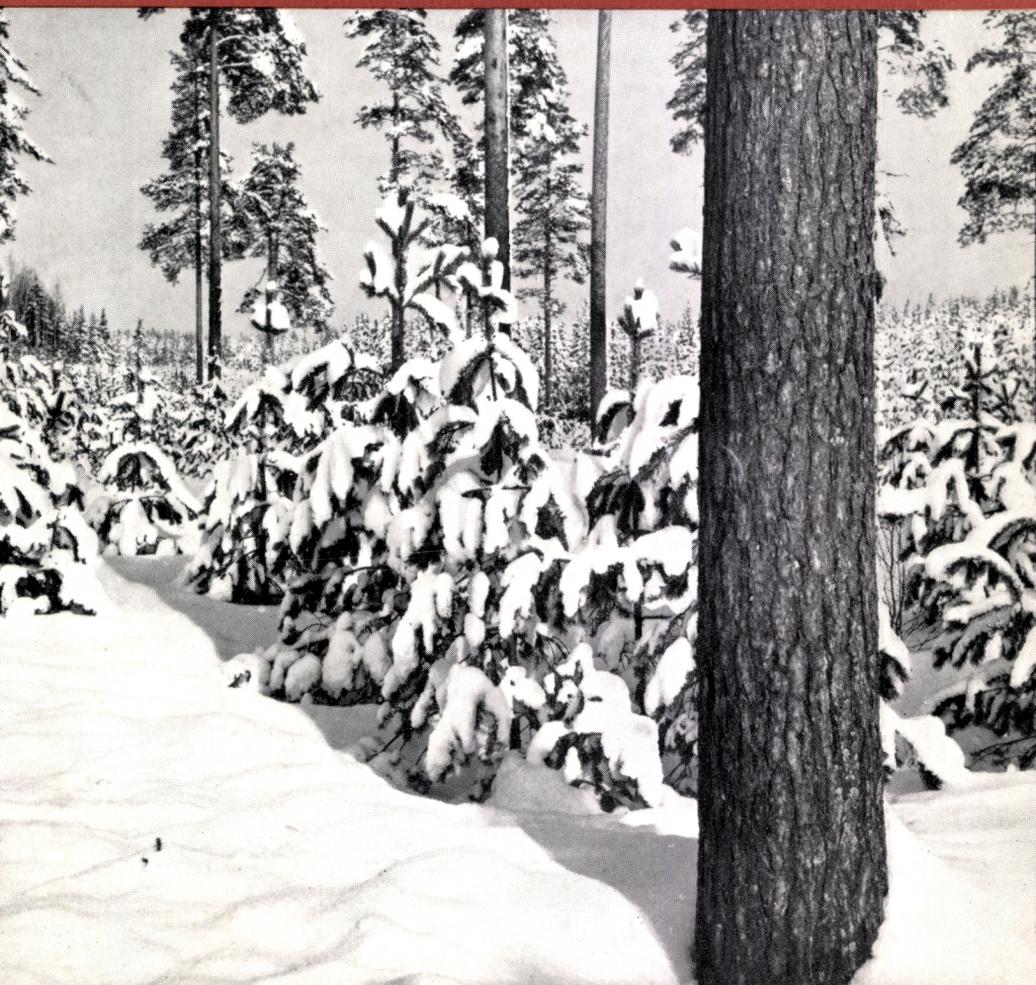


THE EXPERIMENTAL AREAS OF THE FOREST
RESEARCH INSTITUTE OF FINLAND No. 2

Ruotsinkylä



The Experimental Areas of the Forest Research Institute of Finland

The prime objective of the Forest Research Institute of Finland is to establish, through experiments and research, the principles for sound development of the country's forestry (Statute 385/1953). To carry out this work, experimental areas and stations have been set up under the Forest Research Institute. These areas, fourteen in all, have a combined area of approximately 60 000 hectares (150 000 acres). As seen from the map on the back cover of this booklet, the experimental areas are scattered throughout Finland. In this way, they represent the various conditions of nature and forestry prevailing in the country. The four conservation areas in Lapland, also totaling 60 000 hectares, provide a supplement to the experimental areas. The State-owned lands under the administration of the Institute are divided into three districts, each under the supervision of a district forest officer. In most of the experimental areas a forest technician is in charge of the local work.

Permanent sample plots and other experimental units have been established in the experimental areas for the research work. The various methods of logging, regeneration, thinning and swamp drainage can be evaluated by utilizing these plots. The usefulness of the results thus obtained can be determined even more closely through research carried out in experimental areas on a larger scale.

The picture on the cover is of a seed-tree stand at Mätäkivenummi. In the background there can be seen a stand of lodgepole pine planted in 1930. — Photo by R. Saarnio, 1957.

The Ruotsinkylä Experimental Area

Purpose. The Ruotsinkylä Experimental Area is situated about 25 kilometers (15 miles) north of Helsinki where the Forest Research Institute has its headquarters. The experimental area was founded primarily to provide the headquarters with nearby land and forest where the Institute could arrange and directly supervise the experiments and research requiring great care and constant inspection. In addition, the geography and forestry of the area are representative of the southern coastal region of Finland.

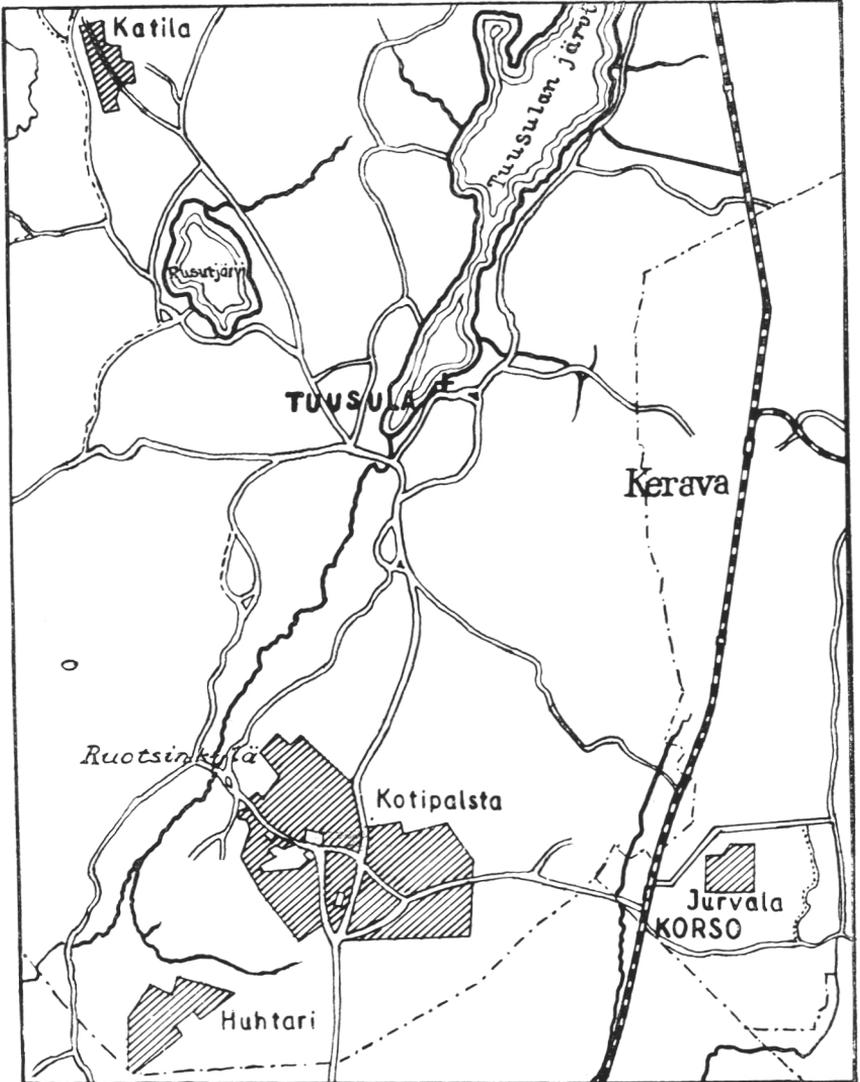
Location. The Ruotsinkylä Experimental Area lies mostly within the commune of Tuusula with a small area in the town of Kerava. Its general location can be seen from the map on the back cover of the booklet.

The name of the area has been taken from the name of the village, Ruotsinkylä, within which most of its land lies.

From a map of the area one can see that access by motor vehicles is especially easy since highways and smaller roads cross through the various parts of the area.

The nearest public accommodations are in the city of Helsinki.

The history of the Experimental area. The Ruotsinkylä Experimental Area has been formed from four former State estates. These estates were: Vävars, which was the former quartermaster's estate (Crono Regements Qvartermästare boställe under Nylands Dragone Regemente), Jeppas, the former farrier's estate (hofslagareboställe under Nylands Cavallerie), Katila, the former sergeant's estate (Sergeants-Boställe wid Kongl. Nylands Infanteriregemente), and Jurvala, a State-owned area which had previously served as compensation for an official's government work. Of the first two estates, the parts under the State Board of Forestry became enjoined to the Experimental area through a deci-



A map indicating the locations of the lands of the Ruotsinkylä Experimental Area (shaded areas). Scale 1 cm. = 1 km. (1 in. = 1.6 mi.).

sion of the Ministry of Agriculture in 1923, those of Jurvala in 1932, and of Katila in 1933.

Area. At the end of 1956 the total area of the Ruotsinkylä Experimental Area was 671 ha. (1 656 ac.). Of the area, 591 ha. (1 459 ac.) was productive forest land, poorly productive 39 ha. (96 ac.), barren land 17 ha. (42 ac.), and fields, lots, and roads 24 ha. (59 ac.). The corresponding figures for the central tract (Kotipalsta) are: 458 ha. (1 131 ac.); 14 ha. (35 ac.); 3 ha. (7 ac.); and 22 ha. (54 ac.); making a total of 497 ha. (1 227 ac.).

Climate. The table below gives the monthly mean temperatures and precipitations in Helsinki (lat. $60^{\circ}10'$, long. $25^{\circ}00'$ E., 4 m. above sea level), Ruotsinkylä (lat. $60^{\circ}22'$, long. $25^{\circ}00'$ E., 60 m. above sea level), and Hattula (lat. $61^{\circ}03'$, long. $24^{\circ}26'$ E., 104 m. above sea level). The temperature values are calculated from observations made over 27 years and precipitations over 20 years during 1925—55 for which the complete weather information is available from all three of the locations. The observations of Hattula have been made at the Ellilä estate on the shore of Vanajavesi.

M e a n T e m p e r a t u r e , C° .
F $^{\circ}$.

	Jan	Feb	Mar	Apr	May	Jun	
Helsinki	— 5.4	— 6.6	— 3.0	+ 2.9	+ 9.2	+ 14.2	
	22.3	20.1	26.6	37.2	48.6	57.6	
Ruotsinkylä	— 7.1	— 8.1	— 4.2	+ 2.4	+ 8.6	+ 13.5	
	19.2	17.4	24.4	36.3	47.5	56.3	
Hattula	— 7.6	— 8.5	— 4.3	+ 2.3	+ 9.0	+ 13.7	
	18.3	16.7	24.3	36.1	48.2	56.7	
	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Helsinki	+ 17.8	+ 16.4	+ 11.6	+ 5.9	+ 1.8	— 2.1	+ 5.2
	64.0	61.5	52.9	42.6	35.2	28.2	41.4
Ruotsinkylä	+ 16.5	+ 14.9	+ 10.0	+ 4.3	+ 0.1	— 3.8	+ 3.9
	61.7	58.8	50.0	39.7	32.2	25.2	39.0
Hattula	+ 16.8	+ 15.1	+ 10.1	+ 4.1	— 0.2	— 4.1	+ 3.9
	62.2	59.2	50.2	39.4	31.6	24.6	39.0



Experiment Station built in 1924. — Photo by O. Heikinheimo, 1939.

Precipitation, mm.
in.

	Jan	Feb	Mar	Apr	May	Jun	
Helsinki	54.6	35.6	36.8	41.6	47.1	44.8	
	2.15	1.40	1.45	1.64	1.85	1.76	
Ruotsinkylä	44.5	27.3	32.2	39.3	47.2	45.4	
	1.75	1.07	1.27	1.55	1.86	1.79	
Hattula	33.5	20.1	24.5	30.2	44.5	44.4	
	1.32	0.79	0.96	1.19	1.75	1.75	
	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Helsinki	53.7	67.3	66.7	78.3	64.1	56.8	647.4
	2.11	2.65	2.63	3.08	2.52	2.24	25.48
Ruotsinkylä	72.0	75.1	65.6	77.9	65.5	49.5	641.5
	2.83	2.96	2.58	3.07	2.58	1.95	25.26
Hattula	69.2	72.1	59.8	62.9	47.6	34.6	543.4
	2.72	2.84	2.35	2.48	1.87	1.36	21.38

The Ruotsinkylä temperatures, both in summer and winter, have thus been lower than the corresponding Helsinki temperatures, during the summer months even somewhat lower than those at Hattula, about a hundred kilometers north of Ruotsinkylä. Another unfavourable climatic factor consists of the great number of swampy strips and silt-bottomed gullies with a microclimate even less favourable than that on the rather high yard at the station headquarters where the observations given above were made.

Elevation and geological background. The experimental area's mean elevation from present sea level is about 60 meters (200 feet). The greatest differences in elevation are found on the central tract, whose lowest points (the southernmost part and Isokorpi) are about 45 meters (150 ft.) and the highest (the top of Mätä-kivenmäki hill) 80 meters (260 ft.) above sea level.

Geologically, the Ruotsinkylä Experimental Area, particularly the central tract, is in many respects interesting. Since the highest former shoreline of the ice-age sea (the Yoldia Sea) in these parts of Southern Finland was slightly more than 80 meters (260 ft.) above present sea level, the peak of Mätä-kivenmäki hill was near the surface of the water. As a result, it has been washed level by the waves. The uppermost shore formations on the side of this hill are 78, 76, and 70 meters (256, 249, 230 ft.) high. Much more distinct than these is the former bank following the 61.5—59.5 meter (202—195 ft.) contour line.

The stones and boulders found in the area were carried by the ice blocks during the ice age which preceded this period. Among the largest of the boulders are the Tapionkivi boulder in the Katila area and the one on the Kotimäki property in Ruotsinkylä. The former is 15 meters (50 ft.) and the latter 3 meters (10 ft.) high; both are of porphyritic granite. The approximately six-meter-high block of rapakivi granite, which was near the highway on Mätä-kivenmäki hill in Ruotsinkylä and from which the names of the hill and adjoining land have been derived, was destroyed in connection with road construction in the 1930's. Smaller pieces of rapakivi granite can still be encountered, for instance, on the

southern slope of Mätäkivenmäki, in the vicinity of the station headquarters, and near the buildings on the Kotimäki property.

The earliest traces of forest vegetation have been found at the bottom of the ditches in the Isokorpi swamp, 51—52 meters (170 ft.) above present sea level. During the last stages of the ice age (Yoldia Age) about 9 000 years ago there was an alder peat-moor here which, after a rise of sea level, had been buried under a layer of sand about one meter (3 ft.) deep. The parts of the alder roots and stems thus sealed in have been preserved even to this day.

Soil. According to a soils map prepared by the Geological Research Institute, the soil on the central tract of the Ruotsinkylä Experimental Area has the following composition: rock 3 %, moraine 8 %, gravel and sands 66 %, silt and clay 2 %, and peat 21 %. Thus, of the loose mineral soils moraine comprises 10 %, gravel and sands 87 %, and silt and clay 3 %. Since the corre-

The Department's of Swamps sample plot No. 19 in Isokorpi. The area was drained in 1929. — Photo by M. Hagman, 1956.





The forest on the nature reserve of Vähänummi is a spruce stand of approx. 140 years. The seed crop of spruce is studied here. Seed traps are visible in the background. —
Photo by R. Saarnio, 1956.

sponding figures for the entire southern half of Finland are on an average 77 %, 19 %, and 4 %, the essential feature of the Ruotsinkylä Experimental Area and a great portion of the southern coastal region comes to the fore: the scarcity of moraine. In addition, it ought to be pointed out that the moraine of Ruotsinkylä is not typical moraine but is leached by water and choked with sediment. Thus by its physical and chemical properties it is less favourable for tree growth than the moraines of Southern Finland in general.

Forest and swamp site types. The vegetation of the area with its features characteristic of the southern coastal area differs from that of Finland's interior. This is evident also in the distribution

of productive forest lands by forest site types. The following list illustrating this has been based on an estimation made in 1951 and 1952. Of the forest lands, 1.7 % was of *Oxalis-Majanthemum* type (OMaT), *Oxalis-Myrtillus* type (OMT) 23.0 %, *Myrtillus* type (MT) 26.1 %, *Vaccinium* type (VT) 19.9 %, *Calluna* type (CT) 4.2 %, drained peat soil (Tkg) 11.7 %, swampy forest land (Kkg) 4.0 %, ditched spruce-hardwood bog (Kkg) 2.5 %, ditched pine bog (Rkg) 2.9 %, natural spruce-hardwood bog (K) 1.8, %, and natural pine bog (R) 2.2 %. Thus, approximately 51 % of the productive forest lands are of *Myrtillus* and better site types, *Vaccinium* and *Calluna* types making up a total of 24 %, and the natural spruce-hardwood bogs and pine bogs 4 %. As compared with the last-mentioned swamps, various converted swamp types accounted for a much greater area, or 21 %. This is understandable since the Forest Research Institute during the years 1924—1956 carried out ditching operations throughout the Experimental area in an effort to drain the swamps; 69 180 meters (43 miles) of ditch have been dug in the area resulting in 249 hectares (615 ac.) of drained swamp. The corresponding figures for the central tract alone are 30 690 meters (19.1 mi.) and 114 ha. (282 ac.).

Flora. The natural vegetation is not particularly rich in species. It is most abundant in the black alder stand (*Alnus glutinosa*) on the Isokorpi swamp on the central tract, along the creek in Lähdeniitty meadow, and in a part of the Vähänummi forest. Of the eutrophic Finnish deciduous trees in the area, those growing naturally are ash (*Fraxinus excelsior*), maple (*Acer platanoides*), basswood (*Tilia cordata*), and also hazel (*Corylus avellana*). Some ash grows in the spruce-hardwood bog in the experimental forest and maple on the Huhtari lot where basswood can also be found. In addition, basswood is found in the experimental forest and on the Lehtikuusimäki hill, together with the hazel. Of the native curly birch a few individuals, mostly shrubby, remain in different parts of the central tract and in Huhtari. On the northern edge of the experimental forest appears an exceptional form of spruce (*Picea Abies* f. *glomerulans*). On Mätäkivennummi is a good-



Heavily-thinned pine stand of 135 years at Mätäkiivennummi. Young pines in the background. The cutting has yielded sawlogs and fuelwood. — Photo by M. Hagman, 1954.

sized pine, the top part of whose crown forms a very large spherical witches' broom. A typical gnarled pine is also found there. Some native spruce, aspen, and mountain ash have been marked off as material for forest tree improvement work.

Among the planted trees, the witches-broom pines planted on the hills of Lilpakanmäki and Paratiisinmäki are of more general interest. On the former location grow also larch hybrids, and lobeleaved grey alder and birch hybrids planted in many places. Numerous exotic species are represented in the Experimental area. The herbaceous plant *Soldanella montana*, which was transferred from Böhmerwald, Czechoslovakia, to the Vähänummi conserva-



A pine seed-tree stand from the years 1926—27. The soil was prepared by removing raw humus
— Photo by C

tion area and to the banks of the Lähdeniitty creek, has survived and spread. On the other hand, the herb *Homogyne alpina* which was also brought from there has not multiplied from seed. In Iso-korpi *Glyceria lithuanica*, and at Mätäkivennummi a few individuals of *Pulsatilla vernalis* have been found.

Fauna. As there are relatively few plant species to be found in the area, neither are many rare animal species represented. The game-bird stock is limited to only the capercaillie (*Tetrao urogallus L.*), heath grouse (*Lyrurus tetrix L.*), and wood grouse (*Tetrastes bonasia L.*). The ringdove (*Columba palumbus L.*), on the other hand, is fairly common, as is the European woodcock (*Scolopax r. rusticola L.*). Moose (*Alces alces L.*) are often seen in the Experimental area. Injuries by them are rather common, particularly to several exotic tree species. The last wolves (*Canis lupus L.*) roamed the vicinity perhaps around 1860. The site of



ots at regular intervals in 1927. The site is the top of Sudenkuopanmäki hill, Mätäkiivennummi-nheimo, 1939.

the pit for trapping them is still visible on the side of Sudenkuopanmäki hill on the central tract where the roads to Maantiekylä and Korso meet. The Susikivi (Wolf Rock) near Isokorpi was a boundary marker in the 1761 general reparceling.

The forests and their development. The oldest information about the condition of the forests on the lands included in the Experimental area is found in the records of the general reparceling, which date back to 1761 (Ruotsinkylä), 1779 (Katila), and 1782 (Jurvala). According to these records the northern and western parts of Mätäkiivennummi were growing young pine, whereas the southern and eastern sides of the highway were growing heavy timber. The forests on the Katila estate were rather young, birch-dominated, burned-over forests, as was part of the Jurvala forests.

More detailed and continuous descriptions of forests appear in

the 1860's. At that time the State began to draw up management plans for the forests on these estates. In addition to describing the forests, they contained regulations concerning the forest operations for the following ten-year period. Included were the silvicultural aspects of logging, quantity of removals, preparation of logging sites for regeneration, etc. Generally the annual felling area was defined by dividing the area of productive forest land by the approved rotation (100—140 years). Seed trees were usually left standing on these areas, and they could be removed only after a sufficient stand of seedlings had been established. At first these areas were long and narrow (e. g., in the Jeppas forest approx. 200×25 m.); later they were more square in shape.

From the statements that were drawn up at the conclusion of this forest management system it appears that the arrangement had generally yielded satisfactory results. With certain exceptions, sufficiently dense, mostly coniferous-dominated young and middle-aged forests were achieved in the felling area.

The grazing lands formed the other part of the forest areas of the estates. Under the pretext of improving the pasture and enlarging cultivated fields, clear cutting and very heavy thinning have been done. Cultivation by burning over has been used, for instance, along the edges of the Lähdeniitty meadow and behind Kotimäki hill. For these reasons there have not generally been any large timber trees on the grazing lands.

In addition to the afore-mentioned measures, the condition of the forests has been affected by the clear cuttings carried out in 1915—1917 by order of the Russian military authorities. They were made on extensive areas in the Isokorpi swamp on the central tract, in Huhtari, and in Jurvala. During the same period the State Board of Forestry cut cordwood and heavy timber both on the central tract and in Katila. During the period 1924—1954 the area of fellings under the Forest Research Institute was distributed as follows: thinning 27 %, accretion cutting 20 %, cutting of standards 39 %, shelterwood felling 6 %, and clear cutting 8 %. The list above applies only to removals yielding commercial wood, thus excluding the treatment of young age classes.



Outdoor grafting of pine. — Photo by M. Hagman, 1956.

Of natural devastations, the most destructive was the storm of August 27 and 28, 1890, in which approx. 700 valuable timber trees of at least 18' \times 9" and about 4 500 stacked cubic meters of smaller wood on the central tract were blown over. The damage on the plots was relatively as severe. Snow has broken trees during several winters, especially the winter of 1955—56. The only recorded forest fire occurred in the summer of 1917.

The combined result of the logging and damage described above appears in the following information obtained from the forest inventory carried out in 1951 and 1952. The productive forest land of the Experimental area was distributed according to the dominant tree species of the stand as follows: 33 % of the forests were dominated by pine, 39 % by spruce, 23 % by

deciduous trees, and 5 % by other tree species (also exotic). The corresponding age-class distribution was: open 3 %, 1- to 20-year-old forest 7 %, 21—40 years 23 %, 41—60 years 29 %, 61—80 years 18 %, 81—100 years 6 %, and 101 years and over 14 %. The mean volume per hectare on productive forest land was in the entire Experimental area as well as on the central tract approx. 100 cu. m., incl. bark, and the mean annual growth per ha. 5.1 cu. m., excl. bark.

Market conditions for the wood. On the central tract of the Ruotsinkylä Experimental Area wood has been sold rather early. Thus, in the forest management plan of 1858 it is stated that it is possible for the locality to sell wood products to the city of Helsinki, which is at a distance of 25 kilometers.» Since birch firewood had the greatest demand among small wood, it was considered desirable in the 1886 revision of working plans that birch become in some instances the dominant tree on the annual cutting areas. The demand for fuelwood, even to very small diameters, has until recent years been especially good. The buyers have been the common people of the area. The first pulpwood sales in the Experimental area took place in the late 1920's.

Until about 1930 the transport of sawlogs and pulpwood from the Ruotsinkylä forests to the coast was done primarily by floating on the Tuusulanjoki river. Railway transportation has also been considered. In the postwar period, since the late 1940's, the longer distance transportation has been handled entirely by motor transport.

Research and experiments. An important part of the research done in the Ruotsinkylä Experimental Area comprises the problems involved in the biology of forest regeneration. The objects of investigation have included the flowering of trees, pollination, the dispersal of pollen and the preservation of its viability, seed ripening, seed crop and seed years, the storing of seed and promotion of germination, as well as the preparation of the soil in connection with regeneration fellings. Closely related to these have been also the maintenance and care of the nurseries, various sowing and planting methods, and regeneration fellings. These ques-



Lodgepole pine on plot No. 65. The seedlings were grown from seed collected in Alberta, Canada. In the picture the trees are 27 years old. — Photo by M. Hagman, 1956.

tions, as well as the evaluation of thinning practices and the effect of overtopped stock, have been studied on permanent sample plots.

The differences of the geographical races of pine and spruce have been investigated by comparative experiments, the oldest of which originated in 1926 and the more recent ones, the »international» experiments, in 1944. Natural larch hybrids have been moved both from the larch stand of Kitee and from Mustila. The oldest experimental plantations (the seedlings of which are from 1937 and 1938) of artificially crossed larch species are also found in this Experimental area, as well as the experiments on the genetics of the lobate characteristic of birch and gray alder leaves.

Work on the breeding of forest trees was begun in the Experimental area in 1950 in cooperation with the Foundation for

Part of an experiment on pine races. When the picture was taken the trees were 30 years old. The pine on the left is of Northern-Finland (Rovaniemi) origin and on the right of Southern-Finland (Raivola) origin. — Photo by M. Hagman, 1956.



Forest Tree Breeding. The first greenhouse built for the purpose was completed in 1949 and a seed extraction plant in 1954. In this work artificial hybridization has been applied with both domestic and foreign tree species. Clones with favourable properties have been grown for seed production and various experiments. In the Experimental station's nursery it has been possible to grow enough seedlings of certified good origin to also permit their sale. The visible results of this work are the hybrid plantations and collections of plustrees.

Experiments with exotic tree species have been made since the earliest years of the Experimental station. By the end of 1956 sixty species and races had been included in the studies and the plantations comprised an area of 74.2 hectares (183 ac.). The results have not met expectations, in most instances due to unfavourable site, its climate and soil.

The permanent sample plots of the Department of Forest Mensuration comprised in 1956 eleven series with a total of 18 experimental plots. Through the Department's work the results of various mensurational methods, e. g., the use of aerial photographs in forest mensuration, were evaluated by comparisons to the stands of the Experimental area.

The Department of Swamps in 1956 had a total of 56 sample plots, comprising 46 series. From these plots the Department is determining the effect of draining on the ground cover, peat type, the swamp's reversion to forest, and the value of different silvi-cultural treatments. Various fertilization and soil improvement experiments have been made, as well as studies dealing with the technical problems of ditching.

Since major portions of the Ruotsinkylä Experimental Area have been used and will continually be used for experiments of longer or shorter duration, the figures on the station's economy — the felling quantity, the income, and the expenses — have no general significance. The numerous changes in the total area also decrease their meaning. Therefore, in order to study sustained yield a special e x p e r i m e n t a l f o r e s t has been set apart from the Experimental area. The tract consists of only 50.8 hec-

tares (125 ac.). A 5.1-hectare (12.7-ac.) tract of the Vähänummi lands, predominantly an old spruce stand, has been set apart as a n a t u r e r e s e r v e. Its forest is left in a natural state; only dead trees are removed.

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