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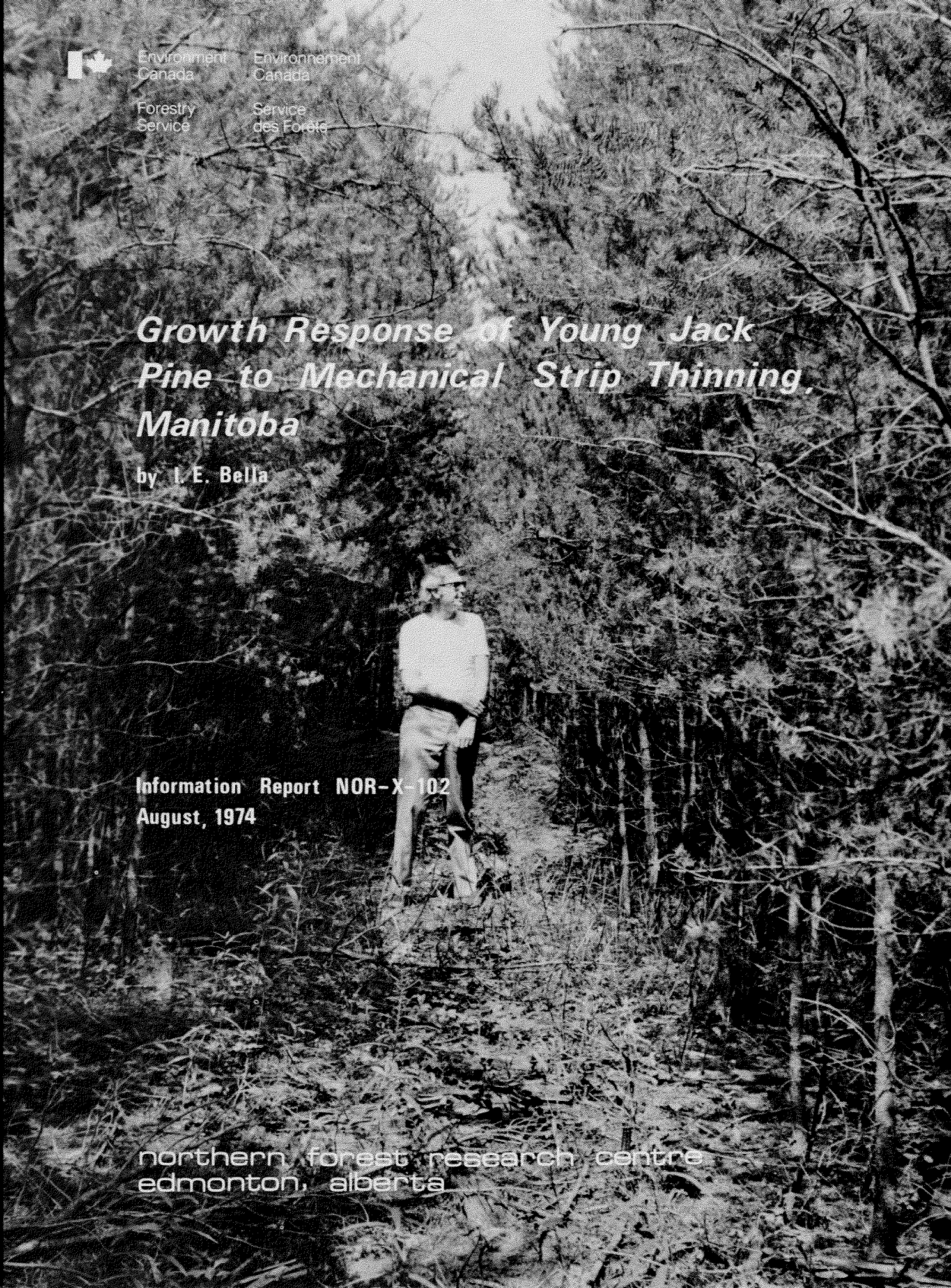

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Growth Response of Young Jack Pine To Mechanical Strip Thinning, Manitoba

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ABSTRACT

Operational strip thinning in relatively open 9-year-old jack pine (Pinus Banksiana Lamb.) stands on sandy fresh sites in southeastern Manitoba resulted in a maximum increase of 40-50% in the following 10-year breast height diameter increment of larger trees close to the cut strips. No real difference in response was found between the two treatment intensities tried: one-way thinning (7-foot cleared swaths alternating with 10-foot-wide reserve strips), and two-way thinning (a second pass made with the chopper at right angles to the first, leaving groups of trees in blocks 10 feet by 10 feet). Strip thinning in denser stands on moist sites produced no significant results.

Unless marked improvements in growth occur in later years this type of strip thinning would be unjustified in similar stands, but it may be useful when followed by selective thinning along the two edges of the leave strips.

RESUME

L'éclaircie par bandes pratiquée dans des peuplements relativement clairs de Pin gris (Pinus banksiana Lamb.) de 9 années sur des stations aréneuses fraîches dans le sud-est du Manitoba, s'est soldée par une augmentation maximum de 40 à 50% de l'accroissement du diamètre à hauteur de poitrine mesuré dans les 10 années consécutives sur les plus gros arbres adjacents aux bandes coupées. On n'a noté aucune différence réelle de réaction entre les deux intensités de traitement essayées: éclaircie à voie unique (des andains de coupe de 7 pieds alternant avec des bandes de réserve larges de 10 pieds), et éclaircie à double voie (une seconde passe effectuée avec la coupeuse perpendiculairement à la première en laissant des groupes d'arbres par blocs de 10 sur 10 pieds). L'éclaircie par bandes dans des peuplements plus denses sur stations humides n'a pas produit de résultats significatifs.

A moins que des améliorations ne se manifestent dans les années à venir, ce type d'éclaircie par bandes ne se justifierait pas dans des peuplements semblables, mais il peut s'avérer utile quand il est suivi d'éclaircie sélective le long des deux lisières des bandes de réserve.

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INTRODUCTION

Young stands of jack pine originating after fires frequently contain as many as 50,000 trees per acre (120,000 trees per ha). At such high densities tree growth may slow before the stand is even 10 years old. Such stands need thinning to maintain rapid tree growth.

Mechanical strip thinning is a relatively low-cost method for reducing stand density, but information is scarce on how much it improves jack pine tree growth. The purpose of this study was to evaluate, in terms of growth, the effectiveness of two intensities of strip thinning in young jack pine stands in Manitoba. The present report contains the first 10-year diameter increment results after treatment on two common site types.

METHODS

The study was conducted in the Sandilands Forests in south-eastern Manitoba in jack pine stands where the provincial government initiated an operational-scale program of strip thinning with drum choppers in the autumn of 1963 (Figures 1 and 2). The flat topography, sandy stone-free soils, and the absence of heavy slash facilitated treatment. Stand density varied between 7,000 and 43,000 trees per acre (17,000 and 100,000 trees per ha). Stands on moist sites (Mueller-Dombois 1964) were about twice as dense as those on fresh sites, with an average of 26,000 trees per acre (64,000 trees per ha) on the moist sites and 12,000 trees per acre (30,000 trees per ha) on the fresh sites. Both of these sites were on nutritionally poor sandy soils and were similar in site quality for jack pine. Mean dbh of the largest trees was 0.7 in. (1.8 cm) on fresh sites and 0.5 in. (1.3 cm) on moist

sites. Average height on both sites was around 7-8 ft (2.1-2.4 m).

Stands were thinned in parallel strips, with 7-ft (2.1-m) cleared swaths alternating with reserve strips about 10 ft (3 m) wide. For greater release, a heavier thinning treatment was tried over a small area, where a second pass was made with the chopper at right angles to the first, leaving groups of trees in blocks 10 ft by 10 ft (3 m by 3 m).

Thirty sample plots, about 10 ft by 10 ft (3 m by 3 m) to conform with leave strips or blocks created by the treatment, were established in spring, 1964 in stands treated in the previous fall. Fifteen plots were established on fresh sites and 15 on moist sites; on each site 5 were in one-way thinned stands, 5 were in two-way thinned stands, and 5 were in untreated or control stands. Measurements included a tree tally by dbh classes, and precise height and dbh of the 10 largest trees per plot (tagged) at establishment, and their distance to the cut strip. The analysis used regression and covariance techniques, the latter to adjust for initial differences in average dbh between treatments.

RESULTS

One-way thinning on fresh sites results in about a 40% increase in dbh increment of the 800 largest trees[1] per acre stocked (2,000 per ha) which constitute the potential crop trees in the stand. After two-way thinning the increase was 30%. These increases were highly significant, but there was no real difference between one-way and two-way thinning treatments. The increases represent slightly more than 0.5 in. (1.3 cm) improvement in dbh increment in the 10 years

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1. Based on adjusted treatment means of the two largest trees per plot.

following treatment (Figures 3 and 4). Although there was an average of 30% improvement in diameter increment after two-way thinning on moist sites, this was not statistically significant. One-way thinning on moist sites had no effect.

One would expect that the greatest response in tree increment after strip thinning should occur adjacent to the open strip; in the centre of the leave strip trees may remain unaffected. Differences in diameter growth in relation to distance to open border would therefore indicate thinning response. On fresh sites, tagged trees close to the open edge grew over 0.5 in. (1.3 cm) more in the 10 years following two-way thinning than trees in the centre of a leave block (Figure 5). This is almost a 40% improvement in dbh increment for the largest class of the tagged trees (1.0 in. or 2.5 cm in 1964), and over 50% improvement for the smaller (0.5 in. or 1.3 cm in 1964). Although the trees were somewhat bigger adjacent to cut strips than in the centre, in stands that received one-way thinning, the effect was not statistically significant. Again, no trends were apparent on moist sites.

Differences in tree diameter growth resulting from treatment should show up as related differences in mean dbh of the entire stand. Naturally, variation in stand density within the leave strips and between plots would likely have a strong influence on this relation and would tend to obscure treatment effects. Plotting mean dbh over number of trees per acre solved this problem. Nevertheless, mean dbh values showed no separation by treatment. This was expected for moist sites on the basis of the previous results. On fresh sites, where at least the larger trees showed significant growth response to thinning, treatment effect seemed to be diluted when all trees were considered,

probably by the limited growth response among small trees.

Tree mortality is usually reduced by thinning because of the increase in available living space and lesser competition by the remaining trees. However, this may not necessarily apply after strip thinning, because this treatment created unstocked openings (cut strips) while leaving stand density unchanged within the residual strips or blocks. Thus it came as no surprise that tree mortality was unaffected by treatment in the first 10 years after strip thinning (Figure 6). In other words, mortality was much the same on both thinned and control plots. However, mortality was strongly associated with and rapidly creased with original stand density.

DISCUSSION AND CONCLUSIONS

Merchantable yield is the best criterion for evaluating the effectiveness and economics of thinning; however, at this early age of the stand, it is possible only to provide an indication of future yield on the basis of diameter growth information.

Strip thinning increased tree diameter growth on fresh sites, but the maximum increase was only about 40-50%, and it occurred after two-way treatment among the larger trees (those tagged). Most of the growth increase was put on trees adjacent to the open strip. These increases were relatively small, and unless marked improvements in growth in relation to the control stand occur in later years, strip thinning even under these conditions would be unjustified. Two-way thinning was tried for experimental purposes only. It is about twice as costly as the one-way treatment and was slightly more effective in

improving tree growth. However, it seems to result in understocking and incomplete utilization of the site and would likely reduce final yield.

The lack of significant response to thinning on moist sites rules out this treatment in similar stands. The reason for this lack of response seems to be the much higher stand density on these sites. Under such conditions trees have generally poor crown development and possibly poor root development, so they are incapable of taking advantage of release from one side. It is disappointing that strip thinning seems to be ineffective in dense stands where control treatment is most needed. However, mechanical strip thinning may be effective even in these stands if conducted earlier, perhaps around 5 years of age, before crowding leaves a strong imprint on the trees.

Stands sampled on fresh sites were initially more open; the trees had better crowns and dominance was expressed. These trees were in a much better position to respond to release, as was borne out also by 5-year growth results from other stands in this area (Bella and De Franceschi 1971). Yet even on fresh sites the majority of trees were unaffected by thinning, as indicated by the similarity in mean dbh and mortality values between treated and untreated plots. At this age the lack of increase in mean dbh as a result of treatment is of no concern because it is only the largest trees that will make up the final crop. However, the similarity in mean diameter and mortality suggests that so far the effect of thinning has been fairly limited. Unless dominant trees on the border nearly double their diameter increment in comparison to similar trees in the control stand and become capable of fully

utilizing the resource potential of the cut strips, and unless mortality of suppressed trees in the residual strips accelerates, strip thinning will have only limited potential for increasing merchantable volume production in jack pine stands.

Although strip thinning alone may not provide sufficient release for a substantial increase in merchantable volume production, in conjunction with selective thinning, which generally results in better tree growth, it could be a much more effective method. First, the stands selected for treatment would be strip thinned so that cut strips 10 ft (3 m) or narrower alternated with 12-ft (3.6-m) leave strips. This may be done at a relatively low cost. Then the two edges of the leave strips would be selectively thinned in 3-ft (0.9-m) widths adjacent to the cut strips, favouring the best dominants and codominants. The centre of the leave strip would be left undisturbed, where a good portion of the trees--in a way acting like a nurse crop--would eventually be crowded out by fast-growing trees on the selectively thinned border. With this combination treatment, only a fraction of the area would require selective thinning (about one-quarter in the above example). Also, use of some of the newly developed brush saws could further reduce the usually high cost of selective thinning (Bella, 1974).

ACKNOWLEDGEMENTS

Several foresters of the Manitoba Department of Mines and Natural Resources actively participated in establishing this study. Credit is also due to Mr. J.P. De Franceschi for his able technical assistance in the field work and analysis of this study.

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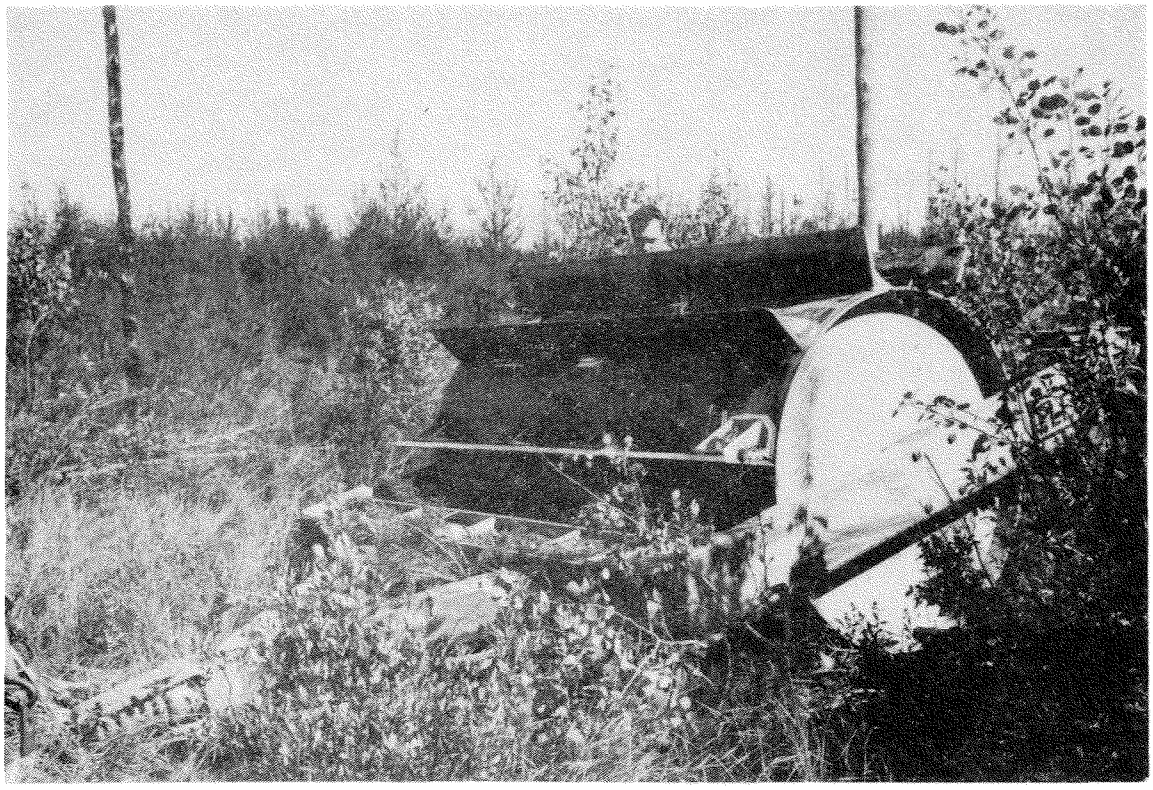

Figure 1. The Fleco Drum Chopper used for strip thinning.

Figure 2. A dense 9-year-old jack pine stand after treatment.

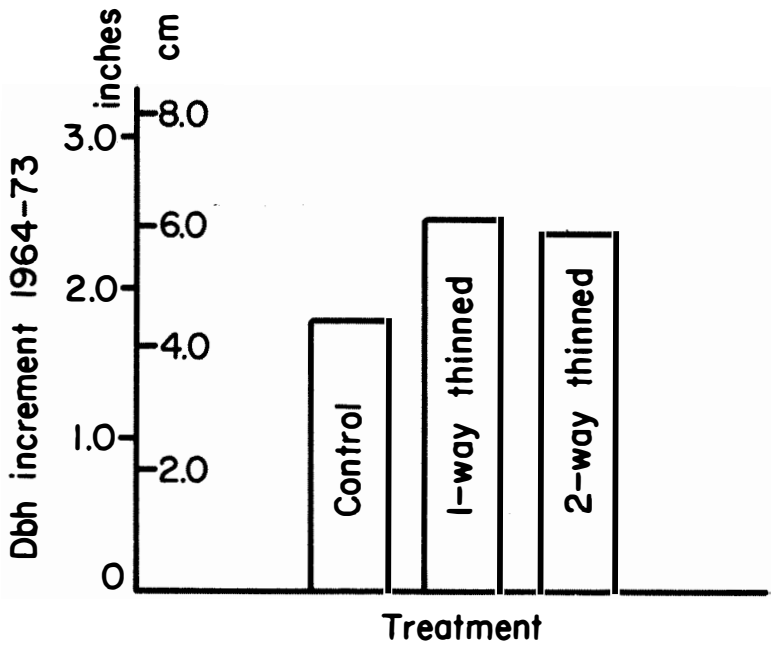

Figure 3. Post-thinning dbh increment of the two largest trees per plot by treatment on fresh sites.

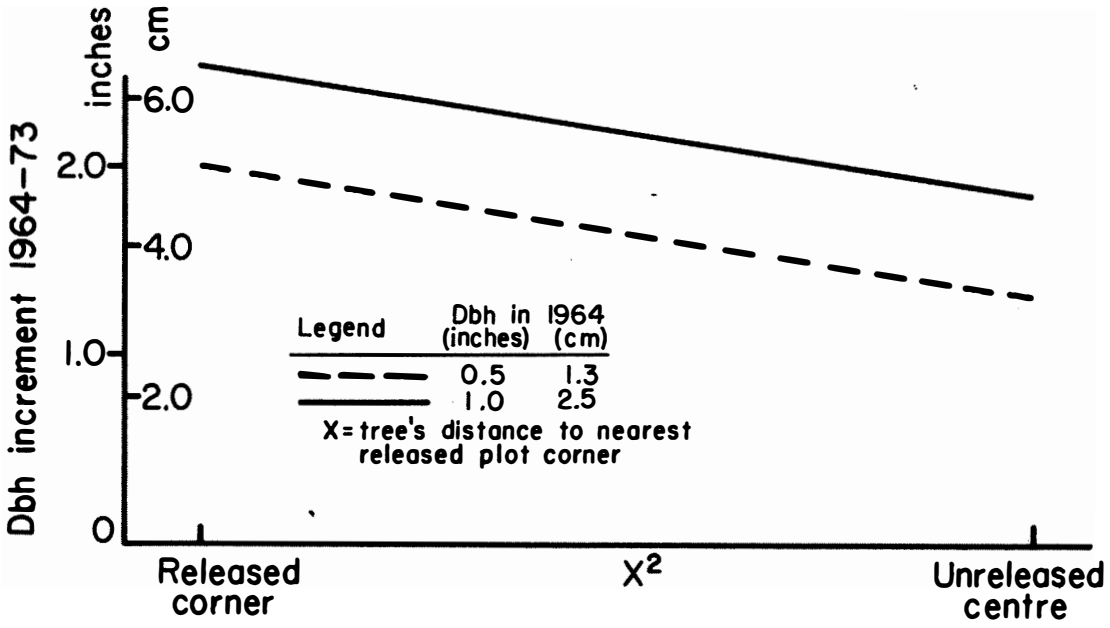

Figure 5. Dbh increment of the 10 largest (tagged) trees in relation to distance from released corner after two-way thinning on fresh sites.

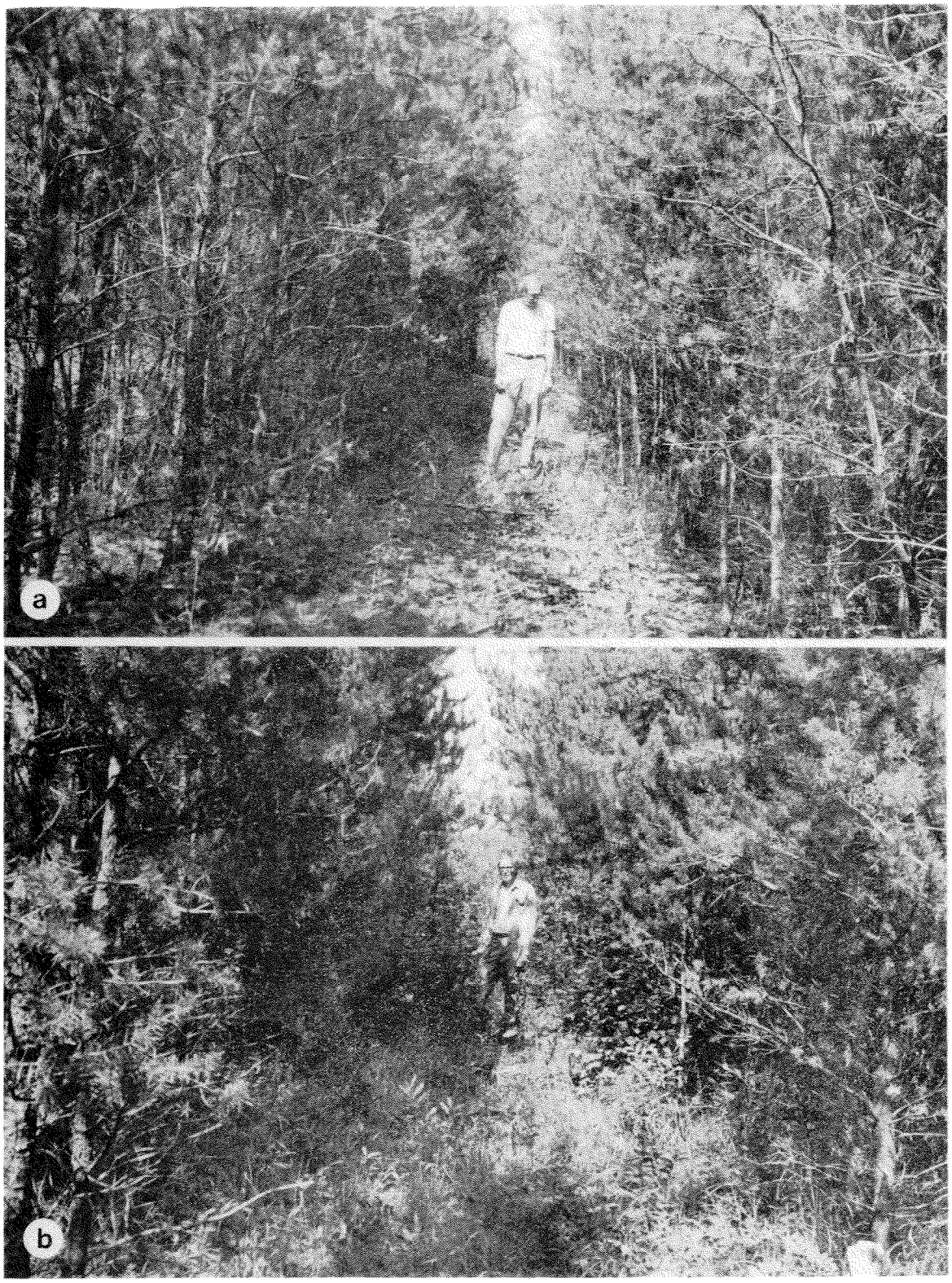

Figure 4. (a) Ten years after thinning, tree crowns occupy a large portion of the cut strip in this dense, 19-year-old stand on a fresh site.

(b) Where the stands were initially more open on fresh sites, crowns as well as tree diameters are bigger. Here, the reoccupation of the cut strips by the crowns is nearly complete.

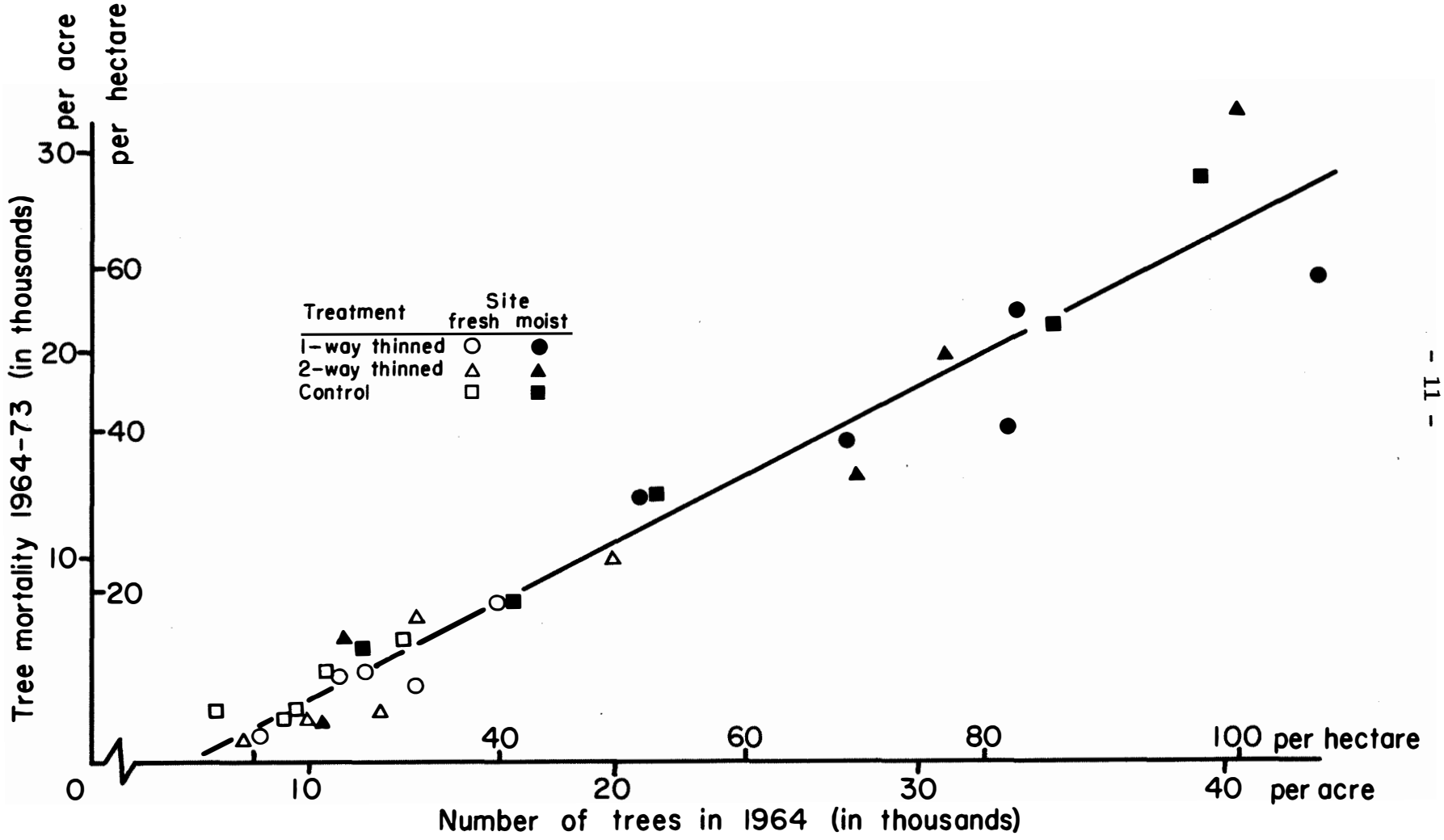

Figure 6. Tree mortality in relation to stand density by treatment and site.