CANADA

Department of Forestry

FOREST RESEARCH BRANCH

WEEKLY RADIAL INCREMENT OF BALSAM FIR IN QUEBEC

AS RELATED TO McLINTOCK'S TREE CLASSIFICATION

PROJECT Q-110)

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ABSTRACT

The radial increment of 38 balsam fir trees (<u>Abies balsamea</u> (L.) Mill.) differing in height, crown class and vigour, has been studied to determine if the McLintock classification gives better correlation with radial increment than other types of classification based on either total height or on crown ratio. Measurements at weekly intervals during the 1961 growing season have shown the superiority of the McLintock tree classification over the other two. It seems, therefore, that the interaction of the factors involved in McLintock classification is essentially valid even for very short predictions. It is suggested that such classification be more widely adopted in Quebec.

INTRODUCTION

The chief and final interest of the forester is in the amount and quality of wood laid down in a tree trunk, and one means at the silviculturist's disposal for influencing quality and rate of growth is unquestionably and above all thinning. But, if thinning can be justified economically, the choice of the tree to reserve must be judiciously made.

Any silviculturist can work out a method of his own to make such a choice, and McLintock (1948) showed that his method was a reliable guide in the spruce-fir region of northeast Maine. The present study was made to find out how the McLintock classification worked for extremely short periods in the Quebec region and how it compares to those based on total height or on the ratio of the length of the living crown over the total height of the tree.

GENERAL

The essence of the classification developed by McLintock in 1948 comprised three variables: crown class, live crown ratio, and vigour. Each of these variables are sub-divided into three sub-classes. The whole classification is represented in Table 1.

Table 1. Basic factors of McLintock's tree classification (From McLintock, 1948)

Variable	Rating in points		
	3	2	1
Crown class	Dominant and co-dominant	Intermediate	Overtopped
Live Crown ratio (in %)	7-10	4-6	1-3
Vigour	I	II	III

In estimating these three variables, McLintock states:

"Overtopped does not mean the same as suppressed; a fir may be overtopped but still not necessarily suppressed because it can grow satisfactorily in the understorey.

Vigor is judged by density character, and color of foliage, length of shoot growth, condition of the bark and general appearance of the crown"

The classification is then based on the concept that relative growth is associated at different degrees to interactions between crown class, live crown ratio, and vigour. Thus on a given site, the number of points assigned, for instance, to a 50-foot tall dominant balsam fir with 15 feet of live crown and dying out, will be as follows: for its dominance: 3 points; for its crown ratio: 1 point; for its vigour: 1 point; making a total of 5 points. According to the classification the potential growth of any given tree will vary proportionately to the points given, that is between 3 and 9.

EXPERIMENTAL DETAILS

Analytical data have been collected at Valcartier, 15 miles north of Quebec city in a 30-50-year-old balsam fir stand. The site, as assessed by lesser vegetation (Dryopteris-Oxalis) and site index[*] (52) is, according to Linteau (1955), a first class for balsam fir. The height of the selected trees varies from 30 to 50 feet, and the diameter at breast height ranges from four to six inches.

Crown class, live crown ratio and vigour class varied widely between the 38 trees graded according to McLintock's tree classification.

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[*] Based on height of dominant and co-dominant fir and black spruce at 50 years.

The first radial readings were made on May 17 when some snow
was still on the ground, and the last readings on August 9, which is
about the end of the growing season. The radial increment of each
tree was measured at regular weekly intervals using a dial gauge
dendrometer similat to the one described by Belyea, Fraser and Rose
(1951). Measurements of radial growth were made on the south side
of the tree at about 4.5 feet above ground level.

RESULTS AND DISCUSSION

Results of the analysis of the possible relationship between
radial increment and total height, crown ratio and McLintock's tree
classification are summarized in Table 2.

Table 2. Values of the correlation coefficients between different
methods of tree classification and radial increment of
38 trees.

Methods	Correlation coefficients "r"	Significance
Total height	.03	Not Significant
Live crown ratio	.14	Not Significant
McLintock	.58	Highly Significant

(For p .01, r .40; for p .05, r .31)

The superiority of the method developed by McLintock over the two others is evident. In the McLintock method, 33.6% of the variation in radial growth is explained while in the other two methods less than 1% of such variation is explained.

Figure 1 illustrates the weekly average cumulative radial increment for the 1961 growing season for 38 trees classified according to the McLintock tree classification. At the initiation of growth in the spring, the relationship between radial increment and the number of points attributed to the trees is, in general, rather confusing. It becomes clearer as the growing season advances, and it is well marked by July 5 and continues to be evident up to the end of the season except perhaps for the trees in class 4 and 5 which slightly deviate from the rule. However, if the extreme classes are considered, it is obvious that the radial increment during the whole growing season is much better for the highest than for the lowest graded trees.

Irrespective of the tree classes, radial increment starts to slow down or decline about the beginning of August. This would indicate the end of the main period of growth for 1961. These fluctuations are, according to Warrack and Joergenson (1950) caused by dehydration of the cell tissues which increases shrinkage in tree trunk. Such fluctuations in growth seem to happen in many species at about the end of the growing season (Belyea, Fraser and Rose, 1951).
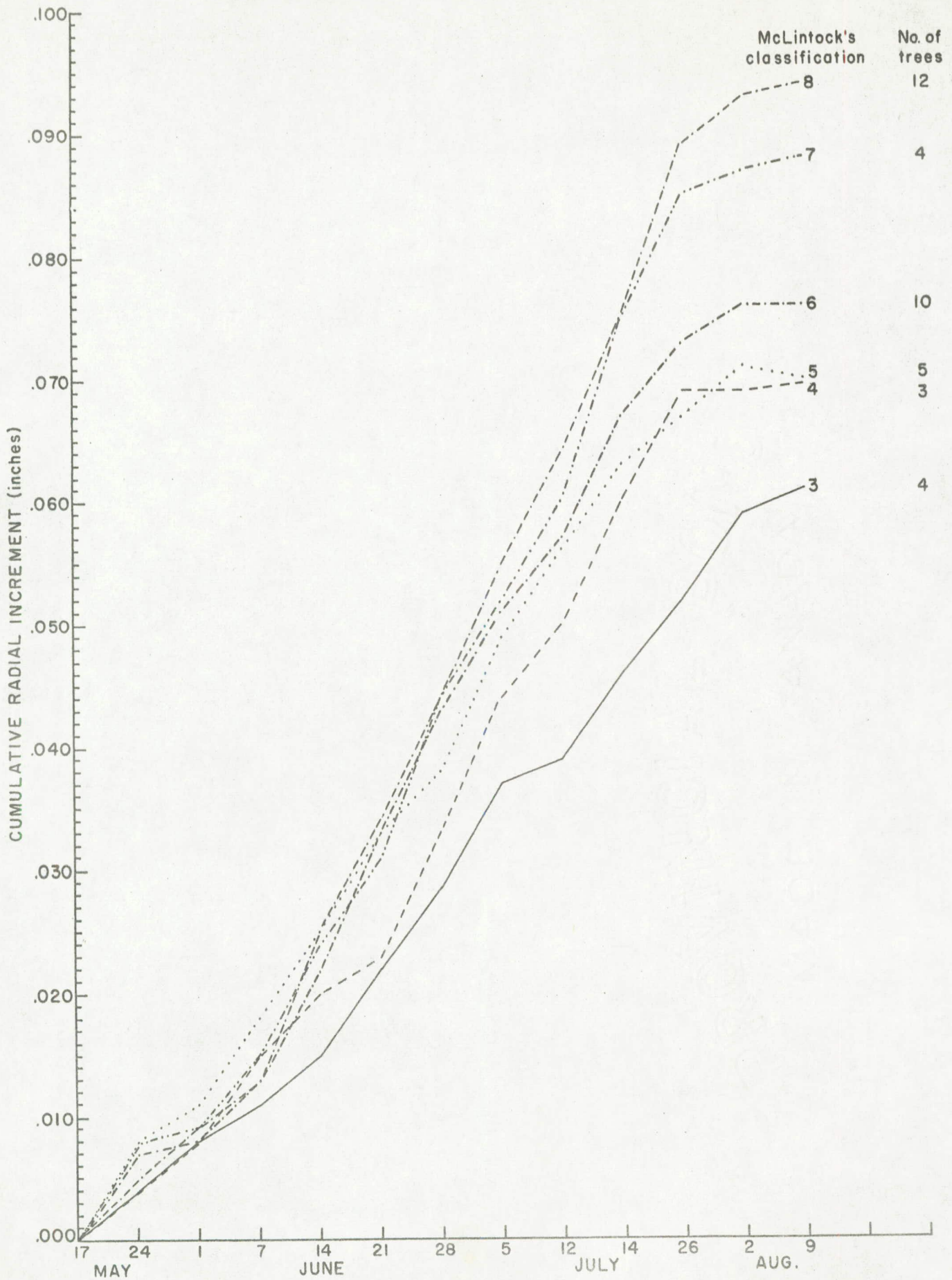
FIGURE I. The relationship between weekly average fir radial increment, 1961, and the McLintock tree classification

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The validity of the features involved in McLintock's tree
classification, when applied to immature trees growing on a given
site-type, can hardly be questioned. They are the end result of growth
factors which, by their interaction, have influenced or are still
influencing individual trees. In a stand there are always trees which,
for one reason or another, exhibit better growth than their neighbours
and the McLintock tree classification takes this into consideration
when characterizing each tree.

CONCLUSIONS

From this short study of the relationship between the radial
increment of fir trees growing on a good site in Quebec and three
methods of tree classification, it is evident that the method developed
by McLintock gives a better correlation than those based on total height
alone or on live crown ratio alone. Althought limited to one locality,
the data, nevertheless, suggest that for stands and sites similar to the
one studied the method developed by McLintock could be of value in the
choice of crop trees in the Quebec region. It is recommended that such
classification be more widely adopted.

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RESMUME

Le présent travail a été abordé dans le but de déterminer si la
classification d'arbres, d'après la méthode de McLintock, est supérieure
à celles basées uniquement soit sur la hauteur totale soit sur le rapport
de la longueur de la cîme vivante à la hauteur totale de l'arbre.
A cet effet, 38 sapins baumiers (<u>Abies balsamea</u> (L.) Mill.) de hauteur,
classes de cîme et vigueur différentes ont été étudiés. Des mesures
échelonnées hebdomadairement durant la période de croissance de l'année
1961, ont montré la supériorité de la méthode de McLintock sur les deux
autres. Il semblerait donc que l'action réciproque des facteurs mis
en évidence d'après McLintock, est essentiellement valide même pour
une très courte période. Il est à souhaiter qu'une telle méthode soit
davantage répandue dans le Québec.

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