

**RESEARCH IN
FORESTRY AND
WOOD SCIENCE IN
FINLAND**



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Text: Viljo Holopainen

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RESEARCH IN FORESTRY AND WOOD SCIENCE IN FINLAND

Preface

Forestry education and research in Finland came into being soon after the middle of the 19th century. Their inception at this point in history is not surprising, for there were already, particularly in Western Europe, powerful forces at work that obviously stimulated interest and emphasized the importance of the forest resources even in Finland. We need here to call attention to only a few of them. For example, there was the industrial revolution generating intense economic development, including an especially great increase in building activity (i.e. construction); there was the emergence of a more liberal economic policy which eliminated many high protective tariffs; there was the rapid technical evolution in transport facilities; and there were immense improvements and expansion in saw-milling, followed later by similar developments in other wood-using industries. In Finland, these developments first meant the rapid rise of saw-milling and, later, of other industries depending on wood as the primary raw material. These industries became the dominant export industries, a position that they have retained to this day.

The growth of the wood-using industries and the importance of forest products as export commodities began to awaken public and government authorities to the fact that the forest resource was vital to the economic life of Finland. Coupled with this awareness was the growing concern about the adequacy of the forest resource to sustain the expanding wood-using industries, and the obvious need for steps to protect, improve and maintain the productivity of the woodlands. Thus it came about that the National Board of Forestry was established in Finland in 1851, at first on a temporary basis, but permanently in 1859. Among the provisions of this establishment was the education of foresters and the initiation of forestry research.

This brochure has two major objectives: (a) To trace the history and development of higher forestry education in Finland from its humble beginnings shortly after the middle of the 19th century to its present strength;

and (b) to describe briefly the nature and scope of forestry research as it is reflected in the organization and activity spheres of various institutions, all contributing to the solution of problems in forest production, wood utilization, or both.

Because of the close and continuing interdependence of research and higher education in forestry as in any field, it seems appropriate at the start to outline some highlights in the growth of higher forestry education and its relation to research as it has developed in Finland over the past one hundred years.

It is to be hoped that this booklet can serve our visitors from abroad as a first hand orientation to Finnish forestry research.

April 1970

The Society of Forestry in Finland

STATE INSTITUTIONS

THE FACULTY OF AGRICULTURE AND FORESTRY OF THE UNIVERSITY OF HELSINKI

Initial Phases and Progress of Higher Education in Forestry in Finland

Higher education in forestry in Finland began in 1862 at a school separate from the university; this school was at Evo situated about 120 km north of Helsinki in the midst of a large forest.

The principal task of the school was to educate forest officers in the service of Finnish forestry, but members of the teaching faculty were also able to initiate forest research. In particular, *A. G. Blomqvist*, the most outstanding teacher of the school, strove purposefully to develop forest research. He published a number of papers on results of his studies and wrote a handbook of forest policy. In recognition of his scientific work he received in 1897 the honorary degree of Doctor of Philosophy at the University of Helsinki.

A. G. Blomqvist served as teacher at Evo during 1862—1903, and for the greatest part of this time (1870—1903) was the principal of the school. However, it became increasingly clear as the years went by that the remote location of Evo caused higher education in forestry to suffer numerous disadvantages and hindered its scientific development. As a consequence it was decided in 1907 to move the staff and facilities of the school at Evo to the University of Helsinki, to where higher education in agriculture had been transferred from Mustiala in 1896. The transfer of higher education in agriculture had resulted in the establishment of a special Department of Agriculture in the Faculty of Philosophy in 1902. Forest education was amalgamated with this in 1908. In 1924 the department became the independent Faculty of Agriculture and Forestry.

At the outset two professorships in forestry were founded in this new faculty: one for silviculture, the other for forest mensuration. The first professor of silviculture was *A. K. Cajander* who served with great vigour and distinction from

1911 to 1934. Since, however, in 1918 he was appointed Director-General of the National Board of Forestry, the teaching duties of the professorship on the undergraduate level had to be handled mainly by deputies and assistants. In addition, A. K. Cajander had to fill the professorship of forest mensuration until 1928.

Subsequently the following chairs have been founded: Forest Policy (1923), Logging and Wood Technology (1930), Peatland Forestry (1937, a permanent extraordinary professorship which was converted to a full chair in 1950), Business Economics of Forestry (1947), Logging and Wood Technology (1948—to be held by a professor using the Swedish language), and Forest Products Marketing (1959). Holders of the chairs of Agricultural and Forest Zoology, and of Plant Biology and Plant Pathology also serve as associates in forest education. They devote part of their time to teaching forestry students in their particular subjects and to advising graduate students. The first of these two chairs was founded in 1921 as a permanent extraordinary professorship, but was changed in 1949 to an ordinary Chair of Agricultural and Forest Zoology. The second of the two chairs was also founded in 1921 as a permanent extraordinary chair but changed in 1948 to a full professorship of Plant Biology and Plant Pathology.

To facilitate the practical field training of foresters the position of Forest Officer of the University was founded in 1907. Until 1930 he also taught logging and wood technology. Since then the Forest Officer has been responsible for giving the basic course in silviculture and conducting practical training at the Forest Training Centre of the University.

Immediately after the shifting of higher education in forestry from Evo to the University of Helsinki, a part of the Korkeakoski Forest District was assigned as the regular outdoor laboratory and training grounds for students in silviculture and forest management. Winter training in logging has also been undertaken at Hyytiälä (Korkeakoski) since 1954. Subsequently, this whole Forest District has been dedicated for use as the Forest Training Centre of the University, though it has remained under the control of the National Board of Forestry. The first Forest Officer of the University was Dr. A. *Benj. Helander*.

The buildings of the Forest Training Centre were not ready for occupation until 1912, but training began in 1910 in a temporary manner. For the purpose of teaching forest mensuration and supervising practical field training, an associate chair of Forest Mensuration was founded in 1962. In 1967 the position of associate professor in Logging and Utilization of Forest Products was established to take care of the general course in logging and to supervise and coordinate practical field training on various levels. In addition to the



A stand of pine saplings (*Pinus silvestris*).

offices mentioned already, there are a number of associate professors and other teachers who lecture in different basic and auxiliary subjects.

Studies and Degrees

The most recent stipulation concerning the examination requirements for forestry studies was made in 1968. According to this, successful execution of the required examinations for the Faculty of Agriculture and Forestry entitles the students to the following degrees:

1. Bachelor of Forestry
2. Master of Agriculture and Forestry
3. Licentiate of Agriculture and Forestry
4. Doctor of Agriculture and Forestry

The last degree is not obtained through a separate examination, but is awarded when a licentiate's doctoral dissertation has been published and officially examined and approved.

The forest examination (Bachelor of Forestry) provides the qualification required by a person whose aim is to enter practical forestry, but the examination is usually also taken by persons who intend to enter a research career. According to the requirements now in force the forest examination takes two forms — the General Forest Examination and the Commercial Forest Examination. The former is a qualification for those who undertake the traditional tasks of forestry (forest management, logging, etc.); the latter prepares experts for the marketing of forest products.

There is, however, a certain specialization within the limits of the General Forest Examination. A student is required to include in his forest examination at least four of the following main subjects: business economics of forestry, forest mensuration, forest pathology, logging technology, forest zoology, marketing of forest products, peatland forestry, silviculture, social economics of forestry, and wood technology.

In each of these subjects he may take a course at three different levels. The most intensive is the *laudatur* course, the next the *cum laude* course, and the least intensive is the *approbatur* course. A student is required to pass the *laudatur* course in at least one main subject and also take at least one other main subject to the *cum laude* level. The fulfilment of a *laudatur* course requires not only a wider knowledge of literature compared with the *cum laude* and *approbatur* courses, but also more practical training and the writing of a *laudatur* thesis.

The combination of subjects is chosen by the student in collaboration with the adviser in the student's main subject, but the final program must be approved by the Faculty. Some main subjects can only be studied in combination with certain others. Thus, a student who chooses silviculture as his main subject must also include in his combination of subjects forest mensuration and peatland forestry; the fourth main subject is optional. As a result of this arrangement, specialists can be educated for every branch of forestry and combinations of subjects corresponding to the requirements in every field of activity can be taken. The main subject of the Commercial Forest Examination is the marketing of forest products.

With Faculty permission a student may select a fourth major subject outside the Faculty of Agriculture and Forestry. For example, he may choose a suitable complementary subject, e.g. botany or genetics in the Faculty of Philosophy, statistics or economics in the Faculty of Political Science.

In order to secure a sufficiently broad background in general forestry a student has also to pass general courses usually of one semester's duration (i.e. courses shorter than the *approbatur* courses) in the following forest subjects: forest mensuration, silviculture, business economics of forestry, social

economics of forestry, and logging technology (also peatland forestry for the General Forest Examination). The students have also to pass examinations in the basic subjects, botany — including plant physiology — and chemistry, and in a number of auxiliary subjects which are mainly determined according to the subject schedule.

The undergraduate course takes about four years and comprises lectures and practical training. The first year is essentially a common curriculum for every forest student. The program consists of basic courses such as botany and chemistry, auxiliary subjects, and general courses in forestry subjects. After the first year a student chooses his combination of main subjects. These largely determine the specialized curriculum that he will follow, i.e. forest management, technology, economics, etc.

In the second year study of the basic and auxiliary subjects is continued but the main stress is placed on lectures in the main subjects.

The third year is devoted to continued lectures and seminar training in the main subjects, with limited study in the auxiliary subjects, and to the preparation of a report based on practical work undertaken during the second summer.

During the fourth year the student concentrates on the *laudatur* thesis and on the final examinations. These examinations — both written and oral — are held once a month. Under this system a student is allowed to take one subject at a time; for example, one examination in a main subject every month.

The *practical training* is of great importance. It takes place mainly in the summer, partly as joint training arranged by the University and partly as special training which is arranged in companies, organizations, and the national forest administration.

Joint training is undertaken with a few exceptions (e.g. training in forest mensuration during the second summer) at the Forest Training Centre of the University at Hyytiälä where the Korkeakoski Forest District is reserved for this purpose. Training is mainly concentrated in the first and second summer according to the following program:

| | 1st summer | 2nd summer |
|--------------------|------------|------------|
| silviculture | 4 weeks | 5 weeks |
| peatland forestry | 2 „ | 2 „ |
| forest mensuration | 5 „ | 5 „ |
| logging | 2 „ | 5 „ |

Every student participates in joint studies during the first summer; but in the second summer only those students participate whose combination of



Birch stand (*Betula verrucosa*) in South Finland.

subjects requires additional field education. In practice, however, almost every student aiming to pass the General Forest Examination is required to take part in the joint training of the second summer.

In addition, joint training in logging is undertaken at Hyttiälä during the third academic year (in January — February). Every student taking logging technology to the cum laude level or higher must fulfil this requirement. Students use the third summer for special training in their main subject. This may be taken in industrial companies, National Forest Service, forest associations, or in corresponding organizations abroad. The length of this training varies and depends on the subject and requirements of the joint training included in the combination of subjects. The length of the special training in the main subjects of the General Forest Examination varies from one to five months but generally takes about two months.

Training for the Commercial Forest Examination is executed mostly in a specialized manner. A part of this special training, which lasts six months, takes place in domestic enterprises, such as roundwood purchasing and logging operations, wood-processing industries (saw mills, board and plywood factories, pulp and paper mills), sales and shipping offices of companies, etc. Every effort is made to see that the students studying the Commercial Forest Examination have an opportunity to secure a third summer's training abroad in a country important to Finland as a buyer.

The number of students accepted to undertake study in preparation for the Forest Examination is limited. Today a total of 55 new students are admitted yearly, about one third of the candidates to study for the Commercial Forest Examination. Usually four to five times as many applications are received as the number of students that can be admitted. The selection of students is based on a number of specific qualifications. The most important qualifications considered in judging the merits of each applicant are academic performance in secondary school, the quality of performance in the student's entrance examination, and the duration and quality of pre-entrance practical training.

Graduate Studies

Graduate studies serve principally for the training of research workers, although, to an increasing degree, they are also considered as additional qualifications for advancement to more senior posts. These studies lead to the examinations of Master of Agriculture and Forestry and Licentiate of Agriculture and Forestry. A licentiate whose doctoral dissertation has been officially examined and approved will be granted the title of Doctor of Agriculture and Forestry.

The examination for *Master of Agriculture and Forestry* is comparable to

the Forest Examination in general character but differs from it mainly in scope and intensity. The first difference is that there are fewer main, basic and auxiliary subjects than in the Bachelor's examination. The combination of subjects comprises at least three main subjects. The second difference is that the studies go more deeply into the main subjects (the cum laude course of the Master's examination corresponds approximately to the laudatur course of the Bachelor's examination). Also the thesis (pro gradu work) of the Master's examination is somewhat more thorough than the laudatur work of the Forest Examination. The Master's examination can be passed either after the Bachelor's examination or without a preceding Forest Examination. Only a few students have recently studied for this degree.

Those who intend to enter more deeply into forest science, and especially those who intend to qualify for research work, usually proceed directly to the degree of the *Licentiate of Agriculture and Forestry* after the Forest Examination. The licentiate course requires a thorough knowledge of a main subject in the Faculty. In addition, the examination includes at least one supplementary subject in which a student has to obtain the highest level of the Master's examination or possess knowledge corresponding to it.

A student must also present a licentiate thesis in his main subject in which he shows his ability to use scientific research methods. The thesis is often the result of research work lasting from two to three years. The licentiate thesis is examined in a special licentiate seminar by a committee consisting of three members appointed by the Faculty. In addition to the members of the committee, others are also allowed to comment on the thesis. Cum laude and laudatur marks in the main subject of the licentiate examination presuppose not only a first class licentiate thesis but also other research, publication in the field and a thorough knowledge of the literature. A student intending to take the licentiate examination must also have had at least one year's service as a Forest Officer.

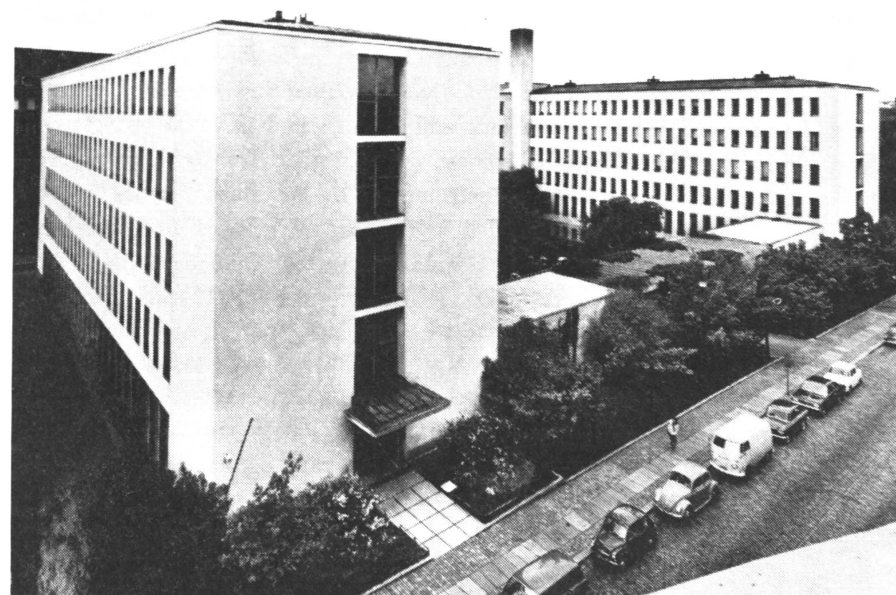
In order to achieve the degree of *Doctor of Agriculture and Forestry* a candidate has to prepare a dissertation which will be officially examined and, on the recommendation of the opponent or opponents, accepted by the Faculty. More recently, it has become increasingly common for the thesis undertaken in partial fulfilment of the degree of a licentiate to be expanded into a doctor's dissertation.

Graduate study involving formal course work has hitherto been relatively limited, and has consisted mainly of seminars. Currently, it is becoming customary for persons studying for the licentiate's and doctor's degrees to take examinations in other faculties, for example in botany, chemistry, mathematics, commercial sciences, statistics, etc.

Research

The University's annual budget does not provide funds for research. Research at the University is therefore financed from other sources, mainly the *National Research Council for Agriculture and Forestry*. Forestry research is also sponsored by certain foundations, especially the *Foundation for Research of Natural Resources in Finland* and the *Finnish Cultural Foundation*.

One result of the lack of sufficient continuity in financing research programs is that professors, lecturers and assistants of the University give preference to theoretical and methodological research. Programs requiring long-term experiments are performed mainly by the Finnish Forest Research Institute.



Forestry House, home of the Forestry Department of the University of Helsinki, and of the Finnish Forest Research Institute.

THE FINNISH FOREST RESEARCH INSTITUTE

Brief History

Towards the end of the 19th century representations were made by practising foresters for the establishment of a special forest research institute. The interest in such an institute stemmed from conviction that progress in forestry required and must be based on systematic research work. An additional factor that spurred interest at the end of the 19th century was that corresponding research institutes had been established in a number of European countries.

In 1906 the Finnish Government (Senate) commissioned A. K. Cajander to study forest research institutes and their activity in European countries, and to work out a proposal for Finland. Cajander visited institutes in Germany, Austria, Switzerland, France, Denmark and Sweden and in 1909 put forward a detailed proposal for the establishment of a Finnish forestry experimental institute. Cajander's proposal was instrumental in the formation of a state committee whose report recommended establishment of a Forest Research Institute. This was founded by a Senate decree of October 24th, 1917, only a few weeks prior to the date (December 6th, 1917) of Finland's Declaration of Independence. The Institute started its activity on the 1st of July, 1918.

The Forest Research Institute is subordinate to the Ministry of Agriculture. Originally it comprised the Departments of Silviculture, Forest Inventory and Yield, and Soils. At later dates the following additional departments were established:

Department of Forest Economics and Department of Peatland Forestry in 1928.
Department of Forest Technology in 1931.

Department of Forest Biology in 1953 (the professorship of Forest Biology was originally founded in 1938 in the Department of Silviculture).

Research Organization

The Forest Research Institute now consists of these ten research departments and three offices: Administration Office, Experimental Forest Office, and Nature Conservation Office (under the supervision of the Government Counsellor for Nature Conservation). General co-ordination of the work of the Institute rests with its Director, a post founded in 1962 and carrying the academic title of Professor. The primary tasks of the different departments are as follows:

The Department of Soil Science studies the silvicultural utilization of soil, its physical and chemical properties, its development and its improvement by various methods.

The Department of Peatland Forestry studies the silvicultural utilization of swamps including suitability for draining and afforestation, ecology of swamp forests, the hydrology of swamps, the effect of various measures on the development of swamp forests, and drainage and other swamp cultivation techniques.

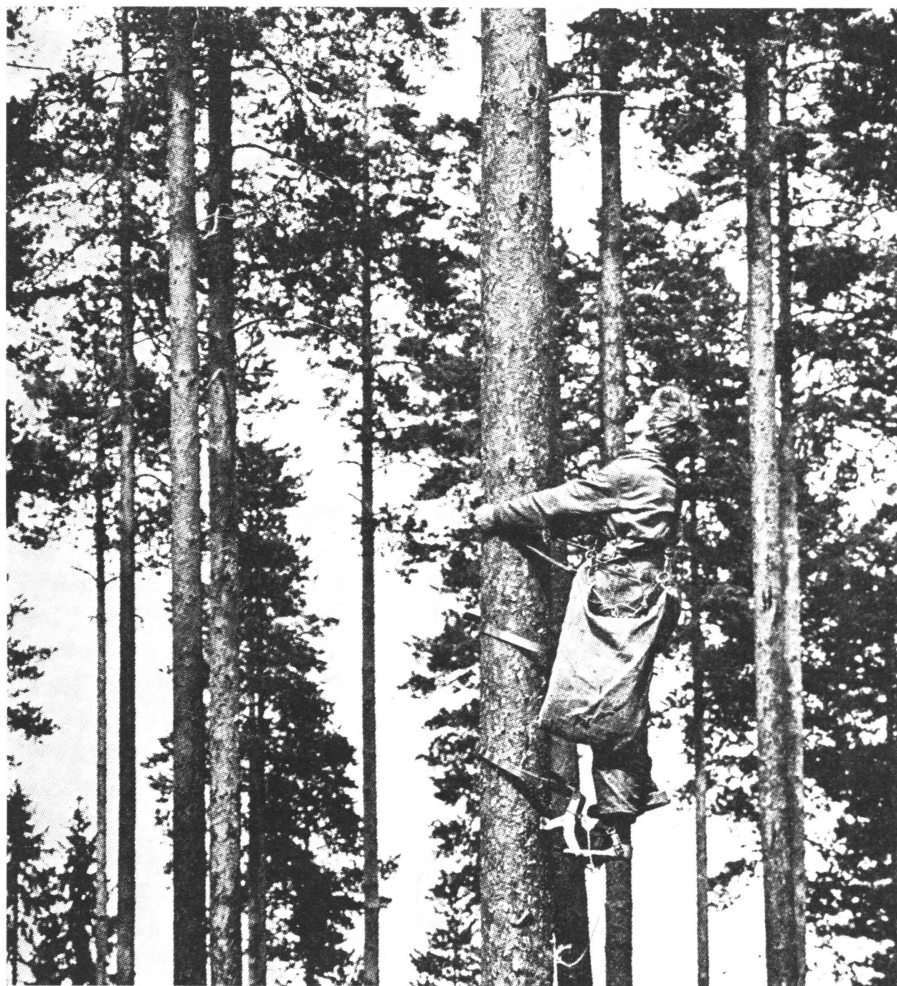
The Department of Silviculture studies natural and artificial forest regeneration, afforestation, factors related to seed crops, nursery production of planting stock and silvicultural methods used in forestry.

The Department of Forest Biology studies the morphology, physiology and ecology of forest trees and the mycology, microbiology and phytocology of forests.

The Department of Forest Inventory and Yield studies the methods of forest mensuration, the structure, growth, yield and development of tree stands, the principles of forest management, carries out national forest inventories and assists the Department of Forest Economics in forest balance studies. A special professorship for yield studies was founded in 1969 to head the newly created forest yield section of the department.

The Department of Forest Technology studies wood properties, wood as an industrial raw material, measurement of timber, forestry work and mechanization in logging and silvicultural operations.

The Department of Forest Economics studies social economics, business and marketing questions in forestry and as related to forest industries, conducts surveys of total drain and wood use, and, assisted by the Department of Inventory and Yield, performs forest balance studies.



Cones from the spring 1968 crossings are collected from the Scots pine breeding stand at Haapastensyrjä

The Department of Forest Zoology studies animals injurious to forests, the damage done by them and possibilities for their control. The Department also makes prognoses of the extent of widespread pest outbreaks.

The Department of Mathematics studies and develops mathematical and statistical methods applicable in forest research, consults with research workers in applying these methods, maintains and develops the data processing system of the Institute and publishes forest statistics.

The Department of Forest Genetics studies the genetic structure of forests

and methods of forest tree breeding as well as carrying out breeding experiments.

Every department is headed by a professor who participates in active research work. He is assisted by a permanent body of technicians and graduate foresters and by auxiliary help as needed.

Since the 1930's the Institute has also been authorized to engage senior research specialists to study specific problems, and since 1963 several posts for senior research specialists have been established. Currently, there are seven such posts, two in the Department of Silviculture, two in the Department of Forest Technology and one each in the Departments of Forest Inventory and Yield, Forest Economics and Forest Genetics.

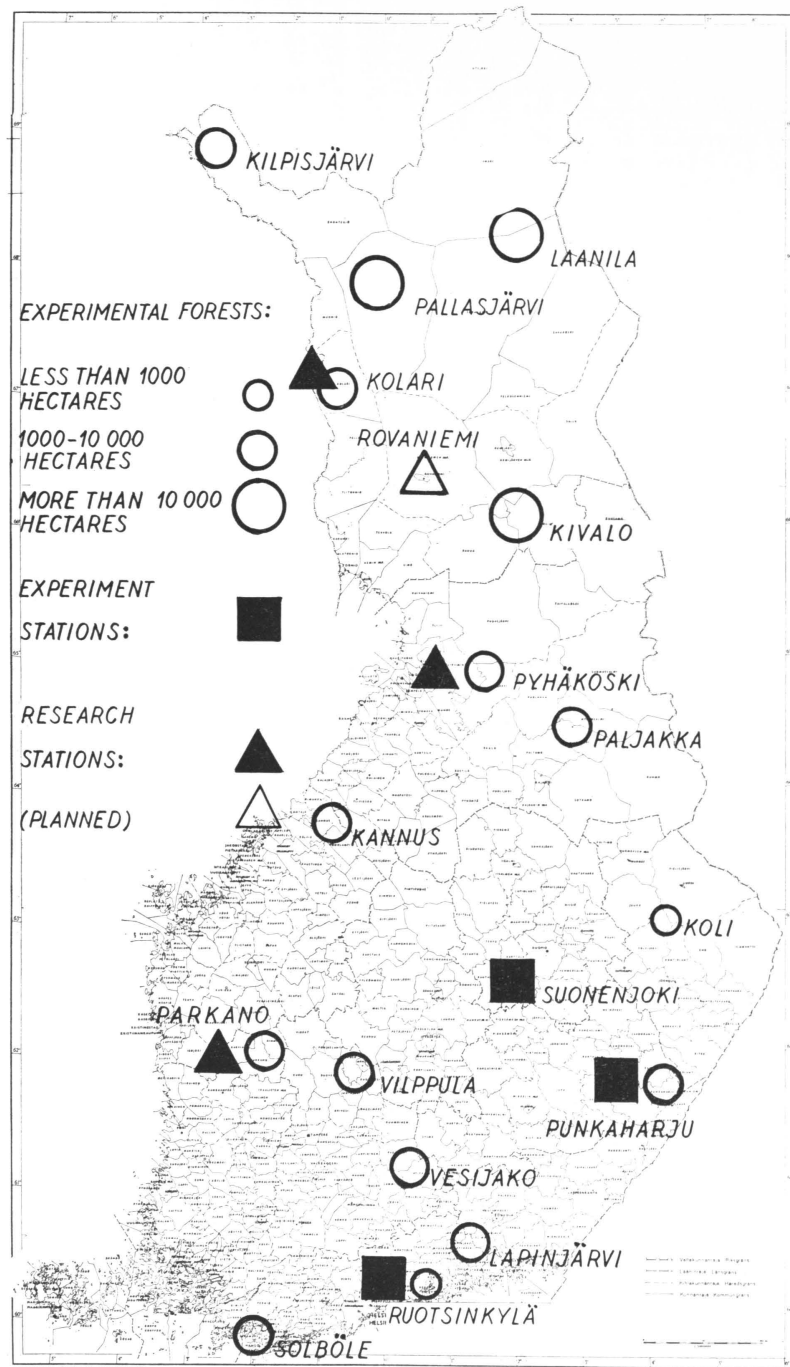
In 1970 the permanent research staff at the Forest Research Institute comprised eleven professors, seven senior research specialists and 54 research assistants. In order to promote collaboration between forestry research and practical forestry a Negotiating Board of the Forest Research Institute was established in 1953. According to the present decree it consists of the Director of the Institute, one of the professors, and eight other members representing various fields of forestry who are nominated by the Ministry of Agriculture. Primary responsibility of this Board is to serve in an advisory capacity pointing out problem areas which in their judgement need investigation and receiving first-hand reports on the progress of the Institute's research program. Thus, an opportunity is provided for the representatives of practical forestry to alert the research staff about critical needs and to stay informed about latest developments.

Until recently, actual research has been undertaken solely by the various research departments. Since 1963 regional *Forest Experiment Stations* have been in operation. Each of these stations is headed by a university graduate competent to undertake independent research work. For the time being the Forest Research Institute operates four forest experiment stations. They contribute to research work by concentrating on certain regional problems, for example, forest drainage (in Parkano and Pyhäkoski) and genetics programmes (in Kolari). In addition, an experimental nursery was recently founded in Suonenjoki.

The Institute's appropriation in the State Budget for 1970 amounts to Fmk. 9 387 000.

Experimental Forests

Experimental forests form an important adjunct to the Forest Research Institute. Reservation of experimental areas for the use of the Institute was



Experimental forests, forest experiment stations and research stations of the Finnish Forest Research Institute

included in the proposal presented by A. K. Cajander and the first experimental forests were established in 1923—24, only a few years after the founding of the Institute. The number of experimental areas has subsequently been increased. At present they cover about 71 000 hectares, fairly evenly distributed throughout the country.

The experimental forests, which are permanently under the control of the Forest Research Institute, offer opportunities for permanent experiments with a minimum of redtape and generally ensure the possibility of carrying through long-term investigations.

The Experimental Forest Office (headed by the Chief Forest Officer) is responsible for the administration of the experimental forests. Regionally, they are divided into three forest districts, each headed by a district forest officer. The districts are further divided into 15 smaller units which are headed by a forestry technician or a foreman. Every researcher at the Institute has the right to set up experiments in the experimental areas.

Beginning in 1939 national parks and nature conservation areas have been established on state-owned land. Some of them are administered by the Forest Research Institute. The Government Counsellor for Nature Conservation, acting as the Head of the Institute's Nature Conservation Office, is the ultimate executive authority for all national parks and conservation areas in Finland.

At present the Forest Research Institute controls two national parks as well as five large and five small conservation areas, totalling approximately 61 000 hectares. Strict nature reserves, areas completely reserved and protected except for research purposes, are important subjects for forest studies and some are therefore also under the jurisdiction of the Forest Research Institute, the remaining national parks, nature reserves and nature conservation areas are administered by the National Board of Forestry.

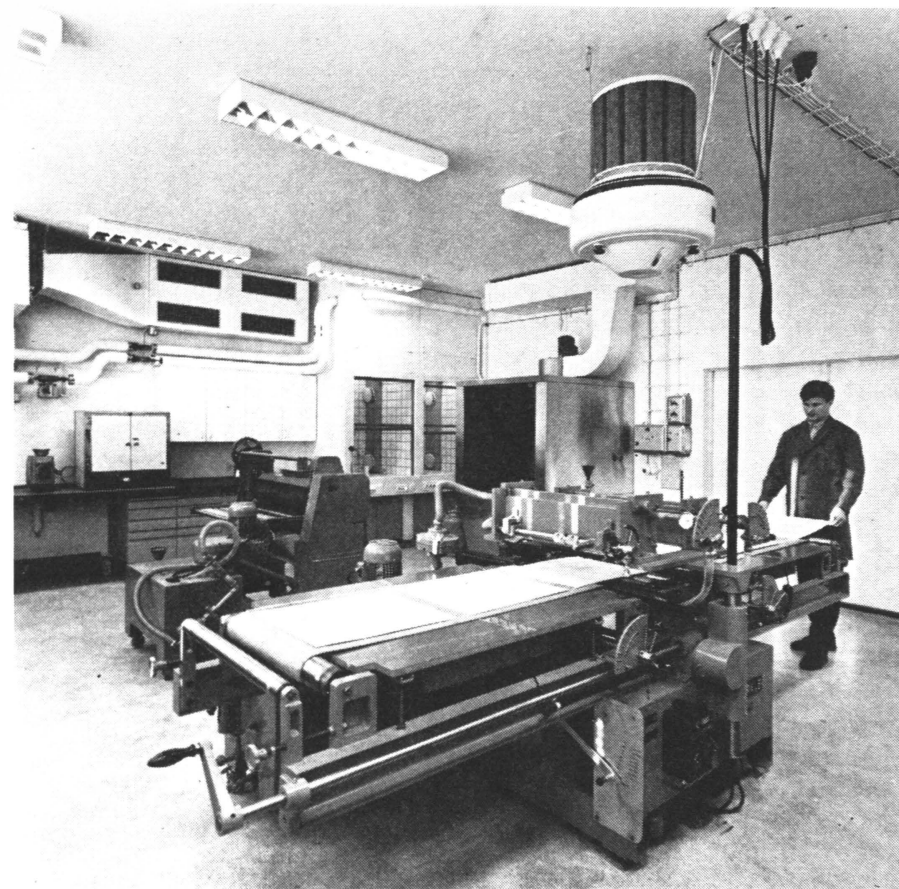
Long-term experiments of the Forest Research Institute also are carried out to some extent in forests other than those of the Institute. In particular there has been long-standing research collaboration with the National Board of Forestry. Bilateral agreements have also been made with some wood-using companies regarding the use of certain areas for experimental purposes. By these arrangements it has become possible to fill certain gaps in the network of the Institute's experimental forests.

Publication Activity

The results of the research work of the Forest Research Institute have been published from the beginning in a special series entitled *Metsäntutkimus-*

laitoksen julkaisuja (Communicationes Instituti Forestalis Fenniae). By the end of 1969 sixty-six volumes had been published, covering a total of 385 separate studies and comprising 28 030 pages.

In order to facilitate rapid publication of the more important findings and topical results the Institute introduced *Folia Forestalia* in 1963. By the end of 1969 seventy-four volumes had been published in this series.



In the finishing room, painting tests are made by a curtain coater, seen in the foreground. A roll coater and a gun spraying cabinet are among the items in the background.

THE TECHNICAL UNIVERSITY OF HELSINKI

Education in technology in Finland commenced in 1849, in the beginning on a rather modest scale, but the decree concerning the foundation of the Technical University of Helsinki was not issued until 1908. Higher education in wood science and wood processing is now mainly given at the Forest

Products Department, established in 1942, which has professorships in the following subjects:

- mechanical wood technology
- paper technology
- printing technology
- wood chemistry
- pulping technology

General courses in forestry and wood-material science are also included in the curriculum of the Forest Products Department.

Besides teaching, the staff of the Department carries out research work in wood science and wood processing. The necessary equipment for research is available at the Department but since no funds are provided for research work in the State Budget it must be financed from various outside sources. The *National Research Council for Technology* and the *Foundation for the Advancement of Technology*, in particular, sponsor technical research in Finland. In addition, some of the members of the teaching staff are working in the State Institute for Technical Research.

The Technical University of Helsinki occupies a special campus at Otaniemi, ten kilometres west of the centre of Helsinki.



With modern electrical measuring devices, the determination of different strength and elasticity characteristics is fast and accurate. This illustration shows how the stress-strain diagram of the bending test is produced automatically during the progress of the test.

THE STATE INSTITUTE FOR TECHNICAL RESEARCH

The State Institute for Technical Research was founded in 1942 to carry out basic research in wood science and materials testing as required by various authorities, private organizations and firms. The Institute also assists the Technical University of Helsinki in teaching and research work.

The Institute comprises 26 laboratories or main research fields which are organized into five groups. Each laboratory has an Advisory Committee composed of experts in that particular field of research and activity. Overall direction of the work of the Institute rests with the Director General and the Board of the Institute. The State Institute for Technical Research as well as the Technical University are subordinated to the Ministry of Commerce and Industry. One of the groups (Wood Group) is responsible for research in wood science and mechanical wood processing. This group consists of the following laboratories and research sections:

Woodtechnical Laboratory:

- general section (material, products and production investigations)
- timber drying section
- wood gluing and finishing section
- industrial waste wood section

Woodworking Laboratory:

- woodworking and tool investigations

Wood Preservation Laboratory:

- decay and discolouration of wood and wood products
- wood preservation technique
- inspection of wood preservatives

At the end of 1969 the research staff of the Wood Group consisted of:

- 3 professors
- 8 masters of science (engineering)
- 1 master of philosophy

Research in the chemical processing of wood is carried out in the Chemico-Technical Laboratory.

The results of the research work are published mainly in the Institute's two series (*Publications and Reports of the State Institute for Technical Research*) and partly in various periodicals.

The Institute is presently situated in the centre of Helsinki but most of the laboratories have been moved to Otaniemi; some are still in the process of moving and the whole Institute will be there after a few years.

THE NATIONAL RESEARCH COUNCIL FOR AGRICULTURE AND FORESTRY

In 1961 six National Research Councils were established in Finland, on the basis of a special law, to promote scientific research and to act as expert committees for the Government on problems connected with science. They also grant scholarships to up-and-coming scientists in order to secure future scientific development. The research councils have occupied an increasingly important position in recent years in both planning and financing. The councils are subordinated to the Ministry of Education.

The members of the councils must be active in research work and are nominated by the universities, university faculties, state research institutions and national scientific societies. The chairman of each council is appointed by the President of the Republic.

The National Research Council for Agriculture and Forestry consists of a chairman and nine members. Four of the members are currently forest scientists and are nominated by the following institutions: the Faculty of Agriculture and Forestry of the University of Helsinki, the Finnish Forest Research Institute and the Academy of Science in Finland.

The new statute concerning scientific research, December 30, 1969, allows an increase in the number of members from nine to fourteen after January 1, 1971. According to this statute members can also be nominated by organizations in the technical field and economic life and by central boards of administration.

The National Research Councils promote research particularly in two ways:

1. They employ research workers: senior fellows, junior fellows and research assistants. The senior and junior fellow posts are filled for a period of three years at a time and the same person is allowed to hold a position for a maximum of seven years.

The posts of research assistants are mainly intended to serve as starting points for those who have passed an academic examination and want to proceed in their scientific career to the doctor's degree.

2. They grant fellowships to research workers for equipment, travel expenses, employing assistants and personal allowances. Each council is allocated a certain amount of money in the State Budget; 220 250 Fmks was granted for forestry research in 1970.

Also, state financial support to scientific societies is distributed on the basis of recommendations made by the Research Councils.

The Councils have no laboratories or institutes. Consequently, the forest researchers employed carry out their work either in the Finnish Forest Research Institute or in the Faculty of Agriculture and Forestry at the University. In 1970 seventeen research workers were employed by the National Research Council for Agriculture and Forestry and seven of them were forest scientists. The National Research Council for Agriculture and Forestry plays an important role in sponsoring forestry research especially in the Faculty of Agriculture and Forestry at the University of Helsinki.

The National Research Council for Technology is responsible for promoting technical research, including research in wood science, in Finland.



Cleaning out a brook with the help of an excavator.

PRIVATE INSTITUTIONS

THE SOCIETY OF FORESTRY IN FINLAND

The Society of Forestry in Finland (SFF) was established in 1909 on the initiative of A. K. Cajander to promote forestry research in Finland and to serve as a link among those who devote themselves to the study of forestry. The Society endeavours to attain its objects principally by:

1. issuing and exchanging publications
2. holding meetings
3. granting financial support for research from its yearly income and funds
4. taking part in international activities in forestry research

SFF started to publish *Acta Forestalia Fennica* in 1909 and *Silva Fennica* in 1926. By the end of 1969 a total of 99 volumes of *Acta Forestalia Fennica* had been published containing 502 separate studies and comprising 38 181 pages. For *Silva Fennica* the figures are 120, 228 and 10 902, respectively. Publication activities are probably the most important function of the Society. The main part of the investigations conducted outside the Forest Research Institute are published in *Acta Forestalia Fennica* and *Silva Fennica*.

The ordinary meetings of the Society are held every month from September to May, inclusive. The meetings are devoted chiefly to scientific lectures containing reports from recently completed investigations. It is a commonly established practice that the results of major investigations in forestry are reported to the Society before publication.

The Society's possibilities for granting financial support for research are rather limited. The grants available are mainly used to encourage young, promising graduates to take up careers in forestry research. The Society takes part in international activities in forestry research, such as exchanging publications (currently with 190 foreign institutions) and by inviting foreign forest scientists to address its meetings. It is one of the five Finnish members of IUFRO.

The membership of the Society consists mainly of ordinary members who are Finnish citizens working in forestry and related research. In 1969 ordinary members numbered 330.

Distinguished foreign scientists in the sphere of forestry and related sciences may be elected as corresponding members.

The administration of the Society is carried out by a Council consisting of the president, vice-president, retiring president, secretary, and three other members elected by the annual meeting. The president is elected for a term of one year. He is not eligible for immediate re-election. The secretary and other officers are elected for a period of three years and they may be re-elected.

The Society receives regular financial support from the Ministry of Education.



Studies of multi-processing machines are also included in the programme.

METSÄTEHO, THE FOREST WORK STUDY SECTION OF THE CENTRAL ASSOCIATION OF FINNISH WOODWORKING INDUSTRIES

Metsäteho was founded in 1945 to conduct forest-work studies with the object of determining fair standards for forest-work wages and rationalizing wood-harvesting operations. Experimenting with new machines and work methods, bringing the results of continuing progress in timber felling, preparation and transportation to the attention of members, and consultation are included in the program. The annual research programme is made up of subjects proposed by the member companies and approved by a council, Metsäteho Committee, consisting of the woodland managers of the biggest forest-industry companies in the country. Metsäteho is supported by over 50 forest-industry companies, all members of the Central Association of Finnish Woodworking Industries. In addition, the State Fuel Centre (Vapo) is a member of Metsäteho. The

research, information and extension staff of Metsäteho consists of a director and eight research officers with academic degrees in forestry.

In the beginning, the main emphasis in research work was placed on investigations in creating a uniform wage basis for timber felling and transport work. These studies are continuously in the programme. Studies aiming at rationalization of forest work have also been in the programme of Metsäteho ever since its establishment and the number of these studies has increased considerably in recent years. The main emphasis today is on these studies; topical items are studies on the suitability of different methods of work, equipment and machines and their improvement. Studies on the development of planning methods aimed at the economic utilization of forest machines are also included in the programme. Metsäteho's investigations have covered, practically speaking, the whole harvesting system from the stump to the mill.

Co-operation with both domestic and foreign research institutes in the forestry branch is lively, especially with those in the Nordic countries.

The results of Metsäteho investigations are published in various series. These series are: Metsäteho Publication, Metsäteho Report, Metsäteho Review, and a series of manuals. The results of comprehensive basic investigations are published as Metsäteho Publications. A total of 44 volumes have appeared to date. The detailed results of applied studies for practical use are issued as Metsäteho Reports (292 in number). Metsäteho Reviews (c. 15—20 issues per year) and manuals (7 in number) are intended for routine use for those engaged in practical work. Ninety-three films (16 m/m) have been made on new work methods and machinery.



Research and Training Centre of the Work Efficiency Association at Rajamäki

THE WORK EFFICIENCY ASSOCIATION (Työtehoseura)

Työtehoseura, the Work Efficiency Association, is a registered private association founded in 1924 and enjoying state support. The association aims at promoting the rationalization of agriculture, forestry and home economics. The association endeavours to carry into effect its objectives by performing rationalization investigations, experiments and educational work, and by publishing the results.

The Forestry Department of the Work Efficiency Association was founded in 1942. The personnel of the department consist of the department head, forest officers, machine experts and the necessary office staff. Research work is performed both in the office of the Work Efficiency Association in Helsinki and in the Research and Training Centre at Rajamäki about fifty kilometres north of Helsinki. The training activity within forestry is concentrated at the Rajamäki school for forest foremen which was established in 1967 in connection with the Training Centre.

During the first period of activity research work was directed to felling methods and tools, and later on to the development of various types of transportation and logging machinery. In the past few years economic, organizational, and sociological problems of small-scale forestry, such as behaviour and cooperation of forest owners, have been included in the research program. At present main attention in logging is paid to work investigations and the development of methods and machines specially for farm conditions and seasonal contract work. In ergonomy the frictionless mutual relationship between the worker and the work has attained special interest and harmful aspects rising from increasing mechanization will be investigated by a cooperative programme with other Finnish and Scandinavian institutions. In the branch of silviculture the development of soil-preparation and planting machines is going on. Permanent experiment areas have been established for the testing of new methods. Standardization work is performed further in the technical development programmes of the forestry branch. Investigation results are published in the *Series and Reports of Work Efficiency Association*, in the *TEHO*-periodical, and in other professional reviews.



An essential part in the activity of the Work Efficiency Association is to develop working methods and machines. In the picture the TTS-Disc-Trencher for soil preparation.



Bundle floating at sea.

UITTOTEHO, THE FLOATING RESEARCH ORGANIZATION IN NORTH FINLAND

Uittoteho was founded in 1951 to carry out studies concerning rationalization of floating in northern Finland.

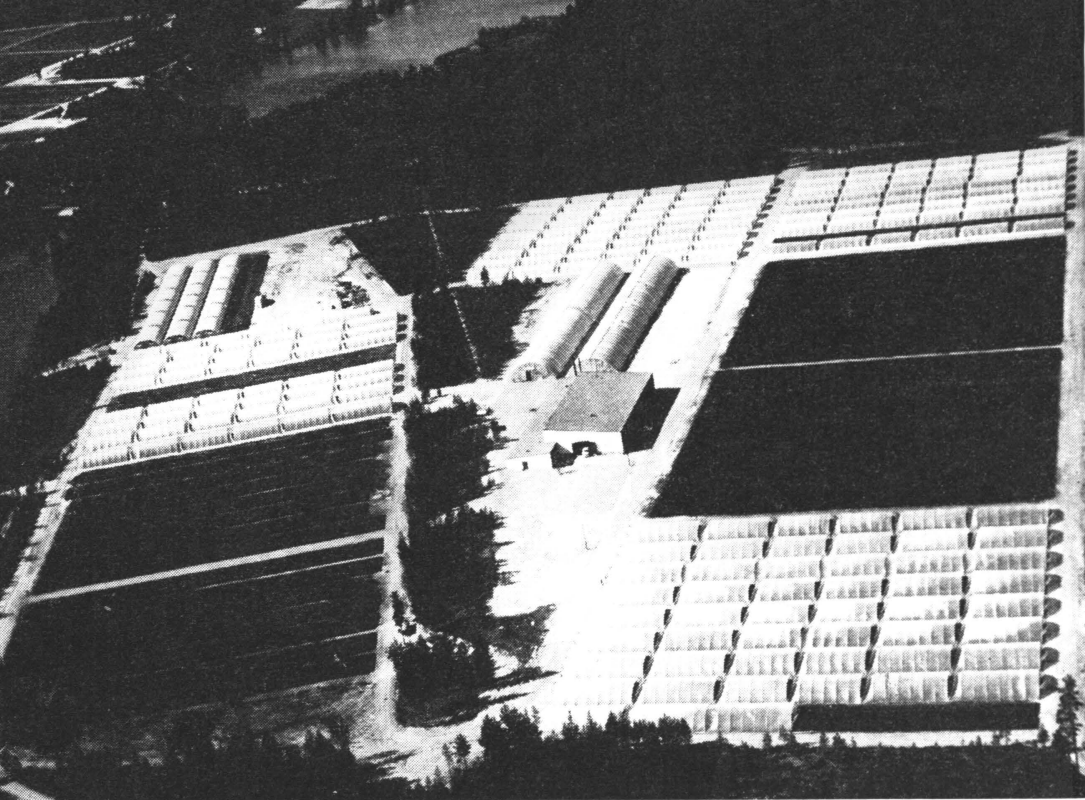
Several floating associations have been members of Uittoteho since its beginning. Its research staff consists of a director and one research forester. The head office is situated in Kemi and the research forester works at Oulu. The annual research programme is confirmed by a board composed of the forest chiefs of the leading member companies and the representatives of the Forest Service and floating associations.

From the beginning the emphasis in the research programme has been on studying the influence power-plant construction has had on floating. The planning and cost calculations related to bundle floating have also been continuously a part of the research programme.

Other important study projects deal with the development of mechanical timber sorting, designing of floating boats, towing of logs on lakes and the sea, sinking and buoyancy problems, and measuring of wood.

Uittoteho is in close contact with the floating organizations in southern Finland, Sweden and Norway.

The research results are published in two different series. One serves mainly the members of Uittoteho; the second is exchanged with other forest research organizations in Finland and abroad.



PIEKSÄMÄKI nursery owned by the Foundation.

THE FOUNDATION FOR FOREST TREE BREEDING

The Foundation for Forest Tree Breeding was founded in 1947 by all the important forestry organizations in Finland. Today it has one tree-breeding centre, Haapastensyrjä, in southwestern Finland, a nursery in eastern Finland (Pieksämäki), a tree-breeding station in western Finland (Vanaja) and a tree-breeding office in southern Finland (Hyvinkää). The head office is in Helsinki, Alkutie 69, Helsinki 66. The main purposes of the Foundation are:

1. to select and maintain exceptionally valuable trees, plus trees and plus stands for breeding purposes
2. to supply enough genetically good or superior seeds and plants for forest regeneration
3. to promote scientific research in forest tree breeding (forest genetics)
4. to keep contact with persons and institutions working in the same field in Finland and in other countries
5. to supply information and publications relating to forest tree breeding.

So far, the Foundation has selected and marked over 9 500 plus trees and 600 plus stands with 550 000 marked trees recommended for seed collection. It has collected about 4 000 kilograms of good seed from standing trees, sold over 100 million seedlings originating from plus trees and plus stands and made two million grafts. At present, it produces annually about 200 000 grafts made from plus trees. There is a total national goal of 3 550 hectares in seed orchards which means 1 420 000 living grafts. About 80 % of the grafts are already completed and it is calculated that in about five years the desired area will be established. These seed orchards will produce all the seed required for nurseries in the country after some ten years. The Foundation now has about ten hectares under plastic greenhouses used for seedling production, grafting, cuttings and experimentation. There are about 10 000 grafts permanently growing in Haapastensyrjä. The crossing and hybridization activities become larger and more systematic year by year.

The Foundation publishes an annual report "*Metsänjalostussäätö*" in Finnish with Swedish and English summaries.



Finnish Pulp and Paper Research Institute, Tapiola.

THE FINNISH PULP AND PAPER RESEARCH INSTITUTE

The Finnish Pulp and Paper Research Institute has developed from a Central Laboratory, founded in 1916, to serve the chemical industry of Finland. Today, the aim of the Institute is the carrying out of technical and scientific research concerned with chemical and mechanical pulp and the manufacture of paper and card-board with a view to promoting progress in these fields.

This work is done on the premises of the Institute, situated in the vicinity of the large technical research centre built for the Technical University of Helsinki and the State Institute for Technical Research, some ten kilometres west of the centre of Helsinki. The total volume of the buildings is 52 000 cubic metres; the site has an area of 2.5 hectares, which will allow for expansion to double the size at a future date.

It is estimated that Institute's expenditure will amount to 8.6 million marks in 1970. The total number of employees at the beginning of 1970 was 242, including 78 graduates. The staff is engaged in work in 16 different departments, including those for chemical pulping, mechanical pulping, paper, board and others concerned with the fields of chemistry and physics. The Library and Documentation Service, comprising 25 000 volumes and 370 periodicals, provides extensive assistance to the Institute and to industry.

Contact with the industries and research workers of other countries is a very important part of the Institute's activity. In 1969, 5 145 visitors were received, 634 of whom were from abroad. Members of the staff of the Institute made 352 visits to domestic mills, and 79 trips abroad. In the same year, 14 different lectures were given abroad by representatives of the Institute. In general, valuable active contacts are maintained with research workers throughout the world.

INDEX OF PERSONNEL¹

The Faculty of Agriculture and Forestry of the University of Helsinki

Address: Unioninkatu 40 B, Helsinki 17
Dean: Nyyssönen, Aarne D.F., Professor

Department of Silviculture

Head: Yli-Vakkuri, Paavo, D.F., Professor
Mikola, Peitsa, D.F., Professor
Sirén, Gustaf, D.F., Professor
Assistants: Luukkanen, Olavi, B.F.
Kellomäki, Seppo, B.F.

Department of Forest Mensuration and Inventory

Head: Nyyssönen, Aarne, D.F., Professor
Kilkki, Pekka, D.F., Acting Assoc. Professor
Assistant: Jaakkola, Sipi, M.F.

Department of Social Economics of Forestry

Head: Riihinen, Päiviö, D.F., Professor
Assistants: Keltikangas, Matti, B.F.
Rinkinen, Ilmo, L.F.

Department of Logging and Utilization of Forest Products

Head: Putkisto, Kalle, D.F., Professor
Wegelius, Theodor, D.F., Professor
Granvik, Bror-Anton, D.F., Assoc. Professor
Assistants: Salmi, Juhani, B.F.
Ylinen, Juha, B.F.

Department of Peatland Forestry

Head: Heikurainen, Leo, D.F., Professor
Assistants: Seppälä, Kustaa, D.F.
Mannerkoski, Hannu, B.F.

Department of Business Economics of Forestry
Head: Keltikangas, Valter, D.F., Professor
Assistant: Ahonen, Leo, L.F.

Department of Forest Products Marketing

Head: Ervasti, Seppo, D.F., Professor
Assistant: Juslin, Heikki, B.F.

Department of Farm Forestry

Head: Makkonen, Olli, D.F., Assoc. Professor

Department of Agricultural and Forest Zoology

Head: Kangas, Esko, D.F., Professor
Assistants: Tulisalo, Unto, L.F.
Lilja, Sakari, M.F.

Department of Plant Biology and Plant Pathology

Head: Mukula, Jaakko, D.F., Professor
Assistants: Mäkelä, Kaiho, D.F.
Kallio, Tauno, L.F.

Forest Officer of the University

Sarasto, Juhani, D.F.

Retired professors: Jalava, Matti, D.F., Professor of Logging and
Utilization of Forest Products
Laitakari, Erkki, D.F., Professor of
Silviculture
Lönnroth, Erik, D.F., Professor of Forest
Mensuration and Inventory
Saari, Eino, Ph. D., Professor of Social
Economics of Forestry

The Finnish Forest Research Institute

Address: Unioninkatu 40 A, Helsinki 17
Director of the Institute: Holopainen, Viljo, D.F., Professor

Department of Soil Science

Head: Viro, Pentti, D. F., Professor
Researchers: Halonen, Olli, M.Ph.
Harjuaho, Väinö, B.F.
Lipas, Erkki, M.F.

¹) Abbreviations on the last page

Department of Peatland Forestry

Head: Huikari, Olavi, D.F., Professor
Researchers: Aitolahti, Matti, B.F.
Kaunisto, Seppo, B.F.
Paarlahti, Kimmo, L.F.
Ravela, Heikki, B.F.

Department of Silviculture

Head: Sarvas, Risto, D.F., Professor

Senior Research

Specialists: Leikola, Matti, D.F.
Lähde, Erkki, D.F.

Researchers: Etholen, Kullervo, B.F.
Helenius, Olavi, B.F.
Huuri, Olavi, M.F.
Raulo, Jyrki, M.Ph.
Rummukainen, Ukko, M.F.

Department of Forest Biology

Head: Saarnijoki, Sakari, Ph.D., Professor
Researchers: Kurkela, Timo, M.F.
Laine, Lalli, M.Ph., M.F.

Department of Forest Inventory and Yield

Head: Kuusela, Kullervo, D.F., Professor

Forest Inventory Section

Head: Kuusela, Kullervo, D.F., Professor

Senior Research

Specialist: Tiihonen, Paavo, D.F.
Researchers: Laasasenaho, Jouko, B.F.
Poso, Simo, L.F.
Salminen, Sakari, B.F.

Forest Yield Section

Head: Vuokila, Yrjö, D.F., Acting Professor
Researchers: Koivisto, Pentti D.F.
Oikarinen, Matti, B.F.

Department of Forest Technology

Head: Heiskanen, Veijo, D.F., Professor

Senior Research

Specialists: Hakkila, Pentti, D.F.
Nisula, Pentti, L.F.

Researchers:

Ahonen, Matti, B.F.
Appelroth, Sven-Eric, M.F.
Harstela, Pertti, M.F.
Leinonen, Esko, B.F.
Rantapuu, Klaus, B.F.
Rikkonen, Pentti, B.F.
Uusvaara, Olli, M.F.

Department of Forest Economics

Head: Heikinheimo, Lauri, D.F., Professor

Senior Research

Specialist: Runeberg, Lorenzo, D.F., Professor

Researchers: Heikinheimo, Matti, B.F.
Huttunen, Terho, B.F.
Hämäläinen, Jouko, B.F., B.Econ.
Järveläinen, Veli-Pekka, L.F.
Keipi, Kari, B.F.
Kunnas, Heikki, M.Soc.Sc.
Kuokkanen, Pentti, B.F.
Mikkola, Pertti, B.F.
Palo, Matti, D.F.
Reunala, Aarne, B.F.
Salo, Esko, L.F.
Sivonen, Sampsa, B.F.

Department of Mathematics

Head: Väliaho, Hannu, D.Pol.Sc.,
Acting Professor
Mathematician: Seppälä, Risto, L.Pol. Sc.
Researchers: Uusitalo, Matti, B.F.
Väänänen, Sulo, M.F.

Department of Forest Zoology

Head: Juutinen, Paavo, D.F., Professor
Researchers: Annala, Erkki, Ph.D.
Heikkilä, Risto, B.F.
Långström, Bo, M.F.
Löyttyniemi, Kari, L.F.
Varama, Martti, B.Ph.

Department of Forest Genetics

Head: Tigerstedt, P.M.A., B.F., Ph.D.,
Acting Professor

Senior Research Specialist: Hagman, Max, M.F.

Researchers: Koski, Veikko, Ph.D.
Oskarsson, Ole, M.F.
Saarnio, Reino, B.F.

Administrative Office

Head: Harkonmäki, Jussi, LL.M.

Experimental Forest Office

Head: Luoma, Kauko K., B.F.

Nature Conservation Office

Head: Kalliola, Reino, Ph.D., Professor
Assistant: Haapanen, Antti, Ph.D.

Parkano Forest Experiment Station

Head: Paavilainen, Eero, D.F.
Researcher: Koskela, Veikko, B.F.

Pyhäkoski Forest Experiment Station

Head: Valtanen, Jukka, M.F.
Researchers: Karsisto, Kalevi, M.F.
Heikkilä, Risto, B.F.

Kolari Forest Experiment Station

Head: Numminen, Erkki, L.F.
Researcher: Malmivaara, Eero, B.F.

Rovaniemi Forest Experiment Station

Head: Lähde, Erkki, D.F.
Researcher: Pohtila, Eljas, B.F.

Retired Professors:

Aro, Paavo, D.F., Professor in
Forest Technology
Heikinheimo, Olli, D.F., Professor in Silviculture
and Director of the Institute
Ilvessalo, Yrjö, Ph.D., Professor in
Forest Inventory and Yield,
Member of the Academy of Finland
Kujala, Viljo, Ph.D., Professor in
Forest Biology
Pöntynen, Viljo, D.F., Professor in
Forest Economics

The Technical University of Helsinki, Forest Products Department

Address: Otaniemi

Mechanical Wood Technology Laboratory

Head: Kivimaa, Eero, D.Sc. (Eng.), Professor
Assistant: Juvonen, Risto, L.Sc. (Eng.)

Pulping Technology Laboratory

Head: vacant
Assistant: Hosia, Matti, M.Sc. (Eng.)

Paper Technology Laboratory

Head: Ryti, Niilo, L.Sc. (Eng.), Professor
Assistant: Aaltonen, Pertti, M.Ph.

Wood Chemistry Laboratory

Head: Sjöström, Eero, Ph.D., Professor
Assistant: Seppälä, Eino, L.Sc. (Eng.)

Printing Technology Laboratory

Head: Perilä, Olavi, D.Sc. (Eng.), Professor
Assistant: Kautto, Hannu, M.Sc. (Eng.)

State Institute for Technical Research

Woodtechnical Laboratory

Address: Otaniemi
Director: Liiri, Osmo, D.Sc. (Eng.), Professor
Research Officers: Kivistö, Antti, M.Sc. (Eng.)
Kilpeläinen, Harri, M.Sc. (Eng.)
Kontinen, Paavo, M.Sc. (Eng.)
Metsä, Aarni, M.Sc. (Eng.)
Paajanen, Tero, M.Sc. (Eng.)
Saarelainen, Urho, M.Sc. (Eng.)
Sorsa, Bror, M.Sc. (Eng.)

Woodworking Laboratory

Address: Otaniemi
Director: Kivimaa, Eero, D.Sc. (Eng.), Professor
Research Officer: Usenius, Arto, M.Sc. (Eng.)

Wood Preservation Laboratory

Address: Otaniemi
Director: Aho, Veli, Ph.L., Professor
Research Officer: Perttunen, Olavi, M.Ph.

The National Research Council for Agriculture and Forestry

Address: Unioninkatu 40 B, Helsinki 17
Chairman: Roine, Paavo, D.F., Professor
Vice-Chairman: Holopainen, Viljo, D.F., Professor
Secretary: Vacant
Assistant secretary: Pietilä, Anita, B. Agric., Acting secretary
Senior Fellows: Oinonen, Eino, D.F.
Nuorteva, Matti, D.F.
Junior Fellows: Hintikka, Veikko, Ph.D.
Ihamuotila, Risto, D.F.
Lounamaa, Kaarlo, Ph.D.
Niemelä, Seppo, D.F.
Sundman, Veronica, Ph.D.
Tanhuanpää, Eero, D.V.M.
Assistants: Ahlström, Antti, D.F., Ph.L.
Eklund, Eva, L.F.
Hackman, Patrick, L.F.
Hämäläinen, Jouko, B.F., B.Econ.
Laiho, Olavi, L.F.
Laine, Jorma, L.F.
Lallukka, Ulla, L.F.
Päivänen, Juhani, L.F.
Varis, Anna-Liisa, L.F.

The Society of Forestry in Finland

Address: Unioninkatu 40 B, Helsinki 17
Chairman: Huikari, Olavi, D.F., Professor
Vice-Chairman: Makkonen, Olli, D.F., Assoc. Professor
Secretary: Vuokila, Yrjö, D.F., Acting Professor

Editor: Tigerstedt, Peter, B.F., Ph.D.
Librarian: Kainulainen, Johannes, M.Sc.

Metsäteho, The Forest Work Study Section of the Central Association of Finnish Woodworking Industries

Address: Rauhankatu 15, Helsinki 17
Director: Hakkarainen, Aulis E., L.F.
Research Chief: Väisänen, Unto, L.F.
Technical Chief: Salminen, Jaakko, B.F., M.Sc. (Eng.)
Chief of Information and Training: Rauhalahti, Markku, B.F.
Research Officers: Kahala, Mikko, B.F.
Savolainen, Raimo, B.F.
Tenhola, Juhani, M.F.
Tuovinen, Arno, B.F.
Information Officer: Nikunen, Aimo, B.F.

The Work Efficiency Association

Address: Bulevardi 7 A, Helsinki 12
Chief of Forestry Dept.: Kantola, Mikko, D.F.
Senior Research Specialist: Hahtola, Kauko, D.F.
Research Officers: Mäkelä, Jouko, D.F.
Levanto, Seppo, B.F.
Haapamäki, Arto, B.F.
Haataja, Paavo, B.F.
Makkonen, Arvi, B.F.

Uittoteho, The Floating Research Organization in North Finland

Address: Pajusaari
Director: Hemmi, Lauri, M.F.

The Foundation for Forest Tree Breeding

Address: Alkutie 69, Helsinki 66
Head: Isoaho, Antti, B.F.

Research Officers: Hahl, Juhani, B.F.
 Kärki, Lauri, B.F.
 Lepistö, Martti, B.F.
 Leskinen, Usko, B.F.
 Niiranen, Juhani, B.F.
 Tyystjärvi, Pentti, B.F.

Water and
 Air Improvement: Passinen, K., L.Sc. (Eng.)

The Finnish Pulp and Paper Research Institute

Address: Juolukkatie 2, Tapiola
 Postal address: P.O.Box 10136, Helsinki 10
 Manag. Director: Jensen, Waldemar, D.Sc. (Eng.), Professor
 Director: Sihtola, Hannes, D.Sc.
 Director: Nordman, Lars, D.Sc. (Eng.) (hon.)
 Director: Palenius, Ilpo, M.Sc.

Library and
 Documentation Service: Holm, B., M.Sc.

Departments:
 Chemical Pulping: Palenius, I., M.Sc.

Bleaching: Vartiainen, V., M.Sc.

Cellulose Chemistry: Sihtola, H., D.Sc.

Cellulose Analysis: Kyrklund, B., M.Sc.

Pulp and Paper Testing: Kahlson, T., M.Sc.

Development of
 Chemical Products: Forss, K., D.Sc.

Biochemistry: Gadd, G. O., M.Sc.

Mechanical Pulping: von Alfthan, G., M.Sc. (Eng.)

Paper: Nordman, L., D.Sc. (Eng.) (hon.)

Board Department and
 Packaging Laboratory: Juselius, A., M.Sc. (Eng.)

Fibre Analysis: Ilvessalo-Pfäffli, M.-S., M.Sc. (Eng.)

Physical: Fogelberg, B. C., M.Sc.

Chemical Analysis: Kahila, S. K., L.Sc.

Abbreviations:

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|--------------|--|
| D.F. | Doctor of Agriculture and Forestry |
| L.F. | Licentiate of Agriculture and Forestry |
| M.F. | Master of Agriculture and Forestry |
| B.F. | Bachelor of Forestry |
| Ph.D. | Doctor of Philosophy |
| Ph.L. | Licentiate of Philosophy |
| M.Ph. | Master of Philosophy |
| B.Ph. | Bachelor of Philosophy |
| D.S.c. | Doctor of Science |
| L.Sc. | Licentiate of Science |
| M.Sc. | Master of Science |
| Sc.D. (Eng.) | Doctor of Science (Engineering) |
| L.Sc. (Eng.) | Licentiate of Science (Engineering) |
| M.Sc. (Eng.) | Master of Science (Engineering) |
| D.V.M. | Doctor of Veterinary Medicine |
| D.Pol. Sc. | Doctor of Political Science |
| L.Pol. Sc. | Licentiate of Political Science |
| LL.M. | Master of Laws |

