Abstract. A program is presented that computes tree valuation by the basic formula method. This program is designed to support portable, hand held, battery operated programmable calculators which are suitable for use in the field. Use of this program eliminates computational error that can jeopardize the validity and practical usefulness of tree valuation by the basic formula method.

Accurate determination of the monetary value of trees is an important yet complex facet of practical arboriculture. Formal procedures have been published to determine tree value using the replacement method and the basic formula method (2, 3). A recent critique (4) illustrated some of the strengths of the procedures and made valuable suggestions for improvement, including some that could require major reorientation of the methodology of valuation by the basic formula method. An additional area where improvements could be made, but that would not require any significant restructuring of procedures, would be to increase the accuracy and precision of the computational aspects of tree valuation.

We have noted occasional serious errors in tree valuations by the basic formula method performed by our undergraduate students in the course Landscape Practices and Arboriculture (ORH 4235). Students are required to perform tree valuations as part of the laboratory component of this course. Valuations are evaluated by comparing those made by different students on the same trees and by comparing the student valuations with those made by a Certified Landscape Appraiser. As Tate (4) points out, some aspects of tree valuation are more subjective than others, and a great deal of the variation we have observed in valuation is attributable to disagreement over subjective aspects, such as the location factor. An additional, and sometimes very serious, source of error is in the computation itself. In some cases valuations were distorted more by computational errors than by disagreement over subjective factors. To help minimize computational error in tree valuation by the basic formula method, we have developed a program for use on an inexpensive (retail cost less than $50), hand held, battery operated electronic programmable calculator. It can be used in the field and will enable the arborist to quickly and accurately complete the computational phase of valuation.

The Program

This program is written in Reverse Polish Notation (1, 5) and calculates tree valuation using the basic formula method. It requires that the user key in tree diameter, species factor, condition factor and location factor. The program internally computes basal area, basic value (the current rate of $27.00 per square inch can be adjusted by changing the entries in program lines 008 and 009), and the net value of the tree. The program presented here was written for use on the Hewlett-Packard HP-11C calculator, but with

Figure 1. The probability and ease of use of programmable calculators allow the quick and accurate determination of tree valuation in the field.
minor transcripcional changes will work on
calculators made by other manufacturers (ver-
sions of this program transcribed for the Texas In-
struments TI-60, TI-66 and Hewlett-Packard
HP-20S and HP-32S are available by contacting
the authors).

A Sample Run. The following example takes
the data presented by Neely (3): A tree with a cir-
cumference of 47 inches (diameter of 14.96 in-
ches) at height of 4.5 feet, a species factor of
85%, condition factor of 75%, and a location fac-
tor of 80%.

1. Load the program into the calculator accor-
ding to instructions on Tables 1 and 2.
2. Key in diameter breast height in inches
   (14.96 inches), then press the STO key, then
   press the 1 key.

Table 1. Operating directions and program listing for com-
puting the monetary value of trees using the basic formula
method, for use on a Hewlett-Packard HP-11C program-
mable calculator.

<table>
<thead>
<tr>
<th>Step</th>
<th>Instructions</th>
<th>Input data</th>
<th>Keystrokes data</th>
<th>Output data</th>
</tr>
</thead>
</table>
| 1.   | If the calculator has been pro-
      grammed, go to step 4. If not,
      switch into pro-
      gram mode             | g P/R      |                |             |
| 2.   | Key in diameter breast height in
      inches                | dbh        | STO 1          |             |
| 3.   | Switch calculator into run mode      | g P/R      |                |             |
| 4.   | Enter diameter breast height, in     | dbh        | STO 1          |             |
|      | inches                               |            |                |             |
| 5.   | Enter species factor, as a           | Species    | STO 2          |             |
|      | decimal fraction                      | factor     |                |             |
| 6.   | Enter condition factor, as a         | Condition  | STO 3          |             |
|      | decimal fraction                      | factor     |                |             |
| 7.   | Enter location factor, as a          | Location   | STO 4          |             |
|      | decimal fraction                      | factor     |                |             |
| 8.   | Execute the program                  | f A        |                | Net value   |
|      |                                       |            |                | of tree, in |
|      |                                       |            |                | dollars     |

3. Key in the species factor as a decimal fraction
   (0.85), then press the STO key, then press
   the 2 key.
4. Key in the condition factor as a decimal frac-
tion (0.75), then press the STO key, then press
   the 3 key.
5. Key in the location factor as a decimal fraction
   (0.80), then press the STO key, then press
   the 4 key.
6. Press the f key, then press the A key. The
   word “running” will flash on the screen for a
   few seconds, then the net value of the tree as
determined by the basic formula method will
appear on the display ($2,420).

The data entered in the above example will be
stored in the calculator for later retrieval even if it is
turned off. To compute additional tree valuations,
new data can be entered and as these data are
entered, they override and erase the previous
data. If only one tree valuation is conducted, the
program can be used for storage of the input
values of diameter, species factor, condition fac-
tor and location factor. These values can be recall-
ed by using the RCL key. Pressing RCL 1 will
cause the display to indicate the diameter, RCL 2
the species factor, RCL 3 the condition factor,
and RCL 4 the location factor.

Table 2. Program listing to determine tree valuation by the
basic formula method using the Hewlett-Packard HP-11C
programmable calculator.

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*At the time this program was written, the accepted dollar
value per square inch of basal area was $27.00. Values can
be adjusted by changing the entries on program lines
008-009 as the need may arise.*
Applications and Use
This program can be used in the field, during the tree's evaluation, eliminating the need to transport field data back to an office for computation. This allows more rapid evaluation and this can be very important, especially in situations where large numbers of trees are being evaluated. Moreover, use of this program allows more accurate and precise determinations than would otherwise be possible. Not only is the possibility of computational error minimized, but the computational precision is greatly increased. In the illustration given above, for example, the value is $2,437, when using the basic formula method in the traditional manner (3). This is due to the rounding off of numbers during the intermediate steps in the traditional manner of computation. When this program is used, the intermediate figures are not rounded off, and this results in greater measured precision in determination of tree value, since the only point at which numbers are rounded off is at the final stage in calculation.

Literature Cited

ABSTRACT

In any series of grafts, some will fail to bond, or the scion will die shortly after grafting. In most species of trees, the majority of graft unions are successful, producing strong, serviceable trees. Some additional graft failure may, however, occur during the first one to three years. In a few species, the unions experience some delayed graft failure, even after the plant has reached its final location on the landscape. Nursery professionals realize that red maple grafts are highly unreliable regardless of rootstock, with as high as a 20% failure rate occurring in plants 3-6 inches in caliper or greater. Unless the tree falls over, its decline or death can easily be misdiagnosed. A debate continues in the nursery industry as to which other species are susceptible to significant delayed graft rejection. Delayed root graft rejection can also stress the tree so that it is susceptible to a host of secondary disease or insect infestations. The best procedure is to expand your specifications to include requirements for identifying rootstock. By recognizing the level of care required to avoid purchasing such plants, we can reduce the number of defective trees planted in our projects.