought out.

Wood Technology:

Training in Wood Utilization and in all the ramifications of the Wood Products Industry (the entire field might be compactly termed Wood Technology), is now offered in the forestry schools at several institutions in the United States. Among the schools ranking high in the quality of their Wood Technology

instruction are University of Idaho, University of Washington, University of Michigan, Syracuse University and Oregon State College.

Such specialization might be said to lie in the domain between pure forestry and pure engineering, since it partakes of the elements of both professions. However, as the ultimate product produced or handled is wood in some form, the industry is more closely linked to forestry than engineering and education is accordingly centralized to some extent in the forestry schools. Basic courses such as botany, general forestry, dendrology, management, forest problems, lumbering and surveying are clearly within the realm of forestry, while drawing, physics, electrical and steam engineering, descriptive geometry and thermodynamics smack of the engineering curricula.

Wood technologists fulfill a definite need in the lumber industry, and without a doubt it will be largely through their efforts in the future that the lumber industry will be able to meet competition from wood-substitute industries. (6) As a whole,the majority of the lumbering industries have failed to recognize this need--have been very chary, indeed, about hiring college-trained men. Some of the larger organizations, which, incidentally, are better able financially to employ experts, have taken in a few college men. But during the depression years following 1929, the lumber business suffered a setback that prohibited the expansion of personnel. They have been hard-put to hold their own with competition, and much of the experimentation with wood has been left to federal research men. (6)

However, when economic conditions improve and when lumbering concerns find themselves making a legitimate profit, then the prospects of the wood technologist will boom upward also. Contingent to the arrival of such improved conditions, what can the forestry schools do to have properly trained men in readiness?

They must develop and maintain a high caliber of instruction so that their graduates will be competent to handle the work assigned to them. This work may vary considerably in nature, but the requirements are sufficiently evident so that forest schools have been able to outline curricula designed to meet these needs. The courses within these curricula, however, are by no means standardized with all schools. In some schools the wood technology divisions attract the weaker students, because the required courses are predominately non-technical, while scientific and mathematical courses are not emphasized.

On the other hand, a few schools have outlined excellent courses designed to train the student thoroughly for the wood industry. It might be interesting to examine the curricula of some of these schools with an eye toward determining where their weak and strong points lie. (See Tables VII and VIII)

Syracuse: Syracuse has excellent laboratory facilities and a large staff; the school offers specialization in three phases of technical and administrative wood utilization; namely, wood technology, conversion and distribution, and pulp and paper manufacture. For purposes of comparison, only the curriculum in wood technology will be considered, since this corresponds to

TABLE VII. AN ANALYSIS OF WOOD TECHNOLOGY CURRICULA OFFERED IN THE UNITED STATES TODAY SHOWING NUMBER OF HOURS REQUIRED IN COURSE GROUPINGS AT EACH INSTITUTION.

Courses	Idaho	Michi-gan	Oregon State	Syracuse	University of Washington
Business Admin.	3	0	16.7	5	5.3
Botany	8	4	6.7	9	5.3
Chemistry	8	8	2	14	6.7
Economics	6	6	2	3	2
Elec. Engineering	5	4	0	0	8
Electives	17	7	15.3	8	22
Engineering (Gen.)	3	7	14.7	8	6.7
English	9	8	6	10	3.3
Forestry	17	19	24.8	18.5	32.4
Lumbering	7	8	10.8	8	6.6
Machine Shop	0	8	0	2	0
Mathematics	19	19	10.7	12	6
Mech. Engineering	8	20	2.7	7	4
Physics	10	10	4	8	10
Social Science	0	0	6	0	0
Speech	0	0	2	2	0
Wood Technology	14	14	8.1	24	16

TABLE VIII. TABULATION INDICATING NUMBER OF HOURS REQUIRED IN INDIVIDUAL COURSES IN WOOD TECHNOLOGY CURRICULA

Courses	Idaho	Michi-gan	Oregon State	Syracuse	University of Washington
Accounting	3	0	6	5	5.3
Alternating Current	2	2	0	0	4
Business Law	0	0	5.3	0	0
Botany	8	4	6.7	9	5.3
Calculus	8	8	0	6	0
Chemistry	8	8	2	22	6.7
Dendrology	4	3	2.7	3.5	4
Direct Current	3	2	0	0	4
Drafting	3	5	0	5	2
Descriptive Geom.	3	3	0	0	0
Economics	6	6	2	3	2
Electives	17	7	15.3	8	22
English	6	6	6	10	3.3
Entomology	0	0	0	2	0/
Forest Policy	3	2	0	0	0
Forest Economics	3	3	2.7	0	2.7
Forest Finance	0	0	6	0	0
Forest Management	0	4	0	0	3.3
Forest Problems	2	0	2.7	3	4.7
General Forestry	2	3	2.7	4	2.7
Heat Engines	0	4	0	4	2
International Trade	0	0	2.7	0	0
Kiln Drying	4	4	2.7	3	2
Logging	3	4	0	3	0
Lumbering	4	2	0	3	3.3
Lumber Grading	0	2	2.7	0	0
Lumber Merch.	0	0	2.7	0	0
Machine Design	0	4	0	0	0
Machine Shop	0	8	0	2	0

TABLE VIII. (Continued)

Courses	Idaho	Michi-gan	Oregon State	Syracuse	University of Washington
Materials	3	3	2.7	0	0
Mathematics	8	8	8	6	3.3
Mechanics	2	3	0	0	0
Mensuration	0	0	8	3	6.7
Milling	0	0	0	2	3.3
Money & Banking	0	0	2.7	0	0
Pathology	3	4	0	2	3.3
Physics	10	10	4	8	10
Preservation	0	4	0	3	3.3
Silvics	0	0	0	1	4
Social Science	0	0	6	0	0
Speech	0	0	2	2	0
Statistics	0	0	2.7	0	2.7
Strength of Materials	0	6	0	3	2
Surv. & Engineering	0	2	14.7	3	4.7
Technical Writing	3	2	0	0	0
The Lumber Plant	0	0	2.7	0	0
Thermodynamics	3	0	0	0	0
Transportation	0	0	2.7	0	0
Utilization Studies	6	3	2.7	15	6.7
Wood Technology	4	3	0	3	4

the wood technology divisions included at Idaho, Washington and Michigan.

Syracuse, relatively speaking, devotes considerable time to chemistry, English and utilization studies. In the freshman year all students take a year of inorganic chemistry followed

in their sophomore year by six more hours of qualitative analysis. Then, in their junior year students get further training when they take eight hours of forest chemistry, which deals with the chemistry of the pulp and paper industry and with organic chemistry. Totalling these all up, it can be seen that 22 hours are devoted to chemistry alone. This is far and above the chemistry requirements in the other schools; Idaho and Michigan rank next to Syracuse in hours of chemistry requirements with 8 hours each, followed by Washington and Oregon State with 6-2/3 hours and 2 hours respectively of required chemistry courses. (32)

Syracuse asks that her wood technologists complete two years of undergraduate work in English; the freshmen year is devoted to typical college freshman English and the sophomore year includes a study of advanced composition which deals primarily with the preparation of reports, technical and professional papers, and business correspondence. However, this is little more than the requirements of other schools. Michigan, Oregon State, and Idaho all have six hours of English and Washington has 3-1/3; Washington's requirements seem decidedly insufficient on this score as this is below the average college requirements for all kinds of technical schools.

In addition to 10 hours of English, Syracuse also requires 2 hours of public speaking. It would seem that other schools might profit materially by adding this subject to their curriculum. Although one semester of speech training manifestly will not produce accomplished orators, the experience is needed; and

later on it will aid the person when he makes his first few speeches as a forester or wood technologist. Syracuse offers the course by divisions so that the foresters have their own group taking the course. Talks are ordinarily on forestry and an effort is made to simulate conditions and topics that may be encountered later on in the industry.

Analyzing the Syracuse curricula still further, it is interesting to note that it is the only one of the four schools requiring products entomology; at the same time it allots 2 hours to products pathology. However, only 2 hours is devoted to the entomology course and it seems doubtful whether a very comprehensive knowledge of the field can be had with this limited study. Probably the officials feel that an intimate understanding of such problems is not necessary for the wood technologist; such work should be handled by the entomology specialist. It does seem strange that the other schools do not require this course, since certain powder post beetles and termites often present serious problems to the handlers and users of wood just as do certain fungi and stain organisms. Such a course might be made more thorough and practical than the average forest entomology course by limiting the study to just those important insects attacking manufactured wood products. Entomology is such a vast field of study with all its thousands of generalities that specialization in one limited portion of the whole is warranted.

University of Idaho: The University of Idaho, although a comparatively small school, supports a very good wood technology

curriculum. Located in the west near extensive lumber industries, the school is potentially in a position to work altruistically with these concerns, who should, theoretically at least, need trained wood technologists. Potlatch Forests of Lewiston, Idaho, have shown their interest recently by setting up two fellowship funds, each of $400 annually, with which to aid outstanding students in the technology field. (48)

Unlike the case at Syracuse, Idaho has a balanced curriculum with a reasonable amount of time devoted to botany, English, chemistry, mathematics and miscellaneous courses in engineering and wood utilization. By her voluminous chemistry requirements, Syracuse has so regimented her courses that only seven to nine hours of elective choices of courses are available to the student. Idaho, on the other hand, has so arranged it that it is possible for all men to choose 17 elective hours of courses. Such a generous allottment of elective courses should permit the student to round out his education to his own personal satisfaction during his last year in school with a few courses that he has long wanted to take.

On the basis of curricula existent at the other schools, Idaho might possibly be criticised in that no forest management, mensuration or silvics courses are included in the training. It does not seem likely that wood technologist would need training in these three courses. It is true that silviculture, as it effects growth rate and species grown, would aid the technologist by letting him know what type of wood to expect from various regions. However, such information, when needed, is available

in government publications. Mensuration would be valuable for the information it includes about units of measure, but this also is available in book and pamphlet form. Management of forests fails to tie in closely to technology work, so far as I can see, and would be valuable only to the person ending up on the raw material side of the picture--that is, the one who actually finds employment in the woods.

Idaho also does not require any surveying of the technology students, and the other schools offer comparatively little of this likewise. Surveying training is important from a general standpoint and would be valuable to the technologist just as it would be to the average citizen who occasionally gets out into the country. A fundamental knowledge of surveying may often produce a position for a person temporarily in need of one. And yet this does not prove that the taking of the course should be compulsory; rather, it might perhaps be listed as a recommended elective.

Oregon State College: Here the students are given a broad and thorough background in many phases of technical forestry their first two years in college. Considerable time is devoted to mensuration and forest engineering particularly. Unlike the plan used at Idaho where the student begins to specialize in his sophomore year, that in effect in the Oregon institution provides for specialization after the second year. (32)

The courses in wood products "are designed to meet the needs of men who desire to prepare themselves for service in the wood-manufacturing industry and special attention is given

to manufacturing conditions existing in the Pacific Northwest." (32) Work such as plant design as related to efficient operation, organization and management of large lumber plants, kiln-drying of lumber, human efficiency and scientific merchandising is taken up in detail.

Doubtless the point which most analysts of the Oregon State curriculum would immediately question is the paucity of chemistry training included in the course. Only 2 hours of general chemistry are required unless the student elects to take the pulp and paper minor option. In this even he receives 24 hours of comprehensive chemistry courses. However, it would seem that a compromise program on this score might be worked out in which the student would receive 8 or 10 hours in chemistry. More training in higher mathematics and in timber mechanics also seems advisable, since comparatively few hours are devoted to these subjects.

The junior and senior years, as has been previously stated, concentrate very much on various business courses. The lumber business of the Northwest is peculiar in that it has marketing and transportation problems enhanced through its remote situation. Principal markets of the region lie many hundreds or even thousands of miles away so that in order to compete with lumber producers located more favorably in relation to markets, these operators in the Northwest must weigh many factors. A tremendous volume of business must be maintained by the larger mills in order to show a profit. Consequently, since he is dealing with such large investments and such a heavy annual

turn-over, the owner must rely on men skilled in foreign trade policy, accounting and banking principles, in efficient plant operation and in successful labor management technique.

This, then, may perhaps provide some inkling as to why the Oregon State curriculum stresses business administration, labor relations and production control aspects of the wood products field. Accounting, business law, finance and economics alone account for some 20 hours of required subjects.

The school has excellent facilities at hand, and expansion in this department of the forestry school seems desirable. In this connection, the school has recently embarked upon such a policy; the staff has been augmented and an endeavor is being made to attract the more capable student into this department.

University of Washington: And now to consider the other western school, the University of Washington; it would seem that their curricula is somewhat weak in divers particulars. Already mentioned is the fact that only 3-1/3 hours of English is required. Furthermore, no calculus is listed and only 3-1/3 hours of mathematics is required. With the exception of Oregon State, this condition is utterly at variance with that existent at the other schools where an average of about 14 to 16 hours of mathematics is demanded. The nature of the work constantly brings mathematics into the technology picture; many of the complex problems of physics, thermodynamics, structures and electricity necessarily assume a knowledge of mathematics. Washington should endeavor to add several mandatory mathematics courses to the curriculum.

The school does not require descriptive geometry as do Idaho and Michigan and only two credits of economics (exclusive of forest economics) are on the organized program. For some phases of technology a course such as descriptive geometry might not be necessary, but all design work is based more or less directly on it. Washington and Syracuse and Oregon State would be wise to add this subject to their list of courses.

The northwestern institution lists twenty-two elective hours of credit open to the student; the university might find it to their advantage to reduce this amount a little by requiring more mathematics of the graduate as well as more English.

Washington, like Idaho and Oregon State, is situated in the heart of a large lumbering region with many large employers of labor--men who are competing on eastern markets with eastern lumber concerns. These companies must concern themselves with new developments. It will take expert wood technologists to produce these changes and improvements--men adept at speaking and writing English and men trained in chemistry and mathematics and the sciences. It lies within a school's power to produce these men.

University of Michigan: The University of Michigan, as is the case with Idaho and Washington, emphasizes the mechanical aspects of wood technology. This school offers a well-rounded curriculum that does not concentrate unduly on any particular phase of wood technology. Only 4 hours of botany are required, and it is possible that the addition of another course in this department would be helpful. Much of the work concerns itself intimately with wood and growth characteristics, features best

taught in botany courses.

Likewise, no business administration courses are included as required courses. A term, or even a year of accounting or business law, often prove to be time well spent later on in the world of business. Just as English and public speaking are very helpful, so a smattering of business administration will very likely come in handy. It might be possible to work these courses into the curriculum by shunting out one of the mechanics courses or possibly the student might be strongly advised to utilize his six to eight hours of electives in this way.

Michigan is unique in that it requires eight hours of shop work in woodworking and metalworking. This type of study is highly desirable; it teaches the person to use his hands and acquaints him by first-hand experience with the characteristics of many materials. Washington and Idaho offer no training in this sort of work while Syracuse only includes one 2-hour course so it seems that minor changes might be made in these schools so as to include at least some training in these subjects.

Summary: Summarizing briefly the weak and strong points of each of the schools it might be said that the University of Idaho and the University of Michigan accent the mechanical phases of wood technology. The curricula of both schools compare quite closely; they include many engineering courses, require considerable mathematics, economics and science and dispense with business administration training.

Oregon State College offers a course which is unique in

the heavy training offered in business courses. This seems highly desirable in view of the school's location and the probable marts of employment open to the graduate. Weaknesses which seem to be in possible need of correction are those in chemistry and timber mechanics.

The University of Washington shows itself to be definitely weak in English, engineering and mathematics, and offers an undue amount of elective courses. Furthermore, too much training is devoted to forest management, silvics and mensuration--time that might better be devoted to English, mathematics, chemistry or botany.

Syracuse, although it is difficult to compare with the other schools since it offers the three alternatives of specialization in wood products work, seems to have an unbalanced curriculum in that English and chemistry, particularly the latter, are stressed too heavily. Too much time is devoted to these subjects and too little to the various mechanics courses so essential to the capable wood technologist.

And now, having considered courses, schools and curricula, the discussion turns toward the student more particularly. Is he fitted for forestry work? Will he be happy leading a rough and outdoor life? Such considerations should be of the highest moment to the student; yet all too often he gives them little thought.

QUALIFICATIONS AND REQUIREMENTS OF A TRAINED FORESTER

Mention has been made of the fact that the U. S. Forest Service has done a great deal to exert a molding influence on the curricula of many forestry schools in the country. Since this organization constitutes the largest single organization employing trained foresters, its demands as to training have of necessity been heeded by those schools interested in placing their graduates with the organization.

It is quite probable that in certain institutions the quality of training in forestry would have been much different had this not been the case. Cultural studies perhaps would have become relatively more important in the training picture. Likewise, professors in certain fields of study would have expressed more individuality in their teaching, unhampered by the knowledge that they were duty-bound to discuss in detail certain material that "the government was likely to ask" on its civil service examinations.

There is, of course, ample justification for the belief that the schools have discharged their duties in a capable manner, if one judges the caliber of teaching by the product of this teaching technique as he now engages in Forest Service work. Over a period of years it has become evident that the U. S. Forest Service has gathered together a unique group of men within its organization. These men have established a reputation which is characterized by a high sense of esprit de corps, efficiency, fairness and impunity so far as departmental dishonesty and

corruptness is concerned.

Natural Qualifications:

Although it has not always been so, the Forest Service is now in a position to select only the most qualified of a large number of applicants from the forestry schools of the country. In a recent address which he gave before a group of western forestry officials and students assembled in Montana, Regional Forester E. W. Kelley outlined the qualifications which he thought should be possessed by the student who had any aspirations toward permanent employment in the Forest Service. (26) Although this agency would manifestly be a group of supermen if it were possible to obtain an ample supply of men meeting all of Mr. Kelley's standards, yet it is interesting to observe the reactions of a practical forester on such a ponderable question as forestry education.

He says that the Service "needs from the forest schools virile, intelligent, straight-thinking, quick-minded, mentally balanced men capable of exercising sound judgement. It needs men . . . who adapt themselves to widely varying conditions and association; men who attract and hold the attention of their associates by reason of their engaging personalities. It needs men interested in human welfare and whose yen for rendering service surmounts desire for monetary gain. . . men who love the feel of the soil; who revere things natural; who crave and seek enjoyment in the woods and on the range.

"It needs men who are gifted with never-satisfied inquisitiveness, and gifted with keen powers of observation--that is,

ability to see what they look at. It needs men who are never satisfied with current practices and accomplishments and who spontaneously struggle to improve the 'what-is's' of the day through the application of their creative genius and ability to apply that genius.

"It needs men possessed of confidence in their convictions, but free of ego and complacency. It needs men with minds tolerant and receptive to the other fellow's point of view; men who can weigh what the other fellow has to offer, and profit from it, on the one hand, and, on the other, if he is wrong, to persuade him into acceptance of the 'rights' of the matter under consideration."

The above points are those which Mr. Kelley would term "natural qualifications" as contrasted with the "scholastic qualifications" which he discussed later. Other qualifications which are certainly desirable are such things as physical fitness, temperament, sincerity, adaptibility, honesty, idealism and loyalty.

Many of the above-mentioned desirable qualities are possessed by most forestry students, who are, as a whole, a sincere, friendly, loyal and honest group of individuals. However, it is not the rule of things to produce numerous human beings so highly endowed as Mr. Kelley would have them be. Lack of a certain degree of physical fitness may be compensated for to some extent by an excellent personality, a superior power of observation, a higher sense of adaptibility, etc.

All of the points brought out are excellent ones; one might

safely say that serious deficiency in any one of the qualifications might very probably bar a person from a successful career in the Forest Service. For example, there have been instances in which loyal, intelligent, highly-trained graduates have been dismissed from the Service largely because their personality was not suited to the organization.

Of the characteristics cited by Mr. Kelley, it might be presumed that honesty, loyalty, sincerity and sound judgement, coupled with a high degree of courage, are the most essential. This applies not only to the U. S. Forest Service, but to any private organization as well. If these traits are well-seated within the individual, he will be accepted into the Forest Service as a valuable unit and will eventually succeed.

Early American foresters typify these traits particularly well--those men who accepted forestry as their life work in the face of heavy odds. They faced public antipathy, financial difficulties, lack of definite knowledge in forestry and a great variety of malpractice in forestry work. Yet by their determined efforts and sacrifices, their courage and perseverance and particularly by their sincerity and loyalty to a cause, we now have an efficient agency which compares favorably with any others existent in the country today.

Scholastic Qualifications:

Passing over to the scholastic achievements of the forestry school graduate, Mr. Kelley sets up a criterion which for the most part is being followed in many schools. He agrees with Graves and Guise that "A general education implies first of all

a knowledge of and interest in human affairs beyond the boundaries of technical forestry. It develops this knowledge and interest. It inculcates breadth of view and wide sympathies. It fosters and kindles clear thinking, critical and creative capacity, concentration, keen perception, dominative judgement and awareness of the inter-relationships of the larger currents in human affairs." (15)

As to specific training he goes on to say that "The Service needs men well grounded in all things natural having to do with land and crop management. This need requires men with a sound working knowledge of how the world came into being--the elements of geology. It needs men with general knowledge of the origin of soils and the progressive development of soils; men with well-rounded knowledge of biology in its broad sense. It needs men who have definite working knowledge of the relationships between the various features which comprise the sum total life of that part of the world in which they live.

"It needs men well grounded in chemistry and physics, in order that they may better understand the 'why's' of the world about them.

"It needs men trained in mathematics because those with a good mathematical background are helped to think more clearly and reason along straighter lines between given starting points and ultimate objectives.

"The Forest Service needs men who have sound working knowledge of the major theories and principles of economic and social sciences, and an understanding of how these basic factors bear

upon and relate to the wild land management job by which the Forest Service is confronted.

"And--special attention to this--it needs men who can speak and write clearly, concisely, and with punch. Unfortunately, all too many graduates have come to the Service grievously deficient in this essential qualification."

Mr. Kelley has summed up the desirable scholastic attainments of the forestry school graduate in admirable fashion. It is interesting to note that he does not mention specific forestry training in his resume, that he confines his remarks to broad basic training in the sciences, English and mathematics. It would almost appear that the government is beginning to seek after well-rounded individuals rather than place a premium on those very well grounded in pure forestry, as has often been the case in the past.

That this fact is true cannot be questioned. The federal government civil service examination in forestry to be given in the spring of 1939 has departed radically from the procedure and subject matter covered in previous examinations. From all reports the first half of the examination will not bear on forestry training at all, but will seek to measure the applicant's knowledge and intelligence. This is an extremely significant move on the part of the government, and may result in further changes in the curricula and teaching methods employed in certain of the forestry schools.

Mr. Kelley corroborates these indications of change when he states that, in his belief, the Forest Service will continue

to demand less and less specific forestry training in colleges. "The Forest Service expects graduates who accept appointment to realize that college training is but one leg which enables a man to compete successfully with others and to march toward productivity of service. With but one leg a man cannot make much progress. The other develops as experience is gained and as qualification gained from training in other ways is enhanced.

"As forest schools drop functional or crafts training from their curricula to make room for more thorough training in the academic subjects, many graduates in the future will enter the Forest Service with less knowledge of the craftsmanship of the job; accordingly, functional training will become more and more a direct responsibility of the employer. With this development, more time must be spent by new appointees in apprenticeship jobs. The Forest Service expects graduates to understand this and to be eager and willing to enter training positions, and not to become restive in them.

The Forest Service expects that men in such positions will share with their employer the responsibilities of qualifying themselves in the craftsmanship of the job. It expects that they will reach out for themselves; read handbooks, ask questions; experiment; and otherwise demonstrate their interests by striving to correct shortcomings as they are revealed."

Having discussed the qualifications, natural and scholastic, of the student, Mr. Kelley proceeds to elaborate on what he feels the Forest Service expects of forest school students. He points out that there is little hope for environmental

misfits, individualists, introverts, egotists, "high-brows" and those lacking qualities of leadership. That this is applicable to individuals characterized to an extreme degree by any one of these faults is certainly true. It is also true that forestry schools have attracted not a few such young men within their folds during recent years--individuals who obviously were never suited to forestry work.

Perhaps the student would never have entered forestry training had he known that the Forest Service would not accept him "if he does not like the woods well enough to wrestle with its problems on the ground; if he cannot get a kick out of living with dust in his nostrils and back of his ears, and with tamarack needles down his back; if he does not like the feel of calked boots and the cruiser coat; if he does not like the lumberjack, the range user and the country people well enough to search out and associate with his constituents and users; if his preference for living in the comfortable centers is so strong that he cannot be content to live away from bright lights and hard sidewalks; if he can't 'take it' and be happy; if he sees no dignity in hard work, then he should not accept the job."

In this connection, a satisfactory plan of training is in effect at the forestry school at Pennsylvania State College in which the student soon finds whether he will be happy with forestry as his life's work or not. The first year is spent at Mont Alto, where the boys are given all phases of practical forestry work. After long-back-tiring work--spent in weeding a nursery bed or pacing in the dusty hills, some of the boys

realize that forestry is not for them and leave the forestry school.

The personnel of the U. S. Forest Service in most communities is looked upon with respect and friendliness. This distinction has been achieved only by the sincerity of purpose, the helpfulness and the refusal to 'kowtow' to social position manifested on the part of government forestry officials.

"Forest officers are public servants. There is no place for cockiness, ego, nor rough-handed dominance in relationships with the public." Those who "think in terms of 'the best people', 'the best families' and hang more credit upon pedigree and exterior polish than upon proven ability to do and serve honestly and well" are not the type of person whom the Service desires. "They fall down because in public forestry a man, if he would avoid trouble, can draw no class distinction between his people; he must accord all the same degree of courtesy and consideration. He must be willing to spend official time with the farmer, the stockman, the miner, the tie-hack or the laborer as with the banker and others rated in the local 'Who's Who'."

This fact, because it is such a very important one, should be carefully made clear to forestry students, some of whom, since they come of well-to-do families, have inbred beliefs that they occupy a somewhat superior plane of life. In college it is only too easy to deepen these beliefs, since social and fraternal associations, fostered largely by ample financial means, often tend to lead the student into the false belief that his is superior to the man who wears less expensive clothing, who must

pay his own way through school and who must be satisfied with temperate and inexpensive recreation.

In his discussion of executive leadership and ability, Mr. Kelley brings out some important qualifications, a few of which have already been discussed in part, which go toward making executive ability and leadership. The fourteen characteristics which he mentions are all worthy of attention; many of them can be developed by diligent effort. He lists good physique, initiative, drive, stick-to-itiveness, interest, judgement, open-mindedness, accountability, imagination, courage, self control, ability to judge people, organizing ability and a sense of humor as requisites of any successful executive.

Although individuals who possess all these attributes developed to a high degree are seldom found, nevertheless, certain of them, such as interest, initiative, courage, self-control and open-mindedness can by studied effort on the part of the person be improved and made stronger. One's success in life is largely measured by the degree to which these characteristics are present; and, if it is at all possible to strengthen one's position by developing them, this would merit study and effort on the part of the person. In this connection, Mrs. Arthur D. Read stresses such qualities as personality, reaction to criticism, physical strength, enthusiasm, honesty, courage, ability to work with others, and powers of observation as being desirable characteristics of any person entering Forest Service work. (34)

It is important for the student to realize that his position

with the Forest Service will not be merely a job governed by a timeclock. He must be prepared to devote long hours to his work in order that his particular unit of the organization will function smoothly. Particularly during the fire and grazing season will his day be full, if the individual should be a ranger.

OPPORTUNITIES IN THE FOREST SERVICE

Actual:

In return for his efforts the forester in federal service is paid a comfortable salary, although this is such that it is certain he will not die a rich man. A Junior Forester's pay starts at $2000 and rises to $2600 per year, while ranger, supervisor and district forester positions pay progressively higher salaries. "The higher grades in the Forest Service pay from five to seven thousand dollars a year." (33)

Gifford Pinchot, who has made his name symbolic of pioneer forestry achievements in the United States, has this to say about forestry work. (33) "Forestry in America is still a young profession, but it has won its place. In less than fifty years American trained foresters have increased from zero to more than 5,000 men. And still there is need for more. Foresters out of a job, depression or no depression, are few and far between.

"What then can a forester expect? Hard work and happiness, and a chance to make use of the best that is in you. Good service to your fellows, but neither ease nor riches. A long, hard row to hoe in a growing, progressive, and supremely useful profession.

"A reasonable living; a chance to rise as you show yourself

worthy; a chance to put forestry where there is none today; the rare chance to be both student and teacher all your life long; the forest for your laboratory and workshop, friendship with nature and the out of doors; and the ever present obligation and opportunity to be a public servant."

Going on still further in a statement made in 1914, Pinchot points out that it is extremely important that the individual be suited to his work. "To the men whom it really suits, forestry offers a career more attractive, it may be said in all fairness, than any other career whatsoever. I doubt if any other profession can show a membership so uniformly and enthusiastically in love with the work. The men who have taken it up, practiced it, and left it for other work are few. But to the man not fully adapted for it, forestry must be punishment, pure and simple. Those who have begun the study of forestry, and then have learned that it was not for them, have doubtless been more in number than those who have followed it through.

"I urge no man to make forestry his profession, but rather to keep away from it if he can. In forestry a man is either altogether at home or very much out of place. Unless he has a compelling love for the forester's life and the forester's work, let him keep out of it."

Student Views:

This observation comes from a trained forester as he looks back over some forty odd years of forestry practice. In contrast to this retrospective viewpoint are the results of a recent poll of freshman forestry student opinion conducted at the

University of Georgia. (30) As future foresters these men were asked why they wanted to become foresters and how they became interested in forestry. Judging from the results of the questionnaire it is apparent that most forestry students, at least in the Georgia institution, expect one or more of the following benefits following their graduation from college:

1. An outdoor life
2. Good financial opportunities
3. Occasion to serve the public
4. Excellent placement possibilities in the lumber industry
5. A healthy life

All of these motives are excellent ones, but often the student does not have a very comprehensive idea of their true meaning. Forestry has been romanticized by word and picture to a large extent, and many city youths entering forestry schools feel that they have the life of a national park ranger before them. Mr. Kelley's remarks, quoted above, make it obvious that this is most certainly not the case in the Forest Service.

That some young men enter the forestry profession only after serious thought on the matter is apparent in a good many instances, and this will become increasingly true when the temporary rapid upward surge in forestry has subsided. Marckworth and Buttrick found that their forestry students became interested in forestry for a number of different reasons, among which were the following: outdoor interests, contact with foresters, outdoor organizations, work in the woods, reading and membership in the C.C.C.

Of course, the first three reasons, as well as the last one, may be expected to be the strongest actuating influences upon

the student, since they are direct and tangible. However, it does seem strange that more students do not have their interests aroused through reading; on the basis of these questionnaires, it was found that only 8.7% and 6.5% for the years 1937 and 1938, respectively, of the total number of students were influenced to engage in forestry work through reading on the subject.

Just as some students take up forestry as their life's work in a helter-skelter sort of way, so some of them apparently give little thought to the qualifications of the institution which they select for their study of forestry. Some of the factors bearing on a rational choice of schools will subsequently be presented.

FACTORS BEARING ON FORESTRY SCHOOL SELECTION

Hasty and Shallow Thinking:

It is obvious that the youth of America has come to feel the need for advanced learning; they realize that such education is essential to their future well-being. The perplexing problem to them is the selection of a course which will train them to lead a contented life with a comfortable sustenance. Of late years (particularly since the inauguration of the C.C.C. program) not a few of these many thousands of students throughout the United States have decided to cast their lot with the forestry profession.

Undoubtedly many of these young men weighed the situation carefully before electing to study forestry. They made inquiries as to the qualifications and life of a forester and

analyzed themselves in an attempt to determine whether they were fitted for the work. (See page 105) More recently, however, many of the entering freshmen have not been so critical in their self-analysis and have not bothered to acquaint themselves with the physical, ethical and intellectual attainments demanded of the capable forester of today.

As a consequence, forestry schools of the country are training many men who are not qualified for the work--men who would not be truly happy and satisfied in the forestry profession. An important contributing factor to this state of affairs has been the prevalence of jobs available to the forestry graduate since the advent of the C.C.C. program in 1933. Unfortunately, forestry schools have gained in enrollment all out of proportion to the capacity of the field, and in all probability it will be these misfits who will experience the most difficulty in obtaining work. (22)

Thus, it would be a very desirable accomplishment if all freshmen planning to study forestry could be made to realize that it is of the utmost importance to them to think the situation over carefully before entering the forestry profession. They should make an effort to talk over their problem with an older Forest Service officer; many books and magazines on forestry would also help to give them an insight into the question. Above all, they should come to realize that forestry work requires men of physical strength, who can spend forty hours of heart-breaking effort on the fire line and still come back smiling; men of courage, who can attack a problem

with determination and resourcefulness; men of high ideals, who have a clean mind and are loyal to their employers--men who will not grumble when they are forced to devote ten, twelve or more hours a day to their job.

General Considerations:

If, after considering all these things, the young man still aspires toward a forestry career, his next consideration will be that of choosing the school he will attend. In many cases his financial status will make it mandatory that he attend the forestry school nearest his home. However, in the event that the student does not have to worry particularly about finances or in case his home state does not have a forestry school, he will be in a position to choose the most suitable of several forestry schools.

In making his choice, the student should take a number of things into consideration. In the first place he should endeavor to find out what the general reputation of each school is; some have been more progressive and are better administered than others. He should investigate the alumni lists of forestry schools as to their employment-after-graduation record in order to gauge his own possible future success. No thinking student, likewise, will neglect to investigate the facilities extended by each school such as the teaching staff, experimental forest areas, library content, working equipment, etc.

He should, furthermore, attempt to discover the objectives and philosophies of teaching followed by these schools--will he be broadly trained, will general knowledge be stressed or

will most of his courses be strictly factual in nature? Should he be thoroughly trained in forestry alone, or should he attempt to acquire a reasonably broad education, and which school will best enable him to carry out these desires? In this connection Graves wonders whether "efforts to train boys for specific jobs result in superficiality of knowledge and of habits of thought and action," and seems to indicate that he believes this to be the case. (16) He goes on further to say that "in an effort to spread over all phases of applied forestry there may be a tendency to slight some of the most important fundamentals of education" such as the art of independant reading and of interpretation and use of knowledge. These points are all of importance, as the first-year student will come to realize more clearly by the time he is a senior.

Finally, in surveying forestry schools the student should be concerned particularly with the different phases of forestry education extended by the schools. Several alternatives are open to the entering student; he might choose to specialize in Wood Products, Utilization, Lumbering or Management and the choice of his field of study should largely influence his choice of a school for most schools are prone to develop thoroughly only one or two of the above-mentioned fields of study. From the above discussion it can be seen that the thinking person will not leap into a course in forestry without giving the matter due consideration and that he will weigh the merits of forestry schools throughout the country before deciding which school is to be his alma mater.

Entrance Requirements:

With the heavy influx of students that have moved into the forestry schools, several institutions have been either compelled to or have chosen to limit their body of students through rigid entrance requirements and enrollment limitation; these limitations must, of course, be examined by the person intending to enroll.

For the most part undergraduate schools merely require that the applicant be a graduate of a standard four-year high school in order to be eligible for entrance in their school of forestry. A few schools, which receive more applications than they are able to care for, such as Iowa and Syracuse, have limited their enrollment through force of necessity. Others, such as Montana State University and Connecticut State College, have set up restrictions with the intention of building up the quality of their forestry students scholastically. The School of Forestry at Montana State University has embarked upon a rigid program of limited enrollment, whereby students from out of the state must rank in the top half of their high school class before their application for admittance will be considered. Transfer students from other colleges must have a better-than-average standing in their work; and all students must "maintain their work at a satisfactory level," or "they are dropped for a year and not readmitted until they can raise their academic record to that which the school of forestry establishes as an essential minimum." (18) It might be interesting to note in passing, however, that

the mortality of the Montana freshman class has in the past year been no heavier than that of the average school (about 50%). Connecticut requires the student to be a high school graduate and he must rank in the top 1/4 of his class, although it was not revealed just how closely the school adhered to this ruling. (5) The newly established division of forestry at Colorado State College, has only recently embarked on a definite policy of restricting enrollments. (19)

California and Michigan list no freshmen or sophomores, although the junior and senior classes usually are subsequently formed by acceptable students from these two classes. (46) Louisiana State University employs a similar system except that students enter the school of forestry as sophomores in place of juniors. It will be interesting to observe future policies of the United States forest schools pertaining to the admission of students. Some have already indicated by their actions that they favor limited enrollment, and would permit only the better students to attend their school. Other schools, typified by Oregon State College, believe that ever student desiring a college education should be permitted to follow his heart's desire, whether it be Forestry or Industrial Arts. (23) Possibly future employment conditions in forestry work will automatically solve the problems of heavy enrollment.

School expenses:

The question of expenses, which bothers so many students regardless of what school they may be in, varies considerably among the various schools, and this too will have much to do

with the final selection of a school. (See Table IX) Obtaining an advanced degree at some of the eastern graduate schools entails the expenditure of quite a sum of money--more than the average student with a pocketbook made gaunt by four years of college is willing to pay. For example, it requires on the average of from $1100 to $1200 to complete just one year at Harvard University. (20) However, the average cost of a year in college in the majority of eastern institutions averages in the neighborhood of $600 with an additional amount of approximately $100 if the student is from another state. (23) Probably the most reasonable of all eastern forestry schools is that at the University of Florida, where the costs to state residents range from a minimum of $344.60 to a maximum of $445.00 for the year. (47)

Many of the schools have some jobs available to students, and in this way it is possible for them to cut down expenditures. Government help, particularly, has aided the needy student, and has in many cases made it possible for outstanding students to attend college. The majority of the money spent by the student goes to pay for his room and board; but books, tuition and course fees often constitute a great deal of the total expenditures. Summer camps, likewise, comprise a major expense, since room and board as well as fees must be paid. These charges vary from approximately $60 to $100 for a camp lasting six to ten weeks.

Summer employment, obtained chiefly by students in the western forest schools, often enables the man to earn most, if

TABLE IX. AVERAGE ANNUAL EXPENSES INCURRED BY THE FORESTRY STUDENT IN UNITED STATES SCHOOLS. *

Institution	Amount
University of California	$ 500-650
Colorado College	400-600
Connecticut State College	650
Duke University	600
University of Florida	340-440
University of Georgia	900
Harvard University	1100-1200
University of Idaho	350-600
Iowa State College	600
Louisiana State University	450
University of Maine	600-700
Michigan State College	450
University of Michigan	550-600
University of Montana	380-500
University of New Hampshire	430-640
North Carolina State College	600
Oregon State College	400-600
Pennsylvania State College	600
Purdue University	450-500
Utah State College	500
University of Washington	450-600
West Virginia University	500
Yale University	900

*Add approximately $100 to the total for out-of-state students.

not all, of his coming school year expenses. Judging from recent enrollments, school costs are not prohibitive to the person with ambition and the will to work.

Junior Forester Civil Service Examination:

Still a further consideration which might influence the choice of forestry schools is the fitness of the school with regard to preparation of the student for government work. Just as has been the case with European countries, the United States government has assumed the leadership in forestry work. To administer the 175,000,000 acres now contained within the national forests of the country it has been necessary to employ hundreds of college-trained men, and these men have been chosen on a competitive basis by means of civil service examination. This Junior Forester examination, as it is called, is given by the government whenever men are needed, and anyone may take it, providing that he has acquired a college degree, is physically fit and is not beyond the age limit.

The majority of professional foresters emerging from school each year would like very much to pass the examination successfully, and all but a very few take the test. Some schools, such as Oregon State College and the University of Idaho, have been very successful in training their graduates to pass the test. On the other hand, graduates of many eastern schools have not been so fortunate, sometimes failing almost in toto in their competitive refforts.

This state of affairs has resulted in numerous comments and some criticism on the part of educators in the east, who

maintain that it is not a suitable system of education which strives chiefly to prepare the student for the Junior Forester examination. They insist that the Forest Service is prone to dictate the policies of the schools, and feel that some schools have catered to the demands of the Service too much. (13) However, viewing the question from a more practical standpoint, such definite preparation of students for the civil service examination has its good points. Schools of the far west are situated in regions comprising the bulk of the nation's National Forests; there is no other field of employment so large or promising as the Forest Service in much of this region, and students are admittedly training themselves for government employment, because it extends them the greatest opportunities.

Conditions in the East are diametrically opposed to those existent in the West; most of the timber is privately-owned, and better markets together with closer utilization encourage one to train for utilization, selling, woodlot management or some other calling associated with forestry. A proportionately smaller number of Forest Service jobs in the eastern states has tended to diminish the importance of federal government work in the forestry schools, although some schools are now beginning to actively aid the student in his preparation for civil service examinations.

Although little information relative to the Junior Forester examination is available which would indicate the success of different forestry schools, the data at hand is interesting.

During the spring of 1936, fourteen of the twenty-three Idaho men who took the examination succeeded in passing it, while in 1937 thirty (all those taking the test) passed it. Louisiana State did not fare so well. In the 1936 tests only one out of three passed. The University of Maine, which trains its men primarily for private and state work in the New England States, has a better record. In 1936 only three out of eleven passed, but in 1937 eleven of the seventeen competing managed to pass.

New Hampshire College with a total enrollment of eighty foresters graduated four men in the spring of 1936 who were able to pass the test. A total of ten took the examination. In 1936, twenty students from North Carolina State College are reported as having taken the test and of this number only two managed to pass. (23) Standing out in contrast to this poor showing is the success enjoyed by Michigan State students, twenty-one out of twenty-eight of whom passed the 1937 examination.

More complete records are available for Oregon State College; her forest school has established an enviable record. Each year Oregon State men taking the test have done uniformly well--better by far than students from most other schools, as these figures should indicate:

Year	No. taking exam	No. passing exam
1929	12	11
1930	19	12
1931	7	5
1932	39	33
1935	--	32
1936	19	13
1937	43	40

However, it is all well and good to talk about the success of past graduates, but the scene confronting the graduating senior in 1939 promises to be radically different. In all probability some 2000 or more forestry school graduates will take the examination and but a small proportion of this number can reasonably hope to secure federal appointments. To the student who has been preparing himself for government work this change will work a hardship: "if the student has directed his efforts too exclusively to problems of public service, he may find himself unprepared in some of the basic requirements for private problems." (16) Graves, speaking of the employment prospect in forestry civil service work for new men, says that "cessation of continued expansion, even without actual reduction of current appropriations, gives little opportunity to employ new men in the public organizations. This may be anticipated in the present situation. The forest schools will be affected because, with the great inflow of students, there is likely to accumulate very quickly a large number of graduates unable to obtain employment." (16) (See page 115)

Undergraduate Enrollment:

Apparently entrance requirements, expenses and the uncertainty of future employment have not dampened the spirits of those young men who have their hearts set on forestry as a life work. The extremely rapid rise in enrollment experienced since the fall of 1934 has resulted, however, in much detailed study and considerable comment pertaining to forestry education. To begin with, it is a thing which vitally concerns the students

themselves, since heavy enrollments materially effect their future employment prospects. Furthermore, the schools have become taxed beyond their facilities, and have been forced either to undergo changes or limit enrollment. Iowa State College has been compelled to limit the number of students in the sophomore class to seventy-five.

Selection of these men is based on individual merit of the applicants, while natives of the state are given preferance. Syracuse University turns away hundreds of applicants annually, and has also instituted a quota system of points whereby any student failing to complete a certain number of points each semester is automatically dropped. (10)

Such rigorous methods are justifiable through force of necessity in these schools; and, although they deny many students the right to the education of their own choosing, yet they permit the schools to operate with few enough students so that good standards are maintained under present facilities. With the innovation of greatly increased enrollments many schools quickly expanded so as to accommodate all those who wished to study forestry on their campus. Schools accustomed to working with fifty or seventy-five forestry students found their enrollment jumping to two hundred or three hundred in a single year. In many cases the result was that the student-professor ratio was increased and field work was hampered through lack of equipment.

These schools, which have undertaken to train all those students wishing to enter the field of forestry, have in many

cases managed to maintain former high standards through a careful selection of additional instructors and an increase in enrollment is plainly evident, in some instances largely because the schools have been conscientious in striving to keep up former standards.

That there has been a marked increase in enrollment is plainly evident, when one considers the present size of individual forestry schools of the country as well as the number

TABLE X. UNDERGRADUATE ENROLLMENTS AT SCHOOLS OF FORESTRY IN THE UNITED STATES, 1903-04 to 1938-39.*

Year	Enrollments	Year	Enrollments
1903-94	19	1921-33	1,363
1904-05	39	1922-23	1,347
1905-06	51	1923-24	1,439
1906-07	98	1924-25	1,624
1907-08	143	1925-26	1,771
1908-09	258	1926-27	1,880
1909-10	357	1927-28	1,957
1910-11	518	1928-29	2,079
1911-12	591	1929-30	2,123
1912-13	637	1930-31	2,120
1913-14	868	1931-32	2,573
1914-15	904	1932-33	2,388
1915-16	944	1933-34	2,246
1916-17	897	1934-35	3,791
1917-18	560	1935-36	5,406
1918-19	498	1936-37	6,032
1919-20	927	1937-38	6,067
1920-21	1,092	1938-39	5,144

*Guise, C.H., 1939. Statistics from schools of forestry.

of graduates emerging from these schools annually. Even as early as the spring of 1934, Fritz writing in the Journal of Forestry stated that "in the next ten years 4000 professional foresters will graduate from American schools," and later developments have proven his estimates to be conservative. (13) However, it is encouraging to note that enrollment in the freshman class throughout the country sustained a decrease of 20 per cent during the past year. (19)

Graduate Students:

It is quite generally conceded by most educators in the field of forestry that four years is insufficient time to fully prepare the professional forester, and that five years would be more desirable. (37) As may be seen from the foregoing discussion, many problems have been raised of late through swelled enrollments. However, nothing has as yet been done about the establishment of a five-year compulsory curriculum in forestry in an attempt to improve the quality of graduating forestry students. Professor R. S. Hosmer of Cornell University seems to arrive at the crux of the whole matter in the following statement made in 1937: "with an additional year for professional training not only should it be possible to include the technical subjects that a forester needs if he is to be a real leader, but also it should permit as well that there be included in the curriculum at least an acquaintance with some of the cultural subjects to which today only a few of our forestry graduates have even been introduced." (21)

None of the undergraduate forest schools, not even the

older eastern schools, have a mandatory five-year course; but several schools, notably California, Idaho and Michigan encourage their students to complete five years of training before leaving school. They argue that in a four-year course a student not only receives a narrow training delinquent in general training apart from forestry, but that even his forestry education is lacking. The average student in forestry has his course subjects pretty much outlined in advance for him during much of the four years he is in school. The character of the courses he takes places them in one of four possible catagories:

1. Technical forestry courses
2. Basic courses apart from forestry
3. Recommended elective courses closely associated with forestry
4. Electives satisfying the student's own hobbies or desires. (37)

Under present conditions insufficient training in courses found under catagories two and four has been provided. Many students find that this is so in their case, and have of their own volition gone on to take an additional year of work, not merely to be the owner of a Master's degree, which is after all incidental, but to round out their education to their own satisfaction. Connecticut State College does not leave this choice up to the student, but insists that "the undergraduate school is for a broad educational foundation" and that it is the duty of "the student to specialize in his particular field at institutions offering graduate work." (23) Possibly the school is allowing the facilities it has at hand to dictate its

policies, but at any rate such a system would tend to produce more broadly-educated foresters.

It has been noted that there is some correlation between the current employment possibilities and the number of graduate students enrolled throughout the country. For example, during the first three years of the Roosevelt administration, the graduate students in forestry dropped off appreciably from figures of previous years, largely because graduates have had little trouble in securing jobs. However, there has been a distinct rise in graduate enrollment as a result not only of greatly increased numbers of graduates with the exhaustion of available jobs that must accompany such a condition, but also as a result of the betterment of graduate schools in institutions formerly not concerned with such departments. Ordinarily about 5% of all forest school graduates return for fifth year training. At present there are 253 students registered for the Master's degree, and it is expected that this number will rise even higher next year. (19)

As time passes, the man with a B.S. degree will realize that his four years of education do not suffice if he is to compete successfully with other graduates, and he will return for an additional year of training. Such trends in advanced education will benefit the individual as well as the country and the forestry profession itself.

Professor Spaulding, writing in the Journal of Forestry, briefly summarizes the matter in the following sentences: "Because of the increasing complexity of forestry practice and

the broadening of its scope, it is evident that we must adjust our instruction and its content to meet the forestry of tomorrow as we see it. The problem of industrial forestry and the practice of public forestry demands a wider base than our present curricula indicate." (40)

He further goes on to say that at the present, fully seventy per cent of his own students voluntarily or involuntarily take five years to complete their education and indicates that "if the student can be shown that he will be better prepared at the end of five years than he would at the end of four years he will willingly devote five years to the process." (40)

Referring to graduate training Professor C. F. Korstian remarks that "the essentials for graduate work are: (1) students of proven capacity who have been thoroughly trained as undergraduates, and (2) instructors who are thoroughly grounded in their special subjects, who have shown productive capacity, and who are able to inspire and stimulate students. They must not be overworked." (29) Unfortunately, through force of compulsion, many schools have been unable to satisfactorily meet the latter requirements, in that nearly all instructors have become burdened with heavy teaching loads.

Sizes of Graduating Classes:

As has been mentioned previously the number of graduates emerging each year have a direct influence upon the number continuing with advanced work. With the many changes that have come to pass in the field of forestry education during the last few years, it might be interesting to analyze the trends in

forestry graduating classes briefly. The size of the various graduating classes in forestry remained fairly constant and uniformly low until the years of 1936 and 1937. Reflecting clearly the effects of Roosevelt's encouraging policies, the schools of the country, without exception, showed large increases in the number of graduates, particularly for 1937 and 1938.

It was not until the C.C.C. movement had been in operation for a little more than a year that freshmen students began to pour into the forestry schools of the country in such large numbers. They had watched these fortunate enough to possess a degree in forestry accept lucrative jobs in the fall of 1933 and the spring of 1934. The fall of 1934 found them eager to cast their lot with those who had so successfully gone before them. At the same time numerous students transferred from other schools as sophomores and juniors. It was largely these transfers that served to swell the graduating class of 1937 to such large proportions. The group graduating in the spring of 1938--those who remained of the eager throng of freshmen who started in the fall of 1934--proved to be the largest group of forestry graduates in the country's history. 969 students received undergraduate degrees while 93 completed work on their Master's degree. (19)

To see just how great have been the increases in graduating classes it might be interesting to choose a few schools at random and examine the sizes of their present senior classes as compared with those during the past nine years. In

the case of the University of Idaho, graduating classes 1928-35, inclusive, averaged nine students each year. In 1936 this figure moved up to fourteen, and in 1937 it increased to thirty-four, an increase of 143% over the largest of all previous classes. In 1938 the group increased still further when an all-time high of 47 was reached. (4) Or consider the trends at the University of Michigan, a somewhat larger school than Idaho. The average class from 1928-35, inclusive, contained approximately 19 students per year; in 1936 the class increased to thirty-six and in 1937 the record number of fifty-eight students were graduated. This was an increase of sixty-one per cent over the next biggest class in the history of the school. (41)

As was the case with Idaho, however, this figure was surpassed by the 1938 class which totalled 61. In some cases this rapid upward trend is beginning to level off, but as yet this is not true of Michigan where the graduating class for the current year numbers approximately 73. The size of each graduating class from 1928 to 1938, inclusive, for each of the two schools discussed above follows:

Year	Michigan	Idaho
1928	10	13
1929	16	8
1930	21	10
1931	22	20
1932	31	13
1933	24	12
1934	18	9
1935	27	15
1936	44	23
1937	56	37
1938	61	47

Such data is typical of the conditions existing in the other schools. Larger schools graduated even more students than did Michigan last spring. Leading the country was Syracuse University with a total of 88 graduates, followed closely by Pennsylvania and Minnesota with 84 and 71, respectively. (19) And so it is simple to see that professionally trained foresters are rapidly on the increase; unfortunately, the question of what is to be done with them all is not so clear.

Thus, it is obvious that all classes and sizes of forestry schools have experienced rises in enrollment. Studying the problem from a national viewpoint tends further to substantiate the evidence presented above. Professor Cedric Guise of Cornell University, who conducts an annual survey of forestry schools in the country, shows that "for the five year period 1929-30 to 1933-34, the undergraduate degrees numbered 344" as an annual average. (18) In 1936 the total number increased to 502, advanced to 777 for 1937 and reached 969 in 1938. (17) It appears that this 1939 class will be slightly larger with approximately 1000 undergraduate degrees, but the following two years should show decreases from this figure of about 200 and 300 for the years 1940 and 1941, respectively. (19)

From this it can be seen that in all probability these enrollment figures will begin to taper off gradually and it is believed that within five years, or possibly a little longer, the number of undergraduates will stabilize at a considerably lower figure than it is now.

Graduate Employment:

While attending school the thinking student often considers the future and might well wonder whether all his educational expenditures have been well invested. The $2000 or $3000, or whatever amount he may have needed to finance his education, represents a tangible and costly investment; and he is, consequently, interested in what the future has in store for him.

If one could always judge the future by the past, the job outlook for graduates of today would be encouraging. Individual schools report that as many as 85% of their cumulative list of graduates have found employment in forestry work or in work closely associated thereto. 65.2% of the total number of Yale graduates are so employed, and this figure would be slightly higher were it not for the fact that non-graduates are included in the total. (44) Some schools have been more fortunate than others in placing their graduates, but in nearly all cases the percentage in forestry work is high. Fritz states that only "33% of the graduates from 1900 to 1929 drifted from the field of forest employment," and goes on to say that during the past few years this percentage has decreased. (13) Guise points out that according to "statistics gathered in 1929, 67% of all forest school graduates were in occupations for which their forestry training had logically prepared them." (18)

In checking over graduate employment, it is interesting to note that there is little difference between the percentage of western forest school graduates employed in forestry work as compared with percentages for eastern schools.

Apparently the need for professionally-trained foresters has been sufficient in each region to absorb the majority of

TABLE XI. EMPLOYMENT OF FORESTRY SCHOOL ALUMNI IN FORESTRY WORK OR WORK CLOSELY ASSOCIATED THERETO

Eastern Schools		Western Schools	
School	% Employed	School	% Employed
Georgia	60	California	90
Harvard	70	Colorado	86
Iowa	93	Idaho	85
Louisiana	90	Montana	85
Maine	68	Oregon State	90
Mich. State	73	Utah	85
Mich. Univ.	71	Washington	85
New Hampshire	80		
North Carolina	55		
Purdue	75		
Syracuse	80		
Yale	65		

those seeking employment. Recent government policies pertaining to forestry have helped conditions greatly, but it is certain that such aid cannot exist forever. It is feared that the future will force a greater number of forestry graduates to turn to other fields of employment. (18)

CONCLUSIONS

Future Employment Outlook:

The question, then, that is uppermost in the minds of those students now in school, and especially those who will soon be graduating, pertains to what the future has in store for them

in the way of employment. Much discussion centers around the fact that the Forest Service does not find the need for new men as great as it has been during the past three or four years. Competition in federal service has become much more keen; it is estimated that more than two thousand men will take the Junior Forester examination this spring, and of this group, the number of men who will be placed in federal work will not be great.

In a recent editorial of the Journal of Forestry, Schmitz discusses the question of employment prospects for the present-day forestry school graduate at some length.* He points out that actually the forestry profession is only now beginning to emerge from a stagnant condition brought about by the unprecedented expansion of federal activities since 1933. Graduates of this period were not required to employ any particular industry, ingenuity or initiative in their job-hunting; nearly all who were reasonably suited to forestry work were immediately accepted in some branch of governmental forestry.

Now, however, Schmitz believes "opportunities for the employment of the foresters of the class of 1939 appear none too bright." Comparatively few of those taking the junior civil service examinations will receive appointments of a permanent nature, although some will be granted temporary federal work. Likewise, a few will be placed in positions within the personnel of state forestry departments, but here, too, the number will be but a small percentage of the total.

After setting up this not-too-inspiring picture which faces forestry graduates of the current year, Schmitz concludes

*Schmitz,H. 1939. What lies ahead for the forestry graduate of 1939. Jour. For. 37:281-282.

that "the forestry graduates of 1939, perforce, will be compelled to seek out, develop, and create jobs." The lumber industry should be capable of absorbing a good many of the graduates, but not in a professional, or even semi-professional capacity, in most cases. These jobs will ordinarily not be secured merely by promiscuously writing letters to a great number of concerns stating that the applicant is a trained forester and college graduate. The persons who secure these positions will do so because they profess to be willing and able to work and because they will be personally on hand when the opportunity offers. "Because of the ability, the energy, and the force of the individual or individuals filling them, some of these jobs will become responsible positions exerting a strong influence on the rate of acceptance of sound forestry practices by private timberland owners or on the extension and preservation of markets for wood."

The discussion also points out that good many of the current crop of graduates will enroll in graduate study. Not a few of these will probably be of inferior scholastic ability and Schmitz cautions such students that "not all those who by 'hook or crook' finally complete the requirements for a baccalaureate degree can successfully carry the work for a graduate academic degree." Any student contemplating such a course of action should analyze his scholastic background, his objectives, his desire for learning, his intellectual capacities and his motives for adopting such a plan of study, lest he be even further disillusioned in the future.

The editorial closes with a brief word of encouragement wherein assurance is given that the forestry profession, forestry schools and the Society of American Foresters are all solidly behind the graduating classes and will help them wherever possible. The situation is not at all hopeless, but has merely changed in that the graduates will be compelled to invade new fields of forestry and make jobs for themselves.

One has only to consider the size and importance of the private logging industry in the United States in order to realize that here lies a potential market for hundreds of trained men, if these men can only make it plain to the industry that their knowledge and training is needed. (41) As yet the industry as a whole has not accepted the forestry school graduate as an indispensable unit in its organization. This is probably due to the fact that federal service has offered a greater proportion of highly paid positions and has also been able to absorb most of the professionally-trained foresters. Logging companies, many of them quite small, competing with one another have also been forced to watch salaries and overhead expenses closely.

The presence of virgin stands of timber throughout the west has acted as a dampener on proposals of sustained yield. Rather than risk possible market drops, higher taxes, fire protection and management costs, the lumberman has adopted the well-known "cut-and-get-out" policy. However, future conditions are certain to change all this; the country will be compelled to adopt policies similar to those now in effect in certain portions of the Southern Pine and Lake States regions,

and this means that a new field will open for men trained in silviculture, management and forest science.

Along with such changes as this will come similar ones in the field of utilization. Men will be needed, and are needed, to take up supervisory positions not only in saw mills but in the multitude of associated lumber industries. Research is constantly bringing to light more and more uses for wood; these products must not only be manufactured, but they must also be sold, and both operations demand skilled men. At any rate, if the trained graduate is ambitious and conscientious, and if he is willing to accept work with only a modest salary to begin with, past data indicates that he should have better than a sixty per cent change of finding work in the field of forestry.

Much is said of the present excess of professionally-trained foresters, and people wonder just what is to become of them all. It is true that the field will be crowded, but is this not the case in almost any technical field of employment? There are many jobless engineers in the country and there are a great many more engineers than foresters being trained in school today. The same holds for almost any profession being taught in schools at the present time. The whole question simmers down to the fact that, if the graduate excels in his work, is honest, ambitious and reliable, he will have little trouble in obtaining a reasonably good job within a few years after graduation. For the graduate who has sluffed through school, doing his work in such a way as merely to "get by", the future might be more questionable.

Future Education in Forestry Schools:

After considering the rapid developments of the past four years, it is difficult to surmise what changes the future will bring in forest education. The big problem that has confronted the different schools in the past few years has been that of excessive enrollment, but it is believed this condition will be relieved somewhat through a gradual rounding off of the number of students brought about by a surplus of graduates in forestry.

Some schools will continue to train all those seeking forestry education of them; this they should be able to do satisfactorily with a decline in enrollment expected for the future. It is, of course, problematical whether all these men will be successful in finding forestry work, but at least they will have received the kind of an education they desired. Other schools, such as Syracuse and Montana, will limit their enrollment to a small proportion of all applicants. Such a policy is condoned by C. H. Guise, who feels that this policy probably will be adopted by more schools in the future. (17)

In considering forestry education of the future, mention should be made of the possibility of changes in the number of forestry schools. It is reasonably certain that additions will be made to the roster of forestry schools; and, if the schools are well-equipped and capable of producing good work, such additions are perfectly acceptable. Actually a heavy obligation rests upon the states who install such training into their school systems; forestry is developing into a

profession of distinction and repute, and for this reason the proposed school should be of high caliber or the matter dropped. In some instances Graves states that "it might be wiser and cheaper to grant scholarships to selected students of ability and send them to an existing school in another state, which is better equipped than any that the first state could afford to create." (16)

Along with changes in the actual number of forestry schools, one might consider the future of those schools already established a little more carefully. Although classrooms have been crowded and equipment limited, forestry schools have been benefitted by heavy enrollments in that increased financial support has been extended them. As has been mentioned before, faculty numbers have been increased, equipment supplemented, new programs instituted and operating expenses in general have been increased. If present budgets can be maintained in the future, even despite the expected decrease in enrollment, the standards of most schools will be raised considerably. (16) Schools should make every effort to see that present funds are not reduced.

In the years to come it is certain that Utilization and Wood Products departments of forestry schools will be more heavily attended than heretofore. It is a definite policy to train men for the "lumber and related industries in such schools as Washington, Michigan and Syracuse", and they have had good success in placing their graduates. Oregon State College, in response to a definite demand for such training evinced by many

students, is expanding its Wood Products department rapidly at the present time. Fritz states that "forest schools should train some students for private forest industries as deliberately and adequately as they now train them for the public employ." (13).

When one considers the future of forestry education, he must also of necessity consider the question of an extended forestry curriculum. Other professions vary in the number of years of academic training which they require of their students. Both law and medicine insist upon advanced study, while engineering and architecture demand but four years of undergraduate training. However, it would seem that there is an intrinsic difference between the professions calling for varying amounts of formal training.

In the case of law and medicine, men in these professions need the advanced training--they would be incapable of doing justice to their work without it. Engineers, however, are often called into specialty fields, in which their previous training serves merely as a broad supplemental background. Some large firms even go so far as to advise their new employees to disregard engineering aspects of their academic training; they prefer to either send their new men to a company training school or to begin them in lower positions and train them on the job.

Forestry, on the other hand, appears to lie midway between the two groups discussed above. Soon after graduation, the forester will more probably be called upon to apply a greater

proportion of his fund of academic knowledge than will the engineer, but not so much as the lawyer or the doctor. More likely than not, if he is placed in a truly professional position shortly after graduation, he may find that his work calls for quick personal decisions and a fairly comprehensive knowledge of the entire forestry picture.

Consequently, if the field of forestry were such that a sizeable demand for trained men existed, a compulsory five-year curriculum might be an advisable step forward in the realm of forestry education. The additional year would enable the student to better equip himself for future duties, just as the doctor prepares himself by advanced study. On the other hand, when the employment situation suffers reverses, as it has at the present time, the proposed step does not seem feasible. If a large proportion of the forestry graduates will be forced to seek employment outside the profession, as seems quite likely at the present time, an additional year of study does not appear to be a profitable expenditure of time.

Although no forestry schools at the present time definitely demand that a five-year curriculum be adhered to, the question is continually under surveillance and discussion by forestry educators. Professor Spaulding, who feels that the curriculum should be lengthened, is at the present time conducting an analysis of forestry school curricula in the United States, and on the basis of this study hopes to outline a five-year curriculum in forestry. (40) It is difficult to forecast the outcome of these proposed alterations, but it is

quite probable that the future may bring some changes. If, on the contrary, forestry parallels the course of the engineering profession (where similar proposals have also been made), perhaps the four-year curriculum will remain.

The forestry schools of the United States have recently passed through a crucial stage in their history; facilities, finances, faculties and curricula have been severely taxed in the effort to provide all applicants with the training they desire. As has been indicated, the peak of the boom has been reached, and a contraction in enrollment has already set in. Under these newer and more favorable conditions, the schools have an excellent opportunity to improve the caliber of their training. Class loads will not be so great, the capabilities of instructors will, if anything, improve and the augmented funds of recent years, if maintained at present levels, will all constitute powerful aids to progress in forestry education.

And so, with all these points uniting to strengthen their position, the chain of forestry schools throughout the country will have an excellent opportunity to produce better trained foresters for the future and, in so doing, to strengthen the profession of forestry in the United States. The responsibilities of teaching have always rested consciously upon the shoulders of most forestry educators; now, however, with increased tools to work with, these men have it within their power to discharge these responsibilities in an even more creditable manner than in the past. The future should bring promising results in the field of forestry education.

APPENDIX

TABLE XII. DATES OF ESTABLISHMENT AND LOCATION OF UNITED STATES FORESTRY SCHOOLS--1939.

School	Date	Location
1. California	1914	Berkeley, Calif.
2. Colorado State	1911	Fort Collins, Colo.
3. Connecticut	1923	Storrs, Conn.
4. Duke*	1932	Durham, N. C.
5. Florida	1937	Gainesville, Fla.
6. Georgia	1906	Athens, Georgia
7. Harvard*	1904	Petersham, Mass.
8. Idaho	1909	Moscow, Idaho
9. Iowa	1912	Ames, Iowa
10. Louisiana	1925	University, La.
11. Maine	1903	Orono, Maine
12. Michigan State	1903	E. Lansing, Mich.
13. Michigan Univ.	1903	Ann Arbor, Mich.
14. Minnesota	1900	St. Paul, Minn.
15. Montana	1914	Missoula, Mont.
16. New Hampshire	1911	Durham, N.H.
17. New York	1911	Syracuse, N.Y.
18. North Carolina	1929	Raleigh, N.C.
19. Oregon State	1910	Corvallis, Oregon
20. Pennsylvania	1906	State College, Penn.
21. Purdue	1926	Lafayette, Indiana
22. Utah	1927	Logan, Utah
23. Washington State**	1907	Pullman, Wash.
24. Washington Univ.	1907	Seattle, Wash.
25. West Virginia	1935	Morgantown, West Va.
26. Yale*	1900	New Haven, Conn.

* Graduate schools only.

** Offers only 3 years of professional training for which a "certificate" is granted.

TABLE XIII. NUMBER OF DEGREES GRANTED FOR COMPLETION OF STUDIES AT SCHOOLS OF FORESTRY IN THE UNITED STATES FOR THE CALENDAR YEARS 1900-1938*

Year	Undergraduate degrees	Master's degrees
1900	1	--
1901	5	--
1902	2	9
1903	3	14
1904	9	29
1905	9	34
1906	24	24
1907	19	27
1908	31	35
1909	47	44
1910	61	48
1911	100	61
1912	122	54
1913	136	37
1914	151	42
1915	124	35
1916	151	36
1917	160	27
1918	65	10
1919	53	6
1920	160	25
1921	126	26
1922	141	44
1923	217	31
1924	215	43
1925	280	44
1926	259	58
1927	263	50

*Guise, C.H. 1939. Statistics from schools of forestry for 1938: degrees granted and enrollments. Jour. For. 37:197-202.

TABLE XIII. (Continued)

Year	Undergraduate Degrees	Master's degrees
1928	302	64
1929	291	54
1930	308	69
1931	394	97
1932	380	78
1933	355	65
1934	337	47
1935	423	58
1936	502	67
1937	803	75
1938	969	93

TABLE XIV. ENROLLMENTS IN SCHOOLS OF FORESTRY IN THE UNITED STATES - FIRST TERM 1938-39*

School		Undergraduate enrollment	Graduate enrollment
1.	California	273	28
2.	Colorado	271	--
3.	Connecticut	16	1
4.	Duke	--	23
5.	Florida	29	--
6.	Georgia	173	--
7.	Harvard	--	4
8.	Idaho	331	14
9.	Iowa	275	9
10.	Louisiana	122	1
11.	Maine	175	5
12.	Michigan State	247	5
13.	Michigan University	140	46
14.	Minnesota	373	14
15.	Montana	265	--
16.	New Hampshire	63	--
17.	New York	461	37
18.	North Carolina	171	8
19.	Oregon State	431	11
20.	Pennsylvania	393	--
21.	Purdue	130	--
22.	Utah	247	8
23.	Washington State	138	--
24.	Washington University	335	19
25.	West Virginia	85	--
26.	Yale	--	60

*Guise, C.H. 1939. Statistics from schools of forestry for 1938; degrees granted and enrollments. Jour. For. 37:197-202.

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