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The Time Table of Vegetative Spreading of the Lily-of-the-Valley (*Convallaria majalis* L.) and the Wood Small-Reed (*Calamagrostis epigeios* (L.) Roth) in Southern Finland

Eino Oinonen

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THE TIME TABLE OF VEGETATIVE SPREADING OF THE LILY-OF-THE-VALLEY (*CONVALLARIA MAJALIS* L.) AND THE WOOD SMALL-REED (*CALAMAGROSTIS EPIGEIOS* (L.) ROTH) IN SOUTHERN FINLAND

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1. INTRODUCTION

This study is a part of a series of studies, carried out in order to compile a time-table of the vegetative spreading of the commonest perennial Finnish forest-plant species. In previous studies (OINONEN 1967 a-c, 1968), the time-tables of bracken (*Pteridium aquilinum* (L.) KUHN), and of *Lycopodium complanatum* L., *L. clavatum* L., and *L. annotinum* L. were fixed. The dimensions of structurally homogeneous and mainly solitary stands of these plant species have been compared, in the study, with the times from fires, and the age of forest stands and parts of forest stands that have grown after the fires. It has been assumed that the time margin enabling regeneration is narrow, and that the maximum dimensions of the clonal stands born, thus indicate minimum time from the fire, in practically the same way as the ages read from cores extracted from the bases of the oldest members of the tree stand. When replicate-dimensioned stands of a plant species are found in an area burned in a single fire, and especially if such replicates are found among the stand-populations of different species, it is probable that the fire has been a common regeneration factor for all of them. This probability is still increased by the regular recurrence of this phenomenon in burned areas studied in different parts of the country, and dating from the same time, and by a linear relationship between the times from the fires and the dimensions of the stands measured in areas burned at different times (the principles of the method of study are discussed in detail in OINONEN 1968, p. 5—7). The materials presented in this paper offer a possibility to discuss this theory on the basis of data from six plant species; they also provide a possibility to check the previously published results.

The lily-of-the-valley (*Convallaria majalis* L.) and the wood small-reed (*Calamagrostis epigeios* (L.) ROTH) are characterized by a patchy distribution. Stands a few square meters in size are often unbroken, circular and with distinct borders, and they stand out clearly among other vegetative cover. It is not very unusual that even large stands with a diameter of over ten or twenty meters are such. It is, however, common that very large stand units are broken up into clusters, or form rows, strings of patches, or arcs. Solitary patches are usually homogeneous in their color, while rather distinct color differences may be seen between neighboring patches of the same species. In the lily-of-the-valley, these color characteristics are best seen in the basal parts of the flower shoots or the leaf sheathes: in extreme cases, they are dark-violet, or blackish brown, and light green. Intermediate phases are common and form a continuous series. In the wood small-reed, color variations of the brown inflorescence are commonly seen, but the leaves also exhibit different hues in different patches: they are cold or warm green and in exceptional cases tinged with violet. In the autumn, the wilting leaves exhibit degrees of individual variations among the patches, probably partly due to different times of yellowing. After snow-melt, the leaves are usually whitish, but sometimes pale yellowish in certain patches. Site quality may be partly responsible for color variations in both species. The color differences appear to be more distinct in fertile than poor sites.

This study is based on the assumption that the color differences primarily distinguish between individuals, and that consistent color characteristics in stands signify clones. This assumption is supported by observations that regeneration from seed is rare in both species (see also KUJALA 1926, for lily-of-the-valley p. 71). Entirely solitary little stands are found in the field, except in recently burned areas, mainly on disturbed sites, such as the sides of railroads, roads and trails, and areas adjacent to gravel pits, building sites, electric and telephone lines, harvesting and regeneration areas in the forests, timber landing sites, edges of drains, and other such areas where the soil surface has recently been broken or uncovered (see also Appendix 1, e.g. no:s

1, 3, 16). Even on such sites, young solitary patches are rare. In dense spruce stands, lily-of-the-valley leaves are sometimes found singly or in small clusters among the trees, as also are bracken leaves, but they are probably mainly relicts of more continuous and larger stands of the past. On such sites, wood small-reed stands are also either discontinuous and sparse or composed of clusters. In agreement with observations made during the preliminary stages of this study, KUJALA (1926, p. 70, 1964, p. 34, 36) has also found that fires, and burning for cultivation, have increased the frequency of both lily-of-the-valley and wood small-reed stands.

Since these plant species are frequently found on common sites, and frequently also on sites of bracken stands and stands of the listed *Lycopodium* species, the possibilities to compare the dimensions of same-site stands are good. Excavations on the outer edges of lily-of-the-valley and wood small-reed stands showed that they were spreading outward, and that the rate of spreading was much smaller than that for bracken and the *Lycopodium* species. Both lily-of-the-valley and wood small-reed stands were found to be permanent, where a number of their stands had been observed for 5—6 years. Not a single patch had appeared nearby, outside of the outer margins of the stands during this period. It was also found in the preliminary studies that even in fairly recently burned areas, there were sometimes large homogeneous solitary patches and stands that could not have been born, because of the slow growth of the annual shoots, after the latest fire. In case they were clones, they were much older. Especially excavations in heathlands* indicated that the underground parts of both species grew commonly in the mineral soil, well protected from the heat of fires. On such sites, they grew in the soil somewhat like bracken rhizomes, but closer to the soil surface. The first comparative measurements of the dimensions of the stands of these species and their frequency distribution were made in heathlands, and some time-size discrepancies were found. The fire resistance of the lily-of-the-valley and the wood small-reed is probably somewhat weaker than that of bracken, and fires may thus more frequently cut into lily-of-the-valley and wood small-reed than bracken stands. Especially the parts of the stands growing on sites with a relatively thick humus layer, where lily-of-the-valley and wood small-reed rhizomes mainly grow in this layer, are vulnerable to fire damage.

Preliminary observations and tests led to the conclusion that a sufficient quantity of data is required to sift out »impurities» and exceptionalities, in order to reveal true size-age relationships by the frequency distribution. At present, the data consist of about 400 lily-of-the-valley and 500 wood small-reed stands, and the worst inconsistencies have been picked out. The results have been partly checked by measuring solitary stands in the battle stations and battlegrounds of Hanko peninsula, on the coast of the Gulf of Finland, dating from 1941.

* Heathlands refer here to open, rather poor, level pine sites on sandy soils. The forest site type (CAJANDER 1949) varies from *Cladina*- to *Vaccinium vitis-idaea*-type.

2. MATERIALS

The data have been collected from southern Finland, south of latitude 64° N, from 29 communes primarily in the southwestern part of the country.

The stands have been measured along the soil surface. The cores of the bored trees have been studied microscopically. Plant specimens have generally been distinguished by the naked eye. In multiclonal mixed stands, only patches with exceptionally distinct characteristics have been delimited; the major part of the data are from solitary stands, often the only ones found in areas of several hectares.

Some errors may have persisted in the times of fires determined or judged from tree borings, despite that any apparently uncertain cases have been kept separate to the extent that this has been possible, and they have not been used in time-stand size comparisons. The number of reliable determinations is sufficient to prevent any significant distortion of the results by errors. The series of borings from the oldest trees and series of same-aged trees leave no doubt in the age determinations and provide a convincing check. The only variation in this series is due to differences in the stump-level age and the marginal time of regeneration. These age data distinctly give the minimum time elapsed after the fires (see OINONEN 1968, p. 20). The dimensions of bracken and *Lycopodium* stands growing on the same sites provide another check. These stand dimensions can also be used as alternative or additional data in determining the times of the fires, with the help of previously published time-tables of growth (OINONEN 1967 a, p. 72, c, p. 6—7 and 66, 1968, p. 26). When these stands are also solitary, interpretation uncertainties are not involved in the comparisons, since »pure» dimensions are compared.

Several large lily-of-the-valley and wood small-reed stands have been measured in areas burned over at various times after the stands were born. A part of them may thus have been cut down to a size somewhat smaller than the potential one, another part may be somewhat larger (in cases where the stand has not developed from a diaspore, but from a small fire relict). Such errors probably tend to cancel each other out and thus probably have no significant effect on the results. Similar variations are also caused by site differences. Since it was not possible to classify the sites adequately during the field work, no site differentiation has been made in computing the results, and in this respect, the data have been treated as a single class. The majority of the data come from *Vaccinium vitis-idaea*-type forests (see Appendices 1 and 2).

Appendices 1 and 2 list, by sample areas, the sizes of lily-of-the-valley and wood small-reed stands and their replicates, their mutual size relationships and the relationships with the sizes of bracken stands and stands of the *Lycopodium* species, the times of fires, and the age of the tree stand. The lily-of-the-valley is represented by 383 individual stands (201 sample areas) and the wood small-reed by 366 (187 sample areas). The comparative species are represented in these data by the following numbers of stands: bracken, 436, *Lycopodium clavatum*, 110, *Lycopodium annotinum*, 197, and *Lycopodium complanatum*, 195 stands. A total of 1687 individual stands have thus been considered.

Part of the stands of the comparative species have already been described in previous publications (OINONEN 1967 a-c, 1968). These have been pointed out in the appendices, in order to enable detailed observations of the connections of the currently presented data with previous ones. The consistent relationships of the lily-of-the-valley and wood small-reed stand sizes confirm previously established connections to the spreading time-table, as is seen in the appended data.

The following table summarizes the frequency of the cases, where lily-of-the-valley and wood small-reed stands can be compared with replicates growing in the same area, with stands of the other species studied, with the time from the fire, and with tree ages indicated

	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.	Time of fire	Age of tree stand
				Number of cases				
Conv.m.*	93	55	118	42	81	75	87	125
Cal.e.		99	127	41	64	72	108	126

* Abbreviations used here and later for the names of plant species:

Conv.m. = *Convallaria majalis*
Cal.e. = *Calamagrostis epigeios*
Pt.a. = *Pteridium aquilinum*
L.cl. = *Lycopodium clavatum*
L.a. = » *annotinum*
L.c. = » *complanatum*

by cores extracted from the bases of individual trees or tree generations.

Since part of the tree stands have been heavily cut, and especially the oldest end of the age distribution has been selectively removed, the oldest stand members have not always been found. Resulting clearly erroneous data have been discarded in the interpretory phase. To attain a degree of random consistency, the same number of comparative pairs, 100 of most closely connected pairs, were selected from both lily-of-the-valley and wood small-reed sample areas for size and age comparisons.

Stands of both plant species could be compared with at most seven comparative values from the same site: the sizes of the stands of the other five species, the time from the fire and the age indicated by cores from the bases of individual trees or tree generations. The numbers of comparative observations were distributed among the sample areas as follows:

	Comparative data for Conv.m., number							Total
	1	2	3	4	5	6	7	
Sample areas, number	50	51	48	29	20	7	6	201
Comparative observations ..	50	102	144	116	100	42	42	596

	Comparative data for Cal.e., number							Total
	1	2	3	4	5	6	7	
Sample areas, number	31	39	50	29	23	9	6	187
Comparative observations	31	78	150	116	115	54	42	586

The distribution of the corresponding stand sizes and their replicates of all five comparative species, in the sample areas was as follows:

	Number of stands of corresponding sizes																											
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	Number of sample areas																											Total
To Conv.m.	17	34	34	29	21	14	13	6	10	6	3	3	2	1	–	2	1	2	1	–	–	1	–	–	–	–	–	1	201
To Cal.e.	6	18	34	29	29	12	15	5	14	3	5	5	3	2	–	1	2	1	1	–	–	1	–	–	–	–	–	1	187

The tabulated numbers do not indicate the total number of corresponding-sized stands of these species in each sample area, since only the most distinct and mainly solitary stands have been looked for. The actual numbers may thus be greater.

Parallelisms between the comparative data have been studied, as in previous studies, by the least-squares method. Each sample area is represented in the computions by only the largest and presumably primary stand of each species; the time-table of vegetative spreading is thus built from the maximum sizes in each sample area (Oinonen 1968, p. 22—23). Thus the time-table does not show the potential maximum or an average based on total size variation. The minimum spreading rate of each species is not revealed by this method of study.

It was found during the collection of the materials that lily-of-the-valley and wood small-reed stands growing on the same site are often of the same magnitude, sometimes of exactly the same size. Rhizome measurements indicated that the annual increment is about the same for both species, 5—8 cm/yr. When it was found in computing the results that the species were spreading at approximately an equal rate, it appeared appropriate to report the results together for both.

3. RESULTS

31. Relationships between parallel populations

311. Stands of lily-of-the-valley, wood small-reed, and bracken

The following regression relationship was computed for the sizes of the 117 largest lily-of-the-valley and bracken stand pairs (x = bracken):

$y = 0.322 + 0.353\ x$ (figure 1).

The relationship between wood small-reed and bracken stands (126 pairs) is

$y = 0.319 + 0.348\ x$ (figure 2).

The equations deviate slightly from each other. At a bracken stand size of 100 m, the diameter of a lily-of-the-valley stand is 35.6 m and wood small-reed 35.2 m. Bracken attains a stand diameter of 100 m in about 283 years (Oinonen 1967 c, p. 65 – 66); according to the data, the difference in the diameters of lily-of-the-valley and wood small-reed stands of this age is only 0.4 m.

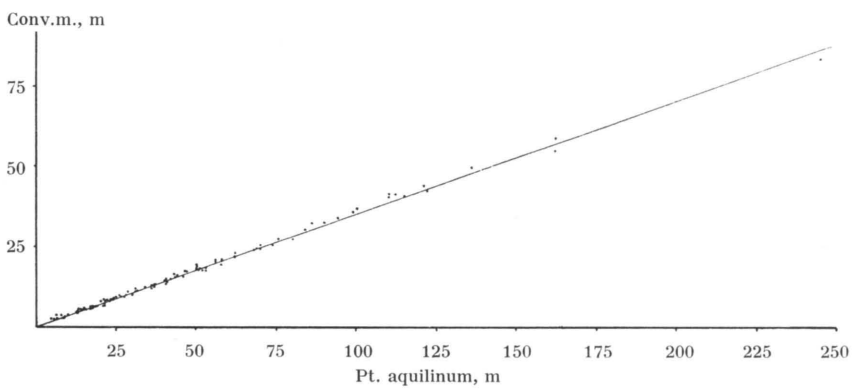

Fig. 1. Relationship between the size of *Convallaria majalis* and *Pteridium aquilinum* stands.
$y = 0.322 + 0.353\ x$

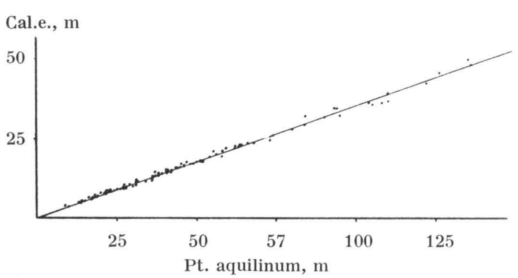

Fig. 2. Relationship between the size of *Calamagrostis epigeios* and *Pteridium aquilinum* stands.
$y = 0.319 + 0.348\ x$

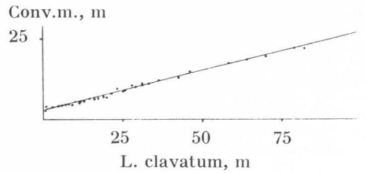

Fig. 3. Relationship between the size of *Convallaria majalis* and *Lycopodium clavatum* stands.
$y = 2.758 + 0.244\ x$

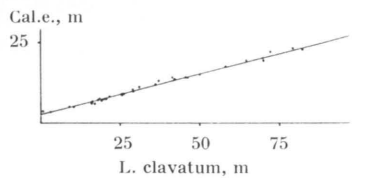

Fig. 4. Relationship between the size of *Calamagrostis epigeios* and *Lycopodium clavatum* stands.
$y = 2.640 + 0.254\ x$

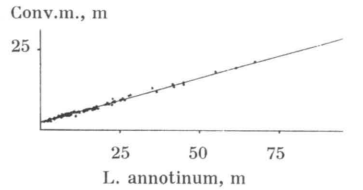

Fig. 5. Relationship between the size of *Convallaria majalis* and *Lycopodium annotinum* stands.
$y = 2.287 + 0.284\ x$

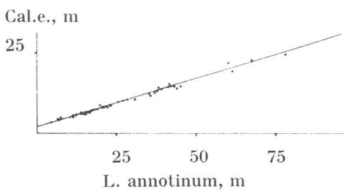

Fig. 6. Relationship between the size of *Calamagrostis epigeios* and *Lycopodium annotinum* stands.
$y = 2.194 + 0.303\ x$

312. Stands of lily-of-the-valley, wood small-reed, and *Lycopodium clavatum*

Stands of *Lycopodium clavatum* which are presumably primary, and thus usable in computing these data relationships, are relatively rare. Stands comparable with the lily-of-the-valley number 36, with the wood small-reed, 34.

The relationship of lily-of-the-valley and *Lycopodium clavatum* stand sizes is described by the equation

$y = 2.758 + 0.244\ x$ (figure 3),

and that of the wood small-reed and *Lycopodium clavatum* by

$y = 2.640 + 0.254\ x$ (figure 4).

The difference between the equations is small. At a *Lycopodium clavatum* stand diameter of 131 m (= bracken, 100 m, Oinonen 1968, p. 26), a lily-of-the-valley stand will be 34.7 m and a wood small-reed stand 35.9 m in diameter. The difference of 1.2 m at the age of 283 years is in the opposite direction as in the preceding comparison.

313. Stands of lily-of-the-valley, wood small-reed, and *Lycopodium annotinum*

Among stands of *Lycopodium annotinum* which have been considered to be primary, 75 counterparts have been found for the lily-of-the-valley and 56 for the wood small-reed.

The relationship of lily-of-the-valley and *Lycopodium annotinum* stand sizes is described by the equation

$y = 2.287 + 0.284\ x$ (figure 5),

and that of the wood small-reed and *Lycopodium annotinum* by

$y = 2.194 + 0.303\ x$ (figure 6).

The equations lead to rather similar diameters. At a *Lycopodium annotinum* stand diameter of 115 m, (= bracken, 100 m, Oinonen 1968, p. 26), lily-of-the-valley stands will be 34.9 m and wood small-reed stands 37.0 m in diameter. At the age of 283 years, the difference is 2.1 m in the same direction as in the comparison with *Lycopodium clavatum*.

314. Stands of lily-of-the-valley, wood small-reed, and *Lycopodium complanatum*

Among *Lycopodium complanatum* stands which have been considered primary, 66 counterparts have been found for lily-of-the-valley and 55 for wood small-reed stands.

The relationship of lily-of-the-valley and *Lycopodium complanatum* stand sizes is described by the equation

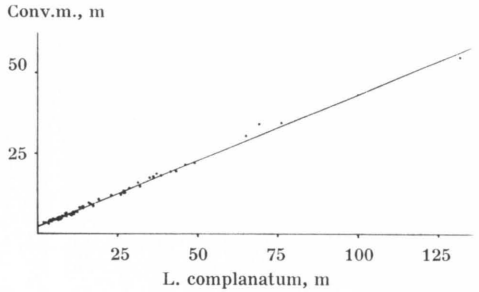

Fig. 7. Relationship between the size of *Convallaria majalis* and *Lycopodium complanatum* stands.
$y = 2.234 + 0.415\ x$

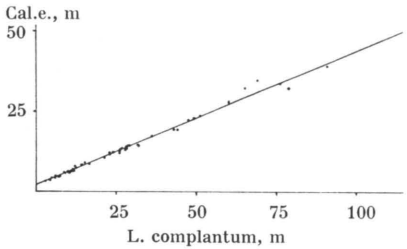

Fig. 8. Relationship between the size of *Calamagrostis epigeios* and *Lycopodium complanatum* stands.
$y = 2.062 + 0.418\ x$

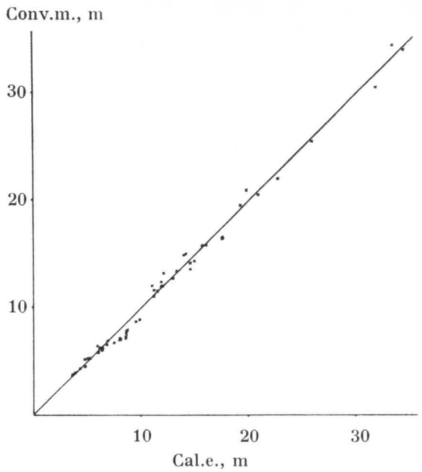

Fig. 9. Relationship between the size of *Convallaria majalis* and *Calamagrostis epigeios* stands.
$y = 0.116 + 0.990\ x$

$y = 2.234 + 0.415\ x$ (figure 7),
and that of the wood small-reed and *Lycopodium complanatum* by
$y = 2.062 + 0.418\ x$ (figure 8).

At a *Lycopodium complanatum* stand diameter of 82 m (= 100 m for bracken, Oinonen 1968, p. 26), the corresponding diameter indicated by the equation is 36.2 m for the lily-of-the-valley and 36.3 m for the wood small-reed. The difference at the age of 283 years is negligible, only 0.1 m, which is smaller than the usual accuracy of measurement along the soil surface in stands of this size.

315. Stands of lily-of-the-valley and wood small-reed

The data include 55 parallel pairs of the lily-of-the-valley and the wood small-reed. The regression equation is
$y = 0.116 + 0.990\ x$ (figure 9).

At a wood small-reed stand diameter of 35.3 m (see item 316), that of the lily-of-the-valley is 35.1 m, only 0.2 m smaller.

316. Stands of lily-of-the-valley and wood small-reed, and time from the fire

87 comparative pairs have been recorded for the lily-of-the-valley and the time from the fire, and 108 for the wood small-reed and this time.

The regression between the lily-of-the-valley stand diameter and the time from the fire is
$y = 0.012 + 0.125\ x$ (figure 10),
and between the wood small-reed and the time from the fire
$y = -0.020 + 0.125\ x$ (figure 11).

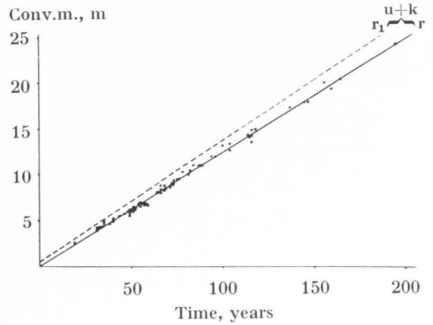

Fig. 10. *Convallaria majalis* stands, the time elapsed since the fire, and the basal age of the tree stand.
r = relationship with time from the fire; r_1 = relationship with age of trees
u + k = time of regeneration + age at butt height

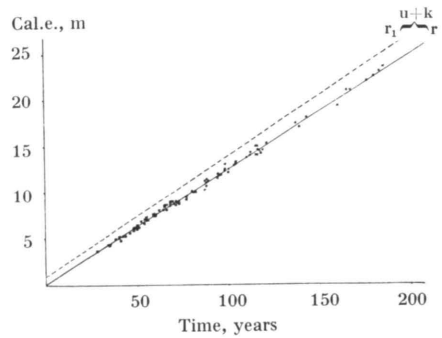

Fig. 11. *Calamagrostis epigeios* stands, the time elapsed since the fire, and the basal age of the tree stand.
r = relationship with time from the fire; r_1 = relationship with age of trees
u + k = time of regeneration + age at butt height

At 283 years from the fire, as in previous examples, the lily-of-the-valley stand diameter is 35.4 m and that of the wood small-reed 35.3 m. The figures are practically equal.

Somewhat different stand diameters were thus obtained in the various computations, as is seen in the following summarization of the results of all comparisons.

The direct comparison with the times from the fires can be considered most accurate, since one of the objects of comparison is definitely fixed and only the other varies. The table shows that the regressions of the lily-of-the-valley and the wood small-reed, with the times from the fire indicate practically

Comparative materials	Diameter at the age of 283 years (Pt.a. = 100 m)	
	Conv.m.	Cal.e.
Pt.a. spreading time-table	35.6	35.2
L.cl. » »	34.7	35.9
L.a. » »	34.9	37.0
L.c. » »	36.2	36.3
Times from the fires	35.4	35.3
Conv.m. and Cal.e. regression at a Cal.e. stand diameter of 35.3 m	35.1	35.3
Average	35.3	35.5

identical spreading rates. The results are similar when comparisons are made with the spreading time-tables of the bracken and *Lycopodium complanatum*. The stand diameters of both members of the comparative pairs vary, when comparisons are made between plant species. The greatest differences were found in these comparisons, approaching and exceeding 2 m at the age of 283 years. Considering the length and indefinity of the manifestation period especially for the *Lycopodium* species, and also the unevenness of their growth rate (Oinonen 1967 c, 1968), the results can be regarded as fairly good. It should be rementioned that relatively few of the data, on which the time-tables for the comparative species have previously been constructed, have been included in the computions.

The spreading rate of lily-of-the-valley and wood small-reed stands, computed by times from fires, is about the same, 12.5 cm/yr in diameter and 6.2 cm/yr in radius.

No data have been found in the literature on the rate of rhizome growth of these plant species, or of the spreading rate of their patches. No comparisons are therefore possible. The largest solitary patches found from the battle stations at Hanko peninsula were 3.7 m for the lily-of-the-valley and 3.6 m for the wood small-reed (maximum age 28 years). According to these findings, the maximum rate of diameter growth is 13.2 cm/yr for the lily-of-the-valley and 12.9 cm/yr for the wood small-reed. Since spreading at a normal rate can hardly start earlier than in the second or third summer after seed germination, the actual maximum rates are probably somewhat larger. The average spreading rate of the four largest patches of both species (appendix 1, no. 16) was 12.5 cm/yr for the lily-

of-the-valley and 12.1 cm/yr for the wood small-reed, assuming seed germination in 1941 and disregarding the slowness of early-period growth. These stands grew in cultivated sandy soil, free of competition (the largest lily-of-the-valley stand on the edge of a field latrine pit, where fertility was probably higher than average), on a site where observations made elsewhere, also, during the field work indicate the largest spreading rates for these species. Surface stoniness, hummocks, high root density and dwarf shrubs retard spreading. The rhizomes show a zigzag growth pattern on such sites rather than the straight one of loose, homogeneous and unobstacled sandy soils.

317. Stands of lily-of-the-valley and wood small-reed, and tree age as indicated by tree-base boring

To eradicate any interpretation errors in the determination of the times of fires, it is useful to compare stand diameters with the corresponding ages of trees or tree generations. In comparisons with 100 same-site diameter-age pairs for both species, chosen according to criteria described earlier (p. 8), computing led to the following regressions:

lily-of-the-valley stands and tree age:

$y = 0.439 + 0.133\ x$ (figure 10)

wood small-reed stands and tree age:

$y = 0.803 + 0.131\ x$ (figure 11)

Inserting the regression lines of the stand diameters and the tree age as indicated by tree-base boring, into figures 10 and 11 shows that the lines are nearly parallel to those indicating the stand-size/time-from-fire relationship. The sum of the regeneration margin and the stump-height age increases slightly with age, partly resulting from the decreasing frequency of the oldest trees with increasing age of their generations. A part may also be explained by possible boring of younger trees closer to the ground level than of older ones with thicker bases (see OINONEN 1968, p. 19—21). At the age of 200 years, the directions of the regression lines deviate 1.2 and 1.6 m, which is rather little. Since the pairs of lines are almost parallel, we may conclude that any errors in the determinations of the times of fires are few and small. — This check considerably strengthens the validity of the results, since the data from which the relationships were computed were independent of each other.

318. Comparative species, and time from the fire

From the data shown in appendices 1 and 2, the following regressions have been computed for the comparative species and the time from the fire. The last column shows the previously published regression equations (OINONEN 1968).

The table shows that the paired equations, partly computed from different numerical data, produce closely similar results. The most distinct deviations are the times of *Lycopodium* manifestation and beginning of normal-rate growth, and even the largest deviations, those for *Lycopodium clavatum* and *L. complanatum*, are little more than a year. Differences in the slopes of the regression gradients for these species result in a deviation at the age of 100 years of 0.4 m for the first and 0.6 m for the second of these species; these deviations can be considered small.

The search and measurements carried out in the battle stations and battlefields of Hanko peninsula have provided additional support to the validity of the results for the comparative species, also. Appendix 1 (no. 16) shows that the diameter of the largest bracken clone was 10.0 m (67 individual stands were found, 0.2—10.0 m), *Lycopodium clavatum*, 3.0 m (4 stands, 1.9—3.0 m), *L. annotinum*, 4.5 m (32 stands, 0.4—4.5 m), and *L. complanatum*, 2.6 m (11 specimens, 0.2—2.6 m), the values thus coinciding rather accurately with the age-diameter lines of the spreading time-tables published previously.

Despite that the parenthesized numbers of specimens found do not provide a satisfactory basis for comparing the regeneration frequencies of the species, it ought to be mentioned,

	From appendices 1 and 2	OINONEN 1968
Pt.a./time from fire	$y = -1.195 + 0.363x$	$y = -1.03 + 0.36x$
L.cl./ »	$y = -9.186 + 0.482x$	$y = -10.63 + 0.50x$
L.a./ »	$y = -7.035 + 0.425x$	$y = -7.50 + 0.43x$
L.c./ »	$y = -5.273 + 0.306x$	$y = -4.31 + 0.29x$

however, that there are only 7 lily-of-the-valley (2.4—3.7 m) and 13 wood small-reed stands (1.5—3.6 m) in these data. The large number of bracken clones is primarily due to the fact that they are most conspicuous and most easily identified as individuals among the species studied. The greatest part of these were found from a stony, moist, rather fertile, burned forest site; stands were rather rare elsewhere. Most of the smallest individual stands of these species were found from the bottom of collapsed dugouts. In some cases it was possible to determine the time when the roof of the dugout had collapsed by the size of these patches and preliminary time-tables.

An illustrative example is provided by two *Lycopodium annotinum* clones found on the bottom of two different dugouts. The patch diameters were 0.35 and 0.6 m, and the ages read from the number of nodes on the shoots above the ground, 6 and 7 years. According to earlier results (OINONEN 1968), *Lycopodium annotinum* sporophytes start spreading at a normal rate some 17—18 years after the spores have been shed, and manifestation occurs 4—6 years earlier, or at an age of 11—14 years. Neither sporeling had started normal-rate spreading. Adding 6—7 years to 11—14 years gives 17—21 years. The maximum age of the trees born in the dugout pits varied, according to borings, between 19—24 years, in good agreement with the age estimates for the *Lycopodium annotinum* patches. — The largest wood small-reed patch found in a dugout pit was 3.0 m in diameter, corresponding to an age of about 24 years. The lily-of-the-valley was not found from these pits.

The studies on Hanko peninsula showed that diasporal regeneration of all the species discussed is quite uncommon, and that the time margin of regeneration is narrow. Few small stands were found, despite that the search was carried out intensively in an area of several square kilometers including vegetation types from the most fertile moist sites to the poorest dry *Cladina*-type heathland forests. According to traditional estimates of the vegetation in these areas, it can be said that all plant species mentioned, with the possible exception of *Lycopodium complanatum*, are common. However, for the most part, they are only seemingly common. Since relatively few new specimens of these species have developed after the considerable amount of disturbance during the battle period, it is of interest to inquire into why the species have become as common as they apparently are. The reasons are probably found in the history of the sites; during hundreds of years there have been numerous opportunities for regeneration, and part of the clones that have developed have had time to grow into large stands (cf. figure 12 and the large parallel stands in the Hanko peninsula sample areas shown in the appendix tables), which have persisted through more recent fires, occasionally intact, but often broken into fragments. They have an extremely strong position of priority on their sites — the stronger the larger the stand has become.

32. Examples of parallel stand sizes in two study areas

Stands no. 176 in appendix 1 and no. 113 in appendix 2 grow in a fairly large homogeneous area on Hanko peninsula (Tammisaari Commune, Leksvall—Tenhola, Harparskog—Skogby—Lappohja). In the entire studied area, a 163—167-year-old hold-over tree generation was found, probably born after a widespread forest fire. The time of the fire, as determined by borings from still older hold-overs, was probably 179—180 years before sampling (samples from the Leksvall—Harparskog area), or during the 1788—1790 War of Gustavus III, when fortifications were built on the Hanko peninsula (cf. OINONEN 1967 b, p. 22). A similar sample area, in respect to the fire, is situated near the town of Kiikala, in the Korkianummi—Hautakrotit area (appendix 1 no. 174 and appendix 2 no. 112). Here the age of the oldest trees is consistently 165—167+ years, according to basal borings. Older-generation trees were not found, and the exact time of the fire could not be determined, but it is presumably the same as that on Hanko peninsula. The mainly solitary stands most closely dating from this period are of the same size in both areas, as is seen in the following table.

When the material is large and stand sizes form a continuous series, stands of corresponding sizes can obviously always be found

Plant species	Hanko peninsula, Leksvall – Harparskog	Kiikala, Korkianummi – Hautakrotit
	Diameter of stand, m	
Conv.m.	23.1	22.0, 21.7
Cal.e.	22.7, 20.7 (x29)	22.8, 22.2, 21.8
Pt.a.	63, 62 (4 stands), 61, 60 (2), 59 (6), 58 (5)	62 (2), 61, 59.5, 59 (2), 57
L.cl.	–	82
L.a.	74.5 (secondary?)	67
L.c.	–	49, 47, 45, 44

among the series for each species. Here, relatively few data have been available, and a small degree of continuity can only be seen in the bracken data from Hanko peninsula, where the next larger stand was 69 m in diameter (one stand only) and the next smaller one 55 m (two stands). The data for the other species exhibit distinct gradations, and no other stands come close to these sizes. Thus it is obvious that the stands have been born after fires that have occurred at the same time, and that the corresponding sizes are a result of even spreading rates. Differences in site quality between the two areas are small, but the Kiikala area is probably slightly less fertile on an average.

33. Comparative time-table of stand spreading

The ratios of the lily-of-the-valley and wood small-reed stand diameters to times of fires (= probable times of birth) on one hand, and the sizes of the stands of comparative species and their spreading time-tables on the other (Oinonen 1967 c, 1968), are seen in figure 12. Figure 12 also shows, for illustrative purposes, a number of parallel stands marked with horizontal connective lines and numbers referring to the appendices, indicating some consistencies in stand-size parallelism in the most favorable conditions. A considerable number of such parallel sizes have been recorded from areas burned in different times; in relation to time, they form linear series. It can be considered probable that most of these stands are clones.

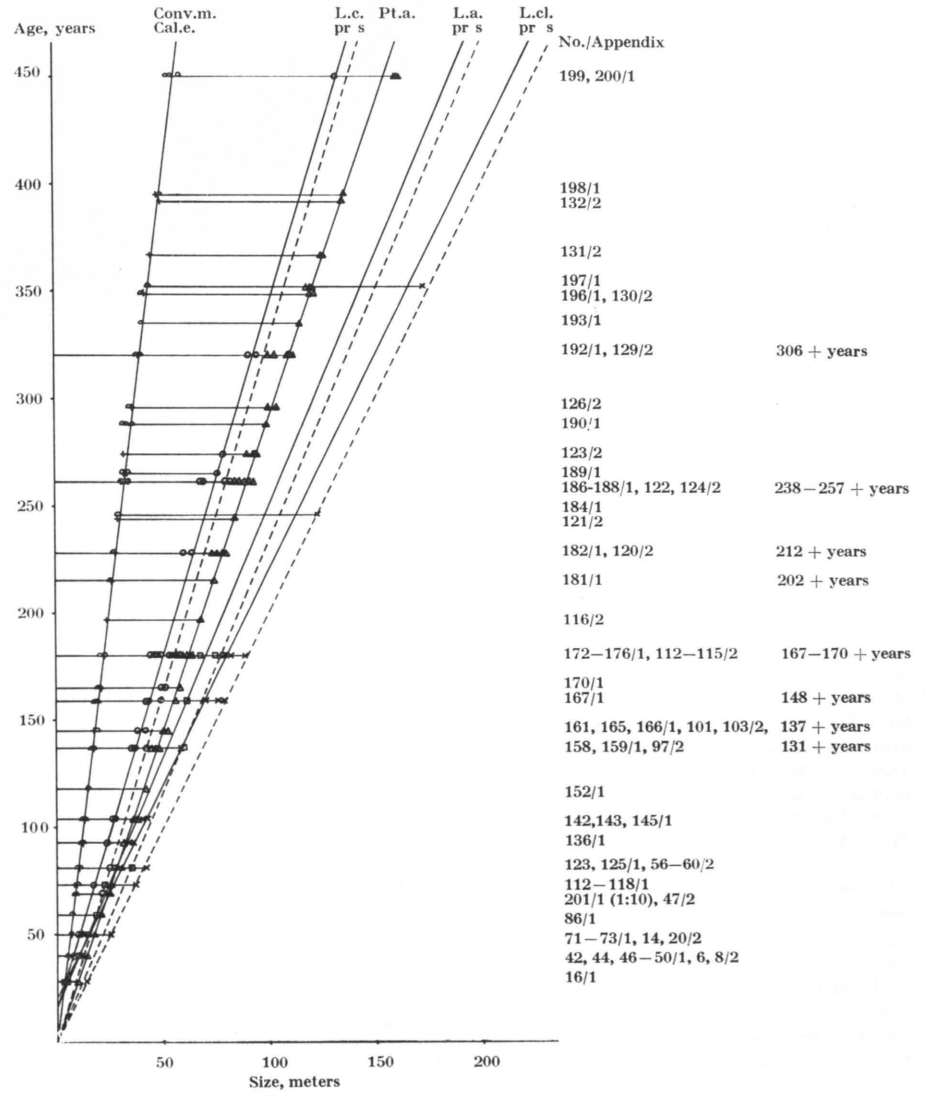

Fig. 12. Parallel time-table of the spreading rates of the stands.

⌓ = *Conv.m.* = *Convallaria majalis*
\+ = *Cal.e.* = *Calamagrostis epigeios*
△ = *Pt.a.* = *Pteridium aquilinum*
× = *L.cl.* = *Lycopodium clavatum*
□ = *L.a.* = » *annotinum*
○ = *L.c.* = » *complanatum*
pr = primary stands
s = secondary —»—

4. SUMMARY

The purpose of this study has been to compile a time-table for the vegetative spreading of the lily-of-the-valley and the wood small-reed. The diameters of the mainly solitary stands of these plant species have been compared to stand diameters of bracken, *Lycopodium clavatum*, *L. annotinum*, and *L. complanatum*, to tree age determined by basal borings, and to times from fires. Verification for the stand diameters has been searched for among replicate-sized stands growing on the same site. In timing, the time-tables of vegetative spreading published for bracken and the *Lycopodium* species (OINONEN 1967 a-c, 1968) have also been used.

Regeneration of the lily-of-the-valley and the wood small-reed from seed is relatively infrequent. Their stands often grow segregated from other individuals, and the distances between stands may be considerable. Both species sometimes regenerate independently of fires, especially on mineral-soil sites that have been scarified for some reason, but regeneration after fire is much more common. The time margin available for regeneration is usually narrow, consisting of only some years. The stands of both species are relatively fire-resistant, especially on heathlands, where the subsurface parts are largely safe in the mineral soil. That large stands are found, is generally due to vegetative spreading and high fire-resistance, and not to efficient regeneration from seed. Such stands have a fairly strong priority position on the sites where they grow; this has considerable significance in determining the composition of the post-fire vegetation mosaic.

The rate of vegetative spreading of both species is practically constant and about equal, 12.5 cm/yr in diameter and 6.2 cm/yr in the radial direction. These are average values of the maximum stand sizes in the data from each sample area; in individual cases, growth rates may vary a little in either direction from this mean. Since the largest stand diameters may, in a part of the sample plots, be somewhat smaller than their potential value, for instance because regeneration by seed has not taken place immediately after the fire, but several years later, the mean rates of vegetative spreading given here may be somewhat lower than the actual ones. The maximum rates recorded are between 13.0 and 13.5 cm/yr, but minimum values are not found by the method used in the study.

The results agree with the results published previously for bracken and the *Lycopodium* species, and thus also provide supplementary evidence for them. The results have been tested against stand-size data gathered from the battle stations and battlefields on Hanko peninsula dating from 1941; the findings have agreed with the main part of the data. The parallelisms found with data from the comparative species and regeneration times are so convincing and are based on a sufficiently large quantity of data that any unidentified errors either in specimen identification or in dating can presumably have no significant effect on the results.

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Appendix 1. *Convallaria majalis* stands and their parallels on the same site.

No.	Size of the stand, m						Age of tree stand, years	Date of fire, years ago
	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.		
1	2.1	—	—	—	—	—	18+	—
2	2.5, 2.0	—	—	—	—	—	20+	—
3	2.6, 2.1	—	—	0.8	3.3, 3.3	—	72+	—
4	2.6, 2.4, 2.3	—	5.5	—	—	—	19+	—
5	2.6, 2.5	—	6.7, 6.6, 6.3, 5.6, 5.6	—	1.5	—	35+	—
6	2.6	—	—	—	—	—	68+	—
7	2.6, 2.6, 2.4	—	4.8	—	1.0×0.8	—	51+, 17+	19–20
8	2.6, 2.5	—	8.3	—	—	—	19+	—
9	2.7, 2.6, 2.5, 2.4	—	—	—	2.35	—	43+, 20+	—
10	2.9	—	—	—	—	—	45+	—
11	3.1	—	9×9	—	—	—	25+	25?
12	3.2×3.1, 3.0×2.9, 2.9, 2.8	—	9, 8.1, 7.9	—	4.3, 4.0, 4.0, 3.8, 3.2, 3.1	3.2, 3.1, 2.6, 2.1, 1.9	60+, 45+, 38+	—
13	3.2	—	—	—	3.5	—	27	27?
14	3.4, 3.3, 3.2, 3.2	—	—	—	2.8×2.8	—	35+	—
15	3.6, 3.1	—	—	—	—	1.9	63+	—
16	3.7, 3.5, 3.4, 3.3	3.6, 3.4, 3.4, 3.1, 3.0	10, 9.5, 9, 9, 9	3.0, 2.5, 2.1, 1.9, 13.4*	4.5, 4.2, 4.1, 4.1, 4.0	2.6, 2.5, 1.6, 1.2, 0.9	—	—
17	3.8, 3.8, 3.6	—	—	3.0	4.5, 3.2, 3.2, 3.1, 2.7	4.0, 0.4	77+, 26+	29?
18	3.9, 2.6	3.8	—	0.8	4.4, 3.7×3.7, 3.3	4.2×4.0	25+	—
19	3.9	—	7.9	—	6.4	4.4	167+, 28+	31
20	3.9	—	6.2	—	5.4	4.4×4.3	74+, 23+	31
21	3.9	—	—	—	—	—	31+, 25+	?
22	4.0	—	10	4.75×3.85	—	3.6×2.4	63+	31
23	4.1, 3.8	—	—	—	6.6, 5.3	—	106+, 20+	32
24	4.2, 4.0	—	—	—	—	3.5×3.1, 1.2	300+, 28+	31
25	4.2	—	—	—	7.0	—	69+	32
26	4.2×4.2	—	13×13	8.1×6.0	8.2×8.0, 5.4	4.2×4.0	114+	?
27	4.3,4.3,4.2,4.1,4.0	4.3×4.2	—	—	7.0, 6.6, 5.3	—	26+	?
28	4.3	4.3	—	—	6.6×5.1, 5.9, 4.3, 3.7	6.0, 5.8, 3.2	65+, 30+	34
29	4.3, 3.9	—	—	7.1, 5.3	—	—	26+	36?
30	4.3	—	—	—	8.7	—	74+, 30+	?
31	4.3,4.2,4.1,4.1,3.9	—	—	—	14*	4.8, 4.6	64+, 30+	33
32	4.4, 3.9	—	—	—	—	—	30+	?
33	4.5, 4.3, 4.3, 4.0	—	—	5.8, 5.7, 4.8	5.6	4.8	91+, 43+, 26+	?
34	4.5	4.8, 4.8	—	—	—	—	148+, 31+	?
35	4.6	—	—	—	6.8×6.3	5.1	64+, 43+	?
36	4.6	—	—	—	—	5.2	43+, 32+	35
37	4.6	—	—	9.1, 8.2×8.1	11.2	7.2	74+	38
38	4.6	—	—	—	7.3, 5.4	5.8, 4.4	108+, 66+	35
39	4.9, 4.5, 4.5, 4.4	—	13.2	—	16.9*, 16.4*	—	60+	?
40	4.9, 4.7	—	—	—	7.4, 7.1, 6.0, 5.3, 4.9	6.0	47+, 30+	35
41	4.9, 4.8	—	12.7, 12.6, 12.0	—	6.8	—	34+	36–37
42	4.9×4.4, 4.6×4.6, 4.4, 4.3	—	13	—	9.6, 8.4	7.6, 5.8, 5.7	98+, 30+	40

Forest site type [1]	Locality	Year	Notes
VT	Lohja commune, side of highway 53 on the border of Karjaa	1968	Forest regeneration area
VT	Nummi, Nummensillanoja	1968	Forest regeneration area
VT	Suomusjärvi, Laperla	1968	Stumps blasted ca. 25 yrs. ago
VT	Suomusjärvi, Huhdanoja	1967	Stumps blasted ca. 25 yrs. ago O.[4]1968, no. 6, p. 46
VT	Suomusjärvi, Varesjärvi	1967	O.1968, no. 6, s. 46
VT	Suomusjärvi, Johdesuo	1967	Stumps blasted ca. 25 yrs. ago
VT	Somerniemi, Saarijärvi	1966–67	O. 1968, no. 2, p. 46
VT	Somerniemi, Kaskisto	1968	Forest regeneration area
VT	Kiikala, Mustasovansuo	1968	Forest regeneration area
VT	Suomusjärvi, Lahnajärvi	1967	Stumps blasted ca. 25 yrs. ago
VT	Snappertuna near Raasepori railroad station	1965	O. 1967 a, p. 29
VT	Suomusjärvi, Varesjärvi–Huhdanoja	1967–68	O. 1968, no. 14, p. 46
VT	Somerniemi, Valkee	1967	Forest regeneration area
VT	Suomusjärvi, Kukinhuoneenmäki	1967	Stumps blasted ca. 25 yrs. ago
VT	Somerniemi, Kaitalammi	1966	Cut ca. 25 yrs. ago?
–	Tammisaari commune, Leksvall–Tenhola, Lappohja	1968	Battle stations dating from 1941
VT	Vihti, Nummelanharju	1968	Forest regeneration area
VT	Suomusjärvi, Laperla	1968	Forest regeneration area
VT	Kiikala, Korkianummi, Nummisuo	1966	O. 1967 c, no. 6, p. 24
VT	Kiikala, Iso-Joutseno	1968	
VT-MT	Karjaa, side of highway 53, Manngård junction	1966	Forest regeneration area
VT	Somerniemi, Saarijärvi	1966	O. 1967 c, no. 5, p. 24
VT	Somerniemi, Kaskisto	1966	
OMT	Pohja, Sällvik	1968	
VT	Somerniemi, Herakkaanlähde	1967	
VT	Suomusjärvi, Laperla	1968	
VT	Somerniemi, Pieni Mulkkulammi	1968	
VT	Kiikala, Hautakrotit	1967	
VT	Kiikala, Lamminjärvi	1967	O. 1968, no. 9, p. 40
VT	Kiikala, Säräkoskensuo	1967	Margin in core 36 yrs. ago
VT	Snappertuna, near Raasepori railroad station	1967	
VT	Suomusjärvi, Varesjärvi	1967	Forest regeneration area
VT	Nummi, Nummensillanoja	1968	Margin in core 33 yrs. ago
VT	Kiikala, Koivulammi	1967	Forest regeneration area
VT	Suomusjärvi, Varesjärvi	1967	Period with thin annual rings 38 yrs. ago Forest regeneration area
VT	Kiikala, Mustasovansuo	1968	O. 1968, no. 12, p. 40
VT	Sammatti, Luskala	1966	
VT	Kiikala, Iso-Joutseno	1968	
VT	Tenhola, Skogby	1968	
VT	Somerniemi, Jyrkkälampi	1967	O. 1968, no. 34, p. 46
VT	Suomusjärvi, Varesjärvi	1967–68	
VT	Somerniemi, Hosojankulma	1966	O. 1968, no. 47, p. 48

Appendix 1. *Convallaria majalis* stands and their parallels on the same site.

No.	Size of the stand, m						Age of tree stand, years	Date of fire, years ago
	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a	L.c.		
43	4.9	—	13, 12	—	—	7.5	302+, 117+, 85+	?
44	4.95, 4.8, 4.3	—	—	11.4, 10.9, 10.1	8.2	—	75+, 32+	38—40
45	5.0, 5.0, 4.5	—	14	—	—	—	87+, 60+, 33+	?
46	5.1×5.1, 5.0, 4.9, 4.8, 4.8, 4.8	—	—	—	7.8, 6.5	—	54+, 45+, 35+	41—43
47	5.2	—	—	—	11.2, 8.9	—	63+	40
48	5.2, 5.1×4.8, 5.1	—	14, 13.4	10.0	—	—	79+, 38+	40
49	5.2	—	—	—	8.8	—	38+	?
50	5.2, 4.5, 4.5, 4.4	4.7, 4.7	—	—	—	6.9×6.9	110+, 67+, 35+	40—41
51	5.3, 5.2, 4.9, 4.9, 4.5	5.2, 5.2	15, 15, 15, 15, 14, 14	—	—	—	60+, 33+, 26+	42?
52	5.3×5.2, 4.9, 4.9, 4.8	5.0	—	—	—	—	77+	45?
53	5.3×5.0	—	—	—	9.6×9.1	7.3	38+	?
54	5.4	—	14, 14, 13	11.7	10.3	—	79+, 50+	43?
55	5.4	—	—	—	—	—	89+, 40+	43?
56	5.4, 5.3	—	—	—	—	—	64+, 38+	?
57	5.4	—	—	—	10.7, 9.2	—	102+	?
58	5.5×5.1	—	—	—	—	—	178+, 43+	49
59	5.5, 4.9, 4.8	—	14.4	—	12.3, 12.2, 8.2	—	84+	41—43
60	5.5, 5.4	—	15, 14	12, 11.2, 10.5	11.5	7.9	79+, 60+	?
61	5.5	—	—	—	—	—	56+	43
62	*5.65×5.0*[2]	—	*13.5*[2]	12.7, 12.1, 11.0	11.9, 11.7, 11.0	9.2, 9.1	73+	42—46
63	5.7, 5.7, 5.2	—	15.5	—	10.6, 8.8	7.7	62+	44?
64	5.8	6.0, 6.0	17	—	—	10.6, 10.3	159+, 45+	51?
65	5.8	—	—	—	13.8×9.0	—	75+	?
66	5.8	—	17, 17, 16	—	—	10.6, 9.8	138+, 37+	49
67	6.0	—	15.0	—	—	—	117+, 41+	51
68	6.0	—	—	—	—	—	147+	50
69	6.0×5.7	6.3×6.2, 6.3×5.5	—	—	—	11.3, 11.1	122+, 42+	49—50
70	6.0	—	—	—	—	—	64+	48
71	6.1, *6.0*	6.4×5.2	17.5, 17.5	—	13.9	*9.9×8.2*	114+	50
72	6.2, 6.2, 6.1, 6.0, 5.7	6.1, 6.1, 6.0, 5.7, 5.7	17	16×14, 12.2, 10.7 25.1*	14.3, 14.0, 13.3, 11.8	10.8, 9.9, 9.7, 9.6	108+, 45+, 36+	49—50
73	6.2×5.2	—	—	14.5	—	—	75+	50
74	6.2, 5.4	—	18, 18	—	14.6, 14.4	10.7	45+, 35+	52—53
75	6.2, 6.0, 5.7	6.1×5.8	—	—	—	8.7	167+, 59+, 45+	49
76	6.2×6.0 6.1×5.3	—	18, 17.5, 17	—	14.2, 13.4, 13.0	—	100+, 85+	50—52
77	6.2	—	—	—	—	—	71+, 45+	50
78	6.3, 6.2, 5.9, 5.8, 5.8	—	—	—	—	—	77+, 46+	52
79	6.3	—	—	—	—	—	80+, 44+	51
80	6.4, 6.2, 5.7, 5.5	5.9	17 (v. 1968 17.5 m)	17, 15, 14, 14, 23*	15.3, 21.2* 21*	9.0, 15*, 14.5*	45+	50—52
81	6.4×5.2	—	17.5	—	15.0	—	257+, 45+	51—52?
82	6.5×6.4	6.8, 6.7	18.7, 17.5	—	16.4×16.0	—	79+, 43+	55
83	6.5, 6.5	—	19, 18	—	—	16.1*	116+, 97+, 83+	53—54

Forest site type[1]	Locality	Year	Notes
VT	Somerniemi, Herakas—Herakkaanlähde	1966	O. 1967 c, no. 96, p. 40
VT	Nummi, Nummensillanoja	1966—68	
VT	Sammatti, Lohilampi	1965	Forest regeneration area
VT-MT	Lohja commune, side of highway 53, on the border of Karjaa	1966—68	
VT	Pohja, Brödtorp	1968	
VT	Vihti, Nummelanharju	1968	
VT	Suomusjärvi, Varesjärvi	1967	
VT	Somerniemi, Salakkajärvi	1966	O. 1967 c, no. 14, p. 25
VT-OMT	Tenhola, Skogby	1968	
VT	Somerniemi, Suojoki	1968	Margin in core 45 yrs. ago
VT	Karjalohja, Härjänvatsa	1966	O. 1967 c, no. 23, p. 26
VT-OMT	Vihti, Ojakkala	1968	Margin in core 43 yrs. ago
VT	Nummi, Nummensillanoja	1968	Margin in core 43 yrs. ago
VT	Snappertuna, near Raasepori railroad station	1967	Forest regeneration site
VT	Sammatti, Oino	1965	
VT	Kiikala, Mustasovansuo	1968	
VT	Karjaa, side of highway 53, on the border of Lohja commune	1966—68	
VT-MT	Siuntio, Grönberga	1964—66	O. 1968, no. 23, p. 40
MT	Sippola, Saaramaa	1966	
VT-MT	Pusula, Kaukela	1964—68	
VT	Suomusjärvi, Huhdanoja	1967	Margin in core 44 yrs. ago
VT	Somerniemi, Liesjärvi	1964	O. 1967 a, p. 36
VT	Vihti, Ojakkala	1968	
VT	Lohja, Lohjanharju	1965	O. 1967 a, p. 36
VT	Kiikala, Lamminjärvi	1967	O. 1968, no. 33, p. 40
VT	Kiikala, Tampinmäki	1967	
VT	Somerniemi, Heposuo	1965—66	
VT	Somerniemi, Karate-lampi	1966	
VT	Suomusjärvi, Laperla	1968	
VT	Kiikala, Varesjoki	1966—67	O. 1968, no. 61, p. 48
VT	Vihti, Ojakkala	1968	
VT	Suomusjärvi, Lahnajärvi	1967—68	O. 1968, no. 84, p. 50
VT	Kiikala, Korkianummi	1966	
VT-MT	Kiikala—Somerniemi, Herakkaanlähde	1965—67	O. 1968, no. 83, p. 50
VT	Kitee—Rääkkylä road on the border of Kitee	1966	
VT	Vihti, Nummela	1968	
VT	Kiikala, Tervakka	1967	
VT	Nummi, Nummensillanoja	1966—68	O. 1968, no. 30, p. 40
VT	Tenhola, Harparskog	1968	Margin in core 51 yrs. ago
VT	Tenhola, Skogby	1968	
VT	Sammatti, Luskala	1964—65	O. 1967 c, no. 63, p. 33

Appendix 1. *Convallaria majalis* stands and their parallels on the same site.

No.	Size of the stand, m						Age of tree stand, years	Date of fire, years ago
	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.		
84	6.5	—	—	—	—	—	92+, 45+	52?
85	*6.5*, 6.3	—	—	—	*14.3*	—	63+	50—51
86	6.7	7.5, 7.4, 6.9, 6.7	21	19.9, 19.3, 19.0	18	—	98+, 58+, 39+	59
87	6.7	—	21	—	17.1, 17.0 ×16.2	—	114+	57
88	6.8	—	21	—	16.8	11.5, 11.0	79+, 50+	58
89	6.9×6.8, 6.7, 6.3, 6.1	—	18.3	—	—	—	131+, 45+	54
90	6.9×6.9	—	—	—	—	11.9	137+, 54+	57
91	6.9, 6.6	6.9	—	19.0	—	11.3	78+	56
92	7×6	—	—	—	—	11.5, 16*	98+, 45+	55
93	7.0	—	—	—	16.7	11	62+	?
94	7.0	—	—	—	17.1, 16.0	—	70+, 60+, 38+	?
95	7.5, 7.4	—	21.5	—	17.6×15.2	—	65+, 25+	?
96	8.0, 8 (×10.2),7.7	8.1	21.5, 21.3	21.3	20.5, 19.7, 19, 19, 18	—	145+, 46+	61—62?
97	8×8, 8×7, 8, 8, 7.8	8×8, 8, 7, 7	—	—	22.5	19*	209+, 61+, 53+	65—67
98	8.1, 7.9, 7.7, 7.7, 7.7, 7.7	8.0, 7.8, 7.8	20	—	21,20	—	131+, 83+, 55+	63—65
99	8.1, 8.0, *7.9*, 7.7	8.6, 8.4, 8.4, 8.2	23, *22.5*, 22.5, 22, 21.5	34*, 31*	21.4, 27.6*	14.3	121+, 79+, 58+	65
100	*8.3*	*8.6*	—	—	—	—	77+	?
101	8.3	—	—	—	—	—	78+	68
102	8.4	—	—	—	21	13	92+, 52+	66
103	8.4	—	23	—	—		179+, 59+	68
104	8.5	—	21	—	—	14.2	62+, 43+	?
105	8.5, 8.5, 8.4	—	24 (×82)	—	—	14, 14	60+	?
106	8.5, 8.5	—	23.5	35.2*	—	—	302+, 100+, 85+	69
107	*8.6*	—	*22*	—	—	—	26+	?
108	8.6, 8.6, 8.4	8.6, 8.6	—	—	30*	—	84+	70—72
109	8.7	—	—	25.1	22.8, 21.3	17.6, 16.8	181+, 92+, 67+	66?72?
110	8.8	8.6	22	—	31.5*, 29.2*	—	125+	66
111	8.8	—	—	—	—	—	60+	68
112	8.85×8.65	8.7, 8.7, 8.4, 8.1	24	25.5	23, 21.6	—	76+, 60+, 53+	73
113	9.0, 8.7, 8.5, 8.5	—	—	—	23	—	83+	72
114	9.1	—	—	37×35*	—	—	63+	?
115	9.2	—	24.5	—	—	—	66+	?
116	9.2	—	—	—	25.1	—	93+, 40+	75?
117	9.4, 9.3, 9.2, 9.0	—	25, 24.5, 24	23, 36.8*	25×17	16.6	87+, 69+	73
118	9.5	—	26.5	—	26.6	—	75+, 69+	?
119	9.5, 9.3, 8.2	—	27.7, 26, 26, 26	—	—	—	208+, 70+	75—77
120	9.7	9.5×8.1	—	36.1*	—	—	72+	?
121	9.9, 9.7, 9.6, 9.6, 9.6, 9.4	9.9, 9.4	—	—	25.7, 35.6 ×35.1*	—	67+	?
122	9.9, 9.6	—	26, 26, 25, 25, 25	—	22.5	16	109+, 66+	74—76
123	10.0	—	28	29	—	—	117+, 69+	81

Forest site type [1]	Locality	Year	Notes
VT	Valkeala, highway 6, neighborhood of Tuohikotti road junction	1967	Margin in core 52 yrs. ago
VT	Pohja, Brödtorp	1968	Pitchy margin in core 50 yrs. ago
VT	Somerniemi, Saarijärvi—Salakkajärvi	1966	O. 1968, no. 47, p. 42
VT	Suomusjärvi, Laperla	1968	
VT	Vihti, Nummelanharju	1968	
VT	Lohja commune, highway 53, on the border of Karjaa	1968	
VT	Kiikala, neighborhood of airport	1967	
VT	Somerniemi, Kaitalammi	1966	O. 1967 c, no. 42, p. 30
VT	Ruovesi, Ryövärinkuoppa	1964	
VT	Suomusjärvi, Huhdanoja	1967	
VT	Karjalohja, Härjänvatsa	1966	
VT	Kiikala, neighborhood of airport	1968	
VT	Suomusjärvi, Varesjärvi	1967—68	O. 1968, no. 103, p. 50
VT	Sammatti, Luskala	1964—66	
VT	Lohja commune, highway 53, on the border of Karjaa	1966—68	
VT-OMT	Vihti, Ojakkala	1968	
VT	Somerniemi, Suojoki	1968	
VT	Kiikala, Iso Mulkkulammi	1968	
VT	Valkeala, highway 6, neighborhood of Tuohikotti road junction	1967	
VT	Suomusjärvi, Myllymäki-Kakarlampi	1967	
VT	Tenhola, Harparskog	1968	
VT	Karjalohja, Härjänvatsa	1962	O. 1967 c, no. 53, p. 32
VT	Somerniemi, Herakkaanlähde	1967	
VT	Tenhola, Skogby—Lappohja	1968	
VT	Karjaa, highway 53, on the border of Lohja commune	1966—68	
VT	Valkeala, Mankki	1967	O. 1968, no. 61, p. 42
VT	Sulkava, Vilkaharju	1967	
VT	Suomusjärvi, Myllymäki	1968	
VT	Tenhola, Skogby	1968	
VT	Lohja commune, highway 53, on the border of Karjaa	1968	
VT	Vihti, Ojakkala	1968	
VT	Kiikala, Nummenharju	1964	
VT	Suomusjärvi, Varesjärvi	1967	Margin in core 75 yrs. ago
VT	Lohja, Lohjannummi	1967	O. 1968, no. 55, p. 42
VT-OMT	Vihti, Ojakkala	1968	
VT	Siuntio, Grönberga	1964—66	
VT	Suomusjärvi, Laperla	1968	Tree stand born after a fire
VT-MT	Karjaa, highway 53, on the border of Lohja commune	1968	
VT	Kiikala, neighborhood of airport	1964—66	O. 1967 a, no. 69, p. 43
VT	Somerniemi, Valkee	1967	

Appendix 1. *Convallaria majalis* stands and their parallels on the same site.

No.	Size of the stand, m						Age of tree stand, years	Date of fire, years ago
	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.		
124	10.0	—	—	—	—	—	148+, 31+	80—81
125	10, 10	—	30	—	—	34×26*	110+, 67+	82?
126	10.3×10.2	—	—	27.9×27.5	—	—	106+, 74+	78
127	10.4	—	—	—	—	—	102+, 71+	82
128	10.7, 10.65	—	—	31.3	27.6	—	79+	?
129	10.9	—	28.7	—	—	19, 26×25.5*	71+	?
130	11.0, 11.0	—	—	—	—	—	120+, 80+	87—88
131	11, 11	11.2, 11.2, 11, 10.9, 10.7	31, 31, 27	35.2, 45.7*	—	—	131+, 71+	87—88
132	11×8, 10.1×9	—	31, 29, 27	33	28	—	110+, 73—	84
133	11.0, 10.6	—	—	—	—	—	185+, 79+	89
134	11.5, 11.5, 11.0, 10.7, 10.7	11.5	31.7, 31	—	—	28.4*	84+, 54+	?
135	11.6, 11.2	11.2	—	—	—	—	163+, 137+, 43+	92?
136	12.0, 11.7, 11.5	12.0	31	36, 35.6, 33.6	—	22.9	121+, 79+	93—94
137	12.0, 11.8, 11.5	11.5	36	—	35.6	—	155+, 62+	95? 104?
138	*12.0*, 11.9	—	—	—	—	*26*, 24.5	166+, 86+	96
139	12.0	11.9, 11.2	—	—	—	—	137+, 53+	96
140	12.4	11.9	—	—	—	26	74+	?
141	*12.4*, 12.4	—	34, *30*	—	—	—	84+	?
142	12.7, 12.5, 12.0	13, 13, 12.5, 12.5	37, 36	—	—	27, 26, 26	200+, 72+	104—105
143	12.8 12.6	—	—	42.4, 40.1	—	—	77+	?
144	13.2, 12.9, 12.7, 12.4	12.1	36, 34, 33	—	35	—	165+, 73+	98—102
145	*13.4*	13.3	*37*	—	—	27.2, 26.2	155+, 93+	104
146	13.6	14.6	40.5	—	42	—	125+	116
147	14.1, 13.8, 13.6	—	—	—	—	28.7, 25	148+, 95+	114—116
148	14.1	14.6, 14.5	41, 41, 38	—	45	—	105+	?
149	14.3	15, 14.8, 14.5, 14.4	40.5, 40	—	41.4	36.3*	152+, 108+	115—116
150	14.4	—	40	—	—	—	204+, 90+	114
151	14.9, 14.6	14.0	40.5	46	45	32.1, 30.0, 36.4*	121+, 79+	116
152	15.0	*14.2*	*42*	—	—	—	148+, 90+	118
153	15.0	—	42	—	—	—	128+	115?
154	15.8, 14.7, 14.2	15.7, 14.7	43.5	—	—	—	83+	?
155	*15.8*, 15.7	16.1	*46*	—	—	—	63+	?
156	15.9	—	44	—	—	31.3	89+	?
157	16.3	—	43	—	—	—	142+, 118+	127? 129?
158	17.4, 17.1, 16.3	—	46.5	—	—	35, 35	231+, 114+, 59+	137?
159	17.4, 17.2, 17.2, 16.9	17.6, 17.5, 17.2	47, 46, 44	58.4	59.5*	36, 42*	163+, 131+	137
160	17.5	17.6	52, 48	—	—	—	232+, 77+	140?
161	18.0	—	52×51, 49 (×62)	—	—	—	166+, 135+	145
162	18.0	—	51, 51	—	—	38.6, 44*	231+, 114+, 59+	147
163	18.3	—	53	64	55×50	—	142+, 60+	?
164	18.4	—	50	—	—	37	89+, 60+	147?
165	18.8	—	50	—	—	—	60+	?

Forest site type[1]	Locality	Year	Notes
VT	Kiikala, Tervakka	1967	Margin in core 80 yrs. ago
VT	Somerniemi, Salakkajärvi—Väärijärvi	1966	Margin in core 82 yrs. ago
VT	Kiikala, airport — Iso-Joutseno	1968	
VT	Rääkkylä—Kitee highway, on the border of the communes	1966	
VT	Vihti, Nummela	1968	Tree stand born after a fire
VT	Snappertuna, highway 53, Raasepori road junction	1966	Tree stand born after a fire
VT	Somerniemi, Taskulampi	1967	
VT	Somerniemi, Hosojankulma	1967	
VT-MT	Karjalohja, Härjänvatsa	1964	O. 1968, no. 70, p. 42
VT	Siuntio, Grönberga	1966	
VT	Karjaa, highway 53, on the border of Lohja commune	1966	O. 1967 c, no. 95, p. 40
VT	Kiikala, Mustasovansuo	1968	Margin in core 92 yrs. ago
VT	Vihti, Ojakkala	1968	
VT	Suomusjärvi, Varesjärvi—Huhdanoja	1967	Margins in core 95 and 104 yrs. ago
VT	Kiikala, Hautakrotit	1967	
VT	Sammatti, Luskala	1964	
VT-MT	Somerniemi, Rinkinattikko	1967	Tree stand born after a fire
VT	Tenhola, Harparskog	1968	
VT	Kiikala, neighborhood of airport	1964—65	O. 1967 c, no. 93, p. 40
VT	Vihti, Nummela	1968	
VT-MT	Pusula, Kaukela	1964—68	
VT	Suomusjärvi, Honkasilta—Pöytäkangas	1967	
VT	Sulkava, Vilkaharju	1967	Also more recent fires in area
VT	Somerniemi, Vähä-Pitkusta—Kalaton	1966—68	
VT	Somerniemi, Pikku-Valkee	1967	O. 1968, no. 84, p. 42
VT	Kiikala, neighborhood of airport	1967—68	
VT	Karjaa, Kaskimaa	1967	
VT	Vihti, Ojakkala	1968	
VT-MT	Suomusjärvi, Sallittu	1968	
MT	Town of Liperi	1966	Margin in core 115 yrs. ago
VT	Lohja commune, Gustavsberg	1968	
VT	Pohja, Sågsjö	1968	
VT-MT	Suomusjärvi, Siitoinjärvi	1967	
VT	Lohja, Ojamonkangas	1965	O. 1967 a, no. 137, p. 57
VT	Suomusjärvi neighborhood of Lahnajärvi camping area	1967	O. 1967 c, no. 103, p. 42
VT	Somerniemi, Herakas—Hosojankulma	1967	O. 1968, no. 95, p. 44
VT-MT	Tenhola, Harparskog	1968	Margin in core 140 yrs. ago
VT	Kiikala, Heposuo—Hautakrotit	1967	
VT	Suomusjärvi, Lahnajärvi, Vähänummi	1967	O. 1967 c, no. 108, p. 42
VT	Nummi, Nummensillanoja—Lakiasuo	1967	
VT	Suomusjärvi, Siitoinjärvi	1967	Probably the same fire as in no. 162
VT	Liperi, Ylämylly	1966	

Appendix 1. *Convallaria majalis* stands and their parallels on the same site.

No.	Size of the stand, m						Age of tree stand, years	Date of fire, years ago
	Conv.m.	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.		
166	19.3, 19.0	—	50,46	—	—	41.5	167+, 137+, 101+	145
167	19.5, 18.5	19.3, 185	58, 57, 55, 54, 54, 53	70, 70, 79*, 76*, 76*	61.5	43, 42, 49*	302+, 148+	157—160
168	20.1	—	—	—	—	—	200+, 78+	155—156
169	20.3	—	56	—	—	47*	106+, 59+	?
170	20.5, 20, 20, 20, 19.9, 19.4	21, 20.9	58, 58	—	—	51*, 50*, 48.7*	179+, 64+	165
171	20.9, 19.3	19.9	56 (×65)	—	—	—	121+	?
172	*21.2*, 19.6	—	*61×58*, 58, 54	—	—	46, *44*	163+, 152+	?
173	21.6	—	62	—	—	—	148+	?
174	22.0, 21.7	22.8, 21.8	62, 61, 59, 59, 57	82	67.3	49, 45, 44	167+, 101+, 65+	?
175	22.1	—	62, 61	79, 88.5*	78*	54*	120+, 105+, 78+	?
176	23.1	—	62, 61	—	—	—	150+	179—180
177	24.2, 23.8	—	68, 65×56	—	—	—	77+	?
178	24.4	—	70, 69	—	—	—	214+, 185+	194—196
179	24.7	—	69	—	—	59*	63+	?
180	25.5, 24.3	—	70	—	—	—	120+	?
181	25.5, 25.1	*26*	*74*, 74	—	—	—	202+, 66+	?
182	27.5	—	80, 80, 79, 78, 76, 75, 74	—	—	—	212+, 48+	?
183	27.7	—	75.5, 72	—	—	—	89+	?
184	29.3	—	—	123*	—	—	75+	?
185	30.5, 28	32	84, 82, 82	—	—	65	202+, 120+	?
186	32.6	—	86	—	—	—	121+, 79+	?
187	32.8	—	90, 90, 88, 86	—	—	—	238+, 70+	?
188	34×31, 31×29	34.5, 33, 31.4, 30.5	94, 93, 91, 90, 86, 86, 85	—	—	69, 68, 82*	209+, 151+, 83+, 48+	?
189	34.4	33.5, 32	—	—	—	76	183+, 125+, 78+	?
190	36, 33, 32	—	99	—	—	—	173+	?
191	37	—	100, 97	—	—	—	200+, 151+	?
192	40.6	—	110, 109	—	—	95*	68+	?
193	40.9	—	115	—	—	—	192+	?
194	41.6	—	112	—	—	—	167+	?
195	41.6	—	110	—	—	—	231+, 59+, 36+	?
196	42.3	—	122	—	—	—	131+, 83+	?
197	44.1	—	121, 120, 120, 118	173*	—	—	89+	?
198	*49.8*	48	*136*, 136	—	—	—	257+	?
199	55	—	162, 162, 161, 161, 148	—	—	132	68+	?
200	59, 53	—	162, 160	—	—	—	70+	?
201	83.5	—	245, 222, 221	—	—	—	192+	?

Forest site type [1]	Locality	Year	Notes
VT	Kiikala, Korkianummi	1966—67	
VT	Nummi, Nummensillanoja—Somerniemi, Herakkaanlähde	1965—68	O. 1968, no. 103, p. 44
VT	Tammisaari commune, Dragsvik	1965	
VT	Somerniemi, Kalaton-lampi	1967—68	O. 1967 c, no. 113, p. 44
VT	Suomusjärvi, Kakarlampi	1967	O. 1967 c, no. 117, p. 45
VT	Vihti, Ojakkala	1968	
VT	Kiikala, neighborhood of airport	1966—68	
VT-MT	Suomusjärvi, Sallittu	1968	
VT	Kiikala, Korkianummi—Hautakrotit	1966—67	O. 1968, no. 110, p. 44
VT	Somerniemi, Saarijärvi—Väärijärvi—Herakas	1966—67	
VT	Tenhola, Skogby	1968	
VT	Vihti, Ojakkala	1968	
VT	Siuntio, Grönberga	1964—66	O. 1967 a, no. 174, p. 65
VT	Pohja, Sågsjö	1968	
VT	Somerniemi, Valkee	1967	
VT	Kiikala, neighborhood of airport	1966	
VT	Tenhola, Skogby—Lappohja	1968	
VT-OMT	Suomusjärvi, Siitoinjärvi	1967	
VT	Vihti, Nummela	1966	Adjacent solitary stands
VT	Kiikala, airport—Hidaisenpyöli	1964—68	O. 1967 c, no. 120, p. 47
VT	Vihti, Ojakkala	1968	
VT	Karjalohja, Härjänvatsannummi	1963—67	O. 1967 a, no. 185, p. 68
VT	Sammatti, Luskala	1963—68	O. 1967 c, no. 124, p. 49
VT	Lohja, Lohjannummi	1966—67	
VT	Punkaharju, Lammasharju—Takaharju	1964	Partly from data collected by R. Miettinen [3]. See also
VT	Kiikala, neighborhood of airport	1964—66	O. 1967 c, no. 130, p. 52
VT	Suomusjärvi, Varesjärvi, northern extension of Pöytäkangas	1967	O. 1967 c, no. 132, p. 53
VT	Valkeala, highway 6, neighborhood of Tuohikotti road junction	1967	
VT	Kiikala, Korkianummi	1966	
VT	Suomusjärvi, Lahnajärvi	1967	
VT-OMT	Lohja commune, Gustavsberg	1968	
VT-OMT	Suomusjärvi, Siitoinjärvi—Lahnajärvi	1967	
VT-MT	Tenhola, Skogby—Harparskog	1968	
VT	Suomusjärvi, Varesjärvi, Pöytäkangas	1967	O. 1967 c, no. 137, p. 56
VT	Karjalohja, Härjänvatsannummi	1964—66	Road cuts into 53 m stand
VT	Valkeala, highway 6, neighborhood of Tuohikotti road junction	1966	On Salpausselkä esker

[1] See CAJANDER 1949.
[2] Slanted numbers: stands have same origin, overlap, or grow next to each other.
[3] Research assistant.
[4] O. = OINONEN
*Probably secondary.

Appendix 2. *Calamagrostis epigeios* stands and their parallels on the same site.

No.	Size of the stand, m					Age of tree stand, years	Date of fire, years ago
	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.		
1	4.0	9, 9, 8	–	–	–	303+, 143+	–
2	4.2, 4.0, 4.0	–	–	–	4.7×4.4, 4.4	76+	35
3	4.4	–	–	6.5, 4.5	6.1×4.0	42+, 25+	36–37?
4	4.4	–	–	–	–	26+	?
5	4.9	14	10.3	7.3, 5.4	5.8, 4.4	108+	38–39
6	5.0	–	–	–	–	63+	40
7	5.0, 5.0, 4.8	13	9.1, 8.2	11.2, 10.5	7.5, 7.0, 6.0	109+, 83+, 30+	37–41
8	5.1, 5.0, 5.0, 4.4	–	–	10.4	–	156+, 36+	40
9	5.2×4.8, 5.1	–	–	–	–	53+	42
10	5.5	14, 14	–	12×12, 12, 10	–	90+, 43+	46
11	5.8	17 (×22.5)	–	11	–	113+, 53+, 45+	48
12	6.0	–	–	12.5, 12.1	10×9, 16*	114+, 72+	48–49
13	6.0, 5.9	–	–	13.2	10.2	166+, 78+	49
14	6.0	–	–	15	–	257+, 40+	50
15	6.0	–	–	–	–	119+	51
16	6.0	–	–	–	–	59+	51
17	6.1	–	–	–	–	78+	48
18	6.1, 6.0, 5.7	–	–	13.3, 22.5*	–	147+, 63+	51
19	6.1	17.5	–	–	–	83+, 44+	51
20	6.4	17 (×21)	–	–	10.8	147+, 74+	50
21	6.5, 6.0, 6.0, 5.9	16	16×16	15, 14.7	14.5*	96+, 48+	53?
22	*6.5*[2]	*18*[2], 18, 17	–	–	11.5, 11.2	71+, 36+	54
23	6.6	–	–	16.2×14.8	–	65+, 45+	56?
24	6.8, 6.7	–	–	15.8	–	92+	52
25	7.0×6.8, 7×5, 6.9, 6.3	19, 18	–	16.7	16.1*	116+, 97+, 43+	53–57
26	*7.0*, 6.3, 6.1	19, 19, 18	–	–	*17**	80+	56–57?
27	7.0×7.0, 7, 7, 6	19, 19, *18.5*	–	–	–	188+, 49+	54
28	7.2, 6.5	–	–	–	–	109+, 81+	55
29	7.2, 7.2, 6.7 (×12), 6.7 (×8)	18, 17	18×18, 17.7	17, 17, 15	12.2	142+, 78+, 46+	54–56
30	7.3	21, 18.7	–	–	–	53+	?
31	7.4	21.5, 21, 20, 19	–	–	12.7, 19*, 18.7*,18.4*	96+, 53+, 45+	58–60
32	7.4	–	–	17.5	–	182+, 83+, 45+	60
33	7.5, 7	–	20, 27*	19×15	–	152+, 50+	59
34	7.5×7.0, 7×6	–	20.4, 17.5	–	–	63+	?
35	7.5, 7.5, 7, 7	21, 19	18.2	–	12.5, 12	106+, 85+	58–61
36	7.6×6.8, 7.1	21	–	18.2	–	123+, 48+	58–59
37	8×7, 7	22	–	–	12.5, 12	123+	62
38	8.4, 8.2, 7.8	–	–	–	14.3	79+	65
39	8.5×7.5, 8.5, 8.0	21.5, 20	21.5, 33*	28.8*,28.3*	14.1	109+, 81+, 60+	65
40	8.5	23.5	–	23.3, 21.7	–	151+, 117+, 50+	68
41	8.5, 8.2	23.5, 23, 22, 21, 21	–	21.2	–	123+, 57+	?
42	8.7, 8.7, 8.2	23	–	–	16.5, 20.1*	169+, 128+, 60+	
						48+	68–71
43	8.7, 8.7 (×10.9)	–	–	–	–	63+	?
44	8.8, 8.5, 8.4, 8.4, 8.2, 8×8, 8	–	–	22.8	21.3*	151+, 83+	71–73
45	8.8×8.0	23	–	19.8, 18.6	–	257+, 53+	68
46	9×9, 9, 9, 8.5, 8	26	25.6	–	–	132+, 66+	71
47	9×8.5	25	–	–	15×14	119+	69
48	9×9	–	–	–	21.4*	126+	68
49	9×8, 8.8, 8.6	–	–	–	–	182+, 120+	71

Forest site type[1]	Locality	Year	Notes
VT	Tammisaari commune, Källvik	1964–65	O.[4] 1967 a, p. 26
VT	Kiikala, Nummenharju	1965	
VT	Tenhola, Harparskog	1968	
VT	Tenhola, Skogby	1968	
VT	Kiikala, Iso-Joutseno	1967–68	
VT	Pohja, Brödtorp	1968	
VT	Sammatti, Luskala	1964–68	O. 1968, no. 12, p. 40
VT-MT	Somerniemi, Liesjärvi	1965	O. 1968, no. 54, p. 48
VT	Tenhola, Harparskog	1968	
VT	Inkoo, Stormossen	1964	
VT	Pohja, Raasepori railroad station – Kaskimaa	1965	O. 1967 a, no. 44, p. 38
VT	Kiikala, Nummenharju	1964	O. 1967 c, no. 32, p. 28
VT	Kiikala, Hautakrotit	1967	
VT	Tenhola, Harparskog	1968	
VT	Kiikala, Immenjärvi	1965	
VT	Tenhola, Skogby	1968	
VT	Somerniemi, Kaskisto	1966	
VT	Kiikala, neighborhood of airport	1967	
VT-MT	Pohja, Sällvik	1968	
VT	Kiikala, Iso-Kolasin	1967	
VT	Karjalohja, Härjänvatsannummi	1964	O. 1967 c, no. 128, p. 50
VT	Pusula, Kaukela	1965	
VT	Sammatti, Lohilampi	1968	Margin in core 56 yrs. ago
VT	Somerniemi, Iso Mulkkulammi	1965	
VT	Sammatti, Luskala	1964–68	O. 1967 c, no. 63, p. 33
VT	Vihti, Nummela	1964–65	O. 1967 a, p. 37
VT-MT	Inkoo, Stormossen	1964	
VT	Kiikala, Hautakrotit – Heposuo	1964	
VT	Lohja, Lohjannummi	1964–66	O. 1968, no. 92, p. 50
VT	Tenhola, Skogby	1968	Tree stand born after a fire
VT-MT	Siuntio, Grönberga	1964–66	O. 1967 c, no. 70, p. 35
VT-MT	Pohja, Sällvik	1968	
VT-MT	Sammatti, Oino	1964	O. 1968, no. 48, p. 42
VT	Karjalohja, Härjänvatsa	1962–66	O. 1968, no. 41, p. 40
VT	Kiikala, Iso-Joutseno – Iso-Kolasin	1965–68	O. 1967 c, no. 46, p. 30
VT	Somerniemi, Hosojankulma	1965–66	
VT	Kiikala, Nummenharju	1965	
VT	Vihti, Nummela	1968	
VT	Pohja, neighborhood of Raasepori railroad station	1965	O. 1968, no. 53, p. 42
VT-MT	Kiikala, Lamminjärvi	1967	
VT-OMT	Vihti, Ojakkala	1968	
VT	Somerniemi, Hosojankulma	1965–68	
VT	Pohja, Brödtorp	1968	Tree stand born after a fire
VT	Sammatti, Luskala	1965–68	
VT-MT	Tenhola, Harparskog	1968	
VT-MT	Karjalohja, Härjänvatsa	1964	O. 1968, no. 62, p. 42
VT	Side of Kesälahti–Kerimäki highway, on the border of the communes	1964	
VT	Kerimäki, Mäkrä	1964	Partly from material collected by R. Miettinen[3]
VT	Pohja, Koppskog	1965	

Appendix 2. *Calamagrostis epigeios* stands and their parallels on the same site.

No.	Size of the stand, m					Age of tree stands, years	Date of fire, years ago
	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.		
50	9.0, 9, 8.7	–	–	–	–	109+, 69+	73
51	9.0, 9, 8.5, 8×8	25	–	–	–	105+, 63+	73
52	9.1, 9.0×8.9	–	25.9	–	–	70+	?
53	9.2	27.1	–	–	21.9*	166+, 101+, 28+	77
54	9.5×9.0, 9.5	28×27, 27	39*	–	–	142+, 80+, 60+	76?
55	9.5, 9.0	–	–	–	–	191+, 64+	77
56	*10*, 10, 9	*28*, 28	–	–	–	127+	81
57	10	28	–	–	–	145+, 71+	79–82
58	10	–	–	–	26.1*,24.5*	166+, 78+	82?
59	10, 9	30, 29, 27	29	29	27	110+, 73+	80–81
60	10.1	–	42*	35.1*,34.5*	–	142+, 60+	80–81
61	10.2, 10.1	31, 29	–	–	–	150+, 62+	87
62	*10.4*	27	–	*28.5*	–	83+	?
63	10.6, 10.3	29, 28	29, 29	–	21.5	110+, 77+	88
64	11, 11, 11×9, 10	–	–	–	–	165+, 83+	88–89
65	11.2	–	–	–	–	130+	89
66	11.4	31.5	–	41.5*	–	77+	?
67	11.4	31.5, 31. 3, 31	–	30.7, 28.7	22.9	114+, 59+	88
68	11.5	34, 32, 31, 31	–	–	–	205+, 67+	94
69	11.8, 11.5, 11.5	–	–	–	–	182+, 83+	95
70	12.3	36, 35, 34, 32	–	–	–	197+, 62+	98
71	12.4	–	50*	42*, 39.2*	24	84+	94–100
72	12.5, 12, 12, 12, 11.5	36, 36, 34, 34, 32, 32	–	–	–	189+, 89+	98
73	12.5, 11.2	–	–	–	–	114+	102
74	12.5, 12.5	36	–	–	–	72+	?
75	12.5, 12.5, 12.5×11.5	–	48*	36.9	26	126+, 92+, 78+	98–100
76	12.9, 12.5, 12	–	–	–	26	116+, 97+	102–103
77	13, 12, 11.7	36	37, 35	–	–	142+, 60+	98
78	13×12.5, 13, 13	–	–	37, 36	–	181+, 82+	100?
79	13.2	38, 36	–	–	26.5, 25.5	302+, 103+	106?
80	13.7, 13.6	–	42	39	–	142+, 96+	110
81	14 (5 stands)	38	41.5	38, 36	28 (4)	167+, 101+, 97+	112–113
82	14, 14	39	–	–	–	92+	?
83	14.0×13.7	–	45.7	–	–	148+, 105+	115
84	14.3	*37*, 41 (×50)	–	*41.2*	28.5, *31.8*	167+, 101+	112
85	14.4	–	–	–	28.8	155+, 62+	117–118
86	14.5×14.5	40.5, 40, 40	–	–	–	152+, 129+, 110+	119
87	14.5	42	–	42.8	31.9	115+	?
88	15.0	42, 41, 40, 38	–	–	–	103+	?
89	15, 15, 15, 14.5×14.5, 14.5	41, 40	50	–	–	172+, 87+	113–116
90	15.3, 15.2, 15.0	–	–	–	–	173+, 113+	121
91	15.8, 15.5	44 (×74), 46 (×64)	–	–	–	205+, 110+, 57+	126–130?
92	16×16, 16×14	46, 46	–	–	–	119+	?
93	16, 16	45	–	–	39*	76+	130?
94	16.6, 15.6	46, 46, 46	–	–	–	232+, 149+, 77+	129?
95	16.6, 16.5	46	–	–	–	151+, 108+, 82+	?
96	17×16, 16	49, 48, 48	–	–	–	235+, 127+	139
97	17×14, 17×12	48	–	–	–	176+, 76+	137?
98	17, 16.5	45 (×51)	–	–	–	92+	?
99	17	48, 45	–	–	–	74+	?
100	*17.6*, 17.5	52, *46* (×*75*)	–	–	–	300+, 182+, 83+	140? 149?
101	17.6	50	–	–	38	167+, 101+	145
102	17.7	51, 50, 50	–	–	–	186+, 72+	143?
103	18, 18	52, 52	–	–	–	178+, 163+, 126+	145?

Forest site type [1]	Locality	Year	Notes
VT	Somerniemi, Iso Mulkkulammi	1965	
VT	Sammatti, Lohilampi	1965	
VT	Sammatti, neighborhood of Lohilampi	1968	
VT	Kiikala, Korkianummi, Nummisuo	1966	O. 1967 c, no. 80, p. 37
VT	Sammatti, Lohilampi	1965	Margin in core 76 yrs. ago
VT	Pohja, neighborhood of Raasepori railroad station	1965	
VT	Inkoo, Stormossen	1964	
VT	Pusula, Mäkkylä	1965–68	
VT	Kiikala, Hautakrotit–Heposuo	1967	
VT	Karjalohja, Härjänvatsa	1964–65	
VT	Nummi, Nummensillanoja	1967–68	
VT	Tenhola, Harparskog	1968	
VT-MT	Pohja, Sällvik	1968	
VT	Somerniemi, Valkee–Herakas	1967	O. 1968, no. 67, p. 42
VT	Sammatti, Luskala	1964–65	
VT	Tammisaari commune, Leksvall	1964	
VT-MT	Tenhola, Skogby	1968	Tree stand born after a fire
VT	Suomusjärvi, Lahnajärvi	1967	O. 1968, no. 126, p. 50
VT	Sammatti, Lohilampi – Oino roadside	1965	
VT-MT	Pohja, Sällvik	1968	
VT-OMT	Tenhola, Harparskog	1968	
VT	Sammatti, Innolampi	1962–68	O. 1968, no. 87, p. 42
VT	Karjaa, Kaskimaa	1965	
VT	Suomusjärvi, Laperla	1968	
VT	Kiikala, Nummenharju	1964	Tree stand born after a fire
VT	Kiikala, Iso-Kolasin – Säräkoskensuo	1965–67	O. 1968, no. 87, p. 42
VT	Sammatti, Luskala	1965–66	
VT-MT	Lohja,Lohjannummi	1965	
VT	Karjalohja, Mustakorpi	1964	Margin in core 100 yrs. ago
VT	Somerniemi, Kaitalammi	1966	Margin in core 100 yrs. ago
VT	Sammatti, Lohilampi	1965	
VT	Sammatti, Luskala	1964–65	O. 1968, no. 79, p. 42, no. 137, p. 52
VT	Pyhäjärvi, Kovelo	1965	Tree stand born after a fire
VT	Nummi, Nummensillanoja	1967	
VT-MT	Kiikala, Korkianummi	1966	
VT	Suomusjärvi, Kakarlampi	1967–68	
VT	Kiikala, Iso-Kolasin – Musta-Kolasin	1965	O. 1967 a, no. 124, p. 53
VT	Heinola commune, Vierumäki	1966	O. 1968, no. 142, p. 52
VT-MT	Karjalohja, Härjänvatsa	1965	
VT	Lohja, Keskilohja, neighborhood of railroad	1964–67	O. 1967 a, no. 129, p. 56
VT	Karjaa, Kaskimaa	1965	
VT-MT	Sammatti, Lohilampi – Oino roadside	1964–68	Margin in core 126 yrs. ago
VT	Kiikala, Hidaisenpyöli	1966	
VT	Karjalohja, Mustakorpi	1964	Margin in core 130 yrs. ago
VT-MT	Tenhola, Skogby–Harparskog	1968	Margin in core 130 yrs. ago
VT	Sammatti, Luskala	1964	
VT	Inkoo, Stormossen	1964	
VT	Lohja, Lohjannummi	1964	Margin in core 137 yrs. ago
VT	Pyhäjärvi, Kovelo	1965	
OMT	Karjalohja, Härjänvatsa	1965	
VT-MT	Pohja, Sällvik	1968	Margins in cores
VT	Kiikala, Korkianummi	1966	Margins in cores
VT-MT	Sammatti, Lohilampi – Oino	1965	O. 1967 a, no. 150, p. 58
VT	Kiikala, Iso-Kolasin–Sakarjärvi	1965	

Appendix 2. *Calamagrostis epigeios* stands and their parallels on the same site.

No.	Size of the stand, m					Age of tree stand, years	Date of fire, years ago
	Cal.e.	Pt.a.	L.cl.	L.a.	L.c.		
104	18	51, 51, 50, 50	–	–	–	180+, 120+	143
105	19.2	54, 54	64.5, 79*	–	44, 41, 47*, 49*	178+, 147+, 45+	157–158
106	20×18.5, 20	56, 56, 51.5	70, 78*	–	–	183+, 148+, 70+	153–154?
107	21, 21, 20.5, 20.5 ×16	–	–	–	–	178+, 102+	166–167
108	21	58	–	–	48.3*	140+, 62+	?
109	21, 20.3	55	–	–	–	131+, 84+	?
110	22, 21, 21, 20	59, 53	72	60, 72*, 68*	47.5*	234+, 170+, 80+	?
111	22	63	–	–	–	200+, 183+, 143+	176
112	*22.2*	62, 59.5	–	–	*47.2*	166+, 65+	?
113	22.5, 20.7 (×29)	63, 63, 62, 62, 62, 61, 60, 59, 59, 59, 59, 59, 58, 58	–	74.5*	–	257+, 167+, 149+	179–180
114	23, 23	64, 63, 61, 59	79	–	53*	200+, 170+, 70+	180–183
115	23	63.5	–	–	–	125+	?
116	23.5	68, 68	–	–	–	77+	?
117	23.5, 23	66, 63 (×93)	–	–	51, 55*	170+, 151+, 83+	181–185
118	24.5	73, 71	–	78	–	182+, 120+	?
119	25.5	73	–	–	–	185+, 102+	?
120	*28×23*	*80*, 73	–	–	60, 64*	183+, 78+	?
121	29.1	84	–	–	–	60+	?
122	31.4	90, 90, 90, 88, 86, 84	–	–	80*	234+, 70+	?
123	32	95, 94, 94, 93, 90	–	–	79×77	179+, 64+	?
124	34.5, *30.7*	93, *92*, 90, 89, 88, 88, 87	–	–	–	257+, 232+	?
125	35.5, 35	105, 104, 102	–	–	–	234+, 70+	?
126	36, 35	104, 100	–	–	–	180+	?
127	36	108, 107	–	–	–	303+, 279+	?
128	36.3, 34.1	110, 109, 109, 105	–	–	95*	231+, 68+	?
129	39, 38.8, 38.4, 38	112, 110, 109, 103, 101, 100	–	–	91	257+	?
130	42, 41	122, 122, 120	–	–	–	209+	?
131	45.3	126, 125	–	–	–	257+	?
132	49.6×40.2	135, 117	–	–	–	125+	?

Forest site type[1]	Locality	Year	Notes
VT	Pohja, Gebbelby–Koppskog	1965	
VT	Kiikala, Varesjoki	1966–67	
VT	Lohja, Lohjannummi	1964–65	Margin of growing period in core
		1964–65	O. 1968, no. 104, p. 44
VT	Sammatti, Lohilampi–Oino	1964–65	
VT	Snappertuna, highway 53, Raasepori road junction	1964–66	O. 1967 c, no. 116, p. 45
VT-OMT	Lohja commune, Gustavsberg	1966–68	
VT-MT	Karjalohja, Härjänvatsa–Sammatti, Lohilampi	1964	Cf. no. 107, in same area
VT	Pohja, neighborhood of Raasepori railroad station	1965	O. 1967 c, no. 170, p. 64
VT	Kiikala, Hautakrotit–Heposuo	1967	Old tree generation born after a fire
VT-MT	Tenhola, Skogby–Harparskog–Tammisaari commune, Leksvall	1968	Cf. O. 1967 b, p. 19-23, stands from large area
VT	Kiikala, Lamminjärvi–Varesjoki	1965–68	O. 1967 a, no. 169 p. 64; 1967 c, no. 120, p. 47
VT	Sulkava, Vilkaharju	1967	Cf. war of Gustavus III 1788–1790, O. 1967 b, p. 19–23
VT	Somerniemi, Suojoki	1968	
VT	Sammatti, Luskala	1964–68	O. 1967 c, no. 119, p. 46
VT-KpRä	Pohja, Koppskog	1965	O. 1968, no. 145, p. 52
VT	Sammatti, Oino	1964–65	
VT	Lohja, Lohjannummi	1964–67	
VT-MT	Tenhola, Skogby	1965	
VT	Karjalohja, Härjänvatsa	1963–67	O. 1967 a, no. 185, p. 68; 1967 c, no. 128, p. 50
VT-MT	Suomusjärvi, Kakarlampi	1967	O. 1967 c, no. 127, p. 50
VT-OMT	Tenhola, Harparskog	1968	
VT-MT	Karjalohja, Härjänvatsa–Sammatti, Lohilampi	1963–68	
VT	Karjaa, Kaskimaa	1965	
VT	Tammisaari commune, Leksvall	1964	
VT	Suomusjärvi, Varesjärvi–Siitoinjärvi	1967	O. 1967 c, no. 132, p. 53
VT-OMT	Tenhola, Harparskog	1968	L.c. solitary in a large area
VT-MT	Sammatti, Lohilampi–Oino	1964–66	
VT-OMT	Tenhola, Harparskog–Skogby	1968	
VT	Sulkava, Vilkaharju	1967	

[1] See CAJANDER 1949.
[2] Slanted numbers: stands have same origin, overlap, or grow next to each other.
[3] Research assistant.
[4] O. = OINONEN
* Probably secondary.

ACTA FORESTALIA FENNICA

EDELLISIÄ — PREVIOUS VOLUMES

Vol. 88, 1968. Paavo Yli-Vakkuri, Pentti Räsänen ja Asko Hilli.
Taimien talvivarastoinnista ja sen vaikutuksesta männyn taimien istutuskelpoisuuteen. Summary: Overwinter Cold-Storage and its Effect on the Field Survival and Growth of Planted Scots Pine.

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