Confidential

FORESTRY AT HARVARD

1944

HARVARD FOREST
HARVARD UNIVERSITY
Petersham, Massachusetts

FORESTRY AT HARVARD

1944

FOREWORD

The following report, FORESTRY AT HARVARD, is an outline of a proposed new policy and course of action to be followed after the war in the further development of the Harvard Forest, the center of instruction and research in forestry in Harvard University. The history of forestry at Harvard and its present status are briefly summarized to provide the basis for such a program.

The thirty-six years which have elapsed since the Harvard Forest was acquired by the University have witnessed a tremendous growth in forestry and related fields having to do with the use of land. Moreover, there is every indication that the postwar years will witness an even faster growth. Clearly, the time for advancement in forestry in America is at hand, and the Harvard Forest has an unexcelled opportunity to play a leading part in it.

This plan for a revised and expanded postwar program for forestry at Harvard was developed by the staff of the Harvard Forest. It is sent you with a request for your suggestions for its improvement and your support in bringing about its final adoption and implementation. Your advice and help will be very greatly appreciated.

Faithfully yours,

A. C. CLINE

Director

FORESTRY AT HARVARD

1944

Introduction

A specific policy towards research and instruction in forestry at Harvard University is needed if continued progress is to be made in this field. The Harvard Forest represents in itself nearly forty years of accumulated long-term research as well as an investment of many hundred thousand dollars of capital. Other organizations within the University, such as the Arnold Arboretum, the Bussey Institution, and the Maria Moors Cabot Foundation for Botanical Research, also have a strong interest in the study of woody plants. Looking towards the postwar development of the University, the faculty should reappraise the status of forestry at Harvard with a view to recognizing its growing importance in the modern world and making it an integral part of the over-all program of the University. In the educational field alone, the prospective influx of students released from the armed forces makes it essential for the University to revise its forestry teaching program in order to do the most for the greatest number without interfering with essential long-term activities.

The present report is designed to summarize briefly the history of forestry at Harvard, to point out the value of continued research and instruction in this field, and to suggest a program by which the facilities of the University can be efficiently utilized.

HISTORY

Interest in forest trees on the part of Harvard University goes back to the early part of the nineteenth century; but not until the establishment of the Arnold Arboretum in 1872 was any part of the University dedicated to their study. Formal instruction in forestry began in 1903, only three years after the establishment of the first forestry schools in this country, at Yale and Cornell. Until 1907 the work was a part of the curriculum of the Lawrence Scientific School, and was offered to increasing numbers of students by R. T. Fisher and two or three other instructors. In 1907, coincident with the transfer of forestry to the newly established Graduate School of Applied Science, the Harvard Forest was acquired and put into use as a field laboratory. Fisher became its first director. From 1903 to 1914, forestry instruction was offered to liberal arts students and consisted of two years of intensive work leading to a bachelor's or a master's degree. The degree of Master in Forestry was first conferred in 1907.

During this period, the Forest was developed chiefly as a field laboratory and demonstration tract for seasonal use, the center of instruction remaining at Cambridge. In addition, it was hoped that the Forest might demonstrate in successful operation various phases of forest culture and afford a regular yield of forest products without depletion of the forest capital. Research was carried on, but it was largely incidental to the pioneer educational and demonstrational activities.

A short-lived School of Forestry, established in 1912, was closed in 1914 and the staff transferred to the Bussey Institution. This shift marked the end of general education in forestry on the

part of Harvard University and the beginning of more intensified use of the Harvard Forest, particularly for research. The staff was reduced in size, and instruction was offered only in specialized fields to students already possessing an undergraduate degree in forestry. The latter limitation permitted earning the degree of Master in Forestry after one year of specialized study. Registration of students dropped off sharply after 1914; classes for the next eight years averaged not more than three students. With emphasis now placed upon research and the research project method of instruction, a number of scientific articles appeared and the Harvard Forest Bulletin series was started. During this period, which included the First World War, Fisher developed to a high degree the philosophy of basing forest practices on the study of natural forces. In particular, the white pine--mixed hardwood succession was intensively studied, and the findings applied to the actual management of the Harvard Forest.

In 1923, instruction in forestry was completely transferred to Petersham, students thereafter spending the entire academic year living and working in the Forest. At the same time the size of the classes was increased, largely by graduates of the New York State College of Forestry, induced to study under Fisher by A. C. Cline, who had become a member of the Forest staff. During the next ten years, research was stepped up to a higher level. By 1934 the Harvard Forest had acquired an international reputation as the oldest intensively managed demonstration forest in North America and as a center of research in silviculture.

The death of R. T. Fisher in 1934 robbed forestry at Harvard not only of its leading spirit, but also of much financial support. Ward Shepard, '13, was made director, and he undertook the difficult

task of raising money in a period of economic depression. His efforts were further complicated by the hurricane of 1938, which blew down practically all of the merchantable timber, a resource which had contributed substantially to the maintenance of the organization. Furthermore, the value of the Harvard Forest as a demonstration of sustained yield management was greatly impaired by this destruction. As the use of the Forest for this purpose had long been in conflict with its use for experimentation, the decision was made in 1939, at which time A. C. Cline became director, to develop the Forest as a field laboratory and research station, and to give up the demonstration of forestry as a business enterprise. Renewed emphasis was placed upon the study of natural forces in the forest and their application to the management of local stands. In 1941, the completion of modern buildings at Petersham and the installation of the Harvard Forest models in the Fisher Museum, both made possible through the generosity of a friend of the Forest, opened the way for a considerable expansion of activities, particularly in the line of increasing student enrollment. Subsequent war conditions, however, have prevented material progress in this direction.

PRESENT POSITION

In 1944, the position of the Harvard Forest is strong in certain aspects and weak in others. A consideration of these factors is essential in the planning of a sound program for the institution.

Strengths

A. As a part of Harvard University. In this simple fact lies the greatest strength of the Harvard Forest. As a part of a great educational institution, the staff has unsurpassed opportunities for cooperating with highly competent specialists in allied fields

and in using excellent library and laboratory facilities.

B. As the oldest intensively managed forest area in North America, the Harvard Forest has educational and demonstrational values unobtainable elsewhere. Painstaking records, with photographs, of stand conditions and silvicultural operations have been maintained year after year for thirty-seven years. Forestry research necessarily consists largely of long-term projects, because of the scores of years required by each generation of trees to reach maturity. A great amount of needed information can be obtained only by examining each stand carefully over a long period of years. The Harvard Forest is the area best suited for this in North America, as its records go back the farthest and are the most comprehensive of any experimental forest.

C. The location of the Forest is fortunate. Only 70 miles from Boston, it is situated in the transition zone between two major forest regions. The wide range of local topographic and soil conditions makes the area unusually varied in forest composition and growth, a condition highly desirable for research and instructional purposes.

D. The physical plant of the Harvard Forest is unusually complete. The modern buildings contain offices, living quarters, library, laboratories, and the collection of Harvard Forest models. The library of some 9,000 volumes is one of the finest on the subject of forestry in this country, having been more than doubled by the recent transfer of European periodicals and texts from the Arnold Arboretum. The collection of twenty-three dioramas, housed in the specially built Fisher Museum, constitutes one of the major tourist sights in the University. They are equally valuable for

scientific demonstration and student instruction. At Petersham the student and the investigator may live and work in modern quarters within the surrounding forest. This close contact with the outdoors is highly essential in advanced forestry instruction and research.

E. The Harvard Forest has, in the past, achieved an international reputation as an institution for advanced study and research.

Weaknesses

A. Separation from the rest of the University. Although nominally a part of Harvard, the Forest is practically an independent institution, independently financed. The staff of the Forest do not really function as members of the Faculty of Arts and Sciences. Such cooperation as has been developed in recent years with other departments of the University has been largely informal in nature.

B. Lack of funds. The assets of the Harvard Forest are largely frozen in the form of land, buildings, and equipment. Income from endowment is sufficient to maintain the Forest and its buildings, but it is not sufficient to maintain adequately more than one member of the faculty. The University makes no direct contribution to the maintenance of the Forest, though it has on several occasions written off small deficits. Only the yearly contributions of a number of generous friends have made possible the continued existence of the Harvard Forest.

C. As a result of small financial resources, there is little faculty stability. Most of the staff work for salaries lower than those paid by most state universities, and with little hope of normal advancement in rank and salary. No staff member has even attained a higher academic rank than assistant professor. Promising

staff members are induced, therefore, to seek opportunities elsewhere. Under such conditions, it has been impossible to keep a high-grade staff at the Harvard Forest. The prestige of the institution has consequently suffered.

D. The lack of a specific University policy towards forestry and the Harvard Forest is one of the underlying causes of its present weak condition. Without a long-range constructive program supported by the University, efficient use cannot be made of the strengths of the Forest; nor can its weaknesses be reduced or eliminated. An indefinite continuation of the status quo will result in further loss of prestige and academic position, both by the Harvard Forest and by Harvard University.

A PROGRAM FOR THE FUTURE

The future of the Harvard Forest is dependent upon (1) the development of a sound long-term program in forest research and education; (2) the gathering of a high-grade staff, small in size, but with normal opportunities for advancement in rank and salary; and (3) the integration of this program with that of other divisions of the University to the end that the Harvard Forest functions not as an independent research station but as an integral part of Harvard University.

In order to determine the position of the Harvard Forest in American forestry, it is necessary to look at other agencies engaged in forest research and education. Research in the applied phases of forestry is being carried out on a broad scale by federal forest experiment stations, state agricultural experiment stations, and other public agencies. The policy of Harvard University should avoid as far as possible fields of research for which adequate public funds

are available, particularly where those fields are of a highly applied nature. Specifically, the Harvard Forest should not conduct research in forest protection, wood utilization, forest influences, logging and marketing, forest surveys, and forest regulation, except in cooperation with public agencies. On the other extreme, fundamental research in botany and the other natural sciences is adequately covered by our colleges, universities, and independent research stations. The Harvard Forest should not encroach upon these basic fields. Rather, the research program of the Forest should be designed to bridge the gap between applied forestry on the one hand and basic scientific knowledge on the other. It is in this intermediate field that the Harvard Forest has gained the greatest prestige; it is this field which is not adequately covered by existing research agencies; and it is in this field that the greatest possibilities for future progress lie.

In education, too, publicly supported forest schools adequately cover professional forestry in its applied aspects. The Harvard Forest should not compete in this field, but should instead turn out men well schooled in the basic sciences and their application to problems in the forest. Such men would be fitted to compete on favorable terms with the graduates of other forestry schools as teachers, scientists, practical silviculturists, and forest administrators. No other school exists in this country today where the student can learn forestry, not as a separate applied science, but as the end product of an integrated study of basic sciences and their application to forest trees.

In both forest education and forest research, then, the Harvard Forest can do an important job that is not being adequately done

elsewhere. In both fields, the Harvard Forest can bridge the gap between the fundamental research activities of our colleges and universities on the one hand, and the intensely practical activities of our publicly supported forest schools and research agencies on the other. There is a real need for this service in American forestry today.

A RESEARCH PROGRAM

Harvard University must therefore interest itself in two general lines of forest research: (1) the extension of fundamental investigations in botany and allied sciences to cover forest trees and forest communities, and (2) the application of this accumulated knowledge to the management of forests.

Fundamental biological investigations in forestry may be divided into the general fields of forest genetics, tree physiology, and forest ecology. Work in the genetics and physiology of forest trees falls within the domain of the Maria Moors Cabot Foundation for Botanical Research. While certain laboratory, greenhouse, and nursery aspects of the work of the Cabot Foundation can best be carried out in Cambridge or Jamaica Plain, the Harvard Forest is the logical locale for investigations involving field trials and the study of trees <u>in situ</u>. Studies of this nature already under way at Petersham include: (1) the experimental propagation of cuttings from forest trees of various species; (2) trials of rooted cuttings on cut-over forest lands; and (3) investigations on the relation of seed origin and other seed characteristics to the growth of resulting seedlings.

The Harvard Forest is too small an institution to support two independent or even semi-independent organizations within the same

quarters without undue loss of efficiency, excessive overhead, and difficulties of personnel relations. Therefore, all men working primarily for other divisions of the University (such as the Cabot Foundation) but stationed at the Harvard Forest, should function as staff members of the Forest, receive part of their compensation from Harvard Forest funds, and be responsible in part to its Director. Such men should carry on a research program which is integrated with the over-all programs of the Harvard Forest and that division of the University for which they primarily work.

While work in forest tree genetics and physiology can best be carried on at the Harvard Forest by the Cabot Foundation and other botanical research organizations already in existence, research in forest ecology should be carried out by the Harvard Forest itself. The long history of the Forest, the varied ecological conditions to be found within it, and the modern laboratories and other facilities located within the Forest itself, make it ideally suited for such research. Investigations now under way in this field include: (1) the relation of topography and soil type to forest composition and growth; (2) factors influencing the natural restocking of trees on hurricane blowdowns; and (3) local climatic variation and its relation to forest type distribution. Studies of this kind should be continued and enlarged as time and funds permit.

Coincident with the accumulation of knowledge in the sciences fundamental to forestry must go the application of such knowledge to the management of forest stands. Work of this type falls largely within the general field of silviculture, which may be defined as the theory and practice of controlling forest establishment, composition, and growth. The Harvard Forest is preeminently suited for work in this field. The several hundred managed stands with care-

fully documented histories form a backlog of accumulated knowledge unobtainable anywhere else in America. Although the 1938 hurricane destroyed most of the older stands of timber, it did but little damage to the younger stands which have been under management and observation since their inception. The accumulated experience in silviculture has been summarized in a series of case histories which are being prepared for publication. Current silvicultural research stresses the application of recent ecological investigations to weeding operations, improvement cuttings, thinnings, and other cultural practices.

Of particular interest in the general field of silvicultural research have been the cooperative studies undertaken with entomologists and pathologists of the United States Department of Agriculture. In these investigations, forest pests are being studied at Petersham with a view to controlling them by taking advantage of the natural forces operative within the forest. This cooperation between Harvard silviculturists and Federal entomologists and pathologists has proved mutually advantageous. Particular emphasis has been placed on the silvicultural control of the gypsy moth, the white pine weevil, the tent caterpillar, and decay hazards in hardwood sprout stands. Such work should be continued and amplified. Similar cooperative work might well be developed between Harvard University and the forest experiment stations of the United States Forest Service.

In order to operate the Harvard Forest efficiently, the staff must interest itself in such practical professional subjects as forest management, forest fire protection, forest mensuration, the extraction of forest products, and wood utilization. Research in these fields, however, should be left largely to public and other research agencies. The University should, however, rather, apply

the research of these agencies to the forest lands under its management. This is not only good business, but also is highly desirable for demonstrational and educational purposes.

The above discussion deals primarily with research in the biological aspects of forestry. Equally important are economic considerations. The Harvard Forest, however, cannot cover both broad fields adequately, because of its limited resources. It should be preeminent in one rather than mediocre in both. A consideration of the natural strengths and facilities of the institution shows the importance of concentrating on the biological aspects of forestry.

There is, however, an excellent opportunity for research and graduate instruction in forest economics in cooperation with the Department of Economics of the University and the Graduate School of Public Administration. In such cooperative research, the Harvard Forest should provide research facilities and advice on the biological aspects of forestry, rather than undertake projects with its own staff. Investigations of this nature have already been successfully carried out in such fields as (1) the land-use history of the Harvard Forest; (2) a plan of land use for Worcester County, Massachusetts; and (3) the economic possibilities of farm forestry and forest farming in central New England.

Inherent in the very nature of forest research is the long-term character of most of the investigations. As a single rotation of forest crops requires from 40 to 100 years, many years are needed for the satisfactory solution of a vast majority of problems. Consequently, forestry research can be efficiently undertaken only by a relatively stable staff working on a long-term research program which is institutional, rather than individual, in nature. As a research worker can seldom hope to round out his investigations in forestry

within his lifetime, special care must be taken in the development of a long-term program to insure the continuity of research and an efficient record system to enable each new man to take up where his predecessor left off. Fortunately, thus far there has been a most exceptional continuity of projects and records at the Harvard Forest.

The pursuance of a long-term research program, however, should never prevent periodic productivity or excuse the lack of it. The dissemination of knowledge, whether through writing, speaking, or teaching, is the only justification for research. Men engaged in forestry research are not freed from this responsibility because of the long-term nature of much of their work. Rather, they must pay particular attention to the periodic production of completed research. Opportunities for this are ample.

A privately endowed institution is always in a much stronger position to prosecute research than are tax-supported or business-supported ventures. Such an organization can benefit others by publishing conclusions drawn from its own mistakes. Public and industrial agencies cannot do this. An endowed institution can also study freely and without prejudice problems which other institutions cannot undertake. The Harvard Forest, being unique in its comparative independence from both government and industry, can make important contributions to American forestry.

Outside the field of forestry, the Harvard Forest can and should serve as a general field research station for the entire University. Here botanists, zoologists, geologists, and other research workers can find varied field conditions within easy reach of modern living and working quarters. The Forest might very well become an "inland Woods Hole" for scientists of a wide variety of interests.

AN EDUCATIONAL PROGRAM

The educational responsibility of the Harvard Forest has three major aspects: (1) training graduate foresters in the specialized fields of silviculture and forest management; (2) training teachers and research workers in forestry; and (3) teaching the principles and problems of forest conservation to interested persons who plan careers in other fields. In the past, emphasis has been placed upon the first of these aspects; but the other two must also be developed if the maximum value is to be derived from the forestry program at Harvard. A curriculum can be organized to carry out this program without requiring any marked expansion in the size of the prewar staff.

Professional Training

Since 1914, the educational policy of the Harvard Forest has been based upon one year of intensive graduate work in forestry offered to graduates of professional forest schools and leading to the degree of Master in Forestry. Under this program, about eighty professional foresters have been given postgraduate instruction. These men have had the opportunity to develop a high degree of technical ability, and many of them have attained positions of prominence. Student enrollment until 1941 was held down by limitations of accommodations and staff, comparatively small scholarships, and a restricted curriculum. Since then, war conditions have prevented an increase in enrollment.

This educational program, though sound, has been subject to distinct limitations. In particular, the program has been too general to afford prospective students a clear idea of the possibilities of work at Harvard and the course of study they would follow. The solution of this difficulty lies in the establishment of a specific

course program designed to cover the same general material as at present in a better organized fashion. Instead of taking four courses in Biology 120 (Forest practice and research) as in the past, the average student should take courses in silviculture, forest ecology, tree physiology, forest genetics, forest management, the extraction of forest products, and utilization. These should be listed under the Department of Biology in a separate subsection entitled "Forestry". A synopsis of the subject matter of these courses follows:

Silviculture. Full course. The first half may be taken as a half-course. Theory and practice of controlling forest establishment, composition, and growth by cultural treatments. Forest protection. Case histories of individual stands in the Harvard Forest. Applied silviculture in temperate North America.

Forest ecology. Full course. The first half may be taken as a half-course. The relationship of trees to climate, soil, topography, and other environmental factors. Structure of forest stands. Forest succession. Elements of biometry.

Tree physiology. Half-course (spring term). General principles of nutrition, water relations, and growth processes with particular reference to forest trees.

Forest genetics. Half-course (fall term). Principles of heredity, variation, and breeding among related organisms with particular reference to forest trees.

Forest management. Half-course (spring term). The application of economics and biology to the operation of a forest property. Forest mensuration.

Logging and utilization. Half-course (fall term). Methods of extracting forest products. Demands and needs of wood-using industries.

This integrated program would give the graduate forester a basic understanding of silviculture, and advanced training of a highly beneficial nature for professional practice. Students who have already had sufficient advanced training in any field would substitute one or more courses in Biology 20, Research in forestry.

Scientific Training

A basic objection to the professional curriculum outlined above is that graduates of forest schools, by the very nature of their training, are generally lacking in the essentials of a liberal education. Too often they are deficient not in technical forestry, but in English composition and speech, in chemistry, in biology, and in the basic knowledge necessary for an understanding of any applied field. In the professional forestry course outlined above, Harvard can help to overcome these difficulties by demonstrating the dependence of forestry on fundamentals, and by showing how this dependence can be utilized profitably by the practicing forester.

There remains a definite need, however, for interesting the better grounded graduates of liberal arts colleges, often men of superior caliber, in forestry. Such students cannot come to Harvard at present for a complete professional training in the practice of forestry leading to the degree of Master in Forestry, as can be obtained at Yale or Duke, but they can come for a broad liberal training in the theory of forestry leading to the degrees of Master of Arts and Doctor of Philosophy. Although such a program has long been available at Harvard, it has never been developed or emphasized. A curriculum of this type should prepare students not only for teaching and research in certain phases of forestry, but it should also aid men planning to enter wood-using industries or any other field in which a general knowledge of forestry would be useful. As no other institution offers such training, and as no other institution has equal facilities for offering such training, this program should be strongly emphasized at Harvard.

Present University organization hinders the development of such a forestry program, in that students studying for the degrees of Master of Arts or Doctor of Philosophy must register with the Department of Biology and meet the requirements of that department. These requirements are not well adapted to graduate work in the very distinct and broad field of forestry. Many students have avoided graduate work in forestry because of the difficulty of planning a satisfactory Ph.D. program.

To meet these objections, a Standing Committee of the Faculty of Arts and Sciences should be established to set up and administer degree programs in forestry. This committee might well include all corporation appointees on the Harvard Forest staff and representatives of the Departments of Biology, Economics, and Geography.

The six courses proposed for the Harvard Forest would be entirely suitable for Master of Arts and Doctor of Philosophy candidates, as well as for Master in Forestry students. Furthermore, research courses might well be taken at Petersham, the Harvard Forest being an ideal locale for investigative projects of a wide variety. In general, candidates for the degree of Master of Arts would probably spend at least one term at the Harvard Forest, and Ph.D. candidates at least two.

The committee on degree programs could profitably draw up a list of courses given throughout the University that are of particular interest to forestry students. With this as a guide, the prospective student could more easily grasp the ramifications of forestry; he would know exactly what allied courses would be recognized as being acceptable for credit towards a forestry degree; and he would therefore be better fitted to plan his course of study. Based on the present catalogue, this list might include the

following courses:

Biology

11a	The principles of genetics (Mangelsdorf and Sax)
16	Outlines of economic botany (Mangelsdorf)
17b	Identification and distribution of flowering plants: Dicotyledons (Fernald)
18	Phylogeny and classification of the flowering plants (Johnston)
19	Problems and methods in the study of vegetation (Raup)
27	Biology of insects (Brues and Carpenter)
32	Plant physiology (Thimann)
111	Biometry (Reed)
118	Comparative morphology and development of vascular plants (Bailey and Wetmore)

Economics

171	Economics of agriculture (Black)
179	Seminar in agricultural, forestry, and land policy (Black)

Geology and Geography

4a	Principles of geomorphology (Bryan)
11b	Regional climatology (Kohn)
13b	Natural resources and problems of conservation (Ackerman)
36a	Aerophotography and aerosurveying (Bagley)

The establishment of specific degree programs in forestry, coupled with the availability of six specific courses in forestry at the Harvard Forest, should go far toward attracting students to the scientific course in forestry at Harvard.

The number of graduate students that can be comfortably housed in Petersham is between ten and twenty, depending upon the number who can secure accommodations outside Shaler Hall and the remodeling of the old school building.

General Education

It would be a mistake to teach forestry only to those making it a career. Many young men interested in the outdoors would like to know more about forest conservation. Furthermore, educated men everywhere are at least mildly interested in forestry as a distinct

and important phase of human endeavor. Harvard University, therefore, should offer to its undergraduated an introductory course in forestry. This could best be given during the summer term at the Harvard Forest. There, undergraduates could carry on college work throughout the summer and yet spend a great deal of time outdoors in an attractive part of New England. Incidentally, this work would serve as an exploratory course for those considering a career in forestry. Every consideration, including the success of the Squam Lake Engineering Camp, emphasizes the fact that a summer course in forestry, offered to undergraduates at the Harvard Forest, would be highly popular and worthwhile. This program could be handled by the resident staff, which is relatively free from graduate students during the summer term.

The number of students that could be taken care of would be limited by the living accommodations available to about twenty.

A DEMONSTRATIONAL PROGRAM

In addition to its activities as a center of research and instruction in forestry, the Harvard Forest plays an important role in public education. Thousands of people visit the Forest, singly and in organized groups, to see the results of long intensive management and to learn forestry first hand. Particular emphasis has been placed on attracting professional and scientific groups to Petersham.

The Fisher Museum, containing the Harvard Forest models, is a major public attraction that is seen by additional thousands. These dioramas present in three-dimensional miniature a coherent summary of the forests and forestry of central New England.

The demonstrational activities of the Harvard Forest have been highly successful in the past and should be continued. Through them the Forest can perform a service in public education unsurpassed by other divisions of the University.

STAFF CONSIDERATIONS

Any marked expansion of the staff of the Harvard Forest at present is out of the question because of financial considerations. The program of Harvard University in forestry, therefore, must be carried out by a staff of approximately the same size as before the war. This can be done. The program proposed above requires the services of a minimum of four men stationed at the Harvard Forest. These include: (1) A director and lecturer in silviculture; (2) an ecologist; (3) a superintendent of the Forest and lecturer in the extraction of forest products and utilization; and (4) a tree physiologist. For full operation of the proposed program, two additional men are needed, one each in silviculture and in forest genetics. A group of this size and composition can teach the courses suggested above, carry out the necessary administrative work, and still have sufficient time for research.

Although the University should not attempt to increase unduly the size of its forestry staff, it should make every effort to develop a high-grade staff. To attract graduate students, teachers of unquestioned ability are needed. The gathering of a small but competent staff should be the primary concern of the University in the field of forestry.

As long as Harvard University has no policy toward academic promotion at the Harvard Forest, it will have great difficulty in gathering a satisfactory staff. Good men will not accept positions

at Petersham unless they have normal opportunities for advancement in academic rank and salary. Without a policy guaranteeing such advancement, the Harvard Forest must rely upon young men interested in acquiring experience and a reputation. The better of these will soon move on to better positions, leaving the inferior men to burden the payrolls and the program of the University.

FINANCIAL CONSIDERATIONS

The key to these problems, of course, lies in the financial stability of the Harvard Forest. Present endowment yields less than $14,000 per year. Ordinarily, revenue from the sale of wood products, from room rent, and from gifts, will amount to an additional $9,000 per year. This total income of $23,000, however, is barely sufficient to cover the overhead of the institution and the salary of the Director. To maintain a staff of five men at Petersham with normal chances for advancement will cost about $8,000 per man including overhead, or $40,000 per year. To guarantee this income, the endowment of the Harvard Forest must be increased from the present amount of $370,000 to about $750,000. Under present University policy, this money must eventually be raised by the Harvard Forest itself. To do so, however, will be difficult as long as the University takes little official interest in the state of affairs at Petersham, and as long as the academic position of the institution is weak. There is every possibility, though, that considerable sums can be raised once a constructive program has been put into practice and once the activities of the Harvard Forest have become academically important. This fact is evidenced by the results already obtained from the Friends of the Harvard Forest, an organization started in 1940.

During the few years of its existence, about $7,000 has been contributed to the Forest by 155 persons.

The process of increasing endowment is a slow one that will take many years. In the meantime, a sound forestry program must be built upon funds already available plus such sums as can be raised quickly. In this connection, close collaboration between the Harvard Forest and the Maria Moors Cabot Foundation for Botanical Research will prove mutually beneficial. The Cabot Foundation was established in 1937 with a view to increasing the rapidity of cellulose production through research in tree and plant breeding. The aims of the Cabot Foundation, then, closely parallel those of the Harvard Forest. Furthermore, much of the work of the Foundation can best be carried on at Petersham. It thus seems quite proper for the Cabot Foundation to maintain a geneticist and a physiologist at the Harvard Forest to work on problems of common interest to both institutions. These men might well spend part of the year in Petersham and part in Cambridge or Jamaica Plain if their programs so warrant. While at Petersham, they would function as members of the Harvard Forest staff and teach the courses in forest genetics and tree physiology outlined above. In return for these services, they should receive a portion of their salaries from Harvard Forest funds.

The only apparent source of funds not being tapped at the present time is Harvard University itself. No direct financial support now reaches the Harvard Forest from this source. Not even tuition charges for instruction in forestry are available to the Harvard Forest. Instead, such funds go into the general income of the University. It seems only proper that the University should recognize a financial responsibility, at least to the extent of refunding an amount equivalent to tuition payments made by forestry students.

The University can adopt a helpful policy in regard to building up its forestry program with little expense to itself by bringing present funds into better relation to existing facilities. If the programs of the Cabot Foundation and the Harvard Forest are integrated to a greater extent than at present, and if general funds of the University are made available to the Harvard Forest to an amount equivalent to tuition charges paid by forestry students, there is reason to believe that the forestry program at Harvard can eventually be developed to a point where, through additional endowment, it is financially stable and self-sufficient.