GROWTH AND YIELD OF JACK PINE

IN MIXED-EVEN-AGED STANDS

IN NORTHERN ONTARIO

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ABSTRACT

The growth and yield of jack pine in mixed-even-aged stands in northern Ontario is examined by using multiple linear regression techniques. Basal area, mean height, and volume growth are predicted on five biologically defined site types. Although it is recommended that, in general, the regression equations should be used for growth prediction, a set of variable density yield tables is also given to serve as guides for forest management.

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INTRODUCTION

Growth and yield prediction literature is extensive, ranging from the construction of local yield tables to those using differential and integral calculus. Since several authors, such as Spurr (1952), Husch (1963) and Moser (1967), have carried out detailed literature reviews on the subject, reference in this paper is made only to growth and yield studies of jack pine (*Pinus banksiana* Lamb.).

Bedell and MacLean (1952) have provided valuable data for the growth and yield of jack pine in the Nipigon area (northern Ontario), and particularly, their stratification of the plots according to biological site types has enriched present growth-prediction knowledge to a great extent. However, in Ontario, perhaps the most valuable contribution to jack pine growth and yield studies was made by Plonski (1956), who prepared normal yield tables for this species. Plonski's tables have been widely used in forest inventory and management, and not only for predicting future yield, but also for estimating the total and merchantable volume of growing stock.

Jack pine yield tables have also been prepared in Saskatchewan by Kabzem and Kirby (1956), in Manitoba by Bella (1968), and in Quebec by Bedell *et al.* (1953).

GROWTH PREDICTION

This report is based on a study of 136 permanent sample plots with a 5- to 10-year remeasurement period. Growth analysis was performed on data from jack pine stands mixed with trembling aspen (*Populus tremuloides* Michx.), white birch (*Betula papyrifera* Marsh.), balsam fir (*Abies balsamea* (L.) Mill.), and black spruce (*Picea mariana* (Mill.) BSP.). The plots contained (in terms of basal area) between 10 and 100% jack pine, and covered five biologically defined site types.

A detailed description of the techniques used for site classification and plot establishment may be found in an earlier paper by Bedell and MacLean (1952); therefore, only a brief definition is given here for each site type, as tabulated in Table 1. The ranges of some of the more important variables, the number of plots, and the mean jack pine percentage have been summarized by site types, and are presented in Table 2.

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Table 1. Site description summaries

	Site A	Site C	Site E	Site F	Site I
Occurrence	On gentle slopes of upland till, or on soils of lacustrine or fluvial origin	On steep to moderate slopes	on kames, eskers, outwash plains, light recessional moraines	adjacent to swamps, at the bases of kames, eskers, terraces, light recessional moraines, and on ridges	on outwash plains, tops of kames, eskers, dunes, steep till slopes
Soil	fine sand–clay	fine sand–clay	sand–gravel	sand–gravel, or clay	sand–gravel, fine sand–clay
Soil moisture	adequate– somewhat moist	dry	dry–adequate– somewhat moist	dry–adequate– somewhat moist– moist–very moist	very dry
Soil permeability	moderate–slow– very slow	moderate–slow– very slow	rapid	rapid or impermeable	rapid–mode-rate–slow– very slow
Species mixed with jack pine	black spruce white spruce trembling aspen white birch balsam fir	trembling aspen balsam fir black spruce white spruce white birch	white spruce trembling aspen white birch black spruce balsam fir	black spruce white birch trembling aspen balsam fir	black spruce trembling aspen

Table 2. Ranges of variables and jack pine content on sample plots

Sites	Number of plots	Age (yr)	Jack pine basal area (sq ft/ac)	Jack pine mean height (ft)	Mean jack pine percentage
A	23	34–135	36–144	45–81	59%
C	45	32–117	38–148	29–79	69%
E	43	35–130	48–139	42–72	75%
F	11	66–126	23– 97	42–77	46%
I	14	35– 51	58–116	27–44	91%
Combined	136	32–135	23–148	27–81	70%

Basal Area Growth

The basal area growth analysis included the examination of the following independent variables: maximum stand age, i.e., age of the largest trees in the plot, basal area per acre of trees $\geq$ 0.6" dbh irrespective of species, basal area per acre of trees $\geq$ 3.6" dbh irrespective of species, number of stems per acre of trees $\geq$ 0.6" dbh irrespective of species, number of stems per acre of trees $\geq$ 3.6" dbh irrespective of species, basal area per acre of jack pine trees $\geq$ 0.6" dbh, basal area per acre of jack pine trees $\geq$ 3.6" dbh, number of stems per acre of jack pine trees $\geq$ 0.6" dbh, mean height of trees $\geq$ 0.6" dbh, mean height of the 40 largest diameter trees per acre, mean height of jack pine trees $\geq$ 0.6" dbh, mean basal area per acre of trees $\geq$ 0.6" dbh, mean basal area per acre of trees $\geq$ 3.6" dbh, mean basal area per acre of jack pine trees $\geq$ 0.6" dbh, and the ratio of jack pine basal area per acre for trees $\geq$ 0.6" dbh to that of the stand.

The dependent variable was considered in the following forms: periodic annual increment (PAI) in basal area per acre of all jack pine trees $\geq$ 0.6" dbh, the logarithmic transformation of PAI in basal area of all jack pine trees $\geq$ 0.6" dbh, the logarithmic transformation of the ratio of PAI in basal area to total basal area for all trees $\geq$ 0.6" dbh, and total basal area of jack pine plus its PAI for trees $\geq$ 0.6" dbh.

The relationships between each form of the dependent variable and the above independent variables as well as some of their products,

ratios, powers, and the logarithmic transformation of age were examined next for model building, by using forward selection, stepwise regression, and backward elimination procedures (Draper and Smith, 1966). The biological meaning and practical applicability of the implied models were then examined; the most favourable *functional model* was in the form of PAI as dependent variable, with maximum stand age, basal area per acre of jack pine trees $\geq$ 0.6" dbh, mean height of the 40 largest diameter trees per acre, and mean basal area per acre of trees $\geq$ 3.6" dbh, as independent variables. This model was fitted separately to the data from each site type, resulting in an adequate regression for all except site F. The differences between these five regression surfaces were tested by the analysis of multiple covariance method (Freese, 1964; Snedecor and Cochran, 1967); a significant difference was obtained for levels (at P.01), but not for slopes (at P.05).

The examination of several more implied models, however, suggested that for *prediction*, the most *practical* and *durable* model is in the form of total basal area per acre of all jack pine trees $\geq$ 0.6" dbh plus its PAI as dependent variable (B_{a+1}), with basal area per acre of jack pine trees $\geq$ 0.6" dbh (B_a), and the inverse of maximum stand age ($1/A_a$) as independent variables (Table 3). The most "durable" model is defined here as the model which has the lowest average standard error when fitted to individual strata in a body of data, such as the five sites. Since PAI is small relative to jack pine basal area, the standard deviation of residuals (or standard error) rather than R^2, was the main criterion for appraising this model (Table 4).

This most durable model was also used to construct net, i.e., living trees only, basal area growth regressions, by changing the dependent variable to total basal area of jack pine trees $\geq$ 0.6" dbh plus its *net* PAI (Table 5).

Height Growth

At the time of plot establishment, height measurements were obtained on only two mechanically located trees per plot, and on one selected dominant tree per species per plot. At remeasurement, however, the data collection improved considerably, since 10 or more trees were measured per plot.

The mean height of jack pine per plot was calculated as follows. The individual tree height measurements, totalling 1,652, were first stratified according to site. A correlation and graphical study of the data within each stratum indicated that the relationship between total height and diameter at breast height is parabolic, and also that the slopes and levels of such curves might be affected by age. Therefore, the coefficients of the following regression were estimated separately for each of the five sites:

Table 3. Total basal area and mean height regressions for jack pine trees $\geq$ 0.6" dbh

$$Y = b_o + b_1 X_1 + b_2 X_2$$

Basal area (in square feet per acre)

Site A $\quad B_{a+1} = -1.005 + 1.010\ B_a + 106.735\ (1/A_a)$

Site C $\quad B_{a+1} = -0.548 + 1.007\ B_a + 85.722\ (1/A_a)$

Site E $\quad B_{a+1} = -0.820 + 1.007\ B_a + 113.614\ (1/A_a)$

Site F $\quad B_{a+1} = 1.100 + 0.999\ B_a - 37.597\ (1/A_a)$

Site I $\quad B_{a+1} = -1.644 + 1.008\ B_a + 123.336\ (1/A_a)$

Combined $\quad B_{a+1} = -0.797 + 1.008\ B_a + 92.843\ (1/A_a)$

Mean height (in feet)

Site A $\quad H_{a+1} = 0.419 + 1.000\ H_a - 0.002\ A_a$

Site C $\quad H_{a+1} = 0.799 + 0.994\ H_a + 0.001\ A_a$

Site E $\quad H_{a+1} = 0.525 + 1.000\ H_a - 0.002\ A_a$

Site F $\quad H_{a+1} = 0.337 + 1.006\ H_a - 0.004\ A_a$

Site I $\quad H_{a+1} = 0.701 + 1.007\ H_a - 0.007\ A_a$

Combined $\quad H_{a+1} = 0.709 + 1.001\ H_a - 0.005\ A_a$

Table 4. Some criteria for judging the reliability of the total basal
          area and mean height regressions

Sites	Number of plots	Mean Y	PAI	Standard error of regression	Standard error of b_1	b_2
Basal area (sq ft/ac)						
A	23	85.872	1.146	0.293	0.002	11.843
C	45	96.879	1.279	0.561	0.003	15.313
E	43	107.451	1.293	0.483	0.003	22.540
F	11	65.319	0.610	0.328	0.005	54.512
I	14	90.298	2.291	0.381	0.006	37.953
Combined	136	95.130	1.311	0.469	0.001	6.707
Mean height (ft)						
A	23	63.47	0.23	0.057	0.002	0.001
C	45	65.48	0.48	0.083	0.002	0.001
E	43	61.87	0.36	0.064	0.002	0.001
F	11	59.72	0.32	0.044	0.003	0.002
I	14	34.89	0.66	0.055	0.005	0.005
Combined	136	60.38	0.40	0.109	0.001	0.001

Table 5. Net (i.e., living trees only) basal area and net mean height
regressions for jack pine trees $\geq$ 0.6" dbh

	$Y = b_o + b_1 X_1 + b_2 X_2$	Standard error of regression
Basal area (sq ft/ac)		
Site A	$B_{a+1} = -1.969 + 1.008\ B_a + 114.288\ (1/A_a)$	1.026
Site C	$B_{a+1} = -0.573 + 0.990\ B_a + 121.870\ (1/A_a)$	0.981
Site E	$B_{a+1} = -1.135 + 0.993\ B_a + 157.130\ (1/A_a)$	0.896
Site F	$B_{a+1} = 1.840 + 0.985\ B_a - 88.262\ (1/A_a)$	0.592
Site I	$B_{a+1} = 1.110 + 0.983\ B_a + 71.770\ (1/A_a)$	0.335
Combined	$B_{a+1} = -1.077 + 0.997\ B_a + 113.404\ (1/A_a)$	0.905
Mean height (ft)		
Site A	$H_{a+1} = 0.693 + 0.998\ H_a - 0.003\ A_a$	0.097
Site C	$H_{a+1} = 0.913 + 0.996\ H_a - 0.001\ A_a$	0.099
Site E	$H_{a+1} = 0.575 + 1.002\ H_a - 0.003\ A_a$	0.080
Site F	$H_{a+1} = 0.536 + 1.003\ H_a - 0.003\ A_a$	0.054
Site I	$H_{a+1} = 1.109 + 1.003\ H_a - 0.010\ A_a$	0.060
Combined	$H_{a+1} = 0.893 + 1.001\ H_a - 0.006\ A_a$	0.120

$$H = b_o + b_1 D + b_2 D^2 + b_3 A$$

where: H is total height

D is diameter at breast height outside bark

A is maximum stand age, and

b_o, b_1, b_2, and b_3 are estimated regression coefficients.

These regressions were then used to estimate the mean height of jack pine per plot, at both plot establishment and at remeasurement.

The prediction of mean height growth of jack pine then followed a procedure similar to that of basal area. The independent variables consisted of maximum stand age, basal area per acre of jack pine trees $\geq$ 0.6" dbh, mean height of the 40 largest diameter trees per acre, mean height of jack pine trees $\geq$ 0.6" dbh, and some of their products, ratios, powers, as well as the logarithmic transformation of age. The dependent variable was examined in the form of PAI in height of all jack pine trees $\geq$ 0.6" dbh, and mean height of all jack pine trees $\geq$ 0.6" dbh plus its PAI. The resulting *functional* model was in the form of PAI as the dependent variable, with mean height of jack pine trees $\geq$ 0.6" dbh, and the ratio of maximum stand age and mean height of jack pine trees $\geq$ 0.6" dbh, as independent variables. However, for prediction, the most durable model was the one where the mean height of all jack pine trees $\geq$ 0.6" dbh (H_a) and the maximum stand age (A_a) were the independent variables, and the mean height of all jack pine trees $\geq$ 0.6" dbh plus its PAI (H_{a+1}) was the dependent variable (Tables 3 and 4).

Net mean height growth regressions were also derived for each site; this was done by replacing the PAI (of all trees) in the latter model with net PAI of jack pine (Table 5).

Volume Growth

The volume of jack pine per plot was calculated with the aid of Honer's (1967) volume tables. Then, the independent variables listed under basal area and mean height growth were examined for model building; the dependent variable was in the form of total volume of all jack pine trees $\geq$ 0.6" dbh.

The regression equation thus derived is:

$$V_a = b_o + b_1 (B_a H_a) + b_2 B_a + b_3 (H_a/A_a)$$

where: V is total volume of all jack pine trees $\geq$ 0.6" dbh

B is total basal area of all jack pine trees $\geq$ 0.6" dbh

H is mean height of all jack pine trees $\geq$ 0.6" dbh

A is maximum stand age

a refers to the start of the prediction period

b_o, b_1, b_2, and b_3 are estimated regression coefficients.

The numerical values of the regression coefficients are (for all five sites combined):

$$V_a = 88.8 + 0.408 \ (B_a H_a) + 2.184 \ B_a + 88.125 \ (H_a/A_a)$$

The PAI in volume was next obtained by integration (through approximation) of the above volume function (Hegyi, 1969). Thus:

$$PAI(volume) = b_1 (B_{a+1} H_{a+1} - B_a H_a) + b_2 (B_{a+1} - B_a) + b_3 (H_{a+1}/A_{a+1} - H_a/A_a)$$

where: a+1 refers to 1 year after the start of the prediction period.

Since basal area and mean height regressions were developed to give yield directly, the estimation of future stand volume is therefore a simple and short procedure, i.e., $V_{a+1} = V_a + PAI$.

YIELD TABLES

Although it is more accurate to use the regressions for growth and yield prediction (because they can account for exact stand conditions), some yield tables (for trees $\geq$ 0.6" dbh) are given in Appendices to serve as guides in forest management. Since the forward prediction period in these tables exceeds 10 years (maximum remeasurement period), only live trees were given increments, i.e., at each step of iteration, net values were used to start both the total and net regressions. For example,

$$B_{a+1} = b_o + b_1 (Net \ B_a) + b_2 (1/A_a)$$

$$H_{a+1} = b_o + b_1 (Net \ H_a) + b_2 A_a$$

Total or gross and net volumes in cubic feet per acre were then calcu-
lated from their corresponding values of basal area and mean height, by
using the stand volume regression. Possible discrepancies between the
yield tables and regressions are due to rounding off.

Since only 23, 11, and 14 plots were available on sites A, F,
and I, respectively, the application of the derived regressions to these
sites may be less reliable. Therefore, Yield Tables 1, 4, and 5 refer
only to average conditions as represented by the sample. However, for
sites C, E, and for all sites combined, variable density yield tables
have been prepared, using different basal area at age 30 for starting
values, i.e., at age 30 years, and at mean height 30 feet, basal area
was chosen to be 30, 50, 70, 90, 110 square feet per acre.

APPLICATION

The application of the regressions and yield tables presented in
this paper is restricted to populations which are within the ranges
given in Table 2. When site classification is either not available, or
is unreliable, it is recommended that the combined regressions or yield
tables be used.

Ideally, future yield should be estimated from the regression
equations rather than from the yield tables, and furthermore, reliable
inventory data should be used for the starting values.

As a test of application, the 136 permanent sample plots used
for obtaining estimates of the regression coefficients were subjected
to volume (total) yield prediction, while using separate regression co-
efficients for each site. Volume yield was first predicted to the end
of the remeasurement period through yearly iteration; then observed and
predicted values were tested for difference by treating them as paired
data. The results of these predictions are summarized in Table 6. The
differences between observed and predicted values are statistically not
significant (at $P.05$).

Table 6. Differences between predicted and observed total volumes

Sites	Number of plots	Mean difference (d) cu ft/ac	Standard deviation of d cu ft/ac	Standard error of mean d cu ft/ac
A	23	2.5	73.6	15.3
C	45	33.2	189.7	28.3
E	43	17.4	155.5	23.7
F	11	-0.3	72.5	21.8
I	14	1.3	55.7	14.9
Combined	136	20.8	144.8	12.4

Where: mean growth prediction period is 8.6 years, and the mean
observed increment over the growth prediction period is
405.2 cu ft/ac.

SUMMARY AND CONCLUSIONS

The growth and yield of jack pine was examined by using multiple
linear regression techniques. Basal area and mean height growth were
predicted separately; volume yield was then obtained through a stand
volume regression, by using basal area, mean height, and age as inde-
pendent variables. Although the direct application of the regressions
is recommended for growth prediction, yield tables are also given to
serve as guides for forest management.

Since site index in mixed stands is considered to have little
meaning, a biological classification of sites has been adopted in this
paper. Such a stratification has partly accounted for some of the vari-
ability in jack pine growth caused by the influence of other species.
This statement is based on the examination of the performance of the
ratio of jack pine in the stand, as independent variable, in both the
basal area and mean height regressions, when obtained separately for
each site, then for combined sites.

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APPENDICES

Yield Tables

(for jack pine trees $\geq$ 0.6" dbh)

N.B. The following Yield Tables are based on the regression equations given in Tables 3 and 5, and on the combined total volume equation. Since the maximum remeasurement period of the data is 10 years, the Yield Tables should also be used only for 10-year forecasts. For example, the values at say age 30 should not be forecast to age 110 but only to age 40, or values at say age 70 should only be forecast to age 80. Furthermore, yield forecasts for a particular stand should only be made if that stand's age, basal area, height, and volume coincide with the starting values given in the relevant Yield Table. In general, the following Yield Tables were developed mainly to provide guidelines for forest management; for forecasting the yield of a particular stand, the relevant regression equations should be used.

Yield Table 1. Yields per acre for jack pine ($\geq$ 0.6" dbh) on Site A
(based on average conditions as represented by sample)

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	30.00	30.00	42.00	42.00	545.2	-	545.2	-
35	40.24	39.42	44.40	44.54	794.1	44.5	779.5	44.3
40	47.62	46.76	46.86	47.00	1000.5	39.2	984.5	38.9
45	53.43	52.53	49.23	49.36	1182.7	34.6	1165.3	34.3
50	57.98	57.06	51.51	51.63	1343.8	30.6	1325.0	30.3
55	61.53	60.59	53.70	53.81	1485.8	26.9	1465.7	26.6
60	64.23	63.27	55.80	55.90	1610.1	23.4	1588.7	23.2
65	66.22	65.25	57.81	57.91	1717.6	20.2	1695.0	19.9
70	67.59	66.60	59.73	59.82	1809.0	17.0	1785.2	16.7
75	68.41	67.41	61.56	61.65	1884.9	13.9	1859.9	13.7
80	68.73	67.73	63.31	63.39	1945.4	10.8	1919.4	10.6
85	68.60	67.60	64.98	65.05	1990.9	7.9	1963.9	7.7
90	68.07	67.05	66.56	66.63	2021.6	4.9	1993.6	4.7
95	67.14	66.12	68.06	68.12	2037.5	2.0	2008.7	1.8
100	65.85	64.83	69.48	69.54	2038.8	-0.9	2009.2	-1.0
105	64.21	63.19	70.82	70.87	2025.6	-3.8	1995.2	-3.9
110	62.23	61.21	72.08	72.12	1997.8	-6.7	1966.8	-6.8

Yield Table 2a. Yields per acre for jack pine ($\geq$ 0.6" dbh) on Site C.
Basal area class 30

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	– *	30.00	–	30.00	–	–	433.5	–
35	–	44.49	–	33.75	–	–	713.9	54.9
40	–	55.76	–	37.41	–	–	979.7	51.9
45	64.82	64.58	40.86	40.97	1231.4	49.5	1229.6	48.6
50	71.91	71.48	44.32	44.42	1468.6	46.0	1462.7	45.2
55	77.41	76.82	47.68	47.78	1688.1	42.4	1678.3	41.7
60	81.62	80.90	50.95	51.05	1889.7	38.8	1876.2	38.1
65	84.77	83.95	54.12	54.22	2073.3	35.2	2056.4	34.6
70	87.03	86.13	57.21	57.30	2239.1	31.7	2219.1	31.1
75	88.55	87.59	60.20	60.29	2387.5	28.3	2364.7	27.7
80	89.45	88.44	63.11	63.19	2518.9	24.9	2493.5	24.4
85	89.83	88.78	65.93	66.01	2633.9	21.7	2606.2	21.2
90	89.75	88.69	68.67	68.74	2733.2	18.6	2703.4	18.2
95	89.30	88.22	71.32	71.38	2817.4	15.6	2785.8	15.3
100	88.53	87.44	73.89	73.95	2887.3	12.8	2854.0	12.5
105	87.49	86.40	76.38	76.44	2943.5	10.2	2909.0	9.9
110	86.22	85.13	78.80	78.85	2987.0	7.7	2951.3	7.4

* Missing values are due to insufficient data.

Yield Table 2b. Yields per acre for jack pine ($\geq$0.6" dbh) on Site C
Basal area class 50

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	– *	50.00	–	30.00	–	–	722.0	–
35	–	63.55	–	33.75	–	–	1018.2	57.8
40	74.21	73.94	37.30	37.41	1298.6	55.2	1296.9	54.2
45	82.42	81.91	40.86	40.97	1563.5	51.4	1557.1	50.5
50	88.69	87.99	44.32	44.42	1808.8	47.4	1798.1	46.6
55	93.41	92.56	47.68	47.78	2034.4	43.5	2019.6	42.7
60	96.87	95.90	50.95	51.05	2240.1	39.5	2221.5	38.8
65	99.31	98.25	54.12	54.22	2426.2	35.6	2404.1	34.9
70	100.89	99.76	57.21	57.30	2592.9	31.8	2567.7	31.2
75	101.76	100.58	60.20	60.29	2740.9	28.1	2712.8	27.5
80	102.04	100.83	63.11	63.19	2870.7	24.5	2840.0	24.0
85	101.83	100.59	65.93	66.01	2983.0	21.1	2950.0	20.6
90	101.19	99.94	68.67	68.74	3078.7	17.8	3043.7	17.4
95	100.21	98.95	71.32	71.38	3158.6	14.7	3121.7	14.4
100	98.93	97.67	73.89	73.95	3223.4	11.8	3185.0	11.5
105	97.40	96.14	76.38	76.44	3274.0	9.0	3234.3	8.7
110	95.66	94.42	78.80	78.85	3311.3	6.4	3270.5	6.2

* Missing values are due to insufficient data.

Yield Table 2c. Yields per acre for jack pine (≥ 0.6" dbh) on Site C
Basal area class 70

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	70.00	70.00	30.00	30.00	1010.6	-	1010.6	-
35	82.89	82.61	33.64	33.75	1323.4	61.8	1322.5	60.7
40	92.68	92.11	37.30	37.41	1620.2	57.6	1614.1	56.6
45	100.03	99.23	40.86	40.97	1895.5	53.3	1884.6	52.3
50	105.48	104.50	44.32	44.42	2149.1	48.9	2133.5	48.0
55	109.41	108.30	47.68	47.78	2380.7	44.5	2360.9	43.7
60	112.12	110.91	50.95	51.05	2590.5	40.2	2566.9	39.4
65	113.84	112.55	54.12	54.22	2779.0	36.0	2751.8	35.3
70	114.74	113.39	57.21	57.30	2946.7	31.8	2916.2	31.2
75	114.97	113.58	60.20	60.29	3094.2	27.9	3060.8	27.3
80	114.63	113.21	63.11	63.19	3222.4	24.1	3186.4	23.6
85	113.83	112.39	65.93	66.01	3332.1	20.5	3293.8	20.0
90	112.63	111.19	68.67	68.74	3424.3	17.0	3383.9	16.6
95	111.11	109.67	71.32	71.38	3499.7	13.8	3457.6	13.4
100	109.32	107.89	73.89	73.95	3559.5	10.7	3515.9	10.4
105	107.30	105.89	76.38	76.44	3604.5	7.8	3559.6	7.6
110	105.10	103.71	78.80	78.85	3635.6	5.1	3589.7	4.9

Yield Table 2d.   Yields per acre for jack pine ($\geq$ 0.6" dbh) on Site C
                  Basal area class 90

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	90.00	90.00	30.00	30.00	1299.2	-	1299.2	-
35	102.27	101.68	33.64	33.75	1631.8	64.8	1626.8	63.6
40	111.15	110.28	37.30	37.41	1941.7	60.0	1931.3	59.0
45	117.64	116.55	40.86	40.97	2227.6	55.2	2212.0	54.2
50	122.26	121.01	44.32	44.42	2489.3	50.4	2469.0	49.4
55	125.41	124.03	47.68	47.78	2727.0	45.6	2702.2	44.7
60	127.37	125.91	50.95	51.05	2941.0	40.9	2912.2	40.1
65	128.38	126.85	54.12	54.22	3131.9	36.3	3099.5	35.6
70	128.60	127.02	57.21	57.30	3300.5	31.9	3264.7	31.3
75	128.17	126.57	60.20	60.29	3447.6	27.7	3408.9	27.1
80	127.22	125.60	63.11	63.19	3574.2	23.7	3532.9	23.2
85	125.83	124.20	65.93	66.01	3681.3	19.8	3637.6	19.4
90	124.07	122.44	68.67	68.74	3769.8	16.2	3724.2	15.9
95	122.01	120.40	71.32	71.38	3840.9	12.8	3793.6	12.5
100	119.71	118.11	73.89	73.95	3895.6	9.6	3846.8	9.4
105	117.21	115.64	76.38	76.44	3935.0	6.6	3884.9	6.4
110	114.55	113.00	78.80	78.85	3959.9	3.8	3909.0	3.7

Yield Table 2c. Yields per acre for jack pine ($\geq$ 0.6" dbh) on Site C
Basal area class 110

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	110.00	110.00	30.00	30.00	1587.7	-	1587.7	-
35	121.65	120.74	33.64	33.75	1940.2	67.8	1931.1	66.6
40	129.63	128.45	37.30	37.41	2263.3	62.4	2248.4	61.3
45	135.25	133.87	40.86	40.97	2559.7	57.1	2539.5	56.1
50	139.04	137.52	44.32	44.42	2829.6	51.8	2804.4	50.9
55	141.40	139.77	47.68	47.78	3073.2	46.6	3043.5	45.7
60	142.62	140.91	50.95	51.05	3291.4	41.6	3257.5	40.8
65	142.91	141.15	54.12	54.22	3484.7	36.7	3447.1	36.0
70	142.45	140.65	57.21	57.30	3654.2	32.0	3613.3	31.4
75	141.38	139.56	60.20	60.29	3800.9	27.5	3757.0	26.9
80	139.81	137.98	63.11	63.19	3925.9	23.3	3879.3	22.8
85	137.82	136.00	65.93	66.01	4030.4	19.2	3981.4	18.8
90	135.51	133.70	68.67	68.74	4115.4	15.5	4064.5	15.1
95	132.92	131.12	71.32	71.38	4182.1	11.9	4129.5	11.6
100	130.10	128.34	73.89	73.95	4231.7	8.6	4177.7	8.3
105	127.12	125.38	76.38	76.44	4265.4	5.5	4210.3	5.3
110	123.99	122.29	78.80	78.85	4284.2	2.6	4228.2	2.4

Yield Table 3a. Yields per acre for jack pine ($\geq$ 0.6" dbh) on Site E
Basal area class 30

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	– *	30.00	–	30.00	–	–	433.5	–
35	–	47.63	–	32.76	–	–	747.2	60.4
40	–	61.38	–	35.47	–	–	1033.9	55.2
45	72.44	72.16	38.05	38.15	1297.8	51.3	1295.4	50.5
50	81.11	80.61	40.68	40.78	1541.2	46.9	1534.8	46.1
55	87.86	87.18	43.27	43.36	1763.1	42.6	1752.9	41.9
60	93.04	92.22	45.81	45.90	1964.3	38.6	1950.8	37.9
65	96.92	95.99	48.30	48.40	2145.9	34.7	2129.2	34.1
70	99.72	98.70	50.75	50.84	2308.3	31.0	2288.9	30.4
75	101.61	100.52	53.15	53.25	2452.4	27.3	2430.4	26.8
80	102.71	101.57	55.50	55.60	2578.8	23.8	2554.5	23.4
85	103.15	101.97	57.81	57.91	2688.1	20.5	2661.7	20.1
90	103.03	101.82	60.06	60.16	2780.9	17.2	2752.6	16.9
95	102.41	101.19	62.27	62.37	2857.8	14.1	2827.9	13.8
100	101.38	100.14	64.43	64.53	2919.5	11.1	2888.2	10.8
105	99.98	98.74	66.54	66.64	2966.6	8.2	2934.1	8.0
110	98.26	97.03	68.60	68.69	2999.8	5.5	2966.2	5.3

* Missing values are due to insufficient data.

Yield Table 3b. Yields per acre for jack pine ($\geq$ 0.6" dbh) on Site E
Basal area class 50

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	– *	50.00	–	30.00	–	–	722.0	–
35	–	66.95	–	32.76	–	–	1047.8	62.6
40	80.30	80.05	35.38	35.47	1345.9	58.2	1344.6	57.2
45	90.72	90.19	38.05	38.15	1621.6	53.1	1615.5	52.2
50	98.77	98.03	40.68	40.78	1872.9	48.4	1862.7	47.6
55	104.92	104.01	43.27	43.36	2101.5	43.9	2087.5	43.2
60	109.52	108.48	45.81	45.90	2308.4	39.6	2290.8	39.0
65	112.84	111.70	48.30	48.40	2494.4	35.5	2473.7	34.9
70	115.10	113.87	50.75	50.84	2660.4	31.6	2636.8	31.0
75	116.46	115.17	53.15	53.25	2807.1	27.8	2780.9	27.3
80	117.06	115.73	55.50	55.60	2935.2	24.1	2906.6	23.7
85	117.01	115.65	57.81	57.91	3045.4	20.6	3014.7	20.2
90	116.42	115.03	60.06	60.16	3138.4	17.2	3105.8	16.8
95	115.35	113.95	62.27	62.37	3214.8	13.9	3180.6	13.6
100	113.87	112.47	64.43	64.53	3275.4	10.8	3239.8	10.6
105	112.05	110.65	66.54	66.64	3320.8	7.9	3284.0	7.6
110	109.93	108.53	68.60	68.69	3351.7	5.0	3313.9	4.8

* Missing values are due to insufficient data.

Yield Table 3c.   Yields per acre for jack pine ($\geq$ 0.6" dbh) on Site E
Basal area class 70

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	– *	70.00	–	30.00	–	–	1010.6	–
35	–	86.27	–	32.76	–	–	1348.3	64.9
40	99.22	98.71	35.38	35.47	1660.5	60.2	1655.6	59.1
45	108.99	108.22	38.05	38.15	1945.3	54.8	1935.7	53.9
50	116.42	115.45	40.68	40.78	2204.7	49.9	2190.7	49.0
55	121.97	120.83	43.27	43.36	2440.0	45.1	2422.0	44.4
60	125.99	124.73	45.81	45.90	2652.4	40.7	2630.9	40.0
65	128.76	127.40	48.30	48.40	2842.9	36.3	2818.1	35.7
70	130.47	129.04	50.75	50.84	3012.5	32.2	2984.7	31.6
75	131.31	129.82	53.15	53.25	3161.7	28.2	3131.3	27.7
80	131.41	129.88	55.50	55.60	3291.6	24.4	3258.8	23.9
85	130.88	129.32	57.81	57.91	3402.7	20.7	3367.8	20.3
90	129.81	128.24	60.06	60.16	3495.9	17.2	3459.1	16.8
95	128.28	126.71	62.27	62.37	3571.9	13.8	3533.4	13.5
100	126.37	124.79	64.43	64.53	3631.3	10.6	3591.4	10.3
105	124.12	122.55	66.54	66.64	3675.0	7.5	3633.9	7.2
110	121.59	120.04	68.60	68.69	3703.7	4.5	3661.6	4.3

* Missing values are due to insufficient data.

Yield Table 3d. Yields per acre for jack pine (> 0.6" dbh) on Site E
            Basal area class 90

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	90.00	90.00	30.00	30.00	1299.2	–	1299.2	–
35	106.02	105.59	32.66	32.76	1651.8	68.4	1648.8	67.2
40	118.14	117.37	35.38	35.47	1975.0	62.2	1966.6	61.1
45	127.27	126.25	38.05	38.15	2269.1	56.6	2255.8	55.6
50	134.08	132.86	40.68	40.78	2536.4	51.3	2518.6	50.5
55	139.03	137.66	43.27	43.36	2778.4	46.4	2756.6	45.6
60	142.47	140.99	45.81	45.90	2996.4	41.7	2970.9	41.0
65	144.67	143.10	48.30	48.40	3191.5	37.2	3162.6	36.5
70	145.85	144.21	50.75	50.84	3364.5	32.8	3332.6	32.3
75	146.17	144.48	53.15	53.25	3516.4	28.7	3481.8	28.2
80	145.76	144.04	55.50	55.60	3648.0	24.7	3610.9	24.2
85	144.74	143.00	57.81	57.91	3760.0	20.8	3720.8	20.4
90	143.20	141.45	60.06	60.16	3853.4	17.2	3812.3	16.8
95	141.22	139.47	62.27	62.37	3928.9	13.6	3886.1	13.3
100	138.87	137.12	64.43	64.53	3987.2	10.3	3943.0	10.0
105	136.19	134.46	66.54	66.64	4029.2	7.1	3983.8	6.9
110	133.25	131.54	68.60	68.69	4055.7	4.0	4009.2	3.8

Yield Table 3e. Yields per acre for jack pine ($\geq$ 0.6" dbh) on Site E
Basal area class 110

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	110.00	110.00	30.00	30.00	1587.7	–	1587.7	–
35	125.61	124.91	32.66	32.76	1955.7	70.7	1949.3	69.5
40	137.06	136.04	35.38	35.47	2289.6	64.2	2277.6	63.1
45	145.55	144.28	38.05	38.15	2592.9	58.3	2575.9	57.3
50	151.73	150.28	40.68	40.78	2868.1	52.8	2846.5	51.9
55	156.08	154.49	43.27	43.36	3116.9	47.6	3091.1	46.8
60	158.95	157.24	45.81	45.90	3340.5	42.7	3310.9	42.0
65	160.59	158.80	48.30	48.40	3540.0	38.0	3507.1	37.3
70	161.22	159.38	50.75	50.84	3716.6	33.5	3680.5	32.9
75	161.02	159.13	53.15	53.25	3871.1	29.1	3832.2	28.6
80	160.11	158.19	55.50	55.60	4004.4	25.0	3963.1	24.5
85	158.60	156.67	57.81	57.91	4117.4	21.0	4073.9	20.6
90	156.59	154.66	60.06	60.16	4210.9	17.1	4165.5	16.8
95	154.15	152.23	62.27	62.37	4285.9	13.5	4238.8	13.2
100	151.36	149.45	64.43	64.53	4343.1	10.0	4294.6	9.7
105	148.26	146.37	66.54	66.64	4383.4	6.7	4333.7	6.5
110	144.91	143.04	68.60	68.69	4407.6	3.5	4356.9	3.4

Yield Table 4.   Yields per acre for jack pine ($\geq$ 0.6" dbh) on Site F
(based on average conditions as represented by sample)

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
60	– *	20.00	–	40.00	–	–	400.2	–
65	–	20.55	–	42.15	–	–	430.1	6.8
70	–	21.57	–	44.25	–	–	469.9	8.7
75	23.23	22.97	46.19	46.28	523.3	10.3	518.5	10.3
80	24.89	24.65	48.17	48.26	579.5	11.8	575.0	11.8
85	26.77	26.54	50.09	50.17	642.7	13.1	638.4	13.1
90	28.82	28.60	51.95	52.03	712.1	14.3	707.7	14.2
95	30.99	30.77	53.75	53.82	786.6	15.2	782.1	15.2
100	33.25	33.02	55.48	55.55	865.5	16.0	860.8	16.0
105	35.56	35.33	57.14	57.21	948.0	16.7	943.0	16.6
110	37.90	37.66	58.75	58.81	1033.4	17.2	1028.0	17.1

* Missing values are due to insufficient data.

Yield Table 5. Yields per acre for jack pine (> 0.6" dbh) on Site I
(based on average conditions as represented by sample)

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	50.00	50.00	25.00	25.00	634.7	-	634.7	-
35	62.30	61.98	29.12	29.31	892.1	51.7	891.9	51.4
40	71.88	71.50	33.27	33.43	1148.7	50.8	1146.9	50.5
45	79.53	79.09	37.23	37.35	1398.1	49.1	1394.3	48.6
50	85.65	85.16	40.99	41.08	1636.5	46.6	1630.5	46.2
55	90.54	90.02	44.54	44.61	1861.2	43.7	1853.0	43.3
60	94.42	93.88	47.89	47.93	2070.5	40.5	2060.1	40.1

Yield Table 6a. Yields per acre for jack pine (> 0.6" dbh) on combined sites
                 Basal area class 30

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	30.00	30.00	30.00	30.00	433.5	–	433.5	–
35	41.99	41.86	33.59	33.73	671.6	47.3	671.6	46.7
40	51.47	51.15	37.20	37.34	901.0	44.8	898.1	44.2
45	58.97	58.50	40.70	40.83	1117.5	42.2	1111.7	41.6
50	64.89	64.30	44.07	44.20	1320.2	39.3	1311.5	38.8
55	69.55	68.87	47.32	47.44	1508.2	36.4	1496.8	35.8
60	73.17	72.42	50.44	50.55	1681.0	33.3	1667.1	32.8
65	75.93	75.12	53.43	53.54	1838.2	30.1	1821.9	29.7
70	77.96	77.10	56.29	56.40	1979.6	27.0	1961.1	26.5
75	79.36	78.46	59.03	59.13	2105.0	23.8	2084.5	23.4
80	80.23	79.30	61.64	61.73	2214.6	20.6	2192.2	20.2
85	80.63	79.68	64.11	64.20	2308.4	17.5	2284.4	17.1
90	80.62	79.66	66.46	66.54	2386.8	14.4	2361.2	14.1
95	80.25	79.28	68.67	68.75	2449.9	11.4	2423.0	11.1
100	79.57	78.60	70.75	70.83	2498.2	8.4	2470.2	8.2
105	78.61	77.64	72.70	72.76	2532.1	5.6	2503.2	5.4
110	77.40	76.43	74.51	74.57	2552.1	2.9	2522.4	2.7

Yield Table 6b. Yields per acre for jack pine (≥ 0.6" dbh) on combined sites
Basal area class 50

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	50.00	50.00	30.00	30.00	722.0	–	722.0	–
35	61.93	61.57	33.59	33.73	988.5	52.4	986.1	51.7
40	71.13	70.58	37.20	37.34	1242.3	49.6	1236.6	48.9
45	78.33	77.65	40.70	40.83	1481.6	46.6	1472.6	45.9
50	83.98	83.18	44.07	44.20	1705.2	43.4	1693.2	42.8
55	88.36	87.47	47.32	47.44	1912.6	40.1	1897.6	39.5
60	91.72	90.75	50.44	50.55	2103.2	36.7	2085.4	36.2
65	94.21	93.18	53.43	53.54	2276.7	33.3	2256.2	32.7
70	95.97	94.90	56.29	56.40	2432.8	29.8	2409.9	29.3
75	97.11	96.01	59.03	59.13	2571.5	26.3	2546.4	25.9
80	97.72	96.60	61.64	61.73	2693.0	22.9	2665.9	22.5
85	97.87	96.73	64.11	64.20	2797.4	19.5	2768.4	19.1
90	97.62	96.46	66.46	66.54	2884.9	16.1	2854.3	15.8
95	97.01	95.84	68.67	68.75	2956.0	12.9	2923.9	12.6
100	96.08	94.92	70.75	70.83	3011.0	9.7	2977.7	9.5
105	94.89	93.72	72.70	72.76	3050.5	6.6	3016.1	6.4
110	93.44	92.29	74.51	74.57	3074.9	3.6	3039.6	3.5

Yield Table 6c. Yields per acre for jack pine ($\geq$ 0.6" dbh) on combined sites
Basal area class 70

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	70.00	70.00	30.00	30.00	1010.6	–	1010.6	–
35	81.86	81.28	33.59	33.73	1305.4	57.5	1300.5	56.7
40	90.78	90.01	37.20	37.34	1583.7	54.3	1575.2	53.6
45	97.70	96.79	40.70	40.83	1845.6	51.0	1833.6	50.3
50	103.07	102.05	44.07	44.20	2090.3	47.5	2074.9	46.8
55	107.18	106.07	47.32	47.44	2317.1	43.8	2298.4	43.2
60	110.26	109.08	50.44	50.55	2525.5	40.1	2503.7	39.5
65	112.48	111.25	53.43	53.54	2715.1	36.4	2690.6	35.8
70	113.98	112.71	56.29	56.40	2886.0	32.6	2858.8	32.1
75	114.87	113.56	59.03	59.13	3038.0	28.9	3008.4	28.4
80	115.22	113.90	61.64	61.73	3171.4	25.1	3139.5	24.7
85	115.12	113.78	64.11	64.20	3286.3	21.5	3252.4	21.1
90	114.61	113.26	66.46	66.54	3383.1	17.9	3347.4	17.5
95	113.76	112.40	68.67	68.75	3462.1	14.4	3424.8	14.1
100	112.59	111.24	70.75	70.83	3523.9	10.9	3485.2	10.7
105	111.16	109.81	72.70	72.76	3568.8	7.6	3529.0	7.4
110	109.48	108.14	74.51	74.57	3597.6	4.4	3556.8	4.3

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Yield Table 6d.   Yields per acre for jack pine (> 0.6" dbh) on combined sites
                  Basal area class 90

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	90.00	90.00	30.00	30.00	1299.2	-	1299.2	-
35	101.80	100.99	33.59	33.73	1622.2	62.6	1615.0	61.8
40	110.43	109.44	37.20	37.34	1925.0	59.1	1913.8	58.3
45	117.07	115.94	40.70	40.83	2209.7	55.4	2194.6	54.6
50	122.16	120.92	44.07	44.20	2475.4	51.5	2456.6	50.8
55	125.99	124.67	47.32	47.44	2721.5	47.6	2699.2	46.9
60	128.80	127.41	50.44	50.55	2947.7	43.6	2922.1	42.9
65	130.76	129.32	53.43	53.54	3153.6	39.5	3124.9	38.9
70	132.00	130.52	56.29	56.40	3339.2	35.4	3307.6	34.9
75	132.62	131.12	59.03	59.13	3504.6	31.4	3470.3	30.9
80	132.72	131.19	61.64	61.73	3649.8	27.4	3613.2	26.9
85	132.36	130.83	64.11	64.20	3775.3	23.5	3736.4	23.1
90	131.61	130.07	66.46	66.54	3881.3	19.6	3840.5	19.2
95	130.51	128.97	68.67	68.75	3968.2	15.8	3925.7	15.5
100	129.10	127.57	70.75	70.83	4036.7	12.2	3992.7	11.9
105	127.43	125.90	72.70	72.76	4087.2	8.6	4041.9	8.4
110	125.52	124.00	74.51	74.57	4120.3	5.2	4074.0	5.0

Yield Table 6e. Yields per acre for jack pine (≥ 0.6" dbh) on combined sites
Basal area class 110

Age	Basal area (gross) sq ft	Basal area (net) sq ft	Mean height (gross) ft	Mean height (net) ft	Volume (gross) cu ft	CAI of volume (gross) cu ft	Volume (net) cu ft	CAI of volume (net) cu ft
30	110.00	110.00	30.00	30.00	1587.7	–	1587.7	–
35	121.74	120.70	33.59	33.73	1939.1	67.7	1929.5	66.8
40	130.08	128.87	37.20	37.34	2266.4	63.8	2252.4	63.0
45	136.44	135.09	40.70	40.83	2573.7	59.8	2555.5	59.0
50	141.25	139.79	44.07	44.20	2860.5	55.6	2838.3	54.8
55	144.81	143.27	47.32	47.44	3126.0	51.3	3100.0	50.6
60	147.35	145.75	50.44	50.55	3369.9	47.0	3340.4	46.3
65	149.03	147.39	53.43	53.54	3592.1	42.6	3559.2	42.0
70	150.01	148.33	56.29	56.40	3792.4	38.3	3756.5	37.7
75	150.37	148.67	59.03	59.13	3971.1	34.0	3932.3	33.4
80	150.22	148.49	61.64	61.73	4128.2	29.7	4086.8	29.2
85	149.61	147.87	64.11	64.20	4264.2	25.5	4220.4	25.0
90	148.61	146.87	66.46	66.54	4379.4	21.4	4333.6	21.0
95	147.26	145.53	68.67	68.75	4474.4	17.3	4426.6	17.0
100	145.61	143.89	70.75	70.83	4549.5	13.4	4500.2	13.1
105	143.70	141.99	72.70	72.76	4605.6	9.7	4554.8	9.4
110	141.56	139.86	74.51	74.57	4643.1	6.0	4591.2	5.8