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A THINNING EXPERIMENT WITH SITKA SPRUCE IN NYSTRUP DUNE FOREST

ET UDHUGNINGSFORSØG I SITKAGRAN I NYSTRUP KLITPLANTAGE

BY

H. A. HENRIKSEN

SYMBOLS — SYMBOLER

i overensstemmelse med I.U.F.R.O.'s vedtagelser
as adopted by the I.U.F.R.O.

T = *age from seeds,* alder fra frø.

N = *number of stems per hectare,* stamtal pr. ha.

$H_{\bar{g}}$ = *height in m., corresponding to mean basal area,* højde, m, svarende til middelstammegrundflade.

$D_{\bar{g}}$ = *diameter in cm., corresponding to mean basal area,* diameter, cm, svarende til middelstammegrundflade.

G = *basal area, sq.m. per hectare,* stammegrundflade, m² pr. ha.

F = *artificial stem wood form factor,* uægte stammeformtal.

V = *total stem volume, cu.m. per hectare,* stammemasse per ha.

I_g = *current increment of basal area, sq.m. yearly per hectare,* løbende grundfladetilvækst årlig pr. ha.

I_v = *current increment of total stem volume, cu.m. yearly per hectare,* løbende stammemassetilvækst årlig pr. ha.

$I_{v\ o\text{-}T}$ = *periodic annual increment per hectare of total stem volume, cu.m., from culture to the age of T years,* gennemsnitlig tilvækst i total stammemasse årlig pr. ha fra kulturtidspunktet til alderen T år.

$I_{v\ a\text{-}b}$ = *periodic annual increment per hectare of total stem volume, cu.m., in the period from a to b years,* årlig gennemsnitstilvækst af stammemasse pr. ha i perioden fra a til b år.

CONTENTS

1. ESTABLISHMENT OF THE EXPERIMENT

In the autumn of 1935 *C. H. Bornebusch* began a thinning experiment with Sitka spruce (sample plot MB) in Nystrup Dune Forest.

The road from Klitmøller running south-east towards Vang first leads across the raised littoral sea bed, a relatively flat, sandblown tract. About four kilometres from Klitmøller the road climbs relatively steeply over the old coast line. Above this there was an area of about 100 hectares planted in Sitka spruce; this was the site of the thinning experiment, and the land belonged to the former Nystrupgaard (*Trap* 1924, Vol. V p. 378).

The good subsoil — sand-mixed clay or clay-mixed sand — is overlaid by shifting sand of thicknesses generally ranging between ¾ and ¼ m. Before the afforestation, which broadly dates from 1909—1916, the land was chiefly used for farming. Report No. 168 (*Henriksen* 1951) says that the farm was discontinued owing to the poorness of the soil. However, this is doubtful. According to statements by local people the soil was if not first-quality, yet suitable for agriculture. The true reason for selling the land to public authorities was probably the owner's lack of money.

The planting is not uniform throughout the area. Some areas were planted exclusively in Sitka spruce, e. g. the location of Group 3 (parcels n, o, and p). Other areas had interplantings of mountain pine (50 per cent. mixture where Groups 1 and 2 are situated, the Sitka spruce rows spaced about 2½ m. apart).

The experiment comprised three Groups, in each of which were represented thinning grades B, C, and D (light, medium, and heavy thinning , respectively). The thinning grade is judged best by being related to A-thinnings (only dead trees removed) of Groups 1 and 2. Parcels n, o and p (Group 3) with grades B, C, and D, respectively, were laid out by the Dune Planting and

Preservation Board as early as 1931/32, but were taken over in 1935 by the Danish Forest Experiment Station when the other part of the experiment was established.

Fig. 1 shows the distribution of the parcels and the thinning grades. The picture is an aerial photograph taken in the spring of 1954, at a time when the below-mentioned decay was in progress. Parcel o has ceased to exist and parcel p is decaying.

Group 1 comprises parcels a, b, c, and d, the thinning grades being B, D, C, and A, respectively. The ground is almost flat and covered with a sand layer of 29 cm. average and was planted about 1916 with a 50 per cent. mixture of mountain pine.

Group 2 comprises parcels e to m, the thinning grades being A in parcel k; B in parcels e and g; C in h and m; and D in f and i. The ground is undulating, but generally sloping in a north-westerly direction (*Henriksen* 1958, Fig. 66). The average thickness of the sandy layer is 38 cm. It was planted about 1914 with a 50 per cent. mixture of mountain pine.

Group 3 comprises parcels n, o, and p, the thinning grades being B, C, and D, respectively. The ground slopes slightly in a northerly direction. The average thickness of the sandy layer is 67 cm. Planted with an unmixed culture in 1909 (o and p) and 1910 (n).

More detailed particulars about the *soil* are given by *Henriksen* (1951) p. 403 et seq.), and *Henriksen* (1958) p. 171, including analysis figures relating to parcel k.

2. DEVELOPMENTS IN GENERAL OUTLINE

Apparently, the cultures have developed satisfactorily, at any rate in the localities chosen for the experiment. There are no abnormalities to suggest special difficulties. The mountain pines were removed by trimming or felling in the period up to the first thinning of Sitka spruce. The experiment started concurrently and the following 15—20 years witnessed an extremely good growth. The volume increment per unit area were among the highest on record in this country (see p. 209 et seq.).

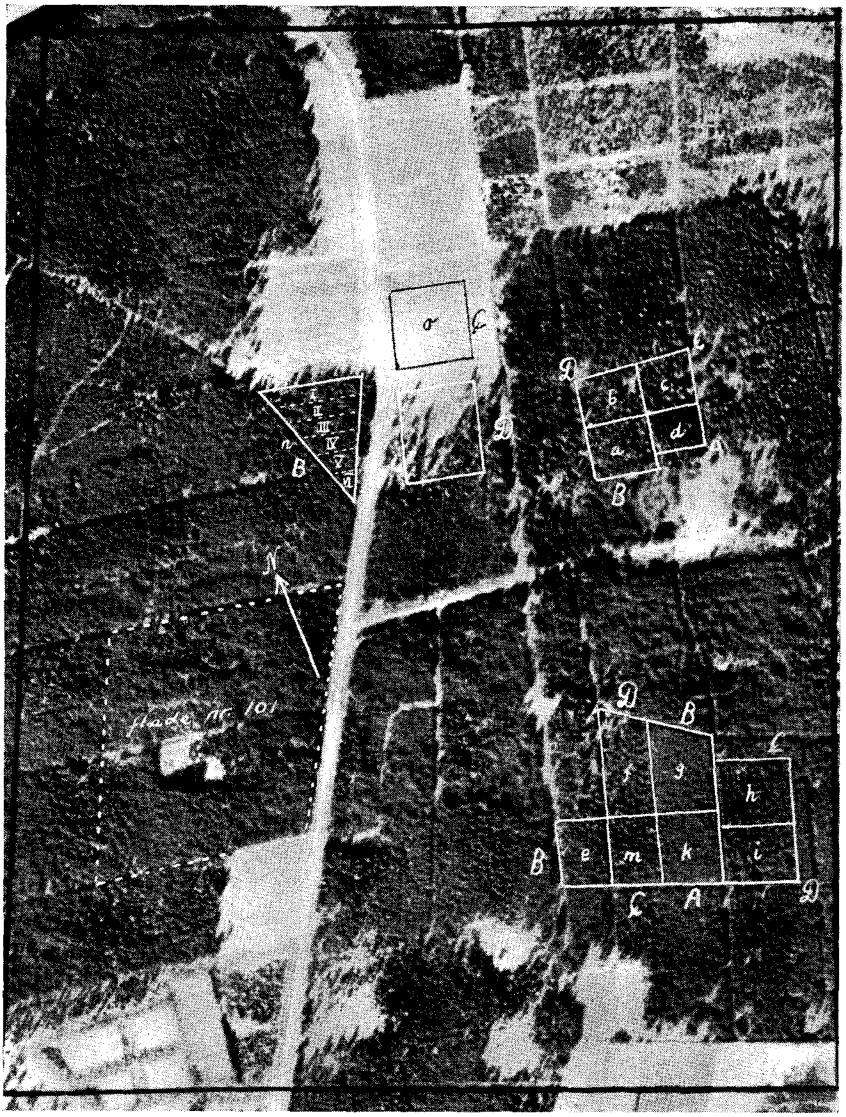

Fig. 1. Air photo (Danish Air Force) of sample plot MB, Nystrup. Spring 1954.

Fig. 1. Luftfoto (Flyvevåbnets) af prfl. MB, Nystrup. Forår 1954.

In the summer of 1948 the first signs of weakening became apparent: attacks by Dendroctonus micans in the stand north of Group 3. However, at that time it was regarded as a freak of nature rather than a symptom of decay. Nobody could foresee that most of the 100-hectare stand would wilt within the next eight years.

The autumn of 1949 saw the first signs of attacks by D. micans in the experimental stand proper: heavy in parcels o and p, and light in parcel n.

By the autumn of 1951 parcels o and p had become somewhat depleted on account of the D. micans attacks. The other experimental stands were completely closed, also parcel n (B-thinning in Group 3). Group 1 showed mild attacks, and Group 2 (the southern one) only insignificant micans attacks, chiefly in the north-westerly corner of parcel f.

The NNE gale on Feb. 11, 1952 (*Jacobsen* and *Rasmussen* 1953), caused serious damage to parcel o, a windfall wedge extending from NE over a considerable distance into the parcel. Some damage was also done to parcel p, whereas only slight damage was caused to parcel n (B-thinning), although its northerly edge bordered on an open culture site on which there was only a light screen of old Sitka spruce. The screen fell, but the edge stand facing parcel n was left almost intact. These windfalls and heavy micans attacks occasioned the clearing of parcel o in the autumn of 1952.

The gale on Feb. 21, 1953 (*Dansk Skovforening* 1953), caused damage especially to parcel p, and also the northern edge of parcel n was damaged a little.

Recurring scattered windfalls and wilting accompanied by heavy D. micans attacks resulted in parcel p being cleared in the spring of 1954. The aerial photograph, Fig. 1, was taken at that time, before the clearing.

Parcel n was cleared in the autumn of 1954 though it was fairly closed, but on its northern edge there were frequent minor windfalls causing a high breakage percentage. Moreover, it suffered severely from micans attacks.

In the autumn of 1954 the health of the trees in the southern Group was still fairly good. There were a considerable amount of micans attacks, and dead trees occurred, but broadly the stands were closed and the crown look was generally good.

By the autumn of 1955 the health condition of the southern Group, especially in the heavily thinned grades, had deteriorated so much that it was decided to establish a screen by felling all dying and dead trees, and then underplant in the heavily thinned parcels f, h, i, and m, as well as parcel e (B-thinning), where the state of health was poor. Markings were made and a health census was taken but felling operations were put off in view of the risk of winter gales.

On Jan. 21—22, 1956, a gale*) caused extensive damage to the parcels selected for underplanting, viz. e, f, h, i, and m. After additional felling of dying and dead trees, these parcels were underplanted in the spring of 1956.

In the summer of 1956 there were still many trees dying. This in connection with a gale occurring about Oct. 1 resulted in the clearing of the remainder of the southern Group: the screening trees of parcels e, f, h, i, and m, as well as the fairly complete stands of parcels g (B-thinning) and k (A-thinning).

In Group 1 (parcels a, b, c, and d) developments were similar to those of the southern Group; however, the disease had progressed more in Group 1 than in Group 2. The final clearing took place in the autumn of 1955.

A detailed account of the health investigations will be given on p. 189 et seq. Here will be mentioned only a few facts noticeable by ocular inspection:

1. In the heavily thinned parcels the state of health was appreciably poorer than in the lightly thinned ones; the mortality was higher.

2. In the early stages of disease the close relation between micans attacks and mortality was conspicuous.

3. Later (1954/56), there were other causes of death; neither micans nor Trametes attacks were involved. Sudden exposure owing to the cessation of parts of stands played a part.

4. Therefore it is not known how long the lightly thinned parcels which were in a better state of health could have remained intact if they had not been surrounded by heavily thinned stands.

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*) This gale also wrought havoc on Bornholm, Zealand, and in other places.

3. RESULTS OF MEASUREMENTS

a. *Method*

General data on measuring and calculation techniques are given by *Henriksen* (1957) p. 281 et seq. and by *Henriksen* (1951) p. 403 et seq., reporting on special features of the present experiment. Below follow a few supplementary details, including data only fully clarified by observations after 1951.

Basal Area Determination. In 1949 all trees were numbered (individual measurement), resulting in a much more accurate determination of the basal area.

Height Determination. Henriksen (1951) states p. 405 that pre-1945 heights are mainly based on a reconstruction by means of years-shoot measurements. Later each examination included height determination in each parcel of both thinning and remaining crop.

Form Factor Determination. The level determination mentioned by *Henriksen* (1951) (percentage deviation from table) has been continued. However, the deviations have not been related to Nässlund's Norway spruce table, but to the diagram showing the stem form factor for Sitka spruce (*Henriksen* 1958, p. 22). The results appears from Table I, where the level (percentage deviation) is given for each measurement year and for each parcel, figures broken up into thinning grades.

Table II shows a rectilinear adjustment of data; a distinction has been made between thinning volume and remaining crop. Broadly the 1954/56 level determinations may be taken as expressions for the final level of the remaining crop, apart from the 1954 A-felling, which operation in fact amounted to thinning.

It appears that the level increases through grades A to D, the final difference between them being approx. 15 per cent.

That this could be so had long been anticipated (*Henriksen* 1951) but the explanation was discounted as improbable.

The reference used for level determination (the above form factor diagram for Sitka spruce) is strictly speaking not quite correct, cf. the remarks previously made by the writer (*Henriksen* 1954). However, the reference is usable for practical purposes because it tolerably corresponds to the form factor change that occurs during the development of a stand (cf. *Henriksen* 1958, p. 24). In other words, the table has no fundamental lopsidedness.

Since no essential objection can be made against the reference, it can be established as a fact that the present thinning experiment shows appreciable differences in form factor levels traceable to different grades of thinning: the heavier thinning, the higher form factor level; or in other words: for a given height the form factor does not drop so much with increasing diameter as would be expected from the diagram.

This corresponds, as demonstrated on p. 187 et seq., to the fact that the relative stem form is largely unaffected by the grade of thinning, while normally the stem form would be expected to deteriorate (greater tapering) with heavier thinning.

Calculation of Volume. Now as before, (*Henriksen* 1951) the calculation is made according to the mean tree method. (Height and form factor corresponding to the tree with mean basal area). Hereby is introduced a unilateral error unfavourable to light thinning, so slight however that it is insignificant in this connection.

All *basal area values* are used without correction.

With a few exceptions all *height* values are used without correction or adjustment. However, as mentioned on p. 180, pre-1945 heights represent reconstructed values.

The form factors are corrected, adjusted values, the form factor diagram used by *Henriksen* (1958) having been applied also here, subsequently corrected by means of the percentages (levels) stated on p. 209. The remaining crop level has also been applied in the case of recent thinnings when these amounted to clearing rather than thinning, viz. in the following instances: parcel a (autumn 55), parcel b (autumn 54 and 55), parcel c (autumn 54 and 55), parcel d (autumn 55), parcel e (autumn 55 and 56), parcel f (autumn 55 and 56), parcel g (autumn 56), parcel h (autumn 55 and 56), parcel i (autumn 55 and 56), parcel k (autumn 56), parcel m (autumn 55 and 56), parcel n (autumn 54), parcel o (autumn 52 and spring 53), and parcel p (spring 54). There is further the following exception: in the years 1953/56, the volumes of thinning were not calculated according to the above form factor table (*Henriksen* 1958) with level correction, but based on direct volume determination by means of meter sectioning, provided however, that it is not classified as clearing (mentioned above) and therefore ranged with the other determinations of the volume of remaining crops.

b. *Increment Progress in Broad Outline*

The results of the measurements largely appear from Table III, which lists all measurements of each experimental parcel.

As mentioned above, there is every indication that the initial development was good. At the time of the first thinning in the autumn of 1935 the average production of Group 2 (parcels e to m) at the age of 26 years was 258 cu.m./ha., i. e. 11.7 cu.m. annually per ha. reckoned from the date of cultivation, or 26 per cent. more than indicated in the yield table for that site class, 2.1.

In the following 18-year period, till the autumn of 1953 (age 44 years), the increment was particularly great: the annual average of Group 2 35.6 cu.m./ha. This is among the highest Danish increment figures on record. By comparison the highest increment figure in the yield table (*Henriksen* 1958, p. 31) is 31.8 cu.m./ha. annually for site class 1 and age from 30 to 35 years.

At the age of 44 years Group 2 had an average volume increment, reckoned from date of planting, of 22.4 cu.m./ha. annually, of 24 per cent. more than shown in the yield table. By the end of this 18-year period the site class had gone up from 2.1 at 26 years to 1.8 at 44 years. By comparison it may also be mentioned that at age 44 the average increment, 22.4 cu.m., is the same as that of site class 1 at age 42.

Over the following three years, age 44 to 47, the increment rate fell steeply concurrently with the rapid deterioration in health. For Group 2 it averaged 14.5 cu.m./ha. annually at age 44 to 47.

This development, the record-setting increase and the steep decrease, applies equally to Groups 1 and 3.

Are the high rates of increment found in the Nystrup experiment exceptional? The answer is both yes and no. They do not occur generally, nor are they typical of the country as a whole. But they would hardly be exceptional in localities similar to Nystrup, where the subsoil is good and overlaid by about half a metre of shifting sand, and where the precipitation is relatively high (about 720 mm. in Thy) (cf. *Henriksen* 1958, p. 166 et seq.). However, an essential prerequisite is that the culture is initially successful. Why the increment rate is favoured by this type of locality is unknown. It would seem natural to attribute the high rate to a generally deep root development (cf. *Henriksen* 1958, i.a. p. 154 et seq.) and the resultant relatively good supply of water.

As mentioned, the Nystrup experiment is remarkable for the great *volume increment,* and not for height increment — site quality 1.8 at 44 years in Group 2. Consequently, basal areas and diameters must be of a large order. However, it is difficult to generalize on these values that are so greatly influenced by the rate of thinning.

In the A-grade (parcels d and k) the *basal area* culminated at about 80 sq.m./ha., the highest Danish basal area figure on record. The D-grade basal area averaged 32—33 sq.m./ha., which does not seem to be a particularly low figure. In the yield table for Sitka spruce the basal area for site class 2 is about 35—37 sq.m./ha. For Norway spruce, site quality 1, (*Møller* 1933) the average basal area is 28—30 sq.m/ha. The D-thinning was admittedly a heavy one, the crown canopy being much broken, the more so when related to the A-thinning.

Trees subjected to D-thinning reached a *diameter* of about 35 cm. in 44 years. This almost corresponds to site class 1 of the Sitka spruce yield table, where, however, the said diameter is obtained with a basal area of about 40 sq.m/ha. Sitka spruce, site class 2, has a diameter of about 27 cm. at 44 years, the basal area being about 36 sq.m/ha. Norway spruce, site class 1, (*Møller* 1933) attains a diameter of 35 cm. at about 51 years with a basal area of about 30 sq.m./ha.

c. Dependence of Volume Increment on Thinning Grade

Table IV summarizes for each Group of parcels the average increments during the period of observation, excluding, however, the final phase characterized by disease.

There is no clear evidence of increment being dependent on thinning grade.

A critical evaluation must, however, be based on adequate knowledge of the initial, natural conditions of growth. As regards Group 3, sufficient particulars of initial factors are not available. More is known about these factors in Groups 1 and 2 — not the heights which, as mentioned, were largely reconstructed at a later date, but the *basal areas*. Usually, the basal area is not considered a measure of quality, that is, a measure of the natural conditions of growth; but for the untouched stand it is adequately indicative of quality. In any case, the replication parcels of Group 2 clearly demonstrate a correlation between the initial basal area and subsequent increment.

Fig. 2 shows the relation between the initial basal area and the periodical volume increment (Table IV) for each parcel of Groups 1 and 2. The replication parcels of Group 2 are connected

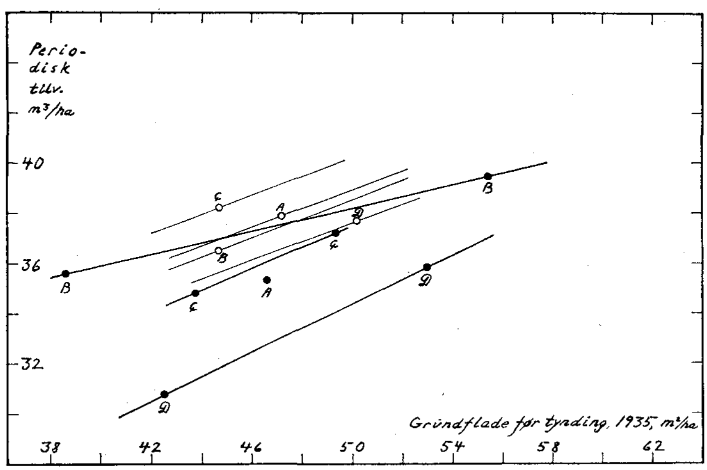


Fig. 2. Relation between initial basal area and periodical volume increment. Each point corresponds to one parcel (Table IV). Capital letters indicate thinning grade.

Fig. 2. Relation mellem startgrundflade og periodisk vedmassetilvækst. Hvert punkt svarer til een parcel (jfr. tabel IV). De store bogstaver angiver hugstgraden.

by straight lines to show the relation between the initial basal area and the subsequent volume increment. It cannot be said whether this relation is characterized best by the relatively slight slope of the B-thinning line (parcels e and g) or by the somewhat steeper slopes of the C-and D-thinnings. It must be presumed that an average gives the best overall characterization of this relation.

Lines with average slopes like those found in Group 2 are drawn through the points of Group 1 (one point corresponding to each of the parcels). In the absence of replication parcels, this slope cannot be determined on the basis of observations in Group 1.

Thereby the yield comparison has been changed from a comparison of points — the values measured direct — to a comparison of the lines in the diagram. The results may be summarized as follows:

Group	1	from A-thinning to B-thinning	increment drops
-	1	from B-thinning to C-thinning	increment rises
-	1	from C-thinning to D-thinning	increment drops
Group	2	from A-thinning to B-thinning	increment rises
-	2	from B-thinning to C-thinning	increment drops
-	2	from C-thinning to D-thinning	increment drops

The data from Group 2 are the best substantiated. There are more and larger parcels in Group 2 than in Group 1.

Even when this is taken into consideration, there is no very clear line. However, it is probable that the rate of increment is lower for D- than for C-thinning. For the other thinning grades the figures give neither ground for assuming that there is a difference, nor for assuming the absence of a difference.

This evaluation is not the same as that made by the writer in Report No. 168 (*Henriksen* 1951), where he assumed that there would be a drop in the rate of increment through thinning grades A-B-C-D. The amended evaluation has been employed, first because the stem form improvement assumed in Report No. 168 did not occur (which possibility, however, was foreseen in 1951). Secondly, because in 1951 the writer attached greater importance to best substantiated Group 2. Thirdly, because the series of observation have been extended.

4. QUALITY OF YIELD

This survey comprises the distribution of the yield over dimension classes as well as tapering, i.e. the relative stem form. Moreover, the Timber Technology Section of the Royal Veterinary and Agricultural College has examined specific weight, strength, etc.; on this research a special report will be published. The economic analysis, p. 199 et seq., contains information about the merchantable products and their sales value.

a. *Distribution of Yield over Dimension Classes*

This distribution has been examined in each of the parcels of Group 2, in principle in the same manner as Group 1 in Report No. 168 (*Henriksen* 1951):

The basal area is divided into 5-cm. diameter classes. The height and the form factor of the class median are stated. The volume is found by multiplication of height, basal area, and form factor. Concerning height curves it should be noted that the thinning height curves up to and including 1945 are drawn according to the writer's method (*Henriksen* 1950) with a constant remaining unchanged during the period, and put at 0 on the basis of measurements in Group 2. The form factors originate from the form factor diagram used for the other calculations of volume (*Henriksen* 1958, p. 22) with the level corrections (Table II) shown on p. 209.

The results are listed in Tables V, VI, and VII. Table VI is a summary of Table V, and in Table VII the results are even more summarized.

Table VII shows that the volumes falling into the lowest dimension class (diameter breast height less than 20 cm.) are not greatly affected by the thinning grade, particularly the practicable thinning grades B, C, and D.

On the other hand there is with increased thinning a great shift (about 200 cu.m.) from the middle-dimension class (20—35 cm) to the largest-dimension class (over 35 cm.).

Obviously this is a local phenomenon bound up with favourable conditions of growth. Under bad conditions where it is difficult to reach 20 cm. dimension, the shift occurs from the smallest-dimension to the middle-dimension class.

As a general rule, it is possible by thinning to shift a substantial part of the yield to larger-dimension classes. The amount of interest attaching to such a policy depends on aims in view and price conditions.

Further it is generally possible to establish a *smallest-dimension class* the yield of which remains fairly unchanged regardless of the thinning grade. In heavy thinning, the small dimensions occur early, in light thinning over a longer period.

b. *Tapering*

The analysis of the form factor level presented on p. 180 gives as a result that the form factor must be more or less uniform for the different thinning grades. This means that the relative stem form should not be appreciably affected by the thinning grade. Now this is at variance with experience gained so far, and with ocular impression: in light thinning the crown development is poor, the volume being shifted from branches to stem.

However, a stem form remaining fairly unaffected by thinning grade was found by means of a number of measurements of Hohenadl's form quotient (*Prodan* 1951, p. 20 et seq.), the ratio of halfheight diameter to 1/10 height diameter. It is a true expression for the relative form of the tree because the relative position of the diameters as distinct from, e.g. the absolute form quotient, is independent of height. In 1956 a considerable number of these form quotients were measured in Group 2 with the results listed in Table VIII.

There is no noticeable form change due to thinning. Unfortunately, the A-thinning figure is not very well substantiated. But for B- and D-thinnings, those grades which are of practical interest, the result is fairly dependable: no change of form.

From the outset it is conceivable that this might be due to low selection in the light thinning grades and a concomitant relatively great number of large-branched trees. But in that case there would also be a relatively great number of trees with a comparatively *high* form quotient, and the low average figure would therefore be the result of a great dispersion from the highest form quotients to the low values ascribable to insufficient selection. Table IX shows the form quotient distribution.

There is no doubt about the result. The high form quotient values do *not* markedly occur in the lightly thinned parcels. Evidently the thinning grade has had no appreciable influence on the relative stem form. This is a specificity of growth which is contrary to general experience.

The only remaining possibility is that the *root swelling* is greater in the case of heavy thinning than in light thinning (cf. *Sabroe* 1939). That this can be so only to a very small extent appears from Table X, which shows the *absolute form quotient* for practically the same trees as in Tables VIII and IX (the ratio of the diameter measured half-way between the breast height and the top of the tree, to the diameter breast height).

The fluctuations are a little greater than in the case of the legitimate form quotient (Hohenadl's), presumably because one of the measurements is made lower on the stem. There is nothing to indicate any appreciable difference of form due to thinning.

Incidentally, the tapering is relatively slight. For Danish common spruce *Sabroe* gives a form quotient variation from approx. 0.65 to approx. 0.75 (*Sabroe* 1939). Thus, the tapering of the Sitka spruce at Nystrup is about the same as that of commonly occurring Norway spruce.

The legitimate form quotient (Hohenadl's), which at Nystrup is about 0.750, corresponds to a legitimate form factor of 0.545 (*Prodan* 1951, p. 21). At the upper end of the Norway spruce variation field given by Prodan, the form factor is between 0.500 and 0.580 (*Prodan* 1951, p. 34). The legitimate form factor for the Apollonic paraboloid is 0.555.

A relative stem form unaffected by the thinning grade results in a appreciably greater tapering *per metre run* in heavy thinning than in light thinning, given trees of average size. If the stated form quotient measure is used, the tapering from breast height to about 11 metres up the stem will be in 1956 (height about 23 m.): B-thinning about 7½ mm. per metre run, in D-thinning about 10 mm. per metre run. Trees of *equal* size (a relatively big tree in the B-thinning compared with a relatively small tree in the D-thinning) will, however, have nearly the same tapering per metre run.

5. HEALTH AND STABILITY

a. *Attacks by Dendroctonus micans*

Attacks by Dendroctonus micans have been briefly mentioned on page 178 et seq., and have also been described by *Gøhrn, Henriksen,* and *Beier Petersen* (1954), and by *Henriksen* (1958).

Table XI shows the development in broad outline.

It will be seen, as mentioned on p. 178, that the attack began in Group 3, and then spread to Group 1, and finally to Group 2.

About three years after the beginning of the attack the stand began to decay and was cleared a few years later. The entire cycle from the onset of the attack to the clearing is about five years. It may be shortened by windfalls, as in parcels o and p.

It will also be seen that in the light thinnings the attacks gathered head later than in the heavy thinnings, particularly in parcels d, k, and n. Also in parcels a and e (B-thinnings), the percentages of D. micans attacks were lower than in the more heavily thinned adjoining parcels.

There can be no doubt about the importance of the thinning grade to the development of D. micans attacks, and consequently to stability. It is not known *how* long a lighter thinning will *in general* be able to prolong the life of a stand. The probability is that it can prolong the life of a stand for a longer period than shown by the experiment, since the lightly thinned parcels were in great danger of infection from adjoining stands and were highly exposed when these disappeared.

In the southern Group, the rate of attack varied somewhat also for equal thinning grades. Among the B-thinnings, parcel e is more heavily attacked than parcel g; among the C-thinnings, parcel m is more heavily attacked than parcel h; among the D-thinnings, parcel f is more heavily attacked than parcel i. The writer has already given an account of this matter (*Henriksen* 1958, p. 295 et seq.), and related it to the slope of the ground: the attacks being heaviest on steep slopes, perhaps owing to faster runoff. Be it as it may, it is certain that the slope of the ground has a great influence on the form of the root system (*Henriksen* 1958, p. 298).

b. *Influence of D. micans Attack on Growth*

An attack by Dendroctonus micans has a strong and rapid impact on the growth of the tree attacked. This has been described in detail by the writer (*Henriksen* 1958, p. 301 et seq.). By way of illustration an extract of *Henriksen* (1958), Table XXXI, stating the diameter increment figures for parcel n (Table XII), is given on p. 221.

It will be seen that in the course of a year or two the attack causes a heavy drop in the increment as compared with unattacked trees. During 3 or 4 years at the most the increment will be negative, in other words, the tree is dying (probably the effect of desiccation).

The increment drop that appears from *unattacked* trees, is probably due to the heavier exposure to which the parcel was gradually subjected (p. 178 et seq.), and which, at least judging by the crown look, had an unfavourable effect (*Henriksen* 1958, p. 306 et seq.).

There can be no doubt that, in addition to the direct effect on the growth of the attacked trees, the attack will indirectly decrease the increment of *unattacked* trees due to sudden exposure when attacked trees and stands ceased to exist.

c. *Attacks by Fomes annosus (Trametes)*

Attacks by Fomes annosus have already been described by *Henriksen* and *Jørgensen* (1952), and by *Henriksen* (1958), and only a summary of observations is given below.

The examination included stump description supported by isolation, of which an account has been given by *Henriksen* and *Jørgensen (1952)* and by *Henriksen* (1958). Other forms of rot occur, particularly in connection with fusions and felling injuries (*Henriksen* 1958, p. 72), but are of minor importance and have not been taken into account. The main results are listed in Table XIII.

The Trametes percentages are comparatively low. If further allowance is made for the fact that Trametes attacks on Sitka spruce are concentrated in the lower part of the stem much more than they are in Norway spruce, it will be realized that these attacks are not very important in the present case. As a rule it is sufficient to cut off lengths of one or maximum two metres when trimming timber.

Now it is of fundamental interest whether the thinning grades have any bearing on the problem in hand. However, very little can be said on this point because the figures are vitiated by errors due to the sporadic occurence of the attacks (cf. *Henriksen* 1958, p. 294). *Henriksen* and *Jørgensen* (1952) concluded that the experiment did not show any correlation between the thinning grade and the Trametes percentage, but that it did support results obtained at Ravnholt (sample plot IT) and Gludsted (sample plot IS) in that Trametes attacks were not found in the A-thinning. It now appears, however (from the clear-cutting in 1956) that the above surmise is not correct, a fact which in itself commands interest (*Henriksen* 1958, p. 295).

It seems that Trametes attacks occur less freqently in the D-thinning than in the C-thinning. The figures are not reliable, but there is one feature common to all the Groups. The Gludsted experiment (sample plot IS, Norway Spruce) points the same way — an increase up to the C-thinning, and then a slight drop. The Ravnholt experiment (sample plot IT, Norway Spruce) does not show this trend. However, it seems to bear out the often-made observation that edge trees, isolated trees, etc. are often relatively vigorous.

This should be no matter for surprise. Some observations suggest that root fusions may contribute towards the spreading of the attack. By means of heavy thinning at an early stage before root fusions have reached full intensity, and by continued heavy thinning, it might be possible to reduce the propensitity to root fusions and theoretically even to prevent it altogether.

d. *Influence of Trametes Attacks on Growth*

The writer has previously reported on research into the question whether Trametes attacks are always fatal to old Sitka spruce (*Henriksen* 1958, p. 314 et seq.). Some of the relevant data originated from the Nystrup experiment (9 heavily Trametes-attacked trees, grades 3—4). To sum up the findings from thinnings, there is often a drop in the increment of Trametes-attacked trees. This may, however, be easily traceable to the fact that preferably weakened trees have been selected for thinning (cf. the crown look) — and thus the result is a foregone conclusion: we find a drop in the increment but without knowing to what extent this may be ascribed to the Trametes attack. However, if the data derive from clear-cuttings etc. and trees showing other obviously probable causes of weakening are excluded, it is very doubtful if it would be possible to find a drop in the increment of Trametes-attacked trees. Table XIV, which is an extract of Table XLI b given by *Henriksen* (1958), shows the results obtained from the Nystrup data.

Though it stands to reason that a Trametes attack may become so rampant that it causes increment drop and death, the above-mentioned investigations do show that attacks on old Sitka spruce are distinctly chronic, but they do not kill the trees quickly.

e. *Causality of Wilting of Sitka Spruce*

There can be no doubt that attacks by Dendroctonus micans play a considerable part in the wilting of Sitka spruce in the Nystrup experiment. It is almost equally certain that no particular importance can be attached to attack by Trametes in this connection. It was shown (p. 190) that the D. micans attack was quickly followed by a drop in the increment and by death, while in the case of Trametes attacks developments were slow. These matters may be pertinently illustrated by Figs. 3, 4, and 5 (identical with Figs. 62, 64, and 65 in *Henriksen* 1958), where the A-thinning is charted for crown look, D. micans attacks, and Trametes attacks in the autumn of 1956, immediately before clearing. It will be noticed that there is a fairly close correlation between

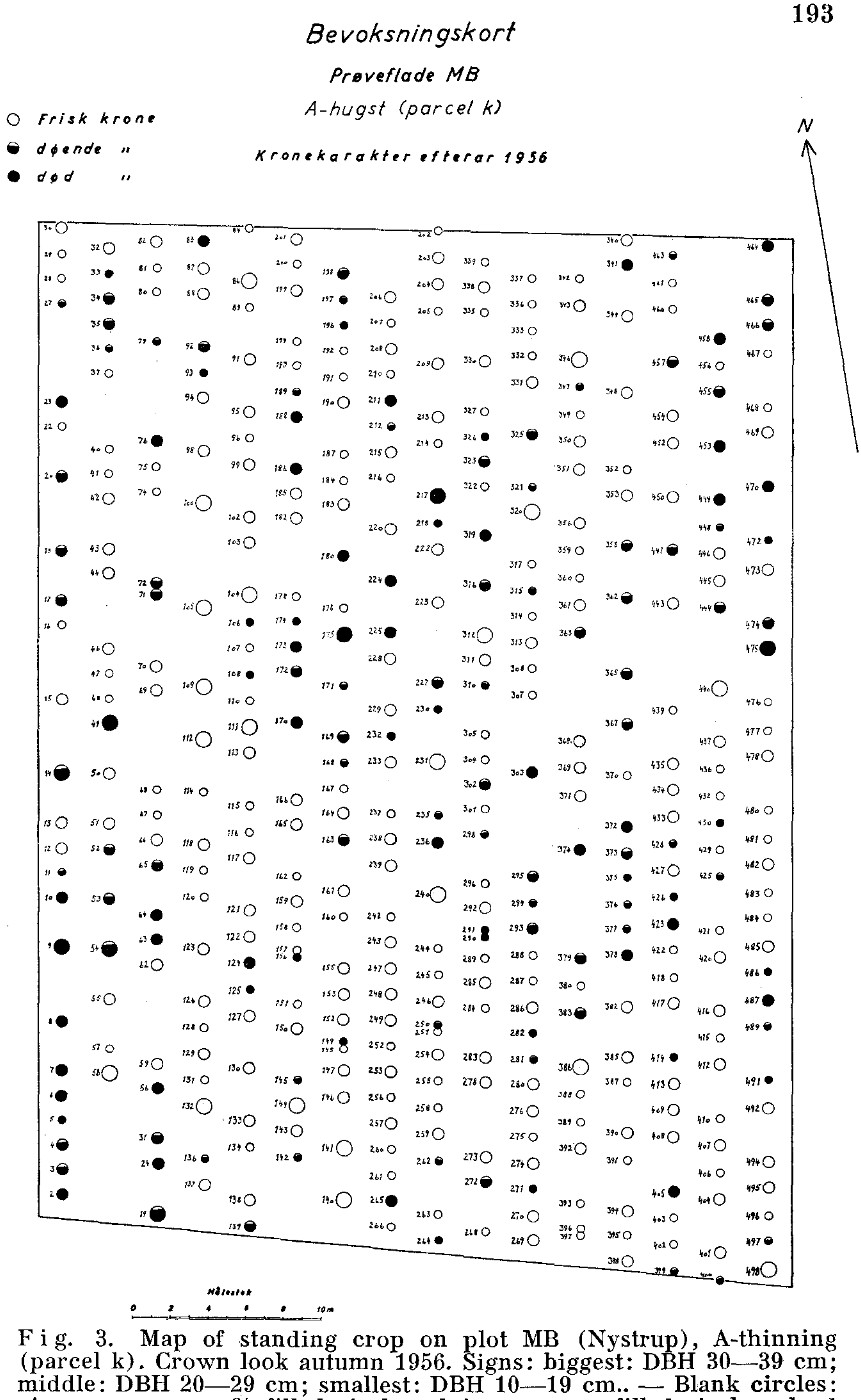


Fig. 3. Map of standing crop on plot MB (Nystrup), A-thinning (parcel k). Crown look autumn 1956. Signs: biggest: DBH 30—39 cm; middle: DBH 20—29 cm; smallest: DBH 10—19 cm.. — Blank circles: vigorous crowns; ⅔ filled circles: dying crowns; filled circles: dead crowns.

Fig. 3. Del af prøveflade MB (Nystrup). Største signatur: Brysthøjdediameter 30—39 cm, mellemste signatur brysthøjdediameter 20—29 cm, mindste signatur brysthøjdediameter 10—19 cm.

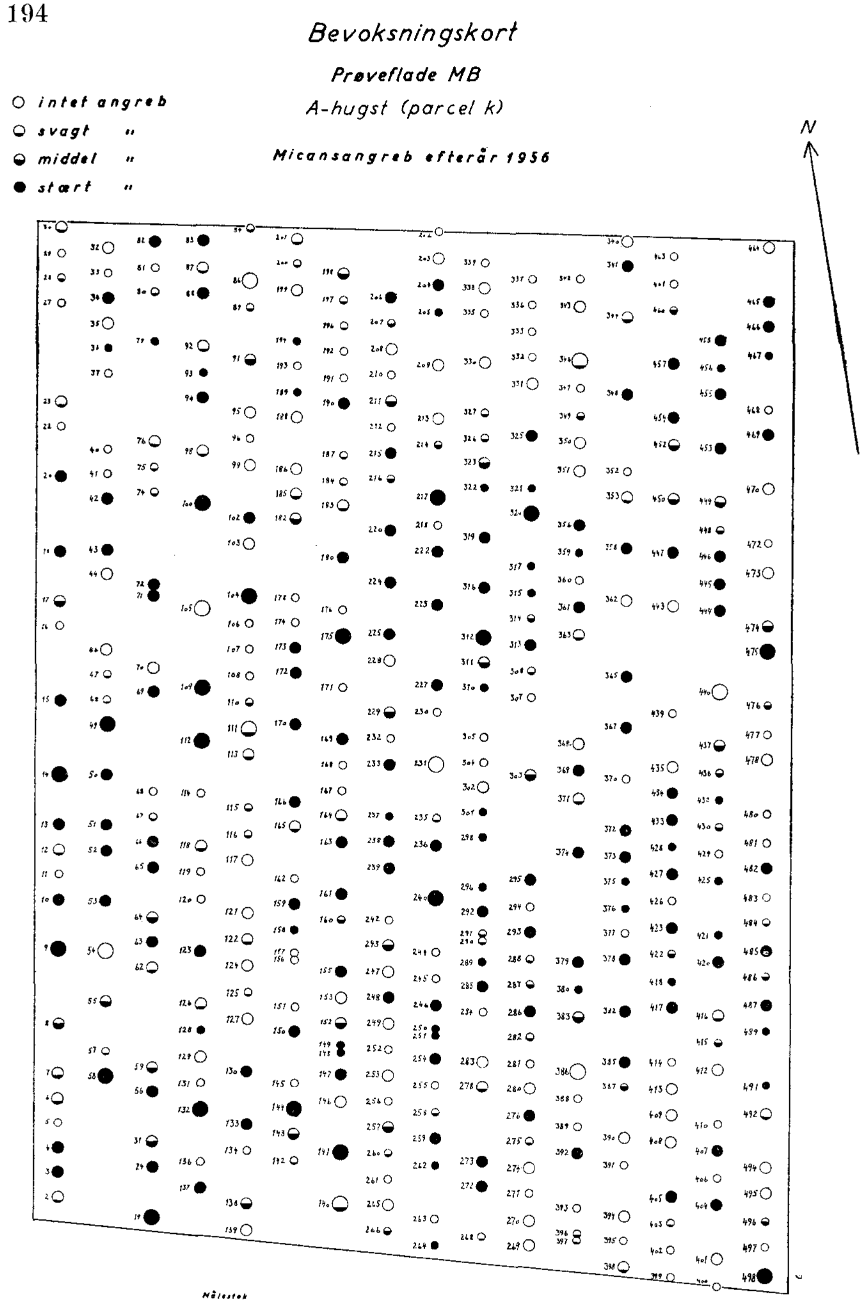


Fig. 4. Map of standing crop on plot MB (Nystrup), A-thinning (parcel k). Micans attack autumn 1956. Signs: dimensions as in Fig. 3. — Blank circles: no attack; ¼ filled circles: light attack; ½ filled circles: moderate attack; filled circles: heavy attack.

Fig. 4. Del af prøveflade MB (Nystrup). Største signatur: Brysthøjdediameter 30—39 cm, mellemste signatur: Brysthøjdediam. 20—29 cm, mindste signatur: Brysthøjdediam. 10—19 cm.

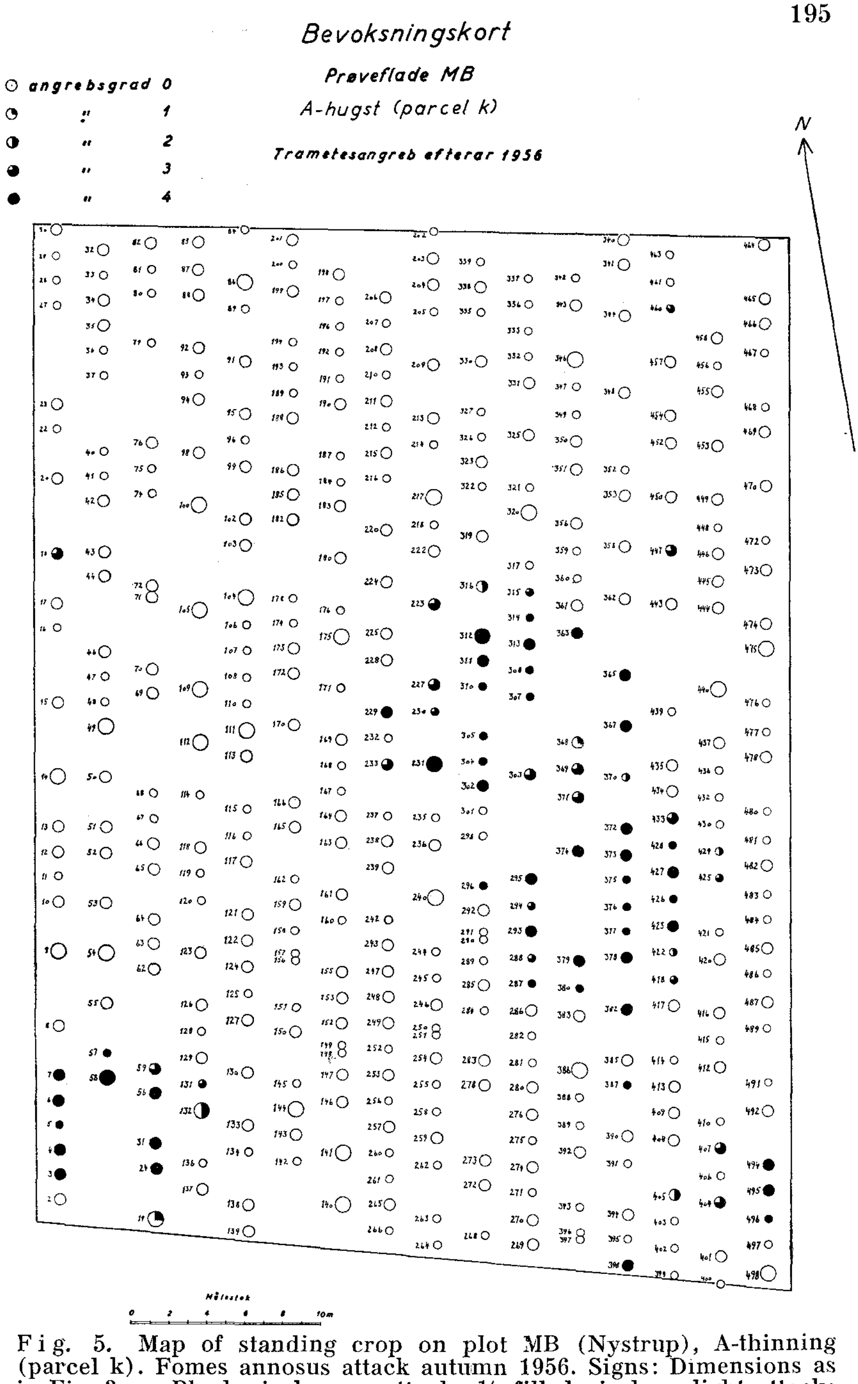


Fig. 5. Map of standing crop on plot MB (Nystrup), A-thinning (parcel k). Fomes annosus attack autumn 1956. Signs: Dimensions as in Fig. 3. — Blank circles: no attack; ¼ filled circles: slight attack; ½ filled circles: light attack; ¾ filled circles: moderate attack; filled circles: heavy attack.

Fig. 5. Del af prøveflade MB (Nystrup). Største signatur: Brysthøjdediam. 30—39 cm, mellemste signatur: Brysthøjdediameter 20—29 cm, mindste signatur: Brysthøjdediam. 10—19 cm.

crown look and D. micans attacks, but no such between crown look and Trametes attacks.

From the outset the possibility exists that the damage was not caused solely by Dendroctonus micans, but that the trees were weakened beforehand and thus made vulnerable. It has been suggested that the extremely dry year 1947 might have caused such a weakening.

Fig. 6 (Fig. 37 in *Henriksen* 1958) shows the diameter increment fluctuations in Group 3, B-thinning and D-thinning (red curves). It will be seen that there was a diameter increment drop in 1947, remarkably small however compared with other localities (*Henriksen* 1958, p. 269 et seq.). The diameter increment had already in 1948 reached its normal level, at which it stood till

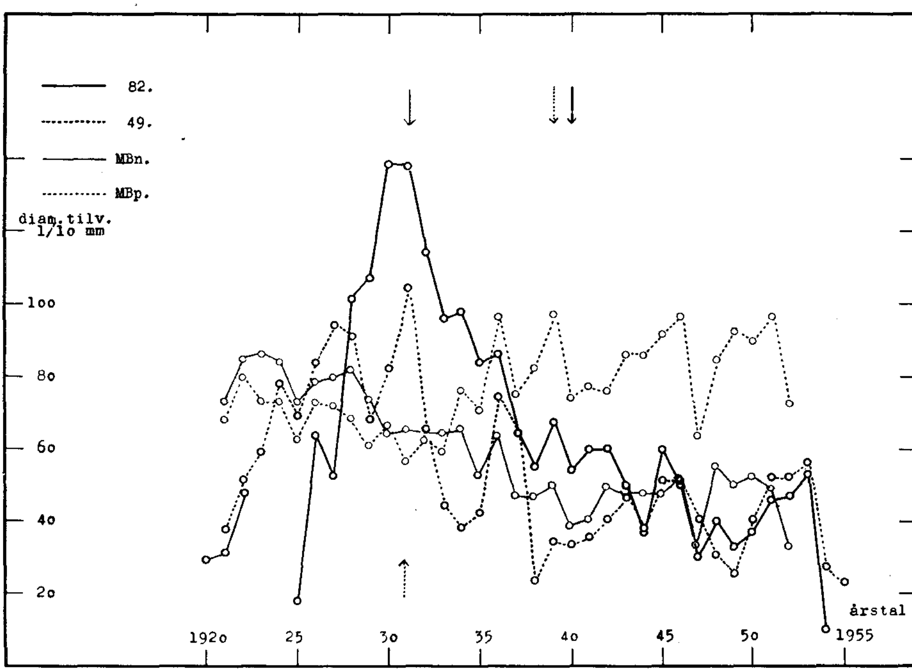


Fig. 6. Diameter increment fluctuations on plots n and p, respectively B- and D-thinning. No. 82 and No. 49 are stands of Sitka Spruce in Tved Plantation (*Henriksen* 1958) showing heavy decreasing increment in 1954.

Fig. 6. Svingninger i diametertilvækst i parcellerne n og p, henholdsvis B- og D-hugst. Nr. 82 og nr. 49 er bevoksninger af sitkagran i Tved Plantage (jfr. Henriksen 1958), der viser stærk tilvækstnedgang i 1954.

1951 inclusive. The diameter increment figures listed in Table III also show that in 1949/51 the diameter increment was normal in parcels n, o, and p, whereas the D. micans attack developed quickly.

There remains the possibility that the individual trees first attacked, not the stand as a whole, were weakened in advance. The writer has shown (*Henriksen* 1958, p. 299 et seq.) that this was not so, at least there was no weakening of such a nature that it would affect the diameter increment.

Besides, this absence of previous weakening of the attacked trees also appears from the data forming the subject of this report, viz. Table XII (p. 221), which shows that in 1950—51, and even in 1952, the trees attacked in 1950—51—52 had full increment.

Hence it may be established as a fact that neither the stand as a whole nor individually attacked trees were previously weakened, at least not to such an extent that it affected the diameter increment. *Evidently, Dendroctonus micans was a characteristically primary cause af decay.*

However, there were undoubtedly contributory causes (*Henriksen* 1958, p. 306 et seq.), perhaps not initially, but at any rate later. As demonstrated by the writer, it was evident in 1954 — prior to the clearing of parcel n — that Sitka spruce was very susceptible to desiccation by wind. The condition of parcel n seemed to show that the sudden exposure of an edge stand could have a fatal effect over a distance of up to fifty metres into an otherwise closed stand. This indicates that at the relevant time the Sitka spruce was in an unstable condition in which its physiological balance could easily be upset. A number of other factors make it likely that the principal difficulty in the cultivation of Sitka spruce is weakening due to desiccation, or inadequate water balance.

Be this as it may, there is *no doubt that other causes than these pathogenes hitherto known contributed largely to the wilting of the Nystrup spruce.* — Fig. 7 is a diagram showing developments in the individual parcels. These are made up into groups, and in each group aranged according to increasing thinning grades. The basal area increment, the development of the D. micans attack, the decay and clearing of the stand are indicated for each parcel. (The basal area increments correspond to Table III, and the other particulars to Table XI).

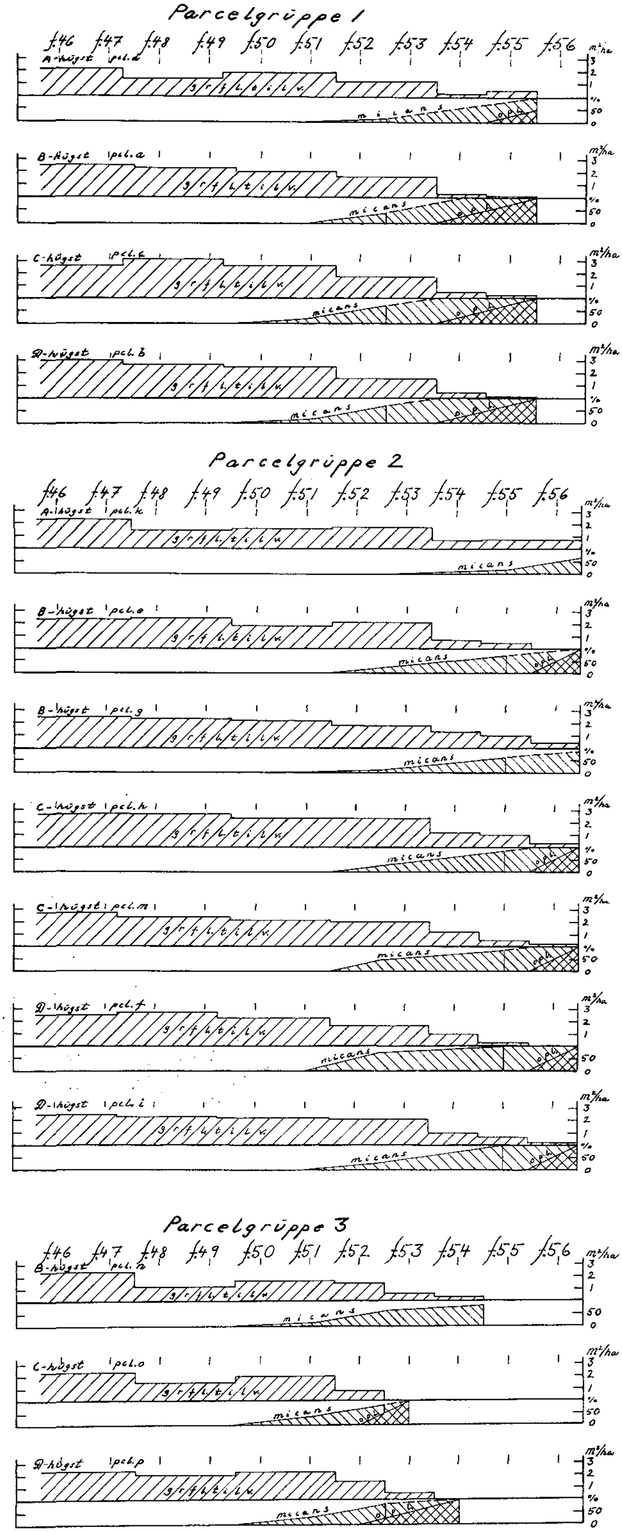


Fig. 7. Health condition and basal area increment. (*f* = spring, *hugst* = thinning, *grfl. tilv.* = yearly basal area increment, micans = attack of Dendroctonus micans in per cent, *opl.* = incipient decay of stand).

Fig. 7. Sundhedstilstand og grundfladetilvækst. (f = forår, grfl. tilv. = årlig grundfladetilvækst, micans = angreb af Dendroctonus micans, opl. = bevoksningens opløsning).

Fig. 7 shows many things of interest, but primarily a certain abscence of interrelation between micans attacks and growth. As already mentioned, it will be seen that there was no drop in increment prior to the D. micans attack, nor at its initial stages. Later, as the stand decayed, the increment fell. Probably the most remarkable fact is that in 1954 the increment dropped in all the parcels existing at that time. Broadly, it was halved. This decrease seems to have occurred fairly independently of the condition of the stand (degree of D. micans attacks and degree of completion). Altogether 1954 was unfavourable to the growth of Sitka spruce (*Henriksen* 1958, i.a. p. 266). The cause was probably climatically conditioned but is otherwise unknown. (*Henriksen* 1958, i.a. p. 266).

However, the main thing is that essential factors other than D. micans attacks, and probably in many places Trametes attacks, contribute towards shortening the life of Sitka spruce. *The increment observations at Nystrup in 1954 suggest that the condition had become unstable independently of the Dendroctonus micans attack which caused such a sensation at the time.*

6. ECONOMIC ANALYSIS

The economic analysis is based on the increment data given above and on particulars of merchantable volumes.

Particulars about the latter are available for the whole observation period in the case of parcels n, o, and p. As far as the other parcels are concerned, only for recent years.

The particulars obtained about merchantable volumes have not been employed direct in the economic analysis, though this *could* have been done in the case of parcels n, o, and p. Experience shows that such figures are too unreliable for that purpose. This applies not only to this experiment, but to sample plots generally.

Instead, the data are employed for the compilation of a sortiment distribution table with the breast-height diameter of the stand used as entry. With this entry the different thinning grades show no fundamental differences as regards sortiment distributions; at least the data evince no such differences.

However, the distribution of the timber over the different dimension classes did not appear from the basic particulars except for some figures from recent years. In addition, it was not easy to classify the said recent figures since, probably on account of windfalls etc., they included a great number of shortened stems, top logs, board blocks, etc.

The distribution of the timber over the dimension classes has, therefore, been made on the basis of the particulars listed in Table V comprising the volume dimension distribution, where the relation between mid-diameter measurement and breast-height diameter is found by means of the stem form given by *Henriksen* (1951, Table IV). These are average figures because advening observations necessitate a relative stem form unaffected by the thinning grade to be taken into account. The volume of timber which according to the particulars about the assortment distribution should be available, is distributed proportionally to the volume which according to Table V is available in the corresponding breast-height diameter classes.

The result is listed in Table XV.

The following comments attach to the merchantable assortments:

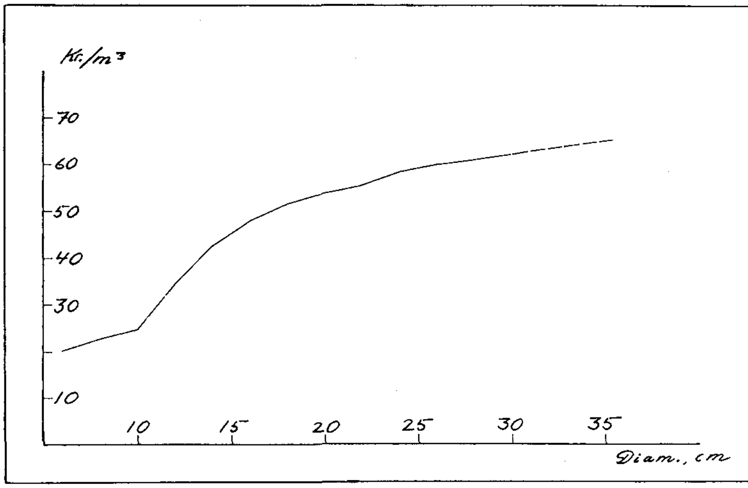
Description	Unit	Solid Content Factor, Cu. m.	Remarks
Saw Timber	cu.m.	1.10	Including rafters
Poles	cu.m. pcs.	1.10 1/15	12—15 cm., 1 m. above stump
Poles	bkr. pcs.	1.00 1/25	10—12 cm, 1 m. above stump
Saplings	bkr. pcs.	1.00 1/50	7—10 cm., 1 m. above stump
Saplings	bkr. pcs.	0.50 1/80	5—7 cm., 1 m. above stump
Saplings	bkr. pcs.	0.50 1/200	Less than 5 cm., 1 m. above stump

Description	Unit	Solid Content Factor, Cu. m.	Remarks
Fencing posts, large	rm. pcs.	0.65 1/130	Top measurements from 8 cm. and upwards, 150—160 cm. long
Fencing posts, small	rm. pcs.	0.55 1/250—300	Top measurements 3—8 cm., 130 cm. long
Fencing posts, not classified	rm.	0.50	
Boxboard wood	rm.	0.70	
Firewood, large	rm.	0.55	Minimum 10 cm.
Firewood, not classified	rm.	0.50	
Firewood, poor quality	bkr.	0.40	

The solid content factors are uncertain, particularly in the case of those given for pieces. They vary with the individual stands, and also with time. Whether these time variations are formal (that is, the product itself is unchanged, and the solid content factor is simply altered when it is found to be wrong), or whether the product itself is changed, is not known.

Yet the above solid content factors lead to acceptable total results. In Group 3 and, in recent years, also in Group 2, a total of 2,387.2 cu.m. has been measured as merchantable produce, using the above solid content factors. According to measurements by the Forest Experiment Station the total was 2,576.3 cu.m. This means that the merchantable produce equals about 93 per cent. of the actual solid content, which seems reasonable in the light of other expecience gained by the Forest Experiment Station. The dispersion on the figures is too great to permit correlation to different grades of thinning. Therefore all volume figures (Table III) have been reduced by 7 per cent. for the purpose of this analysis.

Price curves indicating the net-on-the-stump price per cubic metre, subject to stand diameter (breast height) being known, have been plotted by means of Table XVI (assortment distribution). The costs of felling and transport of piled and heaped products have been deducted. Particulars about the price of



F i g. 8. Price graph with entry for DBH in thinning (felling costs etc. substrated).

F i g. 8. Priskurve (netto på rod) med indgang for $D_{1,3}$ i hugsten.

products as well as of the cost of labour have been supplied by the Directorate of Dunes. Fig. 8 shows the 1954 price curve. It will be seen that the price rises steeply up to 20—25 cm., whereupon the value per cubic metre rises rather slowly.

As already mentioned, the economic analysis is based on the measurement data given in Table III, or more specifically on thinning grades B, C, and D in Group 2 up to 1954, the last year when the parcels were fairly complete. For each thinning grade, an average figure for the individual parcels has been used without correction.

On account of differences in age and in the dates when operations ended it is difficult to procure representative figures for all three groups, and it is therefore necessary either to make the analysis for all three groups separately, or confine it to a section. The latter procedure has been followed here, the calculation being made only for Group 2 because the data available for that group were best substantiated, and in addition it was the longest-living group.

The analysis has been carried out on the dual basis of a fixed price level, and of varying prices obtained during the period; not the nominal prices but prices weighted with an index figure for the movements of the general price level. This means that if the price level and the price of timber rise at the same rate, there is no true rise in prices. Only if the price of timber varies more or less than the price level will there be a true variation in the price.

Which index figure should be used, is doubtful. It depends on the problem posed. The retail price index, e.g., may be used. In the period 1935—1954 this index rose from 100 (based on 1935 prices) to 220. Or the wholesale price index may be used. During the said period this index rose from 100 to 341. It would also be reasonable to use a figure related to the forestry cost level. Such a figure has been used here, the cost of felling 1 cu.m. of timber in full length being used as index figure.

As already mentioned, particulars about the price of products and labour costs have been obtained from the Directorate of Dunes. An extract (Table XVI) shows the price movement of some the most important products.

It will be seen that during the period under review the actual prices of timber have more than doubled, particularly due to the heavy price rises in the post-war period.

On the basis outlined, the actual calculations made for the purpose of economic analyses have been carried out as follows:

1954-prices applying to the whole period.

The volumes (Group 2, B, C, and D-thinning) have been reduced by 7 per cent. (cf. p. 201).

These volumes have, for each thinning year, been multiplied by the net-on-the-stump prices (Fig. 8), and the net-on-the-stump value has thus been obtained.

The net-on-the-stump values have been projected on to the autumn of 1954 and added up, the rate of interest being 0, 2, 4, and 6 per cent.

The total value thus found has been reduced by the cultivating costs, estimated at 2,000 kroner per ha. according to the 1954 price level, projected from 1914 to 1954.

Index-weighted actual prices

The calculation has been made as above, the only difference being that instead of the 1954 price curve, a curve plotted for each thinning year has been used.

Moreover, as the index is based on the year 1935, the cultivating costs of 2,000 kroner must also be index-weighted by division by the 1954 index (260), making the said cost 769 kroner, corresponding to the 1935 cost of labour.

The results are shown in Table XVII.

If the 1954 value of the *remaining crop* in the B-thinning is put at 100, it will be 87 in the C-thinning, and 70 in the D-thinning. The fact that the volume is smaller in the C-thinning and in the D-thinning cannot be compensated for by the diameter-conditioned appreciation.

If the value of *thinnings* in grade B is put at 100, this value will obviously always be greater in grade C and still greater in grade D. Just *how much* depends on whether a fixed price level or the actual prices are used for the calculation, as well as on the rate of interest. The actual prices give a relatively low value, the whole process having occurred during a real rise in prices. A low rate of interest gives the lowest value of the thinning volume, since the projection gives the lowest value when a low rate of interest is used for the calculation. Extremes of the value of the D-thinning volume exist for actual prices and 0 per cent. rate of interest, in which case it equals 142 per cent. of the B-thinning value; and 6 per cent. rate of interest and fixed price level, where it equals 172 per cent. of the B-thinning value.

The different methods used for the value assessment of the thinning influence the calculation of the *value index* — the final expression for the economic effect of the relevant thinning grade.

If the calculation is made on the basis of *actual prices*, B-thinning is best economically, because a relatively larger part of the wood volume will be held over and thus profit by the rise in prices. This applies to both 0 and 4 per cent. rates of interest.

If the calculation is made on the basis of a *fixed price level*, the difference between the economic results of the thinning grades is not very great at low rates of interest (0 and 2 per cent.). At rates 4 or 6 the difference will be greater on account of the greater effect of early thinnings.

Generally, hazy notions attach to the *rate of interest*. The rates charged or allowed by banks are not very illustrative because they must be corrected according to the rising or falling value of money during deflation or inflation, before the true rate of interest is arrived at. The magnitude of these changes in value can be established only if and when they have taken place. On the whole, Denmark has witnessed a slow inflation since the 1890's, particularly during the last three decades. If the retail price index, which in 1954 was 220 with 1935 as base, is taken to express the decrease in the value of money, the decrease has been 4¼ per cent. annually during the period from 1935 to 1954. The true rate of interest on money deposited in a bank and nominally carrying interest at the rate of 4½ per cent. annually, is only ¼ per cent. annually. If interest at a nominal rate of 6 per cent. is paid on a debt, the true annual interest is only about 2 per cent.

Besides, each forest owner uses his own rate of interest, depending on his investment facilities — in fact his general financial position.

The question arises whether this economic analysis is of general interest or confined to the cultivation of Sitka spruce in the Nystrup Plantation.

It is not closely bound up with the locality, but to *any relatively brief period with a high volume increment.* Under these circumstances light thinning is relatively advantageous even at a fixed price level. The period suitable for felling was only 19 years. In such a brief period, the "projection" process, which often makes heavy thinning economically advantageous, plays a relatively small part. In this brief period the increment was so great that even B-thinning exceeded the part of the price curve where the rise is great (under approx. 25 cm. breast-height diameter).

That economic analysis where *actual prices* are used, obviously depends on time. The reverse condition, viz. a *lesser* rise in the prices of wood than in the general price level, would have been unfavourable to the B-thinnings. The only deduction of general validity is that money can be made by those who are able to make a correct estimate of future price developments.

The notion that has prevailed for several years, that heavy thinning is economically advantageous (the German Bodenreinertrag doctrine), is not generally valid. It depends upon time, locality, and conditions.

The question whether it is possible to keep the B-thinning longer in rotation than the D-thinning has not been discussed, because in the present case the clearing of the B-thinned parcels followed so soon after the clearing of the D-thinned parcels, probably partly due to the great exposure to which the B-thinned parcels were subjected. Experiments with larger, more naturally bounded units have been started (Tranum). If the period during which the increment is high could be extended for only a few years, it would mean a substantial economic gain. If instead of clearing and planting new Sitka spruce cultures it were possible to extend by five years the high-yielding period (current increment about 35 cu.m. per hectare per annum) it would mean a gain of about 65 cu.m. per hectare, or about 4,000 kroner per hectare according to the 1954 price level. To this should be added an increase in the stand's value of about 500 kroner per hectare due to larger dimensions.

TABLES

T a b l e I. The measured form factor level in relation to form factor diagram (Henriksen (1958)).

T a b e l I. De målte formtals niveau i relation til formtalsdiagram (Henriksen (1958)).

Time *Tidspunkt* (f=spring e=autumn)	Parcel *Parcel*	A-thinning *A-hugst* No. *antal*	per cent. %	B-thinning *B-hugst* No. *antal*	per cent. %	C-thinning *C-hugst* No. *antal*	per cent. %	D-thinning *D-hugst* No. *antal*	per cent. %
e. 35	f							51	—2.1
	p							23	—1.5
e. 37	f							17	—1.4
	p							19	—0.2
e. 41	g			10	—0.4				
	f							11	+2.9
	p							11	+2.3
e. 47	b							15	+3.9
e. 49	n			50	—1.2				
	p							50	+2.3
e. 51	e, g			10	—2.8				
	h, m					9	+1.2		
	f, i							10	+2.1
e. 52	n			15	—1.0				
	0					15	—0.2		
	p							15	0.0
f. 53	n			11	+1.3				
	p							11	+3.2
e. 53	e, g			30	—2.1				
	h, m					20	—0.7		
	f, i							20	+3.1
e. 54	a			32	+4.8				
	b							18	+6.7
	c					24	+5.2		
	d	20	—10.3						
	e			23	—7.8				
	f							27	+8.0
	g			8	—1.7				
	h					17	—3.0		
	i							4	+11.7
	k	10	—13.5						
	m					18	+5.5		
	n			31	—2.6				
e. 55	a			15	+6.6				
	b							15	+7.0
	c					8	+3.6		
	d	15	—4.0						
e. 56	g			15	—2.3				
	k	30	—7.8						
	h, m					15	+1.2		
	f, i							15	+9.5

Table II. Smoothed course of level (form factor), in percentage.

Tabel II. Udjævnet niveauforløb (formtal) angivet i procent.

Time *Tidspunkt*	A-thinning *A-hugst* Remaining crop *Bl. best.*	 Thinning *Tynding*	B-thinning *B-hugst* Remaining crop *Bl. best.*	 Thinning *Tynding*	C-thinning *C-hugst* Remaining crop *Bl. best.*	 Thinning *Tynding*	D-thinning *D-hugst* Remaining crop *Bl. best.*	 Thinning *Tynding*
e. 35	0.0	—1.0	0.0	—1.5	0.0	—1.5	0.0	—1.8
e. 37	—0.6	—2.1	0.0	—1.5	+0.3	—1.4	+0.8	—1.2
e. 39	—1.3	—3.2	—0.1	—1.4	+0.5	—1.2	+1.6	—0.4
e. 41	—1.9	—4.3	—0.1	—1.4	+0.8	—0.8	+2.4	+0.3
e. 43	—2.5	—5.4	—0.2	—1.3	+1.1	—0.6	+3.2	+1.0
e. 45	—3.2	—6.5	—0.2	—1.3	+1.4	—0.4	+4.0	+1.7
e. 47	—3.8	—7.5	—0.3	—1.2	+1.6	—0.1	+4.8	+2.4
e. 49	—4.5	—8.7	—0.3	—1.2	+1.8	+0.1	+5.6	+3.1
e. 51	—5.1	—9.7	—0.4	—1.1	+2.1	+0.4	+6.4	+3.8
e. 53	—5.7	—10.8	—0.4	—1.0	+2.4	+0.7	+7.2	+4.5
e. 55	—6.3	—11.9	—0.4	—1.0	+2.7	+0.9	+8.0	+5.2
e. 56	—6.7		—0.4		+2.8		+8.4	

Table III. Results of measuring (all figures per hectare).

Tabel III. Resultater af træmålingen (alle tal er pr. ha).

Plot (*prøveflade*): MB
Group (*gruppe*): 1
Parcel (*parcel*): a

Grade of thinning (*hugstgrad*): B
Area (*areal*): 0.1500 ha

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years *T* *år*	Remaining crop Number *N* *stk.*	 m $H_{\bar{g}}$ *m*	 cm $D_{\bar{g}}$ *cm*	*Efter tynding* sq.m *G* m^2	 cub.m *V* m^3	Thinning m $H_{\bar{g}}$ *m*	 cm $D_{\bar{g}}$ *cm*	*Tynding* sq.m *G* m^2	 cub.m *V* m^3	Curr. increment sq.m *Lb. tilvækst* I_g m^2	 cub.m I_v m^3
e. 35	24	2540	11.8	14.7	42.86	258.4	8.4	6.2	1.87	9.3	3.84	37.6
e. 37	26	2347	13.0	16.4	49.66	328.6	9.9	7.3	0.87	4.9	2.76	32.4
e. 39	28	1994	14.1	18.0	50.54	361.3	13.1	12.9	4.63	32.1	2.50	36.0
e. 41	30	1673	15.4	19.5	50.13	392.2	14.4	14.8	5.41	41.0	2.31	37.1
e. 43	32	1480	16.7	20.9	50.69	432.6	15.8	16.4	4.06	33.7	2.14	34.3
e. 45	34	1253	17.9	22.2	48.72	445.6	17.2	19.6	6.24	55.5	2.54	46.2
e. 47	36	1100	19.5	24.0	49.89	500.0	18.3	19.3	3.91	37.9	2.31	30.9
e. 49	38	927	20.3	25.8	48.46	501.7	19.0	21.5	6.05	60.0	2.06	37.5
e. 51	40	873	21.5	27.0	50.09	549.2	21.2	24.3	2.48	27.5	1.62	36.9
e. 53	42	727	22.9	27.7	43.77	519.2	21.8	28.8	9.55	103.7	0.17	— 0.2
e. 54	43	513	22.8	27.9	31.39		22.3	27.4	12.55	152.0	0.11	
e. 55	44						22.7	28.0	31.50	366.8		

$I_{v\ 0-40}$ 23.6 m^3 (cub.m) $I_{v\ 24-40}$ 36.5 m^3 (cub.m)

$I_{v\ 0-44}$ 23.1 m^3 (cub.m) $I_{v\ 24-44}$ 32.8 m^3 (cub.m)

Table III. Results of measuring (all figures per hectare).

Tabel III. Resultater af træmålingen (alle tal er pr. ha).

Plot (*prøveflade*): MB — Grade of thinning (*hugstgrad*): D

Group (*gruppe*): 1 — Area (*areal*): 0.1987 ha

Parcel (*parcel*): b

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years *T* *år*	Remaining crop, *Efter tynding*: Number *N* *stk.*	m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m *G* m^2	cub.m *V* m^3	Thinning, *Tynding*: m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m *G* m^2	cub.m *V* m^3	Curr. increment, *Lb. tilvækst*: sq.m I_g m^2	cub.m I_v m^3
e. 35	24	1802	12.3	15.6	34.62	217.2	9.7	11.0	15.55	78.9		
e. 37	26	1344	13.8	17.7	33.09	232.9	13.1	15.6	8.91	59.5	3.69	37.6
e. 39	28	1153	14.8	19.6	34.77	263.5	13.9	17.1	4.41	31.2	3.04	30.9
e. 41	30	956	16.0	21.9	36.05	294.7	15.3	18.9	5.36	42.2	3.32	36.7
e. 43	32	755	17.2	24.5	35.47	311.1	16.6	20.4	6.40	55.1	2.91	35.8
e. 45	34	639	18.5	26.6	35.55	336.1	18.3	24.9	5.66	52.7	2.87	38.9
e. 47	36	513	20.1	29.4	34.75	355 5	19.5	26.4	6.85	68.3	3.02	43.9
e. 49	38	388	21.2	32.4	31.90	340.8	20.4	29.0	8.33	86.2	2.74	35.8
e. 51	40	352	22.9	35.0	33.85	392.2	22.4	32.7	2.97	33.5	2.46	42.5
e. 53	42	262	23.9	37.2	28.46	344.2	23.3	34.6	8.54	100.3	1.58	26.2
e. 54	43	161		37.9	18.11		23.4	37.0	10.80	127.9	0.45	4.0
e. 55	44	45	24.4	39.0	5.42	66.8	24.2	37.4	12.72	157.6	0.03	

$I_{v\ 0\text{-}40}$ 25.0 m^3 (cub.m) — $I_{v\ 24\text{-}40}$ 37.7 m^3 (cub.m)

$I_{v\ 0\text{-}44}$ 24.0 m^3 (cub.m) — $I_{v\ 24\text{-}44}$ 33.2 m^3 (cub.m)

Table III. Results of measuring (all figures per hectare).

Tabel III. Resultater af træmålingen (alle tal er pr. ha).

Plot (*prøveflade*): MB — Grade of thinning (*hugstgrad*): C

Group (*gruppe*): 1 — Area (*areal*): 0.1662 ha

Parcel (*parcel*): c

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years *T* *år*	Remaining crop, *Efter tynding*: Number *N* *stk.*	m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m *G* m^2	cub.m *V* m^3	Thinning, *Tynding*: m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m *G* m^2	cub.m *V* m^3	Curr. increment, *Lb. tilvækst*: sq.m I_g m^2	cub.m I_v m^3
e. 35	24	1721	12.0	16.8	37.99	226.6	10.6	9.9	6.69	38.4		
e. 37	26	1516	13.3	18.7	41.67	276.0	12.8	16.2	4.24	27.3	3.96	38.4
e. 39	28	1209	14.4	20.5	39.79	284.8	13.9	16.9	6.86	48.2	2.49	28.5
e. 41	30	1119	15.5	22.5	44.33	340.1	14.8	17.9	2.41	18.2	3.48	36.8
e. 43	32	933	16.8	24.6	44.15	365.7	16.1	20.2	6.01	49.2	2.92	37.4
e. 45	34	764	18.1	26.4	41.93	376.4	17.6	24.0	7.05	61.5	2.42	36.1
e. 47	36	626	19.9	28.6	40.04	394.4	19.3	25.5	7.38	71.8	2.74	44.9
e. 49	38	529	21.2	31.3	40.75	425.9	20.5	27.9	5.52	56.5	3.11	44.0
e. 51	40	475	22.4	33.5	42.02	462.2	22.0	30.7	4.00	43.6	2.63	40.0
e. 53	42	373	23.4	35.2	36.31	416.3	23.0	34.1	9.36	104.4	1.83	29.3
e. 54	43	199		36.1	20.28		23.6	34.7	16.46	192.3	0.43	9.0
e. 55	44	91	24.1	37.5	9.98	116.9	23.9	35.3	10.58	125.2	0.28	

$I_{v\ 0\text{-}40}$ 24.4 m^3 (cub.m) — $I_{v\ 24\text{-}40}$ 38.2 m^3 (cub.m)

$I_{v\ 0\text{-}44}$ 23.8 m^3 (cub.m) — $I_{v\ 24\text{-}44}$ 34.4 m^3 (cub.m)

Table III. Results of measuring (all figures per hectare).

Tabel III. Resultater af træmålingen (alle tal er pr. ha).

Plot (*prøveflade*): MB — Grade of thinning (*hugstgrad*): A

Group (*gruppe*): 1 — Area (*areal*): 0.0547 ha

Parcel (*parcel*): d

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years	Remaining crop					Thinning				Curr. increment	
		Number	m	cm	sq.m	cub.m	m	cm	sq.m	cub.m	sq.m	cub.m
	T	*Efter tynding*					*Tynding*				*Lb. tilvækst*	
	år	*N*	$H_{\bar{g}}$	$D_{\bar{g}}$	*G*	*V*	$H_{\bar{g}}$	$D_{\bar{g}}$	*G*	*V*	I_g	I_v
		stk.	*m*	*cm*	m^2	m^3	*m*	*cm*	m^2	m^3	m^2	m^3
e. 35	24	2468	11.8	15.6	46.93	279.1	8.4	7.4	0.31	1.5		
e. 37	26	2468	13.1	16.8	54.52	360.7					3.80	40.8
e. 39	28	2468	14.0	17.6	60.00	421.7					2.74	30.5
e. 41	30	2468	15.1	18.2	64.44	491.4					2.22	34.9
e. 43	32	2377	16.3	19.0	67.64	561.2					1.60	34.9
e. 45	34	2358	17.6	19.7	71.81	643.3					2.08	41.1
e. 47	36	2102	19.1	21.4	75.41	733.1	12.4	10.0	0.71	4.6	2.16	47.2
e. 49	38	1956	20.3	22.3	76.10	787.9	18.2	13.8	2.18	20.4	1.44	37.6
e. 51	40	1920	21.1	22.9	79.25	852.8	18.5	16.3	0.77	7.1	1.96	36.0
e. 53	42	1773	21.7	23.4	76.37	836.9	20.1	21.2	5.14	49.6	1.13	16.9
e. 54	43	1353		23.7	59.74		22.0	22.6	16.84	181.2	0.21	10.5
e. 55	44						22.2	23.8	60.24	676.7	0.50	

$I_{v\ 0\text{-}40}$ 24.6 m³ (cub.m) — $I_{v\ 24\text{-}40}$ 37.9 m³ (cub.m)

$I_{v\ 0\text{-}44}$ 23.5 m³ (cub.m) — $I_{v\ 24\text{-}44}$ 33.0 m³ (cub.m)

Table III. Results of measuring (all figures per hectare).

Tabel III. Resultater af træmålingen (alle tal er pr. ha).

Plot (*prøveflade*): MB — Grade of thinning (*hugstgrad*): B

Group (*gruppe*): 2 — Area (*areal*): 0.1431 ha

Parcel (*parcel*): e

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years	Remaining crop					Thinning				Curr. increment	
		Number	m	cm	sq.m	cub.m	m	cm	sq.m	cub.m	sq.m	cub.m
	T	*Efter tynding*					*Tynding*				*Lb. tilvækst*	
	år	*N*	$H_{\bar{g}}$	$D_{\bar{g}}$	*G*	*V*	$H_{\bar{g}}$	$D_{\bar{g}}$	*G*	*V*	I_g	I_v
		stk.	*m*	*cm*	m^2	m^3	*m*	*cm*	m^2	m^3	m^2	m^3
e. 35	26	2572	11.4	13.8	38.62	227.2						
e. 37	28	2572	12.9	15.2	46.51	310.2					3.94	41.5
e. 39	30	2118	14.0	16.7	46.24	333.4	12.5	10.5	3.82	26.1	1.78	24.7
e. 41	32	1810	15.5	18.4	48.28	386.9	14.5	14.5	4.75	36.4	3.40	45.0
e. 43	34	1593	16.7	19.5	47.43	411.9	15.8	15.6	4.01	33.6	1.58	29.3
e. 45	36	1398	18.0	21.0	48.19	451.9	16.6	16.4	3.54	31.3	2.15	35.7
e. 47	38	1216	19.6	22.4	48.00	493.0	18.7	18.7	4.63	46.3	2.22	43.7
e. 49	40	1125	20.5	23.8	49.79	534.8	19.5	20.4	2.96	30.6	2.38	36.2
e. 51	42	1062	21.4	24.9	51.59	579.6	20.3	20.3	2.03	22.3	1.92	33.6
e. 53	44	950	22.3	25.8	49.62	583.1	20.6	26.3	6.07	59.7	2.05	31.6
e. 54	45	790		26.0	42.01		22.5	26.5	8.34	89.7	0.73	
e. 55	46	315	22.7	26.5	17.29	205.7	22.6	26.0	25.21	300.3	0.49	4.5
e. 56	47						22.8	26.4	17.25	206.5	—0.04	

$I_{v\ 0\text{-}44}$ 21.7 m³ (cub.m) — $I_{v\ 26\text{-}44}$ 35.7 m³ (cub.m)

$I_{v\ 0\text{-}47}$ 20.6 m³ (cub.m) — $I_{v\ 26\text{-}47}$ 31.2 m³ (cub.m)

Table III. Results of measuring (all figures per hectare).

Tabel III. *Resultater af træmålingen (alle tal er pr. ha).*

Plot (*prøveflade*): MB — Grade of thinning (*hugstgrad*): D
Group (*gruppe*): 2 — Area (*areal*): 0.2779 ha
Parcel (*parcel*): f

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years *T* *år*	Remaining crop — *Efter tynding* Number *N* *stk.*	m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m *G* m^2	cub.m *V* m^3	Thinning — *Tynding* m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m *G* m^2	cub.m *V* m^3	Curr. increment — *Lb. tilvækst* sq.m I_g m^2	cub.m I_v m^3
e. 35	26	1868	10.8	16.0	37.35	200.5	9.8	11.6	15.69	79.6	3.40	34.7
e. 37	28	1411	12.3	18.0	36.03	220.7	12.0	15.1	8.13	49.2	2.83	33.6
e. 39	30	1126	13.8	19.7	34.24	236.7	13.7	17.9	7.45	51.2	3.68	39.1
e. 41	32	907	15.1	22.3	35.55	268.9	14.9	19.0	6.05	46.0	2.68	36.8
e. 43	34	774	16.6	24.2	35.52	297.8	16.5	22.7	5.39	44.7	2.72	37.5
e. 45	36	633	18.0	26.4	34.62	315.3	17.9	24.3	6.34	57.5	2.54	37.3
e. 47	38	514	19.4	28.7	33.18	327.0	19.0	26.5	6.53	62.9	2.81	40.2
e. 49	40	435	20.8	31.4	33.70	354.7	20.2	28.0	5.11	52.6	2.18	34.1
e. 51	42	389	22.0	33.7	34.60	384.4	21.8	30.7	3.46	38.5	1.73	30.1
e. 53	44	335	23.1	35.9	33.83	397.0	21.8	31.6	4.23	47.6	1.01	
e. 54	45	230		36.8	24.59		23.0	35.4	10.25	121.0	0.32	7.7
e. 55	46	68	23.8	38.3	7.87	94.2	23.4	36.6	17.04	203.4	—0.01	
e. 56	47						24.0	38.3	7.86	95.6		

$I_{v\ 0\text{-}44}$ 23.2 m^3 (cub.m) — $I_{v\ 26\text{-}44}$ 35.9 m^3 (cub.m)
$I_{v\ 0\text{-}47}$ 22.1 m^3 (cub.m) — $I_{v\ 26\text{-}47}$ 31.9 m^3 (cub.m)

Table III. Results of measuring (all figures per hectare).

Tabel III. *Resultater af træmålingen (alle tal er pr. ha).*

Plot (*prøveflade*): MB — Grade of thinning (*hugstgrad*): B
Group (*gruppe*): 2 — Area (*areal*): 0.2251 ha
Parcel (*parcel*): g

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years *T* *år*	Remaining crop — *Efter tynding* Number *N* *stk.*	m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m *G* m^2	cub.m *V* m^3	Thinning — *Tynding* m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m *G* m^2	cub.m *V* m^3	Curr. increment — *Lb. tilvækst* sq.m I_g m^2	cub.m I_v m^3
e. 35	26	2865	10.2	15.4	53.28	270.6	7.6	7.8	2.10	8.9	2.98	36.7
e. 37	28	2679	11.7	16.6	57.89	335.9	10.9	9.6	1.34	8.0	1.94	29.8
e. 39	30	2204	12.9	17.8	54.98	353.9	11.9	13.5	6.79	41.5	3.06	41.9
e. 41	32	1866	14.3	19.2	54.17	388.9	13.8	16.1	6.92	48.7	2.03	34.6
e. 43	34	1599	15.7	20.4	52.18	412.9	14.6	17.1	6.05	45.2	2.10	40.8
e. 45	36	1399	17.2	21.6	51.48	452.5	16.3	17.7	4.91	41.9	2.54	45.4
e. 47	38	1275	18.7	23.0	52.89	508.4	18.2	20.5	3.67	34.9	2.41	47.8
e. 49	40	1084	20.3	24.4	50.80	535.2	19.0	21.2	6.92	68.8	2.13	40.7
e. 51	42	1026	21.5	25.6	52.71	590.4	21.0	22.8	2.35	26.2	1.90	38.2
e. 53	44	946	22.6	26.7	53.07	627.3	21.4	23.4	3.43	39.4	1.24	
e. 54	45	902		27.0	51.53		22.5	28.7	2.78	31.6	0.99	15.6
e. 55	46	773	23.0	27.4	45.62	545.6	22.7	26.1	6.90	81.2	0.43	
e. 56	47						23.3	27.5	46.05	561.2		

$I_{v\ 0\text{-}44}$ 24.8 m^3 (cub.m) — $I_{v\ 26\text{-}44}$ 39.5 m^3 (cub.m)
$I_{v\ 0\text{-}47}$ 24.1 m^3 (cub.m) — $I_{v\ 26\text{-}47}$ 36.1 m^3 (cub.m)

Table III. Results of measuring (all figures per hectare).

Tabel III. Resultater af træmålingen (alle tal er pr. ha).

Plot (*prøveflade*): MB — Grade of thinning (*hugstgrad*): C
Group (*gruppe*): 2 — Area (*areal*): 0.1802 ha
Parcel (*parcel*): h

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years T *år*	Remaining crop *Efter tynding* Number N *stk.*	m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m G *m²*	cub.m V *m³*	Thinning *Tynding* m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m G *m²*	cub.m V *m³*	Curr. increment *Lb. tilvækst* sq.m I_g *m²*	cub.m I_v *m³*
e. 35	26	2048	11.5	15.1	36.77	214.4	8.9	10.6	6.94	32.6	3.39	31.2
e. 37	28	1681	12.8	17.1	38.47	248.7	10.9	13.6	5.08	28.1	2.84	32.5
e. 39	30	1343	14.2	18.8	37.42	269.9	12.8	15.8	6.73	43.7	2.58	30.9
e. 41	32	1160	15.4	20.3	37.71	295.0	14.9	18.7	4.86	36.7	2.19	31.5
e. 43	34	1049	16.7	21.7	38.76	331.4	15.7	19.5	3.33	26.5	2.06	26.0
e. 45	36	855	17.5	22.9	35.09	315.0	17.4	22.6	7.78	68.4	2.76	40.6
e. 47	38	788	19.0	24.8	38.12	373.0	17.9	20.9	2.48	23.1	2.70	40.0
e. 49	40	688	20.3	26.7	38.58	403.3	19.7	25.1	4.94	49.6	2.36	35.1
e. 51	42	622	21.4	28.7	40.18	440.2	20.3	24.5	3.13	33.3	2.32	46.0
e. 53	44	560	23.1	30.5	40.88	487.3	22.2	28.7	3.94	44.8	1.16	
e. 54	45	466		31.0	35.14		23.5	30.6	6.90	79.5	1.01	12.7
e. 55	46	250	24.1	32.3	20.46	253.4	23.5	30.4	15.69	192.1	0.36	
e. 56	47						23.9	32.6	20.82	253.8		

$I_{v\,0\text{-}44}$ 21.9 m³ (cub.m) — $I_{v\,26\text{-}44}$ 34.8 m³ (cub.m)
$I_{v\,0\text{-}47}$ 21.2 m³ (cub.m) — $I_{v\,26\text{-}47}$ 31.7 m³ (cub.m)

Table III. Results of measuring (all figures per hectare).

Tabel III. Resultater af træmålingen (alle tal er pr. ha).

Plot (*prøveflade*): MB — Grade of thinning (*hugstgrad*): D
Group (*gruppe*): 2 — Area (*areal*): 0.1341 ha
Parcel (*parcel*): i

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years T *år*	Remaining crop *Efter tynding* Number N *stk.*	m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m G *m²*	cub.m V *m³*	Thinning *Tynding* m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m G *m²*	cub.m V *m³*	Curr. increment *Lb. tilvækst* sq.m I_g *m²*	cub.m I_v *m³*
e. 35	26	1864	11.4	14.6	31.12	180.9	9.5	10.8	11.33	56.5	3.21	30.2
e. 37	28	1424	12.8	16.4	30.20	197.5	11.8	14.6	7.34	43.8	2.50	24.6
e. 39	30	1186	13.8	18.1	30.36	214.5	13.0	16.1	4.85	32.2	2.72	33.3
e. 41	32	1007	15.3	20.0	31.48	249.5	14.2	17.5	4.32	31.6	2.23	26.4
e. 43	34	865	16.3	21.6	31.78	269.4	15.2	18.8	4.16	32.8	2.06	24.7
e. 45	36	723	17.2	23.6	31.66	282.6	16.2	19.5	4.24	36.1	2.56	41.6
e. 47	38	582	19.1	26.1	31.15	311.2	18.5	23.1	5.62	54.6	2.34	30.8
e. 49	40	522	20.0	28.0	32.14	334.9	19.9	26.4	3.68	37.9	2.25	32.4
e. 51	42	455	21.0	29.9	32.06	350.8	20.9	29.5	4.58	48.9	2.09	32.9
e. 53	44	403	22.3	32.0	32.39	378.5	20.8	30.6	3.84	38.1	1.02	
e. 54	45	373		32.4	30.75		21.5	33.7	2.66	30.1	0.71	14.8
e. 55	46	209	23.2	33.4	18.25	222.7	22.8	32.0	13.21	159.6	0.21	
e. 56	47						23.8	33.6	18.46	233.3		

$I_{v\,0\text{-}44}$ 19.8 m³ (cub.m) — $I_{v\,26\text{-}44}$ 30.8 m³ (cub.m)
$I_{v\,0\text{-}47}$ 19.4 m³ (cub.m) — $I_{v\,26\text{-}47}$ 28.5 m³ (cub.m)

T a b l e I I I. Results of measuring (all figures per hectare).

T a b e l I I I. Resultater af træmålingen (alle tal er pr. ha).

Plot (*prøveflade*) : MB — Grade of thinning (*hugstgrad*) : A

Group (*gruppe*) : 2 — Area (*areal*) : 0.2128 ha

Parcel (*parcel*) : k

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years *T* *år*	Remaining crop *Efter tynding* Number *N* *stk.*	m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m *G* *m²*	cub.m *V* *m³*	Thinning *Tynding* m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m *G* *m²*	cub.m *V* *m³*	Curr. increment *Lb. tilvækst* sq.m I_g *m²*	cub.m I_v *m³*
e. 35	26	2660	10.9	14.9	46.61	256.6						
e. 37	28	2660	12.2	16.0	53.73	329.7					3.56	36.6
e. 39	30	2660	13.6	16.6	57.33	393.7					1.80	32.0
e. 41	32	2646	14.6	17.6	64.36	473.6					3.51	40.0
e. 43	34	2650	16.0	17.9	67.03	548.0					1.34	37.2
e. 45	36	2495	17.3	18.9	69.97	619.8					1.47	35.9
e. 47	38	2349	18.4	20.0	73.58	693.2	16.0	10.8	0.90	7.6	2.26	40.5
e. 49	40	2321	19.5	20.5	76.37	764.0	16.8	13.7	0.28	2.4	1.53	36.6
e. 51	42	2321	20.4	20.9	79.55	834.1					1.59	35.1
e. 53	44	2138	21.0	21.9	80.26	859.6	17.7	13.4	2.59	22.9	1.65	24.2
e. 54	45	2077		21.9	78.55		21.8	22.6	2.45	25.0	0.74	
e. 55	46						21.1	20.5	7.76	79.6 }	0.84	} 35.5
e. 56	47						23.0	22.4	72.46	861.6		

$I_{v\ 0\text{-}44}$ 22.3 m³ (cub.m) — $I_{v\ 26\text{-}44}$ 35.3 m³ (cub.m)

$I_{v\ 0\text{-}47}$ 23.2 m³ (cub.m) — $I_{v\ 26\text{-}47}$ 35.4 m³ (cub.m)

T a b l e I I I. Results of measuring (all figures per hectare).

T a b e l I I I. Resultater af træmålingen (alle tal er pr. ha).

Plot (*prøveflade*) : MB — Grade of thinning (*hugstgrad*) : C

Group (*gruppe*) : 2 — Area (*areal*) : 0.2041 ha

Parcel (*parcel*) : m

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years *T* *år*	Remaining crop *Efter tynding* Number *N* *stk.*	m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m *G* *m²*	cub.m *V* *m³*	Thinning *Tynding* m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m *G* *m²*	cub.m *V* *m³*	Curr. increment *Lb. tilvækst* sq.m I_g *m²*	cub.m I_v *m³*
e. 35	26	1876	11.5	16.4	39.52	226.3	10.0	12.2	9.81	50.4		
e. 37	28	1563	13.0	18.3	40.97	265.2	12.0	14.7	5.32	32.3	3.38	35.6
e. 39	30	1279	14.4	19.9	39.74	287.8	13.5	16.9	6.40	43.5	2.58	33.1
e. 41	32	1088	16.0	21.9	40.90	328.5	15.4	19.4	5.68	44.3	3.42	42.5
e. 43	34	902	17.4	23.7	39.77	350.2	16.7	20.3	6.05	51.7	2.46	36.7
e. 45	36	809	18.6	25.4	41.12	387.0	18.3	23.2	3.72	34.7	2.54	35.8
e. 47	38	681	19.8	27.5	40.52	402.8	19.5	25.1	6.32	62.5	2.86	39.2
e. 49	40	573	21.0	29.6	39.42	414.7	20.3	26.4	5.90	61.0	2.40	36.5
e. 51	42	519	22.1	31.5	40.52	447.7	21.2	26.8	3.06	33.3	2.08	33.2
e. 53	44	475	23.8	33.2	41.04	492.3	23.0	31.8	3.50	40.1	2.01	42.4
e. 54	45	382		33.7	34.18		23.7	33.1	7.98	98.1	1.12	
e. 55	46	196	24.1	34.7	18.46	222.9	23.8	33.3	16.26	195.4	0.54	} 10.4
e. 56	47						24.5	34.8	18.63	230.0	0.17	

$I_{v\ 0\text{-}44}$ 23.7 m³ (cub.m) — $I_{v\ 26\text{-}44}$ 37.2 m³ (cub.m)

$I_{v\ 0\text{-}47}$ 22.7 m³ (cub.m) — $I_{v\ 26\text{-}47}$ 33.4 m³ (cub.m)

Table III. Results of measuring (all figures per hectare).

Tabel III. Resultater af træmålingen (alle tal er pr. ha).

Plot (*prøveflade*): MB — Grade of thinning (*hugstgrad*): B
Group (*gruppe*): 3 — Area (*areal*): 0.3555 ha
Parcel (*parcel*): n

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years	Remaining crop *Efter tynding*					Thinning *Tynding*				Curr. increment *Lb. tilvækst*	
	T *år*	Number N *stk.*	m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m G *m²*	cub.m V *m³*	m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m G *m²*	cub.m V *m³*	sq.m I_g *m²*	cub.m I_v *m³*
Tynding 1931/32										18.5		
e. 35	30	3339	11.7	12.8	42.78	263.3	8.9	6.1	4.17	21.9	3.60	34.7
e. 37	32	3018	12.8	14.3	48.70	326.0	9.2	7.5	1.29	6.7	2.42	28.5
e. 39	34	2726	13.8	15.3	49.85	359.1	12.2	11.8	3.69	23.9	3.04	41.9
e. 41	36	2155	15.3	17.1	49.76	398.2	13.5	12.2	6.16	44.7	1.58	29.8
e. 43	38	1814	16.5	18.3	47.79	414.0	15.7	13.9	5.14	43.7	2.24	40.5
e. 45	40	1522	18.0	19.7	46.37	440.7	17.1	15.9	5.89	54.2	2.45	33.5
e. 47	42	1347	18.9	21.2	47.60	473.2	17.4	16.1	3.67	34.4	1.21	24.3
e. 49	44	1193	19.8	22.2	45.86	478.5	19.3	18.5	4.16	43.3	1.76	43.5
e. 51	46	1128	21.4	23.1	47.28	542.3	20.5	20.6	2.10	23.1	1.56	10.2
e. 52	47	1032	21.2	23.3	44.04	497.6	21.9	25.3	4.80	54.9		
f. 53	47	889	21.0	23.4	38.14	426.0	22.4	22.9	5.90	71.6	0.63	29.7
e. 53	48	793	21.9	23.4	34.16	402.5	22.3	24.8	4.61	54.2	0.30	
e. 54	49						23.0	23.5	34.46	431.2		

$I_{v\ 0\text{-}46}$ 20.4 m³ (cub.m) — $I_{v\ 30\text{-}46}$ 34.6 m³ (cub.m)
$I_{v\ 0\text{-}49}$ 20.6 m³ (cub.m) — $I_{v\ 30\text{-}49}$ 32.8 m³ (cub.m)

Table III. Results of measuring (all figures per hectare).

Tabel III. Resultater af træmålingen (alle tal er pr. ha).

Plot (*prøveflade*): MB — Grade of thinning (*hugstgrad*): C
Group (*gruppe*): 3 — Area (*areal*): 0.4798 ha
Parcel (*parcel*): o

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years	Remaining crop *Efter tynding*					Thinning *Tynding*				Curr. increment *Lb. tilvækst*	
	T *år*	Number N *stk.*	m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m G *m²*	cub.m V *m³*	m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m G *m²*	cub.m V *m³*	sq.m I_g *m²*	cub.m I_v *m³*
Tynding 1931/32 og 1933/34										79.9		
e. 35	31	2161	11.7	14.0	33.12	200.0	9.3	10.1	5.90	29.3	3.64	35.0
e. 37	33	1759	13.1	15.9	34.89	235.8	12.0	13.2	5.50	34.2	2.78	32.0
e. 39	35	1511	14.5	17.5	36.24	272.2	12.7	14.5	4.22	27.5	2.94	36.7
e. 41	37	1213	16.0	19.4	35.90	298.1	14.7	16.4	6.23	47.5	2.36	31.8
e. 43	39	1042	17.2	21.0	36.19	324.9	16.0	18.3	4.43	36.8	2.56	35.6
e. 45	41	863	18.5	22.8	35.20	339.9	17.8	20.9	6.10	56.2	2.39	34.1
e. 47	43	763	19.7	24.7	36.47	373.6	18.8	22.1	3.51	34.4	1.51	24.1
e. 49	45	663	20.6	26.0	35.25	378.3	19.7	23.6	4.25	43.5	2.00	26.1
e. 51	47	586	21.2	27.5	34.82	382.4	21.2	27.0	4.42	48.1		
e. 52	48	338	22.4	28.5	21.59	252.4	21.4	26.9	14.13	158.4	0.90	28.4
f. 53	48						22.4	28.5	21.59	252.4		

$I_{v\ 0\text{-}47}$ 19.1 m³ (cub.m) — $I_{v\ 31\text{-}47}$ 31.9 m³ (cub.m)
$I_{v\ 0\text{-}48}$ 19.3 m³ (cub.m) — $I_{v\ 31\text{-}48}$ 31.7 m³ (cub.m)

T a b l e III. Results of measuring (all figures per hectare).

T a b e l III. Resultater af træmålingen (alle tal er pr. ha).

Plot (*prøveflade*): MB   Grade of thinning (*hugstgrad*): D

Group (*gruppe*): 3   Area (*areal*): 0.4861 ha

Parcel (*parcel*): p

Time of measuring *Måletidspunkt* e=autumn (*efterår*) f=spring (*forår*)	Years T *år*	Remaining crop *Efter tynding* Number N *stk.*	m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m G *m²*	cub.m V *m³*	Thinning *Tynding* m $H_{\bar{g}}$ *m*	cm $D_{\bar{g}}$ *cm*	sq.m G *m²*	cub.m V *m³*	Curr. increment *Lb. tilvækst* sq.m I_g *m²*	cub.m I_v *m³*
Tynding 1931/32 og 1933/34										142.5		
e. 35	31	1674	12.6	15.0	29.55	192.1	11.6	11.8	8.54	52.0		
e. 37	33	1242	14.3	17.2	29.00	216.1	13.4	14.9	7.52	52.2	3.48	38.1
e. 39	35	1080	15.5	19.2	31.16	251.1	15.0	16.0	3.11	24.6	2.64	29.8
e. 41	37	872	16.7	21.5	31.62	274.1	16.0	18.9	5.87	48.8	3.16	35.9
e. 43	39	736	18.2	23.8	32.79	311.5	17.4	19.9	4.17	38.4	2.67	37.9
e. 45	41	640	19.2	26.0	33.90	338.5	18.5	22.9	4.05	39.3	2.58	33.2
e. 47	43	529	20.8	28.1	32.73	356.1	20.5	26.2	5.74	61.4	2.28	39.5
e. 49	45	420	22.6	30.5	30.65	365.0	21.3	26.6	6.14	69.3	2.03	39.1
e. 51	47	385	22.7	32.8	32.58	382.4	22.3	30.8	2.61	30.0	2.27	23.7
e. 52	48	317	23.0	33.7	28.20	335.3	23.0	33.5	5.98	69.5	1.60	22.4
f. 53	48	245	22.9	33.9	22.03	261.5	23.4	33.0	6.17	73.8		
e. 53	49	187	23.1	34.8	17.74	210.2	22.7	32.9	4.89	56.3	0.60	5.0
f. 54	49						23.1	34.8	17.74	210.2		

$I_{v\ 0-47}$ 21.9 m³ (cub.m) $I_{v\ 31-47}$ 34.6 m³ (cub.m)

$I_{v\ 0-49}$ 21.5 m³ (cub.m) $I_{v\ 31-49}$ 32.3 m³ (cub.m)

T a b l e IV.

T a b e l IV.

Group of parcels *Parcel-gruppe*	Period (f=spring, e=autumn) *Periode (f=forår, e=efterår)* Year *Årstal*	Age in years *Alder*	Periodic volume increment for each of the four thinning grades (in brackets indications of the parcels) *Periodisk vedmassetilvækst for hver af de fire hugstgrader (i parentes parcelbetegnelserne)* cub.m/ha./year *m³/ha/år* A	B	C	D
1	e. 35/e. 51	24/40	37.9(d)	36.5(a)	38.2(c)	37.7(b)
2	e. 35/e. 53	26/44	35.3(k)	35.7(e)	34.8(h)	35.9(f)
				39.5(g)	37.2(m)	30.8(i)
Average for groups 1 and 2 *Gennemsnit for gruppe 1 og 2*			36.6	37.2	36.7	34.8
3	e. 35/e. 51	30—31/ 46—47		34.6(n)	31.9(o)	34.6(p)
Average for groups 1, 2 and 3 *Gennemsnit for gruppe 1, 2 og 3*				36.6	35.5	34.8

Table V. Dimension distribution of yield in Group 2.

Tabel V. Produktionens dimensionsfordeling i parcelgruppe 2.

	Distribution in DBH classes, cu.m./ha *Fordeling til brysthøjdediameterklasser, m³/ha*									
	below 10 cm	10-15 cm	15-20 cm	20-25 cm	25-30 cm	30-35 cm	35-40 cm	40-45 cm	45-50 cm	total
A-thinning, parcel k *A-hugst, pcl. k*										
Thinning *Tynding*										
e. 1935										
37										
39										
41										
43										
45										
47	2	6								
49		1	1							
51										
53	1	14	8							
	3	21	9							33
Remaining crop, autumn 1954 *Bl. best. e. 1954*		30	184	319	241	110	11			895
Total *Ialt*	3	51	193	319	241	110	11			928
B-thinning, parcel e *B-hugst, pcl. e*										
Thinning *Tynding*										
e. 1935										
37										
39	5	18	3							
41	1	16	19							
43		7	26	1						
45		5	25	1						
47		2	27	17						
49			9	17	5					
51			6	16						
53			2	9	42	7				
	6	48	117	61	47	7				286
Remaining crop, autumn 1954 *Bl. best. e. 1954*		1	24	187	226	131	21			590
Total *Ialt*	6	49	141	248	273	138	21			876
B-thinning, parcel g *B-hugst, pcl. g*										
Thinning *Tynding*										
e. 1935	6	3								
37	4	4								
39	1	27	14							
41		11	29	9						
43		7	30	6	2					
45		5	28	9						
47		1	12	17	5					
49			18	44	7					
51			1	22	3					
53			5	18	12	4				
	11	58	137	125	29	4				364
Remaining crop, autumn 1954 *Bl. best. e. 1954*			8	128	339	148	20			643
Total *Ialt*	11	58	145	253	368	152	20			1007

contd. (*fortsættes*)

Table V, continued.

Tabel V, fortsat.

	Distribution in DBH classes, cu.m./ha *Fordeling til brysthøjdediameterklasser, m³/ha*								
	below 10 cm	10-15 cm	15-20 cm	20-25 cm	25-30 cm	30-35 cm	35-40 cm	40-45 cm	45-50 cm	total
C-thinning, parcel h *C-hugst, pcl. h*										
Thinning *Tynding*										
e. 1935	5	21	7							
37	1	14	13							
39	1	11	22	8	2					
41		3	18	14	2					
43		1	10	16						
45			11	36	13	7				
47			6	16	1					
49			3	23	13	7	4			
51			3	11	14	5				
53				6	22	14	3			
	7	50	93	130	67	33	7			387
Remaining crop, autumn 1954 *Bl. best. e. 1954*			6	22	138	186	123	31		506
Total *Ialt*	7	50	99	152	205	219	130	31		893
C-thinning, parcel m *C-hugst, pcl. m*										
Thinning *Tynding*										
e. 1935	6	23	20	1						
37	1	10	20	1						
39		8	25	11						
41		2	20	19	3					
43		1	19	24	8					
45			5	16	9	5				
47			2	20	31	10				
49			3	13	31	8	6			
51			1	5	16	10	1			
53					9	20	11			
	7	44	115	110	107	53	18			454
Remaining crop, autumn 1954 *Bl. best. e. 1954*				7	61	218	173	40	5	504
Total *Ialt*	7	44	115	117	168	271	191	40	5	958
D-thinning, parcel f *D-hugst, pcl. f*										
Thinning *Tynding*										
e. 1935	11	34	31	3						
37	1	15	29	4						
39		6	28	15	2					
41		2	23	16	5					
43			9	20	11	5				
45			2	31	22	3				
47			2	11	39	10				
49				7	27	19				
51				2	9	26	2			
53				1	11	25	11			
	12	57	124	110	126	88	13			530
Remaining crop, autumn 1954 *Bl. best. e. 1954*				2	21	107	165	90	23	408
Total *Ialt*	12	57	124	112	147	195	178	90	23	938

contd. (*fortsættes*)

Table V, continued.

Tabel V, fortsat.

D-thinning, parcel i *D-hugst, pcl. i* Thinning *Tynding*	below 10 cm	10-15 cm	15-20 cm	20-25 cm	25-30 cm	30-35 cm	35-40 cm	40-45 cm	45-50 cm	total
	Distribution in DBH classes, cu.m./ha *Fordeling til brysthøjdediameterklasser, m³/ha*									
e. 1935	10	33	13							
37	2	18	20	4						
39		6	25	1						
41		3	24	4	1					
43		1	19	9	4					
45		2	15	15	4					
47			9	21	25					
49			2	9	18	9				
51			2	3	11	33				
53				1	18	10	7	2		
	12	63	129	67	81	52	7	2		413
Remaining crop, autumn 1954 *Bl. best. e. 1954*				15	77	153	108	31	7	391
Total *Ialt*	12	63	129	82	158	205	115	33	7	804

Table VI. Distribution of yield in dimension classes, cub.m per hectare.

Tabel IV. Produktionens fordeling over dimensionsklasser, m³/ha.

Thinning grade *Hugstgrad*	below 10 cm	10-15 cm	15-20 cm	20-25 cm	25-30 cm	30-35 cm	35-40 cm	40-45 cm	45-50 cm	total
	DBH class *Brysthøjdediameterklasse*									
A	3	51	193	319	241	110	11			928
B	8	54	143	251	320	145	20			941
C	7	47	107	134	187	245	160	35	3	925
D	12	60	126	97	153	200	146	62	15	871

Table VII. Distribution of yield in dimension classes, cub.m per hectare.

Tabel VII. Produktionens fordeling over dimensionsklasser, m³/ha.

	DBH class *Brysthøjdediameterklasse*		
	below 20 cm. *under 20 cm*	20-35 cm. *20-35 cm*	above 35 cm. *over 35 cm*
A-thinning *A-hugst*	247	670	11
B-thinning *B-hugst*	205	716	20
C-thinning *C-hugst*	161	566	198
D-thinning *D-hugst*	198	450	223

T a b l e VIII. Mensurations of Hohenadl's form quotient. cub.m per hektar.

T a b e l VIII. Målinger af Hohenadl's formkvote.

Thinning grade *Hugstgrad*	Parcel *Parcel*	Number of trees *Antal træer*	Hohenadl's form quotient *Hohenadl's formkvote*
A	k	29	0.731
B	e, g	100	0.759
C	h, m	91	0.755
D	f, i	83	0.751

T a b l e IX. Distribution of form quotient values.

T a b e l IX. Formkvoteværdiernes fordeling.

Form quotient *Formkvote*	A-thinning *A-hugst*		B-thinning *B-hugst*		C-thinning *C-hugst*		D-thinning *D-hugst*	
0. *0,*	No. *antal*	per cent. *%*	No. *antal*	per cent. *%*	No. *antal*	per cent. *%*	No. *antal*	per cent. *%*
60—65	0	0.0	0	0.0	2	2.2	0	0.0
66—70	8	27.6	5	5.0	6	6.6	6	7.2
71—75	14	48.3	38	38.0	37	40.7	41	49.5
76—80	5	17.2	47	47.0	37	40.6	30	36.1
81—85	2	6.9	10	10.0	7	7.7	6	7.2
86—90	0	0.0	0	0.0	2	2.2	0	0.0
Total *Ialt*	29	100.0	100	100.0	91	100.0	83	100.0

T a b l e X. Mensurations of absolute form quotient.

T a b e l X. Målinger af absolut formkvote.

Thinning grade *Hugstgrad*	Parcel *Parcel*	Number of trees *Antal træer*	Absolute form quotient *Absolut formkvote*
A	k	29	0.672
B	e, g	100	0.711
C	h, m	91	0.700
D	f, i	82	0.690

T a b l e X I. Trees attacked by Dendroctonus micans, in percentages.

T a b e l X I. Træer angrebne af Dendroctonus micans, procent.

Parcel *Parcel*	Thinning grade *Hugstgrad*	e. 49	f. 51	f. 52	e. 52	f. 53	e. 53	f. 54	e. 54	s. 55	e. 55	e.56
a	B				43		inc. d.				cl. c.	
b	D		17		74		inc. d.				cl. c.	
c	C		25		72		inc. d.				cl. c.	
d	A				9				inc. d.		cl. c.	
e	B				26					74	inc. d.	cl. c.
f	D		m. a.		74					100	inc. d.	cl. c.
g	B				11					60		cl. c.
h	C				23					83	inc. d.	cl. c.
i	D				30					98	inc. d.	cl. c.
k	A				2					18		66 cl. c.
m	C				47					89	inc. d.	cl. c.
n	B	2	13		58				81 cl. c.			
o	C	2	41	inc. d.	86	cl. c.						
p	D	1	34	inc. d.	85			cl. c.				

e=autumn
e=efterår

f=spring
f=forår

s=summer
s=sommer

m.a.=mild attack
m.a.=svagt angreb

inc.d.=incipient decay of stand
inc.d.=begyndende opløsning af bestanden

cl.c.=clear cutting of stand
cl.c.=afdrift af bestanden

T a b l e X I I. Diameter increment of micans attacked trees compared with diameter increment of non-attacked trees.

T a b e l X I I. Diametertilvækst hos micansangrebne træer sammenlignet med ikke angrebne træer.

Year of growth *Vækstår*	Annual diameter increment, mm. *Årlig diametertilvækst, mm* 1950 og 1951	1952	1953	1954
Non-attacked trees (152) *Ikke angrebne træer (152)*	3.8	4.4	2.5	1.7
Trees attacked during 1950-51 (45) *Træer angrebet i løbet af 1950-51 (45)*	4.0	4.4	0.6	—0.4
Trees attacked during 1952 (78) *Træer angrebet i løbet af 1952 (78)*	4.3	4.7	1.5	—0.5

Table XIII. Trametes percentages, grades 3 and 4. Stump description 1947/56.

Tabel XIII. Trametesprocenter, graderne 3 og 4. Stødbeskrivelser 1947/56.

Group *Parcel-gruppe*	Thinning grade *Hugst-grad*	Parcel *Parcel*	No. of trees examined *Undersøgt antal træer*	No. with Fomes annosus *Antal med Fomes annosus*	Percentage with Fomes annosus *Procent med Fomes annosus*
1	A	d	87	1	1.1
	B	a	125	12	9.6
	C	c	94	5	5.3
	D	b	101	2	2.0
2	A	k	505	76	15.0
	B	e, g	375	54	14.4
	C	h, m	270	40	14.8
	D	f, i	250	17	6.8
3	B	n	472	36	7.6
	C	o	283	42	14.8
	D	p	209	23	11.0

Table XIV. Diameter increment of Trametes attacked trees in percentage of diameter increment of healthy trees (on the assumption of the same diameter).

Tabel XIV. De Trametesangrebne træers diametertilvækst i procent af sunde træers vækst (forudsat samme diameter).

Year *Årstal*	per cent. %	Year *Årstal*	per cent. %
1931	113	1946	109
1932	114	1947	103
1933	119	1948	91
1934	118	1949	98
1935	111	1950	101
1936	104	1951	94
1937	106	1952	98
1938	105	1953	101
1939	114	1954	99
1940	121	1955	126
1941	117		
1942	105		
1943	114		
1944	109		
1945	106		

Table XV. Sortiment distribution, in percentages.

Tabel XV. Sortimentsforhold. Procent.

DBH *Diam. i brysthøjde cm*	Saw timber *Tømmer*	Poles diam. 12-15 cm. 1 m. above stump *Bånd*	Poles diam. 10-12 cm. 1 m. above stump *Store lægter*	Saplings diam. 7-10 cm. 1 m. above stump *Små lægter*	Saplings diam. 5-7 cm. 1 m. above stump *Store stager*	Saplings diam. below 5 cm. 1 m. above stump *Små stager*	Fence posts diam. of top above 8 cm. *Store hegnspæle*	Fence posts diam. of top 3-8 cm. *Små hegnspæle*	Fence posts not classified *Usort. hegnspæle*	Box board *Kassetræ*	Firewood diam. above 10 cm. *Stort brænde*	Firewood not classified *Usort. brænde*	Firewood poor quality *Ros*
6		3.6		3.6	12.4	3.1	13.3	6.4			21.8	35.8	
8		6.5	4.4	7.6	8.8	11.3	14.2	4.0			22.8	20.4	
10		9.6	6.6	5.7	5.7	13.3	16.4	2.6		3.4	24.2	12.5	
12	20.4	11.4	4.8	3.3	1.6	5.5	15.0	2.3		12.4	17.1	6.2	
14	44.8	8.8	2.5	1.3	0.6	2.1	6.9	1.2	7.6	14.8	6.8	2.6	
16	64.1	4.8	0.9	0.9			3.1	0.5	7.6	13.3	3.1	1.7	
18	77.7	2.3	0.4	0.4			1.5	0.4	5.8	9.4	1.1	1.0	
20	85.8	0.9					1.3		5.9	5.2		0.9	
22	91.0	0.4					0.8		3.8	2.6		0.9	0.5
24	93.0						0.4		2.8	2.2		0.6	1.0
26	94.4								1.7	2.0		0.6	1.3
28	94.4								1.4	2.1		0.6	1.5
30	94.4								1.1	2.3		0.8	1.4
32	94.7								0.6	2.2		0.9	1.6

contd. *(fortsættes)*

Table XV, continued.

Tabel XV, fortsat.

Distribution of saw timber, in percentages.
Den procentiske fordeling af tømmeret.

	Mid-diameter, cm.				
	11-17	18-20	21-24	25-31	over 31
	Midtdiameter, cm				
	11-17	18-20	21-24	25-31	over 31
15	100				
16	94	6			
17	87	10	3		
18	80	16	4		
19	70	24	6		
20	61	31	8		
21	53	35	12		
22	45	39	16		
23	36	38	21	5	
24	29	38	26	7	
25	22	37	31	10	
26	16	34	37	13	
27	11	31	41	17	
28	8	28	42	22	
29	6	24	42	28	
30	5	19	41	35	
31	3	14	40	41	2
32	2	11	37	46	4
33	2	8	34	50	6
34		5	31	54	10
35		3	26	57	14
36		2	20	59	19

T a b l e X V I. Price movements of some important products.

T a b e l X V I. Prisbevægelsen for nogle vigtige effekter.

Year *Årstal*	Gross Sales Prices *Bruttosalgspriser*				Index*) *Indeks*)*	Gross Sales Prices ÷ Index *Bruttosalgspriser: Indeks*			
	Saw timber 11/17 cm. kr./m³ *Tømmer 11/17 cm kr./m³*	Saw timber 25/31 cm. kr./m³ *Tømmer 25/31 cm kr./m³*	Poles diam. 12-15 cm. 1 m. above stump kr./piece *Bånd kr./stk.*	Saplings diam. 5-7 cm. 1 m. above stump kr./piece *Store stager kr./stk.*		Saw timber 11/17 cm. kr./m³ *Tømmer 11/17 cm kr./m³*	Saw timber 25/31 cm. kr./m³ *Tømmer 25/31 cm kr./m³*	Poles diam. 12-15 cm. 1 m. above stump kr./piece *Bånd kr./stk.*	Saplings diam. 5-7 cm. 1 m. above stump kr./piece *Store stager kr./stk.*
1935			0.75	0.15	100			0.75	0.15
1937	12.00		1.25	0.20	110	10.9		1.14	0.18
1939	20.00		1.50	0.25	172	11.6		0.87	0.15
1941	24.00	30.00	1.65	0.20	183	13.1	16.4	0.90	0.11
1943	24.00	30.00	2.00	0.30	183	13.1	16.4	1.09	0.16
1945	24.00	30.00	2.00	0.25	201	11.9	14.9	1.00	0.12
1947	25.00	31.00	1.75	0.45	214	11.7	14.5	0.82	0.21
1949	29.00	35.00	2.00	0.60	220	13.2	15.9	0.91	0.27
1951	38.00	44.00	2.50	0.70	220	17.3	20.0	1.14	0.32
1953	48.00	57.00	3.20	0.80	249	19.3	22.9	1.29	0.32
1954	70.00	83.00	4.00	0.80	260	26.9	31.9	1.54	0.31

*) Referring to the price for felling of 1 cub.m. timber laid out in full length.

**) Refererer til prisen for skovning af 1 m³ uafkortet tømmer.*

Table XVII. Economic survey. Value index in kr./ha and relative value index, all B-thinning figures put equal to 100.

Tabel XVII. Økonomisk analyse. Værdital i kroner pr. hektar samt relative værdital, idet alle tal for B-hugst er sat lig med 100.

Rate of interest *Rente-fod %*	Value group *Værdi-gruppe*	1954 price level *1954-prisniveau*			Index-weighted actual prices *Indekskorrigerede, virkelige priser*		
		B-thinning *B-hugst*	C-thinning *C-hugst*	D-thinning *D-hugst*	B-thinning *B-hugst*	C-thinning *C-hugst*	D-thinning *D-hugst*
0	Thinning *Tynding*	15180	20698	22953	2864	3668	4069
	Remaining crop *Bl. bestand*	34437	29798	23967	13245	11461	9218
	Cultivating *Kultur*	2000	2000	2000	769	769	769
	Value figure *Værdital*	47617	48496	44920	15340	14360	12518
2	Thinning *Tynding*	16510	22864	25445			
	Remaining crop *Bl. bestand*	34437	29798	23967			
	Cultivating *Kultur*	4504	4504	4504			
	Value figure *Værdital*	46443	48158	44908			
4	Thinning *Tynding*	20618	30024	33829	3783	5144	5790
	Remaining crop *Bl. bestand*	34437	29798	23967	13245	11461	9218
	Cultivating *Kultur*	9986	9986	9986	3840	3840	3840
	Value figure *Værdital*	45069	49836	47810	13188	12765	11168
6	Thinning *Tynding*	24211	36552	41582			
	Remaining crop *Bl. bestand*	34437	29798	23967			
	Cultivating *Kultur*	21805	21805	21805			
	Value figure *Værdital*	36843	44545	43744			

contd. (*fortsættes*)

Table XVII, continued.
Tabel XVII, fortsat.

Rate of interest *Rentefod %*	Value group *Værdigruppe*	1954 price level *1954-prisniveau*			Index-weighted actual prices *Indekskorrigerede, virkelige priser*		
		B-thinning *B-hugst*	C-thinning *C-hugst*	D-thinning *D-hugst*	B-thinning *B-hugst*	C-thinning *C-hugst*	D-thinning *D-hugst*
0	Thinning *Tynding*	100	136	151	100	128	142
	Remaining crop *Bl. bestand*	100	87	70	100	87	70
	Cultivating *Kultur*	100	100	100	100	100	100
	Value figure *Værdital*	100	102	94	100	94	82
2	Thinning *Tynding*	100	138	154			
	Remaining crop *Bl. bestand*	100	87	70			
	Cultivating *Kultur*	100	100	100			
	Value figure *Værdital*	100	104	97			
4	Thinning *Tynding*	100	146	164	100	136	153
	Remaining crop *Bl. bestand*	100	87	70	100	87	70
	Cultivating *Kultur*	100	100	100	100	100	100
	Value figure *Værdital*	100	111	106	100	97	85
6	Thinning *Tynding*	100	151	172			
	Remaining crop *Bl. bestand*	100	87	70			
	Cultivating *Kultur*	100	100	100			
	Value figure *Værdital*	100	121	119			

SUMMARY.

A thinning experiment with Sitka spruce in Nystrup Dune Forest.

In 1935 C. H. Bornebusch established a thinning experiment with Sitka spruce in Nystrup Dune Forest.

The soil — formerly arable land — consists of sandy clay overlain by a ¼—¾ m. layer of shifting sand.

The experiment comprised three groups of parcels (Fig. 1) in each of which were represented the thinning grades B, C, and D (light, medium, and heavy thinning, respectively). Besides, in Groups 1 and 2 there were unthinned parcels (A-thinning). Group 1 comprised parcels a-b-c-d, Group 2 parcels e-f-g-h-i-k-m, and Grup 3 parcels n-o-p.

The trees — partly mixed with mountain pine — were planted in 1909—16. The planting thrived well. In the subsequent years increments were obtained exceeding the Danish Sitka spruce yield table (*Henriksen* (1958)) by about 25 per cent., a result not unusual on sandblown, good soils (*Henriksen* (1958)). In the 1935—53 period (age about 26—44 years) the current increment was about 35—40 cu.m./ha, and the average increment from planting reached about 22 cu.m./ha/year. Detailed information on the increment is stated in Table III. The extraordinarily great volume increment must be ascribed to a great basal area increment — not to any particularly great height increment.

The relation between the grade of thinning and increment appears from Fig. 2. In this diagram the increment during the observation period (the period in which the stands were well closed — Table IV — is plotted against the basal area at the beginning of the experiment. The replication parcels of Group 2 show a clear correlation between the initial basal area and the increment during the observation period. A similar correlation is assumed to be applicable also to Group 1. — If the difference in the initial basal areas — as an expression of the differences in natural growing conditions — are taken into consideration, the interrelation of increments in A, B, and C-thinnings is very uncertain. However, it appears to be more certain that there is an increment drop from C to D thinning of the order of 7—10 per cent.

It appears from Tables V, VI, and VII how the yield is distributed over classes of diameter breast height (DBH).

In Tables VIII, IX, and X it is seen that the relative stem form — contrary to previous experience — seems to be fairly unaffected by the thinning grade. Tables VIII and IX contain Hohenadl's form quotient (cf. *Prodan* (1951) pp. 20 et seqq.), and Table X contains the absolute form quotient (cf. *Sabroe* (1939)).

1948 brought serious attacks of Dendroctonus micans in Group 3, which soon decayed and had to be cleared in 1953—54. The attack quickly spread to the other experimental parcels. In 1956 the last of these parcels were cleared. It is demonstrated that the micans attack resulted in rapidly decreasing increment and in the death of

the trees attacked (Table XII). The D. micans attack was considerably stronger in the heavily thinned parcels than in the lightly thinned ones (Table XI).

Attacks of Fomes annosus (Table XIII) were appreciable, but assumed relatively modest proportions. No relation to the thinning grade is noticeable, if anything there is a *drop from the C- to the D-thinning,* a phenomenon which occurs in all three groups of parcels. The Fomes annosus attack does not seem to have seriously affected the growth of the individual tree (Table XIV).

One recordable cause of the decay of the stands is, in any case, the attacks of Dendroctonus micans (Table XII), whereas the Fomes annosus attack has hardly been of major importance. Figs. 3, 4, and 5, in which the A-thinning in parcel k is charted for Dendroctonus micans attacks, Fomes annosus attacks, and crown look (needle-shedding), provide an immediate impression of the close connection between micans attack and death, while no such connection is noticeable with regard to Fomes annosus attacks.

It has been demonstrated (Fig. 6, and *Henriksen* 1958) that there was no question of *preceding* weakening, either of the stands in general or of the trees attacked.

Hence, there is no doubt that the Dendroctonus micans attacks played a very active part in the decay of the stands.

There were, however, as demonstrated by *Henriksen* (1958), other causes that rendered it probable that the primary drawback in the cultivation of Sitka spruce is water deficiency (conspicuous in the event of sudden exposure, heavy thinning, etc.). The existence of contributory causes of the decay of Sitka spruce appears perhaps most clearly from Fig. 7 which, i.a., shows that in 1954 the increment of all the existing parcels went down approximately by one half, irrespective of their previous state of health. The cause is probably climatically conditioned, because 1954 was in several locations unfavourable to the growth of Sitka spruce.

The *economic survey* comprises Group 2 up to 1954, when the parcels were still fairly complete. The analysis is based on the information on increment contained in Table III, on the table of assortment distribution (Table XV), and on prices communicated by the Directorate of Dunes; a summary of these prices is given in Table XVI.

The analysis has been made on the basis of a fixed price level (1954 prices), and on the prices actually obtained, the latter, however, weighted with the index figures of the fluctuations in the general price level. For index figures has been used the price of the felling of 1 cu.m. of timber in full length. The price fluctuations henceforward taken into account are those movements in the price of timber which differ from the fluctuations of the general price level. Accordingly, all values have been projected on to 1954. The rates of interest used are 0, 2, 4, and 6 per cent. By subtracting from the summated 1954 values, the cultivating costs (which at 1954 price level amount to

2,000 kr./ha) projected on to 1954, the value figures for the individual thinning grades are obtained (Table XVII).

If account is taken of the actually obtained prices, light thinning is advantageous, because a large proportion of the volume produced has taken share in the price rise. Under stable price conditions, the heavy thinning is advantageous at a rate of interest of 4 or, better still, 6 per cent.

RESUMÉ.

Et udhugningsforsøg i sitkagran i Nystrup plantage.

I 1935 anlagde C. H. Bornebusch et udhugningsforsøg i sitkagran i Nystrup Klitplantage.

Jorden — tidligere anvendt til agerdyrkning — består af sandblandet ler overlejret af ¼—¾ m flyvesand.

Forsøget bestod af tre parcelgrupper (fig. 1) med hver af hugstgraderne B, C og D repræsenteret (henhv. svag, middelstærk og meget stærk hugst). I parcelgrupperne 1 og 2 var desuden utyndede parceller (A-hugst). Parcelgruppe 1 omfattede parcellerne a-b-c-d, gruppe 2 e-f-g-h-i-k-m og gruppe 3 parcellerne n-o-p, — ialt 14 parceller.

Plantningen — delvis i blanding med bjergfyr — blev foretaget 1909—16. Kulturerne lykkedes godt. I de følgende år opnåedes tilvækster, der for samme højdebonitet overgår den danske tilvækstoversigt for sitkagran (*Henriksen* (1958)) med ca. 25 %, et forhold, der ikke er usædvanligt på sandføgne, gode jorder (*Henriksen* (1958)). I perioden fra 1935 til 1953 (alder ca. 26—44 år) var den løbende tilvækst ca. 35—40 m³ pr. ha, og gennemsnitstilvæksten fra kultur kom op på ca. 22 m³ pr. ha årligt. Tilvækstoplysningerne er i detailler anført i tabel III. Den ekstraordinært store massetilvækst må tilskrives stor grundfladetilvækst — ikke just nogen særlig stor højdetilvækst.

Relationen mellem hugststyrke og tilvækst fremgår af fig. 2. I dette diagram er tilvæksten i iagttagelsesperioden (den periode hvor bevoksningerne var sluttede) — jfr. tabel IV — sat i relation til grundfladerne ved forsøgets start. Gentagelsesparcellerne i gruppe 2 viser en tydelig relation mellem startgrundflade og tilvækst i iagttagelsesperioden. En lignende relation er antaget også at gælde for parcelgruppe 1. — Med forskelle i startgrundflade taget i betragtning — som et udtryk for forskelle i naturbetingede vækstmuligheder — er forholdet mellem tilvæksten i A-, B- og C-hugst meget usikkert. Derimod synes det mere sikkert, at der er et tilvækstfald fra C- til D-hugst af størrelsesordenen 7—10 %.

Af tabellerne V, VI og VII fremgår, hvorledes produktionen har fordelt sig på brysthøjdediameterklasser.

Af tabellerne VIII, IX og X ses, at den relative stammeform — mod hidtidige erfaringer — synes ret upåvirket af hugststyrken. Tabellerne VIII og IX angiver Hohenadl's formkvote (jfr. Prodan (1951) s. 20 ff.) og tabel X absolut formkvote (jfr. Sabroe (1939)).

I 1948 begyndte stærke angreb af Dendroctonus micans i parcelgruppe 3, der hurtigt sygnede og måtte afdrives 1953—54. Angrebet bredte sig hurtigt til de andre forsøgsdele. 1956 blev de sidste forsøgsdele afdrevet. Det er påvist, at micansangrebet hurtigt medførte tilvækstnedgang og død hos de angrebne træer (tabel XII). Angrebet af D. micans var væsentligt stærkere i de stærkt huggede parceller end i de svagt huggede (tabel XI).

Angreb af Fomes annosus (tabel XIII) var betydende, men af relativt beskedent omfang. Der ses ingen relation til hugststyrken — måske *et fald fra C- til D-hugst,* et forhold der viser sig i alle tre parcelgrupper. Angrebet af Fomes annosus synes ikke at have synderlig indflydelse på det enkelte træs vækst (tabel XIV).

Som årsag til bevoksningernes hensygnen må i hvert fald anføres angrebene af Dendroctonus micans (tabel XII), hvorimod angrebet af Fomes annosus næppe har spillet nogen større rolle. Figurerne 3, 4 og 5, hvor A-hugsten i parcel k er kortlagt med hensyn til angreb af Dendroctonus micans, angreb af Fomes annosus, samt kroneudseende (nåletab), giver et umiddelbart indtryk af den nære forbindelse mellem micansangreb og død, medens der ikke ses nogen sådan relation til angreb af Fomes annosus.

Det er påvist (fig. 6, samt *Henriksen* 1958), at der ikke var tale om nogen *forudgående* svækkelse, hverken for de pågældende bevoksninger som helhed eller for netop de træer, der blev angrebet.

Der er således ingen tvivl om, at angrebene af D. micans spillede en meget aktiv rolle ved bevoksningernes hensygnen.

Imidlertid var der også andre årsager, som påvist af *Henriksen* (1958), der sandsynliggjorde, at den fundamentale svaghed ved dyrkning af sitkagran er faren for svigtende vandbalance (eklatant ved pludselig eksponering, stærke hugstindgreb etc.). At der *var* andre årsager til sitkagranens hensygnen fremgår måske tydeligst af fig. 7, hvor man blandt andet ser, at i 1954 blev tilvæksten gennemgående halveret i alle dengang eksisterende parceller uanset deres hidtidige sundhedstilstand. Antagelig er årsagen af klimatisk natur, idet sitkagranen i 1954 havde stærk tilvækstnedgang på flere lokaliteter.

Den *økonomiske analyse* omfatter parcelgruppe 2 indtil 1954, da parcellerne endnu var nogenlunde fuldstændige. Grundlaget er de i tabel III indeholdte tilvækstoplysninger, sortimentstavlen (tabel XV) samt priser meddelt af Klitdirektoratet, hvoraf et uddrag findes i tabel XVI.

Opgørelsen er dels foretaget med fast prisniveau (1954-priser) og dels med de virkeligt opnåede priser, idet disse dog er korrigeret med indekstal for det almindelige prisniveaus bevægelser. Som indekstal er benyttet prisen for skovning af 1 m^3 tømmer. De prisbevægelser, der herefter tages i regning, er ændringer i træprisen, der afviger fra bevægelserne i det almindelige prisniveau. Herefter er alle værdier diskonteret frem til 1954. Der er anvendt rentefod 0, 2, 4 og 6 %. Ved fra summaværdierne pr. 1954 at subtrahere kulturomkostningerne

— med 1954-prisniveau 2000 kr. pr. ha — diskonteret frem til 1954, fremkommer værditallene for de enkelte hugstgrader (tabel XVII).

Når man regner med de virkelige priser, er den svage hugst fordelagtig, idet en forholdsvis stor del af den producerede masse har taget del i prisstigningen. Med fast prisniveau er den stærke hugst fordelagtig ved rentefod 4 og navnlig 6 %.

REFERENCES.

Dansk Skovforening: 1953: Stormen den 21. februar 1953. Dansk Skovforen. Tidsskr. 38: 580—583.

Gøhrn, V., Henriksen, H. A., Petersen, B. Beier, 1954: Iagttagelser over Hylesinus (Dendroctonus) micans. Forstl. Forsøgsv. Danm. 21: 383—457.

Henriksen, H. A., 1950: Højde-diameter diagram med logaritmisk diameter. Dansk Skovforen. Tidsskr. 193—202.

— , 1951: Et udhugningsforsøg i sitkagran. Forstl. Forsøgsv. Danm. 20: 403—418.

— *& Jørgensen, E.,* 1952: Rodfordærverangreb i relation til udhugningsgrad. Forstl. Forsøgsv. Danm. 21: 215—252.

— , 1954: Die Holzmasse der Buche. Forstl. Forsøgsv. Danm. 21: 139—214.

— , 1957: Forsøgsvæsenets prøveflader i Abiesarter. Forstl. Forsøgsv. Danm. 23: 281—344.

— , 1958: Sitkagranens vækst og sundhedstilstand i Danmark. Forstl. Forsøgsv. Danm. 24: 1—372.

Jacobsen, B. & Rasmussen, C., 1953: Stormen den 11. februar 1952. Dansk Skovforen. Tidsskr. 38: 193—206.

Møller, C. M.:, 1933: Boniteringstabeller og bonitetsvise tilvækstoversigter for bøg, eg og rødgran i Danmark. Dansk Skovforen. Tidsskr. 18: 457—513 & 537—623.

Prodan, M., 1951: Messung der Waldbestände. Frankfurt a/M.

Sabroe, A. S., 1939: Rødgranens form og formtal. Forstl. Forsøgsv. Danm. 14: 281—428.

Trap, J. P., 1924: Kongeriget Danmark. København.

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