Bulletin of the Eastern Native Tree Society

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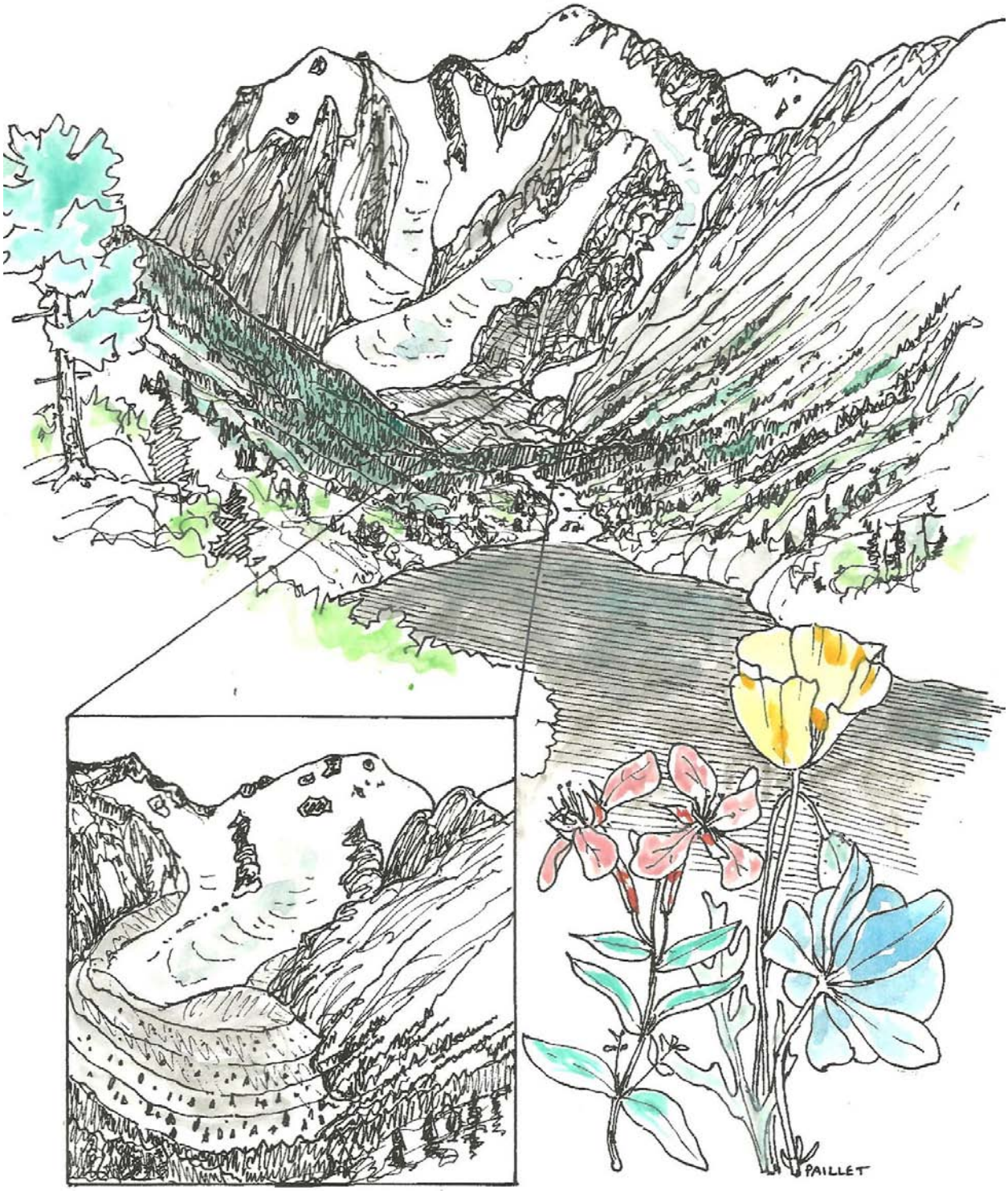

EASTERN NATIVE TREE SOCIETY

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.

Membership and Website Submissions:

Membership is free when you sign up for our discussion group, ENTSTrees, at: http://groups.google.com/group/entstrees?hl=en. Submissions to the ENTS 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 ENTS website. The Eastern Native Tree Society and the *Bulletin of the Eastern Native Tree Society* editorial staff are solely responsible for its content.

COVER: An artistic rendition of the glaciers at Shavlinsky Lake in Russia. Line drawing/watercolor by Fred Paillet.

TABLE OF CONTENTS

A NEW ENTS MAGAZINE

Our switch to the ENTS Bulletin Board System (BBS) has changed the way we communicate with each other (as well as easing the burden on Ed Frank, ENTS webmaster and online guru). With his newly-found freedom, Ed has decided to expand upon the free literature dispense by ENTS to the public, and has created a new monthly e-magazine with the goal of more timely distribution of BBS posts, especially for trip posts, pictures, and other pressing events. The first issue of this new magazine, *eNTS*, is available for free download on the ENTS website (http://www.nativetreesociety.org/), and contains some glorious photography provided by Will Blozan on his recent work in the giant sequoias, amongst other items.

Not to worry—we will continue to publish the *Bulletin of the Eastern Native Tree Society* several times each year as material becomes available. My work and family schedules, plus shortages of publishable materials, will continue to limit how often the *Bulletin* is published, but the new magazine should help us improve the timeliness and reach of the work of the Eastern Native Tree Society.

So, make sure to keep posting your field trips to the ENTS BBS!

Don C. Bragg
Editor-in-Chief

Developing fruits of Osage-orange* (Maclura pomifera) *in the Rick Evans Grandview Prairie Wildlife Management Area near Columbus, Arkansas. Photo by Don C. Bragg.

ANNOUNCEMENTS AND SOCIETY ACTIONS

Seventh Forest Summit To Be Held in October 2011

Professor Gary Beluzo cordially invites the public to the Seventh Forest Summit to be held on Thursday, October 13 through Friday, October 14, 2011 at Holyoke Community College in Holyoke, Massachusetts. As always, this year's program is free to the public, and will feature a number of top scientists and other key individuals who cherish our forests. The program is still being formed, but to date the keynote speaker is Dr. David Stahle, a prominent dendrochronologist from the University of Arkansas. Other confirmed participants include Dr. Henry Art (Williams College), Dr. Jesse Bellemare (Smith College), Professor Beluzo (Holyoke Community College), Dr. Don C. Bragg (US Forest Service), Dr. Lee Frelich (University of Minnesota), and Dr. Neil Pederson (Columbia University). Please check on the Summit's website (http://www.hcc.edu/forest/) for future updates to the program.

Fall 2011 ENTS Rendezvous Also In October

According to tradition, the fall ENTS Rendezvous will immediately follow the HCC Forest Summit. This year's event, to be held on Saturday, October 15, 2011, will be held in Charlemont, Massachusetts. Details will follow—check the ENTS Bulletin Board and website for further information.

Answer to Last Issue's "Puzzler" Tree Species

Do you remember the two pictures of a tree from southeastern Arkansas that I showed on pages 8 and 11 of the last issue of the *Bulletin of the Eastern Native Tree Society*? Did you get the species identification right? If you guessed *Zanthoxylum clava-herculis* or the "toothache tree" also called "Hercules' club" or "prickly-ash" by some, you are correct! *Zanthoxylum clava-herculis* is native to the southeastern United States and is similar in many ways to a different spiny (but unrelated) species, *Aralia spinosa*. It got its common name "toothache tree" because of chemicals in the bark and leaves of this species that numb the mouth when chewed. Prickly-ash also has distinctive spines on some of the bumps on the bark, as was seen in these pictures.

Photographs by Don C. Bragg.

EXTERNAL BASELINE METHOD FOR MEASURING TREE HEIGHT

Robert T. Leverett

Founder and Executive Director, Eastern Native Tree Society

INTRODUCTION

Tree measuring is the quintessential specialty of the Eastern and Western Native Tree Societies (ENTS and WNTS, respectively). ENTS mainly covers the eastern United States. A couple of years ago, we added the Rocky Mountain region and Alaska to be handled by WNTS. Even more recently, we joined forces with West Coast redwood guru Michael Taylor, and now have an opportunity to participate in the immense challenges of measuring some of the Pacific giants. The possibility has some of us mesmerized. Additionally, ENTS President Will Blozan is functioning as part of an elite team measuring the huge George Washington Giant Sequoia. Other members of the sequoia team include Drs. Steve Sillett and Robert Van Pelt. We are reaching the pinnacle of challenge and performance. To be sure, others measure trees, professionally and for sport, but outside the West Coast gurus, few match our intensity and commitment to accuracy. We are always looking to improve field methods for measuring the common dimensions of tree girth, height, and crown spread, and more complex measurements such as trunk and limb volume, projected crown area, and even crown volume. No surprises for anyone perusing the ENTS website, online bulletin board, or past editions of the *Bulletin*.

We've now been at the measuring business for years. One wonders if there is anything left for us to accomplish toward crafting new measurement methods and techniques that can handily be used in the field. Avant-garde computer graphic techniques for tree measuring are a wide open-field, but that is in-door work. We Ents prefer being in the fresh air, working with live trees instead of computer images. But, are we nearing the end of innovation? One might think so. However, our measuring mission is quite broad. At the far end of the spectrum we work to attain ever-higher levels of measurement accuracy and research advanced methods for locating exceptional trees. In this pursuit, we have adopted the use of LIDAR technology. It is proving itself. We also experiment with new high-end laser equipment. In this department, Michael Taylor's expertise is proving invaluable. He is endlessly creative, and there are always new gadgets to test and find uses for, and the gadgetry spans a wide range of prices. Some equipment items are clearly out of the price range of most ENTS members, but other items are surprisingly inexpensive for what they deliver. The bottom line is that opportunities continually emerge to evaluate new low cost equipment for members who are interested in achieving greater measuring accuracy.

In past *Bulletin* articles, I've discussed ways of extending the life of measurement methods that utilize inexpensive equipment. One article explored ways of using tape and clinometer and tangent-based calculations to get around the problems that tape and clinometer users have traditionally encountered. In this article, I will extend the method, which I now call the External Baseline Method (EBLM). But first, let's review the traditional tangent method that has been the bread-and-butter height measuring technique in the field of forestry for decades.

TANGENT METHOD FOR MEASURING TREE HEIGHT

The tangent or percent slope method for measuring tree height depends on two simple instruments: an ordinary tape and a device that measures vertical angles. The inclinometer (or just clinometer) is the most common instrument for measuring vertical angles. The method employs the geometry of a right triangle, and in particular, the tangent function. In the simplest application of the tangent method (commonly depicted in drawings that accompany clinometers), the measurer moves to a position where the top and base of the tree are simultaneously visible. From the chosen measurement point, the clinometer is used to identify the position on the trunk that is at eye level. The distance from the eye to the level point is then measured with a tape. The distance obtained from eye to trunk becomes the base of two adjoining right triangles. From the position of measurement, keeping the eye in place, the measurer takes the vertical angles to the top of the tree and to the base. With one distance and two angles, all necessary inputs have been obtained for the method. The following diagram (Figure 1) and equations show the required calculations to compute full tree height.

$$H_1 = D\tan(\theta_1) \quad [1]$$

$$H_2 = D\tan(\theta_2) \quad [2]$$

$$H = H_1 + H_2 \quad [3]$$

In Figure 1, D is the baseline, θ_1 and θ_2 are the angles to the top and base of the tree, respectively. H_1 and H_2 are the components of total tree height, with H_2 being the component above eye level and being the height component below eye level. As can be seen in the diagram, the two height components are added together to get total tree height. The drawing shows the base of the tree below eye level. If the base is actually above eye level, then H_2 is subtracted from H_1. If angles above eye level are entered as positives and angles below eye level are entered as negatives, the formula becomes:

$$H = H_1 - H_2 \quad [4]$$

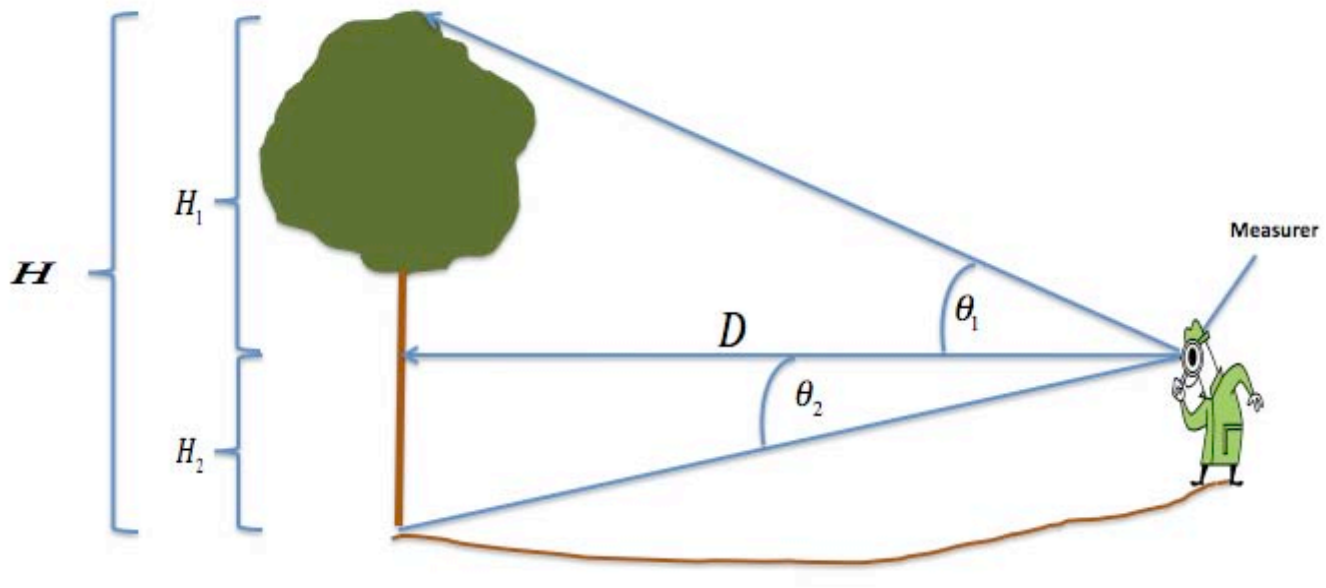


Figure 1. Standard tangent method.

The above calculations can be simplified by using a clinometer with a percent slope scale, which gives the tangent values of the angles, expressed as percentages of baseline distance. So, if a reading of 80 is taken for the top of a tree from a percent slope scale, the interpretation is that the height of the tree above eye level is 80% of the baseline distance. If the baseline is exactly 100 ft, then the height of the tree is 80 ft (80% of 100 ft). So, with a percent slope scale and a 100-ft baseline, the clinometer gives the component of tree height directly that is being measured, i.e., above or below eye level. Under these conditions, one reads tree height, above or below eye level directly from the percent slope scale. What could be easier?

In fact, this simple way of measuring trees has been virtually canonized within the timber profession. The measurement model shown in Figure 1 has been programmed into many brands of hypsometers, including Laser Technology instruments (e.g., Impulse LR 200, The TruPulse 360, and the TruPulse 200). These instruments allow the measurer to shoot to the trunk at a convenient point, and then the instrument corrects for slope and returns the level distance from eye to trunk. The measurer then take angles directly to the top and base of the tree, and the instrument returns the vertical distance between the top and base, or what is been called the top and base. It is one-stop shopping, and there has been significant resistance to change.

The simple tangent-based tree height method, whether performed with tape and clinometer or by hypsometer, has been used countless times and continues to be the standard procedure for tree height measuring within the timber profession and by those who certify nominations to the National Register of Big Trees. However, the method is not without flaws. Applied as described above, it incorporates assumptions that are often not met. It requires the top of the tree to be vertically over the base and a level baseline. If these conditions are met, then the tangent method works fine for what is being measured. However, if the tree is leaning, or the highest point is on a sprig that is not centered over the trunk, then the triangle formed by stretching a tape from the eye to the trunk, as one leg of the triangle, then extended up to the point being identified as the high point of the crown as a second leg, and finally, from the high point back to the eye does not form a right triangle, and a measurement error results from an incorrect baseline. In these cases, the baseline will be too long or too short. Adjustments can be made to the baseline, if the measurer knows how to do it, but even with adjustments, accuracy is not always easy to achieve, and the requirement to adjust the baseline, especially in complex terrain, takes away from the simplicity of the method. The top of the tree not being vertically over the base is the notorious crown-offset problem that we have discussed in ENTS for years. It is why we adopted the sine top-sine bottom method, which solves the crown-offset problem, but requires a good laser rangefinder to measure direct distances to the target.

Experienced ENTS measurers all know the weaknesses of the conventional tangent method, and consequently routinely use the sine top-sine bottom method of measuring tree height. But as mentioned, our bread-and-butter method requires a laser rangefinder in addition to the clinometer, and a scientific calculator with trigonometric functions. Long-time clinometer users often balk at buying an expensive new piece of equipment, or even doing the simple sine-based calculations. They frequently argue that the tape and clinometer method has served generations of timber specialists well. But this defensive line of thinking obscures the challenge of establishing a correct baseline to the crown-point being measured. Consequently, significant height errors are commonly made with the tangent method. And those who make crown-offset measurement errors often seem oblivious to the underlying assumptions called for by each technique.

The big question is: are there are ways to use only tape, clinometer, and scientific calculator, adjusting for treetops not vertically positioned over their bases? Yes, there are several. One method is crown-point cross-triangulation. It is discussed in Will Blozan's operator guide to measuring. Another method is to position oneself perpendicular to the vertical plane that contains the top and the base, when the top is visibly offset from the base. Then a baseline taken directly to the trunk and perpendicular to the plane containing the base and crown-point can be substituted for the real baseline that should run, eye level from the measurer's position to a point directly beneath the crown-point.

The true baseline is the hypotenuse of a right triangle and the surrogate baseline is the leg of the triangle from eye to trunk. The error made with the surrogate baseline is not great for baselines of 100 ft or more and offsets of less than 20 ft. With a crown-offset as great as 20 ft for a surrogate baseline of 100 ft, the error in the height, at an angle of 45 degrees to the crown, is a modest 1.98 ft. The actual height of the crown would be 101.98 ft, but the calculated height will be 100 ft. Most tree measurer's can live with a 2-ft height error, so this adjustment works, and for trees with a crown-offset distance of under 10 ft and surrogate baselines of 100 ft or more, the height error shrinks to insignificance. So why not employ this adjustment and not worry further about the problem.

The answer to the above question is that neither of these methods for adjusting for crown-point offset is easy to apply in the field. Conceptually, the methods are easy to understand, but they often fail to produce the desired increase in accuracy when applied in a dense forest with limited crown visibility, or in sloping terrain. How does one determine the location of the vertical plane that contains the crown-point and the base and a position that is perpendicular to the plane for a line taken from measurer directly to the base? One can think of ways, but they can be labor intensive. For example, one might first identify the high point of a tree and move to a point where the eye, the high point, and base are in alignment, i.e., all lying in the same vertical plane. Running a tape from the position directly to the base presumably would pass vertically beneath the high point. If the tape is left on the ground, it might not be obvious where the point above would fall along the path of the tape as one approached the tree, but it would be somewhere on the tape.

However, once at the trunk, a compass bearing could be taken at right angles the path of the tape and the measurer could move to a position along the perpendicular path to where the high point and base were simultaneously seen. The vertical angle to the high point and the distance to the base would provide inputs to the tangent-based formula. Unfortunately, as one moves around in a closed canopy forest, one can quickly lose sight of the crown-point. With enough time, alignment may be achieved, but suddenly, the method starts to be less attractive. Measuring straight-trunked, leaning conifers may create confidence in the method, but attempts to apply it to broad-crown hardwoods in dense forest can quickly dissipates that confidence.

Applying cross-triangulation is likewise tricky. It generally takes two long tapes and two individuals to do the procedure without a lot of work. Otherwise, a compass is needed to maintain one's direction when creating the crossing lines needed to identify where a plumb line from the crown-point touches the ground. The reader is urged to consult the ENTS measurement guidelines for a diagram.

Does this mean that we in ENTS simply need to abandon the tangent method except in the simplest of circumstances? Not necessarily. We need to rethink how we establish a baseline, which leads to the External Baseline Method (EBLM), the subject of this article. Please note that in a preceding *Bulletin* article, I referred to the baseline as "exterior"—I have since chosen to use the term "external."

EXTERNAL BASELINE METHOD

In order to understand the theory behind and how to successfully apply the EBLM, we need to first reprogram our thinking. Suppose we think in terms of a target as being anything for which we choose to measure the height above and below eye level. Our target could be the top of a bridge, an ornament on a building, a railing on an overpass, a point on a limb of a tree jutting out over a body of water. We seek to break the traditional connection between measuring heights and trees. When we think along this new path, we no longer visualize the object to be measured as the equivalent of a vertically aligned telephone pole in a level parking lot.

Trees are irregularly shaped objects in 3-dimensional space. Consequently, if our target happens to be a tree, we do not assume that its top is directly above its base. If there is a base to the object being measured, and we want to measure the height from top to base, i.e. full height, we assume neither that the base is vertically over the top or that the base is directly accessible. For example, we might want to measure how much vertical space lies between the top of a chimney on a house and a limb extending over the chimney, or the top of a tree on the opposite side of a stream or fence with no direct accessibility. To drive home the point, when we think along these lines, we dispense with the traditional model of a tree as a vertical structure with a base that is accessible to us, and a top positioned vertically over the base. To deal with the new geometry, we establish an external baseline.

Our task in these measurement situations is to establish a baseline, the ends of which are directly aligned with the target, i.e., the line and the target all lie in the same vertical plane, but the baseline does not extend to the base, if the target has one. Another way of visualizing this setup is to see the baseline as pointing directly toward the target, but not reaching to its vicinity. Once we establish the baseline, we then sight the target from both ends and take the vertical angles to the target from the ends. In the simplest application of this method, we try to establish a level baseline. We can then simply measure the length of the baseline with a tape. The baseline's length and the two vertical angles are fed to a formula to get the target's height above eye level from the closest end of the baseline. We can repeat the procedure for the base of the object and add the

two height components together to get total height. Let's put these statements into a formula.

If d = baseline length, a_1 equals vertical angle from closest end of the baseline to the target, and a_2 equals the vertical angle to the target from the far end of the baseline. If we define H as the height of the target above eye level from the nearest end of the baseline, then the following formula gives the value of H:

$$H - \frac{d \tan(a_1) \tan(a_2)}{\tan(a_1) - \tan(a_2)} \quad [5]$$

This relatively simple formula can be fed into a calculator in the field. If both top and bottom of the tree can be seen, the formula can be applied in similar fashion to compute the components of height above and below eye level for the entire tree, if a tree is what we are measuring.

If the baseline cannot be made level, which will most often be the case, then the measurements become more involved and require more extensive analysis. Let's establish the following variables to handle all possible situations:

P_1 = position of eye at start of baseline;
P_2 = position of eye at end of baseline;
P_3 = position of target;
d = length of baseline;
a_1 = angle from eye to target from P_1;
a_2 = angle from eye to target from P_2;
a_3 = angle of baseline, i.e., slope angle of baseline;
H = height or P_3 above P_1.

Using these definitions, we define the following configurations or measurement scenarios:

1. P_2 and P_1 are level and P_3 is above P_1 and P_2 (This is the most desired configuration—a level baseline implies that $a_3 = 0$)
2. P_2 and P_1 are level and P_3 is below P_1 and P_2
3. P_2 is above P_1 and P_3 is above P_1 and P_2
4. P_2 is below P_1 and P_3 is below P_1 and P_2
5. P_2 is below P_1 and P_3 is above P_1 and P_2
6. P_2 is above P_1 and P_3 is below P_1 and P_2
7. P_2 is below P_1 and P_3 is below P_1 and above P_2
8. P_2 is above P_1 and P_3 is above P_1 and below P_2

These scenarios represent geometrical configurations of the measurement space. How many formulas are required to cover the scenarios? It can be shown that one suffices. In all situations, P_1 and P_2 are the positions of the measurer's eye or the centroid of the angle-measuring device, i.e., the clinometer. For more precise measurements, a tripod is used. The centroid of the clinometer is placed at the centroid of the tripod. If the clinometer is above the centroid (point of tripod swivel), moving the swivel arm forward or backward changes the location of the centroid of the clinometer in 3-dimensional space, and the resulting changes in distance must be taken into account to obtain extreme measurement accuracy. However, the calculations to adjust for centroid position will not be covered here. They will appear in a future article. For the purposes of this article, we assume that measurer at least partially compensates for swivel or head tilt. The single formula that covers the eight configurations identified is:

$$H = \frac{d \tan(a_1) \cos(a_3)[\tan(a_2) - \tan(a_3)]}{\tan(a_1) - \tan(a_2)} \quad [6]$$

There are several ways to carry out the measurements indicated in the above formula. The approach I have chosen for this article is one that I have tested. We begin with a convention that must be observed. P_1 will always be the point closest to the target at P_3. The first step in applying the method is to compute the values of d, the baseline, and a_3, the angle of the baseline. For scenarios 1 and 2 as previously listed, $a_3 = 0$. The baseline d is measured directly with a tape or laser rangefinder.

The measurer begins by placing identifying markers on the ground at the ends of the baseline. Call the point on the ground at start of the baseline G_1, which is the closest position to P_3. The position at the end of the baseline is G_2. When standing at G_1, the position of the measurer's eye is identified as P_1. The position of the eye at G_2 is designated as P_2. The measurer moves to G_2 and shoots the angle and measures the distance from the eye, P_2, to the ground at G_1. The angle is designated as x_3 and the distance as d_3. Using these measurements and the measurer's height, i.e., the vertical distance from the ground to the measurer's eye defined as H_e, the following formulas calculate the eye-to-eye distance of P_2 to P_1 and angle from P_2 to P_1 as d and a_3, respectively. The values x_3 and d_3 in the following formulae can be used to calculate a_3 and d:

$$a_3 = \tan^{-1}\left[\frac{H_e + d_3 \sin(x_3)}{d_3 \cos(x_3)}\right] \quad [7]$$

$$d = \frac{d_3 \cos(x_3)}{\cos(a_3)} \quad [8]$$

Next, the measurer shoots the angle of P_3 from P_1 and P_2 and substitutes a_1, a_2, a_3, and d in the formula that was given previously for H.

From this mathematical foundation, the reader may wonder how well EBLM can be applied under field conditions. An experiment was performed involving the measurement of 40 target trees. For comparison purposes, the targets were all measured using the sine method employing the Laser Technologies TruPulse 360 and the Bosch GLR825. The TruPulse 360 was used to measure angles. It measures angles accurate to ±0.1 degrees. The Bosch GLR825 was used to measure x_3 distances. The GLR825 has a rated accuracy of ±0.0254 inches.

TEST RESULTS

Table 1 gives the results of the last 12 measurements. In the table, notice that the greatest difference between the two methods is 1.91 ft. Most difference are on the order of ±0.5 ft. The average difference for the 12 trials is 0.54 ft. However, close agreement between the methods cannot be attained unless extreme care is exercised. Angles and distances must be accurate, especially because small angle errors on short baselines become magnified.

Table 1. Results of the last 12 measurements using the EBLM method.

Tree	H_e	d_3	x_3	H_x	D_x	a_3	d	a_1	a_2	H	TP360	Diff.
1	5.40	19.70	-16.20	-5.50	18.92	-0.29		31.80	28.80		92.00	
	5.40	19.70	-0.28	-5.50	18.92	-0.01	18.92	0.56	0.50	92.61	92.00	0.61
2	5.40	37.50	-9.40	-6.12	37.00	-1.12		37.60	30.70		101.00	
	5.40	37.50	-0.16	-6.12	37.00	-0.02	37.00	0.66	0.54	99.09	101.00	1.91
3	5.40	30.90	-9.00	-4.83	30.52	1.06		39.40	32.40		83.00	
	5.40	30.90	-0.16	-4.83	30.52	0.02	30.52	0.69	0.57	82.68	83.00	0.32
4	5.40	32.90	-11.10	-6.33	32.28	-1.66		59.80	41.20		59.50	
	5.40	32.90	-0.19	-6.33	32.28	-0.03	32.30	1.04	0.72	59.53	59.50	0.03
5	5.40	84.15	1.70	2.50	84.11	5.36		26.10	20.80		107.00	
	5.40	84.15	0.03	2.50	84.11	0.09	84.48	0.46	0.36	107.10	107.00	0.10
6	5.40	25.60	-11.60	-5.15	25.08	0.58		51.50	25.70		19.00	
	5.40	25.60	-0.20	-5.15	25.08	0.01	25.08	0.90	0.45	19.15	19.00	0.15
7	5.40	28.30	-4.40	-2.17	28.22	6.53		43.60	38.40		113.50	
	5.40	28.30	-0.08	-2.17	28.22	0.11	28.40	0.76	0.67	114.11	113.50	0.61
8	5.40	45.95	-6.00	-4.80	45.70	0.75		49.10	33.90		72.50	
	5.40	45.95	-0.10	-4.80	45.70	0.01	45.70	0.86	0.59	72.05	72.50	0.45
9	5.40	76.50	2.10	2.80	76.45	6.12		44.60	32.40		113.50	
	5.40	76.50	0.04	2.80	76.45	0.11	76.89	0.78	0.57	113.09	113.50	0.41
10	5.40	24.00	-12.90	-5.36	23.39	0.10		54.40	46.50		101.50	
	5.40	24.10	-0.23	-5.36	23.39	0.00	23.49	0.95	0.81	100.64	101.50	0.86
11	5.40	51.40	-5.60	-5.02	51.15	0.43		53.00	37.80		93.50	
	5.40	51.40	-0.10	-5.02	51.15	0.01	51.16	0.93	0.66	94.58	94.00	0.58
12	5.40	55.70	-4.30	-5.02	51.15	0.43		55.70	34.90		86.00	
	5.40	65.90	-0.08	-5.02	51.15	0.01	65.72	0.97	0.61	86.52	86.00	0.52
											Average:	0.54
											Standard Deviation:	0.49

The attractiveness of the EBLM depends of how easy it is to measure a_3 and d. Fortunately, this can be done fairly simply and quickly with nothing but a clinometer and tape. The measurer positions himself at G_2. With the clinometer, the angle is taken from P_2 to G_1. The distance is also measured from the eye at P_2 to the G_1 with a tape stretched from the eye to the ground, or laser rangefinder. Help from an assistant may be required with the tape. If a clinometer is used that can carry an error of as much as 0.25 degrees, then the error translated to H can be unacceptably large, particularly if the baseline is short. A minimum baseline of 40 ft is recommended if angle errors can exceed 0.1 degrees. An error of ±0.25 degrees is possible with most clinometers. However, some tilt sensors in hypsometers are accurate to 0.1 degrees. Using a hypsometer with this accuracy level and a laser rangefinder for distance, do you need to even consider the external baseline method? The answer is probably yes, the reason being that the laser may fail to return bounce form the target where clutter is in the way. Also, if the hypsometer is designed to use only the conventional tangent technique, it serves no better than tape, clinometer, and a scientific calculator.

MEASURING BOTH THE TOP AND BASE OF TREE

The method described covers measuring either the top or base of the tree above/below eye level. To use the method for both top and base, consider the following diagram (Figure 2). The EBLM requires eight measurements and the use of three separate formulae. The set of formulae is applied once for the top of the tree and once for the bottom. An Excel spreadsheet has been developed that automates the calculations and is available on the ENTS BBS/website. Two BASIC programs will be written and made available in the future—one for

iPhones and the other for laptops and desktop computers. The following extract from the Excel spreadsheet shows the calculations required to choose the right formula for a_3 and d. The first is in terms of the variables defined above and the second shows actual cell references.

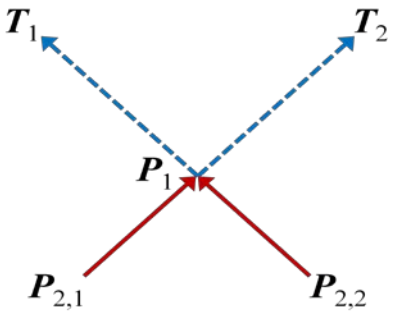


Figure 2. A tree is being measured with* $\mathbf{T_1}$ *and* $\mathbf{T_2}$ *being the top and base (or vice versa). Two baselines are established, each aligned with their respective target, and having the same* $\mathbf{P_1}$ *position. This ensures that the eye position stays the same for the top and bottom measurements.

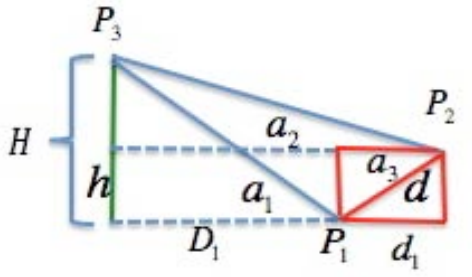
SUMMARY

The three formulas presented above make the EBLM more complicated than either the conventional tangent method or the simple sine top-sine bottom method that ENTS champions. I doubt that EBLM is going to get the use of the other methods in the field even with a programmable scientific calculator. So, the question arises, is it really needed. Time will tell, but it does solve a variety of troublesome problems. If the laser rangefinder can't see a target through clutter, EBLM may be the answer. It is also the answer for clinometer and tape users where the target is remote with little or no chance of resolving crown-point offset problems. The tests performed so far show that the accuracy is comparable to sine top-sine bottom where angles and the baseline measurements are accurate.

At the risk of repeating the message too often, I emphasize that ENTS is an organization of tree measurers. We take pride in pushing the envelope, and we adopt specialized methods for particular circumstances. The EBLM is not intended for use by casual big tree hunters, nor is it likely to be adopted by timber professionals. It doesn't replace our sine-based procedure, but it could prove useful in a limited number of situations. At the least, it has a temporary spot in our tool kit. The same can be said of Michael Taylor's Triangle Method. The innovations won't end with either method. We will continue experimenting to achieve ever-higher accuracy levels. Some methods will prove themselves over time and others will fall by the wayside. The lesson is that that tree measuring is not a simple task. The well-intentioned, but highly misleading "stick methods" for measuring tree height will continue to proliferate, courtesy of the Internet, and tape and clinometer users will continue to misapply that technique. The efforts of ENTS-WNTS members and our West Coast colleagues serve as a counterbalance to the traditional over-simplified treatments of tree measuring.

APPENDIX A: DERIVATION OF THE EXTERNAL BASELINE METHOD FOR TREE HEIGHT

The derivation of the key formula used in the EBLM follows. In the EBLM section of the main article, eight measuring configurations were listed. All lead to the same formula. The configuration shown below corresponds to #3 in that list:



In the above diagram, the baseline d is represented by the diagonal red line. Its angle relative to level is depicted by a_3. P_1 and P_2 represent the positions of the measurer's eye at the ends of the baseline and P_3 is the target. The measurer sights the target at P_1 and gets the angle a_1. Similarly, the targeted is sighted at P_2 with the angle being a_2. H is to be computed, which is the elevation of the target above the measurer's eye at P_1. Other measures are as shown in the diagram.

The $h = d\ \sin(a_3)$ derivation of H follows:

$$H = D_1 \tan(a_1) \quad [A1]$$

$$d_1 = d\cos(a_3) \quad [A2]$$

$$H + h = (D_1 + d_1)\tan(a_2) \quad [A3]$$

$$D_1 \tan(a_1) + d\ \sin(a_3) = (D_1 + d_1)\tan(a_2) \quad [A4]$$

With some simplifying and substitution, the following formula is arrived at:

$$D_1[\tan(a_1) - \tan(a_2)] = d[-\sin(a_3) + \cos(a_3)\tan(a_2)] \quad [A5]$$

Further substitution yields:

$$H = \frac{d\ \tan(a_1)[\cos(a_3)\tan(a_2) - \sin(a_3)]}{\tan(a_1) - \tan(a_2)} \quad [A6]$$

Which likewise can be further simplified, and recognizing that:

$$\tan(a_3) = \frac{\sin(a_3)}{\cos(a_3)} \quad [A7]$$

the final formulation is arrived at:

$$H = \frac{d\ \tan(a_1)\cos(a_3)[\tan(a_2) - \tan(a_3)]}{\tan(a_1) - \tan(a_2)} \quad [A8]$$

ALTAI MOUNTAIN TREK IN RUSSIA

Fred Paillet

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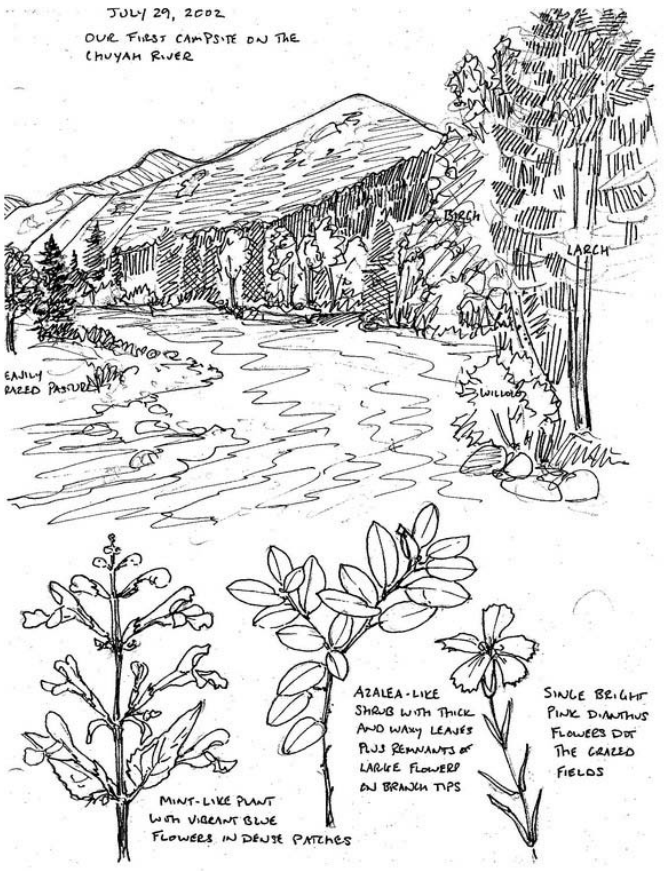
EDITOR'S NOTE: *This narrative and line drawings of a trip to Russia by Dr. Fred Paillet is intended to broaden the perspective of readers of the Bulletin of the Eastern Native Tree Society…Think of this journey as similar to that made of naturalists in America in the early 19th Century.*

July 26, 2002

Arrive back in Moscow. Mixed weather, with layers of clouds and scattered showers. The clouds and the long twilight remind me of summer days in Fairbanks. Meet the trip participants: Judith from Austin, Jo from Houston, and Jim from Seattle. Walking around the hotel, get to examine the Moscow River and the adjacent urban lots. The river water is not all that scummy for a city river, with small fish, lily pads, and even ducks with a few fuzzy ducklings floating about. Wagtails seem to be everywhere around the edge of the water. The one and only tree of the abandoned lots in the city is apparently box elder (*Acer negundo*). A check of my references shows that this species or anything like it is not native to central Asia or Europe, and must be introduced. But it seems unusual that an alien species should be so pervasive in a new land.

July 27-28, 2002

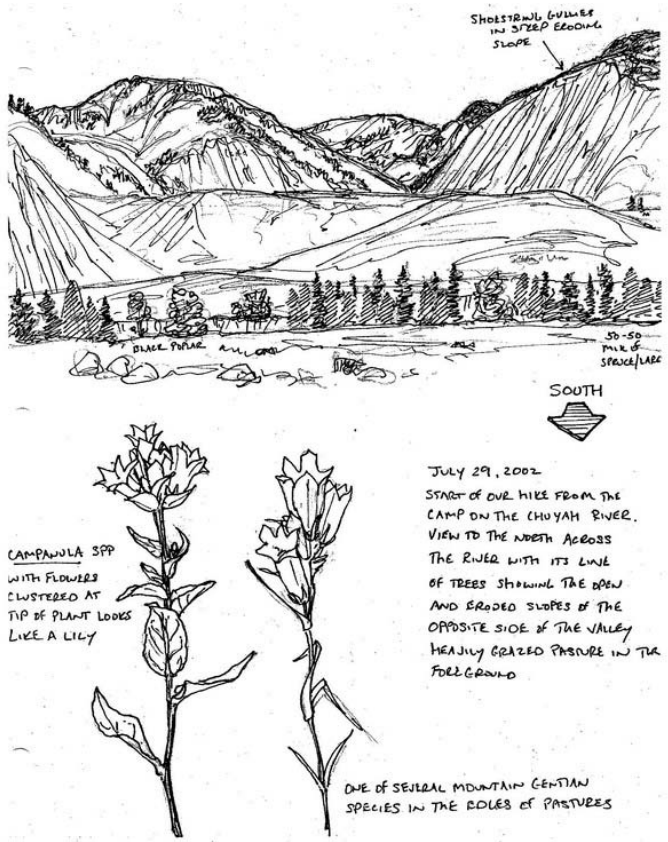
Tour of Novosibirsk. Sunny and warm both days with just a few fair weather clouds. Meet a part of the guide team at the airport—three giggly girls by the name of Inna, Tanya, and Vera. We stay in a hotel downtown and not far from the great Ob River. Pick up a souvenir spike from the Trans-Siberian Railway, and enjoy a river boat ride with views of the shaggy cottonwoods (probably European black poplars) on an island. The city is embedded in the great Siberian pine taiga—a continuous forest of *Pinus sylvestris* with minor amounts of birch (*Betula pendula*) and aspen (*Populus tremula*). We get the best close-up of the forest at the city zoo, which our guide Olga says was built into the "virgin forest." This is in fact a clean and spacious zoo, easily equivalent to the best of ours in the United States. If this zoo was built into old-growth forest, the trees are all about 30 to 40 cm in diameter and look like typical mature Scots pines with their layered crowns and orange-red bark. We get to see examples of the old log architecture of the town with gingerbread trim and bright blue or green shutters. Olga indicates that larch was the preferred wood for building, and that the natural resins of the wood protect from decay and insects. If that is the case, one wonders where the larch wood came from, since all of the surrounding forest seems to be pine. Suppose it is possible to bring in wood from the distant mountains, since there are railways and a major river draining those uplands. In a visit to the local market, we see a great variety of dried mushrooms which Olga insists that we taste as being far superior to anything we could find in western markets. The local fish catch includes something easily recognized as the Asian equivalent of our walleye. Olga calls this pike-perch, given in Russian as "soodak." I am a bit surprised that Jim, a native Wisconsin boy, is not all that excited about tasting soodak. We eventually have some in soup, and it does resemble its western counterpart in terms of flakey white meat, even if subjected to the insult of being boiled in broth.



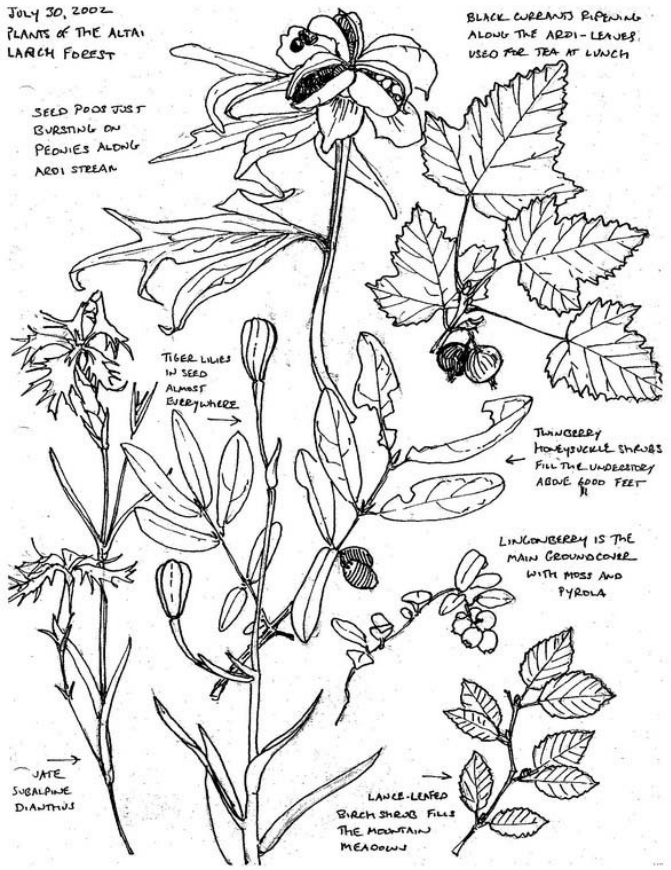
July 29, 2002

Drive to Aktosh village and start of hike. A misty morning with clouds thickening dramatically to the east as we go; dark clouds over the mountains seem to portend rough weather, but all we get are a few sprinkles as the clouds seem to lift in the late afternoon. We depart from Novosibirsk through continuous pine taiga and wake up outside of Biysk amid the fertile Russian plain. This is a flat land of black soil with green fields and copses of black poplar extending off towards the

horizon. Great thickets of box elder line the railroad tracks. We meet the three girls and three additional guides: Andre (head guide), Oleg and Kirill. We all pile into a van and head towards the Altai. Driving southeast from the city, the fertile grassland is interrupted by a finger of pine taiga. Assume that this marks a linear extent of sandy, infertile soil much like the old glacial lake beaches in Manitoba that host fingers of jack pine forest within the Canadian Prairie borders. Further east, the grassland resumes and we are following a major river valley. Shortly after, bluffs begin to rise on either side. These grow in size and amount of exposed bedrock, and soon became clothed in the familiar orange-barked pines, while the flood plain is full of birch and poplar. As low mountains rise around us, the pine forest becomes continuous. From that point on, there is a slow but steady displacement of the pine by birch. Bracken fern and hawthorn seem to be dominant in the understory. See a couple of symmetrical fir trees planted outside a café, and assume this is Siberian silver fir (*Abies sibirica*). Catch sight of a copse of symmetrical conifers among the birches along the flood plain, and assume these are the same species—they certainly don't look like spruce. And this will be the only look we get at fir for the whole trip…

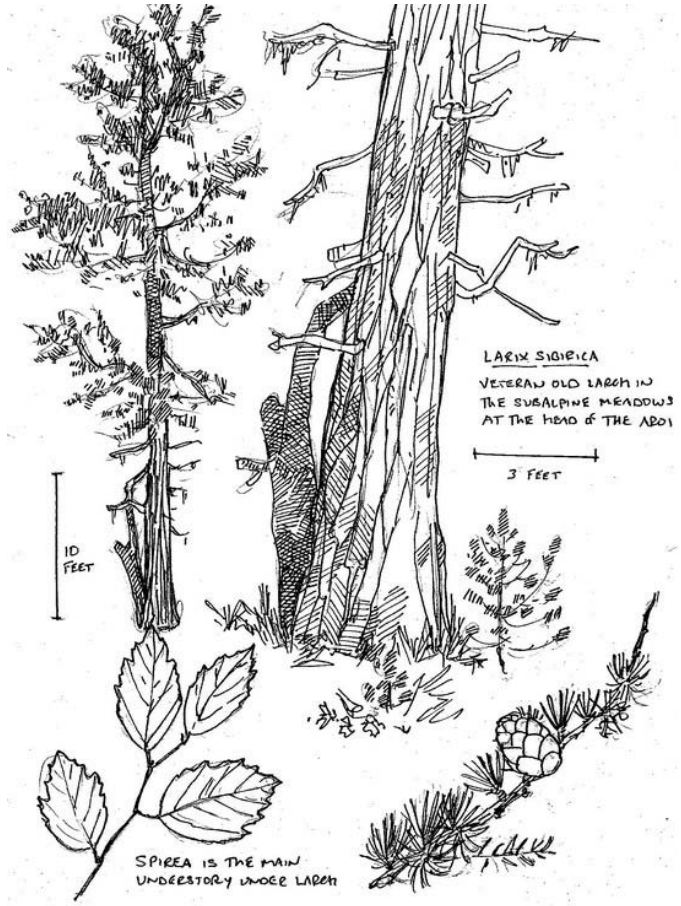


The mountains continue to grow in stature as we depart from the river valley along a secondary drainage. Birch soon replaces pine entirely. But as soon as birch dominates the forest, individual larches start to show up down along the stream below us. A tree willow similar to our black willow and a smaller tree with gray-green leaves like Russian olive also grow along the watercourses. Soon larch has all but replaced the birch. If there are worries about the Altai harboring a single-tree taiga, these are dispelled by the observation of a line of shaggy spruce trees (*Picea sibirica*) along the drainage. Spruce becomes more numerous and begins to move up the slopes as we get above maybe 1200 m. Then at maybe 1500 m the first Siberian pines (*Pinus cembra* var. *sibirica* or *Pinus sibirica*, depending on which authority you choose) appear. The similarity to Swiss stone pine is obvious in the symmetrical branch whorls and lighter green foliage of the horizontal branches. The road finally crests out in a wide mountain valley with great vistas of barren, rocky ridges all around. These mountains look just like the rounded and frost blasted granite schist mountains of the Front Range. The floor of the valley is dotted with wind-twisted and gnarled Siberian pines similar in every way to limber pines growing along eastern Montana hogbacks.



After a lunch stop amid the pines in this mountain pass, we resume travel down into another river valley and across another pass. The range in the first pass appears lightly grazed, but rangelands soon assume the heavily used condition of the American West. At least the degree of use never approaches the extreme conditions I have seen in places like Armenia and Morocco. We pass cows, goats and sheep on the road. These animals must have nerves of steel as the van careens by at full speed. One false move and they could be roadkill. The forest remains the same: a basic fabric of larch, with spruce along streams and on north-facing slopes, pine abundant at higher elevations, and birch lining the stream channels. The roadside is lush with wildflowers, including the familiar fireweed and a vibrant sky-blue delphinium. Other blues are added by a large-

flowered geranium and dense thickets of a blue flowered plant with opposite, mint-like leaves. Over a distance of about 25 kilometers the larches seem to have been defoliated by some pest. Some copses of birch also seem to have been defoliated in part, but that could just be the effects of hailstorm. The larch is continuously stripped over so large an area that this has to be the result of an insect agent.



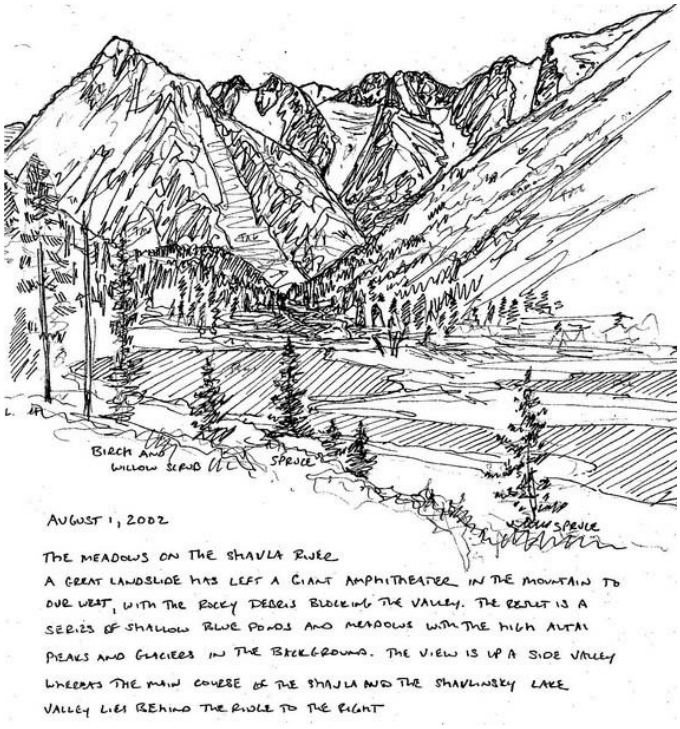
Arrive at the start of the hike a couple of hours before dark. Have dinner at a local café where the menu is quite limited—fish, kielbasa, or cutlet with noodles. The fish looks like a small whitefish, the kielbasa is essentially Vienna sausage, and the cutlet is ground meat of unknown provenance. We cross the raging Chuyah River on a rickety timber bridge and set up camp on a terrace below a steep wooded slope. We are not alone—several other parties of river floaters and perhaps hikers are using camps along the river. Jim is out late as he negotiates the deal to provide pack horses for our gear.

July 30, 2002

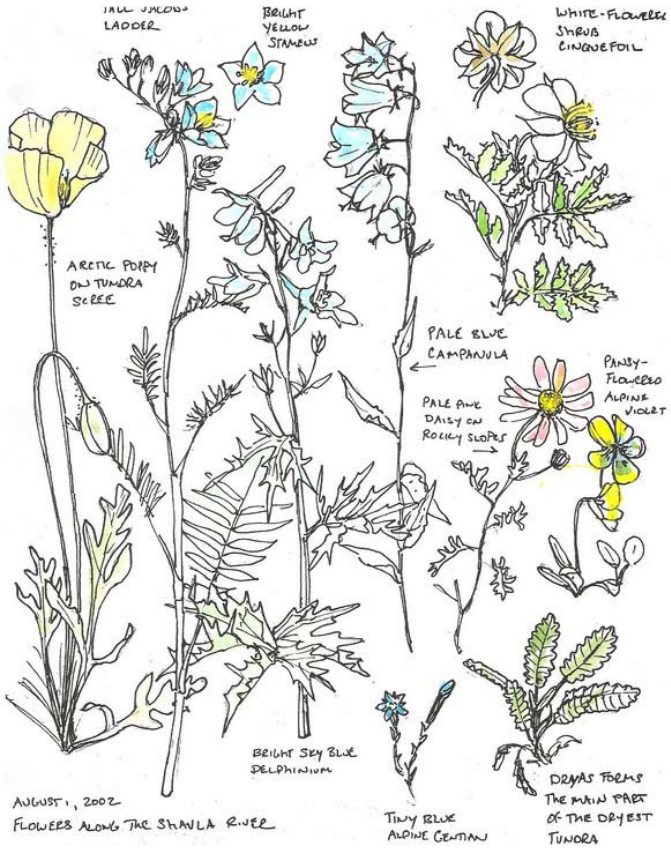
Hike up out of Chuyah River valley to a campsite along headwaters of the Aroi stream. Light rain in the early hours of the morning, but patches of blue in an unstable sky all day, with a small shower in the mid-morning. During breakfast our horses arrive. The wrangler will be Timofeyo, a wiry local character who looks exactly like what you would get if you ordered a Mongol horseman from central casting. He wears the standard uniform you see in all National Geographic photos from the region: gray sport coat, red button-down collar dress shirt, gray pants, and black leather boots, topped off with a Nike-logo baseball cap. There will be three horses along with Timofeyo and his two grandsons. The horses object to the loading while we start out hiking on the left bank of the Chuyah thorough heavily grazed pasture. The river is incised into a shallow ravine to our north that is marked by a line of trees—larch and spruce with a few old cottonwoods. The contrast in exposure is dramatic: heavy timber above us on north-facing slopes, but mostly open and eroding slopes across the way with a few stringers of larch timber on ridge crests and in the declivities of more distant ridges. Shoestring gullies line the unstable faces of the steepest south-facing slopes. Probably not much different from the Roaring Fork valley below Aspen, where the slope aspect has a similar effect on the growth of timber on the valley sides.

The one common shrub besides willows along the water is branched leguminous bush roughly equivalent to our catclaw mesquite, except that the claws aren't there. Where a small irrigation ditch runs through the meadow there are thickets of that light blue flower with mint-like leaves, and an interesting *Campanula* where the deep blue "bells" are all clustered at the top of the stem as if in a single many-ruffled flower. Even in the driest and most heavily grazed areas a bright pink dianthus presents its single showy flowers. One rank-looking flower of the open fields is a form of larkspur with very dull, pale yellow flower spikes, and is similar to the European wolfsbane. A disappointing contrast with the showy delphinium we saw along the road.

The trail veers off to the right and heads diagonally up the slope through an opening between rock outcrops, emerging up on the higher slopes above the river. It is now clear that we will contour up the side of the slope into deep forest while the river becomes confined to a steep and wild gorge. The trees are a mixture of spruce and larch with a number of healthy and symmetrical Siberian pines growing up into the stand. I wonder about a seed source, but there is a single large and contorted pine perched on the top of the cliffs below. The understory is composed of a mixture of a tall *Spirea* and the clawless catclaw shrub. One occasional shrub is new and different: an erect woody plant with small, oval, shiny olive-green leaves. Looks like a species of azalea, complete with the remains of large flower petals dried around ripening seed pods. The ground cover could be straight from Alaska: a deep carpet of sphagnum moss with lingonberry (*Vaccinium vitis-idea*), pine drops (*Pyrola*), and horsetails (*Equisetum*). The coniferous forest contains a few small groves of aspen, but they lack the open and airy look of Colorado aspen groves. Perhaps because they are buried in closed forest, and because the bark is not creamy white and is marked with diamond-shaped scars. The aspen certainly do not stand out the way the few birches do.

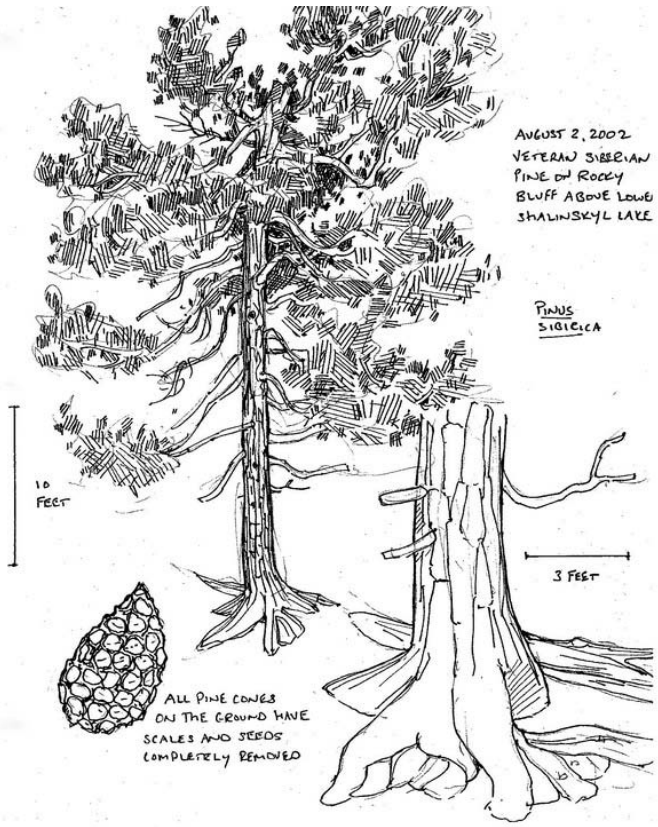


As the trail goes up, the canyon walls come together, forcing the Chuyah into a wild torrent of yellow-brown water racing between sheer tan rock walls. The size and color of the rock walls remind me of the Yellowstone Canyon even if the color of the water does not. The opposite walls and mountain looming above are almost devoid of vegetation. The mountain dirt road switch-backing up that slope almost makes you dizzy just to contemplate. We encounter several parties of Russian backpackers going the other way, suggesting that this is a well-used wilderness. I find it rather encouraging that so many "local" residents are enjoying the outdoors. The trail works its steep way up the slope to cut over the shoulder of a small ridge marked by a giant anthill. There are a few small openings in the woods here, one of which is an old camp site. This is my first introduction to Russian camping. There is a large stone ring with forked sticks planted on either side to hold a wooden bar from which pots are suspended. Old burned out cans and other trash are scattered about. Probably similar to camps in American forests back in the 1950's before the advent of the modern wilderness ethic.



The trail then descends down to the Aroi "River" which is hardly more than a little mountain stream in a steep ravine in the canyon wall. This creek is actually more of a waterfall than a stream. We stop for lunch in another of those well-used camp sites just on the other side of the stream. While Andre and his crew start a fire and prepare what will be the usual extended lunch, I can explore up and down the creek a ways. A perfectly clear little stream with no sign of fish life. A brilliant mound of tall fireweed shines form a gravel bar in the center of the channel. Lots of the catclaw shrubs, but also thickets of black current with clusters of a few big berries – looking more like gooseberries than currants. The rich soil of the small terraces on this brook show signs of showy flowers from earlier in the spring: seed pods of iris, peony, tiger lily and clematis are abundant. Lunch consists of soup made from scratch from potatoes, onions, and canned beef, accompanied by tea, bread, salami, and cheese.

After lunch we follow the trail up the steep face of the cliffs to the point where the higher Aroi first plunges over the canyon walls. On the way we pass a small opening with dead larch "poles" and a number of thrifty young larch saplings. Wonder if this is a small burn, or some other disturbance—can't find any obvious signs of charring on the dead trees. Also note two different pine saplings with reddened tops that might indicate white pine blister rust. With all of the healthy young pines filling in the understory under the larch and the abundance of currants in the shrubbery wonder why there is so little evidence of blister rust. Above that point the trail switches back and heads steeply upward to join the Aroi where that stream begins its plunge into the gorge. The vegetation also looks even more like anywhere in Alaska. There are now common bog blueberry, crowberry, and Labrador tea mixed in with the ground cover.



But one shrub is truly unusual, and becomes more common as we head up. This is a kind of twinberry honeysuckle (*Lonicera* sp.) with a growth form similar to our high-bush blueberry, and pairs of elongated blue berries dangling from leaf nodes on terminal branches. This looks to be about the same species as advertised in the latest garden catalogs as *Lonicera kamchatkensis*. The berries have a sweet and pleasant taste—at first. But then there is a deeply bitter aftertaste. The Russian girls go for these by the handful, but they are a bit too strong for me. We follow the little brook for at least a mile to a place where the forest opens up. Assume that this camping spot has been chosen so as to provide forage for the horses. Even so, the panoramic view of alpine meadow and scattered old larches with the barren ridge above makes this an appealing location.

The campsite is an interesting area to explore. Superficially, this looks a lot like a Front Range timberline valley—if you allow for the brush being mostly shrub birch instead of willow, and the trees being larch and not Englemann spruce. The rounded mountains in the background have that same boulder-pile look, and there are windblown pines scattered at tree line. The meadow in front of us is dotted with old shaggy trees, and sparkles with monkshood and asters. The relatively sparse foliage of the larches makes the festoons of lichen noticeable, whereas they would be less obvious in dense spruce crowns. The many lily plants with ripening seedheads suggest that the display must have been spectacular when the tiger lilies (red, orange or yellow?) were in full flower.

None of that delphinium in view from camp, but some nice displays just downstream. The most interesting flower here is a large and robust pink dianthus with elaborately frilly petals and entirely unlike anything I have seen in the wild before. The flower seems both too ornate and too common to be wild. The basic fabric in the meadow is the dwarf birch. This plant has the general growth form of Alaskan dwarf birch (*Betula nana),* but the leaves are spade-shaped and not perfectly round. A few injured birch branches hold prematurely orange leaves, showing that fall display must be similar to the orange fire that envelopes the Alaskan birch brush in early September. Closed larch forest begins immediately behind the camp. The open understory of the forest is different from montane North American forests because there are many of the twinberry shrubs, and because of the many young Siberian pines growing up into the space between larches. Gives a very different ambiance to these woods in comparison with the spacious pine forests of the American west. You sometimes see limber or bristlecone pines coming into lodgepole pine forests, but never so continuously distributed as Siberian pines in this larch forest.

The evening gives our first introduction to camp life. Timofeyo harvests firewood by lassoing the lower dead branches on the larch trees around camp and then pulling them down. We have a main course of instant mashed potatoes. Either Andre and company have no experience with this product, or they believe what they hear about American appetites, because we are each served enough potatoes for four. Salami and cheese on the side, with bread, sardines/kippers and meat paste for good measure. Tea and cookies for dessert.

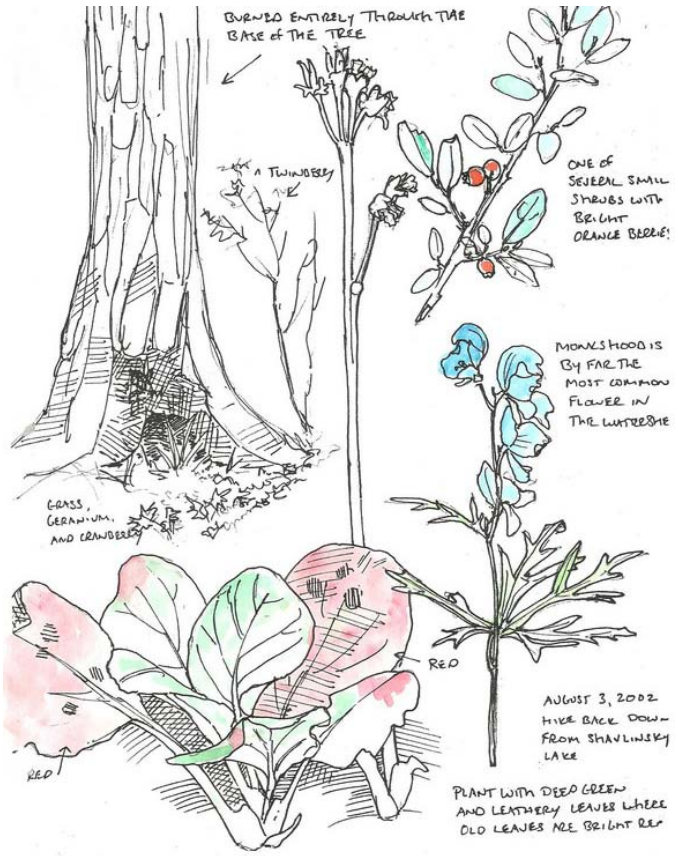
July 31, 2002

Across the plateau and into the Eshtico River valley. Steady light rains again in the early morning hours, but the clouds begin to lift during breakfast. More clouds drifting in the mid-morning, a short, violent thunderstorm in the afternoon, and clearing in the evening. Start out along the right margin of the meadow through mature larch forest with many young pines. The skies are clearing, but the air is sultry and the shrubs are dripping wet. As we approach tree line, large cone-bearing pines come into the woods. Although I would like to put a pine cone in my sketchbook, can't find a single intact cone on the ground. Instead, find the cores of cones where the scales

have been ripped off and you can see the large sockets where the nuts have been removed. The apparent culprit is in evidence. These nutcrackers sound and act just like our Clark's nutcracker, but the color scheme is completely different: pinstripes and a skullcap instead of black, gray, and white patches. But the issue is more fundamental than that. If everything were analogous to Rocky Mountain forests: 1) Siberian pines would grow with multiple stems because birds cache groups of seeds at a time; and 2) the pines would grow mostly on unstable scree slopes where birds are prone to bury seeds in loose soil. Instead, Siberian pines are scattered continuously in the understory of the larch taiga, and grow mostly as single-stemmed young trees. Even the big old twisted timberline trees grow mostly with single trunks. If you look around you can find seedlings and even big trees in clusters of two or three, but they are easily less than 10% of the total. If you use the empty sockets in the dismantled cones as a gauge of seed size, the pine nuts must be as aerodynamic as marbles. So they don't get around in the forest on their own. There must be an agent for dispersal that gets uneaten seeds scattered individually and widely through the forest. Certainly not the way nutcrackers and jays interact with nut pines in America.

After a couple of miles we emerge into the tree-line forest dominated by big old wind-battered pines. Here the analogy with our limber, whitebark, and bristlecone pines is apt. There are great avenues of that frilly dianthus, along with at least five different kinds of gentians, most of which have exact counterparts in the Rockies. The way continues up past an old cabin onto a tundra plateau with a few rock "turrets" that must be classic tors. Suspect this area has been subject to periglacial climate without glaciation for an extended period such that resistant rock "ribs" stand out as tors and the surrounding slopes are mantled with colluvium. In the pass itself the ground feels spongy because we are walking on several meters of peat. Much of the vegetation underfoot is typical of arctic tundra: dryas, prostrate willows, sedges, grass of Parnassus, oxytrope, and even a few arctic poppies. All you would need to add would be a little cloudberry to complete the picture. But there is no time to marvel at the scenery because the weather is closing in. Behind us there are layers of cloud creeping up the valley, and ahead a bank of turbulent mist is enveloping the ridges. Cold rain and drizzle for a while, and then the weather lifts to let shafts of sunlight shine on wildflowers that sparkle in the dew. The most dramatic flowers are bright blue clusters of a form of monkshood that has such large and vibrant flowers that it passes for Texas Bluebonnets.

Our trail continues down into the next drainage through a broad tundra basin that Andre refers to as "The Plateau." The small stream on our left dries up as the water seeps underground. A dry stream from the left produces a small pond where its alluvium dams the valley. These wide gravel bars hint that there is a lot of water here for a short time during the spring run-off. A rounded peak on the left has a large cirque cut out and prominent moraines encircling the outlet. This north-facing cirque must have harbored a small mountain glacier during the local equivalent of the Wisconsin era, providing further evidence that this area was once even colder, but never actually over-ridden by ice sheets. The outlet from the cirque has been breached by the meltwater stream, and a number of larch trees grow from the gravels in that stream bed at a location a good half kilometer and at least 100 m higher than the main tree line. The effect is even more prominent on the south-facing slopes behind us, where isolated full-sized larches grow from the steepest scree slopes. The deep, peaty tundra must not provide a suitable substrate for the germination of larch seeds or the insulation the peat provides keeps the soils so cool that seeds can't get established. Either way, it is clear that trees can do quite well on these sites once they get started. The effect is like the spruce line in Denali, where erect spruce are scattered out beyond the closed forest, rather than the Rockies where there is a belt of stunted dwarf trees indicative of retreating tree line.



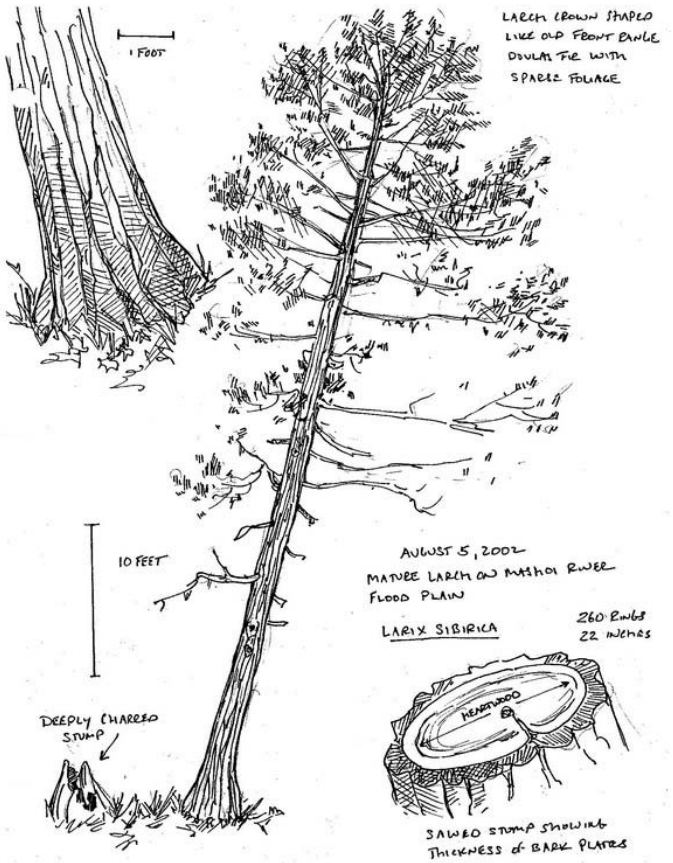
We stop for lunch at a junction of streams just below a parked truck. It appears that mountaineers have managed to take this truck up an old road we crossed along the way to this point to begin their trek. We circle up in a little sheltered area along the creek while Timofeyo and Andre round up firewood from the distant timber. This is the usual drawn out lunch with soup and tea along with salami, cheese, and bread. But the timing is less than perfect. Clouds close in and a couple of nearby lightning strikes get our attention. A few gulps of the hot lunch and then we all huddle with our backs to the wind while cold rain and then hail pelt down on us. At least the storm doesn't last long. We are soon hiking down a slippery and unstable trail alongside the clear Eshtico. A rather ordinary looking

dipper explodes out of the clear water and lands on a mid-stream rock to perform deep knee bends. The color scheme is a bit lighter than our American version, but that is the only obvious difference. The familiar dwarf fireweed makes bright displays along the side of the water with the familiar monkshood and delphinium.

Before long the trail angles up onto the slope above the river as the last of the clouds lift and we are treated to a cloudless sky. Cross a ridge and descend down the other side towards a glacier-fed tributary of the main river. This is deep larch forest with the usual scattering of pines underneath. One interesting plant covers the ground over large areas. This plant grows with rosettes of large leathery round leaves and has spent flower stalks with the remains of small white flowers and maturing seed pods. What makes this plant so spectacular is the fact that some of the largest older leaves have turned a bright scarlet color. Because of the size of the leaves and the intensity of the color these low-growing rosettes catch the eye as much as any wildflowers. I can't find the plant in my references, but it looks suspiciously like the *Bergenia* offered in nursery catalogs. We pause to regroup at a camp site near the junction of the two streams. Then back on the trail, crossing the glacial tributary on a rickety log bridge. From here on the trail descends a wild and primeval looking river. Hardly any pools; just a straight alley of churning and foaming white water raging down between two lanes of boulders; with periodic piles of shattered tree trunks and tangled root plates to vary the scenery. The trail itself is a muddy and slippery morass as a result of the recent rains, the horse traffic, and steep terrain. As wild as the country looks, there are a number of backpacking parties here. I suppose one should feel slighted to have to share the wilderness with so many others. But it strikes me as a positive factor that so many native Russians appreciate their own outdoors. The trail crosses a couple of avalanche chutes full of broken trees and tangles of shrub birch. We descend to a level where tree birch and aspen both appear, and choose a campsite among larch and pine. The plunging water makes good music to sleep by.

August 1, 2002

Up the Shavla River to Shavlinsky Lake. A nearly cloudless and sunny day. Hike the short distance down the Eshtico from camp to the junction with the Shavla River. The trail cuts the corner through a large "meadow" that is really a tangle of birch brush with mud underneath. Pretty sloppy going. But the mind is occupied by the vista of jagged mountains and shining white glaciers that appears in the distance. After the meadow the trail dries some and there is a view of the Shavla River. This stream is larger than the Eshtico and has the familiar turquoise blue water of glacial meltwaters. In fact, you can see a fundamental difference. The headwaters of streams on the plateau have shrunk to a trickle because the spring snowmelt is over. In contrast, the glacial streams have swollen to their greatest size and volume because this is the maximum radiation season. Suspect that in May the Eshtico was perhaps twice the volume of the Shavla at a time when snowmelt dominated over glacial meltwater production. Now we have a steady pull up the valley without much view of either the river or the peaks ahead because we are buried in deep forest or tall birch and willow brush. Only a few interesting wildflowers like new forms of *Campanula* and the familiar old *Polonium* to look at along the way. That is why it comes as a real treat to top out on a small rise and step into a little meadow with an awesome view. There are blue ponds before us and the soaring ice-studded mountains beyond. The geology is pretty easy to read. A huge amphitheater on the opposite ridge shows where a great mass of rock detached from the mountain and rolled down to block the valley. The natural dam caused the meadow and shallow ponds to form upstream, while a steep torrent falls over the rocks below. Looking at the rockslide now, there are old trees growing from the surface, including one huge Siberian pine that must be approaching a millennium in age by analogy with our limber pines. On the other hand, the river has not had time to cut very far into the rock pile. So the rockslide is probably a few thousand years old.



Even if you are not a geologist, this spot is a great place for lunch. We brew the usual soup and tea. But Vera and the girls have another treat. They make compote from the bitter blue twinberries. Even if the fruit taken straight is a bit much for me, the crushed berries added to boiling water with a little sugar make a superb tea. The bitter aftertaste now has been tamed to provide just enough of a bite to make the brew truly refreshing. The trail remains fairly flat above the debris dam until the valley forks. Then there is steep haul through thick timber to Shavlinsky Lake. This lake also seems to have been dammed by a rockslide. A vast log jam obscures the outlet, and the water has that deep turquoise blue color. In fact, the lake

reminds me a lot of Lake Louise, with its elongate shape, blue glacial water, and steep mountain glaciers at the far end. But there are a number of campsites on the left (east) shore, and they are all occupied. We have to hike most of the way to the upstream end before there is a vacant place to put the tents. This is on a small peninsula where a tributary drops into the lake, and opposite another camp. The whole area shows signs of extensive use, like left over food dumped in the bushes and toilet paper scattered all about in the brush. Estimate there must be 100 people camping along the 1.5 kilometer length of the lakeshore. Even with all that, this is a pretty spectacular campsite. The only real drawback is a stiff, cold wind off the lake in the evening. Even that cooperates by dying away completely as soon as the sun falls behind the ridges across the way. After the standard meal of macaroni and canned meat with all the accessories, Timofeyo and company show how to eat pine nuts. He has obtained a Siberian pine cone—probably lassoing it off the top of a tree. The younger grandson toasts the cone on the coals of the campfire. After the cone has been roasted and cooled, the kid deftly peels off scales, pops out the nuts, cracks the shells with his teeth, and spits out the hull. Great to see this exhibition as a reminder of how important pine nuts are as starvation rations for Siberian natives.

August 2, 2002

Hike up and around upper Shavlinsky Lake. Clear for most of the day, but a small distant thunderhead seems to expand and disperse into a thin cloud deck after sundown. Follow the trail up along rocky bluffs above the lake and then down around by the inlet. Notice black "blobs" in the lake near the shore and realize these are bodies of clear water from springs that dilute the blue lake water. An interesting shrub cinquefoil grows along the unstable slopes; looks like potentilla with a white, rose-like flower. Dwarf fireweed blooming intensely near the lake inlet—in much the same habitat but perhaps without quite the lush abandon one sees on the Alaskan North Slope sand bars. Follow the blue river up through larch and pine forest to a steep rocky wall. This is a glacial moraine where the river seeps out from the upper lake through underground fissures among the boulders. Suspect that this is the Wisconsin equivalent age moraine. An attractive pink chrysanthemum daisy blooms from the dry soil between boulders. Also notice that there are two different kinds of prostrate juniper. One is the familiar common juniper with its long needles *(Juniperus communis*). The other has the conventional blunt juniper scales and must be rock cedar (*Juniperus sabina*). We are forced to make a rugged climb through the boulder pile on the east side of the lake. Then across alpine meadow for lunch in the shade of a huge old pine with all of the wind-blown character and contorted layers of wood one sees on bristlecone and limber pines in Colorado. Here we have a great view of one of two glaciers descending into the valley. Crevasses and icefalls are laid out before us. The end of the glacier is ringed by a series of fresh moraines. The terminal moraine at the base of the ice is as high as the level of the ice itself, and completely free of vegetation. Below this large moraine are a whole series of smaller moraines looping maybe a half kilometer down slope. The moraines have sparsely distributed larches, with the size of the trees decreasing progressively towards the most recent moraine. Looks to me like the smaller moraines mark the progressive retreat from the neoglacial advance, while the largest and innermost moraine represents the stable position of the ice for the past century or so. The recent acceleration of global warming has apparently caused the ice to start retreating from this larger moraine. Pretty much a textbook illustration of glacial sediments.

The hike back is uneventful. Spot a pica among the rocks and see a large chipmunk like ground squirrel equivalent to our golden mantled ground squirrel—stripes and all. See a handsome little bird about the size of a sparrow, but with a rich orange-brown color to back and tail. Nutcrackers scolding more or less continuously from perches in the biggest pines. The most spectacular view is towards the lake below where the shadows of the jagged peaks to the left produce black geometric patterns on the bright blue water.

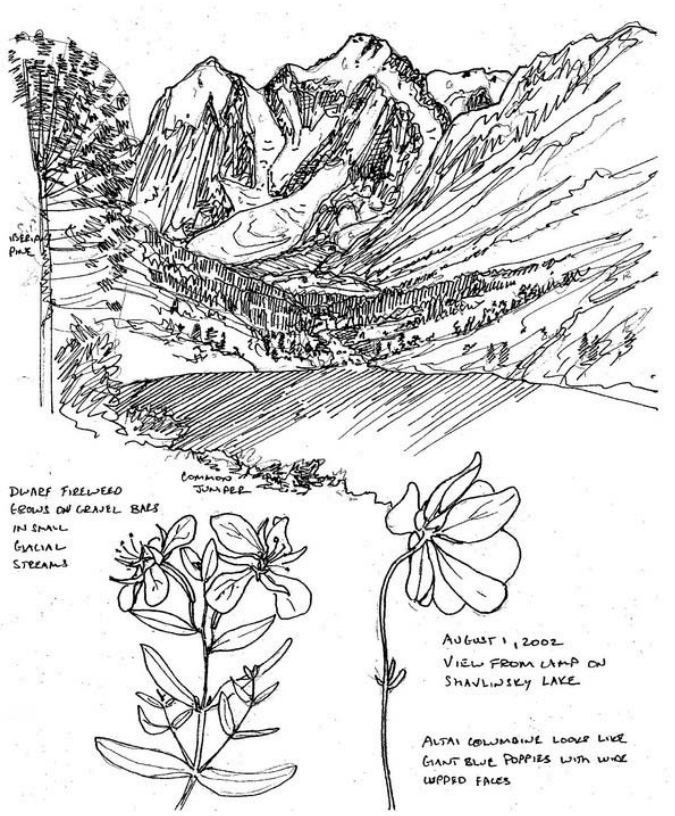
August 3, 2002

Return to Eshtico River valley. Clear overnight but a thin cloud deck returning by breakfast, thickening during the day, generating a little virga, and then clearing out late in the day. Hike back down the valley, paying special attention to signs of past fires. A number of larches show fire scars at the base. These are different from what we see in the Rockies, being generally confined to the very bottom of the tree, and occasionally present in the form of a tunnel right through the base. In some of the oldest and thickest forest still find deeply charred stumps standing from fires that must have burned a century or more ago. This is much like the Rampart Range

where you see burned snags standing from fires in the 1870s among thick ponderosa and Douglas-fir stands. We stop for lunch in a clearing that is an old burn still recovering, with the slowness of the development of the forest probably related to the dry microsite on the river terrace. Then down to the river junction and back up the Eshtico. Spot a chickadee-like bird that is probably a close relative of the coal or willow tit, and flocks of a small gray-green bird that is constantly chattering in the brush. A streaked little brown bird flying in one of the burned areas sounds just like a common redpoll.

August 4, 2002

Hike over divide into Karasoo River and then down to bridge on Mashoi River. A clear and hot day with hardly a cloud. The hike up the river is more of the same—dense larch and pine, old burned out snags, and chewed up pine cones. Finally use the telephoto lens to get a picture of Siberian pine cones in the top of a tree as the best I can do to get a close look at undamaged cones. See a pair of medium brown birds with streaked breasts that are about the size of our robin and acting about the same. These must be fieldfares or some Asian *Turdus*. Arctic poppies in bloom on steep scree slopes above the river. See plenty of columbine in seed and wonder about the flowers.



We depart from our previous trail on the tundra plateau to go through a high pass into the Karasoo River, a tributary of the Mashoi, which will be our route back down to the Chuyah valley. There is no trail here, so we start up dry channels and into low birch scrub. This scrub is clearly the familiar dwarf arctic birch with the perfectly round leaves of *Betula nana*. The tundra comes in two types: the wetter tundra with birch, sphagnum, lingonberry and pyrola; and the dry tundra with caribou lichen, dryas, prostrate willow, and sedge. One of these prostrate willows has the same large oval leaves with the thick and deeply veined texture of the familiar prostrate willows in Alaska. There are animal paths all through the scrub, which must be from domestic livestock. But there is one great drawback to this trek: the horseflies are large, abundant, and aggressive!

Cross over the low pass and ramble on down to a pair of shallow tundra lakes for lunch. The tundra lawn adjacent to the lake has a lot of those big white mottled gentians that are so familiar in the Rockies and a tiny little violet with pansy-like flowers. The star gentian (*Swertia*) appears to be especially ubiquitous in all alpine habitats. The lakes are probably similar to those on the Arctic coastal plain—small depressions enlarged by wind erosion. Scraping together enough dwarf birch wood to make the lunch is a real challenge, while hot soup seems a bit superficial on such a warm and dry day. Figure we lose more fluid to the horse flies than we will recover from the soup and tea. In this pass we discover a small field of columbine in bloom—and it is quite a flower. Instead of having several flowers on one stem, and each flower a bundle of tubes, these columbine look like giant, sky-blue poppies. The flowers are single and a good 8 to 10 cm across. The five tubes are shortened, the trumpets broad, and the flower face nodding downward, so that the flower has the same shape as a poppy. It is a real artistic challenge to sketch the flower and keep the flies at bay all at the same time.

The trek down the broad valley starts out with a couple of miles over what almost approaches tussock tundra. Wet sedge marsh, spongy sphagnum where you sink in a ways on each step, and ankle tangling birch brush. We flush maybe half a dozen ptarmigan from the thickets. These look, sound and act identical to Alaskan willow ptarmigan. At about the same time, a mid-sized falcon with red-brown underbelly flies by. We walk from one tor to another in this periglacial landscape. The ground underfoot is patterned, with evenly spaced "boils" of fresh soil. This leads one to suspect that these are deteriorating frost polygons where the edges are settling and the centers rising in response to the annual frost churning of the soil. A few larches cling to these little rocky islands, and to the scree slope of the ridge off to our left. One pleasant surprise is that there are lots of blueberry bushes full of ripe berries mixed in with the birch. These look just like the Alaskan tundra blueberry: short and stubby plants with single large and sweet berries attached to stubby woody stems. Potentilla with its bright yellow flowers is also scattered in the tundra shrubbery. Cows graze in the distance, explaining the animal paths on the surrounding slopes. Even after a good three miles we find that the mighty Karasoo is completely dry. We eventually follow the dry channel down to where a road cuts across through the timber and switches back down into the Mashoi valley. The woods here have an open and spacious understory with a thick layer of herbaceous growth under the larches. Although most flowers are gone, you can see the leaves and seed pods of geranium, tiger lily and peony. Towards the bottom there is plentiful crop of red currants. The

slopes across the way are thickly timbered, but show lanes where past fires have burned. The most prominent is a fresh-looking burn right across from where the guides have set up camp. A liter of cold Mashoi water tastes pretty good about now.

August 5, 2002

Day hike to Mashoi Lake. Clear in the morning, but a flat layer of clouds builds over the mountains and blossoms into weak thundershowers that mostly just pass over and disintegrate. Start hiking though more lush larch forest until the valley narrows and the terrain becomes rough. There are dozens of camps here, many with Russian mountaineers. So this still does not feel quite like real wilderness. Stop to examine a recently cut larch—55 cm in diameter and about 260 growth rings. The bark plates must be a good 10 cm thick on this tree, and comparable to the thick bark on intermountain Douglas-fir. Find a new flower—a tall orange-yellow composite with a single stem and a single large "daisy" flower a good 7 cm in diameter. Not abundant, but attracting attention wherever they occur. Gentians, dianthus, and geraniums aplenty along the way. Although the river is a narrow foaming torrent by camp, it fans out into a wide, rock studded stream in many places, probably because of the rocky sediment brought down from side channels. Several of these are dry now, but probably ran as torrents for a short time during the snowmelt season. Single-stemmed white pines are abundant everywhere under the larch in the canyon, and spruce is most common down along the edge of the river. Cross one side torrent on a large fallen spruce, and stop to chat with a Moscow businessman and his guides. By coincidence, his experience includes a lengthy business trip to my hometown of New Haven, Connecticut.

The approach to the lake is announced by a giant wall of rock debris. The river arises right out of the base of this geological formation. Once again, this is an example of a huge landslide blocking the valley. There is a giant ragged hole where these rocks came down from the ridge above. Perhaps the most interesting observation is that the angular boulders lining the edges of the stream where the water issues from under the rocks are covered with bright orange lichen. This is the same lichen one sees on little rock piles in the Alaskan tundra where birds of prey and ravens encourage such growth via fertilization. These rocks are at least 80% covered with the lichen, suggesting that the growth here has something to do with the mineralization of the water seeping out of the rocks. The trail switches back and forth up the face of the rock pile and in and around numerous hummocks, swales, and sinkholes in the debris pile. Barberry, currants, and roses full of orange hips grow here. The main ground cover is crowberry and caribou lichen. A pika with a mouth full of hay scampers across the trail and into the rocks. Spot both the larger ground squirrel and something that resembles our least chipmunk, as well as the familiar pine squirrel. The view from the top of the rock pile shows another blue glacial lake extending off towards another crevasse-strewn glacier winding down from ragged peaks. The sides of the lake show signs of substantial water level fluctuation caused by the fact that the lake does not have a single outlet sill; the water has to make its way through the rock pile. The distant inlet shows a substantial delta has built up in the time since the rock fall dammed the lake. As on the Shavla River, the size of the ancient pines growing on the rocks suggests that the rock fall occurred more than 1000 years ago. During lunch at the lake, the harmless-looking flat clouds develop into a thunderstorm which rumbles a lot and rains very little.

Back in camp by late afternoon to enjoy currant compote made by the girls and time to explore the burned slope across the river from camp. Seeing the slope is made possible by a convenient if rickety bridge over the Mashoi. The burn looks recent since all of the killed timber is still standing with most of the bark and virtually all of the fine branches in place. But one knows from Colorado and Montana that such appearances are deceiving. Looking at the new growth, there are numerous larch seedlings that show at least 5 years of growth from the branch nodes. I suspect the burn is maybe ten years old. Many trees survived on the flood plain, but the kill was essentially 100% where the flames ran up the slope above. The river terrace is now a riot of fireweed, while the lower slopes have been taken over by shrubs. Black currant is abundant, but Labrador tea—a minor species elsewhere—is by far the dominant plant. Find another familiar Alaskan plant here, the red bearberry; but it is a minor component of the vegetation and nowhere near as dominant as in the Alaskan arctic.

August 6, 2002

Hike out along Mashoi and Chuyah Rivers to our pick-up point. This is a day of unsettled weather—although the skies cleared the previous evening, there are low clouds and light rain at breakfast, clearing out for a while, then thickening clouds with a short shower, after which the skies clear completely. The hike is down a well-used mountain road with truck-loads of mountaineers passing us along the way. Not very stimulating outdoor adventure, except that the scenery is still spectacular. The road is on the east facing side of the valley such that slight variations in exposure alternate open, brush-dotted slopes with deep alleys of timber. The terrain across the way is divided into strips of various ages in recovering from past fires. We pass a recently abandoned homestead and encounter plenty of signs of livestock use. The rough mountain road crosses the still dry bed of the Karasoo and switches down to the head of the Chuyah gorge. Here we rest on the other side of a rough but serviceable timber bridge; strong enough for heavy vehicles but without anything like a guardrail. The gorge itself is a thing of raw beauty: rust and lichen encrusted cliffs with ledges full of moss, wildflowers and little spruces are poised above the surging brown water. The clumps of pale pink chrysanthemum daisies are especially attractive in this setting. Rough old cottonwoods hang over the water. They have the same leaf shape and deeply ridged bark of balsam poplars or black cottonwoods in America. The leaves are sticky but don't have the familiar balsam fragrance; wonder if this is a variant of the European black poplar or a whole new species?

Our trail departs from the road here, heading up the cliffs to follow the upstream course of the Chuyah. This is an open south-facing slope dotted with that familiar clawless catclaw shrub, and sparsely vegetated with at least two different species of *Artemisia* in the areas between bushes. One of these seems just about identical to our *Artemisia frigida*. A whole flock of those attractive little orange-brown birds flutters through the shrubs. The trail winds around rock turrets with little groves of spruce and larch, which makes me wonder why spruce is generally tied to moist places along stream courses, and yet can find lodging on these dry outcrops. Must be a combination of seed source and micro-site conditions. Then the trail descends to a wide, grassy meadow on the gentle slopes where the river wanders over to the other side of the alley. Here the Chuyah is a long, placid pool in sharp contrast with the raging torrent of the gorge just downstream. This is the direct result of the merging of the Moshoi with the main stream because the coarse sediments from the latter provides a huge debris pile to dam the river channel. We stop for lunch in a grove of stately spruce where a small spring issues from the hillside. Lots of tree-sized willows and black currants in the understory. The spruce here are strikingly similar to blue spruce in Colorado where they grow right along the edge of the water, produce that same needle covered picnic site, and have that same corrugated bark pattern.

After the usual lunch with soup, tea, and all the extras, continue up the river to the road. This entails more ledge climbing as the river again veers to our side of the valley. This amounts to the best—or worst, depending on your point of view—session of ledge-hopping we have on the trip. Suddenly we are in a pasture adjacent to the road with local picnics under way. We cut through a herd of horses with several new foals, and then walk a ways down the road to meet the van. Dinner in a local restaurant, a nice bottle of Kuban wine, and then camp along the Chuyah at the place where it all started. One final mystery is solved at the camp site. During the trip we had a mysterious fruit spread labeled "djem" with pictures of orange berries on branches with oblong, olive-like leaves on the container. The Russian olive-like tree or large shrub seen along the river has branches on many but not all trees or shrubs loaded with little orange berries. Perhaps this is a monoecious species such that only female plants bear fruit. Kirill assures us this is djem, and the berries have a pleasant citrus like flavor.

August 7, 2002 Van ride back to Belakurika and return to civilization. Fair weather all day—clear at dawn and only scattered cumulous in the late afternoon. Drive back the same way, through a series of valleys where the lower tree limit must be around 1500 m. This time we cut off of the main highway to travel over dirt roads in the mountain foothills through miles and miles of rural countryside. These are low mountains similar to mountains of Kentucky, except that they are made out of metamorphic rock, and the deciduous forest is mostly birch, with just a few larches and even fewer aspen mixed in, and pine on the steep outcrops. Homesteads and villages follow the stream courses. It is depressing to see such nice flowing streams are muddy and discolored from the very headwaters by the use of livestock and the runoff from all of these little habitations. The houses are mostly timber construction with corrugated metal roofs and the elaborate, brightly painted window shutters so familiar in Siberia. There are no lawns here—every bit of fertile soil right at the doorstep is planted in useful products like cucumbers, tomatoes, and cabbage. Great effort has been made to fit all of these in as closely as possible. Every house seems to have at least a half-hectare devoted to potatoes, and pumpkins seem to be an important crop, too. There are almost always plots of brilliant flowers. One hopes that these are here to brighten everyday life, but suspects that they are just another cash crop to be sold at the local market. After a long day of this travel we arrive at what appears to be the industrial town of Belakurika to find our lodging is a small ski resort that looks as if it were carved out of the Black Forest, with lots of new construction and a veritable arcade of gift shops, boutiques, and beer gardens arrayed along a mountain stream. Congenial place to wind down from a wilderness trip.

LOOKING BACKWARD, MARCHING ON

Robert T. Leverett

Founder, Eastern Native Tree Society

Here it is almost the middle of 2011 and time to take stock. We have a lot going on. Looking back, we have visited a number of new sites like Morristown National Historic Park in New Jersey. We have made some astounding discoveries/confirmations like the world's tallest tuliptree. We have completed some important projects such as modeling of the Poplar Forest tuliptree. The BBS, website, and *Bulletin* continue to be outstanding. The ENTS tree database is functional. We have begun the video on tree measuring. We have an empowered European arm that adds true class to ENTS. We have stellar performers in the scientific community to impart credibility to our efforts. I can hear big Ed saying, see Bob, I told you so, and he's right.

Looking forward, Neil's tuliptree article, which he is graciously including me as a coauthor, is about finished. Gary Beluzo and I are planning the 7th Forest Summit and 2011 ENTS Rendezvous. Soon Don Bertolette and I will host the second annual rendezvous of WNTS. And Don plans to present an avant-garde tree measuring guide on his Alaska champion tree website. I am beginning a project to photographically document MTSF and MSF as a joint FMTSF/ENTS-DCR partnership. I will also be training DCR personnel who certify champion trees in tree measuring techniques. Will and company have begun the special tuliptree project for the GSMNP. Big Larry continues to roll as he documents more and more of those wonderful live oaks. Steve and Rand continue rolling across the Ohio countryside, changing our notion of what the Buckeye State still has to offer. Eli does similarly for central Georgia. The list goes on and on.

It would be hard to argue with our successes, and I think we're going to continue on an upward path. Amidst all the bad economic and environmental news, our successes are a breath of fresh air. We have held our focus and success is paying dividends as our numbers increase. Is there any area where I'd like to see us expand operations? Well, yes, I surely hope we can attract more serious tree measurers so that we can expand our list of outstanding forest sites and build a tree database of accurate measurements others that will suffice for scientific research. I see little evidence that outside groups and individuals are going to pick up the slack. Let's face it, tree measuring is our niche and we are unique in our abilities to locate tall tree sites and convert them to indices that foster meaningful comparisons.

With a very few exceptions, the champion tree programs can't do that. It is not in the nature of academic research to focus on maximums for their own sake. Forestry is about growing trees and cutting them at an age and size that falls well short of our interests. So, who, if not ENTS, will continue to perfect tree measuring and piece together the picture of what each species does and where across its full range? The answer is nobody…

So what, if anything stands between us an expanded tree measuring mission? Over the long run, probably nothing. If we keep our noses to the grindstone, we'll get there. But in the near term progress will continue to be slow unless we can establish hooks into communities that have at least a potential interest in what we do. I've tried to make connections into the schools and almost succeeded twice. But it is a tough sell. There is always initial enthusiasm and interest, but the efforts never quite get off the ground. I'm open to ideas. How can we move the measuring boat forward to attract a much wider audience? And where are the lady measurers? Why is this almost exclusively an old boy occupation?

Just wondering…

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*
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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.

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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.

A thorny issue—a honeylocust* (Gleditsia triacanthos) *growing on the Rick Evans Grandview Prairie Wildlife Management Area near Columbus, Arkansas. Photo by Don C. Bragg.