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Computation of Southern Pine Site Index Using a TI-59 Calculator

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SUMMARY

A program is described that permits computation of site index in the field using a Texas Instruments model TI-59 programmable, hand-held, battery-powered calculator. Based on a series of equations developed by R.M. Farrar, Jr., for the site index curves in USDA Miscellaneous Publication 50, the program can accommodate any index base age, tree age, and height within wide limits for the four principal southern pine species: loblolly (*Pinus taeda* L.), longleaf (*P. palustris* Mill.), shortleaf (*P. enchinata* Mill.) and slash pine (*P. elliottii* Engelm.). Small errors in estimating average stand age or height cause large errors in estimating site index, especially for young stands. The program is used to explore the sensitivity of site index estimates to age and height errors.

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INTRODUCTION

Forest management is influenced by the productivity of the tract supporting the timber. Site index — the expected average height of the dominant and codominant stems in a stand at a reference base age — is a measure of the productive capacity of the land for a given species. Traditional methods of computing site index require lengthy calculations back at the office. To determine approximate site index of southern pine stands in the field, foresters have often relied upon ocular interpolation of the curves for index base age 50 presented in Miscellaneous Publication 50 (USDA Forest Service 1976). But ocular interpretation of site index differences for young stands is very difficult and translation to other index base ages is also difficult with the curves.

This report contains a listing of the program for a Texas Instruments model TI-59 calculator[1] that allows foresters to compute site index quickly and accurately in the field. The program also enables foresters to translate indexes to different base ages, to compare expected heights at different ages on the same site, and to compare site indexes implied by differing heights of trees the same age. Finally, a sensitivity analysis of site index estimates is reported that illustrates the inaccuracy resulting from small errors in determining stand age and stand height.

PROGRAM BACKGROUND

Farrar (1973) expressed the site index curves in Miscellaneous Publication 50 as equations having the form:

$$\begin{aligned}\text{Log(SI)} = \text{Log(ATH)} &+ b_1\left[\frac{1}{\text{IBA}} - \frac{1}{\text{ATA}}\right] \\ &+ b_2\left[\left(\frac{1}{\text{IBA}}\right)^2 - \left(\frac{1}{\text{ATA}}\right)^2\right] \\ &+ b_3\left[\left(\frac{1}{\text{IBA}}\right)^3 - \left(\frac{1}{\text{ATA}}\right)^3\right] \\ &+ b_4\left[\left(\frac{1}{\text{IBA}}\right)^4 - \left(\frac{1}{\text{ATA}}\right)^4\right]\end{aligned}$$

where Log = logarithm, base 10
SI = site index
ATH = average total height of the dominant and co-dominant trees in a stand
IBA = site index base age
ATA = average total age-from-seed of the dominant and co-dominant trees in the stand

Farrar (1975) later developed a FORTRAN program to calculate site index (or height) arrays from inputs of index base age, average tree age and average height (or site index).

The calculator program presented here (appendix, Program Listing) uses coefficients Farrar (1975) developed to describe site index curves in Miscellaneous Publication 50. Thus, the same limitations regarding age, site index, and average height apply (table 1).

The User Instructions contain five basic steps (appendix). The first step initializes the program's parameters and prepares the calculator for one of the next four steps, each a different program option.

Step 1: Program Initialization

During initialization, the calculator memory is partitioned between storage for program steps and for constants and the program is entered into calculator memory. If the memory is not partitioned properly, the program cannot be loaded. Program

[1]The use of trade, firm, or corporation names in this report is for the information and convenience of the reader. Such use does not constitute official endorsement or approval of the product or firm by the USDA to the exclusion of others which may be suitable.

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Table 1.——*Limits for species equations*[1]

	Loblolly	Longleaf	Shortleaf	Slash
Age limits (years)	10–80	15–100	10–100	10–60
SI limits, base age 50 (feet)	60–120	40–120	40–100	60–100

[1]From Farrar (1975, table 1).

execution begins with the constants for the desired species being retrieved from storage and positioned in the general equation subroutine. The program moves automatically to step 2 after completing initialization.

Step 2: Site Index Calculation

This step, the subroutine labeled E inside the program, automatically calculates the average total age and average total height of the stand at the sampling point from the ages and heights of individual trees. The calculator display prompts the user for data using a numerical code. When the display contains 1111111111, the next datum needed is the site index base age; 2222222222, the tree age; 3333333333, the tree height. Ages and heights for a minimum of 10 dominant and codominant trees should be measured and entered. The display flashes the number of trees already entered before prompting the user for the next age. A zero is entered for tree age after the data for all trees at a sampling point are entered, causing the program to prepare for index calculation. The program asks for the index base age, then computes average age, average height and site index of the stand. The average age and average height flash in the display and site index is displayed. If the calculator is attached to a PC-100 printer, the results are also printed.

From Step 2, the user can branch to any of the next three steps by entering the appropriate letter (A,B, or C). If the calculation of site index is desired at another sample location in the stand, press "RUN/STOP" and the program will recycle and prepare for the first tree age at the next sample location. Previously calculated site indexes, average ages or average heights are not stored in calculator memory. For a different species, go back to step 1.4.

Step 3: Height Projection

This step, the subroutine labeled A inside the program, calculates an expected height for each age specified by the user, given site index and index base age, the inverse of step 2. Step 3 can also be used to convert from one index base age to another. For example, a particular stand of longleaf pine may have a site index of 70, base age 25. At age 50, the dominant and codominant trees would have an average height of 110 feet. Because age 50 can also be considered an index base age, the height at this age becomes the site index — 110 feet.

When the program displays 4444444444, enter site index. After entering the age for which height is desired, the program calculates expected height. Press "RUN/STOP" to recycle for another age. All the variables entered are also printed if a PC-100 printer is attached.

Step 4: Height Vector

This step, the subroutine labeled B inside the program, calculates a vector of expected average heights of dominant and codominant trees for a vector of average stand ages. The user specifies site index, base age, and the increment between ages when heights are desired. The program prompts 5555555555 for the age increment in years. The program begins at age 10 (15 for longleaf) and continues computing heights for each age until the upper age limit is reached (table 1). When the upper age limit is reached, 9876543210 is displayed. Both the age and height vectors are printed if a PC-100 printer is attached.

Step 5: Site Index Vector

The site index vector, the subroutine labeled C inside the program, is similar to the height vector. The user specifies the stand age, index base age, height increment and the maximum height desired. The program calculates the site index associated with each height, beginning at 10 feet, for the specified average stand age. The program prints 999 for output if site index is less than 10 feet or greater than 170 feet. The end of the vector is marked by 987654321. The height and site index vectors are both printed if a PC-100 printer is attached.

Using the Program

Foresters should thoroughly familiarize themselves with the program before using it in the field the first time. The following 10 operations should be performed.

1. Keystroke the program (appendix) into the machine after properly partitioning the memory.
2. Write 2 sets of cards for the program.
3. Clear the memory.

4. Reload the recorded program.
5. Run a complete listing (2ND LIST and INV 2ND LIST) of the recorded and reloaded program.
6. Verify keystroke accuracy against Program Listing (appendix).
7. Correct any mistakes.
8. Rewrite both sets of cards, if necessary.
9. Run the test problems (appendix) to verify that the program is working properly.
10. Use a data set you have previously analyzed and compare the program's results with your prior results.

SENSITIVITY ANALYSIS

Users must bear in mind the age limitations inherent in Miscellaneous Publication 50 (USDA Forest Service 1976). The ages specified for loblolly, shortleaf, and slash pine are ring counts to pith from cores taken at dbh, plus 3 years. For longleaf pine, age is ring count to pith from cores taken at dbh, plus 7 years. All of the data came from naturally regenerated, second-growth stands. Consequently, the ages are all estimated *age-from-seed*. Users should calculate the ages of their trees the same way.

Using the program for plantations can create problems. In the first place, the height growth patterns depicted by the site index curves for natural stands may not match the patterns in plantations, especially plantations on old field or prepared sites. Assuming that the curves are suitable, there is still another problem. When a plantation is established, the 1-0 (bare-rooted) seedlings planted are already 1 year old from seed. Thus, when a plantation is 25 years old, the trees are actually 26 years from seed. Common practice presumes that the average height of dominant and codominant trees in a plantation 25 growing seasons after planting is the site index with an index base age of 25 years. But this presumption creates a one year height growth error in this program. The height of a stand planted 25 years previously is the site index only if the index base age is 26 or the seedlings planted were grown in containers and were less than 6 months old when planted. Thus, the presumption that average plantation height equals site index is only correct for plantations 24 years after establishment with 1-0 (bare-root) seedlings.

Serious errors are created when evaluating site quality based on young, fast-growing stands if the year's difference in age-from-seed versus age-from-establishment is ignored. For example, suppose the average height of dominant and codominant trees in a loblolly pine plantation 11 years from seed (10 years after establishment) is 36 feet. Site index, base age 50 for 11 years and height 36 feet is 80. But if the age is mistakenly entered as 10, based on the age since establishment, site index for a height of 36 feet is 96. The error of one year induces a 20 percent error in site index (fig. 1). If these overestimates of

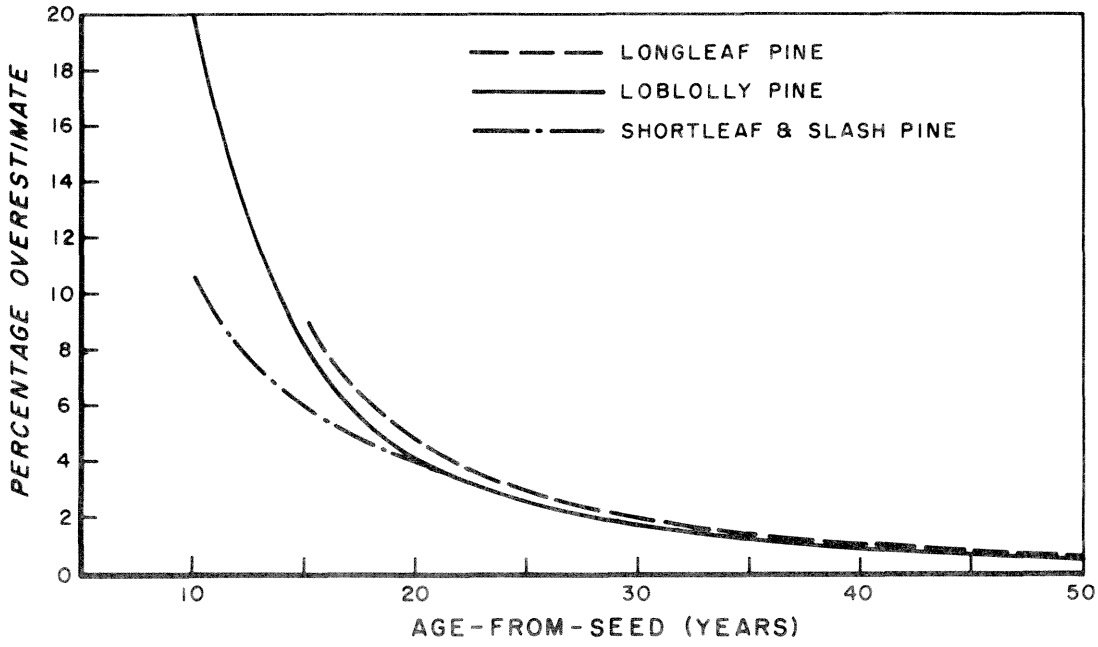

Figure 1.—*Site index percentage overestimate resulting from a one-year aging error, $SI_{50} = 80$ for each species.*

site index are used as arguments in some stand volume and growth predictors to estimate present and future volumes, they obviously cause overestimates of both volumes and growth. The problem becomes most acute when young, fast-growing stands are on the verge of merchantability and when the log-rule being used, such as the Doyle Rule, penalizes small stems. Under these conditions, overestimating site index by 10 to 20 percent can lead to overestimating future growth and yield by 33 to 50 percent over 20 to 30 year rotations (Feduccia et.al. 1979). Economic evaluations of investments in possible intermediate treatments founded on such overestimates of site index will conclude that higher rates-of-return will be earned than will actually occur. Consequently, landowners may over-invest in stand treatments and inefficiently allocate scarce management funds.

Foresters should take care when comparing their own plantations with published yield tables or with growth and yield models that vary with site index. They should determine whether the published information was constructed using age-from-seed or age-from-establishment and which age is implied in the site index base age. Then, this program can be used to properly enter the published plantation yield tables or utilize published equations for comparison.

In the authors' experiences, field foresters using clinometers tend to overestimate tree heights by 2 to 10 percent compared to actual heights measured with a tape after felling. It is often difficult to actually see the true tree top because closed crown canopies or intervening branches near the top of the tree can obstruct the measurer's vision. Consequently, heights taller than those actually existing are often recorded. However, in contrast to the misspecification of age, height errors are not compounded. Site index is only raised by the same percentage as the percent height error.

The nature of the errors flows directly from the form of the estimating equation. Because ages are used in the exponent of the equation, the equation is much more sensitive to aging errors than height estimation errors. But, overestimating actual heights compounds the problem of determining site index for plantations when the year that seedlings spend in the nursery is ignored.

Sound data collection procedures should eliminate the age and height estimation errors. If accurate data are used, this program will provide site indexes and height growth projections far superior to results from ocular interpolation of curves without having to retreat to the office for computations.

LITERATURE CITED

Farrar, R.M., Jr. Southern pine site index equations. J. For. 71:696–697; 1973.

Farrar, R.M., Jr. Southern pine site-index computing program. Res. Note SO-197. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station; 1975. 7 p.

Feduccia, D.P., Dell, T.R., Mann, W.F., Jr., Campbell, T.E., and Polmer, B.F. Yields of unthinned loblolly pine plantations on cutover sites in the west gulf region. Research Paper SO-148. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station; 1979. 88 p.

USDA Forest Service. Volume, yield, and stand tables for second-growth southern pines. Misc. Publ. 50. Washington, DC: U.S. Department of Agriculture, Forest Service; 1929 (rev. 1976). 202 p.

Appendix

Program Listing

```
000  43 RCL    080  42 STO    160  99 PRT    240  60 DEG    320  54  )    400  43 RCL
001  30  30    081  13  13    161  35 1/X    241  01  1     321  85  +    401  14  14
002  91 R/S    082  86 STF    162  42 STO    242  00  0     322  53  (    402  44 SUM
003  76 LBL    083  04  04    163  08  08    243  00  0     323  43 RCL    403  15  15
004  16 A'     084  76 LBL    164  43 RCL    244  77  GE    324  13  13    404  43 RCL
005  43 RCL    085  15  E     165  07  07    245  88 DMS    325  65  ×    405  00  00
006  16  16    086  58 FIX    166  65  ×     246  43 RCL    326  53  (    406  32 X:T
007  42 STO    087  00  00    167  71 SBR    247  30  30    327  43 RCL    407  43 RCL
008  10  10    088  00  0     168  10 E'     248  99 PRT    328  08  08    408  15  15
009  43 RCL    089  36 PGM    169  95  =     249  91 R/S    329  45 Y^x    409  77  GE
010  17  17    090  01  01    170  99 PRT    250  76 LBL    330  04  4     410  91 R/S
011  42 STO    091  71 SBR    171  91 R/S    251  70 RAD    331  75  -     411  61 GTO
012  11  11    092  25 CLR    172  43 RCL    252  06  6     332  43 RCL    412  59 INT
013  43 RCL    093  76 LBL    173  32  32    253  00  0     333  09  09    413  76 LBL
014  18  18    094  90 LST    174  91 R/S    254  77  GE    334  45 Y^x    414  80 GRD
015  42 STO    095  43 RCL    175  61 GTO    255  88 DMS    335  04  4     415  43 RCL
016  12  12    096  32  32    176  89  π     256  43 RCL    336  54  )     416  39  39
017  43 RCL    097  91 R/S    177  76 LBL    257  30  30    337  54  )     417  71 SBR
018  19  19    098  32 X:T    178  12  B     258  99 PRT    338  54  )     418  66 PAU
019  42 STO    099  43 RCL    179  43 RCL    259  91 R/S    339  54  )     419  61 GTO
020  13  13    100  38  38    180  34  34    260  76 LBL    340  92 RTN    420  50 I×I
021  86 STF    101  67  EQ    181  91 R/S    261  60 DEG    341  76 LBL    421  76 LBL
022  01  01    102  14  D     182  98 ADV    262  08  8     342  13  C     422  66 PAU
023  15  E     103  43 RCL    183  99 PRT    263  00  0     343  43 RCL    423  99 PRT
024  76 LBL    104  33  33    184  42 STO    264  77  GE    344  31  31    424  66 PAU
025  17 B'     105  91 R/S    185  07  07    265  88 DMS    345  91 R/S    425  66 PAU
026  43 RCL    106  78 Σ+     186  43 RCL    266  43 RCL    346  98 ADV    426  66 PAU
027  20  20    107  71 SBR    187  31  31    267  30  30    347  99 PRT    427  66 PAU
028  42 STO    108  66 PAU    188  91 R/S    268  99 PRT    348  35 1/X    428  66 PAU
029  10  10    109  61 GTO    189  99 PRT    269  91 R/S    349  42 STO    429  66 PAU
030  43 RCL    110  90 LST    190  35 1/X    270  76 LBL    350  08  08    430  66 PAU
031  21  21    111  76 LBL    191  42 STO    271  10 E'     351  43 RCL    431  92 RTN
032  42 STO    112  14  D     192  09  09    272  53  (     352  32  32    432  76 LBL
033  11  11    113  43 RCL    193  43 RCL    273  01  1     353  91 R/S    433  91 R/S
034  43 RCL    114  31  31    194  35  35    274  00  0     354  99 PRT    434  43 RCL
035  22  22    115  91 R/S    195  91 R/S    275  45 Y^x    355  35 1/X    435  30  30
036  42 STO    116  98 ADV    196  99 PRT    276  53  (     356  42 STO    436  99 PRT
037  12  12    117  99 PRT    197  42 STO    277  53  (     357  09  09    437  91 R/S
038  43 RCL    118  35 1/X    198  14  14    278  43 RCL    358  43 RCL              0.   00
039  23  23    119  42 STO    199  01  1     279  10  10    359  36  36             0.   01
040  42 STO    120  08  08    200  00  0     280  65  ×     360  91 R/S            0.   02
041  13  13    121  79  x̄     201  42 STO    281  53  (     361  99 PRT            0.   03
042  86 STF    122  32 X:T    202  15  15    282  43 RCL    362  42 STO            0.   04
043  02  02    123  71 SBR    203  22 INV    283  08  08    363  14  14            0.   05
044  15  E     124  66 PAU    204  87 IFF    284  75  -     364  43 RCL            0.   06
045  76 LBL    125  35 1/X    205  02  02    285  43 RCL    365  37  37            0.   07
046  18 C'     126  42 STO    206  88 DMS    286  09  09    366  91 R/S            0.   08
047  43 RCL    127  09  09    207  05  5     287  54  )     367  99 PRT            0.   09
048  24  24    128  79  x̄     208  44 SUM    288  54  )     368  42 STO            0.   10
049  42 STO    129  71 SBR    209  15  15    289  85  +     369  00  00            0.   11
050  10  10    130  66 PAU    210  76 LBL    290  53  (     370  01  1             0.   12
051  43 RCL    131  65  ×     211  88 DMS    291  43 RCL    371  00  0             0.   13
052  25  25    132  71 SBR    212  43 RCL    292  11  11    372  42 STO            0.   14
053  42 STO    133  10 E'     213  15  15    293  65  ×     373  15  15            0.   15
054  11  11    134  95  =     214  98 ADV    294  53  (     374  76 LBL       -2.41737  16
055  43 RCL    135  99 PRT    215  71 SBR    295  43 RCL    375  59 INT      -273.824   17
056  26  26    136  91 R/S    216  66 PAU    296  08  08    376  43 RCL        4227.7   18
057  42 STO    137  15  E     217  35 1/X    297  33 X²     377  15  15     -19758.5   19
058  12  12    138  76 LBL    218  42 STO    298  75  -     378  98 ADV     -11.8701   20
059  43 RCL    139  11  A     219  08  08    299  43 RCL    379  71 SBR           0.   21
060  27  27    140  43 RCL    220  43 RCL    300  09  09    380  66 PAU      1263.79   22
061  42 STO    141  34  34    221  07  07    301  33 X²     381  65  ×     -12409.5   23
062  13  13    142  91 R/S    222  65  ×     302  54  )     382  71 SBR    -11.104909  24
063  86 STF    143  98 ADV    223  71 SBR    303  54  )     383  10 E'     -83.244961  25
064  03  03    144  99 PRT    224  10 E'     304  85  +     384  95  =      2239.678   26
065  15  E     145  42 STO    225  95  =     305  53  (     385  32 X:T   -11260.453  27
066  76 LBL    146  07  07    226  71 SBR    306  43 RCL    386  01  1      -8.80405  28
067  19 D'     147  43 RCL    227  66 PAU    307  12  12    387  00  0       22.7952  29
068  43 RCL    148  31  31    228  43 RCL    308  65  ×     388  77  GE  9876543210.  30
069  28  28    149  91 R/S    229  14  14    309  53  (     389  80 GRD  1111111111.  31
070  42 STO    150  99 PRT    230  44 SUM    310  43 RCL    390  01  1   2222222222.  32
071  10  10    151  35 1/X    231  15  15    311  08  08    391  07  7   3333333333.  33
072  43 RCL    152  42 STO    232  43 RCL    312  45 Y^x    392  00  0   4444444444.  34
073  29  29    153  09  09    233  15  15    313  03  3     393  32 X:T  5555555555.  35
074  42 STO    154  43 RCL    234  32 X:T    314  75  -     394  77  GE  6666666666.  36
075  11  11    155  32  32    235  87 IFF    315  43 RCL    395  80 GRD  7777777777.  37
076  43 RCL    156  91 R/S    236  04  04    316  09  09    396  71 SBR           0.   38
077  21  21    157  76 LBL    237  70 RAD    317  45 Y^x    397  66 PAU  9999999999.  39
078  42 STO    158  89  π     238  87 IFF    318  03  3     398  76 LBL
079  12  12    159  98 ADV    239  01  01    319  54  )     399  50 I×I
```

User Instructions

Step	Procedure	ENTER	Press	Display
1.0	INITIALIZE THE PROGRAM PARAMETERS			
1.1	Partition the calculator.	6	2ND OP 17	479.59
1.2	Load the program, reading card sides 1 to 4.	side #	INV 2ND WRITE	side #
1.3	Begin execution.		RST R/S	9876543210.
1.4	Select the species desired: A′ = loblolly; B′ = longleaf; C′ = shortleaf; and D′ = slash		2ND (letter)	2222222222.
2.0	SITE INDEX CALCULATION[a]			
2.1	Enter the present tree age (PTA).	PTA	R/S	3333333333.
2.2	Enter the present tree height (HT).	HT	R/S	2222222222.
2.3	Do steps 2.1 and 2.2 for all n sample trees.			
2.4	After entering the last sample tree height, enter 0 for the next PTA.	0	R/S	1111111111.
2.5	Enter the index base age (IBA) desired.	IBA	R/S	Site Index
2.6	To prepare the program for calculating site index at a new sample location. If a new species is desired, go to step 1.4		R/S	2222222222.
3.0	HEIGHT PROJECTION		A	4444444444.
3.1	Enter site index (SI).	SI	R/S	1111111111.
3.2	Enter index base age (IBA).	IBA	R/S	2222222222.
3.3	Enter the stand age (SA).	SA	R/S	Expected HT
3.4	Recycle the program for the next stand age.		R/S	2222222222.
4.0	HEIGHT VECTOR		B	4444444444.
4.1	Enter site index (SI).	SI	R/S	1111111111.
4.2	Enter index base age (IBA).	IBA	R/S	5555555555.
4.3	Enter age increment (AI). The program continues until upper age limits are reached.	AI	R/S	Ages & Heights 9876543210.
5.0	SITE INDEX VECTOR		C	1111111111.
5.1	Enter index base age (IBA)	IBA	R/S	2222222222.
5.2	Enter the average tree age (ATA)	ATA	R/S	6666666666.
5.3	Enter height increment (HTI).	HTI	R/S	7777777777.
5.4	Enter maximum height (HTMAX). The program continues to HTMAX. If an SI outside the range $10<SI<170$ is computed, the program prints 9999999999. The end is marked 987654321.	HTMAX	R/S	Heights and Site Indexes 987654321.

[a]To get to step 2.0 without going through step 1, press E from anywhere in the program.

Program Test Problems

Step	Action	Printer tape	Calculator display
1.0	Initialize the program		
1.1	Partition the calculator		479.59
1.2	Load the program by reading cards		1,2,3,4
1.3	Begin execution		9876543210.
1.4	Select loblolly pine (A')		2222222222.
2.0	Calculate site index using the data (E)		
2.1	PTA — 16,15,18,17,16,17,15,16,16,17		3333333333.
2.2	HT — 47,42,51,47,43,48,43,45,44,49	1, 2, ...	1,2, ..., 10. &
2.3	Repeat 2.1 and 2.2 for all 10 trees	...., 10	2222222222.
2.4	Enter 0 for PTA after HT = 49		1111111111.
2.5	Enter IBA = 25	25	
	Display flashes the average age.	16	16
	Display flashes the average height:	46	46
	Display stops flashing, SI appears:	68	68
3.0	Calculate expected stand heights (A)		4444444444.
3.1	Enter SI = 80	80	1111111111.
3.2	Enter IBA = 25	25	2222222222.
3.3	Enter SA = 18	18	
	Expected height is displayed	60	60
3.4	Recycle for next SA: R/S		2222222222.
3.3	Enter SA = 27	27	
	Expected height is displayed	85	85
4.0	Calculate a height vector (B)		4444444444.
4.1	Enter SI = 70	70	1111111111.
4.2	Enter IBA = 30	30	5555555555.
4.3	Enter AI = 10	10	
	The display flashes	PTA = 10 20 30 40 50 60 70 80	
	and printer prints:	HT = 23 50 70 84 93 100 104 108	
	The end marker appears:	9876543210.	9876543210.
5.0	Calculate an SI vector (C)		1111111111.
5.1	Enter IBA = 50	50	2222222222.
5.2	Enter ATA = 67	67	6666666666.
5.3	Enter HTI = 20	20	7777777777.
5.4	Enter HTMAX = 200	200	
	The display flashes	HT = 10 30 50 70 90 110 130 150 170 190	
	and printer prints:	SI = 999 27 45 63 81 100 118 136 154 999	
	The end marker appears:	9876543210.	9876543210.

Guldin, Richard W., and Farrar, Robert M. Jr. Computation of southern pine site index using a TI-59 calculator, U.S. Department of Agriculture Forest Service, General Technical Report SO-48. South. For. Exp. Stn. New Orleans, La. 8 p. 1983.

A program is described that permits computation of site index in the field using a Texas Instruments model TI-59 programmable, hand-held, battery-powered calculator. Based on a series of equations developed by R.M. Farrar, Jr., for the site index curves in USDA Miscellaneous Publication 50, the program can accomodate any index base age, tree age, and height within wide limits for four principal southern pine species.

Keywords: Growth, timber management, loblolly pine, longleaf pine, shortleaf pine, slash pine, computer program, plantation, dendrochronology.