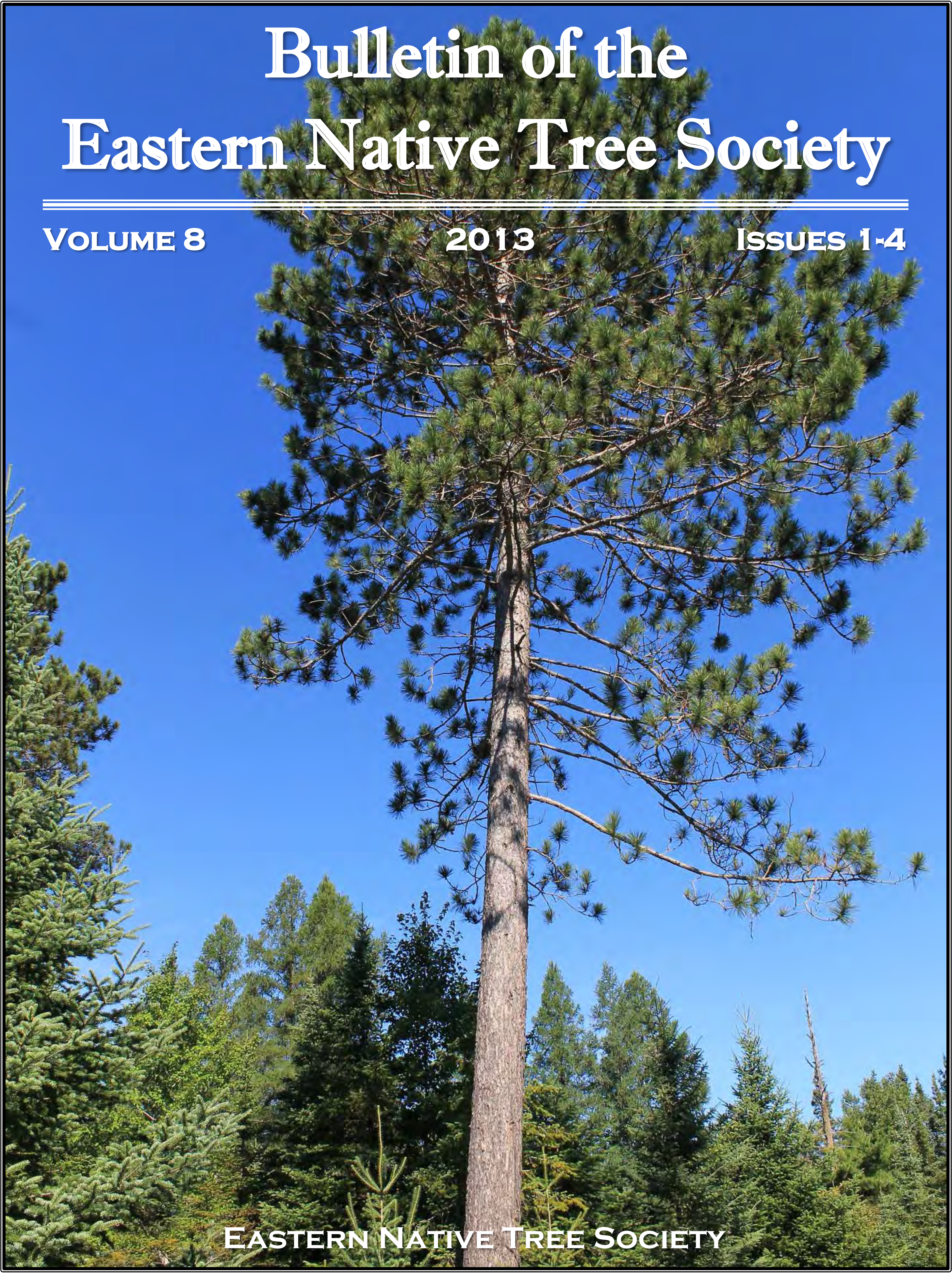
Bulletin of the Eastern Native Tree Society

Volume 8 2013 Issues 1-4



Eastern Native Tree Society

Bulletin of the Eastern Native Tree Society

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Mission Statement:

The Eastern Native Tree Society (ENTS) is a cyberspace interest group devoted to the celebration of trees of eastern North America through art, poetry, music, mythology, science, medicine, and woodcrafts. ENTS is also intended as an archive for information on specific trees and stands of trees, and ENTS will store data on accurately measured trees for historical documentation, scientific research, and to resolve big tree disputes.

ENTS Officers:

Editorial Board, *Bulletin of the Eastern Native Tree Society*:

Membership and Website Submissions:

Membership is free when you sign up for our discussion group, Native Tree Society BBS, at: http://www.ents-bbs.org/index.php. Submissions to the Native Tree Society website in terms of information, art, etc., should be made to Edward Frank at: ed_frank@hotmail.com.

The *Bulletin of the Eastern Native Tree Society* is provided as a free download in Adobe™ PDF format (optimized for version 5 or newer) through the Native Tree Society website. The Native Tree Society, the Eastern Native Tree Society, and the *Bulletin of the Eastern Native Tree Society* editorial staff are solely responsible for its content.

COVER: Red pine* (Pinus resinosa) *is sometimes found on slightly higher and drier ground in conifer swaps of the northern Lake States. Photo by Don C. Bragg.

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RETURN OF THE *BULLETIN OF THE EASTERN NATIVE TREE SOCIETY* (?)

Late last year I reluctantly announced that I would discontinue production of the *Bulletin of the Eastern Native Tree Society* due to declining submissions and my own (then recent) acceptance of the editorship of the *Journal of Forestry*. I have missed putting this e-journal together ever since, so I recently decided to see if I could resurrect the *Bulletin*, even if in a more limited and abbreviated form. This effort has been facilitated by a submission of some new material, my regret over not finishing one of Bob Leverett's epic measuring articles, and the untimely demise of the national champion shortleaf pine.

This issue should be considered more of a test run than a promise—it still takes quite a bit of work to assemble even a single issue of the *Bulletin*, and my other responsibilities have not diminished over the last year. However, if this comes together with a minimum of hitches, I would look to opportunistically continue to edit and publish the *Bulletin* as time, resources, and materials permit. For this renewed effort to be truly successful, I will still need y'all to continue to provide me with new materials (papers, pictures, poems, stories, musings, announcements, etc.). So, let's see where this takes us!

Don C. Bragg
Editor-in-Chief

p.s.: That means you! Send me new materials!!

A smoldering pine stand following a prescribed fire on the University of Arkansas-Monticello campus in the spring of 2013. Photograph by Don C. Bragg.

ANNOUNCEMENTS AND SOCIETY ACTIONS

2013 Tree Climbers Rendezvous
October 9-14, 2013
Simpsonwood Conference Center
Norwood, Georgia

Sponsors:
Tree Climbers International (TCI) and Native Tree Society (NTS)

For more details, including logistical information, please visit the website:
http://treeclimbing.com/index.php/climbing/the-2013-rendezvous
Agenda and detailed daily schedule:
http://treeclimbing.com/images/stories/Rendezvous/Daily_Schedule.pdf

HIGHLIGHTS OF FEATURED SPEAKERS PROGRAM:

Wednesday, October 9, 2013 [6:45 p.m.]
OPENING SESSION

Patty and Peter Jenkins: Welcome and Introduction to Tree Climbers International (TCI)
Bob Leverett: Introduction to the Native Tree Society (NTS)
Tim Kovar: "The Growth of Recreational Tree Climbing Around the World"
Peter Jenkins: "30 Years of Recreational Tree Climbing"

Thursday, October 10
TREE PHYSIOLOGY [3:30 p.m.] and DENDROMORPHOMETRY—
THE SCIENCE OF TREE MEASUREMENT [6:45 p.m.]

Kim Coder: "Great Fall Colors Bring Great Spring Leaves"
Bob Leverett and Will Blozan: "Quest for the Giants: Highlights of NTS Superlative Tree Discoveries"
Monica Jakuc Leverett, pianist: Nature Music for the Piano by Michael Gatonska and others

Friday, October 11 [6:45 p.m.]
CANOPY RESEARCH AND FOREST PRESERVATION

Meg Lowman: "Saving the Forests of Ethiopia-One Church at a Time"
Joan Maloof: "Among the Ancients: Sharing Stories of Special Forests"
Book signing by both speakers

Saturday, October 12
"TREEHAB" [9 a.m.] and REDWOODS: North America's Tallest Trees [6:45 p.m.]

John Gathright: "Taking Treehab Beyond the Treetops"
Richard Preston: "A Climb in the Redwood Canopy with Richard Preston"
Cameron Williams: "Water Dynamics in Giant Trees"
Book signing by Richard Preston
Party and "Toast/Roast" Ceremony

Sunday, October 13 [9:00 a.m.]
TROPICAL TREE CLIMBING

Bart Bouricius: "Giant Emergent Trees of the Amazon Basin"
D'Arcy Trask: "Captured, But Not Touched: Measuring the General Sherman Tree"

This is a joint meeting with the Native Tree Society!

LESSONS FROM COOK FOREST: PART II

Robert T. Leverett

Founder and Executive Director, Eastern Native Tree Society

Editor's Note: This continues a paper by Bob Leverett…

CROWN-POINT OFFSET—A NEW LOOK

With the instrument preliminaries out of the way, we now turn to the source of measurement error that has the most impact and is the least understood—an incorrect baseline to the target. Let's examine why there was a great variability in results for the calculations from the morning exercise. If the measurer has good measuring devices so that instrument accuracy isn't an issue, determining where the top of the tree is located relative to both the base and the measurer becomes the big challenge.

With the tangent method, if the trunk is accessible and the crown and base are visible to the eye, nothing prevents the measurer from going through the motions of measuring, but how good are the results? Tape and clinometer users often assume measurement errors are attributable to misreading the clinometer or stem from instrument calibration. But these are seldom the source of major errors. ***Location of where the top of the tree is (or what is identified as the top) relative to both the base and the measurer is the source of the error.*** A former national champion pignut hickory in North Carolina was mis-measured by an astounding 67 ft and a former national champion red maple in Michigan was mis-measured by 60 ft! NTS has a dozen or more examples of trees having been mis-measured by 50 ft, and mis-measurements in the range of 20 to 30 ft are common. ***The success or failure of the tangent method depends on getting the baselines correct. The instruments do not compensate for locations.***

The cardinal rule for tree measurers using the tangent method is to establish correct baselines to the top and base of the tree. The baseline to the bottom is seldom a problem, and the crown is almost always a problem because of the horizontal crown-offset distance. For example, suppose the top of a tree, its base, and the measurer are in alignment. Further assume that crown-offset for a tree is 12 ft in the direction of the measurer, and the level distance to the trunk is 70 ft. If the angle to the crown is 45 degrees, and the measurer is not conscious of the crown-offset situation, their determination of height will be HT = 70 × tan(45) = 70 ft above eye level. However, the actual baseline to the crown is 58 ft (70 – 12). So, the actual height above eye level is: HT = 58 × tan(45) = 58 ft. The measurer makes a 12-ft error by using the 70-ft baseline to the trunk. Instead of 70 ft, suppose the measurer had been positioned at a distance of 50 ft from the trunk. At this closer distance, the angle to the top would be:

$$A = 58\, tan^{-1}\left(\frac{58}{38}\right) = \ 56.76°$$

The measurer's calculation of height from 50 ft away will be 76.3 ft (HT = 50 × tan(56.76) = 76.3 ft). At this closer distance, the error in height becomes 18.3 ft. The absolute crown-offset is the same, i.e. 12 ft, but its impact varies with distance: the closer to the tree, the greater the error. ***So the principle is that for tangent-based calculations that do not consider crown-point offset, the measurement error is magnified as the measurer moves closer to the tree.*** From greater distances the reverse is true. At 100 ft away from the trunk, the measurer would conclude that the tree's height to be 65.9 ft. The error has dropped to 7.9 ft. Had the correct baseline been used, there would be no difference in the computed heights from any of these distances. But can the measurer determine simply if there is a crown-offset? By observing the spot chosen as the top from a couple of separated locations, the measurer can confirm the existence of a crown offset, although its magnitude will not be directly known. When the observer is at right angles to the vertical plane containing the top and base, the offset will appear greatest.

There is a way of determining the correct height of a target above eye level without needing to establish a traditional baseline extending from the eye to the trunk. An external baseline is established that is in line with the target. The trunk's position is not relevant, but the target and the external baseline must lie in the same vertical plane. From each end of the baseline, the angle to the target is taken. The height of the target above eye level from the end of the baseline nearest the target can then be computed. A level baseline is assumed, as shown in Figure 1. The formula needed to compute the height of the target above eye level is:

$$HT = \frac{D \tan a \times \tan b}{\tan a - \tan b} \quad [1]$$

Where D = baseline length, a = angle from closest point of baseline, and b = angle from farthest point of baseline. If the baseline is at an angle of c, from the farther station, looking toward the tree, then the formula becomes:

$$HT = \frac{D \tan a \cos c\,(\tan b - \tan c)}{\tan a - \tan b} \quad [2]$$

Complete discussions with accompanying diagrams of the External Baseline Method (EBLM) appear on the NTS website and elsewhere.

But before leaving EBLM, let's consider a generalized way of analyzing the impact of crown-offset on tangent-based calculations. Suppose the measurer's eye, the crown-point, and

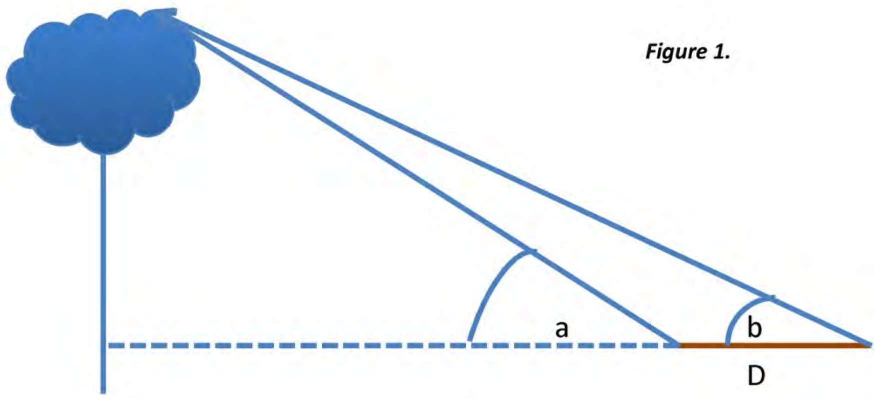


Figure 1.

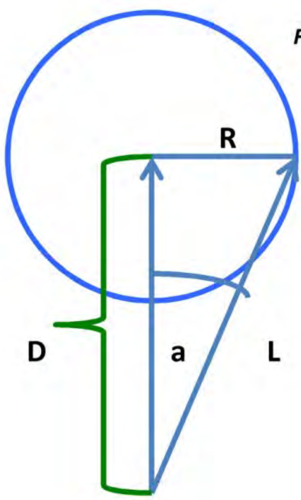


Figure 2 (left).

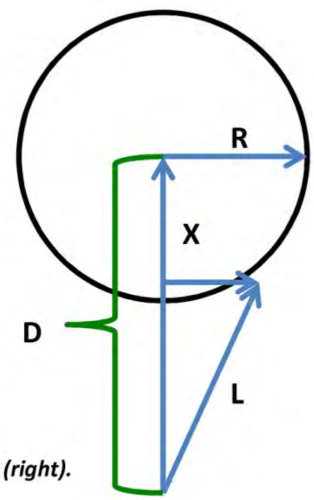


Figure 3 (right).

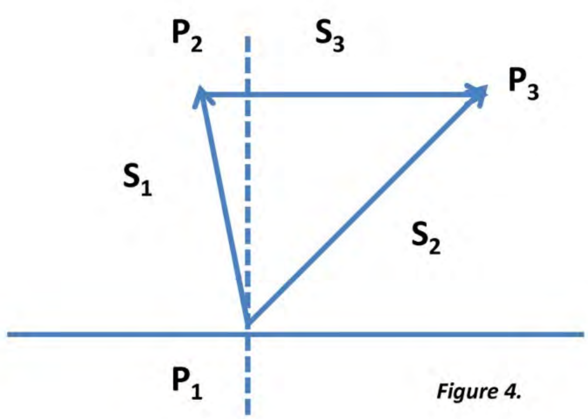


Figure 4.

the baseline are all in alignment. If the crown-point is 120 ft above the measurer's eye, the baseline from eye to trunk is 100 ft, and the crown-offset is 12 ft, we know that the actual baseline to the crown is 88 ft. The angle from eye to crown will be equal to $\tan^{-1}(120/88) = 53^o$. At a trunk baseline of 150 - 12 = 138 ft, the angle will be 41.01 degrees. In the case of the 100-ft baseline, the measurer would calculate the height of the tree to be 136.38 ft (HT = 100 tan(53.75) = 136.38). For the 150-ft baseline, the height would have been calculated to be 130.44 ft. The impact of the offset diminishes with longer baselines. The errors are reduced. At a 200-ft trunk baseline, the angle to the crown-point would be 32.55 degrees and the height would be calculated as 127.66 ft, which still represents an error of 7.66 ft. These determinations have all assumed the eye, base, and crown-point are in alignment, but if the measurer walks around the tree, the impact of the offset changes dramatically.

Average Height and Baseline Determinations

We now examine the impact of different baseline lengths of the measurer relative to the top and base of the tree for a specified crown-offset. We begin with the standard approach of establishing a common baseline to the trunk. It is in fact a surrogate baseline for the crown, and we've seen that for the same top, the computed height can range over a wide interval. Let's begin with a specific example. We align the baseline with the crown-point and allow the baseline to range from 100 to 200 ft. Can we determine the minimum, average, and maximum heights that will be calculated for this baseline range for a crown-offset that is 12 ft? We have done this already for the minimum and maximum. For the preceding example, they are 127.66 and 136.38 ft respectively. But what about the average? We might assume that it is the average of the minimum and maximum, i.e., (127.66 + 136.38) / 2 = 132.02. It turns out that the average is different, so we turn to integral calculus for help.

By definition the average value of a continuous function $f(x)$ on the interval $a \le x \le b$ is defined by the definite integral:

$$y = \frac{1}{b-a}\int_a^b f(x)dx \quad [3]$$

For our example, a = 100, b = 200, and:

$$f(x) = x\,tan\left(\frac{120}{x-12}\right) \quad [4]$$

where x = surrogate baseline distance, true height of tree = 120 ft, and crown-offset = 12 ft. Hence,

$$H_{avg} = \frac{1}{200-100}\int_{100}^{200} x\,tan\left(\frac{120}{x-12}\right)dx = 130.93$$

So, we see that the average height calculated against a true height of 120 ft for trunk baselines from 100 to 200 ft and for a crown-offset in alignment with the measurer's eye is 130.93 ft. The measurer is haunted by the impact of the 12-ft offset for very long baselines. At 300 ft from the trunk, the height calculation would still yield 125 ft, or 5 ft too much. At 400 ft, the error is still 3.71 ft. ***There is no reasonable distance at which the baseline error does not have a substantial impact.***

If the height point is on the opposite side of the trunk from the measurer, the calculated heights will underestimate the true height**.** However, in field situations, it is often not possible to align the crown-point, base, and eye in the same vertical plane, and in the case of tangent-based measurements, you actually don't want to do this. The ideal case is to be positioned so that the baseline is at 90 degrees to the vertical plane that runs through the crown-point and the base. The crown-offset error will be minimized in this situation. According to WNTS President Don Bertolette, experienced inventory foresters working for the U.S. Forest Service in the western U.S. would position themselves at a 90-degree angle to straight-trunked, leaning conifers to minimize the crown-offset error problem. The method works well with western conifers, but is less valuable for broad-crowned hardwoods that fork into a multiple limb structure at relatively low heights above their bases.

As an example of the efficacy of the 90-degree rule, when it can be applied, suppose the crown offset distance on a tree being measured is 12 ft. Assume the distance to the trunk is 100 ft, and the angle to the crown-point is 50 degrees from the measurer's vantage point. If the baseline is 90 degrees to the vertical plane that contains the crown-point and the base (actually center of the base), then the actual baseline to the crown is $D = \text{sqrt}(100^2 + 12^2) = 100.72$. The true height as compared to the calculated height follows: HT = 100 tan(5) = 119.18; HT = 100.72 tan(50) = 120.03; difference = 120.03 – 119.18 = 0.85 ft. In this example, we see that the estimate using the distance to the trunk as a surrogate for the true baseline understates the actual height by only 0.85 ft. Positioning ourselves so that the baseline is at 90 degrees to the vertical plane containing the crown-point and base always yields a conservative calculation of true height above or below eye level, because the correct baseline is the hypotenuse of a right triangle that includes the surrogate baseline as one leg. The hypotenuse is always the longest side of a right triangle. But positioning oneself to make use of the 90-degree rule can be extremely difficult if not impossible for trees with complex crowns and in difficult terrain.

The next step in analyzing crown-offset errors is exploring their magnitude. The measurer can play 'what-if' games. It quickly becomes evident that for any particular measuring configuration, the largest error occurs when the measurer, crown-point, and base are in alignment; i.e. they lie in the same vertical plane. The least error is when the measurer is positioned 90 degrees to the vertical plane that contains the crown-point and base. Imagine level lines drawn from the measurer to the trunk and to the intersection with the vertical line from eye level of to the crown-point. The horizontal angle ***a***, generated by these lines emanating from the measure's eye, is 0 if the crown-point is directly in line with the measurer and base and increases to the point where the line to the crown is tangent to the circle with a radius equal to the crown-offset. It then decreases. We are interested in the impact on the baseline for different values of ***a***. If the crown-offset is known, the true baseline can be calculated. Figure 2 shows the variables.

For a particular crown-offset R, angle $\boldsymbol{a}$ (a compass can provide an acceptable measure), and distance D to the trunk, the length of the actual baseline L can be calculated and compared to the surrogate D through either of the formulae:

$$L_1 = \frac{\sin\left[\sin^{-1}\left(\frac{D}{R}\sin a\right)-a\right]}{\sin a}R \quad [5]$$

$$L_2 = \frac{\sin\left[180-\sin^{-1}\left(\frac{D}{R}\sin a\right)-a\right]}{\sin a}R \quad [6]$$

where L_1 is the distance if the crown-point is in quadrants 2 or 3, and L_2 if in 1 or 4. Once we compute the actual baseline, the impact of a baseline error from using a line to the trunk is easy to calculate. The critical skill is to be able recognize the magnitude of error that can result from a particular measuring scenario and minimize it.

As the final topic in crown-offset analysis, consider Figure 3. In this figure, we want to compute the average length of L in terms of the variables x, R, and D, and then the computed height HT. If we start with the crown-point aligned with our eye and the base, x is 0. As we walk clockwise, x increases until it equals R at 90 degrees. So, the new variable x takes the role of angle $\boldsymbol{a}$ in the preceding diagram, varying from 0 to R**,** back to 0**,** then to **-**R and again to 0 at our starting point. When x =0, the measurer, crown-point, and trunk are in alignment. At one 0, the crown-point is between our eye and the trunk, and at the other 0, it is on the direct opposite side of the trunk. As previously noted, when $x = R$, the measurer is positioned at right angles to the vertical plane that joins the trunk and crown-point. If HT is the actual height of the tree, H_{avg1} and H_{avg2} are the average computed heights for quadrants 2 and 3 for H_{avg1}, and H_{avg2} for quadrants 1 and 4. The formulae for the L and H values follow:

$$L_{avg1} = \int_0^R \frac{1}{\sqrt{x^2+\left(D-\sqrt{R^2-x^2}\right)^2}}dx \quad [7]$$

$$L_{avg2} = \int_0^R \frac{1}{\sqrt{x^2+\left(D+\sqrt{R^2-x^2}\right)^2}}dx \quad [8]$$

$$H_{avg1} = \frac{D}{R}\int_0^R \frac{1}{\sqrt{x^2+\left(D-\sqrt{R^2-x^2}\right)^2}}dx \quad [9]$$

$$H_{avg2} = \frac{D}{R}\int_0^R \frac{1}{\sqrt{x^2+\left(D+\sqrt{R^2-x^2}\right)^2}}dx \quad [10]$$

Embedded in the last two equations is the calculation of L. Computing these averages requires the use of integral calculus. The definite integrals shown can be evaluated numerically or by using scientific calculators that offer a feature to evaluate definite integrals. The CASIO fx-115 ES provides this capability for under $20. It has been thoroughly tested and can be relied upon for these kinds of integrals.

As an example involving all the variables, suppose the surrogate baseline D = 100 ft and crown-point offset R = 12 ft. What will be the minimum, average, and maximum values of actual baseline to the crown L and the computed height H? The minimum L is 88 (100 – 12) ft. The maximum L is 112 (100 + 12) ft. The average in quadrant 1 is the value of the first definite integral, or 109.65 ft and L - D = 9.65 ft. The value of L in quadrant 2 is 90.83 ft and D – L = 9.17 ft. When the horizontal angle is at 90 degrees to the baseline, L = 100.72 ft. So, at 90 degrees, the true baseline is only 0.72 ft more than the surrogate baseline. This is where the minimum height error occurs using the surrogate baseline.

Suppose we extend the baseline D to 200 ft. L_{avg} equals 190.70 ft in quadrant 2 and D – L = 9.3 ft. What are some of the implications of these distances? Let's take the first scenario with the 100-ft baseline. Suppose we select the point for which the true baseline equals the average within quadrant 2. Further suppose the actual height of the tree is 100 ft exactly. Then the vertical angle (v) to the crown will be equal to $\tan^{-1}$ (100 / 90.83) = 47.75°. Since the measurer would have used a baseline of 100 ft, the computed height (HT) would have been equal to 100 tan(47.75) = 110.09 ft. Since the height is by definition 100 ft, the error at a point on the radial curve of L_{avg} = 90.83 ft is 10.1 ft. For the 200-ft surrogate baseline, the angle to the crown would be 27.67 degrees, giving a computed height of 104.87 ft. The error at this distance becomes 4.87 ft for the same crown-offset of 12 ft. ***These examples reveal the danger of using surrogate baselines, and make a solid argument for using direct distances to the target. Direct distances to the target are assumed in the sine-based methodology.***

We can we compute the average height for quadrants 1 and 2 (4 is symmetrical with 1, and 3 is symmetrical with 2)? The definite integrals for H_{avg1} and H_{avg2} cover these scenarios. For quadrants 1 and 4, H_{avg} = 91.25 ft and for quadrants 2 and 3, H_{avg} = 110.2 ft. As a final formula, we can compute the average calculated height for quadrants 1 and 2 by combining the equations [9] and [10]:

$$H_{avg12} = \frac{H_{avg1}+H_{avg2}}{2} \quad [11]$$

Since quadrants 3 and 4 are symmetrical to 1 and 2, the average for 1 and 2 is sufficient.

As another example, consider the following scenario: HT = 120 ft, R = 15, and D = 80. What is the average calculated height for quadrants 2 and 3? Using the integral, we get 140.05 as the average for quadrants 2 and 4, and 104.23 for quadrants 1 and 3. The average for quadrants 1 and 2 is 122.14 ft. So the average error for quadrants 2 and 4 is 140.05 - 120 = 20.05 ft. Given that the true height is stipulated to be 120 ft, the average of 122.14 sounds close for all possible points. But, these are not the result of offsetting errors. Of all the possible positions that could be taken for a surrogate baseline of 80 ft, only two measurements would be accurate. The largest error would be from the measurement for horizontal angle $\boldsymbol{a}$ = 0, which yields a calculated height of 147.69 ft for an error of 27.69 ft. The minimum error would be (120-117.944) = 2.055 ft. The average of the largest and smallest values of *HT* for quadrant 2 is 129.0 ft, which sounds like this might be the average of all possible errors for the quadrant, but it isn't. The actual average is 140.05 ft obtained through integration.

Computing Crown-offset Magnitude and Direction

From the foregoing, it should be clear that the serious tree measurer must take the crown-offset into account if using the tangent method. With the sine method, it isn't necessary, but with a laser rangefinder, clinometer, and compass, the actual offset distance and direction from the trunk can be calculated. This is useful information in documenting the statistics of important trees. Figure 4 sets up the problem and identifies the variables.

In Figure 4, P_1 is the location of the measurer. P_2 is the base, and P_3 is the crown-point, S_1 is the horizontal distance from P_1 to P_2, S_2 is the horizontal distance from P_1 to P_3, and S_3 is the horizontal distance from P_2 to P_3, which is the crown-offset. Distances S_1 and S_2 are measured with laser and clinometer. If L_1 and L_2 measure the slope distances from P_1 and P_2 and P_1 to P_3, respectively, and the vertical angles are V_1 and V_2 respectively, then:

$$S_1 = L_1 \cos V_1 \qquad [12]$$

$$S_2 = L_2 \cos V_2 \qquad [13]$$

If A_1 is the compass bearing from P_1 to P_2, and A_2 is from P_1 to P_3, then $A_3 = A_2 - A_1$ if $A_2 > A_1$, and $360 - A_1 + A_2$ if $A_2 < A_1$. Once we have A_3, we can compute S_3 as follows using the law of cosines:

$$S_3 = \sqrt{S_1 + S_2 - S_1 S_2 \cos A} \qquad [14]$$

This is the crown-offset distance. To get the direction of P_3 from P_1, we need to first compute the angle $P_1P_2P_3$. We will define this angle as A_5 and use the law of sines:

$$\frac{\sin A_5}{S_2} = \frac{\sin A_3}{S_3} \qquad [15]$$

where $A = \sin^{-1}\left(\frac{S_2}{S_3}\sin A_3\right)$. The direction A_z of P_3 from P_2 is calculated using one of the following routines: $|A_2 - A_1| < 180$, $A_z = 180 + A_1 - A_5$; $|A_2 - A_1| > 180$, $A_z = 180 + A_1 + A_5$; $|A_2 - A_1| = 180$, $A_z = 180 + A_1$.

The above routine is best handled through an Excel spreadsheet. If the measurer possesses an LTI TruPulse 360, that instrument allows the measurer to take azimuth readings directly for trunk and crown. A_z can then be computed simply. As an alternative, if the measurer invokes the missing line routine of the TruPulse 360, one of the direct returns is azimuth of P_3 as seen from P_2. The TruPulse 360 justifies its price difference with simpler instruments through these advanced features that have many practical applications.

SUMMARY

The success of the 2012 NTS Cook Forest workshop on advanced tree measuring techniques points to the direction for future workshops of the same type. Cooperative efforts between NTS, American Forests, and Laser Technology Inc. could magnify the value of such events. There is planning afoot to make this a reality. The overall objective is to provide the measurer with a repertoire of techniques to fit all field situations and to sharpen the measurer's skills when it comes to understanding and evaluating the sources of error that accompany each method. Knowing one measurement technique is not enough. The serious measurer needs to be proficient in all of them, and most importantly, understand the assumptions behind each. This is the only course out of the dilemma we face in a forest of mis-measured trees.

The key lesson for tangent measurers to grasp is that the tree height problem has never been one involving a single baseline. Tangent method users come to instinctively think of a single baseline to the trunk, and that is a problem. ***Tree height measuring has always been a two-baseline problem, one for the crown-point and one for the base, and its reduction to that of a single, common baseline for the sake of convenience has led to frequent and often large height errors.***

Where a common baseline is employed, the only two acceptable scenarios incorporating a single baseline to the trunk are: (1) when the top of the tree is vertically over the base, and (2) when the measurer can successfully position himself/herself so that the common baseline lies at a 90 degree angle to the vertical plane that contains the crown-point and the center of the base. As has been explained, the 90-degree rule can work for straight conifers and relatively young hardwoods that still exhibit apical dominance, but it does not work for larger, older trees with broad crowns, due to the difficulty of establishing the 90-degree position. As a consequence, tree height measurement routines that use the traditional tangent method, be they with tape and clinometer or with a hypsometer with that method built in, are destined to result in height errors, and a lot of them. This has profound implications. It means that the 3-point measurement method built in to hypsometers such as the LTI TruPulse and Impulse lines and Nikon's Forestry 550, keep the door open to continued measurement errors by unsuspecting users of those methods. This having been said, I should emphasize that the LTI and Nikon products have the sine method built into them. With LTI it is called the VD (vertical distance) return and I use it all the time. The user can also use the VD return from the missing line routine. So, both LTI and Nikon include the sine method, and this point needs to be understood by would-be tree measurers who focus on achieving ever-greater accuracy.

This leads me to another point. Users of high performance hypsometers irrespective of brand confuse the accuracy of their lasers and tilt sensors with the need to employ the right mathematical measurement model. They think that high levels of accuracy in distance and angle measure are sufficient without regard to the measurement model being assumed. Others assume if they are careful and can repeat the distance and angle measurements from a point, that the repeatability of their readings justifies the results. Nothing could be farther from the truth. The readings must be supported by the mathematical model explicitly or implicitly invoked.

In the best of all measurement worlds, the hypsometer manufacturers would explain how to use their products to minimize measurement errors from whatever the source. Most of them likely assume that the proper techniques are taught within the disciplines that use their instruments. That has not been shown to be the case. However, I am pleased to report that LTI is very receptive to working with NTS and American Forests to accomplish this objective. I have a feeling that a lot of traditional tape and clinometer users are going to become frustrated, if not angry, as they begin reading the cautions against doing what they have been doing literally for decades. There is no easy path to change. That is just the way it is.

As a final point, a number of detailed comparisons between the tangent and sine method have been accomplished in the past decade. Two of them are:

Diggins, T. 2007. A comparison of base-line tangent tree height measurements to the sine method. Bulletin of the Eastern Native Tree Society 2(2):9-12.

Bragg, D.C., L.E. Frelich, R.T. Leverett, W. Blozan, and D.J. Luthringer. 2011. The sine method: an alternative height measurement technique. USDA Forest Service Research Note SRS-22. 11 p.

And lastly, there are numerous posts on sine versus tangent in the NTS BBS under the topic of Measurement and Dendromorphometry.

As the accuracy of laser rangefinders improve and with advanced features that allow the users to hit the target despite a cluttered field of view, current justifications for sticking with the tangent method will disappear. Even so, the method will remain as a measurement tool in the tool chest. It will find limited applicability, along with the method of similar triangles. There is no such thing as having too many measurement options.

Burnside's Bridge on the Antietam Civil War battlefield in Maryland. The large American sycamore along the base of the bridge is said to have been there during the 1862 battle. Photograph by Don C. Bragg.

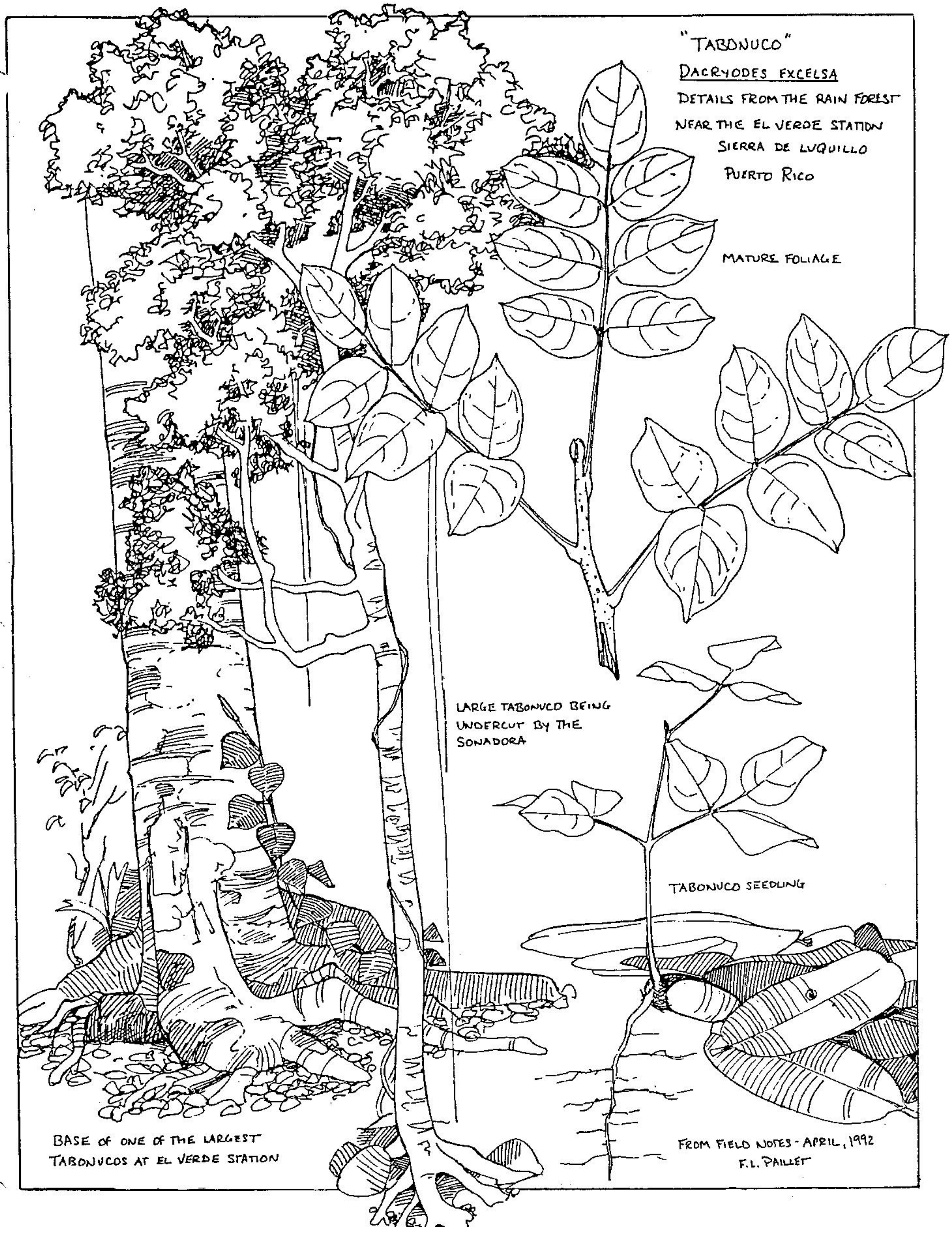
ORIGINAL LINE DRAWINGS

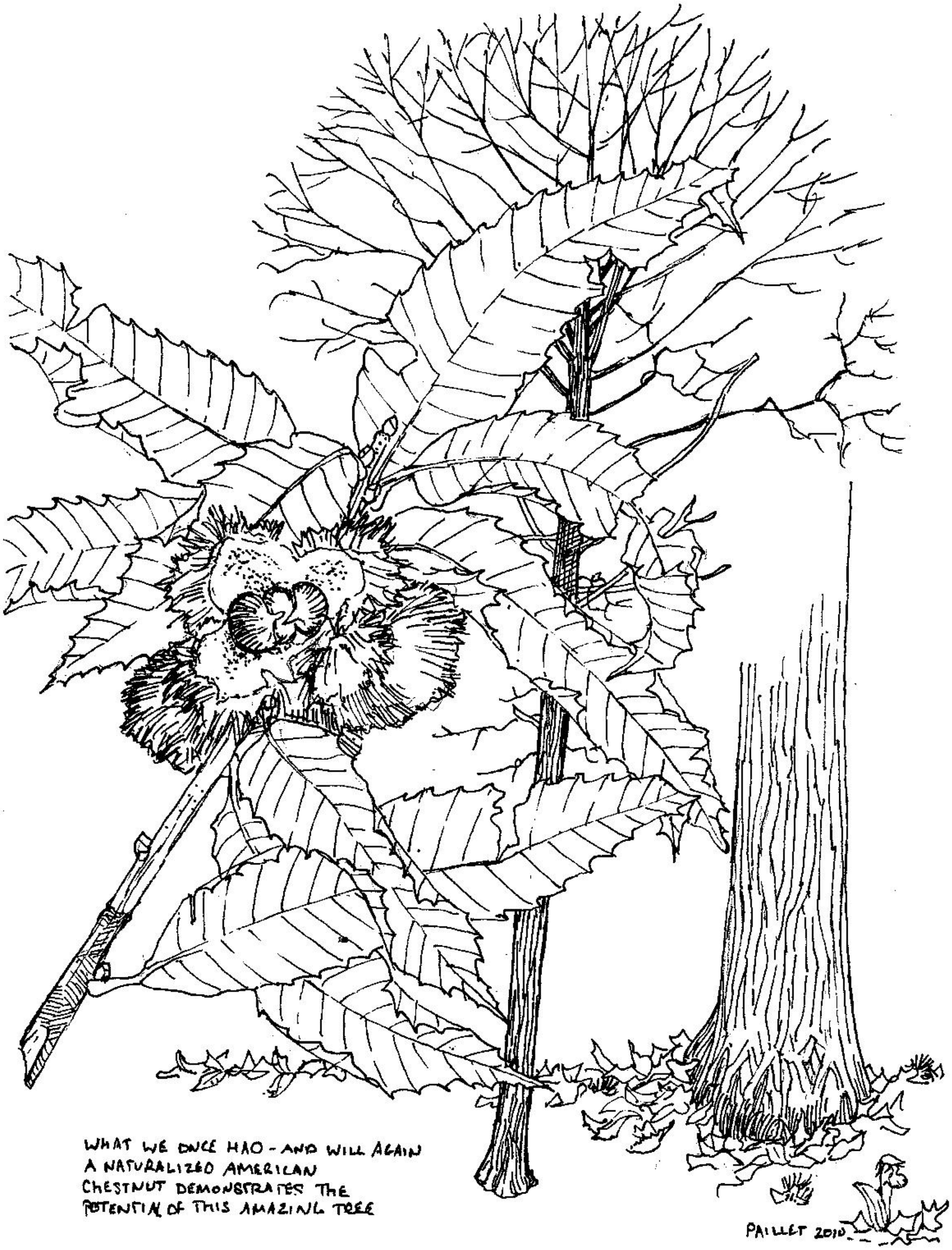
Fred L. Paillet

Adjunct Professor, Department of Geosciences, University of Arkansas

EDITOR'S NOTE: *These line drawings were offered a while ago by Fred Paillet but I had not yet gotten them into print. They are original artwork sketched by Dr. Paillet, retired USGS geologist and now adjunct professor at the University of Arkansas, while he traveled the world. Since he was so kind to offer these for the* Bulletin, *I wanted to give them the honor due his efforts.*

QUERCUS STELLATA
MONARCH OF THE CROSSTIMBERS


"TABONUCO"
DACRYODES EXCELSA
DETAILS FROM THE RAIN FOREST
NEAR THE EL VERDE STATION
SIERRA DE LUQUILLO
PUERTO RICO
MATURE FOLIAGE
LARGE TABONUCO BEING
UNDERCUT BY THE
SONADORA
TABONUCO SEEDLING
BASE OF ONE OF THE LARGEST
TABONUCOS AT EL VERDE STATION
FROM FIELD NOTES - APRIL, 1992
F.L. PAILLET


WHAT WE ONCE HAD - AND WILL AGAIN
A NATURALIZED AMERICAN
CHESTNUT DEMONSTRATES THE
POTENTIAL OF THIS AMAZING TREE
PAILLET 2010

THE FALL OF A CHAMPION: JULY 2013

Don C. Bragg

Research Forester, USDA Forest Service, Southern Research Station, Monticello, Arkansas

It is with much regret that I must report the demise of the national champion shortleaf pine (*Pinus echinata*) from Ashley County, Arkansas. A sudden, small, but intense windstorm in early July 2013 felled this impressive pine, which once measured about 36 inches in DBH and almost 140 ft tall.

This pine was originally located and measured by my former field technician Bruce Walsh, who was rightly proud of his discovery. After Bruce's untimely demise, we decided to name the tree the "Walsh Pine" in his honor.

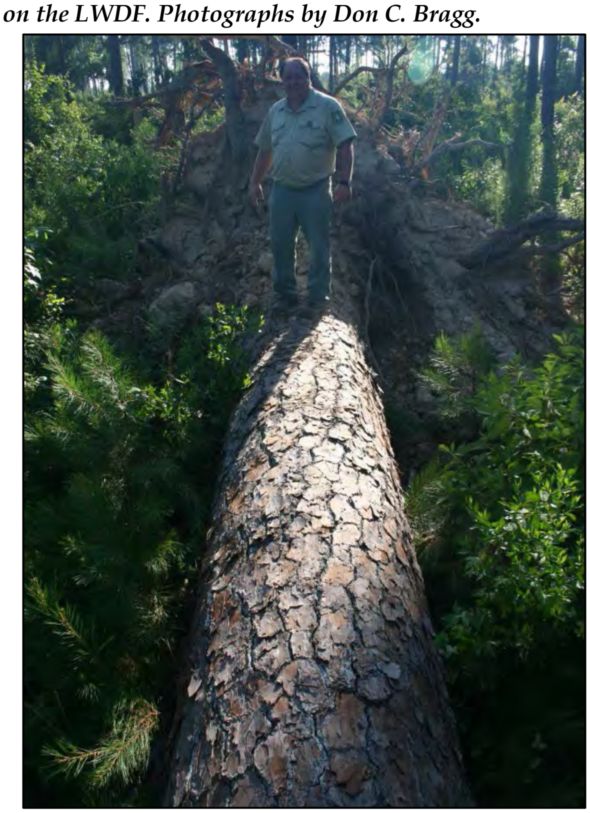
Left: The now-deceased national champion shortleaf pine at its prime, shortly after its discovery. Photograph by Don C. Bragg.

Right: ***The Levi Wilcoxon Demonstration Forest has been experiencing a gradual decline and mortality of its large pine. Photograph by*** *Don C. Bragg.*

The Walsh Pine and an even larger loblolly pine (called by locals the "Morris Pine") are part of the Levi Wilcoxon Demonstration Forest (LWDF) located just a few miles south of the city of Hamburg, Arkansas, along US Highway 425. This stand of timber had been set-aside by the Crossett Lumber Company in the late 1930s to serve as an uncut, unmanaged example of the once mighty virgin pine-dominated forests that covered much of southern Arkansas and northern Louisiana.

Over the years, the ownership and management of the LWDF had passed between several industrial and investment owners to its current owner, Plum Creek Timber Company. All of these owners have largely honored the original intention of the set-aside, and have limited any cuts to this stand to the occasional salvage of dead or dying trees.

Above: USFS forestry technician Kirby Sneed examines the large, shattered stump of a loblolly pine that had been tipped over by the July 2013 windstorm at the LWDF. Below: More wind damage on the LWDF. Photographs by Don C. Bragg.



Above: Not only was the Walsh Pine the Arkansas state champion shortleaf, but it was recognized by American Forests as the national champion.

Left: The cut stump and some top are all that remain of the former champion.

Photographs by Don C. Bragg.

HOW OTHERS DESCRIBE TREE HEIGHT MEASURING

Robert T. Leverett

Founder, Eastern Native Tree Society

EDITOR'S NOTE: This Founder's Corner post actually represents the combination and summary of a number of recent emails and responses by Bob on this topic.

The American Forests project, testing new laser range-finders, and our on-going efforts to do a better job of measuring the dimensions of trees has led me to look at lots of descriptions on the Internet on how to measure tree height. Here is a quote from a state champion tree site that shall go unnamed: "The total height of the tree is considered to be the distance between the base of the tree trunk and the topmost twig. The most reliable measuring tools are the Abney hand level, clinometer, or transit. If these tools are not available, one can measure the tree's height with a straight stick."

The majority of state coordinators seem locked into a self-defeating pattern. They need to keep things simple for the public. Understood! But then they mislead readers on what is actually involved to get heights accurate enough to be published. The simple solution to me would be to describe two measurement processes: (1) a simple in-the-ball-park process for the nominators, and (2) a more rigorous processes for the certifiers. Lots of sympathy for the first group and no mercy for the second! This is the route I'll be recommending to American Forests. We'll see how far I get, but I think there are sympathetic ears for tightening down the rules for the certifiers.

On one website, the coordinator acknowledged the difficulty in measuring height and stated that the certifiers would often take multiple measurements and average them. This illustrates the lack of understanding on what the numbers represent and why the differences between measurements that exceed a couple or three feet (equipment-based errors). Why they believe averaging a set of incorrect numbers somehow magically cancels out the errors and allows them to arrive at a valid figure is mystifying to me, but there are plenty of examples of people thinking along those lines.

Measurers who use a laser-based hypsometer and can't find an opening to the center area of a crown (where they assume the top will be) are often at a loss as what to do thereafter. In truth, if you can't identify the sprig that you are calling the top and be able to locate it relative to other contenders and to the base of the trunk, then you are fooling yourself about what you are doing. This is a lesson that appears a long time in the coming, and it is made all the more difficult when the measurer is stumped by the underlying trigonometry and instead relies on a set measurement protocol. There is no substitute for experience and the use of a little commonsense. That being said, from what you are seeing as well as others, including myself, big strides have been made, and I expect as others take up the challenge, some of them will be teaching us a thing or two.

I expect that there have always been experienced tree measurers out there who recognized that standard measurement protocols were flawed and continued to be used in lieu of more exacting methods for a variety of reasons, not the least of which was acceptability to other measurers, i.e., the "old guard."

As an optimist, I think we will likely see a steady march toward tightening the reins by other state level coordinators. I expect that as they discover Ed Frank's excellent guides on Wikipedia:
http://en.wikipedia.org/wiki/Tree_height_measurement
even the most entrenched will want to improve their sites. Maybe we're seeing the beginning of a revolution in improving recreational tree measuring. If we consider the level of expertise that exists in the mountaineering community, we can imagine some of it spilling over into tree measuring from unexpected directions. When the word circulates that American Forests is strengthening their guidelines, there will likely be a ripple effect.

INSTRUCTIONS FOR CONTRIBUTORS

SCOPE OF MATERIAL

The *Bulletin of the Eastern Native Tree Society* accepts solicited and unsolicited submissions of many different types, from quasi-technical field reports to poetry, from peer-reviewed scientific papers to digital photographs of trees and forests. This diverse set of offerings also necessitates that (1) contributors specifically identify what type of submission they are providing; (2) all submissions should follow the standards and guidelines for publication in the *Bulletin*; and (3) the submission must be new and original material or be accompanied by all appropriate permissions by the copyright holder. All authors also agree to bear the responsibility of securing any required permissions, and further certify that they have not engaged in any type of plagiarism or illegal activity regarding the material they are submitting.

SUBMITTING A MANUSCRIPT

As indicated earlier, manuscripts must either be new and original works, or be accompanied by specific written permission of the copyright holder. This includes any figures, tables, text, photographs, or other materials included within a given manuscript, even if most of the material is new and original.

Send all materials and related correspondence to:

Don C. Bragg
Editor-in-Chief, *Bulletin of the ENTS*
USDA Forest Service-SRS
P.O. Box 3516 UAM
Monticello, AR 71656

Depending on the nature of the submission, the material may be delegated to an associate editor for further consideration. The Editor-in-Chief reserves the right to accept or reject any material, regardless of the reason. Submission of material is no guarantee of publication, but does imply the consent to do so.

All submissions must be made to the Editor-in-Chief in digital format. Manuscripts should be written in Word (*.doc), WordPerfect (*.wpd), rich-text format (*.rtf), or ASCII (*.txt) format.

Images can be submitted in any common format like *.jpg, *.bmp, *.tif, *.gif, or *.eps, but not PowerPoint (*.ppt). Images must be of sufficient resolution to be clear and not pixilated if somewhat reduced or enlarged. Make sure pictures are at least 300 dots per inch (dpi) resolution. Pictures can be color, grayscale, or black and white. Photographs or original line drawings must be accompanied by a credit line, and if copyrighted, must also be accompanied by a letter with express written permission to use the image. Likewise, graphs or tables duplicated from published materials must also have expressly written copyright holder permission.

PAPER CONTRIBUTIONS (ALL TYPES)

All manuscripts must follow editorial conventions and styling when submitted. Given that the *Bulletin* is edited, assembled, and distributed by volunteers, the less work needed to get the final product delivered, the better the outcome. Therefore, papers egregiously differing from these formats may be returned for modification before they will be considered for publication.

Title Page

Each manuscript needs a separate title page with the title, author name(s), author affiliation(s), and corresponding author's postal address and e-mail address. Towards the bottom of the page, please include the type of submission (using the categories listed in the table of contents) and the date (including year).

Body of Manuscript

Use papers previously published in the *Bulletin of the Eastern Native Tree Society* as a guide to style formatting. The body of the manuscript will be on a new page. Do not use headers or footers for anything but the page number. Do not hyphenate text or use a multi-column format (this will be done in the final printing). Avoid using footnotes or endnotes in the text, and do not use text boxes. Rather, insert text-box material as a table.

All manuscript submissions should be double-spaced, left-justified, with one-inch margins, and with page and line numbers turned on. Page numbers should be centered on the bottom of each new page, and line numbers should be found in the left margin.

Paragraph Styles. Do not indent new paragraphs. Rather, insert a blank line and start the new paragraph. For feature articles (including peer-reviewed science papers), a brief abstract (100 to 200 words long) must be included at the top of the page. Section headings and subheadings can be used in any type of written submission, and do not have to follow any particular format, so long as they are relatively concise. The following example shows the standard design:

FIRST ORDER HEADING
Second Order Heading
Third Order Heading. The next sentence begins here, and any other levels should be folded into this format.

Science papers are an exception to this format, and must include sections entitled "Introduction," "Methods and Materials," "Results and Discussion," "Conclusions," "Literature Cited," and appendices (if needed) labeled alphabetically. See the ENTS website for a sample layout of a science paper.

Trip reports, descriptions of special big trees or forests, poetry, musings, or other non-technical materials can follow less rigid styling, but will be made by the production editor (if and when accepted for publication) to conform to conventions.

Table and figure formats. Tables can be difficult to insert into journals, so use either the table feature in your word processor, or use tab settings to align columns, but DO NOT use spaces. Each column should have a clear heading, and provide adequate spacing to clearly display information. Do not use extensive formatting within tables, as they will be modified to meet *Bulletin* standards and styles. All tables, figures, and appendices must be referenced in the text.

Numerical and measurement conventions. You can use either English (e.g., inches, feet, yards, acres, pounds) or metric units (e.g., centimeters, meters, kilometers, hectares, kilograms), so long as they are consistently applied throughout the paper. Dates should be provided in month day, year format (June 1, 2006). Abbreviations for units can and should be used under most circumstances.

For any report on sites, heights must be measured using the methodology developed by ENTS (typically the sine method). Tangent heights can be referenced, especially in terms of historical reports of big trees, but these cannot represent new information. Diameters or circumference should be measured at breast height (4.5 ft above the ground), unless some bole distortion (e.g., a burl, branch, fork, or buttress) interferes with measurement. If this is the case, conventional approaches should be used to ensure diameter is measured at a representative location.

Taxonomic conventions. Since common names are not necessarily universal, the use of scientific names is strongly encouraged, and may be required by the editor in some circumstances. For species with multiple common names, use the most specific and conventional reference. For instance, call *Acer saccharum* "sugar maple," not "hard maple" or "rock maple," unless a specific reason can be given (e.g., its use in historical context).

For science papers, scientific names MUST be provided at the first text reference, or a list of scientific names corresponding to the common names consistently used in the text can be provided in a table or appendix. For example, red pine (*Pinus resinosa*) is also known as Norway pine. Naming authorities can also be included, but are not required. Be consistent!

Abbreviations. Use standard abbreviations (with no periods) for units of measure throughout the manuscript. If there are questions about which abbreviation is most appropriate, the editor will determine the best one to use. Here are examples of standardized abbreviations:

inch = in	feet = ft
yard = yd	acre = ac
pound = lb	percent = %
centimeter = cm	meter = m
kilometer = km	hectare = ha
kilogram = kg	day = d

Commonly recognized federal agencies like the USDA (United States Department of Agriculture) can be abbreviated without definition, but spell out state names unless used in mailing address form. Otherwise, spell out the noun first, then provide an abbreviation in parentheses. For example: The Levi Wilcoxon Demonstration Forest (LWDF) is an old-growth remnant in Ashley County, Arkansas.

Citation formats. Literature cited in the text must meet the following conventions: do not use footnotes or endnotes. When paraphrasing or referencing other works, use the standard name date protocol in parentheses. For example, if you cite this issue's Founder's Corner, it would be: "…and the ENTS founder welcomed new members (Leverett 2006)." If used specifically in a sentence, the style would be: "Leverett (2006) welcomed new members…" Finally, if there is a direct quotation, insert the page number into the citation: (Leverett 2006, p. 15) or Leverett (2006, p. 16-17). Longer quotations (those more than three lines long) should be set aside as a separate, double-indented paragraph. Papers by unknown authors should be cited as Anonymous (1950), unless attributable to a group (e.g., ENTS (2006)).

For citations with multiple authors, give both authors' names for two-author citations, and for citations with more than two, use "et al." after the first author's name. An example of a two-author citation would be "Kershner and Leverett (2004)," and an example of a three- (or more) author citation would be "Bragg et al. (2004)." Multiple citations of the same author and year should use letters to distinguish the exact citation: Leverett 2005a, Leverett 2005b, Leverett 2005c, Bragg et al. 2004a, Bragg et al. 2004b, etc.

Personal communication should be identified in the text, and dated as specifically as possible (not in the Literature Cited section). For example, "…the Great Smoky Mountains contain most of the tallest hardwoods in the United States (W. Blozan, personal communication, March 24, 2006)." Examples of personal communications can include statements directly quoted or paraphrased, e-mail content, or unpublished writings not generally available. Personal communications are not included in the Literature Cited section, but websites and unpublished but accessible manuscripts can be.

Literature Cited. The references used in your work must be included in a section titled "Literature Cited." All citations should be alphabetically organized by author and then sorted by date. The following examples illustrate the most common forms of citation expected in the *Bulletin*:

Journal:

Anonymous. 1950. Crossett names giant pine to honor L.L. Morris. Forest Echoes 10(5):2-5.

Bragg, D.C., M.G. Shelton, and B. Zeide. 2003. Impacts and management implications of ice storms on forests in the southern United States. Forest Ecology and Management 186:99-123.

Bragg, D.C. 2004a. Composition, structure, and dynamics of a pine-hardwood old-growth remnant in southern Arkansas. Journal of the Torrey Botanical Society 131:320-336.

Proceedings:

Leverett, R. 1996. Definitions and history. Pages 3-17 *in* Eastern old-growth forests: prospects for rediscovery and recovery, M.B. Davis, editor. Island Press, Washington, DC.

Book:

Kershner, B. and R.T. Leverett. 2004. The Sierra Club guide to the ancient forests of the Northeast. University of California Press, Berkeley, CA. 276 p.

Website:

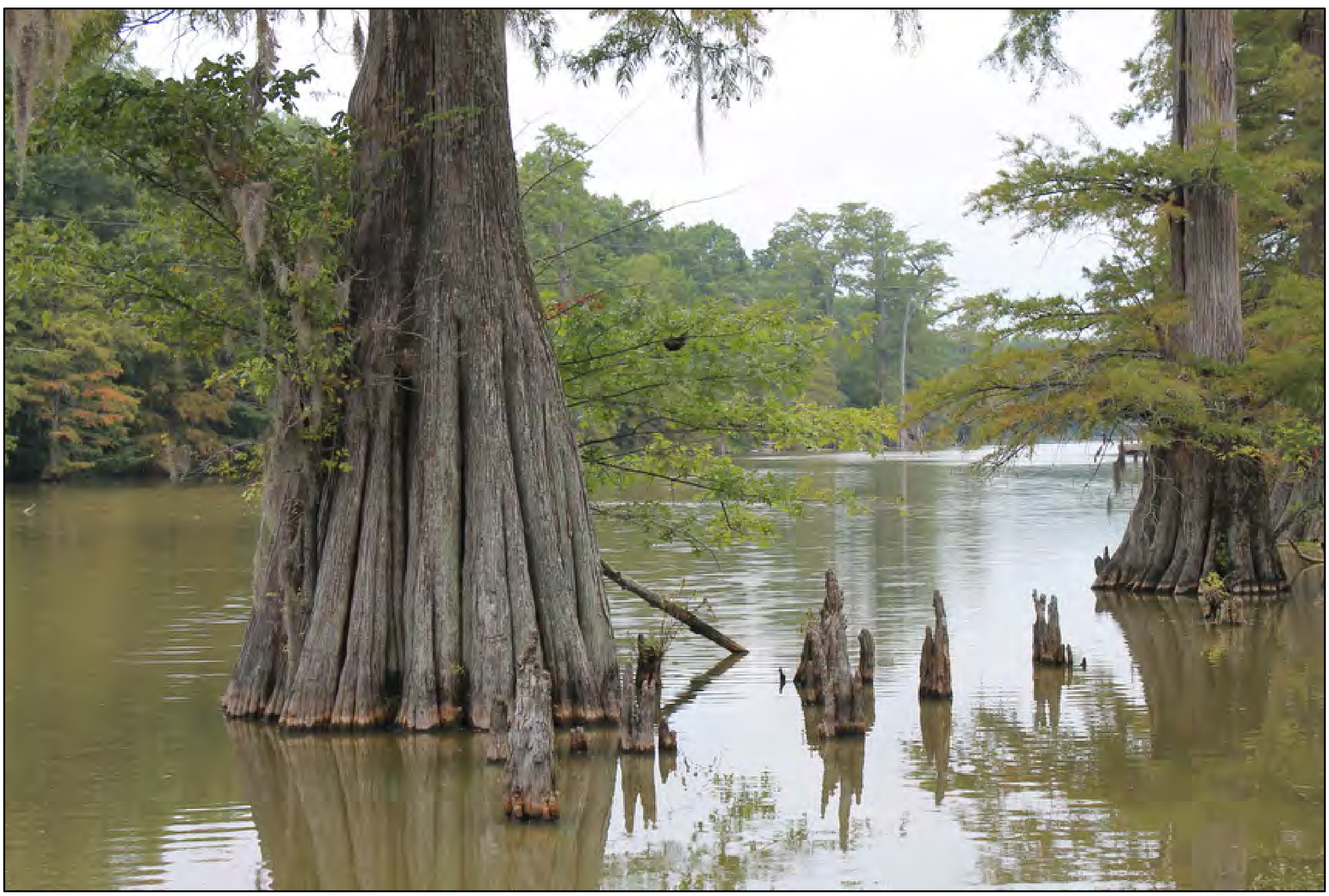
Blozan, W. 2002. Clingman's Dome, May 14, 2002. http://www.uark.edu/misc/ents/fieldtrips/gsmnp/clingmans_dome.htm. Accessed June 13, 2006.

Use the hanging indent feature of your word processor (with a 0.5-in indent). Do not abbreviate any journal titles, book names, or publishers. Use standard abbreviations for states, countries, or federal agencies (e.g., USDA, USDI).

ACCEPTED SUBMISSIONS

Those who have had their submission accepted for publication with the *Bulletin of the Eastern Native Tree Society* will be mailed separate instructions to finalize the publication of their work. For those that have submitted papers, revisions must be addressed to the satisfaction of the editor. The editor reserves the right to accept or reject any paper for any reason deemed appropriate.

Accepted materials will also need to be accompanied by an author contract granting first serial publication rights to the *Bulletin of the Eastern Native Tree Society* and the Eastern Native Tree Society. In addition, if the submission contains copyrighted material, express written permission from the copyright holder must be provided to the editor before publication can proceed. Any delays in receiving these materials (especially the author contract) will delay publication. Failure to resubmit accepted materials with any and all appropriate accompanying permissions and/or forms in a timely fashion may result in the submission being rejected.



Large baldcypress lining the shore of a lake at Leroy Percy State Park just south of Greenville, Mississippi. Photo by Don C. Bragg.