

A Report
to the
Friends of the Harvard Forest

on

Wartime Activities and Accomplishments
of the Harvard Forest



Harvard University
Harvard Forest

Petersham, Massachusetts

March 1, 1945

Policy

The activities of the Harvard Forest since December 7, 1941, have been dictated largely by the needs of the war. Soon after Pearl Harbor, the decision was made not to accept students during the emergency, thus permitting the staff to devote a large part of its effort to activities directly or indirectly connected with national defense. Those men remaining at Petersham undertook special research related to war needs, at the same time carrying on the long-range experimental studies begun in the past; while those on leave of absence devoted full time to war work or military duties.

Staff

Albert C. Cline, the Director, has been with the Government in Washington since early 1942, first with the Lumber Branch of the Office of Price Administration, and now with the Lumber Products Division of the War Production Board. He is Chief of the Program Branch of the Division, which deals with the lumber control plan, and is particularly occupied at present with the lumber required for rehabilitation purposes in England and the liberated countries. At the same time, he has been able to keep in touch with the work of the Forest and to advise in its direction. Russell J. Lutz, Assistant to the Director, is now a Captain in the U. S. Marine Corps in command of a Pioneer Company in action in the Philippines. The work at the Harvard Forest for the past two years has been under the immediate direction of Stephen H. Spurr. Others who have contributed to the wartime accomplishments at Petersham include P. R. Gast, Karl A. Grossenbacher, James Vlamis, and C. Thornton Brown, Jr.

Keeping Up to Date

All of the "continuing" research projects in the Harvard Forest have been maintained. A number of these were begun from 25 to 35 years ago. More than thirty experimental stands have been given required silvicultural treatment, and over one hundred others under long-time observation have been remeasured according to plan. The record system of the Forest, which goes back to 1908 and is considered to be the most complete and detailed of its kind in this country, has been reorganized and brought up to date for the first time since the destructive hurricane of 1938.

The Library

The Harvard Forest library has been greatly augmented by deposits of periodicals and books on forestry and related subjects from the Arnold Arboretum, and is now one of the finest forestry libraries in the country, particularly in the field of European literature. Under the direction of Miss Elizabeth Carpenter, the card catalogue is being brought up to date and the recent acquisitions reclassified. The absence of students and the assistance of a member of the Widener Library staff have permitted making considerable progress in cataloging.

Camouflage Research

The Harvard Camouflage Committee, an interdepartmental organization consisting of members of the staff of the Maria Moors Cabot Foundation for Botanical Research, the Harvard Forest, the Arnold Arboretum, and the Biological Laboratories, has served the armed forces in an unofficial capacity. Much of its work was carried on at the Harvard Forest and financed by the Cabot Foundation. The results of its extensive research on the lasting properties of cut foliage have been incorporated in two illustrated reports which have been distributed to camouflage officers throughout the armed forces. The section in the official Army camouflage manual on the use of cut foliage is based in its entirety upon the research of this committee. Technical aspects of this research are being published in an article by Dr. Grossenbacher, Mr. Spurr, and Dr. Vlamis.

Forest Aerial Photography

The interpretation of forest conditions from aerial photographs is important both in military reconnaissance and in postwar forestry. The Harvard Forest is the first research organization in the country to undertake an intensive investigation of forest aerial photography. Through the cooperation of the Fairchild Aerial Surveys, Inc., the Forest has been photographed from the air at different altitudes and with different types of film. The possibilities of color and infra-red film, in particular, are being investigated. Two papers dealing with phases of this investigation have already been prepared. Among other things, this study has demonstrated that tree heights can be measured nearly as accurately from aerial photographs as from the ground.

Other Research

In addition to war projects, members of the staff have found time to complete a number of experimental studies and to publish their findings. Among these are articles dealing with such subjects as the use of lumber in the war, the importance of seed weight in determining growth of white pine seedlings, and a technique for propagating promising new strains of forest trees by rooting cut twigs in full sunlight.

Cooperative relations between the Harvard Forest and the Bureau of Entomology and Plant Quarantine, Bureau of Plant Industry, and the Forest Service of the U. S. Department of Agriculture, have been continued. Ten years of joint research on the gypsy moth have gone far to demonstrate that the insect can be controlled by forest practices. Other insects that have been studied include the white pine weevil, the spruce budworm, and the tent caterpillar.

These investigations form part of an integrated research program begun under the guidance of Richard T. Fisher, and based upon the philosophy of working in harmony with natural forces.

Visitors and Field Days

Despite the war, the Forest has continued to attract many visitors, both laymen and professional workers. Although the opening of the Fisher Museum of Forestry coincided with the advent of gasoline rationing, approximately five thousand people during the past three years have come to see the Harvard Forest models and other exhibits on display there.

Many groups of visitors have been shown the field operations and experimental treatments in the Forest, including scientists from as far afield as Great Britain and New Zealand. The Forest was host to the Massachusetts subsection of the Society of American Foresters in the summer of 1944.

The Friends of the Harvard Forest have held their annual Field Day in the Forest each September without interruption. These occasions have generally been limited to a half day because of wartime conditions, and have stressed the war work of the Forest staff. They have also provided an opportunity for walks through nearby parts of the Forest to see the silvicultural work in progress. The Field Days have been attended by from forty to eighty people each season.

Gifts from Friends

Since the war began, 155 members of the Friends of the Harvard Forest have contributed \$4,931 to the support of the Forest in response to the annual appeals. In addition, there have been special gifts, totalling \$19,500. These contributions have been of the greatest assistance and encouragement in carrying on the wartime work of the Forest and in maintaining the plant and services in good working condition.

Importance of Continued Financial Support

Even the reduced scale of activities at the Harvard Forest during these war years requires more money than is brought in by existing endowments. Sales from forest products cannot provide any substantial part of current income for a number of years to come, inasmuch as the 1938 hurricane destroyed most of the older timber in the Forest. Fortunately, the intensively managed young stands constituting the most important experimental assets of the Forest escaped destruction.

In the postwar period, the staff should be augmented if the unusual facilities of the Harvard Forest are to be fully utilized, and if the Forest is to remain a major center of forestry education and research. This program is perfectly possible—provided the Friends of the Harvard Forest continue their interest and support, and the organization shows the expected increased growth in years to come. The Friends of the Harvard Forest are looked upon as an integral part of the Harvard Forest, a part making possible increased accomplishments by the staff in teaching, research, demonstration and public education in forestry and allied fields.

The Friends of the Harvard Forest

PER ARBORES AD SILVAM

October 27, 1947

To the Friends of the Harvard Forest:

The enclosed is both a report of operations at the Harvard Forest and an appeal for funds to support current work. Prepared by Dr. Hugh M. Raup, the new Director of the Forest, it carries the gist of discussions at the Field Day of the Friends on September 5 and reviews the history and present situation of the institution in a fresh and interesting way. As Dr. Raup indicates, the program he has in mind promises, in time, to be of great practical significance to the towns of central New England. As Sponsors of the Friends of the Harvard Forest, we endorse the appeal and urge all members to give it generous consideration.

Checks may be made payable to Harvard University and sent to the Director of the Harvard Forest at Petersham. Such contributions will be deductible from your taxable income.

Sincerely yours,

THE SPONSORS

Henry James

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Mrs. Richard T. Fisher

John M. Woolsey, Jr.

HARVARD FOREST
HARVARD UNIVERSITY
Petersham, Massachusetts



October 27, 1947

To the Friends of the Harvard Forest:

Four years have elapsed since any formal appeal for funds has been made to the Friends of the Harvard Forest. During the past year -- the first year of my directorship -- I have given much thought to our objectives and to our most serious needs. It now seems proper to make an appeal for funds to meet the particular need which seems to me to overshadow all others.

Before outlining the proposed program for which funds are desired, I should like to make a brief report on developments at the Forest during the past year. For those of you who were present at the Field Day on September 5, this report will not be new.

Woods Operations

Woods operations went on much as they have during the years of the war. We had only three men working, mainly on cordwood for use in heating our own buildings. A few inferior pines were cut and sold as logs. In the late spring and summer, we added two more men to our woods crew, and will go into the current season's cutting operations with five instead of three. Funds for this increase have come from a generous gift made to the Forest last winter. Something of the significance of the enlarged woods work thus made possible will appear in what follows.

Buildings

Last autumn and winter, funds were given us by an anonymous donor for the renovation of the old Forest Headquarters building. The work, now finished, has given us four housekeeping apartments for married students or visiting research workers. The apartments are supplied with basic furniture, electric refrigerators, and stoves. Completely new water and heating systems have been installed, and the house will make comfortable quarters both in summer and winter. The building has now been rechristened "Community House", a name for it that is old in the annals of the town.

Several changes have been made in the "household" at Shaler Hall, the Forest's main building. This building was first occupied in the spring of 1941, but was not used to its full capacity until the past summer. A dining room organization was set up, modeled upon that used by the University in Cambridge. A food storage room had to be constructed in the basement, and more adequate refrigeration supplied. A freezer was acquired in the spring, and a new and larger refrigerator installed in the kitchen.

Those of you who have visited the building in the past may remember that its acoustics left a great deal to be desired. They have been partly corrected by soundproofing the common room, dining room, kitchen, and all the corridors and lavatories. The building is now a much more satisfactory place in which to live and work.

Staff

During the year one additional member has been added to the Forest staff. This is Dr. Scott S. Pauley, who has been appointed Assistant Professor of Forestry for a term of five years beginning July 1, 1947. He is now living with his family in our Highway House, which is across the road from Shaler Hall. Dr. Pauley's appointment is a joint one, arranged between the Harvard Forest and the Cabot Foundation of Harvard. The Cabot Foundation's research work on the development of rapidly growing trees now requires space for the expansion of its test plots. Dr. Pauley will be in charge of the expansion, much of which will be at the Harvard Forest. In addition to this work, Dr. Pauley will introduce experiments on the improvement of growing stock in the Forest, and take a share of the Forest's responsibility for its long term experiments.

Instruction

The instruction of graduate students in forestry is being carried on much as it has been in the past. Our first graduate student after the war appeared in February of this year, and another came in June. Three more have come in September. We are continuing to offer the degree of Master in Forestry, with particular emphasis upon the field in which we are most adequately equipped to give instruction, that of silviculture. Harvard is unique among schools of forestry in having a large acreage of hardwood forest which has been under management for about forty years. The materials and experience available here make our institution the most significant in the country for the training of hardwood silviculturists. Instruction, so far as we can visualize it at present, will always be limited to a small and carefully selected group of students.

During the past summer we introduced an experiment in instruction. Three regular University courses in botany and forestry were offered. Two of these were given by the staff of the Forest, and the third by Dr. I. M. Johnston, who came up from Cambridge for the purpose. There were fifteen students here for the twelve weeks' summer term of the University, and we feel that the experiment was highly successful. Something similar to it will no doubt be continued in succeeding years, varying the courses offered. When the University goes back to a two-term system with summer school, as it will do next year, our offering will be reduced to two courses and will last for only eight weeks. We believe that the experiment of the past summer will have good results, not only in its effects upon individual students, but also upon future relationships between the Harvard Forest and the University in Cambridge. We believe that one of our major problems at the Harvard Forest has been the breaking down of what I have termed "intellectual barriers" that have isolated the students and staff at the Forest from the stimulation that can come from contacts with the University as a whole. On the other side of the scale, we wish to make the Forest useful to those departments of the University, such as Biology, Economics, and Geography, whose fields are most nearly related to our own.

Publications

With regard to publications, we have just seen through the press the first part of the Forest's Thirty-Year Progress Report (Bulletin No. 23), and those of you who did not receive a copy at the Field Day have had one mailed to you. Another bulletin, on the silvicultural aspects of gypsy moth control, is now in press. Further, we have inaugurated a series called the Harvard Forest Papers, which will print shorter articles prepared by the

staff and students. Two of these short Papers are now in press, and a third is on hand in manuscript. A book on the use of aerial photographs in forestry has been prepared by Mr. Spurr and is now in the hands of the publishers.

Review of Policy and Objectives

In outlining the program for which we are in need of funds, I think it would be well for me to explain the background of silvicultural work at the Forest which has led to our present concepts. The Harvard Forest was instituted in 1907 as a station for research in the management of woodlands in this part of the Northeast, and for the demonstration of the results of its research. The Forest began its operations in 1908, when the "white pine period" in the post-agricultural forest development in these parts was at its height. Huge acreages which had formerly been in pasture or cultivation had grown up to nearly pure stands of white pine, which reached commercial maturity during the first twenty years of the present century. At that time forestry in America was very new, as was also the knowledge of natural development in vegetation. It was thought, erroneously, that this part of New England was a natural white pine region; consequently, the first silvicultural experiments at the Harvard Forest were designed to perpetuate the valuable pine, either in pure stands or in hardwood mixtures, by various methods of cutting and planting. Industrial outlets for the pine were ample, and it was hoped that a profitable production could be maintained.

The first twenty years of the Harvard Forest's history clearly demonstrated that white pine, in commercially valuable stands, could not be perpetuated on the relatively good soils of the Forest except at an expense which was not commensurable with the expected returns. This was due to the fact that the white pine was not a permanent type here, but was only the first step in a succession leading to hardwood forests. The story of the negative results obtained in our early experiments is clearly told in the Thirty-Year Progress Report which I have mentioned above. The net result was a nearly complete shift in emphasis from pine silviculture to that of the volunteer hardwood stands which replaced the pine. New experiments were inaugurated to hasten and improve the production of hardwood sawtimber on the lands of the Harvard Forest. These experiments, mostly of a long term nature, are now in progress, and there is every reason to believe that excellent hardwood timber can be produced here in rotations perhaps eighty or ninety years long.

A third objective in the Forest's operations dates from the beginning in 1907 and is, in a sense, inseparable from the two which I have mentioned. One of the stipulations made by the University at the establishment of the institution was that the Forest should be economically self-supporting. This requirement did not apply to the research or instructional aspects, but rather to the Forest as a tract of managed timberland. So long as white pine was abundant in nearly pure stands, and so long as adequate markets were available, this requirement was met. During the extensive logging of the pine, however, the market for it began to decline; and although we still derived a very considerable revenue from the sale of pine logs during the early 1930's, it was beginning to be increasingly difficult to finance the Forest's operations from such sales. The hurricane of 1938 finally eliminated the white pine as a source of revenue.

With the shift in objectives from pine to hardwood silviculture, the derivation of revenue from the sale of by-products in the management of the hardwood stands seems never to have been seriously explored at the Forest. It was recognized that many years would elapse before the young hardwood forests

would produce an income from the sale of sawtimber, and the financial support of continued operations was looked for in increased endowment and annual gifts. The by-products above mentioned are, and will continue to be, in the form of cordwood. There has always been a small market for cordwood as fuel in nearby communities, but it has never been looked upon as promising enough to merit much attention. Herein, it seems to me, there has been a serious oversight in the Forest's efforts to attain one of its major, over-all, objectives — that of financial self-support as managed woodland. If the management of hardwoods is to develop and become widespread in its application, it seems to me that this management must be shown to be financially sound procedure, and that one of the Forest's major contributions should be research and demonstration in this direction.

I believe that such work has regional implications of great importance to a large section of New England and the Northeast, for the only values that can be realized from the widespread hardwood forests that have followed pine will be for many years in the form of cordwood. The town of Petersham is typical of many in this region. Approximately 90% of its surface is covered with forests, and most of this is in hardwoods forty years old or younger. It will be at least another forty years before sawtimber will be available here in quantity. However, large amounts of cordwood are now available and will increase greatly as time goes on. It can be extracted, under good silvicultural management, in such a way as greatly to improve the quality of the later crops of sawtimber, and in such a way as to shorten the rotation. At the same time, provided industrial as well as domestic markets for the cordwood can be developed, it will constitute a cash crop for woodland owners. One of the largest problems in New England at the present time is to find and develop outlets for this cordwood and to manage its harvesting in such a way as to attain the maximum improvement in the final crops of timber.

We propose to enlarge the woods operations of the Harvard Forest so as to demonstrate the proper management of our hardwoods and the disposal of the resulting cordwood by-product. We have recently made an inventory of the supply of cordwood that can be harvested from the Harvard Forest during the next thirty years. It is more than adequate to justify our embarking upon such a program as I have proposed. Some of it will come from our softwood plantations, more from young hardwood stands that are badly in need of thinning, and there will be a large quantity from the salvage of stands damaged by the hurricane.

Our greatest immediate need is for management in this undertaking. We are at present understaffed, and those of us who are here cannot devote to the program the time necessary for its proper execution. We need an additional member of the staff who can give a large proportion of his time and energy to managing the enlarged operations in the woods and to exploring outlets for the product.

A man who can do these things must be a highly trained silviculturist whose interest and experience lie in the management of native hardwoods. He must be one who will further the basic silvicultural research program of the Forest, and who can take his place in our program of instruction. At the same time he must have business acumen sufficient to handle investigation into marketing outlets and the improvement of harvesting methods. Men with these attributes are uncommon, but we believe that one can be found. We propose to give such a person an appointment as assistant professor of forestry for a term of five years.

It seems to me that financial support from the Friends of the Harvard Forest can be put to no better use at present than to aid in meeting the cost of such an addition to the staff.

Hugh M. Raup
 Director

The Friends of the Harvard Forest

PER ARBORES AD SILVAM

December 13, 1948

To the Friends of the Harvard Forest:

The enclosed is a brief report, prepared by its Director, Dr. Hugh M. Raup, on the affairs at the Harvard Forest. The report carries with it an appeal for funds to support the current work of the institution. Those of you who were present at the Field Day in September will have heard most of this report as it was presented verbally by Dr. Raup on that occasion. Research and operations at the Forest are proceeding at an ever increasing tempo, and their adequate support is a worthy cause.

We urge all the Friends to give this appeal their generous consideration. Such contributions as you make will be deductible from your taxable income. Checks should be made payable to Harvard University and sent to the Director of the Harvard Forest, Petersham, Massachusetts.

Sincerely yours,

THE SPONSORS

Roger Kinnicutt

Henry S. Morgan

Mrs. Llewellyn H. Howland

John M. Woolsey, Jr.

HARVARD FOREST
HARVARD UNIVERSITY
Petersham, Massachusetts



December 13, 1948

To the Friends of the Harvard Forest:

The unflinching interest on the part of the members of your organization in the affairs of the Harvard Forest, and your generous support of its projects, are deeply appreciated. I believe that our institution, in its silvicultural research and demonstration as well as in its instruction of students, is making a solid contribution to man's knowledge of the growth and development of one of our principal natural resources. It is becoming clear to those who have studied the production of wood that for too long our country has regarded the forests as an inexhaustible mine, and that we must learn to nurture them. The forests of the nation constitute a renewable resource if they are properly understood and managed. These conclusions are not conjectures, but are buttressed by incontrovertible facts. An enlightened silviculture, therefore, becomes the starting point for a continuously renewed source of wood for every use. The Harvard Forest is the one institution in the country that devotes itself primarily to this phase of research in forestry, and it holds an unusually strong position for the carrying out of such research. This is especially true because of its close integration with those departments of Harvard University, such as Biology, Economics, and Business Administration, that can broaden the scope of its work.

As most of you know, the Forest is inadequately endowed and must depend for much of its support upon the good-will of many persons and organizations. This appeal is for funds to meet current needs; and I welcome an occasion to give you a brief account of our past year's work.

Staff

During the year, the resident staff of the Forest was increased by the appointment of Mr. Earl P. Stephens as Technical Associate. Mr. Stephens has a Bachelor of Science degree from West Virginia University, and received the degree of Master in Forestry here at Harvard in February 1948. He was then appointed Technical Associate for full-time work. Upon his shoulders falls a great deal of the maintenance of forest records and the planning of its woods operations. He has also begun a highly significant investigation of marketing outlets for wood products. During his year as a student he made a new stand map of the Tom Swamp tract, thus completing our new series of maps begun in 1946.

Dr. Pauley's work as a member of the Cabot Foundation continues to develop. He has started a nursery near the Forest buildings for the production of growing stock, and has acquired the use of several parcels of State land in the neighborhood of the Quabbin reservoir for the expansion of test plots. During my absence this past summer, he performed in excellent fashion the duties of Acting Director of the Forest.

Mr. Spurr devoted most of the year to additional research in the cruising of forests from aerial photographs. His book, "Aerial Photographs in Forestry," was published in January.

The Forest profited greatly during the fall and winter of 1947-1948 by the presence of Dr. Helge Johnsson of the Swedish Forest Tree Breeding Institute. Dr. Johnsson is a forest geneticist and spent about six months in North America collecting material for experimental work in Sweden. Between September 15, 1947, and January 15, 1948, he used the Harvard Forest as a base of operations, actively collaborating with Dr. Pauley. Together these two men made extensive collecting trips through eastern Canada, the Mississippi River states, and along the northwest coast.

Operations

Woods operations during the year consisted largely of thinnings, salvage, and improvement cuttings in the hardwood stands of the Forest. On the occasion of the Friends' Field Day in 1947 some of you saw the results of the thinning in Compartment II of the Tom Swamp tract. These operations were continued in Compartment I of that tract in the spring of 1948. In addition to this we have made salvage and improvement cuttings in hurricane-damaged areas of Compartment VII of the Prospect Hill tract. The principal product resulting from all these operations has been cord wood. During the past several years the cord wood cut at the Forest has been barely enough for our own needs, but this year, in addition to having an ample supply for our own use, we accumulated a considerable surplus for sale. The winter of 1947-1948 was a difficult one for woods operations because of the heavy snow that came late in December and persisted through most of March. Cutting was almost completely suspended during this period, but mechanization of operations in the spring so increased production that the loss was made up. During the summer and autumn of 1947 we secured from the War Assets Administration through the University's Purchasing Department, five pneumatic chain saws, an air compressor with which to operate the saws, and a 2-1/2 ton Army truck. This equipment has nearly doubled the rate of our production of cord wood.

Buildings

Substantial gifts in the way of buildings and equipment have been made to the Forest during the year. A generous friend presented us with a new saw mill and a new bulldozer. The saw mill has been delivered but the bulldozer will not be available until some time in 1949. The same friend has presented the Forest with funds to build a house which will be designated as the Director's residence. Its construction was begun in June 1948, and it is well on the way to completion. It is located on a bit of open ground across the road from the Community House.

Instruction

With regard to instruction, we have five students this year, all candidates for the Master's degree in Forestry. Three of them are married men, living in Community House; the other two reside in the dormitory. Visitors to the Forest have been numerous. They range from casual travelers who stop to see the Museum, to serious students who come to see both current work and the results of our research. The Forest holds interest for students

in several fields other than silviculture. This is particularly true in the fields of Economics and Business Administration, for we possess unique data on the cost of silvicultural operations.

The annual Field Day of the Friends was held on Saturday, September 25. Attendance was excellent, although we wish that more of you had been able to come. We sincerely hope that we shall have many more such occasions.

Sincerely yours,

Hugh M. Raup

HARVARD FOREST
HARVARD UNIVERSITY
Petersham, Massachusetts



November 21, 1949

To the Friends of the Harvard Forest:

Each year at about this time it is customary for the Friends of the Harvard Forest to be solicited for funds in support of the institution. I wish to express the greatest appreciation for the generosity manifested by the Friends in the last few years. Your contributions have been very useful indeed, and most generous.

As you know, the Forest is dependent to a very considerable extent upon annual gifts for the development of its program of instruction and research, and for the maintenance of its records and woods operations. It is engaged in experiments designed to further our knowledge of the silviculture of southern New England, and in training men for the development of good silviculture in whatever part of the world they find themselves. In the nature of things, this experiment and instruction must be subsidized, for with the present situation in wood production and marketing it is impossible for the experiments to pay their own way.

For those of you who were at the fall meeting of the Friends on September 10th, the content of the enclosed report will not be new. For those who were not here, it will serve to acquaint you with the progress of events at the Forest during the past year.

Sincerely yours,

Director

REPORT ON THE HARVARD FOREST FOR THE YEAR
SEPTEMBER 1, 1948 to SEPTEMBER 1, 1949

During the past year the Harvard Forest has continued its usual program of woods operations and instruction. Several notable developments have occurred, however, both in equipment and operations.

Staff

The staff of the Forest has remained unchanged with one exception. Dr. Scott Pauley has continued his work in the expansion of the Cabot Foundation's test plots for the development of rapidly growing trees. He has secured the loan of land from the Metropolitan District Water Supply Commission in the nearby Quabbin Reservation and has put out one plantation of hybrid poplars. Other areas in the same locality have been made ready for plantations to be put in next year. Dr. Pauley has been in residence at the Forest except for a collection trip in the Ohio and Mississippi Valleys during the winter and a journey to Sweden, Denmark, and Finland during the summer of 1949.

Mr. Stephen H. Spurr took a leave of absence beginning in the summer of 1948 and continuing until June 1949. During this time he was engaged in graduate study toward the degree of Doctor of Philosophy in Forestry at Yale University. Upon his return in June, he took up again his research work on the cruising of timber from aerial photographs, and continued it through the summer with two technical assistants.

Mr. Earl Stephens continued throughout the year as technical assistant at the Forest, doing excellent work in supervising the woods operations and maintaining the Forest records. He has also made an extensive study of the published and unpublished research that has been carried on at the Forest during the past forty years, and has organized it in such a way that it can be used. Mr. Earl E.

Smith, who was here as a student during the academic year 1948-49, became a technical assistant in June of this year. Mr. Stephens left the Forest in September to pursue his studies toward a doctor's degree in biology at Cambridge, and Mr. Smith will continue in his place for the year 1949-50.

During the fall and early winter, it was necessary for me to spend a great deal of my time in Cambridge teaching a course in the Department of Biology. During that time, I was able, however, to spend two or three days a week at the Forest. After the first of February I was here continuously except for a trip to Cuba and Honduras in the latter half of February and the first half of March.

Instruction

Five graduate students were in residence at the Forest during the academic year. They proved to be an unusually able group and did excellent work. An equal number came to Petersham in September for the current year.

Something of a new departure in the use of our instructional and research facilities has been undertaken as a result of my journey to Honduras last winter. A business organization with large horticultural and agricultural interests in Tropical America is committed to an extensive program of reforestation. It is greatly in need of men trained to initiate and carry out research in the silvicultural management of its plantations and natural forest regeneration. In order to facilitate the desired development, it has sent a young man, Mr. A. C. Chable, to the Harvard Forest for a year or more of study and research. Mr. Chable arrived in May, and has apprenticed himself to our research program. He has been given an appointment as research fellow in the University, and his expenses are being met by his employers.

Woods Operations

Woods operations during the year consisted largely of salvage and improvement cuttings and thinnings in the Prospect Hill Tract. The principal product

has been in the form of cordwood, although a few logs, both hardwood and softwood, have accrued. During the fall and early winter, the operations of the preceding year in Compartment VII were continued into the eastern part of this compartment. In the winter and spring, a salvage and improvement cutting was made in a hemlock stand in the eastern part of Compartment II.

The cordwood operation was greatly facilitated during the year by improvements in methods for handling the wood. A chain saw was utilized almost entirely, the logs being drawn from the woods to the roadside where they were sawn into four-foot lengths and placed directly on trucks. By this method two handlings of the wood were eliminated. In preceding years a cut of 250 cords was looked upon as a good year's work, and it commonly was not finished until midsummer. During the past year, upwards of 300 cords were cut, and the work was finished before the beginning of summer.

Buildings and Equipment

During the year a new house was built at the Forest to serve as a residence for the Director. This was made possible by a generous gift from a Friend. The house was begun in June of 1948 and occupied in April 1949. It is located near the administration building, and consists of eight rooms. Architecturally it is done in the Colonial style characteristic of the locality.

Several pieces of equipment were acquired through War Surplus purchases made by the University during the year. The most notable items thus acquired were two engines suitable for use as power units in forest operations. The sawmill, acquired last year as a gift from a Friend, was finally set up during the summer of 1949, using one of these engines for power. The mill has been housed in a new building and is now in operation. It will be used for experimental sawing and to produce lumber from such timber as will come from our salvage and improvement cuttings.

Visitors

The number of visitors to the Forest and to the Fisher Museum has greatly increased over past years. We have records of 1623 from September 1, 1948 to September 1, 1949. In January of this year we began keeping records of the number of persons with whom one member of the staff or another has spent considerable time. To September 1, this number totaled about 220. Visitors consisted of a great variety of persons, ranging from individuals who wished advice about forest management, to groups interested in various phases of conservation, and student groups from other schools.

General Considerations

In my three years as Director of the Forest, I have devoted most of my efforts to getting woods operations and instruction under way after the lean years of the war. At the same time I have endeavored to maintain and improve the research program and its records. During these three years the position of the Harvard Forest in relation to American forestry as a whole has become increasingly clear.

Scientific forestry and forestry education began in America at about the beginning of the present century. They began in an atmosphere of forest abundance which had persisted from the colonization of the continent. Wood was not only abundant, but was a nuisance in many regions that were desirable for agriculture. American forestry began its scientific life based upon European ideas and techniques. These ideas were drawn principally from Germany, largely because of German proficiency in the handling of coniferous woods.

The field of forestry can be divided into two phases. One of these is the growth or production of trees, and is commonly designated as "silviculture". This phase is a biological one, and its basic problems are biological. The second phase involves the recovery of wood from the forests and its utilization. This might be called the engineering phase of the profession.

Throughout the history of American forest science and instruction, the greater emphasis has always been placed upon recovery and utilization. This appears to have been due to the superabundance of natural stands of wood, and to the lack of an economic necessity for silviculture. Western European nations long ago altered their emphasis from recovery to production, but in America this change has barely begun.

Natural stands of forest in America are rapidly disappearing, due not only to increased demands for lumber and pulpwood, but also to a great enlargement in the field of wood technology. The latter is leading to increased demands for wood to be used as fabricated building material and for chemicals. Recent estimates indicate that the nation is using its wood 50% faster than the wood is being produced by the land.

Modern trends in American forestry teaching and research are now heavily weighted in the direction of the protection of the forests that remain, and toward improved utilization with the elimination of waste. These trends represent only a palliative. Silviculture has not kept pace with them in the over-all development of forestry.

From the above considerations, it seems evident that the most pressing need in American forestry is the rehabilitation of silviculture. It must cease to be a minor handmaiden to the profession, and must become a central theme. We do not yet know how to grow most of our common forest trees on a sustained yield basis. The groundwork for a revitalization of silviculture must be through research devoted to this field.

Harvard University is in an unusually favorable position for the development of silvicultural research. It has three prime assets upon which to build such work. First is the Harvard Forest, with its splendid physical equipment and its forty years of research history. Second is a close relationship with departments of the University in Cambridge, whose facilities are available for instruction and investigation. Third is a tradition of independence which loses nothing of

importance by being intangible. It is a tradition that knows no barriers among the disciplines that can contribute to the solution of silvicultural problems, and it is a tradition which opens the way for the exploration of new avenues of approach to such problems.

The primary aim of the Harvard Forest, then, is to develop men who can and will initiate and carry out research in methods for the growth of wood -- wood for all uses and wherever it is needed. The Harvard Forest itself should be maintained as an efficient productive institution, utilizing all its University relationships, and serving primarily as a training ground for research men. This training should not be limited to research in the growth of trees in New England, but should develop in students a philosophy of investigation which will be applicable in the South, the Pacific Northwest, the Tropics, or wherever the need arises.

Hugh M. Raup
Director

HARVARD FOREST
HARVARD UNIVERSITY
Petersham, Massachusetts



November 27, 1951

To the Friends of the Harvard Forest:

Enclosed herewith is a brief report on the present state of the Harvard Forest, and on developments that have occurred in the past year. Those of you who attended the annual Field Day on September 8th will find that the report contains essentially the material presented verbally on that occasion.

No written description of the Forest and its work can ever be entirely satisfactory, and it is particularly difficult to compress such a description into the few pages that can be used here. A far better way to learn of the Forest is to visit it. This, of course, you are cordially invited to do. If you find it inconvenient to come for the annual Field Day, please do not hesitate to come at some other time.

The financial assistance you have given the Forest in the past years has been generous and is fully appreciated. You will note in the enclosed report that the institution needs annual gifts to the extent of several thousand dollars in order to maintain its program at the present level. Gifts from Friends during the past few years have made up this difference, and it is hoped you will continue your contributions.

Sincerely yours,

Hugh M. Raup
Director

REPORT ON THE HARVARD FOREST FOR THE YEAR

SEPTEMBER 1950 to SEPTEMBER 1951

Introduction

It is customary at this time of year to send to the Friends of the Harvard Forest a report on the affairs of the institution to which they have so generously given their support. The preparation of such a report is not only a pleasant duty but is highly profitable as well. It requires that the Director and Staff of the Forest take stock of the institution as a whole, and attempt to evaluate their own annual contribution to its management and use.

Staff

The staff of the Harvard Forest has undergone some changes during the year. Dr. Stephen H. Spurr tendered his resignation, effective December 31, 1950. Dr. Spurr spent the latter part of the summer and the autumn on a trip in the British Isles and Europe, visiting forestry schools and research institutions. Upon his return he went directly to a new position in the School of Forestry at the University of Minnesota. Dr. Scott S. Pauley remained in residence at the Forest throughout the year, continuing his research in forest genetics under the auspices of the Maria Moors Cabot Foundation. Mr. Earl P. Stephens returned to the Forest in June of 1950, and served as technical assistant during the year. He has had most of the responsibility for managing the woods operations and maintaining the permanent records of them. In October 1950, Dr. Ernest M. Gould joined the staff as a research fellow in forest economics. Dr. Gould has initiated a more or less detailed study of our accumulated records of woods operations. Dr. John C. Goodlett came to our staff in July of this year. He will concern himself primarily with problems in forest soils. Mr. Herschel G. Abbott, who was a student here during the academic year, served as technical assistant in the summer of 1951. He is continuing his studies during the current year and working for the Forest as a half-time assistant. I gave a course in plant geography at the University in Cambridge during the fall term. This necessitated my spending about half of each week there. In February and March, I made another journey to Honduras to review the reforestation work of the United Fruit Company. Except for these interruptions, I was at the Forest nearly continuously throughout the year. Mr. Charles F. Upham has continued as woods superintendent, with a crew of four additional men.

Buildings, Equipment, Operations, and Special Events

The only addition to buildings made during the year was an extension of the foundation and floor of the structure which houses our sawmill. It was made to provide space for lumber storage, and was constructed entirely with our own materials and labor. Other than this there have been only routine improvement maintenance and minor alterations.

Woods operations during the year have consisted of improvement cuttings and thinnings in Compartment V of the Prospect Hill Tract, and in the pruning and thinning of coniferous plantations in Compartments I and II of the same tract. The work in Compartment V, around the southern base of Prospect Hill, involved some thinnings of hardwood stands, and the clear-cutting of a few areas that were very badly damaged by the hurricane of 1938. Early spring thaws in March made it impossible to continue operations in these remote parts of the Prospect Hill Tract. The woods crew was then moved to the coniferous plantation areas in Compartments I and II immediately back of the headquarters buildings. Thinnings and improvement cuttings were made in these plantations during April, May, and a part of June. It was found that some of the red pine plantations would yield poles that could be sold to tobacco farmers in the Connecticut Valley, and something over 600 of these poles were cut and peeled for delivery later in the summer.

Except for some white pine lumber cut from Compartment V and the tobacco poles from the plantations, most of the product of the year's operations has been in the form of cordwood, which will be used for fuel to heat our buildings. A small amount of fuelwood will be sold in the town of Petersham.

An important addition to the Forest equipment during the year has been a small, one-man, chain saw. A larger chain saw, acquired about three years ago, had considerably increased the efficiency of the cutting operations, and the smaller new one has made further notable improvements. Both of these saws have been deposited with us by their manufacturers for trial.

Two special events of the past year are worthy of note. The first was the dedication of a bronze tablet commemorating Dr. E. G. Stillman's gift of our new headquarters building and museum. The tablet was contributed by the Board of Overseers' Committee to Visit the Harvard Forest, and was executed by Mr. Theodore B. Pitman. The dedication was held on the occasion of a meeting of the Visiting Committee at the Forest.

The Forest invited its alumni for a two-day visit in the latter part of July. So far as I am aware, such a meeting has not been held before, although many of the alumni have visited us on former occasions. Although the attendance was not large, the gathering was enjoyable and profitable. On this occasion the alumni formed an organization which we hope will become active.

Instruction and Research

Three of our students of the year 1949-50 availed themselves of a course in tropical botany offered by the Department of Biology during the summer of 1950. Mr. Earl E. Smith, who served with us as technical assistant in 1949-50, also took the course. This group, consisting of eight students in all, spent the month of July at the Atkins Garden and Research Laboratory in Cuba, and the first two weeks in August on a conducted tour of the United Fruit Company's plantations in Honduras. The course seems to have been highly successful. During the academic year, we had one new student as candidate for the master's degree in forestry. He was a graduate of the University of Maine, and did excellent work here. Two new students arrived in June to begin studies for the master's degree. They came under the new plan of instruction to be described below.

During the year we had a large number of visitors. About 1750 have signed the guest book in the museum, and we have given demonstrations of one kind or another to about 620. The number of outside institutions using the Harvard Forest for demonstration shows a steady increase. During the year we have had groups from the School of Forestry at Yale University, the New York State College of Forestry at Syracuse, the forestry departments of the state universities of Connecticut, Rhode Island, and Massachusetts. We have also had groups from the Biology Department of Tufts College, from the Worcester Natural History Museum, and from various clubs and other organizations concerned with the conservation movement.

Research at the Forest has been notably enlarged and extended during the year. It consists first in the maintenance of records of operations which contribute to our long-term projects. Not only have these records been added to in the usual manner, but improvements have been made in their general organization.

Several projects of short-term nature have been started or continued. Mr. Stephens has instituted a rather detailed study of forest development in a part of the Tom Swamp Tract. His work there should make a large contribution to our knowledge of natural trends in the development of forest types. Work on forest soils, begun by Mr. Stout in 1948, is being continued under the direction of Dr. Goodlett. A report on some of the results of this research is now in preparation and will soon be published. Dr. Gould's research in forest economics is producing much of use and interest to our entire research program. He is analyzing our records of operations with a view to comparing the input of labor and materials to the output of forest products.

Dr. Pauley has expanded his test plots for hybrid and selected poplars on land secured by loan on the Quabbin Reservation just south of the Tom Swamp Tract. Also, in the spring of 1951 he secured nursery stock of white and red pines from widely scattered stations in the United States and Canada. These stations were selected in such a way as to represent the natural ranges of the two species. The stock was planted in the Prospect Hill Tract, on land that was formerly in unsuccessful plantations. The old plantations were cleared away for the purpose. The experiment is designed to demonstrate the natural variability of the two species, and the behavior of the various geographic strains when planted in this region.

Two special research projects begun in the summer of 1950 with financial support from the Cabot Foundation were continued during the year. These projects were mentioned in my report for 1949-50. Mr. Frank Raymond, a graduate student in biology, lived at the Forest during the summer of 1950, making collections of the native fungi of the soils. He cultured these fungi in our laboratory, and during the following year continued their study at the University in Cambridge. This project will require a number of years for completion, but I believe that it should make a significant contribution to our knowledge of the biology of forest soils.

The second project, initiated in the summer of 1950 by Dr. David Hackett, is concerned with the use of herbicides in the control of hardwood stump sprouts. Dr. Hackett laid out a series of experiments, utilizing hormone-like poisons in varying concentrations and with varying methods of application. These experiments show considerable promise for the successful control of hardwoods.

Finances and Administration

When the Stillman bequests of the Black Rock Forest and the Black Rock Forest Trust Fund were acquired, the Black Rock Forest was set up as a subdepartment of the Harvard Forest, with funds administered from the Harvard Forest. During the past fiscal year the University has established what is known as the Harvard Black Rock Forest Corporation under the laws of the State of New York. Although the Black Rock Forest thus becomes technically separate from the Harvard Forest, it will continue to function in the manner originally designed, for it will continue under combined directorship with the Harvard Forest. The total Harvard Forest budget for the fiscal year 1950-51 was \$61,519, and that of the Black Rock Forest \$18,795. During the year the Harvard Forest received gifts for immediate expenditure of \$6,962. With these gifts and the new income from the Black Rock Forest Trust Fund the Harvard Forest was able, for the first time in many years, to end the fiscal year in a good financial position.

It is highly desirable that the Forest increase as rapidly as possible its income derived from the sale of wood products. In the nature of things, this cannot go forward quickly because of damage done by the hurricane of 1938. However, during the past year we have realized a value of about \$6,200 from cordwood and lumber. About \$3,400 of this was cash, and the remainder in the form of fuel for the heating of our own buildings.

General Considerations

During the past fiscal year some notable changes have been made in our program of instruction. The primary aim of the Harvard Forest is to develop men who can initiate and carry out research in methods for growing wood — wood for all uses and wherever it is needed. Emphasis upon the field of silviculture, and upon research in this field, are a logical continuation of basic policies which were settled upon by Mr. Fisher during his lifetime. These policies appear to be as sound now as they were then, in terms both of fundamental needs in forestry and of Harvard's resources.

The accomplishment of our educational aim has required decision and action on several fronts. First, it has been necessary to define clearly our academic status in the University, and to establish workable procedures for the handling of students. Second, many persons familiar with the problems of forestry education in general, and with Harvard's resources in this field, have felt that we should be able to draw graduate students from wider and more varied sources than we have in the past. This need follows logically from the long-continued increase of emphasis upon research, and from the steadily broadening research aims of the Forest. It is desirable that we draw students not only from undergraduate professional schools, but also from colleges of liberal arts, and that we have both groups represented here at the same time. To do this has required that we broaden the subject matter of our training program. Finally, it is highly desirable that we have the goodwill of the profession of forestry in our venture.

In 1946, when I became Director of the Forest, and for many years prior to that time, the system by which our students were selected and given their degrees was somewhat anomalous so far as the rest of the Harvard Graduate School was concerned. No material improvement was made until the spring of 1949 when the Provost of the University appointed a committee in

the Department of Biology to explore the whole question. As a result of this committee's deliberations we now have a policy which brings our graduate student relationships completely within the orbit of the Graduate School of Arts and Sciences, wherein they function through the Department of Biology or the Department of Economics.

One of the outstanding results of this scheme has been to raise somewhat the academic level of incoming graduate students. Through a regularized relationship with the Department of Biology, we now have an excellent source of advice and a much sounder base for judgment of students. In brief, we have a mechanism for striking a reasonable academic level for selection.

The present scheme accomplishes another important result. It has become increasingly clear that we should have a means whereby promising students could take a doctor's degree in problems pertaining to silviculture. Two of our men in the past couple of years have been pursuing such a program. It is particularly desirable that they should have opportunity to do Ph.D. work in the biological and economic problems of silviculture through the Departments of Biology and Economics. In order to do so, they should be acceptable at the outset as Ph.D. candidates in the Graduate School, and this means a more careful selection such as is now possible.

During the past year we have altered the basic requirements for the admission of graduate students so that we can accept men from colleges of liberal arts as well as those from undergraduate forestry schools. At the same time we have changed our residence requirements and our program of study to meet the new situation. Minimum residence for the M.F. degree is now one academic year and its two adjacent summers. The training program has been broadened to satisfy the needs of men who have had no previous technical instruction.

To further the new plan, three special fellowships were set up. They are known as the "Richard Thornton Fisher Research Fellowships in Silviculture", and carry stipends of \$2,000 each.

Complete endorsement of the present educational program of the Harvard Forest by the forestry profession can be expected only when we have produced men who demonstrate the high capacity expected of them. This will be a slow process, although the way can be prepared somewhat by demonstration at the Forest to interested professional men and students who come to see what we are doing.

Students trained at the Harvard Forest have always been small in numbers but have turned out to be large in influence. The small number at present is in part a reflection of changes following the war. Immediately after the war the numbers rose to five and six, more than had been here at any one time since 1931. This was a reflection of the G.I. benefits, as it was in colleges and universities throughout the country. The term of these benefits is now about over, and numbers have dropped off accordingly. There is no question that we can gradually raise the number of men we can take care of by our present methods. We have set a limit of six as a starting point.

REPORT ON THE HARVARD FOREST FOR THE YEAR

SEPTEMBER 1951 to SEPTEMBER 1952

Introduction

The following paragraphs contain a brief description of the state of the Harvard Forest as it appears in the autumn of 1952, and an account of its principal activities in the past year. Appended to the report is a short discussion of the research program which is now in being at the Forest.

Changes in Staff

The staff of the Forest has, with two exceptions, remained unchanged during the past year. Beginning July 1, 1952, Dr. Scott S. Pauley ceased to be a member of our staff, and entered upon a new appointment as Forest Geneticist to the Cabot Foundation. Much of his research will continue to be done here at Petersham, and he will continue to live here and to have his office in Shaler Hall. He has also been appointed Lecturer in the Department of Biology, and will have the supervision of graduate students who are primarily interested in forest genetics. The other staff change is an addition, in the person of Mr. Shelley W. Potter, Jr. Mr. Potter came to us in July of 1952 as a Research Associate. He is man of considerable professional experience and has had his forestry training at the University of Michigan and at the New York State College of Forestry.

Buildings and Equipment

In January of 1952 the Forest received, as a gift from Mrs. Charles Jackson of Boston, the Higginson house in the village of Petersham. The property has come to us at an opportune time, for we have been in need of housing for married graduate students and staff. The house is fundamentally in good condition and is so arranged that it can rather easily be subdivided into four housekeeping apartments. Some progress was made on alterations during the winter and spring, and by mid-June we had three of the four apartments ready for occupancy. All three were used during most of the summer of 1952. The house does not have adequate heat for winter residence. When funds are available we expect to install a new heating system for the whole house.

Visitors

Visitors to the Forest continue to increase in numbers. Not only is the institution being used by more of the University classes in Cambridge who find materials and ideas here to supplement their class and laboratory work, but groups from other schools become more frequent each year. Also on the increase are visits from professional foresters who come to see the progress of our research and to use our reference material. An instance of this was a visit of all the county foresters of New Hampshire during the fall of 1951. In the summer of 1952 we had another meeting of the alumni

of the Harvard Forest, most of whom are professional foresters. There were 18 at this meeting.

The Forest holds interest for people representing diverse fields. The largest category is of those whose interests are in the biological aspects of forestry. Next to these are students and teachers in the field of land use economics. The town of Petersham as a whole, and the Harvard Forest in particular, constitute a well documented case history of the development of the use of the land since its first occupation by Europeans in the early 1700's. This history involves not only the development of the forests, but also of agriculture, small industries, and population trends.

Instruction

Two new students came to the Forest in June of 1952. They will remain with us until September of 1953, and are candidates for the degree of Master in Forestry. In addition to these new students there are others who are in various phases of more advanced studies toward the doctor's degree in biology with special reference to silvicultural problems. Mr. Earl P. Stephens, now on our staff, is pursuing research for his doctoral dissertation on natural trends in forest development. Mr. Earl E. Smith has spent the past year in the island of Cuba where he has been gathering materials for a thesis on the forest resources of Cuba. He is supported in this work by the Harvard Forest, the Cabot Foundation, and by the Atkins Garden and Research Laboratory in Cuba. The Atkins Garden has been his base of operations while in the field. Mr. Wang Chi-wu has been at the Forest during the year working part time for us, and at the same time preparing a doctoral dissertation on the forest vegetation of China. Both of the students who were here in residence last year as candidates for the master's degree are continuing their work for the doctorate in Cambridge this fall. Also Mr. Herschel Abbott, who was here last year as Research Associate, is now working for his doctorate in Cambridge.

In the fall of 1951 we entered upon a new venture in instruction. Six graduate students from the Department of Economics and the Graduate School of Public Administration in Cambridge were brought to the Forest for one week in mid-September. These men had been carefully selected from various government agencies, such as the Soil Conservation Service, the Production and Marketing Administration, and the Geological Survey, and had been awarded fellowships for a year's study in Cambridge. While they were at the Forest, we gave them a rigorous and comprehensive review of problems in land use as they are represented here, using particularly the problems of forest land use as illustrative material. This venture appears to have been quite successful, and was repeated in September, 1952. It is expected that it will continue in future years.

Last year we drew up a prospective program for the training of men in tropical forestry. This program was an outgrowth of my experiences with the reforestation program of the United Fruit Company in Honduras over the past few years, and is proposed as a partial answer to the need for men trained in tropical forestry. In support of the program, which must be regarded as an experiment, the United Fruit Company has contributed a fellowship to carry one student through a period of four years. The curriculum for this student will involve study and apprenticeship both here and in the tropics, and will involve a year of residence in Cambridge to complete the requirements for a doctor's degree in biology. We expect to have a student ready for the fellowship in June of 1953.

Collaboration with Other Institutions

A significant part of the activity of the Forest is to be found in cooperative efforts with institutions outside the University. For a number of years we have been continuing the experimental work in forest entomology and forest pathology with the Bureau of Entomology and Plant Quarantine and the Bureau of Plant Industry of the U.S. Department of Agriculture. In the autumn of 1951 the United States Forest Service requested aid in the form of office facilities for two men working in New England on the national survey of forest resources. Two men from the Service have occupied office space in our building during the past year and are continuing to do so for the coming winter. For a number of years we have felt the need for a survey of the geological history of the soils and land forms in the Harvard Forest. This is finally coming to pass through the efforts of the U.S. Geological Survey, whose representatives began work in the summer of 1952 on the "Athol Quadrangle". This quadrangle of the U.S.G.S. map series includes all of our Prospect Hill Tract and most of the Tom Swamp Tract. The Survey is using the Harvard Forest as its base of operations for field work, and we have gladly given its people such facilities as they need.

Publications

Two papers have been published from the Harvard Forest during the year. One of these is a report by Dr. David P. Hackett on his research here in the use of hormone sprays for the control of hardwood sprouts. His report was presented at the Northeastern Weed Control Conference in New York in December of 1951, and has been issued separately in mimeographed form. The other publication is our Bulletin No. 24, "Species Distribution and Soils in the Harvard Forest", by Mr. Benjamin B. Stout. Those who have visited the Forest in the last two or three years will have heard about the studies of subsoils carried on by Mr. Stout. This bulletin describes his results in some detail. Also during the year we have received the manuscript for Part II of our thirty-year progress report. This is by Mr. A. C. Cline and Mr. Russell Lutz who were the authors of Part I. It will probably go to press sometime during the coming winter, and will appear as Bulletin 25. Another manuscript which is nearly ready for publication is by Dr. John C. Goodlett, who is a member of our staff. The manuscript describes Dr. Goodlett's studies over the past few years on the identity and distribution of forest types in northern Pennsylvania.

Research Program at the Harvard Forest

In the past few years I have said a great deal about research at the Harvard Forest, and have tried to state the significance of our research program. I have said repeatedly that our primary purpose here is the training of men who will be capable of dealing intelligently with the long-range problems of forest production. With this as a basic aim, and using the methods of training that are traditional at the Forest, an active and soundly conceived research program becomes our most important single educational tool. On various occasions I have described individual research projects briefly, and each year we try to demonstrate for the Friends, in the field, some phase of the work that is going on. In the past five or six years we have been devoting a great deal of time not only to the pursuit of such projects, but also to the general structure of the research program as a whole -- how its parts fit into a larger picture and how best to organize the whole so that its parts will be most effective.

Research at the Harvard Forest is based upon two major premises. A basic one is that we believe forestry in America is moving gradually into a new phase. It involves forest production in contrast to a long phase which has involved primarily the liquidation of forests and the recovery of wood from unmanaged stands. The second premise is that the biology and economy of forest enterprises can no longer be considered as a self-contained field, fenced in by the boundaries of woodlots, whether the latter be small or very large. In other words, forest enterprises are so closely related to other uses of the land that they cannot be kept in separate compartments.

The basic problems in learning to grow trees are biological, for there are biological limits, or "ceilings", to forest production which have not been determined. These ceilings differ widely with different sites, forest types, and intensities of management. We know only a few elementary facts about the nature of site and the selection of species for sites. The degree of biological control we can have over the forests is still infinitesimal, and will remain so until we learn a great deal more about site. Call this "control" by any of a number of terms -- "management", "silviculture", or any combination of the various common subdivisions of forestry -- the fundamental biological ceilings are still there and still unknown, and the cost of exercising even meager controls is still unknown.

In the old period of plenty, when we had so much wood in America that it seemed inexhaustible, decisions on what to do with forests were easy. Biological problems of production could be pushed into the background, and business decisions could safely be based upon our growing experience with the recovery and utilization of wood. If we were at the other extreme -- in a wood famine -- decisions would also be relatively easy, as they now are in many parts of Europe and the British Isles. Society as a whole would recognize that we had to have productive forests, no matter what they cost, and would pour its collective energy and money into them. Actually, we are somewhere between these extremes, where decisions are much more difficult. We still have, as a nation, a great deal of wild forest to cut, but we know that it cannot last forever at the rate we are using it. We know that we have to learn to produce forests; but the biological and economic experiments that are needed cannot be financed on a "famine" or "disaster" basis. The trees must be grown by the owners of the land, and within the present economic structure. This involves the owners in difficult economic decisions concerning the allocation of resources, and brings us to the second premise upon which we base our work.

Most of the forest lands in the United States are privately owned and operated, many of them, as adjuncts to farms, country residences, camps, or to complex manufacturing enterprises. Here in New England a small landowner may have from 50 to 1,000 acres or more of woods. He may be a dairy farmer, or someone who works in a factory and has bought the land as a home, or he may be a business man who holds the land as an investment or for recreational purposes. A great number of people seem to own land simply for the satisfaction of owning it. The values attached to such properties are almost infinitely variable, as are also the resources that can be brought to bear on forest management by the owners. Similar variability can be found for larger holdings such as those of the wood-using industries, and those of the municipal, state, and federal governments. Separate balance sheets for these lands, considering them simply as forest enterprises, are relatively meaningless; for there are too many different values and resources combined in any single woodland operating unit.

Owners of woodland throughout the country are becoming increasingly conscious of the significance of forests to themselves and to society. There is increasing demand for knowledge of what to do with forest land -- knowledge of what can be done that will make the forests more useful for whatever purpose is desired. Whether holdings are large or small, in the hands of individual farmers, business people, large industrial concerns, or the public, their demands are for what might be thought of as "recipes" for productive use of the land. The development of such recipes is not simple. The complexity begins with the wide variation in what people want from their land, and at the other end are problems of what can be done, with our present knowledge, to achieve their ends.

Before realistic recipes can be drawn up for the use of forest lands, it is necessary to know what is biologically feasible on the land. What is biologically possible may or may not be economically possible for the owner of the land, whether his holdings are large or small. Biological feasibility therefore has to be proposed in terms of alternative plans, the economic implications of which must be spelled out in such a way that the owner can make a choice that will fit his wishes, capacities, and concepts of value. Needless to say, the biological and economic aspects of such problems are inseparable.

A considerable part of research in forest production must of necessity be on a simple trial and error basis. Because it takes a long time to grow trees, there has to be a certain element of continuity and stability in the general plan. On the other hand, there is always a danger that the program will become a "blueprint" which might so determine the course of events that new ideas could not be brought in. In its general structure, therefore, our program involves a compromise between the maintenance of enough stability to insure the ordered completion of long range experiments, and enough of flexibility to permit infinite variety in attacks upon problems of forest production.

Our research program has two parts that are not truly separable. We have some hundreds of long-range experiments in the behavior of trees under various kinds of treatment. These experiments constitute a sort of "research overhead", to the maintenance of which a certain portion of our resources must be committed. The experiments must be kept under constant review, so that their original designs can be realized. From time to time we start new ones; but we do this with great care, because each one makes an addition to our "overhead" that will continue for many years. The cost of starting it may be only a small part of the cost of seeing it through to useful results.

The second part of the program revolves around the question of why and how the trees behave as they do. Here are problems in the structure and physiology of trees, the relations of trees to one another in mixed stands, the history of forest stands and the present trends in their development, the way in which forests are related to soils and climates, and the effects of present and past treatment of the forests and soils. These problems involve observation, experiment, and all the imagination we can bring to them. They arise in the minds of the people who are working at the Forest and follow no preconceived patterns. Together they make up a great area of flexibility in the program as a whole.

In designing a research program that will bring us nearer to the recipes that are needed, we cannot deal, at any one time, with more than a fraction of the problems that arise. At the present time, influenced greatly by the natural behavior of our forests in what we have come to think of as the white pine-hardwood succession -- the phenomenon that demolished the Forest's earlier basis for sustained yield -- we are trying to find out where we stand in natural trends of forest development. This is a biological problem of many facets. Mr. Stephens' current work in Compartment VI of the Tom Swamp Tract is an example of it. During the past three years we have been attempting to learn something about the aspects of site that are related to soils. This research, now being carried on by Dr. Goodlett, has led us away from the more conventional approaches to problems in forest soils, and into methods used by geomorphologists for the study of land forms. The economic aspects of forest production, in terms of existing social and biological realities, and applied to specific cases, form the material for Dr. Gould's research. Here also we are following an unconventional path, wherein forest economics is looked upon not as an isolated field concerned only with forests, but as a part of the total use of the land.

HARVARD FOREST
HARVARD UNIVERSITY
Petersham, Massachusetts



November 14, 1953

To the Friends of the Harvard Forest:

The enclosed report on the Harvard Forest covers the year September 1952 to September 1953. It will inform you of the Forest's activities during the year, and if compared with similar reports made since the war, it will indicate something of the development that has occurred in our educational and research work. It was given in essentially its present form on the occasion of the annual Field Day in late August.

The sustained interest in the activities of the Institution on the part of the Friends of the Harvard Forest, and their continuing generosity, are greatly appreciated. As most of you know, the present level of operations here still requires annual gifts for the balancing of the budget. Gifts from the Friends during the past few years have provided this balance, and we sincerely hope that they will continue to do so.

Sincerely yours,

Hugh M. Raup
Hugh M. Raup
Director

REPORT ON THE HARVARD FOREST FOR THE YEAR ENDING SEPTEMBER, 1953

The forest during the past year has continued its program of activities in what we believe to be a reasonably orderly manner. The year has been marked by a series of events the recounting of which will illustrate the present status of the institution and the increasing tempo in which it operates.

The Tornado of June 9, 1953

The Harvard Forest was inordinately fortunate in escaping serious damage from the tornado in June of this year. This storm seems to have begun its course of damage in the western part of the town of Petersham. The damaged area is a narrow strip running in a southeasterly direction, crossing the Hardwick Road and South Street about a mile south of the village of Petersham, and crossing the Worcester road (Route 122) at Connor's Pond. It continued southeastward through the north part of the town of Barre, through Rutland, and into Holden where it began to do its most serious damage to housing and people. In its Petersham course it went through parts of Compartments VII and VIII of our Slab City Tract, in general making a mess of things, but doing damage only to timber that had already been more or less decimated by the hurricane of 1938. At Connor's Pond it took down a small stand of pine on land that we own on the west side of the pond. In its course across this valley it just missed our best old-growth stands, which are located in Compartments IX and X of the Slab City Tract.

Woods Operations

Our woods operations during the fall and winter of 1952-53 continued to be centered in Compartment VI of the Prospect Hill Tract. We have now opened up this compartment with a small but effective network of woods roads that will enable us to manage it much more effectively in the future. The timber was generally of low quality, and the operation consisted mainly of salvage and improvement cutting. Most of the work was finished there by early spring, and netted sufficient cordwood for our own use and for sales in the coming fall and winter. We also derived a few logs which were or will be sawed into lumber at the mill. With the cutting operations so well advanced by spring, we looked forward to having our men carry on a series of experimental operations, particularly in pruning, during the summer and early fall. We had hardly got started with this when the tornado struck. It was advisable to get out immediately such pine logs as were blown down, to save them from attack by boring insects. Consequently most of the summer has been spent at this work, not only salvaging the logs but sawing them up into lumber. We shall derive about 30,000 board feet of pine from this operation, and have a ready sale for it.

Buildings and Equipment

The buildings in the neighborhood of the Forest Headquarters continue to be in reasonably good condition, but not without the usual repairs and replacements, expected and unexpected. Among the expected items has been the routine painting of the Fisher Cottage and the Director's house. The trim on Shaler Hall and the Fisher Museum is badly in need of paint, and probably will be the major painting job for next year. An unexpected and more or less devastating item was caused by the dissolution of the boiler in the heating system of the Forest Cottage occupied by Mr. Earl Stephens and his family. A new boiler had to be installed at considerable expense.

We have made no changes in the Higginson House during the past year. Only one of the apartments there has been occupied during the current summer. This house will reach its greatest usefulness only when we can supply it with a heating plant.

The Winsor House, near the top of Mann Hill and across from the Country Club, was given to the University for the benefit of the Harvard Forest on January 1 of this year. The Forest did not consider it justifiable to receive this house for use, and therefore received it with the understanding that it would be sold and the proceeds used by the Forest. The sale of the house is being handled by the Treasurer of the University, through a Boston real estate agency. It is to be hoped, of course, that the sale can be made in the near future.

The principal change in our equipment for woods operations has been the purchase of a new bulldozer. This came upon us rather suddenly, and was accomplished in the latter part of the summer. It satisfies a need that we have felt for some time, but the matter was brought to a head in part by the increasing tempo of our woods operations generally, and more specifically by the heavy work required in salvage after the June tornado.

Staff

The technical staff of the Forest has remained essentially unchanged although there have been two alterations in the positions of those who are here. Dr. John C. Goodlett, Mr. Earl P. Stephens, and Mr. Shelley W. Potter, Jr. continue as research associates. Dr. Ernest M. Gould, Jr., who has been here since 1950 as Research Associate, has now been given a five-year appointment as Forest Economist. He also holds a lectureship in the Department of Economics in the University at Cambridge. Dr. Wang Chi-Wu, who was here as a half-time research associate for two years while he was finishing his dissertation for the doctorate, completed this work in February and received his degree. He now remains on our staff as a full-time research associate. Dr. Scott S. Pauley remains at the Forest as Forest Geneticist to the Cabot Foundation, using this institution as a base for his research.

Visitors

The stream of visitors to the Forest continues to enlarge. There was a relatively quiet period in mid-winter, but otherwise we have had a succession of visiting individuals and groups. This does not count the casual visitors to the museum, 1580 of whom signed the book during the past fiscal year. The ones I refer to especially are those with whom we spend time in discussion or demonstration. The following will give you some idea of the kinds of people who come and the interests that are involved.

In September of last year a group of five Conservation Fellows from the graduate schools of Economics and Public Administration at Harvard were here for a little over a week. During that week we gave them a general review of the forests and forest problems, both biological and economic, of this region, and took them for a two-day trip in northern New England in order to give them a general view of the forest situation in which we are located. These men came from widely scattered localities in the United States, and represented both federal and state public services.

In October we had our usual weekend visitation from the Conservation Seminar which is conducted each year at the University in Cambridge. Also during the fall we had a class of students for half a day from the Yale School of Forestry. In October there was a two-day meeting, at the Forest, of the Board of Overseers' Committee to Visit the Harvard Forest. In November there was a class of students in General Ecology from the Department of Biology in Cambridge for a day. Last fall I gave my regular course in the University at Cambridge and used the Harvard Forest for field work in connection with it. I brought students from this course to the Forest on four consecutive week ends.

In the spring we had another round of visiting student groups both from the University in Cambridge and from other schools. Students in a course in the conservation of natural resources given by Prof. Arthur A. Maass in the Department of Government in Cambridge came for a week end. Later we had two groups of students from the New York State College of Forestry at Syracuse. There were about 20 in each of these, coming a week apart and staying for a night and a day each. Also in the spring we had another forestry class from Yale. The largest group from another school that we have ever had came early in June from the University of Maine. There were about 35 of them for a night and a day. This is the first time we have had students from the University of Maine, but I suspect we shall be on their regular schedule in future.

In the latter part of June the Research Advisory Council to the Northeastern Forest Experiment Station held its annual meeting at Amherst, and came to the Harvard Forest for a field trip and luncheon. This was a very welcome group, for it brought here faculty representatives from several forestry schools, as well as a group of industrial and government research executives.

In the current summer we have had a meeting of the principal forest economists who are actively engaged with research in this field for the northeastern states. This was an informal but productive meeting that

went on for four or five days. The alumni of the Forest held a two-day meeting here late in July. This was the third annual meeting of the alumni, and we hope that the series will continue.

In addition to the groups already mentioned there have been many representing primary and secondary schools in the general vicinity of Petersham. Many of these have come under the auspices of the Audubon Society's school training program which centers at Cook's Canyon in Barre. Not only have the visitors from Cook's Canyon involved school children, but also groups of nature study teachers who come to the Cook's Canyon sanctuary for special training.

In the late spring we also gave what assistance we could in the formulation of the current summer's program at the F. Harold Daniels School of Forestry and Conservation in the town of Rutland. This school is operated by the Worcester Museum of Natural History. The men chosen to operate it this summer were sent here to the Forest for three days, during which time we gave them a sort of short course of training in the local forest scene.

Instruction

Our program of instruction, as usual, is difficult to describe and classify. A great deal of it is by way of demonstration to visitors. We have had during the year two regular students who are candidates for the master's degree in forestry. They have been in residence since June of last year, and are just now in the process of finishing theses describing their individual research problems. The three students who were here last year are all continuing at Harvard as candidates for the doctorate in biology. Two of them will remain in residence in Cambridge for the coming academic year, while the third finished his residence requirement in June and has taken a teaching position in the School of Forestry at the University of Massachusetts. While there he will continue to work on his thesis. Two men have received their doctor's degrees in biology during the past year with their research concentrated in the field of forestry. One is Dr. Wang Chi-Wu who wrote his dissertation on the Forest Vegetation of Eastern Asia, and the other is Dr. Earl E. Smith who wrote his on the Forest Resources of Cuba.

I wish to call attention to what appears to be a significant trend in our academic training program. Until the past few years by far the commonest program for the individual student was to come for one year, take a master's degree in forestry and go immediately into professional work. Within the past five years the greater proportion of our students have continued at Harvard as candidates for the doctorate in biology with emphasis upon forestry research. With one exception, all of those who have been here during the past three years have done so. We do not know whether this trend will continue, but we are inclined to encourage men to go on for more advanced training if they can do it. During the past five years we have raised our standards of admission so that all those selected will be acceptable for a more advanced degree in the Graduate School of Arts and Sciences should they wish to continue.

In the coming year we shall have one new resident student. Out of eight or ten applications received in the spring only three were acceptable under our standards. Two of them were later attracted to other schools. The one who is coming was awarded our United Fruit Company Fellowship in Tropical Forestry. He was very carefully selected as a candidate for the doctorate, and comes from the New York State College of Forestry. He began his work in June, when he went immediately for a summer trip to Cuba and Honduras. He will return here in September where he will remain in residence for about a year. After that he will return to the tropics for approximately two years.

Collaboration with Other Institutions

Our collaborative work with other institutions continues in much the same manner that it has in past years. We continue to give office space in our building to the federal forest service for use in its forest survey operations in this part of New England. There have been four men here in that work during the past summer, and two men throughout the year. We expect this to continue for at least another year.

Work by the U. S. Geological Survey on the Athol Quadrangle, which was begun last summer, was continued this year. It was originally designed to be done in two years, but it looks now as though at least one additional summer will be necessary. We have supplied housing for Dr. Donald F. Eschman who is engaged in this work, and have given him what other assistance we could. Dr. Goodlett of our staff has spent most of the past summer working with him in the field.

The Harvard Conference on Forest Production

For the past two or three years we have been considering setting up, for professional foresters, a conference that would meet here for a short period during which there could be round table discussion of mutual problems. This project has gradually taken form, and we are putting it into operation this year. It is scheduled to occupy the last two weeks of October. It is admittedly something of an experiment, but our experience of the last few years has led us to believe that it will be a worthwhile venture. At one time we considered calling it a "short course," but decided to avoid all semblance of formal teaching. It is to be called the Harvard Conference on Forest Production, and is being designed as an informal gathering, in a research atmosphere, of young to middle-aged practicing foresters who have already had some years of professional experience. Those who are coming will form a fairly representative cross section of the profession. The largest number, proportionately, will come from the industries, but there will be a few from the government services. There will be one representing a school, which was unexpected because the schools will be in session at the time of the Conference. Regionally also the members will be representative. We shall have men from Maine, New Hampshire, Massachusetts, Wisconsin, Washington, Georgia, South Carolina, and West Virginia.

Research Program

I shall not attempt a review of all our research activities, but merely try to bring you up to date with current progress. Our work on forest soils, begun several years ago in our efforts to use and evaluate our forest soils maps, continues to grow both in volume and significance. Dr. Goodlett has continued his work on the physical characteristics of our deeper soil profiles, on his studies of the effect of frost in the soils, and on a general review of all the soils research that has been done here in past years. He recently read a paper at the Northeastern Forest Soils Conference held at the University of Maine in which he gave an evaluation of our soils maps in terms of recent studies. Mr. Stephens has continued the investigation of his small plot of forest land in Compartment VI of the Tom Swamp Tract. On the occasion of the Friends' Meeting in 1952 he gave a demonstration of what he had done up to that time, and his progress since then has yielded a vast amount of new information, and has given rise to a great deal of new thinking. Dr. Gould received a research grant during the past year from the Committee on Research in the Social Sciences at Harvard, and with it is undertaking an investigation of forest cutting practices in New England, particularly as regards the purposes and motivations of these cutting practices. Also during the year he has continued his collaboration with Dr. Solon Barraclough of the U. S. Forest Service in a searching review of the materials actually available to foresters and forest owners whereby they can make predictions in forest production. The manuscript of their report is now nearly finished and will be published, we hope during the coming fall or winter, as a bulletin from the Harvard Forest. Mr. Potter, since coming to us last July, has devoted a great deal of his time to the management of our woods operations, and has been highly successful at it. He has also begun a rather elaborate program of research in the effects of pruning, and in the methods of pruning. Dr. Wang, since he finished his thesis in February, has become involved with research having to do with natural variation in some of our common forest trees. This work will make use of materials and ideas not only from the field of forest genetics, but also from forest ecology and taxonomy. Dr. Wang has been getting together material during the spring and summer from localities as far away as central Maine, Cape Breton Island, and our Black Rock Forest in southern New York.

I have only a few remarks to make about our research program in general. They are an outgrowth of my continued effort to understand the actual course of events in the program, and particularly to recognize some of the motivations that are behind it. Most of you are familiar with the Forest's research in its efforts to regenerate the white pine, and in its failure to do this on the uplands within the present or foreseeable economic situation. I have come to look upon the natural phenomenon of the white pine-hardwood sequence as a basic motivating influence in our research. It began to be effective when the realization of it dawned upon the people here at the Forest during the early 1920's. A large part of our work since that time, perhaps most of it, has been related in one way or another to our efforts to understand this phenomenon, in the hope that an understanding of it would lead to some measure of control. The major part of our soils research during the past 30 years has been entangled

with it, and most of the impulses that led to our land-use research grew out of it. Our 30-year progress report, published in 1947, shows clearly to what extent the phenomenon overshadowed all of the Forest's work.

I am now suggesting that another and quite different natural phenomenon bids fair to influence our research for some time to come. This was the hurricane of 1938. In the 15 years since the hurricane much theorizing has been done as to its effects upon the forests and the forest economy. I think, however, that the shock of the event itself was so great that it prevented a clear view of the long-term results. Only now, with our increasing consciousness of the biological, economic and social aspects of forest production, and with our recent research upon the actual effects of the wind upon the trees themselves and upon the long-term development of both the forests and the soils, are we beginning to see the full implications of what happened. We are perhaps still too close to the event fully to realize it.

It has become very clear that large parts of the forests of this region have been blown down repeatedly during the past few hundred years. The evidence for this is in the historical records of great storms, but more particularly in the woods themselves. The blowdowns have destroyed the forests and have at the same time stirred the soils by the uprooting of the trees. The recent research of Dr. Goodlett in Pennsylvania and of Mr. Stephens here in Petersham thoroughly documents this history. The effective winds have been of various kinds. Some, like the recent tornado, have been effective locally, while probably the most significant have been the great hurricanes of tropical origin. How far we shall be able to generalize with the concept as a whole we do not know. But there is abundant evidence of major blowdowns throughout most of the eastern part of the deciduous forest region of North America, extending from the Ozarks and the southern Appalachians to Cape Breton Island. There certainly are differing intensities of the effects over so large a region, but what these differences will be is yet to be discovered. A basic concept arising from our studies -- a concept that we believe to have far-reaching significance for long-range planning in the development and use of forests -- is that the forests and the soils on which they grow are relatively unstable things, and that any long-term plan based upon long-continued stability is unrealistic. This idea, it seems to me, opens up a vast new field in the study of forest production.

Hugh M. Raup
Director

HARVARD FOREST
HARVARD UNIVERSITY
Petersham, Massachusetts



20 November 1954

To the Friends of the Harvard Forest:

The enclosed report on the Harvard Forest was prepared on the occasion of the annual Field Day which was held on Saturday, September 11, 1954. It covers the activities at the Forest in the year September 1953 to September 1954. Only a few were present for the Field Day because a conflict developed between this annual event and one of our several hurricanes.

The consistent interest in the activities of the institution on the part of the Friends of the Harvard Forest, and their continuing generosity, are greatly appreciated. Annual gifts from the Friends during the past few years have greatly facilitated our work, and we hope that you will continue to provide them. I wish to call your attention particularly to the last two pages of the enclosed report, for in them I have outlined a particular need for which the Forest requires additional funds. These funds would be for publication of our research papers, and I have proposed that at least in the next few years gifts from the Friends should be allocated specifically for this purpose.

Sincerely yours,

Hugh M. Raup
Director

REPORT TO THE FRIENDS OF THE HARVARD FOREST, 1954

Staff

The personnel of the Harvard Forest staff, with one exception, has remained unchanged during the year. Beginning July 1, Dr. Wang Chi-Wu, who had served full time as Research Associate on the Forest payroll, was transferred to a joint appointment involving the Harvard Forest and the Cabot Foundation, his salary to be divided equally between these two institutions. However, in August Dr. Wang left the Forest to take a position for a year as Assistant Professor of Forestry at the University of Florida.

Buildings and Equipment

The Winsor House, a dwelling in Petersham that was given to the University for the benefit of the Harvard Forest in January of 1953, was sold in April of 1954. Part of the net proceeds from this sale has been put into capital, to form the Winsor Fund, and the remainder is to be used for improvements at the Higginson House.

The Higginson House, located in the village of Petersham, has been subdivided so as to allow the installation of four housekeeping apartments. Three of these apartments have been made usable, while the fourth still requires some alterations. None of these apartments has been livable in the winter, for the old heating plant was totally inadequate. It became clear during the spring of 1954 that we would need winter living space in at least two of these apartments, and we have therefore had installed a hot water heating system which will burn oil as fuel. This heating plant will serve the two central apartments, with a boiler sufficiently large to supply the south apartment when the latter is completed. We have decided for the time being to make no attempt to heat the apartment in the west wing of the house, but to keep it for summer occupancy.

The only new construction undertaken during the past year was a lath house for seedbed and nursery stock. This was put up in the field north of the Community House. It was made from materials turned out in our own sawmill, and was constructed by our woods crew. Its immediate purpose is to serve some experimental work, but in the long run it will be the site for the production of growing stock that may be needed for plantations.

The largest single addition to equipment during the year was a new bulldozer purchased for use in our woods operations. Need for it was brought to a head in the clean-up work which arose after the tornado of June, 1953. During the year the Forest also acquired an additional chain saw.

Woods Operations

The principal operations of the woods crew during the fall and winter were in certain experimental plots laid out for a cooperative research program with the Bureau of Entomology and Plant Quarantine. This program is concerned with the study and control of the white pine weevil which is the most damaging pest affecting the white pine in this region. The portion of the experiment allotted to the Harvard Forest, other than the use of the land, was the woods labor involved. Further account of this experiment will be found in another part of the present report.

Other than routine maintenance and the construction of the lath house previously mentioned, the woods crew found time in the spring and early summer to continue the tornado salvage in Compartments VII and VIII of the Slab City Tract. Most of the damage there was to miscellaneous hardwood stands of poor form and quality which had been decimated in the hurricane of 1938. The principal product of these operations will be cordwood for fuel.

It is of note that this year shows another sizable increase in the financial returns from the sale of wood products. Cash sales amounted to \$6024, and the value of materials used in the forest itself came to approximately \$2102, making a total of \$8126. During this year we ventured for the first time into the production of railroad ties. Our ordinary salvage and improvement cuttings and thinnings yield a certain number of hardwood logs sufficiently large to make ties and at the same time to yield a modest quantity of clear lumber from the sidewood. A market for the sidewood has not yet been found, but the production of ties seems to be a worthwhile undertaking in itself.

Finances

The total budget of the Harvard Forest for the fiscal year was \$77,165. Gifts for immediate use totaled \$9937, of which \$3000 was for a fellowship. These gifts did not quite make up the deficit, but the year ended with the Forest in reasonably good financial condition.

Research

The research program of the Forest continues as in past years. Considerable progress has been made with routine inventory of plantations, especially those of white pine. For three months in the winter we had with us a young Danish forester who came as an American-Scandinavian Foundation trainee. While he was here he measured most of our white pine plantations.

Dr. Ernest M. Gould, Jr. has spent much of the year preparing the final draft of his bulletin on the economics of the management of small farm woodlots. This has been done in collaboration with Dr. Solon L. Barraclough, formerly of the Northeastern Forest Experiment Station. During the spring Dr. Gould began active work on a research project concerned with the individual motivation of woodlot owners who have had cutting done on their lands during the past few years. Financial assistance for this project is in the form of a generous grant from the Federal Reserve Bank of Boston.

Dr. John C. Goodlett spent most of the summer and fall of 1953 working in the field with Dr. Donald F. Eschman of the U. S. Geological Survey. In this period he made large contributions to our knowledge of the distribution of individual species and forest types in the neighborhood of the Harvard Forest. With our steadily increasing knowledge of local site differences, this kind of meticulous mapping work becomes essential for an understanding of our forest-site relationships. Also during the fall, winter and spring Dr. Goodlett continued his studies of soil-frost phenomena, following the behavior of soils under the influence of alternate freezing and thawing from day to day and from week to week. In the spring of 1954 he was appointed a collaborator with the U. S. Department of Agriculture, and spent about a month in field work in northeastern Pennsylvania and adjacent New York. Here he was associated with men from the Bureau of the

Soil Survey and the Geological Survey, in mapping forest types in relation to soils and glacial deposits.

Mr. Earl P. Stephens has continued his detailed investigations of a small tract of forest in Compartment VI of the Tom Swamp Tract. Most of his time has been spent at office work, in the analysis of the vast amount of specific information that he has accumulated.

Mr. Shelley W. Potter, Jr. has carried forward his investigations of pruning. In the summer of 1953 he initiated a series of experiments in the pruning of red pine in our various plantations. These experiments involve the effects of pruning at various intensities, and the effects of different techniques upon the healing of wounds. Much of Mr. Potter's time has been devoted, of course, to the management of our regular woods operations, and to the marketing of such wood products as we have to sell.

Dr. Wang Chi-Wu gave most of his time during the past year to study of ecotypic and racial differentiation among some of our common forest trees. His experiments and observations spread from central Maine to southern New York State. He has made a study of ecotypic differentiation within the limited geographic area of the Harvard Forest, initiated studies of geographic races among the white birches, started experiments in the variation of photoperiodic response in the white birch, and has begun some intra- and interspecific crosses among the birches. In addition to this work he has made a study of the seed origins of red pine in the Harvard Forest plantations.

As noted above, the Forest has undertaken a collaborative research project with the Bureau of Entomology and Plant Quarantine on the control of the white pine weevil. Preliminary experiments in the silvicultural control of the weevil were started here under similar auspices soon after the hurricane of 1938; but they failed, due in large measure to inadequate methods for the control of hardwood sprouts. The recent advent of hormone-like sprays for the control of hardwoods gives promise that more precise control measures are now possible. The experiments recently set up involve two major divisions. First is a study of the biology of the weevil itself -- its habits and development as related to local conditions such as climate, shade, and predators. The second part is designed for the experimental control of stand composition and form as related to the incidence of weeviling.

Four areas of four to five acres each were selected, and carefully described. The areas were selected for their general similarity as nearly as this could be accomplished. All of them contain hardwood stands in which there was a considerable amount of understory pine. One was left untreated as a control, a second was clear-cut of everything but the young pine which had appeared under the hardwood cover, and in a third about half of the hardwood cover was removed. In the fourth the larger hardwood trees were girdled, and all hardwood seedling and sprout growth was given a treatment with basal spray. The stumps were also sprayed in the clear-cut and partially-cut areas. Site variation in the Forest, particularly with regard to soils, is so great that truly comparable areas cannot be found. All results will have to be interpreted in light of these differences. The experiment as it now stands is expected to run for at least five years.

The work of Dr. Donald F. Eschman on the geology of the Athol Quadrangle continued during the summer of 1953, and was carried forward again in the summer of

1954. The Forest's contribution to the project, which is sponsored entirely by the U. S. Geological Survey, has been in providing housing for Dr. Eschman during the summer, and in giving him what field assistance we could.

In 1939 the Harvard Forest was the scene of an experimental soils mapping project carried on by the Bureau of Soil Survey of the Department of Agriculture. It was decided at that time to map an experimental forest in considerable detail, using the standard criteria in use by the Bureau of Soils for agricultural purposes. Following this, an effort was to be made to evaluate the map so constructed for use in silviculture. The maps of the Harvard Forest soils were completed in 1941, and have been in use here since that time. As planned, determined efforts have been made to use them in the mapping and evaluation of forest sites. The net results of these studies show that for most of the well- to moderately-drained soil series, the correlation between the distribution and behavior of forest types and the soils as mapped is not good. As a result of our work here, and following a conference held at the Forest in July, the Bureau of the Soil Survey has proposed that it undertake a reexamination of at least a part of the Harvard Forest soils. The present plan calls for very detailed studies of areas to be selected on the basis of the magnitude of the problems they present. Work probably will not be begun on this project until a year from this autumn.

Instruction

Two students who came to us in the summer of 1952 finished their residence and thesis requirements for the master's degree in September of 1953. One of these immediately took up study in Cambridge to complete residence for the doctorate in biology. The other took a job for a year, and has now returned to Harvard for more advanced study. One student was in residence throughout the year. He is the recipient of our United Fruit Company Fellowship in Tropical Forestry. After spending the summer of 1953 on a trip to Cuba and Honduras, he came to us in September to remain for a year. During this time he has been treated as one of our regular graduate students, and has prepared a thesis for the degree of Master in Forestry. The plan is for him to remain at Petersham until the late fall of 1954, and then to go back to the tropics. Two new students arrived at the Forest in June of 1954 to begin their fifteen months residence for the master's degree.

The use of the Forest's facilities for short-term instruction of students from other parts of the University continues to grow and to assume greater significance. A group of ten students from the Graduate School of Public Administration came to us about mid-September for ten days of "indoctrination" prior to their regular studies in Cambridge. They were the Conservation Fellows drawn from various government agencies throughout the country, and were in general charge of Dr. Ayers Brinser. After several days of intensive demonstration at the Forest they were taken on a four-day field trip in northern New England. This is a program that we have been developing during the past few years, and plans are made for its continuance in the fall of 1954.

Other groups from the University in Cambridge have also continued to use the Forest. Most of them are from the Department of Biology, but some are from other departments. In the summer of 1954 we have a graduate student in zoology in residence at the Forest for field studies. This is a use of the Forest which I wish to encourage, and I hope that it may be repeated in future.

Students from other schools also continue to have the Harvard Forest on their regular schedules of spring and autumn field trips. During the year we have had groups from Yale, the universities of Maine and of Massachusetts, and from the New York State College of Forestry. In addition we have had a great many visitors who have come for demonstration of our work.

Harvard Conference on Forest Production

In the fall of 1953 we held at the Forest a conference devoted to the problems of the use of the land for the production of wood. Fifteen professional foresters attended the conference, which occupied the last two weeks of October. These men came from various parts of the country -- the Northeast, the Lake States, the South and the Northwest Coast. Ten of them represented the wood-using industries, primarily in pulp and paper production. One came from a university, two from the Northeastern Forest Experiment Station of the U. S. Forest Service, one from the Massachusetts Department of Conservation, and one from the New Hampshire Forest Extension Service.

The theme of the conference was "Forestry in Transition." It proposed that forestry is at the beginning of a period of change from complete dependence upon the harvesting of wild stands to the growth of forests through various kinds of management. Throughout most of the conference the base of operations was of course the Harvard Forest itself, but at no time was the Forest used except as a point of departure for discussion. Its own experiments in silviculture were looked upon as a case history in the kind of research that will be necessary if the transition is to be accomplished equitably. Also throughout the conference both biological and economic problems were considered together.

Although the Forest had been experimenting with this use of its facilities, the Conference of 1953 was the first on such a large scale. It was not considered as a "course of study," but rather as a situation in which mutual problems could be discussed. It carried no academic credit, and only enough charges were made to cover the direct cost to the Forest.

Relations with the Town of Petersham

During my directorship of the Forest I have given considerable thought to the relationship of the University to the town of Petersham. Technically we are a tax-free institution, owning some 2300 acres of land, most of which is in the township, and maintaining a large installation of buildings and equipment in the town. I have thought it of some interest to calculate what our existence here probably means to the social and economic structure of the town.

Some 39 persons, including children, living in the town draw the major part of their living costs from the Forest, and about ten other persons some fraction of their income. Of our total Forest budget approximately half goes into salaries and wages paid to people who live in Petersham. A very considerable part of our building maintenance is done by town residents, perhaps in the amount of about \$1500 a year.

Although we are and have always been a tax-free institution, the Forest has over the past 40 years or so made an annual financial contribution to the town. This now amounts to \$900 a year, and is allocated by the town for work on its roads.

I believe that our relations with the town are reasonably cordial and effective. We have working arrangements whereby road work that cannot be done with our equipment is done with town equipment at low cost to us. In return, whenever our men and equipment can be useful for minor projects that the town undertakes, we do not hesitate to lend equipment, and, within reasonable limits, the time of our men.

Publications

The regular publications from the Harvard Forest, its "Bulletin" and the "Harvard Forest Papers," have been few since before the war. Since I became director in 1946 I have made no attempt to "force" the publication of research papers, preferring to allow such things to develop slowly as our staff and students produced material for them. Since 1946 three Papers and two Bulletins have been published, but all of these except one bulletin were based upon research done prior to the war. The one based upon later research is that of Mr. Benjamin B. Stout on "Species Distribution and Soils in the Harvard Forest" (Bulletin No. 24).

Material for publication is now beginning to accumulate rapidly, and we attach first importance to getting it into print and distributed so that it can be used. Needless to say the problem of financing has become acute. The budgeting of funds for publications was for many years no serious difficulty for the Forest because Dr. E. G. Stillman personally financed them. Consequently, there has not been a large "traditional" item for publication in our budget.

We have, currently, two Harvard Forest Bulletins in press. They are now in proof, and should be issued during the fall. One is by Dr. Goodlett, and deals with research carried on by him in collaboration with the U. S. Geological Survey and the Bureau of Soil Survey in Potter County, Pennsylvania. It deals with the distribution of forests as related to soils, rock formations, land-use history, and stand history in that region. This will come out as Bulletin No. 25. Bulletin No. 26 will be an "Economic Analysis of Farm Forest Operating Units." It was prepared by Dr. E. M. Gould, Jr. and Dr. Solon L. Barraclough. The research for this paper was financed jointly by the Northeastern Forest Experiment Station, the Committee on Research in the Social Sciences at Harvard, and the Harvard Forest. The cost of its publication will be met jointly by the Forest and the Committee on Research in the Social Sciences.

Another publication which has been closely related to the Forest's work is a paper on "The Forests of Cuba." This has been printed under the auspices of the Maria Moors Cabot Foundation as its Publication No. 2. Both the research and the publication have been supported jointly by the Cabot Foundation, the Harvard Forest, and the Atkins Garden and Research Laboratory in Cuba.

There are three manuscripts on hand that should be published under the auspices of the Harvard Forest as soon as possible. One of these is the second part of our Thirty-Year Progress Report. It deals with four case histories in Compartment IX of the Tom Swamp Tract, the so-called Adams-Fay Lot. It has been prepared by A. C. Cline and R. J. Lutz, and is essentially ready for the printer. We have had this manuscript on hand for a year or two, and during that time it has been critically read not only by our staff but by others particularly interested in the culture of white pine.

A second paper of some magnitude has been prepared by Dr. Herbert H. Rasche on "Temperature Differences in Harvard Forest and Their Significance." This paper is of great value to us in our silvicultural research, and no doubt will continue to be for many years. Research for it was done at the Forest in 1947 and 1948 while Dr. Rasche was a graduate student at Harvard. It was done under the auspices of the Research and Development Division of the Army Quartermaster Corps, in which Dr. Rasche was and is an officer.

A third manuscript is a short one by Mr. William H. Hatheway. It is on "The Influence of Soil Moisture on Site in Tom Swamp I." This paper is Mr. Hatheway's thesis, presented when he was a candidate for a master's degree at the Forest. It is an excellent piece of work, and is an important link in our recent soils research. It would be suitable for publication as one of our shorter "Papers."

The preceding three papers are ready or nearly ready for printing. A fourth is by Mr. Benjamin B. Stout and deals with his studies of tree root structure in the Black Rock Forest. This should, of course, be published from the Harvard Black Rock Forest rather than from the Harvard Forest at Petersham. Current research will yield before many months another large paper which should be published as soon as it is finished. This will be the work of Mr. Earl P. Stephens of our staff on his detailed studies of forest history.

In our use of the Forest for demonstration and for conferences on silvicultural problems we have found that one of our most valuable assets is our ability to present actual case histories of forest stands. These cases are derived from our accumulating records and from other historical studies. The nucleus for them was in the first part of the Thirty-Year Progress Report, but we have developed many more since that was written, and have brought some of the earlier ones up to date. We have about 36 of these case histories currently in use, all of them in mimeograph form for distribution to people who come for demonstrations. The unit cost of such "temporary" publications is not great, but in the aggregate they make a sizable charge which can be counted upon to increase.

All of this makes it clear that the Harvard Forest will have to allocate more funds for publication in future than it has in the past. Such allocation, within our present financial structure, can be done only at the expense of our research program itself. I am hesitant to use this method, and would prefer to find new funds if this is at all possible.

Responses to the appeal for funds sent to the Friends of the Forest each year have always been generous. They have totaled, annually, between \$1700 and \$2000. The amount budgeted in the current fiscal year for publication is \$2300, though in view of the manuscript we now have on hand or in prospect for the near future, this sum should be considerably increased. In past years annual gifts from the Friends have been put into general funds and used for various purposes. I have proposed recently that gifts from the Friends, at least in the next few years, be designated specifically as a publication fund. I have proposed further that suitable acknowledgment of the source of the fund, the "Friends of the Harvard Forest," be made in the publications themselves. The Forest will appreciate it greatly if the Friends will make a special effort to make such a fund adequate to our needs.

Hugh M. Raup
Director

HARVARD FOREST
HARVARD UNIVERSITY
Petersham, Massachusetts



22 November 1955

To the Friends of the Harvard Forest:

The enclosed report on the affairs of the Harvard Forest covers the year September 1954 to September 1955. It was presented verbally to those of you who attended the annual field day held at the Forest on September 9.

The continued generous support of the Forest by its Friends is a source of inspiration to all of us who share the responsibility for the maintenance and operation of the institution. I trust that it will continue in future years. The appended report will at best give only an outline of the Forest's activities in the past year. A much better view of them can be had from personal visits, and I hope that you consider yourselves welcome here at any time during the year.

Sincerely yours,

Hugh M. Raup
Director

REPORT TO THE FRIENDS OF THE HARVARD FOREST, 1955

Staff

The staff of the Harvard Forest has been variously altered during the year, with two resignations and one advance in position. Dr. Wang Chi-Wu, who was serving as Research Associate, left the Forest in August of 1954 to take a position as Interim Assistant Professor of Forest Genetics at the University of Florida. Part of Dr. Wang's research program in the occurrence and distribution of the races of eastern forest trees is being continued, and he returned to the Forest for two weeks in the spring of 1955 to care for it. Mr. Earl P. Stephens, who had been on our staff for several years as Research Associate, and at the same time had been completing a dissertation for his doctorate in Biology, resigned in June of 1955 to take a position in forestry teaching and research at the Ohio Agricultural Experiment Station at Wooster, Ohio. Dr. John C. Goodlett, who has been serving since 1951 as Research Associate, was voted a five-year appointment as Forest Geographer at the Harvard Forest and Lecturer in Forest Biology, effective July 1, 1955.

Two other changes in the personnel at the Harvard Forest should be mentioned. Dr. Scott S. Pauley, employed since 1947 by the Forest and the Cabot Foundation, and stationed at the Harvard Forest, resigned in June of 1955 to take a position in the School of Forestry at the University of Minnesota. In July of 1954 came Dr. Martin Zimmermann, formerly of the Department of General Botany at the Swiss Federal Institute of Technology, Zurich. Dr. Zimmermann is employed by the Cabot Foundation, with the titles of Tree Physiologist and Lecturer in Biology. He is stationed here and has the use of our laboratory and other facilities for his chosen research.

Woods Operations

Woods operations, with one exception, were much as in the preceding year. Cordwood sales showed an increase of about 50 cords. The cut of railroad ties was about twice that of the year 1953-54, and appears to be a profitable venture. It is being made possible by the slow but steady increment in our comparatively young stands of hardwood. Sidewood from the ties, though of high quality, is of necessity in small dimensions. Even so, we have managed to sell it to the furniture industry at a good price. In addition to ties and cordwood there has been a certain amount of white pine that has been turned into lumber at our mill and partially disposed of. Some of this has gone into the furniture industry, but the larger proportion has gone into wooden boxes. The market outlet for box-board lumber declined during the winter, but began to come back in late spring. This left us with a considerable inventory in this class of material at the end of our fiscal year.

Most of the woods operations in the Harvard Forest during the year consisted of salvage and improvement cuttings, and were located in Compartments VII and VIII of the Slab City Tract, in Compartment VII of the Tom Swamp Tract, and to a small extent in Compartment IV of the Tom Swamp Tract. In the first of these the operations finished the clean-up of damage done by the tornado of June 9, 1953.

The exception mentioned above is concerned with operations in our Matthews Plantations in the town of Hamilton, Massachusetts. These plantations are on land bequeathed to the University in 1929. They consist mainly of miscellaneous stands of coniferous trees, both native and exotic. During the past few years little has been necessary except to give them time to grow. However, some of them are beginning to need thinning. The hurricanes of the late summer of 1954 did considerable damage to the area, and it became necessary to clean out wind-thrown or damaged trees. To do this I engaged the services of Mr. Fred Hunt, a young forester who has developed a business of the thinning and improvement of plantations. In addition to the clean-up and salvage, Mr. Hunt did some of the necessary thinning. A certain amount of this thinning had been done prior to the hurricane under the guidance of our staff, and under the supervision of Mr. Standish Bradford who resides in the vicinity. Funds to support all of these operations have come from the accumulated income of a small endowment bequeathed to the University for the support of the plantations.

In the course of the salvage and improvement work, a considerable amount of mature white pine scattered in various places on the land was cut. Due to widespread damage by the hurricanes in this region, local markets for pine logs were glutted. Consequently, the logs were hauled to our mill at the Harvard Forest and there sawed into lumber. This has added considerably to our inventory, and will be disposed of during the coming year. Income from it will be divided between the Harvard Forest and the Matthews Plantation Fund.

Finances

The total operating budget for 1954-55 was \$91,758. Gifts for immediate use totaled \$10,901. With endowment income, sales, rental income, the above gifts, and the use of income and gifts not spent in previous years, the Forest closed the year without a deficit.

Visitors

Visitors to the Forest continue to be numerous, many of them coming for demonstrations of one kind or another. A small meeting of alumni was held for two days in July of 1954. The annual field day for the Friends of the Harvard Forest, scheduled early in September, was poorly attended because it coincided with one of the hurricanes.

Instruction

Two new students were in residence during the year, beginning in mid-June of 1954, and two new ones were accepted in June of 1955. The two in residence during the year, in addition to carrying on their work at the Forest, commuted to Cambridge two or three times a week to attend classes there. This is the first time in many years that such an arrangement has been made, and it appears to have been successful. Improvement in roads and transportation, particularly within the last two or three years, has greatly facilitated commuting. I gave my regular course at the Biological Laboratories in Cambridge during the fall and early winter of 1954-55, and accomplished it entirely by driving in to Cambridge on two or three days a week. I believe that these developments have considerable significance, for they illustrate the gradual dissolution of the geographic isolation that has always troubled the Forest in its relations with the University in Cambridge.

The holder of our United Fruit Company Fellowship in Tropical Forestry, Mr. Thomas H. Schubert, left in November, 1954, to spend a period of approximately two years in the tropics. Most of his work is on the Fruit Company's lands in Honduras, and thus far has been concentrated upon the culture of teak.

Visiting classes from the University in Cambridge and from other schools have made extensive use of the Forest during the year. In September of 1954 eight Conservation Fellows from the Graduate School of Public Administration came here for a few days of demonstration prior to registration. In addition to their visit here, they were given long field trips in northeastern New York state and in New England. The Harvard Forest staff and students collaborated in this program, which covered, in all, a period of about ten days. Plans are made to repeat it in the fall of 1955. During the autumn I used the Forest for two week-end field trips of my class in plant geography. Also in the autumn came a class in land-use economics, and one in general ecology from the University in Cambridge. In November we had a class from the Yale School of Forestry.

The heaviest concentration of visiting students came, as usual, in the spring. During the month of May and the first ten days of June about 150 students were given demonstrations at the Forest. Most of them were here for at least a day and a night. They came from classes in our own university and from the forestry schools of Yale, the University of Maine, and the New York State University.

A second Harvard Conference on Forest Production was held here between October 10 and 23, 1954. Fifteen practicing foresters came for field demonstrations and discussion of mutual problems. They came from the eastern half of the United States wherein they represented the principal forest regions. Further, they formed a good representation of the profession of forestry, coming from the universities, the industries, state and federal services, and from private consulting agencies. This conference, as did

that of 1953, appeared to be successful, and we look forward to making it an annual event. Our entire staff and student group has taken part in it, and in addition to stating problems of widespread interest to everyone, it has been extremely stimulating to our own people.

Research

Dr. Ernest M. Gould, Jr. has continued his research on the economics of small woodlot management in New England. He spent a considerable part of the year collecting and analyzing information derived from a number of sources on the motivation for woods operations in these small holdings. This study was financed in part by a grant of funds from the Federal Reserve Bank of Boston. In the spring and early summer of 1955 Dr. Gould became involved in a further project along these lines in New Hampshire. For this project the Harvard Forest has entered into collaboration with the Cooperative Extension Service in New Hampshire, the Northeastern Forest Experiment Station, the Federal Reserve Bank of Boston, and the Soil Conservation Service. Initial funds for it are coming from the Sears, Roebuck Foundation. The program involves some 50 case studies of pilot farm forest operating units, scattered throughout the state of New Hampshire. The study is designed to extend over a five-year period.

Dr. John C. Goodlett spent the winter writing up his field work of the preceding two years. Part of this covered his work on frost phenomena in the Harvard Forest soils, and part of it his studies in eastern Pennsylvania made during the summer of 1954. In the latter work he served as a collaborator with the U. S. Department of Agriculture, operating in company with a geologist and a soil scientist. Results of this work will be published by the Bureau of the Soil Survey or the Geological Survey. In the spring of 1955 he entered into collaboration with the U. S. Geological Survey in western Virginia, spending several weeks in the field there in company with Dr. John T. Hack of the Survey.

Mr. Earl P. Stephens finished his doctoral dissertation in June of 1955, based upon work carried on during the past three and a half years in Compartment VI of the Tom Swamp Tract. This thesis brings together and correlates a large amount of field observation on the history and development of a specific forest stand. It is, I believe, a unique contribution, and we plan to publish it as a Harvard Forest Paper in the near future.

Mr. Shelley W. Potter, Jr. has continued his research on the pruning of red pine in our plantations. This work was started about two years ago, and has required time for the results of various kinds of pruning to be apparent. Mr. Potter has also continued to supervise our woods operations and to handle the marketing of our wood products.

The collaborative research project with the Bureau of Entomology and Plant Quarantine on the silvicultural control of the white pine weevil continues. Personnel from the Bureau have visited the study areas from time

to time, keeping records of infestation and the general behavior of the young pines and the insects under the varying treatments that were given them at the beginning.

In the summer of 1954 we continued to give assistance to Dr. Donald F. Eschman of the U. S. Geological Survey in his work on the Athol Quadrangle. He has used Harvard Forest living quarters, and such field assistance as we could give. He returned in June of 1955 for a final summer on the project.

Staff and students at the Forest continue to work out case histories for specific stands that have been under management for many years. This is part of a general program to get into succinct and usable form the information that has been accumulating here since 1908. Only in rare instances do the cases summarize complete research. Rather they are reports of progress to date; and even though incomplete, they begin to show useful results. Further, they facilitate the planning of future operations in our long-term research program.

Publications

Two Harvard Forest bulletins have been published during the past year. The first of these is by Dr. John C. Goodlett on "Vegetation Adjacent to the Border of the Wisconsin Drift in Potter County, Pennsylvania," and the second is by Dr. Ernest M. Gould, Jr. and Dr. Solon Barraclough on "Economic Analysis of Farm Forest Operating Units." Another publication, by Earl P. Stephens, is on "Research in the Biological Aspects of Forest Production." It appeared in the JOURNAL OF FORESTRY for March, 1955.

Hugh M. Raup
Director

HARVARD UNIVERSITY
HARVARD FOREST
PETERSHAM, MASSACHUSETTS



December 22, 1961

To the Friends of the Harvard Forest:

Attached to this letter is a report on the affairs of the Harvard Forest for the year ending in mid-September, 1961. It is essentially the same report that I gave orally to those of you who were present at the Annual Field Day on September 16th.

I should like to suggest the desirability of adding new members to our list of Friends of the Harvard Forest. An excellent way to do this would be for each of you to send me the name and address of at least one person whom you know, and whom you would like to recommend. May I ask you to do so?

Your continued support of the Forest is much appreciated, I can assure you. Please feel free to visit us at any time, and if you have questions about the Institution I shall do what I can to answer them.

Sincerely yours,

A handwritten signature in cursive script that reads 'Hugh M. Raup'.

Hugh M. Raup, Director

Staff

The technical staff of the Forest has remained unchanged during the year 1960-61. It consists of Mr. Walter H. Lyford, Soil Scientist; Dr. Ernest M. Gould, Jr., Forest Economist; Dr. William F. Murison, Forest Biologist; Mr. Jack J. Karnig, Forest Manager for both the Harvard and Black Rock Forests; and myself. Dr. Gould was away on leave of absence after September 1, 1960, and returned about mid-September of this year. Mrs. Marion S. Hambleton has continued as secretary, and Mrs. Dorothy B. Waid has worked about half time in the library except during the summer. Miss Elizabeth Carpenter, our business secretary and librarian, retired at the end of the fiscal year, June 30, 1961, after 37 years of continuous service to the University. Finding a replacement for Miss Carpenter was not easy, but we believe we have found her in Miss Barbara M. Kelley who came to us August 21. Mr. Charles F. Upham remains our excellent superintendent of woods operations.

An event of major significance in the staff structure of the Forest has occurred during the past year. Our staff has always had to be content with short-term appointments, at most five years in length. This has been due first to the fact that the financial resources of the Forest were not sufficient for many years to support permanent appointments; and second to the fact that the research staff and the research program of the institution have been in a formative stage in recent years when more adequate funds were available. This situation, however, could not be expected to continue, for it would be necessary to offer permanence to first-class men if and when they appeared. Such an instance came up during the past year, and our Forest Economist, Dr. Gould, has been given an appointment without limit of time beginning in September 1961.

Woods Operations and Building Improvements

All of our woods operations of the past year were highly conditioned in one way or another by the severity of the winter. The first snow came in November, and it began to accumulate in quantity about the second week of December. The snow remained at varying depths in the woods until the first week in May. Woods operations were greatly hampered by several severe storms, so that a great deal of time and labor had to be expended merely in snow removal around the Forest buildings and in retrieving cordwood that had been stacked in the forest. The depth of snow accumulation in the woods was such as to prevent almost entirely any extensive woods operations. With the snow, for short periods in January and February, came extremely cold weather, with temperatures exceeding 20 below zero.

In spite of these difficult conditions two operations were successfully accomplished. One of these was the result of the sudden appearance of a market for red pine poles and posts, particularly poles, a large proportion of which are used in the building of barns. The poles and posts are cut as thinnings in our red pine plantations, and are sold to the Koppers Company in Nashua, New Hampshire. This market is particularly advantageous to us because it allows us to sell trees which are too small for most uses. Furthermore, with the current ravages of the root rot disease in the red pine plantations, caused by Fomes annosus, we are able to realize something on trees that would almost certainly be lost anyway. The market has some disadvantages. It is subject to drastic fluctuations that are apt to occur rather suddenly. We dare not accumulate an inventory of poles to supply future demands, for we find that red pine in this form will not store for longer than about six months, and in mid-summer for not longer than six weeks. If we are to continue to supply the market, therefore, we must be flexible

enough in our woods operations to start cutting and shipping whenever an order appears. Several of our red pine plantations are quite near the Headquarters buildings, so that it was possible to get into them in March and begin cutting in spite of the deep snow.

The other operation that proved feasible in the heavy snow was along the Prospect Hill Road which runs from the Administration Building through the northerly part of the Prospect Hill Tract and around its northern boundaries. This is a town road which is used a great deal because it forms the principal access to the northern part of our land, and also to the fire tower which is on the top of Prospect Hill. The Town has kept the road itself in reasonably good condition, but the roadsides had gradually so grown up to large trees that it had become almost impossible to make the road usable for trucks if there was much snow in winter. With the enthusiastic permission of the Town Tree Warden, and also that of the only other property owner served by the road, our woods crew thinned out the trees between the roadway and the stone walls, and did a general clearing operation as far as the Petersham-Phillipston town line. Almost six weeks were spent at this work, which netted us 40 cords of fuelwood and something over 2,000 board feet of logs. We believe we have not only improved the usability of the road, but also its appearance.

With the improvement in the weather during the spring, salvage and improvement cuttings were made in Compartments V and VII of the Prospect Hill Tract. These yielded a good volume of wood which has put us well ahead in our cordwood needs for the coming year. Adjacent to the cutting area in Compartment V is one of the oldest plantations in the Forest, established in 1913. It is a row-wise mixture of five species, eastern white pine, Scots pine, western yellow pine, Norway

6.

spruce and Douglas-fir. It was severely damaged by the hurricane of 1938 which left many of the trees bent or partially blown over. Although it is a small plantation (1.6 acres) and now of doubtful significance so far as its original purpose is concerned, because the crew and their equipment were near by it was decided to clean it up. Trees that were too malformed to be of any future value were removed, and complete records were made of each tree of each of the five species that was left.

Improvement in the heating system in our main building, made during the summer of 1960, proved to be highly satisfactory. During the winter we extended the benefits of the conversion to hot water to the library, common room and three of the offices in the north end of the building.

Research

Work on long-term research operations has continued as usual. Measurements were made of a low thinning experiment begun in 1956 in Compartment I of the Tom Swamp Tract and intended to be measured at intervals of five years. In the years immediately following the hurricane of 1938 a number of sample plots were laid out for the study of post-hurricane regeneration. Dr. Murison has relocated all of these sample plots during the year. Although Mr. Lyford has made some general surveys of the soil situation in the Forest, he has concentrated most of his efforts in Compartment I of the Tom Swamp Tract. He had already begun research in a part of this area in the years before he came here as a member of the staff, but has now extended it into study of the soils as related to forest distribution and development in the whole compartment.

Dr. Zimmermann's research on the physiology of trees under the aegis of the Cabot Foundation continues to be a welcome and stimulating part of the work that goes

on at the Harvard Forest. An additional research program supported by the Cabot Foundation is about to begin here. This will be under the direction of Dr. Brayton F. Wilson, Jr. who arrived on the first of September. His research will be concerned with experimental studies on the growth of wood.

During the summer of 1961 we employed three forestry students, one from the University of Oklahoma, one from the University of Massachusetts, and a third from Rutgers University. The work we have for such men as these, though often routine, requires skills and attention to detail for which they are trained. We were fortunate in that all of the men who came this year were excellent. We gave each of them one or two high school boys as field assistants, and Dr. Murison planned and supervised all their operations.

One of the men spent most of his time in the small detached piece of about 45 acres, known as the Schwarz Tract, that we have in the western part of the town. This came to the Forest by bequest in 1928 for the express purpose of developing the esthetic aspects of forest management. A small endowment came with it, the income from which can be used for this purpose only. Careful management plans for the tract were made in the early 1930's, but they came to grief when the hurricane of 1938 thoroughly devastated most of the area. Very little has been done since then except to let the trees grow. This year we decided to carry out at least the beginnings of new plans for realizing the original purpose for which the tract and the endowment were intended. All of the boundaries of the lot were relocated, the lines cut out, and markers painted. A network of trails was opened up so that all the major types of vegetation are now readily accessible, and a parking area was established. About three and one-half acres of woods along Birch Drive, a part of the

8.

tract that was not completely blown down in 1938, were given a "low thinning", so that its present appearance is that of an open stand with some crop trees of high quality in a "free-to-grow" position.

After finishing the work on the Schwarz Tract the crew that operated there moved to a small area lying between Route 122 and Harvard Pond. Prior to 1938 this land had a rather handsome stand of white pine on it, and was a favorite picnic site; but the hurricane destroyed it completely. In subsequent years it has grown up to a dense stand of red oak, white oak, red maple, black oak, and paper and black birch, with small white pine in the understory. Again with esthetic aims in mind, we have tried to treat this stand so that the place will once more be attractive for recreation purposes. It is now open and park-like, with selected trees pruned. A road has been opened in such a way that motorists can drive into and out of it with ease.

A second student spent the entire summer on another detached tract, in the town of Hamilton, Massachusetts, where we have about 60 acres of miscellaneous plantations, most of them exotic conifers. These plantations came to the Forest by bequest in 1929, also with a restricted endowment. The plantations were all quite young at the time they were acquired by the Forest, and although they were carefully surveyed and mapped, little was done to effect any improvement in them. They have suffered some damage from fire and the hurricanes of the early 1940's, and about 1955 we did a certain amount of thinning and salvage cutting there. During the past summer we had our student forester make a thorough review of all the plantations and an evaluation of their present condition. He cleared out the trails that give access to them, reopening many trails that had fallen into disrepair. Toward the end of the summer he found time for a good deal of timber stand

improvement work, much more of which is needed.

The third student worked primarily on thinning, improvement cutting and measurement in plantations on the Prospect Hill Tract here at the Forest. Seven different plantations were given treatments ranging from routine weedings for the removal of hardwoods to the harvesting of red pine poles. A particularly complex project was the weeding, pruning and remeasurement of a Norway spruce provenance experiment that had been established in 1944.

Students and Visitors

No full-time graduate students were in residence during the year 1960-61. One new student arrived, about mid-September of the current year. He is a graduate of the forestry school of the University of Wales.

The Forest and its facilities have a steadily increasing flood of visitors from this country and abroad. During the past year there have been, of course, a great number visiting the museum. We do not know the total number of these, for many do not sign the guest book at the front door. Ordinarily they come and go without our knowing much about it. Those we try to keep track of are the ones with whom we spend time in talking about our research either here in the building or in the woods. In most cases we take people into the woods. In the past year we have spent time with about 330 people. Approximately 20 of these have come as individuals, while the remainder have been in groups ranging from three to many as 40. Some have been here for only a day or half a day, but fully half of them, about 165, have been accommodated for at least one night and some of them for longer. Most of those staying overnight have been supplied with meals. I will not attempt to list the groups of visitors or the places from which they came. We had, as usual, students from the principal forestry schools

10.

of New England, adjacent New York State and New Jersey. Harvard students came from the Department of Biology and the Graduate Schools of Design and Education. There were an unusual number of foreign visitors, largely because of the World Forestry Congress which was held in Seattle in August of 1960. A considerable number of these people lingered on in the United States during the autumn, visiting research and educational institutions. The annual Conference on Forest Production was omitted in the autumn of 1960, but will be reconvened in October of this year.