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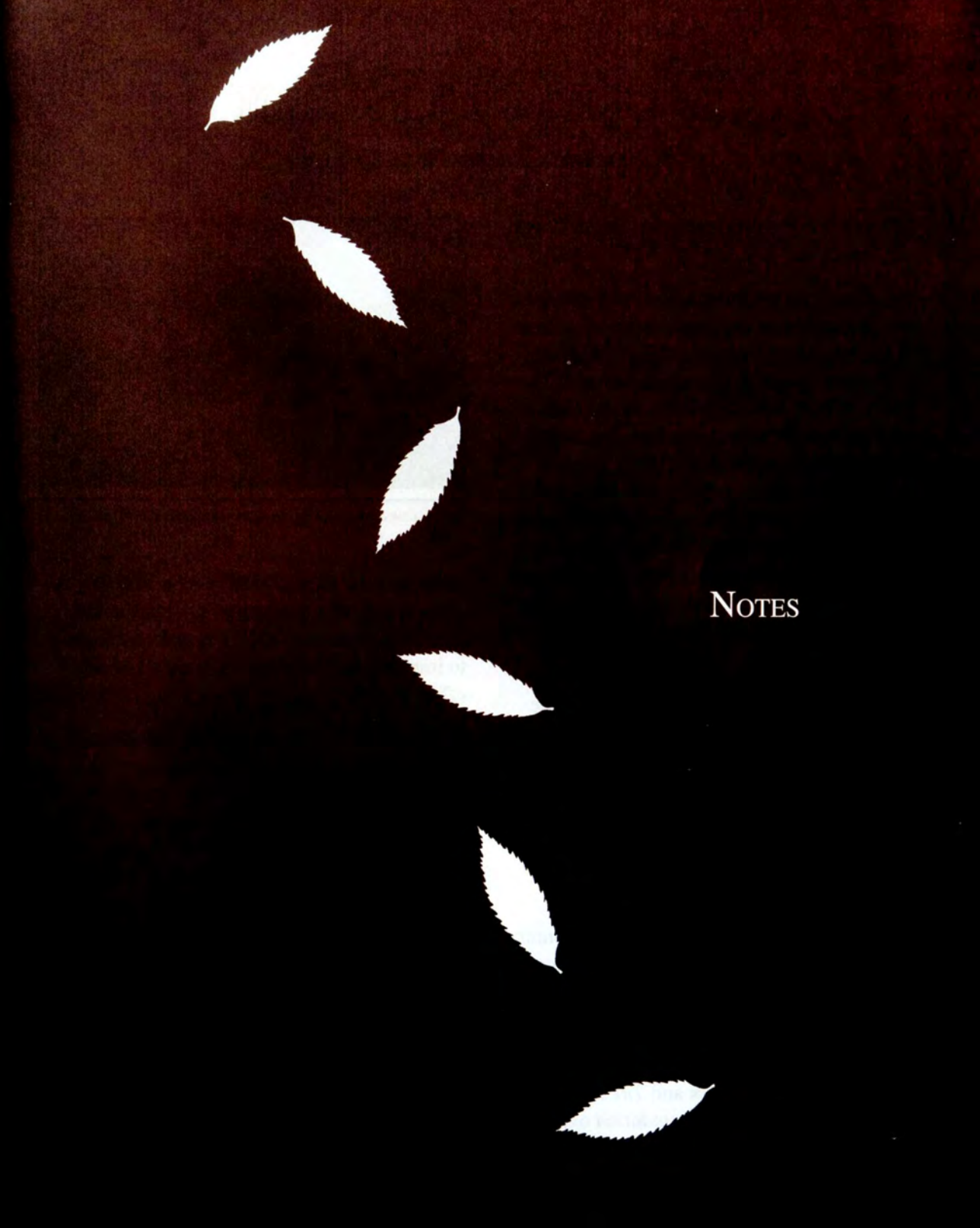


Notes

From the Editor

A New Look for the Next 25 Years

TACF's 25th Anniversary has finally drawn to a close.

We started this celebratory year in February, with a planting of an American chestnut tree at the Abraham Lincoln national birthplace in Hodgenville, KY, in conjunction with The National Park Service (NPS) and the Kentucky Association of Professional Surveyors (KAPS). We ended the year with a planting of an American chestnut on Governors Island, NY, in conjunction with The Appalachian Regional Reforestation Initiative's (ARRI) pledge to plant 38 million trees over three years as part of the United Nations Environment Program's (UNEP) Seven Billion Tree Campaign.

And...somewhere in the middle of all this, we still found time to hike the length of the Appalachian Trail twice, break ground on a new laboratory in Meadowview, VA, win two awards for our book *Mighty Giants: An American Chestnut Anthology*, and have our 25th Anniversary Meeting in Chattanooga, TN.

WHAT A YEAR!

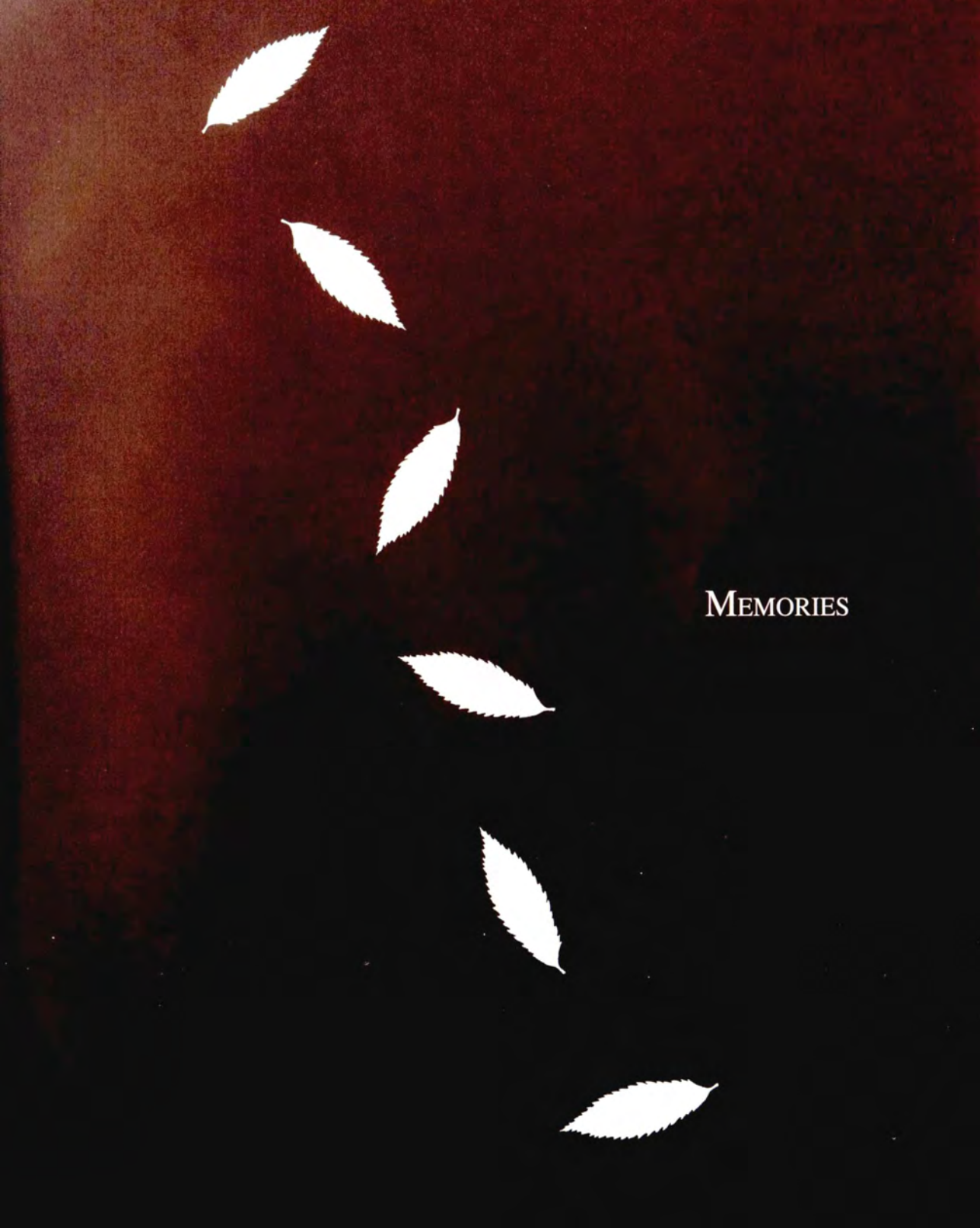
Now, as we head into the next quarter century, it is time to continue our successes, update our processes, and make sure everything we do is the very best it can be.

With that in mind, I humbly steer attention to the new look of *The Bark* and *The Journal of The American Chestnut Foundation* over the past two years. While the information and content of the publications remain basically the same, the design, paper, and style has undergone some intensive surgeries and continues to improve and shed new light on all of our efforts.

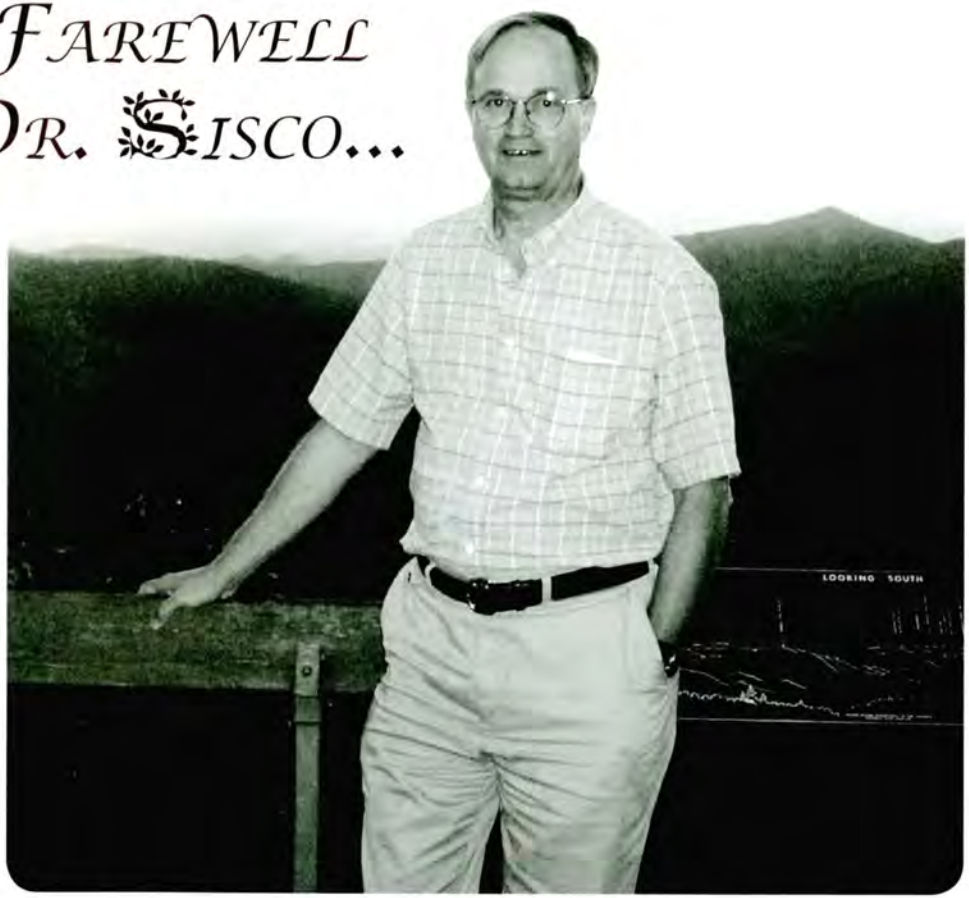
Group shot of the planting on Governors Island, NY, Dec 11, 2008.

This issue of *The Journal of The American Chestnut Foundation* contains all the hard science for which *The Journal* is known for. Check out what is happening with the A.T. and the MEGA-Transect Project. Read about other chestnut projects happening at the University of Georgia and Grove City College in Pennsylvania. Finally, sit back and read about 25 Years of TACF.

TACF wants to make sure our friends and members are recognized and honored appropriately for everything they do. So, please, if you have any suggestions, comments, or questions, contact me at anytime.


MEMORIES

FAREWELL DR. SISCO...



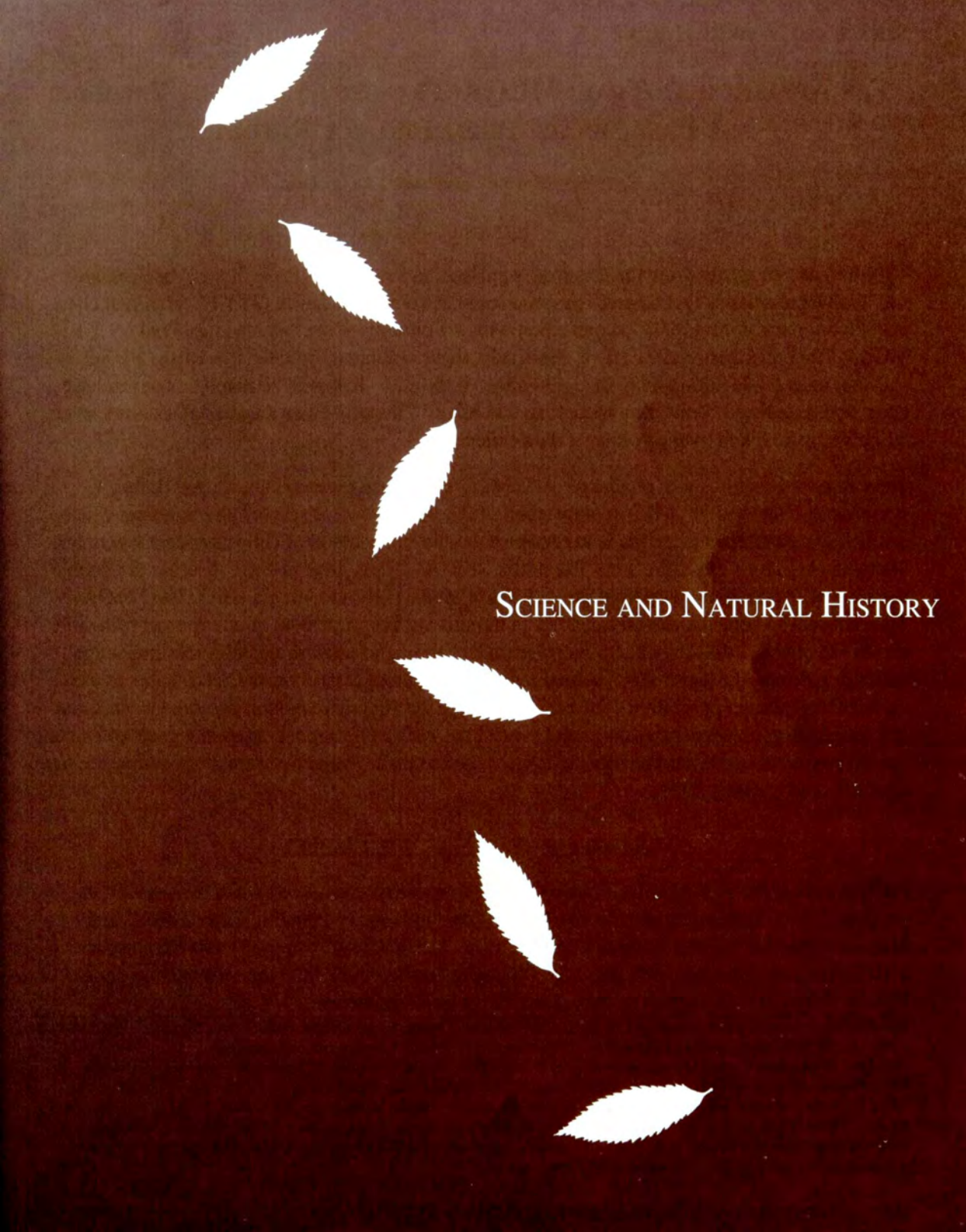
At the 25th Annual Meeting in Chattanooga, TN, TACF Southern Regional Science Coordinator Dr. Paul Sisco handed in his resignation letter

Dr. Sisco's tenure with TACF began in April of 1998. A man of many talents and interests, Dr. Sisco dedicated his career to the science discipline and has been a shining example of a great staff member, a great leader, and a great mentor in citizen science. TACF would not be where it is without the help of people like Dr. Sisco.

Thank you, Paul...from the bottom of our hearts, Thank you, Paul!

Paul was honored at the 25th Anniversary Meeting with a Legacy Tree in his name. That tree will forever live in TACF's Legacy Orchard and will be a lasting testament to Dr. Sisco's unwavering dedication to TACF's mission. Dr. Sisco will now transition to a member of TACF's Board of Directors and will always be remembered for all of his great work.

Thank You and Good Luck, Paul!


SCIENCE AND NATURAL HISTORY

The Appalachian Trail MEGA-Transect Chestnut Project: A Preliminary Pilot Project Report

By: Kathleen Marmet[1] and Sara Fitzsimmons[2]

Introduction

Thirty-six volunteers from the Potomac Appalachian Trail Club (PATC), the Appalachian Trail Conservancy (ATC) and The American Chestnut Foundation (TACF) submitted chestnut count reports during 2008 in connection with the piloting of the Appalachian Trail (A.T.) MEGA-Transect Chestnut Project. Collectively, these volunteers counted more than 10,000 chestnut trees while hiking more than 400 miles of the A.T. It should be noted that several sections were hiked and counted by more than one hiker. Counting those duplicated sections, over 500 miles were hiked by the volunteer data collectors.

The Chestnut Project is part of a larger A.T. MEGA-Transect partnership initiated during a symposium convened by ATC[3] in November, 2006. A transect, or strip of ground along which ecological measurements are made at regular intervals, is a method of collecting data where it is impractical to study the entire area. The prefix MEGA- means great or large, and has the double meaning of referring to the span of the A.T. from Maine (ME) to Georgia (GA). The MEGA-Transect seeks to engage citizen scientists in monitoring key indicators of environmental health, and to use new and existing data to increase understanding of environmental issues impacting both the A.T. and the larger Appalachian region. With those resources, the ATC hopes to use the MEGA-Transect program to "inform and engage the American public, decision-makers and stakeholder organizations to manage and protect the A.T. environment, attain the goals of existing natural resources and environmental legislation, and to make sound decisions for positive change" (Dufour and Crisfield, 2008).

Genesis of the Chestnut Project

Participation in the A.T. MEGA-Transect initiative was first considered while researching the possibility of A.T.-based events for the TACF 25th Anniversary Planning Committee. Kathy Marmet suggested to President and CEO Marshal Case that TACF might benefit from becoming a MEGA-Transect partner, and, in early 2007, he submitted the TACF logo for posting on ATC's MEGA-Transect web page as an expression of partnership interest.

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[2] Northern Appalachian Regional Science Coordinator, The American Chestnut Foundation, The Pennsylvania State University, 206 Forest Resources Lab, University Park, PA 16802, phone: 814-863-7192, e-mail: sara@acf.org

[3] ATC is a volunteer-based non-profit organization dedicated to the preservation and management of the A.T. The A.T. includes more than 2170 miles of trail through the Appalachian heart of the American chestnut range, within a 250,000 acre protected greenway stretching from Maine to Georgia. ATC staff and volunteers coordinate efforts of 30 trail maintenance clubs and their volunteers, numerous federal and state agencies, and nearly 40,000 members.

The partnership for the Chestnut Pilot Project developed informally through email exchanges and phone conversations, including several conference calls set up by Caroline Dufour, ATC Lands and Resources Coordinator, to enable TACF scientists, ATC staff and potential coordinators of trail club volunteers to explore the feasibility and scientific usefulness of collecting chestnut data along the A.T. In addition to her understanding of the A.T. and the relationships between the diverse government agencies and trail clubs sharing responsibility for A.T. maintenance, Dufour also contributed important insights based on her awareness of best practices for citizen science[4].

An inspiration for the Chestnut Pilot Project came from a study conducted by Eric Wiese in 1999, while a student of Dr. Hill Craddock at the University of Tennessee at Chattanooga. Wiese recorded counts of all American chestnut trees that he could see from the trail (a visual transect), while hiking the entire length of the A.T. during a single hiking season (Jordan and Sisco, 2006; Wiese and Craddock, 2000). He used the Appalachian Trail Data Book, a hiker resource listing mileage between trail landmarks (updated and published annually by ATC[5]). He attached a counter to his hiking pole, recording the count in his Data Book and resetting the counter when he reached a known landmark. He counted more than 40,000 American chestnuts along the A.T. Wiese converted his counts over segments of varying lengths into chestnuts per mile so that he could compare frequency of observed chestnut with trail altitude[6].

METHODS

Doug Boucher, Bob Pickett and Kathy Marmet met in December of 2007 to develop plans for training of volunteers and details of the data gathering process. Boucher, a forest ecologist[7], provided scientific expertise. Pickett, PATC Naturalist, had agreed to recruit and coordinate PATC volunteers to collect data. Marmet took notes, asked questions and created a draft plan and data collection forms which were circulated for comment among those who had participated in the conference calls.[8]

One goal was compatibility with the Wiese data. Pickett took on the task of dividing the length of the PATC-maintained portion of the A.T. into segments compatible with the Wiese data. Because the area of visibility along the trail is variable, the Wiese data do not provide population density measurements that can readily be compared to other studies of American chestnut populations. Based in part on Wiese's after the fact estimates of typical trail visibility, a distance of fifteen feet on either side of the centerline of the trail was selected for the pilot project counts. Although Wiese had counted everything that he could identify as American chestnut, a minimum height of three feet was adopted for the pilot project.

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[4] See http://www.birds.cornell.edu/citscitoolkit/toolkit/resources for links to citizen science best practices resources.

[5] Wiese used the Appalachian Trail Data Book 1998 (20th ed.) & 1999 (21st ed.), Daniel D. Chazin, ed., The Appalachian Trail Conference (now Appalachian Trail Conservancy) Harpers Ferry, WV.

[6] Data available at: http://chestnut.cas.psu.edu/mega-transect.html

[7] Boucher is also a founding Board Member of the Maryland Chapter of TACF, a former Professor of Biology at Hood College, currently Director of the Tropical Forest and Climate Initiative for the Union of Concerned Scientists.

[8] Documents available at: http://chestnut.cas.psu.edu/mega-transect.html

Two report forms were developed: a Chestnut Count Report and a "Large Tree" Report. The Chestnut Count Report instructs data collectors to count all trees having a live stem 3 feet or more in height and a base within 15 feet of the trail. Multiple shoots originating from a single root system would be counted as one tree. In addition to requesting a total count, the form included space to record the count, asked for the number of doubtful identifications (not to be included in the count) and requested an estimate of the area of trail visibility where less than 15 feet on either side of the trail.

Data collectors completed a separate "Large Tree" Report for each tree with circumference 25 inches or more at 4.5 feet above the ground. This form included a request for GPS location, if known, distance from trail, which side of the trail and other location information. Data collectors were asked to record measurement of circumference in inches at four and a half feet above ground (breast height) and give an estimate of tree height. They were also asked to note whether there were flowers present, burs present on the ground or on branches, obvious signs of blight, whether there were multiple shoots from a single root system, and if so, the number of shoots in addition to the one measured.

ATC Web Editor Leanna Joyner set up an interface based on the two report forms at www.appalachiantrail.org/chestnutmonitoring to enable volunteers to submit data reports online. Each report submitted via the web interface generated an email report, and recorded the data in a spreadsheet on the ATC web server. For the pilot project, data collectors were asked to return the paper data sheets that they had used in the field by mail regardless of whether they submitted their data online.

Marmet prepared a data collector kit to be provided to each volunteer at training. The kit included a large zip lock bag to protect report forms from rain, a Chestnut Count Report form and several "Large Tree" Report forms, a set of eight double sided, laminated 4 ¼" by 5 ½" chestnut identification cards[9], an inexpensive five-foot measuring tape, a pencil, a large addressed and stamped return envelope and a checklist of essential and helpful items for data collection. Not included at the time of training, but recommended (and included in the Pennsylvania kits) is a fifteen-foot length of heavy cord or small rope for measuring distance from the trail. Suggested optional items include trail maps, hand lens or microscope, a GPS unit and a digital camera. Training sessions were held in several locations including Gambrill State Park near Frederick, MD, the Shenandoah National Park Headquarters in VA and several locations in eastern PA. These hands-on workshops served to teach potential hikers how to identify American chestnuts, the guidelines for what trees to count, and how to measure the larger trees. The above-mentioned packets were also distributed to each hiker.

[9] Files for printing identification cards are at http://www.vatacf.org/treeid.html

The first Chestnut Count Report was submitted via the web interface on June 1, 2008 for a count completed May 18th. Of the total of 209 Chestnut Count Reports submitted between June 1 and November 12, 2008, 69 reports had been submitted through the web interface. The last web interface report was submitted October 20th for a count completed October 6th. The earliest count date reported was April 8 for counts in New Jersey by an active Pennsylvania volunteer. This would have been before the earliest training date. The last Chestnut Count Report was received November 12, 2008. Some of the reports submitted during November were submitted by email only. No "Large Tree" Reports were submitted electronically.

Results

Counts were submitted for a total of 402.8 miles of trail between Neels Gap in Georgia, and Bellvale, NY (5.9 miles north of the New Jersey line), between which is a total distance of 1329.2 miles (Table 1). Average trail miles hiked for all data collectors was just over 14 miles. Excluding the top four data collectors - who hiked and counted as many as 112 miles - the average distance hiked was 8 miles.

The average chestnut count per mile of trail hiked was 20.9 for all data collectors, and varied from none to 86.4. Data collectors reported obscured vision for only 1.9% of the total area of the thirty-foot trail corridor included in counts.

State	Count of American Chestnuts	Total Distance Hiked and Counted	Total Miles of Trail per State	Percent of Trail Miles Counted	Chestnut Density (trees/mile)
GA	2673	36.8	83.3	44.18	72.64
VA	3078	142.2	554	25.67	21.65
WV	2	5.5	6.4	85.94	0.36
MD	1192	37.8	40.8	92.65	31.53
PA	2356	102.2	229.3	44.57	23.05
NJ	795	71.3	71.3	100.00	11.15
NY	12	7	88.3	7.93	1.71
Grand Total	10108	402.8	1073.4	37.53	25.09

Table 1. Counts of chestnuts within each state hiked. In most states, not all sections were hiked. In the case where sections were hiked and counted by two or more hikers, the largest of the counts were used in these sums.

Only five "Large Tree" Reports were submitted for trees twenty-five inches or larger in circumference at four and a half feet above ground. Several other large trees were noted on count forms, including some just outside the count corridor, some less than twenty-five inches but producing burs and some noted in areas for which counts were not submitted.

Notes on count forms and email correspondence with data collectors include a variety of information that may be helpful in refining the pilot project design. One data collector, who is accustomed to using a GPS unit while hiking, recorded geographic coordinates for each of the trees reported on his Chestnut Count Report. Another hiker, Laurie Potteiger of ATC, sent photographs of each of the large trees that she reported (Figure 1 next page), along with reflections on the count process by email. All data collected, including notes from hikers, are available at this website: http://chestnut.cas.psu.edu/mega-transect.html.

DISCUSSION

Figure 1: New Jersey American chestnut north of Sunfish Pond.

By utilizing the concept of the transect, this pilot study set out to better define best practices for establishing 1) a baseline snapshot of chestnut density along the Appalachian Trail and 2) a data set from which those variables that define chestnut occurrence could be extracted. In addition, by incorporating the use of volunteer citizen scientists, the project has an added benefit of increasing awareness not only among project participants, but also several communities of hikers, naturalists, and residents along the trail.

Laurie Potteiger, who hiked over 112 miles total, hiked the entirety of the New Jersey section. Her counts of trees found along the trail can be found in Figure 2[10] . Based on Potteiger's counts, one can see significant pockets of high chestnut density where other areas have few to no chestnuts. What makes that one section in the central part of the New Jersey Appalachian Trail special for chestnut survival? Are there differences in soil type between those areas? Elevational differences? Land use differences? Most likely, it's a combination of all of those.

The observation of pockets of trees in some areas, but none in others, has been noted in other contexts. In 1993, Dr. Fred Paillet documented the irregularity of presence and absence of American chestnut clones in several locations within the natural range (Paillet, 1993). With more data and/or a refinement of scale on which to observe occurrence along the Appalachian Trail, those variables that appear to dictate density of American chestnut sprouts may be derived.

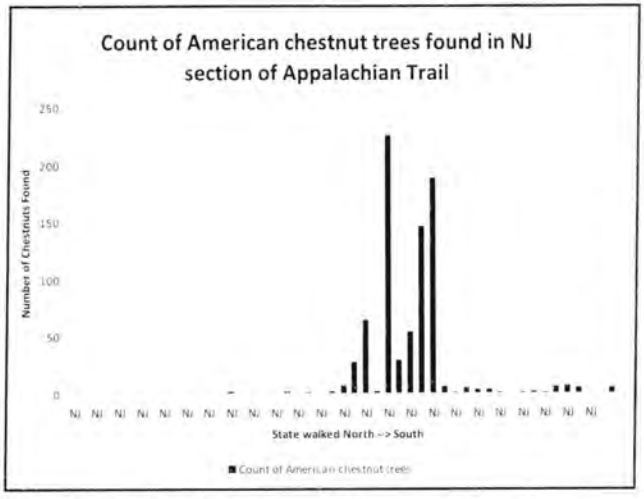

Figure 2. This chart shows a distinct difference in chestnut density along certain parts of the Appalachian Trail within New Jersey.

One possible way to look at several variables on a large geographic scale is to more fully utilize GIS (Geographic Information System) technology. Many layers of geographic information are available at no cost. But, currently, there are no geographic data associated with the counts taken by our volunteer hikers in 2008. To do this type of analysis, trail segments used as data-collection units must first be defined in terms of GPS coordinates. Once this is done, it may be possible to analyze the pilot and future data in terms of several abiotic variables that are potential predictors of chestnut, including elevation, aspect, slope, and rock and soil types.

[10] Note that these counts differ considerably from the counts of another hiker who counted the same area. This issue will be covered below in the "Refinement of Methodology" section.

A detailed database of GPS coordinates exists for the centerline of the A.T., shelters, and trail and road crossings. Using these datasets together, it will likely be possible to unite GPS coordinates with the available segment data used by hikers. Unfortunately, that process will likely be time consuming and the task of analyzing hundreds of miles of chestnut counts in terms of the potentially identified variables may be quite formidable, requiring the piecing together of many data sets designed for smaller areas.

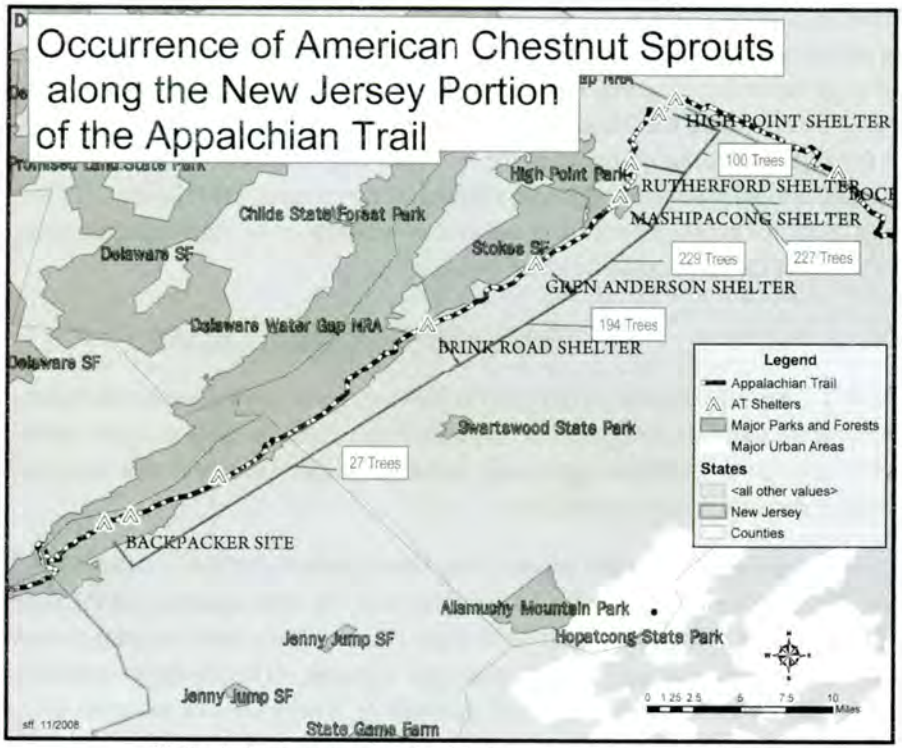

Figure 3. *More sprouts were found in the northern half of the NJ trail.*

But there is still great potential. Looking again at Laurie Potteiger's counts of chestnut sprouts in a geographic format (Figure 3), with only a single layer, that of location of public lands, we can see a definite pattern of chestnut distribution. The trees Potteiger found are all in the northern half of the NJ sections of trail, on the outskirts of publicly owned lands. Why are more chestnuts found near those lands managed by the state (Stokes State Forest and High Point State Park) while fewer are found on Federal lands (Delaware Water Gap National Wildlife Refuge area)? Of course, other variables likely contribute, but looking at only one layer can give one an idea of the potential power of geographic based analysis.

Examples of analysis of these types of geographic data applied to chestnut presence and absence do exist. Among those involved in the refinement of the A.T. MEGA-Transect chestnut pilot project are Dr. Songlin Fei[11] and Joe Schibig[12]. Fei et al., (2007) collaborated on a spatial habitat modeling study of American chestnut in Mammoth Cave National Park. Professor Schibig and his students and volunteers inventoried American chestnut sprouts in the park from 2003

[11] Assistant Professor of Forest Biometrics & Spatial Analysis at the University of Kentucky, Department of Forestry.
[12] Professor of Biology, Science Department, Volunteer State Community College, Gallatin, TN

–2006, recording ecological data and geographical coordinates with a GPS unit. Dr. Fei used the chestnut coordinates to map the chestnut sites over various geological formations within the park and to generate a predictive map of the most likely areas in the park to find additional chestnut trees. The results of the Mammoth Cave National Park study illustrate the potential usefulness of the type of data being gathered in the A.T. MEGA-Transect Chestnut Project, particularly if it can be made compatible with other data linked to geographic coordinates. It also provides a model for using graphic display of complex analytical techniques to communicate results to non-scientists—a key aspect of the Citizen Science process[13].

Refinement of Methodology

The A.T. MEGA-Transect Chestnut Project has been carried out so far primarily by volunteers and with virtually no budget. The experience and results from the pilot process suggest possible improvements to the initial approach, and raise important issues that will need to be addressed as planning for future work continues.

At the beginning of the pilot project, the data segments defined by the 2008 Appalachian Trail Data Book seemed to be the best available units for data reporting in the absence of equipping volunteers with GPS units. The 2008 Data Book defines 1494 segments over a total distance of 2185 miles for an average of 1.46 miles per segment. The shortest segment is 0.1 mile; the longest 7 miles. More than half the trail distance is in segments of between 0.9 miles and 2.8 miles. By looking at the current dataset, however, it appears that some longer segments outlined by the data book may overlook potential environmental variables that may be important to defining chestnut presence. For the next steps, the planning group will need to determine whether the Data Book segments are small enough units to provide adequate detail for analysis.

If the Data Book segments are not small enough, how can we establish a fine enough scale on which our hikers can feasibly base counts? One possibility is to implement the use of GPS units. The finest scale possible, of course, would be to GPS every tree encountered. One pilot data collector recorded GPS coordinates and diameter at breast height for all 25 American chestnut trees counted in two segments totaling 3.8 miles, and indicated that he did not find it difficult or particularly time consuming to take those measurements. But in some segments of the same distance, hundreds of trees were found. In addition, for all data collectors to use GPS units, we would need funding or donation of sufficient GPS units to make them available to all data collectors, and would need to provide training in the use of GPS units.

In general, the web interface worked fairly well, and was used by many volunteers. It will be interesting to see what comments the volunteers have on their experience of using the interface. A few discrepancies found between paper and web entries suggest possible areas for improving the reliability of web entries.

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[13] See 2007 TACF Annual Meeting presentation by Fei at http://chestnut.cas.psu.edu/mega-transect.html

A major issue for the entire project is the reliability of data submitted by the volunteers. In some cases, the hikers had never seen an American chestnut tree and experienced only a one-day, intensive identification workshop before they set off to find the trees. In some sections that were duplicated, counts were at least on the same scale. For instance, in southern PA near Michaux State Forest, hikers found and identified roughly the same number of trees, typically within the same range. But in some cases, like that in New Jersey, one hiker found significantly fewer sprouts, hundreds fewer, than a second hiker.

A primary variable to note is not only the difference in hikers, but also the date hiked. In both cases, one hiker went either in the early spring or late fall. At both of these times, chestnuts may be found, but it's generally more difficult to identify trees without leaves than during the height of the season when both leaves and flowers may be present. Typically, both in the lab and in the field, it's much easier to identify leaf samples in late June and early to late July. Based on these observations, it appears that it would be prudent to set a more stringent range of dates for data collection in the future. Instead of letting hikers count whenever they can, it may be best to ask hikers to hike only during mid to late summer.

The task of counting American chestnuts within a forest setting requires a complex skill set. The ability to distinguish between American chestnut and other trees is relatively simpler to teach than the ability to systematically seek out the variety of visual patterns presented by American chestnut (See accompanying illustrations by Fred Paillet). Assessing and improving reliability of counts will be a key focus for 2009.

Conclusion and Next Steps

The A.T. MEGA-Transect Chestnut Project generated considerable interest among potential volunteers without any concerted effort to publicize it. Those who participated as data collectors were generous in their willingness to share their experiences so that we could learn from them. The project has also generated interest among TACF scientists. With dozens of hikers involved and introduced to the chestnut project, the pilot project for chestnut counting within the framework of the A.T. MEGA-Transect can be deemed a success. Though not all sections were hiked, the organizers of the project have learned a great deal that can be applied to a more in depth and, possibly, larger scale project along the Appalachian Trail.

By establishing a baseline, it will be possible to monitor how certain changes will affect chestnut density. Disturbances such as deer density, fire, blow-downs, pest invasions, and climate change, could all be examined by their effect on chestnut density and distribution throughout the trail over the coming decades. We will also have a way to monitor the long-term status of chestnuts in a wild area, free from development and address questions such as, what is the life-span of a chestnut sprout and how are they affected by various disturbances?

ATC has submitted a letter of intent to the National Science Foundation (NSF) Informal Science Education program with the intention of submitting a full application for funding in June 2009. At its October 24, 2008 meeting, the TACF Science Cabinet endorsed TACF participation in the ATC grant application, and established a committee to work with the project. The key to future success of the Chestnut Project is to use the pilot project experience and expertise of scientists who have done related research to refine the data gathering process. If that can be done, volunteer effort may be more effectively used and has the potential to produce data that are likely to make a substantial contribution to future understanding of American chestnut ecology. This article and the accompanying web page are an invitation to contribute to that process.

Acknowledgements:

The authors would like to thank Dr. Doug Boucher, Bob Pickett, Dr. Hill Craddock, Tracey Coulter, the Appalachian Trail Conservancy, the Potomac Appalachian Trail Club and all those who have volunteered their time, thought and effort to piloting the A.T. MEGA-Transect Chestnut Project.

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Sketches of the MEGA-Transect Project

Text and Illustrations by Dr. Fred Paillet, Department of Geosciences
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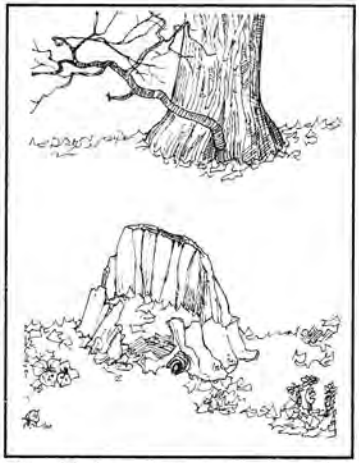
The idea of the MEGA-Transect as a vehicle for characterizing the large-scale distribution of chestnut in the southern Appalachians really intrigued a veteran chestnut researcher from New England. In my earlier work I had noted that there were several peculiarities about the distribution of chestnut on the landscape that needed explanation. Not the least of which was how a tree that was supposedly obliterated by a serious disease could remain so abundant nearly a century after the disease first appeared. I knew that a similar abundance of chestnut sprouts must occur further south because recent forestry publications identify released chestnut stems as the dominant woody biomass (and an important competitor for desirable hardwoods) in North Carolina and Virginia stands in the first few years after harvest. I had long suspected that a real analysis of the role of chestnut in modern landscapes would require a careful mapping of chestnut and the location of pre-blight chestnut trees over large areas. But my research funding had long ago pointed me away from chestnut, so that work would be left to others. The MEGA-Transect project might be the basis for just that kind of ambitious and definitive study of how chestnut is functioning as a viable shrub in the modern forest ecosystem.



An old chestnut stump on the A.T. in Georgia shows sockets where live basal sprouts were once attached, just like those on a large living tree shown for comparison.

Although almost all chestnut sprouts are derived from former seedlings, this is the rare exception where a living sprout is attached to the base of a former tree.

I had the chance to take a more serious look at chestnut in the southern Appalachians when a consulting project coincided with the retirement of a relative to the woods of northern Georgia. I used the opportunity to spend two glorious weeks tramping through the forest along the Appalachian Trail, and in adjacent side trails such as those of the Slickrock Wilderness and Great Smokey Mountain National Park. In New England, chestnut was and is located in mixed oak stands on dry uplands and outwash sediments along major rivers such as the Connecticut and

Sometimes sprouts are released into an opening, demonstrating the rapid growth capacity in chestnut, while hypovirulence suppresses the ravages of blight.

Although blight killed the large chestnut trees along the A.T. before 1940, the natural rot-resistance of chestnut wood allows some trees to remain standing today.

Merrimack. Much of this land was reverting from cultivated fields or pasture when blight arrived generally before 1925. In contrast, much of the southern Appalachian habitat for chestnut was probably never without forest cover, and had experienced blight somewhat later. When combined with the differences in climate, I wondered if I would see the same conditions related to chestnut sprout distribution on my southern foray.

The short answer to that question is yes! In the sections of the Trail visited last spring, I saw all of the same things I had been seeing in New England. Chief among these were: 1) the tendency for chestnut sprouts to form dense clusters in some places while being absent from otherwise similar locations; 2) chestnut sprouts not necessarily associated with locations where there were large chestnut trees at the time blight arrived; 3) the lack of live sprouts attached to the base of former large trees suggesting that most live sprouts are "old seedlings" that never grew as trees; and 4) the tendency for heavily suppressed chestnut sprouts to survive blight for decades before the main stem (but not the plant itself) succumbed when an "epidemic" of blight swept through the area. Land use and particularly livestock predation could possibly explain everything I was seeing in New England. It seems intriguing that the same patterns do show up along the Appalachian Trail even though site history must have been so different.

If most living sprouts are old seedlings, their distribution can tell us something about how chestnut propagates in the forest, which would be of real use in planning the re-introduction of blight-resistant chestnut. How could we use the MEGA-

Transect results?

My idea of a detailed study of chestnut distribution is based on a "nested" set of study sites. The project would start at the largest scales, mapping the general distribution of terrain, forest class, and land use history. A very broad and highly generalized map of chestnut distribution along transects cutting continuously across that landscape would give the most general portrayal of chestnut.

Progressively smaller study plots would be "nested" within specific areas of the broadest transect to focus on specific questions, such as the effect of altitude and geologic substrate on chestnut.

So the MEGA-Transect does seem like an important first step in getting to the bottom of the natural and man-made influences on chestnut distribution-as well as what that distribution could possibly tell us about getting blight-resistant chestnut back onto the landscape. ♠

A typical chestnut sprout along the A.T. in Georgia shows a long history of stem girdling by blight and repeated release of basal sprouts.

A typical example of a location where a dense clustering of living chestnut sprouts and an absence of stumps indicates a former abundance of chestnut seedlings.

Recent Advances in American Chestnut in Vitro Propagation

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Introduction

Our lab at the Warnell School of Forestry and Natural Resources at the University of Georgia has been working on developing a system for in vitro mass propagation of American chestnut for several years as part of a biotechnological approach to aid with restoration of the species. The in vitro propagation approach we have applied is somatic embryogenesis (SE), a tissue culture process that produces clonal populations of structures resembling seed embryos. Somatic embryos can be germinated to produce seedling-like plants (somatic seedlings). SE is a very powerful technology, with the potential not only to generate thousands of chestnut somatic seedlings for planting stock, but also to provide the means for producing genetically engineered trees and for conserving chestnut germplasm for future use via cryostorage. We were the first to report somatic embryogenesis in American chestnut (Merkle et al., 1991), but efforts to develop a robust SE-based propagation system for the tree made only incremental advances for several years (Carraway and Merkle, 1997; Xing et al., 1999, Robichaud et al., 2004). However, over the past few years, progress in this area has accelerated and American chestnut embryogenic material can now be manipulated in suspension culture to produce hundreds of somatic seedlings at a time (Andrade and Merkle, 2005, Johnson et al., in press). Even with these advances, much research remains to be done before SE can be used for mass propagation of blight-resistant chestnut trees. Here, we would like to present a summary of our more recent progress and describe the current status of our propagation system and how it can aid with restoration efforts.

Embryogenic Culture Initiation

We attempt to initiate new embryogenic chestnut cultures almost every season to add more genotypes to our collection and to provide fresh culture material for experiments. Our protocol for culture initiation involves collecting green, immature burs containing nuts in which the seeds are still at a very early stage of development, dissecting the burs and nuts to retrieve the immature seeds, and culturing the immature seeds on a semisolid induction maintenance medium (IMM; Andrade and Merkle, 2005) containing the auxin 2,4- dichlorophenoxyacetic acid (2,4-D). In our experience, we have found that each ovary (which will eventually develop into a nut) of the female chestnut flower contains between 9 and 21 ovules, which can become seeds following fertilization. If the nut is allowed to continue to develop to maturity, usually one of these seeds becomes dominant and its embryo eventually fills the nut. All the other seeds in the nut abort,

although sometimes more than one embryo develops in a nut. We have found that the optimal time to start cultures from these seeds is a little over one month following pollination, when all the seeds are still alive and about 1-2 mm in diameter. A low percentage (2-3%) of these seeds cultured on IMM will produce an embryogenic culture (Fig. 1). Until very recently, all of our cultures were initiated from open pollinated nuts collected by cooperators at The American Chestnut Foundation (TACF) or the American Chestnut Cooperators Foundation (ACCF) and shipped to us. While the cultures initiated from these seeds were very useful to us for developing our regeneration system, the trees produced from them probably will not make a major contribution to restoration efforts because the male parent of each culture is unknown.

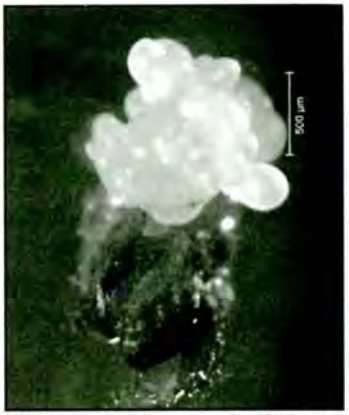

Figure 1. *Newly-initiated embryogenic culture from immature American chestnut seed, showing remains of seed and cluster of globular somatic embryos. Bar is 0.5 mm.*

However, over the past two seasons, TACF breeders from a number of chapters, including the Georgia Chapter, as well as ACCF breeders have provided us with nuts resulting from controlled pollinations between pairs of known American chestnut parents. Thus, the trees we are now regenerating from the cultures started from these seeds will have a known parentage. We can maintain these cultures for years by transferring them every three weeks to fresh IMM. However, all of this culture maintenance entails considerable labor and supply costs. Therefore, we cryostore several copies of each culture in liquid nitrogen (Holliday and Merkle, 2000) to save on labor and supplies, and only actively maintain about 20 lines to use for experiments at any given time. The ability to cryostore our American chestnut cultures allows us to preserve chestnut germplasm indefinitely, and we can recover the cultures whenever they are needed. Thus, cryostorage not only has the advantage of convenience, but it also makes it possible for us to maintain archives of chestnut germplasm that might otherwise be lost as the source trees dissappear due to blight or other causes.

Scaled-up Somatic Embryo Production Using Suspension Cultures

While our culture initiation and maintenance procedures have not changed much over the past several years, our somatic embryo production system has undergone a major transition. Previously, to produce somatic embryos, embryogenic tissues maintained on semisolid IMM, which we call proembryogenic masses (PEMs), were transferred from IMM to semisolid embryo development medium (EDM), which is the same as IMM, but lacking 2,4-D. The transfer to 2,4-D-free medium allowed the PEMs to continue developing into somatic embryos. However, not only were the numbers of somatic embryos produced using this approach low, but they developed asynchronously and were often malformed. In addition, the embryos tended to be fused into clusters and were often damaged when we tried to separate them from the clusters for germination. These problems prompted us to develop an embryo production protocol based on

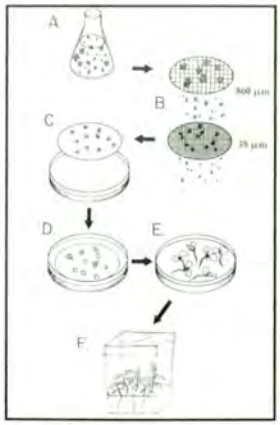

Figure 2. *Flow chart for production of chestnut somatic embryos and somatic seedlings.* **A.** *Embryogenic material is grown in suspension culture.* ***B.*** *Embryogenic suspension is size fractionated on stainless steel screens and the cell cluster fraction between 38 and 860 µm is saved.* ***C.*** *Saved cell clusters are collected on nylon mesh and plated with the mesh on embryo development medium.* ***D.*** *Embryos develop from plated cell clusters to the cotyledon stage. Cotyledon-stage embryos are transferred to fresh plates of embryo development medium to continue development, and then stored at 4° C for at least 12 weeks for pre-germination cold treatment.* ***E.*** *Embryos begin germination in the cold.* ***F.*** *Germinants are transferred to germination medium in GA7 vessels to complete conversion to somatic seedlings.*

embryogenic suspension cultures, described in Andrade and Merkle (2005) and illustrated in Fig. 2. Briefly, suspension cultures are initiated by inoculating about 1 g of PEMs into liquid IMM in a 125 ml Erlenmeyer flask. Suspension cultures are grown on a rotary shaker in the dark for 45 days, during which time they are "fed" by aspirating out old medium and adding fresh medium every two weeks. During this time, the PEMs multiply by going through several cycles of growth and "shattering" to make hundreds or even thousands of small proembryos (Fig. 3). To start the proembryos on a synchronous path of development to mature embryos, we pass the suspensions through a series of stainless steel sieves to obtain a Population of proembryos between 860 µm and 38 µm in diameter, which is collected on a disk of nylon mesh.

This nylon mesh with the proembryos is then transferred to a Petri plate of semisolid EDM and incubated in the dark. Usually within a few weeks, hundreds of somatic embryos begin to develop from the proembryos on each plate. Because the embryos develop from small proembryos of approximately the same size, they tend to grow singly or in very loose clusters, and in a relatively synchronous fashion (Fig. 4). Thus, as a result of developing the suspension culture/ size fractionation protocol, we gained access to large populations of singularized, undamaged embryos to use inexperiments aimed at raising somatic seedling production. In combination with the cold treatments described below, using the size-fractionated cultures greatly enhanced somatic seedling production efficiency. Embryos derived from suspension cultures of two lines tested had much higher conversion frequencies (46% and 48%) than those from cultures maintained on semi-solid medium (7 % and 30%; Andrade and Merkle, 2005).

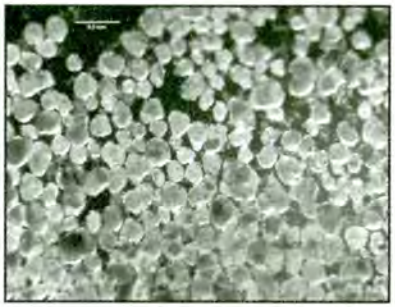

Figure 3. *American chestnut embryogenic suspension culture following size fractionation to synchronize embryo development. View of proembryos is through the bottom of the culture flask. Bar is 0.5 mm.*

Figure 4. *Early cotyledon-stage American chestnut somatic embryos approximately 3 weeks following plating of the size fractionated suspension culture. Embryos are on nylon mesh overlaid on embryo development medium.*

Improvements in Somatic Seedling Production

Prior to 2005, only a few handfuls of American chestnut somatic embryos had been successfully germinated and grown into somatic seedlings that could survive transplantation to the nursery or field (Xing et al., 1999, Robichaud et al., 2004). In the case of the Robichaud et al. (2004) study, a somatic seedling production efficiency of only 0.4% (23 somatic seedlings out of 5700 somatic embryos that went into germination treatments) was achieved, and only 6 of these plants survived transfer to the greenhouse. Using populations of somatic embryos derived from the fractionated suspension cultures described above, we tested a number of variables we thought might improve somatic seedling production (conversion). Two factors that proved to be important were a cold pre-germination treatment and supplementing the germination medium with activated charcoal. The cold pre-germination treatment was tested to mimic the cold conditions provided by nature that zygotic embryos in nuts need prior to germination. For this treatment, Petri plates of embryos on EDM are stored in a refrigerator at 4 -5° C for a certain period of time. Then, they are removed from the cold and "planted" in plastic GA7 vessels (Magenta Corp.) containing 100 ml of germination medium (GM), which is the same as EDM, but lacking glutamine, and moved to a lighted incubator to complete conversion. We found that a minimum of 12 weeks of cold treatment was critical for conversion of chestnut somatic embryos to somatic seedlings, raising conversion frequencies for one line to 47%, compared to 7% with no cold treatment (Andrade and Merkle, 2005). We also found that not only did the somatic embryos continue to enlarge while in the cold, but many of them began to germinate, just as cold-stored chestnut seeds do. Supplementing the GM with 5 g/l activated charcoal improved conversion frequency for one line from 19% to 59% and kept roots from darkening (Andrade and Merkle, 2005). We have continued to test different treatments to improve somatic seedling production. Cold treatments even longer than 12 weeks (up to 18 weeks) proved beneficial for some genotypes, but not others. For example, for one clone, 18-weeks of cold yielded a significantly higher conversion frequency (80%) than the 12- and 15-week treatments (60% and 33%, respectively) (Johnson et al., in press). Another factor that appears to show promise is light quality. Red light and far-red light supplied by light-emitting diodes (LEDs) improved germination and conversion frequencies for some genotypes. In fact, somatic embryos of one genotype completely failed to germinate under white light, but successfully produced somatic seedlings under red and red + far-red light, with conversion rates of 73% and 60%, respectively (Johnson et al., in press). Other experiments to optimize levels of activated charcoal and medium gelling agent in the GM are underway.

The Next Challenge: Improvements in Somatic Seedling Quality

While we feel we have made good progress raising somatic seedling production efficiency, we continue to struggle to improve the quality of the somatic seedlings. American chestnut seedlings from germinated nuts grow quite vigorously and are easily capable of reaching over 2 m under optimal nursery conditions (Johnson et al., 2008). To be desirable planting stock, our

somatic seedlings should have similar growth potential. However, chestnut somatic seedlings characteristically get off to a slower start than zygotic seedlings and until recently, would seldom reach over 30 cm during their first season of growth in potting mix. There are probably a number of factors responsible for the lower apparent vigor of our somatic seedlings. One of these is the fact that somatic embryos we germinate have only about one-fifth of the biomass of a mature zygotic American chestnut embryo, and much lower levels of starch and protein (Carraway, 1996). While we can culture the somatic embryos for longer periods to get them to larger sizes and somewhat higher starch and protein levels, we have found that somatic embryos that reach a centimeter or more in diameter germinate at very low frequencies (unpublished data), which has also been reported with European chestnut somatic embryos (Vieitez, 1995). Thus we are currently forced to employ embryos that are lacking a full complement of storage products. Another factor that may be involved in the low somatic seedling vigor is the fact that the somatic embryos are germinated and grown for several weeks on a gelled medium in a GA7 vessel, resulting in an unbranched taproot with no root hairs. Such a plant is at a disadvantage when transferred from tissue culture conditions to potting mix. Given these problems, our current research has focused on testing alternative treatments for somatic embryo germination and early growth. Under our current protocol, the chestnut somatic seedlings are removed from the GA7 boxes, their roots are washed free of medium and they are planted in potting mix. The plants are grown under fluorescent lights in domed trays to maintain high humidity. After one week, the domes are vented to gradually lower the humidity over another few weeks, after which time the somatic seedlings can be moved to the greenhouse. Recently, with support from the New York Chapter of The American Chestnut Foundation (TACF), we have begun to test alternatives to growing the newly germinated embryos in gelled medium. One of these alternative treatments is to germinate the somatic embryos in temporary-immersion bioreactors, in which the embryos are immersed in liquid GM for only a few minutes every day until they have germinated. We are also testing alternatives to peat-based potting mix to speed early growth of the germinants. One of these alternatives is a plug made of a mixture of peat and polyurethane manufactured by Grow-Tech. Since these plugs can be safely autoclaved, we can transfer the newly-germinated somatic embryos to them and grow them under *in vitro* conditions until they are ready to be transferred to the hardening-off chamber. Early results with the Grow-Tech plugs are encouraging (Fig. 5). We

Figure 5. *American chestnut somatic seedling grown in a Grow-Tech plug following germination in vitro.*

Figure 6. *American chestnut somatic seedlings showed rapid growth in the greenhouse following repotting in 15 gallon pots. Stick is 1 m.*

hope all of these changes will not only improve the vigor of our somatic seedlings by shortening their time on gelled medium, but will eventually allow us to scale-up somatic seedling production

In addition to these changes in the lab, recent improvements in greenhouse handling of the chestnut somatic seedlings, including a change in potting medium, rapid transfer to larger pots, decreasing watering frequency and the use of shade cloth for the first few weeks following transfer to the greenhouse, have significantly improved growth rates. This past season, some of our somatic seedlings responded to these changes by adding almost 1 m of height growth (Fig. 6).

Figure 7. *American chestnut somatic seedlings in the nursery at the UGA School of Forestry and Natural Resources' Whitehall Forest, Athens, GA. Stick is 1 m.*

To date, we have only installed a few small "demonstration plantings" of our American chestnut somatic seedlings in two nurseries in Georgia (Fig. 7), but survival has been high, and first-season growth has been impressive. Some somatic seedlings planted at the Georgia Forestry Commission's Flint Nursery reached over 1.5 meters in one season (Kormanik and Merkle, unpublished data). Thus, even though the somatic seedlings start out with slower growth rates than zygotic seedlings from nuts, they appear to have the potential to substantially catch up in the nursery with proper care.

Future Applications of Chestnut SE Technology

The availability of a reliable system for generating large populations of clonal chestnut trees via in vitro culture has a number of potential applications, both scientific and practical. One major reason we put a large effort into developing SE technology for chestnut is to provide a platform for genetically engineering the tree with anti-fungal candidate genes. Most scientists who work with transgenic plants understand that getting transgenes into plant cells is not the most critical part of the process—rather it is having target cells with a very high regeneration capacity, as we have with our embryogenic chestnut cultures. In our lab at the University of Georgia, we have taken advantage of the rapid proliferative ability of our embryogenic chestnut suspension cultures to produce hundreds of transgenic chestnut plantlets engineered with a candidate anti-fungal gene (Andrade et al., 2006, Andrade et al., in preparation). Embryogenic chestnut cultures have also been used by our collaborators at SUNY-ESF to produce transgenic chestnuts (Polin et al., 2007, Rothrock et al., 2007). As the focus of this article is the status of the in vitro propagation system,

we plan to summarize our gene transfer work in a future article in the Journal of TACF.

Another proposed application of embryogenic chestnut cultures could make a very powerful compliment to TACF's backcross breeding program. As TACF's B_3F_3 material begins to be produced, one might reasonably predict that demand for planting stock from these families will be very high, while at least initially, the numbers of nuts produced in seed orchards will remain limited. TACF breeding programs which have just begun in other parts of the range (i.e. GA, AL), will lag even further behind in producing blight-resistant, regionally adapted seedlings to plant. TACF members will no doubt strongly desire seedlings to plant on their own land, and many will want sufficient numbers of trees to plant several acres on their property. In addition, the USDA Forest Service is expecting to plant large-scale tests of TACF material on National Forests (personal communication, Barbara Crane, Regional Geneticist, USDA Forest Service Region 8). Populations of somatic seedlings derived from B_3F_3 seeds could help fill the gap until orchards come into full production. In addition, since we can cryostore cultures while somatic seedlings derived from those same cultures are tested in the field, if there are genotypes that turn out to show elite performance in the field, we can retrieve those varieties from cryostorage and propagate large numbers of trees from them. We have approached TACF with the idea of testing the applicability of our SE system to B_3F_3 material. Since our technology was developed with pure American chestnut material, it may need some modification to work well with the hybrid backcross material. We look forward to continuing our cooperative research with The American Chestnut Foundation and hope to have the opportunity to test our SE protocols on B_3F_3 material soon.

Acknowledgements

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Survivorship and Recruitment of American Chestnut Trees in Haun Orchard, Sandy Lake, Pennsylvania

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Introduction

Until about one hundred years ago, the American chestnut tree, *Castanea dentata,* was a dominant tree species in the deciduous forests of North America (Wang et al., 2006). The species' natural range covered over 200 million acres of the eastern United States (Figure 1). The American chestnut grew well in a wide variety of soils, topographies, and light conditions (Wang et al., 2006). This keystone species was a significant food source for wildlife, in addition to providing valuable, rot-resistant wood in local economies (Connors et al., 2002). However, the widespread population was devastated across its natural range by the chestnut blight, *Cryphonectria parasitica,* introduced from China in the late 19th century (Linder-Basso et al., 2005). By 1960, the vast majority of *C. dentata* were dead or dying across the species' natural range (Jacobs, 2007).

Figure 1.

C. parasitica was first observed in the US in 1904 (Robichaud et al., 2004), and exhibits the following characteristics. As the fungal pathogen invades the cambial tissues, the tree develops cankers to close off the infection. Once the cankers girdle the branch, stem, or trunk, the tissue above the girdle dies (Connors et al., 2002). However, the tree roots are unaffected by the fungus and remain healthy (Jacobs and Severeid, 2004). Stems regenerate from the base of the tree, grow for several years, and are eventually infected and die back. This cycle often continues for decades, producing a mixture of dead, dying, and relatively healthy stems around an older, dead stump. (Diskin et al., 2006) Wang et al. (2006) consider the American chestnut to be functionally extinct, in spite of the fact that the species survives as understory sprouts throughout much of its original range.

In response to the near demise of the American chestnut, the US Department of Agriculture and The American Chestnut Foundation (TACF) are engaged in efforts to restore the

valuable tree (Robichaud et al., 2004). The Foundation's efforts in the last twenty years have focused on a double backcross breeding program that produces trees that are 15/16th American chestnut and 1/16th Chinese chestnut (*Castanea mollissima*). *C. parasitica* is not lethal to the congeneric Chinese chestnut (Linder-Basso et al., 2005). The double backcross reconstitutes the homozygotic resistance of the Chinese while maintaining the American morphological characteristics of a forest canopy tree (Diskin et al., 2006). These traits are necessary if the species is to be reestablished across its original range (Jacobs and Severeid, 2004).

Our research was done in consultation with TACF's regional science coordinator, Sara Fitzsimmons, who oversees TACF PA chapter's research effort. The study focuses on a unique orchard of American chestnut trees in Mercer County, PA, planted by the late Charles Haun. He planted approximately 450 trees in 1980 on his 208-acre farm near Sandy Lake, PA. He planted the 450 orchard trees using nuts gathered from trees already on his property. These included a 10m tree that, while infected, continued to grow and reproduce for over 30 years (Prenatt, 1987). These original seed trees have long since died. His son, Fred Haun, is the present owner and resident of the farm. To his knowledge, no other chestnut trees were planted in the orchard since the original planting in 1980 (personal communication with Fred Haun).

TACF has taken interest in the orchard due to the large number of trees that have survived since the original planting. Currently, the orchard does not have a regular management plan. The 267 trees that have survived the last 28 years are in varying states of health and decline. Nearly all display the typical pattern of infection, die back, and re-growth characteristic of diseased American chestnut trees. However, many trees have reached reproductive maturity, despite the cycle of growth and infection. The purpose of this research was to establish baseline data of survivorship and health of the trees in the orchard.

Materials and Methods

During field examination and analysis, living trees were found and tagged along the original orchard grid lines. All visible trees were labeled with a letter and a number on a piece of marking ribbon at approximately breast height on a living branch or stem. The letter corresponded to the east to west columns, A to O, with the road bordering the south. The number corresponded to the north-south running rows along the soybean field, 0 to 33. The labeling started at the northeast corner of the orchard, where the first tree was A0.

We also marked the location of any surviving volunteer trees that were recruited since the planting. All living trees were characterized by size, number of branches, and overall health. Also, bur counts were taken on every fifth tree in rows A through I, for a total of 38 trees. The numbers of living and dead stems were counted on 32 trees.

Volunteers, trees recruited from the nuts of orchard trees, were also marked with ribbon. These trees are growing in the orchard out of the planted pattern and are labeled according to the two nearest orchard pattern locations, e.g. 'Vol F12 and F13.'

All visible trees were categorized by size and health. This information is meant to be qualitative, not quantitative, and to give baseline data on which to compare future growth.

Bur counts were made on 38 trees located on rows 2, 7, 12, 17, 22, 27, and 32. Only rows A through I were counted as the burs began to fall before all rows were labeled. In some cases, neighboring trees were counted if the targeted tree was not visible due to tree height in a forested section. Bur counts were given as ranges sufficient to determine bur production trends in future growing seasons. Several trees had branches that had died earlier in the season. These branches usually contained smaller, dried up burs. These dead burs were not counted.

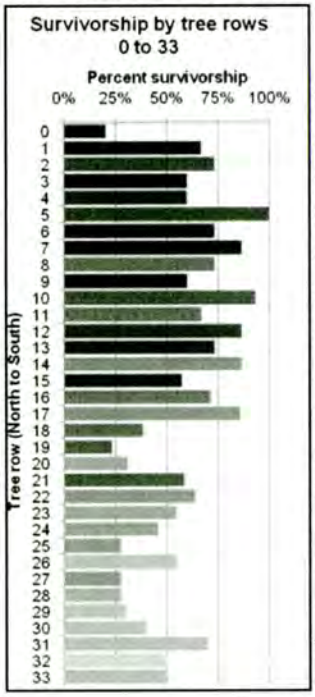

Figure 2.

Results

Of the original 450 trees, 267 were located and tagged. Consequently, 183 trees have either died or are not visible due to dense vegetation. The survivorship in the orchard since the original planting is 59.4%. Roughly, survival increases south to north and east to west as one moves through the orchard. Trees in the northern half of the orchard had a higher rate of survival than did trees in the southern half (Figure 2). Survivorship in rows 0 to 16 was 71.1%, while in rows 17 to 33, survivorship was 45.7% (Figure 3). We also located and tagged 18 volunteer trees, which were not planted by Charles Haun. Most volunteers were small trees that showed evidence of growth and die-back.

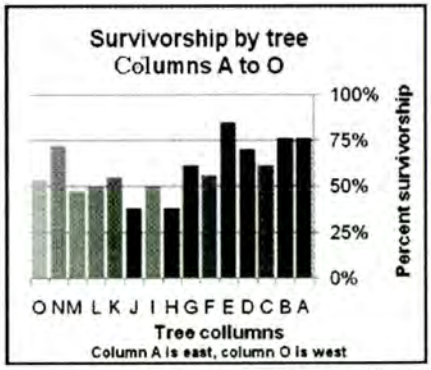

Figure 3.

Stem counts made on the 32 trees ranged from 2 to 36 stems, typical of blight-weakened trees that die back and resprout. The average, as seen in Table 1, was 15.1 stems per tree. Many of the healthier, larger trees had few additional stems around the main surviving and relatively healthy trunk. All of the trees in the orchard showed significant signs of *Cryphonectria* infection, except for some of the smallest volunteers. The largest trees with fewer stump sprouts typically had large trunk and branch cankers.

Table 1.

Number of Stems	Number of Trees
1-5	3
6-10	4
11-15	14
16-20	3
21-25	4
26-30	1
30+	3

Bur count categories are seen in Table 2. The average number of burs per tree was 37.4. However, the highest numbers of burs (>100) were associated with small- or medium-sized trees toward the eastern side of the orchard, roughly following a survival trend.

Table 2.

Number of Burs (approximately)	Number of Trees
0	14
1-15	5
16-50	7
51-100	6
101-175	4
176+	2

The burs on all living branches appeared healthy. We observed minimal worm or insect damage. All examined burs contained three nuts each.

Discussion

The purpose of this study was to do a site characterization of a nearly 30-year-old orchard of American chestnut trees that exhibits remarkable survival as well as significant infection, decline and regeneration. The site is notable for a strong annual reproductive effort off thousands of nuts and a significant number of volunteers. Interesting patterns of survival, infection regeneration, and bur production give many opportunities for additional studies of this unique stand of American chestnuts.

The differential survival of trees in the northern half vs. the southern half of the orchard may be the result of habitat differences and infection loading as one moves from the more forested northern and western edge to the more agricultural and open south and east. The northern half of the orchard has less non-chestnut woody growth, perhaps due to occasional mowing in the past. There is little likelihood that survivorship differences between opposite ends of the orchard are due to genetic differences in seed stock. All original plantings were from seeds produced from a few original naturally occurring trees that came from the property (personal communication with Fred Haun).

The orchard's high overall survivorship may be a result of Charles Haun's selective breeding. Years before planting the orchard trees, Haun cultivated saplings from other reproductive trees and continued into the 1970's, when he had a tree that was 10m tall. That tree, while not immune, exhibited a strong blight resistance. Nuts from the resistant tree, as well as those from others on his property, were the source of the trees cultivated in the orchard. As a result, the orchard trees, while completely American in genotype, show a resistance to the fungus. Charles Haun was able to harvest nuts from the orchard in the 1980's (Prenatt, 1987).

Given the production of the 2007 season, a modest harvest can still be gathered. The tendency for smaller to midsized trees to have the highest number of burs suggests that these trees may be putting forth a reproductive effort prior to a significant blight-induced die back. Further tracking of the health of the higher-producing trees in future growing seasons may show interesting trends of decline and recovery.

The stem counts reflect the characteristic post-infection regeneration and die back sequence typical of blighted American chestnut trees. The number of stems suggests that the roots of the trees that have died back are still reasonably healthy and are holding their own against continued aboveground reinfection.

Conclusion and Further Research

With baseline data gathered, future research can focus on the tree health and survivorship. Trajectories of baseline data can be developed for individual trees. Thus, general health of the trees can be tracked using size, bur counts, and stem number. In addition, genetic analysis and correlations with health can be established to determine if Charles Haun was successful in selecting for trees that have at least minor resistance to the blight (Prenatt, 1987). We hope to determine the genetics of individual trees and correlate this with the degree of resistance and survivorship.

Several trees, particularly in the north end of the orchard, have large trunks (diameter <8"). Most other trees have a larger number of smaller stems, signifying many cycles of growth and infection. This may suggest that some type of resistance or hypo-virulence is operating. Also, we would like to investigate whether environmental factors such as moisture, soil nutrients, and distance from infection sources are influencing tree health.

Permanent markers need to be put in place in the near future. The ribbon markers are only temporary. We are considering several ways to non-intrusively but permanently mark the trees for easy field identification.

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Acknowledgements:

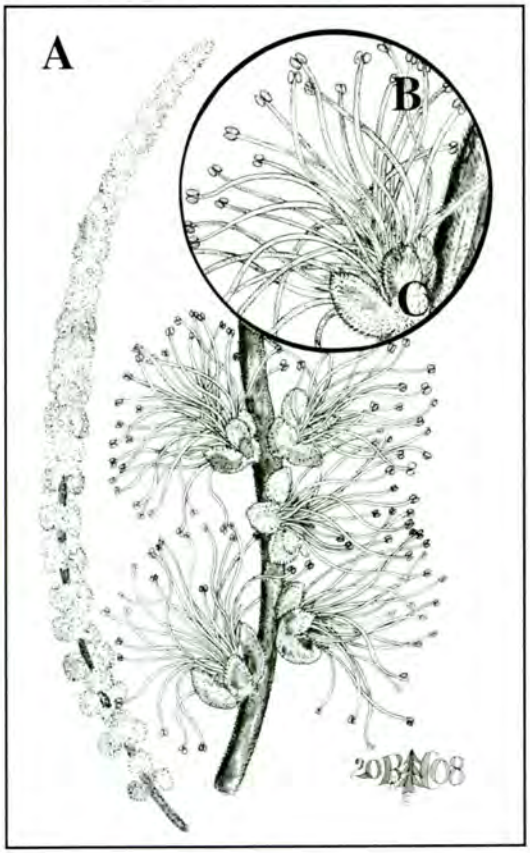
Many thanks to Gary Micsky of PA-DNR for all of his help.

The Rite of Chestnut Reproduction as observed in Pennsylvania

By Bill Lord and Illustrations By Bruce Lyndon Cunningham

The chestnut dance with life begins each year in the merry month of May. The terminal bud at the end of each branch commences new growth as the tips of new leaves emerge and expand. A tell-tale circle or scar marks the starting point. New leaves develop alternately along the advancing stem and when they have about reached their full size, and where sunlight is rich, new probes of life extend from the leaf axils. They derive from the same germinal cells that formed the leaves but they respond to a change in the genetic signals and will form slender catkins [floral spikes] of all male or staminate flowers. Formed in early June, the buds will not bloom immediately but burst into their cream colored display around the first of July (Figure 1).

Figure 1
A: *The all-staminate catkin.* ***B:*** *An enlargement of a staminate flower showing Stamens consisting of the thread-like filaments, topped by bi--lobed anthers.* ***C:*** *Calyx with sepals.*



Meanwhile bisexual catkins form at the terminal end of new growth. The upper portion is staminate, separate from 1-3 inconspicuous tufted globes clasping the lower catkin stem. Each of these small tufted globes will become a spiny bur and now contains three female flower buds.

The all male catkins, though they are located further back on the branch, approximate both the number and the length of the leaves on the new growth.. For healthy fast growing American chestnut new growth averages three feet a year with both male catkins and leaves 6- 9 inches long. The array of male catkins is easily sufficient to cover mountain sides with a "summer snow." The bisexual catkins are fewer in number and approximately half as long .

It is now early July The all staminate catkins are the first to bloom, ripen and shed pollen. They do not hang in pendants like the catkins of the related oak, but reach out as though competing with the leaves for sunlight and space. Seen through a hand lens they show a dense array of spindly filaments each topped by a bi-lobed "pinhead" anther.

Warm, sunny days are the rule. The creamy color and musky odor attracts crowds of nectar and pollen seeking insects: bees, wasps, ants, beetles, hover flies, and butterflies. Their very numbers imply a role in pollination. The pollen is also lifted by updrafts of warm air that descends as it cools through the passage of the day, spreading pollen from tree to tree.

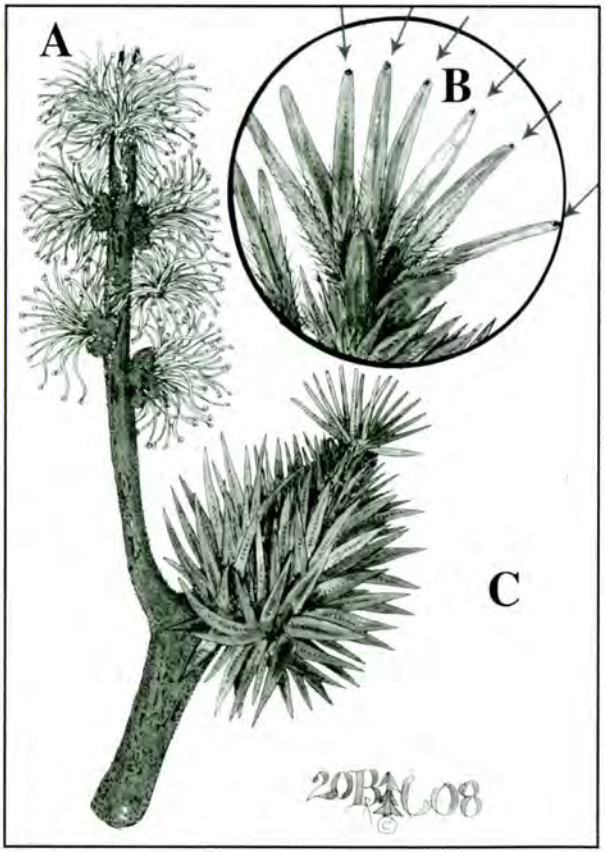


Figure 2
A: *A bi-sexual catkin.* ***B:*** *An enlargment of a single female flower with the tiny, sticky stigmas at the tip of the styles.* ***C:*** *Female flower with numerous small leaflets or bracts which will develop into the familiar and formidable spines; topped by the protruding styles that occur in groups of 7-9 for each of three flowers per bur.*

Given hot, sunny weather the pollen shed of the all staminate flowers could be over in a week, followed in sequence by pollen-receptive female flowers (Figure 2). Each set of three is enclosed within a frilly array of bracts [modified leaves.] These future burs are now larger, with the ovoid shape of a miniature pineapple and though generally less than an inch high, are easily accessible near the end of the branch to both insects and wind currents. However, insect activity is concentrated on the staminate flowers, seeking nectar and pollen. Insects apparently ignore the female flower, but probably come into occasional contact. The combined styles of the three flowers extend like so many fingers from the top of their bract enclosure. On average each flower has 7-9 styles, each with a barely visible stigma at its tip. Green at first, the styles whiten and spread outward and apart when the stigmas are receptive to pollen. The all-staminate flowers launch pollen for about a week, [or days longer during cooler weather] after which the female flowers become receptive to pollen for about 8-10 days. The stamens of bisexual catkins begin to shed pollen at the end of receptivity for the female flowers.

With hot sunny days and an absence of cool or rainy weather, the mating season will end by late July. [Note: This data was obtained from a second back cross orchard in Schenley Park Pittsburgh.]

The different maturity timing for the male and female components might seem to be an adaptation to prevent self pollination,. However, individual trees do not bloom in unison and the three sequences inevitably overlap. The chestnut, in common with many other plants, assures cross pollination through a very efficient genetic control called self-incompatibility. It involves a single SI gene that has numerous genetic varieties or alleles. This fascinating process has stimulated much botanical research. Knowledge about the chestnut dates t an excellent study by John W. McKay (1942).

When the SI allele of the female flower and of the pollen [male] are identical a biochemical reaction is triggered that prevents fertilization. This is what occurs when a chestnut is self pollinated. Since there are many SI alleles, most of the pollen from other chestnut trees will have a different SI allele and thus assure cross breeding.

In rare instances a chestnut tree will apparently produce nuts by self pollination. McKay 's study indicates that no fertilization [union of male and female sex cells] occurs. He observed that the SI gene apparatus functioned. Self pollination succeeded in generating a pollen tube extending down the style, but the union of male and females sex cells [gametes] was prevented. McKay hypothesized that so called self fertilization in the chestnut is actually a form of parthenogenesis wherein a nut is formed without the involvement of pollen.

McKay, using a light microscope with a magnification of 1000x was able, "..to show the presence of pollen-tube ends within the cavity of the embryo sac [within the ovule] and male gametes were seen adjacent to the egg and fused polar nucleus, but syngamy [fertilization] was not observed. Incompatibility between male gametes and the egg apparatus is thus indicated. It has not been possible to detect the presence of pollen tubes in tissues of the stigma, style and ovary with standard methods of technique." This view became possible with the advent of the electron microscope in the 1950s

The rite of reproduction, given passage by appropriate SI alleles, is a marvel to comprehend. A chestnut pollen unit, or grain, in common with all flowering plants, is the male sex cell, or gamete, formed in an anther. When the pollen is ripe, the anther opens and pollen is released. Chestnut stigmas, though very small at the tip of the styles, are very sticky and readily secure chestnut pollen on contact (Figure 3). Each pollen grain contains two nuclei. One generates a tube that progresses down the style. While in transit the remaining nucleus divides to form two separate nuclei. The tube extends and penetrates an ovule within the ovary. One pollen nucleus combines with the egg nucleus within the ovule to form the plant embryo, and the other pollen nucleus combines with two "polar nuclei" within the ovule to form the "meat" [endosperm] of

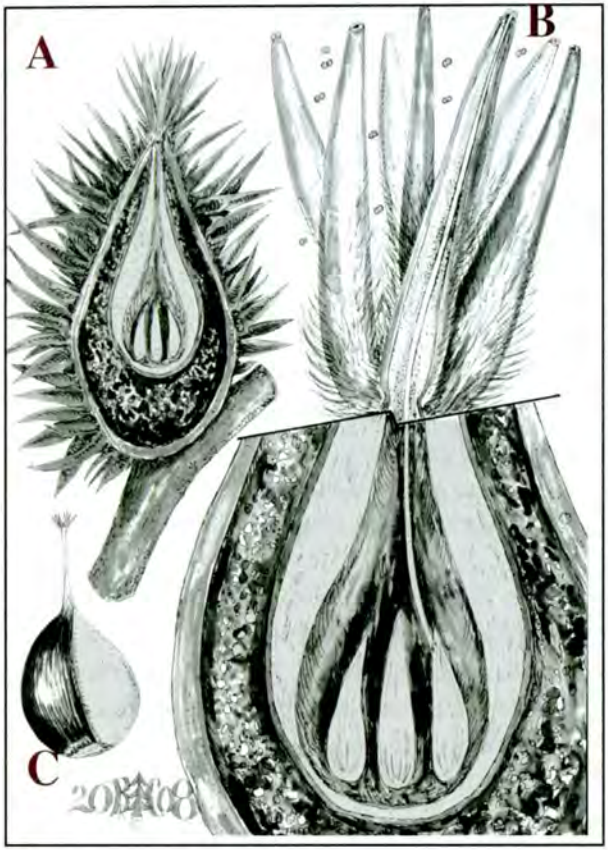


Figure 3
A: *A cross section of a developing bur showing the pathway for each group of styles down to three separate ovaries.* ***B:*** *the desent of a pollen tube into an ovary whereby an ovule will be fertilized by a pollen nucleus or sperm.* ***C:*** *A chestnut showing the whisk like tail showing the remnants of the styles.*

the nut which will provide nourishment to the embryo when it germinates.[2] It is also the tasty treat we enjoy roasted over an open fire. Only one nut is usually produced per each of the three flowers [three nuts] within a bur.

A recent study utilizing the electron microscope indicates that a number of chestnut pollen tubes make an unhurried, intermittent journey from a stigma, down a style to an ovule. This delayed fertilization is characteristic of the plant family Fagaceae, which includes the beech, chestnut and oak. The specifics of the study applied to the Japanese beech, *Fagus japonica*, but we may infer that delayed fertilization is also present in the chestnut (Sogo, A et al., 2006).

The once "stubby" set of three flowers will develop into a formidable spine covered ball, protecting three nuts. Frost may or may not nip open the burs, on that opinions differ. But frost time is when the burs are ripe and open on the tree. Blue Jays and squirrels will feast and carry some off to bury providently for winter. At night, nuts spill to the ground, their sound, "like the dripping of large rain drops."

[2] go to http:://www.cartage.org.lb/en/themes/Sciences/Botanical Sciences/Plant Reproduction/Flow.

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Carl Mayfield and Sons: Chestnuts Unlimited

By Bill Lord

Carl Mayfield is a long time, productive member of The American Chestnut Foundation (TACF) as a grower, writer, and a practitioner of nut grafting. The latter requires skill and dedication, qualities Carl demonstrates in the workshops he has given to fellow enthusiasts. My chestnut buddy, Larry Patchel, acknowledges the difficulty of nut grafting. "I admire his success rate of 50%, but I'm nowhere near it." As explained by Carl in his recent article, Nut-Grafting (2007), "Nut grafting is a means of grafting scion wood from a chestnut tree directly into the nut. The resultant product will replicate the tree from which the scion wood is grafted."

Larry and I arranged to meet Carl and his two sons, Andy and Sandy, June 8, at their chestnut research farm on a northern ridge of Massanutten Mountain in Shenandoah County, Virginia. They have a 37 acre in-holding within the George Washington National Forest acquired around 1994. A clearing has been made in the otherwise undeveloped land amid a re-growth forest predominantly of oak-hickory, black gum and red maple with a mountain laurel and blueberry understory. The rocky soil has a ph of 5.5, favorable for pre-blight timber chestnut and presently for abundant sprouts surviving as shaded, slow growing shrubs.

In addition to transplanting nut-grafted chestnut, the Mayfields have many activities in progress. On this very warm and sunny day Larry and I were particularly interested in appraising the blight resistance and growth pattern of a 1996 planting of 300 B_2F_2 nuts. We are the custodians of a planting of 102 B_2F_2 seeds, also planted in 1996, in Highland Park, Pittsburgh. Maintaining a chestnut orchard may be a labor of love but it is laborious nonetheless. We saw full evidence of both the care and the inevitable setbacks that caretaking entails.

Each newly grown or transplanted seedling was protected from deer by a ten foot section of 5 foot high garden fence, formed into a circular cage about 38" in diameter. An aluminum cuff around the base of the stem thwarted voles and rabbits.

Regarding setbacks, the orderly rows of chestnut were planted at five foot intervals ten feet apart, and were bisected by a swale, or a low area now devoid of trees. The Mayfields discovered the land lay below several springs and being poorly drained was unsuitable terrain. As the saying goes, "Chestnut do not like wet feet."

Carl was aware of this and did not plan to plant in this area. However, he received 300 nuts, ten times more than expected. Therefore he needed to expand the planting in all directions, including the swale. "We had a back hoe operator provide a drainage ditch, diverting the drainage water. This appeared to work to perfection initially, but several springs proved to be troublesome," and the chestnut have since died. Additional forest was cleared to provide space for all 300 nuts by July. Chestnut love sun and growth was shade- inhibited the first two years. "It was more than a year later when we cut more trees to let more sunlight into row one. Thus trees in row one have a right to be smaller than the center of the planting."

Larry and I concentrated our study on 30 trees in the southeast corner of the orchard, where the land sloped gently down to meet the low treeless area. They represented about half of the original total planted in this section. Trees dying from blight or other causes had been removed and the remaining non-selected survivors were heavily blight infected. We measured dbh [diameter at breast height] with a caliper and visually estimated the height. Most of the trees we selected had no cankers, a few had one or two per tree, the largest an ellipse 4" in length. All had a vertical type growth. We determined an average dbh of 2.2", ranging from 7/8" to 4' 3/4, " and an average height of 20 feet, from 12'-30 '. This data, while obviously not scientific, is presumptive that Mayfield's B_2F_2's have produced trees that complement Dr. Burnham's blueprint.

During our visit Larry and I enjoyed hearing Mayfield chestnut lore. During the 1990's Carl was the caretaker for Virginia's Amherst [County] tree. This legendary blight survivor was full grown when chestnut researcher Dr. Richard Jaynes first heard about it and flew from Connecticut to see it in 1969. Carl had a 45 foot surviving "loner" at his site on Massanutten Mountain that he dubbed his "Shenandoah tree." Like almost all loners it could not self-pollinate. Carl related his ingenious method of bringing Amherst pollen to the mountain..

> *"When we found the Shenandoah tree, there were four dead oak trees nearby that had obviously died from shade from the chestnut tree. We brought four plastic milk bottles with water and catkins from the Amherst tree. We attached about 50 yards of heavy cord to each plastic bottle. With a small iron weight tied to the loose end of the cord we were able to sling the loose end of the cord up and over each of the dead oak trees. Andy pulled on this loose end of the cord while I guided the plastic bottles up to the top of the dead oaks, using another loose cord to guide the bottles through the oak branches, minimizing any damage to the catkins. When near the top of the dead oaks we secured the cord with the catkins very near the crown of the chestnut. This process was completed four times to get the four plastic bottles near the chestnut crown on four sides. We did this two years in a row and obtained heavy production of chestnuts. I gave 100 of the harvest to Fred Hebard. The squirrels, of course, planted many chestnuts near the tree."*

Although the Shenandoah tree has since succumbed to the blight, Carl succeeded in introducing the (hopefully!) good genes of the Amherst tree. We saw at least two carefully protected seedling

offspring growing close by the stump of the mother tree.

This was our first visit to Massanutten Mountain and Carl and his sons described its scenery and history as we drove to and from their property. The mountain rises above the Shenandoah Valley and extends 50 miles southwest from Front Royal, between the Blue Ridge to the east and the Alleghenies to the west. We ascended traveling south from Front Royal through a narrow, rock bound passage into Fort Valley, five wide miles of rolling green farmland with a high ridge on either side. "Where is the fort?" I asked, assuming there must be one. "There isn't any fort," said Andy, "the valley itself is a fort." Traversed by Passage Creek, the valley lies within steep mountain borders on all sides, forming a natural refuge. George Washington knew the area well and during a time when his military fortunes were in peril, he considered it as a place to regroup and wage guerilla war. Fortunately success at the battles at Trenton and Princeton made this unnecessary.

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From Then to Now

A 25 Year Journey

By Marshal T. Case

"A 25 Year Journey" is a an updated reprint of Marshal Case's Keynote address, "A 22 Year Journey" from the 2005 Annual Meeting in Lexington, KY.

Vision, passion, perseverance, dedication, volunteerism and citizen science--these words, in their modest way--represent the ranks of The American Chestnut Foundation of yesterday and today. Following, is an in-depth look at the progress of TACF in three phases.

Dr. Charles Burnham, eminent scientist from Minnesota, understood that carrying a classic backcross breeding program through enough generations could be the answer to restoration of a blight-resistant American chestnut back to our eastern forests of the United States. Although the federal government and many state commissions had tried previously to figure out how to fight the blight and how to incorporate Chinese genes into a tree that could eventually compete again in eastern forests, those attempts failed.

Despite many doubts on the part of TACF founders, members, and the board of directors that the science program would succeed, the organization moved forward, and was incorporated in 1983. It is important to qualify that "succeed" meant to produce an almost entirely pure American chestnut tree and to build a self-sustaining organization that would support this effort.

Founders and original board members were determined that TACF would grow slowly and deliberately, and that they would invest both time and money in an organization that would be around for "a long time." The vision, faith, persistence, and dedication that were apparent in the leadership of the early years have carried through to today. In fact, Don Willeke, Jennifer Wagner, and Bill MacDonald--all still significantly involved in TACF--were among its early leaders. Mr. Willeke acts as legal counsel, Jennifer Wagner and her sister Cheri have provided a very favorable long term lease for the "Wagner" research farm, and Bill MacDonald has only recently stepped down from his role as Treasurer.

TACF's initial budget of $5,000 in 1983 has grown to a $2 million dollar budget projected for 2008/2009. There were fewer than 300 dues-paying members in 1986 and there are 6,000 in 2008. One of TACF's significant early financial supporters was William Raoul of Chattanooga, Tennessee, who saw to it that TACF held together financially (and therefore scientifically) during the early critical years. Wallace Dayton of Dayton's Department Stores and Barry Bingham of the *Louisville Courier Journal* were two philanthropists whom William reached out to in order to

keep operations going. Barry Bingham has continues to be a major financial supporter to this day.

Founding member Don Willeke and former president James Ulring have both expressed surprise at TACF's progress; achieving in 25 years what was not expected until the year 2040!

The mission of the Foundation and its membership has remained constant: to restore the American chestnut to its native eastern forests. This kind of determination and integrity in an organization is only as strong as the determination found with its members, directors, and founders. The glue that has held the organization together has always been the King of the Forest, the American chestnut tree, and the vision held by a collective body of individuals who all realized the significance of restoring a species once thought lost forever.

The beginning years were often more than challenging. "Ragtag," "bare bones," "bankruptcy," and "on the brink" were words and phrases used often by the small number of early leaders who were committed to the vision of the future. Decisions about TACF were made for the good of the organization, and not for the good of one person or even one state. There was a willingness to be patient and to do all the small things that would help bring TACF to the next level of professional existence. Maurice Levitte, an early director of TACF, believed in the state chapters and believed that the only way to build this organization was through a network of state chapters. The strength of TACF now and into the future is and will be based on a strong state chapter network of talented and dedicated volunteers.

The Beginning Years: 1983-1994

Mr. Willeke states TACF was formed around the coffee table of David and Audrey French. This was where the idea of a long-term, permanent chestnut organization that would have its own financial resources and its own research land was first considered. Willeke suggests that only an independent and independently-financed not-for-profit foundation would be capable of achieving the goal to restore American chestnut to eastern forests.

In April 1983, The American Chestnut Foundation became the official name of the organization. Phil Rutter, of Minnesota, became the first President of the Board of Directors and Don Willeke became the Secretary of the Board. Don donated his services and handled all the legal work required to incorporate. On June 22, 1983, TACF was incorporated in Washington, D.C. as a tax-exempt entity. There were 14 members on the first board of directors, compared to 34 in 2008. By October 1983, one small contribution had been received and board meeting locations alternated between the Bell Museum and the St. Paul Campus of the University of Minnesota. But getting board members to attend meetings was a challenge as none of the proposed members had officially accepted the invitations.

In February 1984, fundraising became a priority with different categories of membership

developed. The first annual meeting took place in a conference room at the University of Minnesota Landscape Arboretum. The first budget, $5000, was approved, after much discussion and Phil Rutter proposed that TACF organize state chapters. The treasury balance was over $4000 by April.

In July 1985, *The Journal of the American Chestnut Foundation* debuted, with Don Willeke as Editor. This Journal has become a hallmark of TACF and is regarded as one of the best of its kind across the United States.

In August 1986, major donor Wallace Dayton of Dayton's Department Stores contributed $7,500. Phil Rutter took a month-long road trip to attend meetings in Pennsylvania, Virginia, North Carolina, and Tennessee to fundraise, and to visit sites where there was interest in seminars on the breeding work of TACF.

In 1987, the lack of broad-based fundraising support threatened the existence of TACF. In time, however, two grants were received: $10,000 from The Salisbury Foundation, and $5,000 from the Hillsdale Fund, both of North Carolina. In September, membership exceeded 550 and the bank balance approached $30,000. The board began to consider the hiring of a half-time research assistant for Dr. Burnham. In November, there was a resolution to designate certain people of extraordinary national and international merit to serve as Honorary Directors of TACF. Dr. Peter Raven, Director of Missouri Botanical Gardens was the first designee. In December, Phil Rutter wrote in The Journal that "the Foundation has reached an awkward, adolescent state of growth" and has moved away from the "all volunteer" state to "hiring some help on occasion." Rutter called for full-time professional workers to bring TACF to maturity. Dennis Fulbright, of Michigan State University, became the editor of The Journal and would go on to serve later as Secretary.
What we now refer to as external research grants were initiated in 1988, with $25,000 being awarded to three universities. Publicity was beginning to pay off as well, with articles about TACF appearing in *Forest World*, *American Forests*, *National Parks*, and *American Scientist*. Other important events included discussions regarding the ideal location for TACF's headquarters; conversations with Jennifer and Cheri Wagner concerning the establishment of the Meadowview research farm; draft copies of a model constitution for state chapters; and the annual meeting in 1988, which took place for the first time in the East, in New Haven, CT.

Refining methods for controlled pollination was the science focus in the beginning years. Remapping of progeny from earlier breeding programs at the Connecticut Agricultural Experiment Station by Dr. Sandy Anagnostakis occurred from 1987 to 1992.

In the still-early years of 1989 through 1996, TACF was reaching some maturity as an organization. In January 1989, two historic events took place: an agreement was reached with the Wagner family for use of Meadowview Farm (and is still in place in 2008), and Dr. Fred Hebard

was hired for the newly-created resident research position at the farm. In April of the same year, Meadowview Research Farm was dedicated and opened for operations. Phil Rutter met with Charles Burnham in Minnesota to select trees for planting at the Wagner Farm and packed them into his car. On his way to Meadowview, he heard a report that there would be a frost and so he took 30 "baby" chestnuts into his motel room for the night! 80 attendees at the planting included *National Geographic* writer Ford Cochrane who ended up planting trees instead of writing about them. And, by the way, this has not been inconsistent over TACF's history--people want to get their hands on the trees.

In 1990, TACF was the focus of an in-depth article in *National Geographic*, and also appeared in *Country Journal* and Horticulture magazines.

John Herrington was hired as the first Executive Director in 1990. This was made possible by generous gifts from Wallace Dayton and Brad Stanback. The Administrative offices were moved from West Virginia University to Bennington, Vermont.

The crossing of progeny from early breeding programs at Connecticut Agricultural Experiment Station onto American chestnut trees in Meadowview began in 1989 and continued through 1995.

1990 was also the beginning of our state chapter network, with the incorporation of the New York State chapter, and initiatives in Maryland and Pennsylvania. Although Maryland wasn't able to get off the ground that year, Pennsylvania went on to be the largest and most active chapter. TACF made an important development decision that year, as well: $10 of annual national member dues would forthwith be allocated to state chapters to build programs and communicate with members.

Financial support in 1991 included a matching grant of $25,000 from the Lyndhurst Foundation. Connecticut held an organizing meeting for a state chapter with leadership from Drs. Phil Gordon and Sandy Anagnostakis, both of whom have continued to be major contributors to chestnut science. Other development initiatives included the creation of two annual fundraising campaigns, the Year-end Appeal, occurring in November, and the Farm Campaign, occurring in June.

Three significant events happened in 1992: Phil Rutter stepped down as President of TACF, former President Jimmy Carter offered to get involved, and newly-written by-laws allowed for all state chapter presidents to be appointed to a position on the National Board with full voting rights. new chapters were chartered-Connecticut and Illinois. Illinois gave up its charter a few years after forming and has not yet been rebuilt. As a result of these problems, TACF put a "freeze" on new chapter formation by choosing not to continue building the chapter program until policies regarding finances and research were in place.

In 1992, Paul Read was elected President, Jennifer Wagner as Vice President, Bill MacDonald as Treasurer, and Bud Coulter as Secretary.

Development of a breeding plan and the creation of the first genetic map of morphological traits in chestnut both occurred in 1992, and were published in 1993. Also in 1993 was the first demonstration that highly blight-resistant progeny could be recovered from F_2s and B_1F_2s.

Board minutes from 1994 read "board is changing from one of predominantly scientists/ academics to one of diversity." Each member of the board had different, but complementary, motivations, short-term goals, and strategies. Productive discussions between the New York State Chapter and TACF resolved their main differences. Paul Read resigned as President, and was succeeded by Bud Coulter.

Also in 1994, in response to a board request, a strategic plan was developed, and Indiana and Pennsylvania became new chapters.

Science focus was on the first screening of 4-year-old B_2 progeny, and demonstration that resistance did not decline with successive backcrosses. The first B_3 nuts were produced, as well as test crosses of highly blight-resistant F_2s and B_1-F_2s with American chestnut.

The Middle Years: 1995-2003

In 1995, former President Jimmy Carter accepted our invitation to become an Honorary Board Member, and immediately reached out for financial support from his many contacts. His letter of acceptance to then Executive Director John Herrington, read:

> *"Thank you for your recent letter inviting me to be listed as Honorary Director of The American Chestnut Foundation. Though my actual participation must of necessity be limited, I am pleased to lend my name if it will be helpful in attracting support for this important effort."*

It is very interesting to note the origin of this eventual commitment from former President Carter. One week prior to William Voigt, Jr.'s death in November 1991, he wrote to John Herrington from his farm in Blackshear, Georgia, to convey that he was working on an article about the restoration of the American chestnut. Mr. Voigt was a member of TACF and was profoundly interested in the work to develop a blight-resistant tree. In the same letter, he asked John to write to Mr. Carter. He felt Carter might be interested in supporting TACF's efforts. John Herrington took the advice , and wrote to the former president, conveying the message. Members of TACF make important things happen every day, and people are drawn to the mission and the vision.

As often happens in life, one chapter opens and another one closes. In 1995, founder Charles

Burnham died. An eminent scientist with a great vision, Dr. Burnham had begun a science program that had turned into a national effort, was gaining momentum each year, and was attracting people from every walk of life. Shortly before Dr. Burnham's death, he called Dr. Al Ellingboe to meet with him and requested that Ellingboe take the science baton and continue to move the program forward. Dr. Ellingboe has done just that, serving since that time in the volunteer advisory role of Science Director.
The Wagner Farm reached full capacity with 5,800 trees in the ground and Mary Belle Price offered to buy a second farm to be named the Glenn C. Price Research Farm in Meadowview in memory of her husband.

TACF was awarded a $75,000 three-year grant from Pew Charitable Trusts for the purpose of hiring a second scientist at the research farms. Interest grew in establishing more chapters but the "freeze" on state chapter formation remained policy.

Under the leadership of new President Bud Coulter, a mission statement was approved at the annual meeting. Dr. Fred Hebard, staff pathologist, expressed concern about too much board involvement in his day-to-day work. The search for the second scientist began. It was changing times with more business management ideas being put forward by President Bud Coulter, along with plans and goals and objectives.

The major science achievement in 1995 included intercrossing F_2s to produce F_3s.

At the beginning of 1996, Dr. Van Shi was hired at Meadowview as a second scientist, under the guidelines of the Pew Charitable Trusts award. The board expressed some concerns about the direction of some state chapters. Year end was expected to show income of nearly $253,000 and have a balanced budget and Apple Computer donated $25,000 in computer equipment to the research farms.

The major science achievement in 1996 was the first planting at the Price Farm, including the first large population of B_3s and first population of B_2-F_2s.

1997 was a major year of change as Executive Director John Herrington announced his resignation and President Bud Coulter wrote to the New York Chapter telling them that the national office was assuming responsibility of membership by year-end and the chapter needed to become part of TACF or lose its rights to use the logo, name, and other privileges.

John Herrington departed TACF in July and Marshal Case was hired to head the Foundation effective mid-October. His background in conservation not-for-profit organization management and fundraising and, in particular, his experience in founding and sustaining successful chapters was a key to his being hired.

Two mandates were presented to the new Executive Director by the board: make a transition from a board-directed to staff-directed organization and figure out how to establish a strong and

cooperative state chapter network by growing the network, if possible.

Brad Stanback and Shelli Lodge-Stanback with Marshal Case at Asheville, NC, 1997 Annual Meeting.

At the Asheville annual meeting, the new Executive Director approached philanthropist Brad Stanback as he was aware of his substantial financial support for operations. They discussed the future location of a central office and Mr. Stanback was requested, in March of 1998, to provide 3.5 years of startup funding($110,000) for an Asheville "satellite" office while still maintaining his current annual operations donation. He and his wife, Shelli Lodge-Stanback, agreed to the plan. In fact, the Stanbacks doubled their annual contribution to $100,000, in addition to the new commitment. The idea behind the "satellite" office in the southeast was to test the potential for financial support and growth and to expand the chapter network with a regional base in the South.

Science achievements in 1997 included publication of a molecular genetic map of chestnut and identification of quantitative-trait loci associated with blight resistance.

The New York State chapter's proposed membership and fundraising agreement was accepted and the "freeze" on new state chapter formation was open to question. Within a couple of months-early in 1998, Eric Evans and Welles Thurber of Maine visited the Bennington office and the new Executive Director outlined a plan for the fifth state chapter. The formula was based on searching out surviving American chestnut trees and establishing a membership of people who would spend a good portion of volunteer time in the field finding new trees, pollinating the flowers and harvesting the nuts, and establishing regional orchards as part of the national science program orchestrated from Virginia.

President Bud Coulter was asked to set up a task force on creating a policy to protect TACF genetic material and this led to what is now known as the "germplasm agreement." This was to become a policy that came close to tearing the organization apart and potentially separating the state chapters from TACF.

The Year End Campaign received a real boost when former President Carter responded to a letter from the Executive Director saying that he was happy to be profiled as one of the active members and offered the following quote:

"I consider the breeding and restoration of blight resistant chestnut trees in the United

States to be one of the most interesting and important scientific projects of our time. I hope that everyone will join Rosalynn and me in supporting this effort, and in encouraging our friends to participate actively."

Major science accomplishments included the first outplanting of clonally propagated, highly blight-resistant F_2s and B_1-F_2s and first screening of B_3 progeny for blight resistance, again demonstrating that resistance did not decline with successive backcrosses.

The biggest challenge during 1999 was rapid program and membership growth and where to best focus staff and volunteer resources to be most effective with the mission. Due to a serious time default with the Pew Charitable Trust funding agreement, the Executive Director-working with Dr. Fred Hebard-moved ahead to hire a replacement for the second science position instead of giving back $25,000. Dr. Paul Sisco was hired to fill the vacant position and settled in Meadowview as part of the science team.

The Bennington office support staff experienced a turnover due to new management and new talent was brought in to help with some major changes in approach to fundraising, membership buildup and networking. A remarkable young lady joined the staff soon after—Daphne Van Schaick. Her intelligence and dedication would help shape the future of TACF.

Strategic planning focused on regional meetings, hosted by state chapters and by the Asheville office. Every effort was made to provide an opportunity for every member to be within reasonable distance of one of the meetings. This was to be an all-organization strategic plan with wide representation from the membership. The Executive Director and science staff were presenters at all meetings and a facilitator conducted each meeting.

Foundation applications and a direct mail campaign for membership buildup became a cornerstone of the fundraising effort. Sudbury Foundation, of Massachusetts, provided $25,000 and sustained it on a yearly basis-focused on New England and building the state chapter network. National Fish & Wildlife Foundation provided $75,000 in a challenge grant for 1999 to initiate a combined education and regional adaptability project, followed by three more successive year challenge grants, and-very significant, Park Foundation of Ithaca, New York awarded $80,000 for an irrigation system for the Glenn C. Price Research Farm.

Brad Stanback of North Carolina was elected to the board of directors. He was acknowledged for his keen interest in the welfare of the struggling organization and his "many lifesaving contributions" to TACF over the years. The Glenn C. Price Research Farm was officially dedicated on June 6th with a large group of members, board members and officers in attendance. Bud Coulter stepped down as President of the board and James Ulring of Iowa was elected President.

Ulring had served as Development Cabinet VP and was chairman of the search committee for the

new Executive Director.

Operating accounts grew to nearly $500,000 and the Foundation endowment fund was close to $250,000. The Maine provisional chapter received full state chapter status and a Carolinas chapter initiative was underway. Massachusetts and Kentucky were discussing potential for a state chapter too.

Hill Craddock, Vice President of the Science Cabinet was busy focusing on the first TACF science audit to be conducted by "outside" scientists-a report card on progress of the breeding program. Hill, working with staff scientists Fred Hebard and Paul Sisco, produced a well thought out and executed plan that was presented at the annual meeting.

Dr. Fred Hebard produced the first plan for B_3-F_2 seed orchards.

Jim Wilson, board member and volunteer Farm Director, worked with board members James Ulring and Bill MacDonald to provide technical support to put the irrigation system in place at the Price Farm. This would prove to be a tree saver a few years later. American Electric Power generously provided a $10,000 power line to the irrigation system.

In 2000, the Executive Director noted that the status of finances was "on budget" and the Foundation was experiencing a "very fast growth curve". Membership jumped from 3,700 to 4,400 in the first five months. The Pennsylvania state chapter, alone, passed the 800-member mark! The Rhymes family signed a 10-year lease with TACF for the West Salem (WI) stand of self-generating American chestnut trees. It was signed the day before loggers were scheduled to arrive to start cutting trees. Through the influence of Jimmy Carter, the Turner Foundation gave $50,000. The board proposed spending $30,000 on external research grants for 2001 and $40,000 for 2002.

Honorary Board member and Nobel Peace Prize recipient, Dr. Norman Borlaug, wrote a letter to the Executive Director in response to the "science audit" copy he had been sent. Dr. Borlaug wrote:

> "*Dear Mr. Case:*
> *I have been fascinated by the progress that has been made in the incorporation of blight resistance into the American chestnut. All who have collaborated in this adventure are to be congratulated for the progress that has been achieved. I can fully appreciate the importance of this project, for I was a young forester working at the Northeastern Forest Experiment Station in the early 1930s when the last of the big chestnuts were being killed by the blight. I was too young and inexperienced at that time, to really understand its implications. But as I continued my studies, and especially when I went into plant pathology, I came to realize what a disaster I had envisioned in those early years. After shifting from my forestry career to genetics and plant pathology and breeding of wheat, where I worked in innumerable countries around the world, I have come to appreciate the*

great genetic variation in pathogens of our crop and forest trees. For that reason, I am especially fascinated by the work you are doing. If there is any desire, perhaps I can serve as an intermediate when you are trying to find the proper connections for testing, since I have been working in cereal production and disease problems in the People's Republic of China for more than 25 years. With best wishes for continued success on this very worthy program-the TACF Breeding Program for incorporating chestnut blight-resistance into the American Chestnut—I remain, Sincerely,
Norman E. Borlaug."

Significant science achievements included the first demonstration of highly blight resistant individuals in B_2-F_2 progeny and lack of segregation was found for blight resistance in F_3s, suggesting the F_2 plants were homozygous for blight resistance. The first B_3-F_2 nuts were produced.

Massachusetts, Kentucky, and The Carolinas all achieved full chapter status in 2000! Tennessee members were expressing interest in becoming a state chapter.

2001 began on a high financial note with Brad and Shelli Lodge-Stanback providing $125,000 for general operations. The Allegheny Foundation of Pittsburgh gave an early gift of $25,000 thanks to Mr. and Mrs. Richard Mellon Scaife. This gift was the result of member Dr. Hill Carter working with board member Bill Lord to get an appointment for TACF's Executive Director with the Scaifes. Good TACF team work.

Paul Sisco took a sabbatical as he looked at the challenge of having a home in Asheville while renting housing in Meadowview in order to work on the science projects at the research farms.

"Charlie Chestnut-A Tree On the Rebound" curriculum went up on the Internet as a free web-based education program. The program has tremendous potential to educate young people about the history and story of American chestnut. Penn State University Office of Intellectual Property signed TACF's germplasm agreement and the Pennsylvania state chapter established a planting on Penn State University land.

TACF's year 2001 was gripped in discussions about the germplasm agreement. Discussions required a lot of coordination and listening. It involved TACF staff, board, chapter leaders, and government agency personnel. There were many viewpoints and people didn't hesitate to express them. President Herb Darling and the Executive Director worked closely together to help resolve the disputes and attempt to hold the organization together.

Alabama began an initiative for a state chapter of TACF.

A small group of officers met with the Executive Director in Albany, NY, just two days after

September 11. It was to be a planning time connected to change of leadership, budget and fundraising. With airplanes grounded across the country, most of the group couldn't make it. Herb Darling, President of the New York Chapter, would be the incoming President of TACF. Herb drove all the way from Buffalo to attend the important planning meeting.

National Fish & Wildlife Foundation challenged TACF with a $100,000 grant, to be matched with $166,500. That was a real stretch, but we made it happen.

The National Park Service sent the chief of science and resource management and six other top scientists and officials to see TACF's work at the Meadowview research farms.

Nut harvests were excellent as the network of volunteers had continued to expand and there were many more orchards in place and the first B_2-F_3 nuts were produced as a major next science accomplishment.

2002 began and ended with more rapid expansion in the program area. Membership reached 5000 and held at that level. However, the year began in turmoil over the germplasm agreement. It was a carry-over from 2001 and staff, board and chapter leaders worked hard to negotiate sticking points that would not compromise the intent to protect the science. The resulting final document was moved by Phil Gruszka, President of the Pennsylvania Chapter, seconded by Don Willeke, TACF's Legal Counsel and Secretary, and when President of the Board of Directors-Herb Darling-put it to a vote there were 18 votes in favor, 0 opposed. That was truly a high point in the history of TACF. The entire "family" stayed together, chapter leaders and board members working together, ironing out disagreements and fine tuning specific points that, part way through the process, seemed endless. A scientist, Sara Fitzsimmons, was added to the staff through a funding formula with Penn State University, TACF and the Pennsylvania state chapter. The new position was titled Tree Breeding Program Coordinator and Orchard Manager.

TACF received a major international award from the Slow Food organization, headquartered in Italy. Fred Hebard and the Executive Director were honored at a special ceremony in Italy and TACF also received several thousand dollars. The award was for the Defense of Biodiversity. Brad Stanback and Shelli Lodge-Stanback continued to provide special funding and, due to their commitment to fund a "satellite" office in Asheville, North Carolina and the success of the program, a full time commitment was made in June with opening of a Southern Appalachian Regional Office. Dr. Paul Sisco, who had been stationed at the Meadowview Research Farms and then on sabbatical, was named Southern Appalachian Regional Science Coordinator. His focus was to assist the new chapters in the southeast with the regional adaptability program, working in collaboration with Dr. Hebard and to promote the overall goals of the strategic plan.

Forrest MacGregor, who had been working part time as Development Director out of the "satellite" office moved to Vermont to pursue personal interests there and TACF soon hired a full time Director of Development and Special Projects with a focus on the southeast. Executive

Director Case actually hired the new staff member in the parking lot during a conference on biodiversity. This is a true story and it was very clear that Phil Pritchard was the right person for the right job at the right time. Phil stated that he had "failed retirement" after successful years with The Nature Conservancy in Florida and was very intrigued with the mission of TACF. It was decided to have Phil focus on new large opportunities where maintaining the data base of membership, renewals, special campaigns and sustaining of existing foundation grants would remain at headquarters in Bennington. The plan was to provide Phil with a wide-open opportunity to gain new "territory" in funding of TACF programs and to combine science and development in the same location. It worked. Great achievements would follow with time. Brad and Shelli Lodge-Stanback had watched their financial support and trust in the work of TACF grow from a modest "satellite" office to a full-blown Southern Appalachian Regional Office.

TACF also purchased a new research farm early in 2002. Mary Belle Price was to later provide the funds to pay off the mortgage and the seed orchard became part of the Glenn C. Price Research Farm.

TACF also signed a formal agreement with Penn State University at official ceremonies at State College in June. This was the first very significant official partnership that helped secure part of TACF's future. Dr. Kim Steiner, Science Cabinet member and Penn State faculty member in forestry and Director of the Penn State Arboretum deserved much of the credit for guiding the agreement through the University network of administration.

Mary Belle Price and Marshal Case at the Glenn C. Price Farm

2002 also proved to be one of the two most challenging recent financial years as confidence in the economy was down and everyone was being careful with any extra donations. The budget had grown from $250,000 to a million dollars in just four short years. However, it had been steady growth and funds came from mostly well established sources and campaigns that could be counted on to produce effective results. The Year End Campaign exceeded $85,000. Ten full time staff, in three operations locations, continued to coordinate a large and growing network of state chapters and partner organizations while raising the necessary funds, still significantly from the membership.National Forest Foundation granted $94,000 and that was the beginning of a special partnership that was to help stabilize TACF operations in the southeast.

Honorary Board member, Jimmy Carter, was awarded the Nobel Peace Prize and joined TACF honorary board member and Nobel Peace Prize award winner, Dr. Norman Borlaug in that very special category.

A major science focus, beginning in 2002 through 2005, was determining inbreeding and effective population sizes for various breeding strategies to help planning for later stages of the breeding program.

USDA Forest Service stepped forward in 2003 with a grant of $60,000. There was a history that led up to the initial grant. Dr. Rob Doudrick, former TACF board member and Forest Service employee, had encouraged the Executive Director a few years back to take a careful look at potential with the Forest Service. Safiya Samman and Sharon Friedman, also Forest Service employees and members of TACF's Science Cabinet, worked diligently to get a meeting with Chief Dale Bosworth. Rex Mann, forest manager with Daniel Boone National Forest and TACF Kentucky State Chapter President also had the ear of top level people within the Forest Service and had been developing strong awareness of our science work and early success. Early in 2003, Chief Bosworth invited a small group from TACF to meet with him at his office in Washington, DC. President Herb Darling, Executive Director Marshal Case, Dr. Paul Sisco, and Phil Pritchard joined with Rex Mann and Safiya Samman for the special hour of discussion with the Chief. Deputy Chief Joel Holtrop, head of State and Private Forestry, was also in the meeting. The Chief was very attracted to the potential for American chestnut to help with forest health and, in particular, he was very impressed with the TACF network of volunteers organized into state chapters and the number of university and other partnerships. TACF fit nicely into two of his highest interest areas.

In July, Joel Holtrop took a small group from the Forest Health section of the Forest Service to tour the Meadowview research farms and to meet with staff. As usual, impressive tree growth, close up observations of the ongoing science, and a chance to talk to Dr. Fred Hebard and see farm hands Danny Honaker and George Sykes doing the work of six people, made for a great impression of what was possible on limited funds. There was a frank discussion of the real needs to move TACF science forward under a pending partnership with the Forest Service. We were looking for $300,000 of support and Joel was talking about $60,000. It was a good beginning and solid friendships were developing due to the tree and the mission.

Congressman Charles Taylor, representing the 11th District in western North Carolina, had inquired earlier about progress of TACF's work as he felt return of blight-resistant American chestnut to his congressional area could have significant long-term benefit to the economy and the work force. Dr. Rob Doudrick had worked in his office for a year and had built up good awareness of our work. Executive Director Case asked Phil Pritchard, based in the Asheville, North Carolina office, to contact Congressman Taylor and suggest that TACF was interested in assistance in obtaining some substantial funding through earmark funding of appropriations. First, Phil made a call to Joel Holtrop to alert him to TACF's intent, as any earmark would come from

the Forest Service budget. This helped form a strong bond due to the honesty of the approach.

As the saying goes, the rest was history. Congressman Taylor, in his position as Chairman of the House Subcommittee on Interior and Related Agencies was successful in gaining an appropriation of $250,000! President Bush signed the bill on November 10. The funds were designated for the Southern Appalachian Regional Office for use in working on chestnut science in the southeast. Those new funds were available in March 2004 and Congressman Taylor indicated that he wanted to help sustain that level of support, or higher, in future years.

The Recent Years: 2004 -2008

The continued growth and new commitments that went along with the appropriations funding, challenged staff to fine tune operations and establish integrated programs for 2004 while developing schedules for reports and foundation grant applications. Other foundation program support included $78,000 from National Fish & Wildlife Foundation and $42,000 from the National Forest Foundation. Brad and Shelli Lodge-Stanback increased their support for operations, with some focus on the Southern Appalachian Regional Office science programs, to $200,000! On the northern front, the Growald family of Shelburne Farms, Vermont, expressed a sincere interest in developing a long-term relationship with TACF to establish a northern seed orchard. That boosted the opportunity for that part of New England to begin to catch up with a regional adaptability program. The partnership would include financial assistance as well as a significant planting site with year-round oversight and maintenance.

Daphne Van Schaick, in her new position of Executive Assistant, experienced a significant buildup in responsibilities. She now coordinated the needs of staff, board, executive committee, state chapter leaders, and tracked all cash flow with the president, treasurer and accounting firm. Daphne made certain grant reports were turned in on time and assembled and submitted all new foundation grant applications, after careful review with designated staff.

Membership held steady at 5,000 and Maryland members, with the assistance of the Pennsylvania state chapter, went from provisional state chapter status to petitioning the board of directors at the annual meeting in State College, Pennsylvania. Maryland was accepted as the tenth state chapter of TACF!

President Herb Darling was voted into the position of Chairman of the Board of Directors and Marshal Case was named President & CEO.

TACF experienced another outstanding year of accomplishments and new initiatives in 2004. The staff plan was to concentrate on the many new programs and projects that had been building up but a couple of new things happened that required added energy and coordination.

The MOU Signing with the United States Forest Service

USDA Forest Service came to the forefront early in October with the official signing of a long-term agreement with TACF. The Memorandum of Understanding established a framework for cooperative research and management activities necessary to maintain and enhance the eastern forest ecosystems by reintroduction of blight resistant seedlings of *Castanea dentata*, or American chestnut, on National Forest System lands for the best interests of the people of the United States. The MOU set forth the intent to coordinate their respective efforts and work cooperatively to restore American chestnut by studying and evaluating the planting of American chestnut seedlings on National Forest System lands. Forest Service attorneys and TACF's Legal Counsel, Don Willeke, approved the final language. Staff on both sides worked diligently to usher the document through the process. Safiya Samman went beyond the call of duty and Phil Pritchard made certain that all communication was coordinated on the part of TACF. The agreement was signed by Forest Service Chief Dale Bosworth and TACF President & CEO Marshal Case in Traverse City, Michigan, at a national gathering of Forest Service administrators, managers and upper level scientists. It was a most historic event.

Peabody Energy became the first major corporate collaborator by signing onto the mission. TACF and Peabody Energy worked up a five-year commitment to test the most advanced chestnut material on mined lands in Kentucky, in cooperation with their subsidiary-Peabody Coal. This was a business arrangement with TACF providing a specific number of nuts beginning in 2004, costing out at $25,000 per year. The total commitment was for $100,000.
TACF was once again in the House Interior Subcommittee Appropriations bill with $250,000 earmarked for the Southern Appalachian Regional Office science programs. Members in key states, where subcommittee members resided, made phone calls and personal visits to improve chances of getting funding approved.

Dr. Fred Hebard produced a Ten Year Science Plan for later stages of the breeding program as one obligation of the Forest Service MOU. There will be three phases in a 30- year plan. At the same time, the strategic plan was updated with participation by all staff. The Carter Center entered into an agreement with TACF to establish a chestnut planting with interpretive signs for the visiting public. There was discussion of a formal ceremony and dedication to happen at a future date.

Membership edged up just over 5,000 and Georgians pulled together a "fast track" chapter, from start to finish in just eight months! At the same meeting, Ohioans received provisional state chapter status.

A major science achievement was the first screening for blight resistance of B_3-F_2 progeny. Some plants with fairly high levels of blight resistance were recovered.

2005 started out at a rapid pace with a number of major planned and unexpected events unfolding to challenge staff and TACF's growing network of state chapters, partners, and collaborators.

Daphne Van Schaick had orchestrated an exceptional Year End Campaign that resulted in $110,000 being donated by February. Brad and Shelli Lodge-Stanback contributed $250,000 by mid-year, USDA Forest Service appropriations were secured for $250,000, National Forest Foundation awarded $65,000 and the Sudbury Foundation renewed its support for $25,000. Norcross Wildlife Foundation provided $5000 to assist with the purchase of a new tractor for the research farm operations and a final payment of $97,235 of the $190,000 bequest was received from the estate of member Dr. Frances Holmes of Virginia.

Membership began to grow above the 5,000 mark, reaching 5,300 by mid-year. Michael Dobos joined the staff as Membership Director and Wendy West Callaert supported the membership effort with data input and assisting Daphne Van Schaick with new growth challenging the system. Wendy also took on organization of the annual meeting.

Jeanne Coleman joined the Bennington staff as Director of Publications and Web Site and the new position of Director of Communications was added to the Southeast Appalachian Regional Office. Meghan Jordan, with years of experience in communications, was the successful candidate and joined the Asheville staff in August.

Our state chapter network of operations continued to expand and, with it, more meetings and orchards and oversight. Dr. Paul Sisco focuses on the southeast and Sara Fitzsimmons, while focused on Pennsylvania, has been expanding her outreach support to northern chapters (as part of the three-way funding and program partnership with the Pennsylvania Chapter and Penn State University) Dr. Fred Hebard continued to visit planting sites, offer advice, provide pollen, and coordinate nut availability with Phil Pritchard, headquarters staff, Paul, and Sara.

Alabamians were closing in on completing the necessary paperwork for full chapter status, under the leadership of David Morris, newly elected president, who pulled together an outstanding board of directors. Ohio was also close to achieving full chapter status, having surpassed the membership goal by a wide margin and engaging in some important science activities.

TACF was invited to be part of an Appalachian Regional Reforestation Initiative on coal mined lands and we signed on and participated in the official signing at the University of Kentucky Arboretum. Kentucky Governor Ernie Fletcher was in attendance as was Dr. Lee Todd, President of the University of Kentucky. We saw much potential in this area to help find ways to heal the landscape by growing American chestnut.

Early spring started a flurry of events and activities that tested the breadth and strength of TACF's staff. Staff changes had happened and, fortunately, new and veteran staff pulled together quickly

President Bush, Secretary of Agriculture Mike Johanns, and Marshal Case walk across the White House lawn.

to take on the many challenges and opportunities.

A White House chestnut planting had been hinted at for more than a year but it wasn't until the week before Arbor Day that the possibility began to look very serious. Meadowview research farms' staff prepared to deliver a tree to Washington, DC on a 48-hour notice. Bennington staff, working with Asheville staff, prepared for all that might be necessary to participate. The event was still not firm until late Tuesday afternoon before Arbor Day that Friday. Dr. Fred Hebard pulled the tree (actually two trees) and farm hand Danny Honaker loaded them on a truck and took off for Washington, DC to have the pending White House tree at hand. Danny delivered the trees by Tuesday and President Case received the "go ahead" call from White House staff just before 5 P.M. on Tuesday.

Phil Pritchard and Daphne Van Schaick coordinated schedules to travel as no final details were available and we all wanted to be ready for anything expected of us. The three of us arrived the night before Arbor Day and we received word that the planting was to be kept to three people: President Bush, Secretary of Agriculture Mike Johanns, and TACF President Case. As many of you know, the event happened and TACF received widespread press. Thanks to many people for helping to make the rare opportunity happen.

TACF was a partner with Smithsonian Folklife Festival and more than 100,000 visitors viewed the interactive living forest exhibit, in view of the Washington Monument. TACF had provided American chestnut trees for the living forest interactive exhibit and signage highlighted our work at key entrance points to the exhibit. In the same four-day period, the Forest Service was celebrating the kickoff to its 100th Anniversary, and TACF was one of four national organizations chosen to participate in the national press conference and kickoff "Friends of the Forest" campaign.

Phil Pritchard and Paul Sisco were involved in a planting of two American chestnuts, provided by Brad Stanback, at the Cradle of Forestry in North Carolina. This was a highlight of the International Conference of Forestry and a major event that provided excellent publicity for TACF and built on the expanding network of influential people who have been attracted to the mission.

A White House Conference on Cooperative Conservation was held in St. Louis and TACF's President Case was invited to attend and participate. President Bush initiated the conference and TACF was one of twelve organizations invited to be represented at a private luncheon with Secretary of Interior Gale Norton during the conference. It was an opportunity to advise Secretary

Norton on how to approach networking in cooperative conservation. Among the speakers were four secretaries, including Donald Rumsfeld and Mike Johanns. It was an opportunity to meet many individuals who had a deep commitment to conservation and networking for success.

A major success for the year was selecting a second scientist to work at the Meadowview Research Farms. Four finalists were brought to Meadowview to see the farms and plantings. It was an excellent field of talented scientists. The search committee included Dr. Ray Hornback, Dr. Al Ellingboe, Dr. Fred Hebard, President Case, and Dr. Bill MacDonald. The successful candidate was Dr. Bob Paris. This was a very significant step for TACF and Fred Hebard has expressed his enthusiasm for the new opportunities as more emphasis was placed on the pathogen and searching for more genes for resistance to the blight.

President Carter and TACF Staff, Board Members, and Friends

In late September, thirteen TACF officers, staff, and special guests journeyed to Atlanta to participate in a very special ceremony at The Carter Center. It was an historic moment in the history of TACF. Honorary TACF director, former President Jimmy Carter, had invited us to have a private meeting followed by a public event where interpretive signs were unveiled in front of an American chestnut planting. The group included: Phil and Liz Pritchard, Treasurer Dr. Bill MacDonald, Science Director Dr. Al Ellingboe, Vice Chair of Development Dr. Ray Hornback, Finance Committee Chairman Dick Will, Director of Communications Meghan Jordan, Legal Counsel and Secretary Don Willeke, Dr. Fred Hebard, President of the Georgia state chapter Dr. Mark Stallings, President Case, and two special guests, author Chris Bolgiano who was one of the editors of our anthology, and author John Egerton who is a civil rights authority and contributed an essay to TACF's anthology.

It is safe to say, that the meeting was a lifetime event of special meaning for all who were in attendance. President Carter was warm and welcoming, spent quality time with the group, talked about his recent humanitarian trip to Africa, and engaged all who participated in the public event at the chestnut planting site. He shared stories of his boyhood in rural Georgia connected to American chestnut and talked about his involvement with the mission of TACF. He also shared his input with the federal appropriations process and how he had contacted his good friend Senator Robert Byrd of West Virginia, encouraging him to gain support for American chestnut research. It turned out TACF was approved for a higher level of $350,000 for 2006. The most interesting part of the formula is that Democrat Senator Robert Byrd worked with Republican Mitch McConnell of Kentucky to draft the language that was written into the Senate Appropriations bill.

The first B_3-F_3 nuts were produced at the Glenn C. Price Research Farms in 2005

January of 2006 started out strong with an anonymous gift of $185,000! And, the Stanbacks gave $250,000 for operations early in the year.

Momentum continued with the growing state chapter network, with new initiatives in two geographic areas-Virginia and Vermont/New Hampshire. The goal was to establish chapter presence with a base in northern Virginia to complement the science on our farms going on over the years in southwest Virginia. An eager group of members aspired to achieve full chapter status in Virginia during the 2006 calendar year. Vermont/New Hampshire members were targeting the annual meeting in October of 2007 to be held in Burlington, Vermont, the first ever annual meeting organized in Vermont.

Dr. Bill MacDonald stepped down as Treasurer of the Board, with many years of service and financial leadership. Carol Kirkland, member from Vermont, was voted in as the new Treasurer. Her proximity to the national headquarters office was considered to be a real plus for staff as the operations continue to grow and finances became more complex.

Essie Burnworth of Maryland was voted in as Secretary, as Don Willeke—one of the founding directors from Minnesota—stepped down after many years of service in that position. Don continued as pro bono Legal Counsel and member of the executive committee.
Herb Darling of New York completed a fourth term as Chairman of the Board and Richard Will of Texas became the new Chairman. Herb helped the Foundation through some of its most challenging years and remained President of the New York Chapter.

On the program side in 2006, many new initiatives added to the strength of the Foundation. Pew Charitable Trusts reached out to the Foundation and requested a three year plan that could help advance the science program. This resulted in a $345,000 commitment-the largest foundation grant to date-and resulted in the hiring of Leila Pinchot as New England Regional Science Coordinator with office and laboratory space at Yale School of Forestry. New England state chapters were gaining ground fast and it was essential to have an extension field staff scientist to assist in the tree orchard program. William White was hired as the much needed technician at our Meadowview farms, also under the Pew Charitable Trusts grant. His focus was to be pollen quality to provide the best material possible to support the many volunteers who operate tree orchards as part of the regional adaptability focus.

On the financial side, several business initiatives resulted in a partnership with Red Wolf Run of Asheville, North Carolina, and support from Northeast Utilities based in Connecticut (a paper to electronic switch by shareholders with the incentive being financial support for the Foundation's tree orchard program in Connecticut/New England)

The second science audit was conducted by independent scientists at Meadowview; a formal

agreement was put in place with the National Wild Turkey Federation; Virginia members were successful in gaining full state chapter status; there was a dedication with a tree planting at Mount Vernon-with a partnership with the Association of Consulting Foresters of America; and there was a closing on a new farm property.

2006 concluded on a very high note. The National Science Foundation awarded a $2 million multiple year grant to advance research on the family of trees which includes American chestnut. With a consortium of universities—North Carolina State University being the lead—work began on the genome of American chestnut with one hope being to discover molecular markers that could help dramatically strengthen the overall science approach for resistance to the fungus. In Novemebr of 2006, Michele Morgan-Krall joined TACF's Bennington Staff and took over as the Membership Director, Merchandise Director, and Website handler. Since her hiring, Michele has hit her stride and has become one of TACF's most valuable employees.

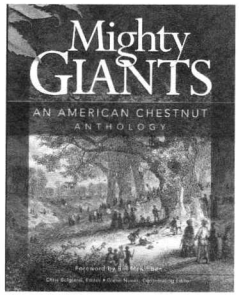
2007 started out with a 4 star award by the non-profit oversight organization, Charity Navigator—this being the highest level of achievement in the Foundation's peer group. TACF's program percentage was impressive with more than 83% of every dollar spent on program. On the heels of this recognition, 1% For the Planet accepted the Foundation as an accredited organization positioning it for major business support.

From left to right: *Secretary Kempthorne, Marshal T. Case, President of The American Chestnut Foundation; Kraig Naasz, President and CEO of the National Mining Association and Brent Wahlquist, Appalachian Region Director for Interior's Office of Surface Mining Reclamation and Enforcement, at a July 26, 2007 ceremony marking the 30th anniversary of the Surface Mining Control and Reclamation Act, planted a blight-resistant American chestnut tree outside the headquarters of the Office of Surface Mining Reclamation and Enforcement in the nation's capital.*

Ceres Foundation provided $100,000 for regional operations, the Stanbacks provided $350,000 which included special support for the research farms as well as operations, and the Board approved a $2.5 million 25th Anniversary Campaign goal.

In July, Secretary of Interior Dirk Kempthorne planted trees in Washington, D.C with President Case as a beginning of high profile cooperative efforts that would lead to a major program later. The planting on the DOI headquarters property attracted national press and attention. Secretary Kempthorne referred to American chestnut as "the tree of hope". Negotiations began for purchase of the Wagner Farm-the first farm under the science program, under lease since 1989, and The Foundation experienced its 10th year operating in the black as it approached its 25th Anniversary Year.

In an all out effort, the decision was made to publish an anthology in celebration of the 25th Anniversary. Yale Press, Cornell University Press, and Penn State Press had all either turned down the offer to publish or didn't understand the significance of such a publication. Within days of the



For your copy, go to www.acf.org

decision to self-publish, "Images from the Past" was discovered through a local Rotary Club meeting in Bennington. President Case was attending and asked the question about publishing an anthology. Within days, a contract was signed and-true to the way American chestnut makes things happen-the new partners understood the urgency of getting the book published in time for the October annual meeting in Vermont. It was a tremendous undertaking by the Bennington staff—an add-on to the full schedule of projects already in the works. The anthology was printed in Canada, first copies delivered in time for the annual meeting, and Governor Jim Douglas was present to receive a personal copy and address the membership about the wonderful work to restore American chestnut to eastern forests.

Vermont/New Hampshire Chapter came together in time to receive full chapter status at the annual meeting. This made the 15th state chapter and 11th new one since 1999.

2008 began with a call to Marshal Case from President Carter. The Turner Foundation, through Ted Turner and his close personal relationship with President Carter, expressed interest in requesting a proposal for possible funding. The stage was set to take next steps and a preliminary outline of needs was sent for consideration.

The Stanback family challenged the Foundation with a $1 million dollar matching grant to help secure the future of the science program-the largest gift ever received by the Foundation. And, they contributed $250,000 for operations at the beginning of the year.

Chairman Dick Will initiated a Legacy Tree Program that, half way through the year, attracted close to $200,000 from donors as part of the 25th Anniversary celebration.

Early in the spring, a major Arbor Day planting, including hundreds of local high school students, happened in Virginia in cooperation with DOI/Office of Surface Mining. Brent Wahlquist, Director of OSM, was a key speaker as was Marshal Case. It was the beginning of a collaboration to include restoration of coal surface mined lands with plantings of American chestnut. Later in the year, the Foundation was awarded a $200,000 grant from OSM that included participation by five universities.

Mighty Giants: An American Chestnut Anthology was entered into three national book competitions and won two awards, including a silver medal from National Book Publishers. Sales continued to be brisk, with over half of the first printing sold. Louis Bedor III, hired as Publications Director just as the anthology was at critical stages of preparation, secured more than 200 permissions for art and photographs in a matter of months. This extra effort had much to do with the quality of the publication and the resulting silver medal.

Leila Pinchot went on to pursue a PhD at University of Tennessee (working with the Foundation's chestnut material) and Kendra Gurney was hired as the new New England Regional Science

Coordinator. The regional office was relocated from Yale School of Forestry to University of Vermont School of Forestry, in cooperation with the research arm of USDA Forest Service.

Bob Paris, research geneticist at Meadowview farms, relocated to West Virginia to focus on the growing program with DOI/Office of Surface Mining. Bob was able to acquire office space at Mountain State University where an extension office of West Virginia University is also located. This followed the pattern set years ago with the Foundation gaining mostly free office and laboratory space connected to each field operation set up at significant cost savings.
In March, TACF membership crossed the 6,000 mark for the first time in the Foundation's history-and-it was accomplished without the aid of a direct mail campaign in over a year. This illustrated the commitment of renewing members and the role internet and wide new publicity was helping to attract new members to the vision.

Dennis Kimball was hired as staff accountant as the Foundation's enormous growth led to new accounting challenges and accompanying audits in association with numerous grants that had to be tracked and accounted for in a timely manner. This also allowed for increased efficiency as grant accounting was integrated and the multiple accounting locations were streamlined into Bennington, Vermont, and, it eliminated the need for an outside accounting firm.

The Board of Directors voted to relocate national headquarters to Asheville, North Carolina to coincide with the hiring of the next President and CEO of the Foundation and to place administrative operations within close proximity to farm operations in Meadowview, Virginia.

As fall began, TACF headed across the Pacific, sending a Science team to China, which included Sara Fitzsimmons, Dr. Fred Paillet, Dr. Fred Hebard, Dr. Kim Steiner and his wife, Susie, and Dr. Songlin Fei.

Pictured Right:China-TACF. L-R in the picture outside of headquarters/museum for DaLaoLing National Forest Park: Dr. Zehao Shen (Associate Professor of Ecology at Beijing University), Ms. Xu Yan (our liason with the Chinese Ministry of Agriculture), Dr. Kim Steiner, Mrs. Susie Steiner, Dr. Fred Paillet, Dr. Fred Hebard, Dr. Songlin Fei, Sara Fitzsimmons, Dr. He Wei (Professor of Forest Pathology at Beijing Forestry University), Mr. Xu Shen-Dong (manager of Dalaoling NFP), and Mr. Han Qingyu (vice-manager of Dalaoling NFP)

Pictured Below Left: The group enters data after a long day of climbing around and measuring trees.

The objectives of this trip were: 1) to seek collaboration in planting and testing of TACF's backcrossed trees in China; 2) to observe the blight fungus in its native environment; and 3) to document the basic ecology of wild Chinese chestnut populations. The trip was funded through the USDA's Foreign Agricultural Service's Scientific Cooperation Exchange Program which they have formed with the Ministry of

Agriculture in China.

As the Foundation approached the half way mark of the 25th Anniversary Year, five major initiatives were on track for completion by end of 2008: purchase of the Wagner Farm, groundbreaking in Virginia for the offices/laboratory/volunteer area of a "green" building in memory of Glenn C. Price, signing of an official Memorandum of Understanding with Department of Interior-Office of Surface Mining, securing headquarters space in Asheville, and producing a special for public television as part of the "Giving Back" series hosted by Hugh Downs.

Thanks to all of you and the many volunteers and supporters who are not with us this weekend. As we look to the future, there are major science challenges ahead. Our great strength is the network of members, many active in TACF state chapters; our diverse board of directors; talented members of both the Science Cabinet and Development Cabinet; university partnerships; USDA Forest Service; Department of Interior-Office of Surface Mining; National Science Foundation; and active foundations like the National Forest Foundation and potential new support from Turner Foundation. The still major untapped area of support is from the corporate and business world. Peabody Energy is a serious partner with both science and funding and has just committed an additional $20,000 for a sixth year. American Electric Power has provided some solid support beginning with the installation of the power line to our irrigation system at the Meadowview research farms and annual contributions for the science work. But there is enormous potential for our chestnut work when it comes to this sector. We need to seek out and cultivate those who understand the great value of the restoration of American chestnut to the eastern forests. It is a story and mission that captures those who learn about it. Within the past month, Banks Hardwood Company has made a major commitment for our future that is already providing ongoing national exposure in that important business arena.

We have barely tapped the potential for what is possible. We are making history as we make progress. This is a mission without equal in the conservation arena. We have been given the rare opportunity to restore a keystone species that is on the brink of extinction.

TACF's 2008 Chairman of the Board, Richard Will, standing next to a Legacy Tree--one of 200 of the most blight-resistant trees TACF has developed since its inception.

For more information about Legacy Trees go to www.acf.org or contact the TACF administrative office.

Submissions to
The Journal of The American Chestnut Foundation

Authors and researchers are invited to submit manuscripts of historic or scientific interest relating to the American chestnut. All submissions must conform to the following guidelines and all submissions are reviewed by TACF editorial board, and are subject to editing and published at the discretion of the Publications Director.

Manuscripts should be submitted electronically in Microsoft Word, Microsoft Works, Adobe PDF, or a .txt document format. Submissions are asked to be to 1,500 words of text plus tables, figures, and must include refrences (if more room is needed, please contact the Publications Director.) **Please submit each table and figure as a seperate file**. Photographs should be submitted as jpg filesand should be at least 300 dpi (dots-per-inch).

The Title Page should include the title of the article, the author's name(s), and the affiliation(s) with complete mailing addresses, phone/fax numbers, and e-mail addresses.
Please set-up the manuscript using the American Psychological Association (APA) format.

Writing about The American Chestnut Foundation

The American Chestnut Foundation: All the first letters are capitalized, including "The," to conform with our legal name. Always use the acronym, TACF; the acronym, "ACF" is trademarked by The Association of Consulting Foresters.

American chestnut: The "a" is capitalized, the "c" of the second word is not.
Blight-resistant: is hyphenated, as in "blight-resistant chestnut" or "the tree will be highly blight-resistant".

Blight resistance: is not hyphenated, as in "The tree will have sufficient blight resistance."

Bur: is preferred to "burr"

Backcross: single word

Backcross breeding: The process used by TACF. Selected offspring of the first cross between Chinese and American chestnut are crossed with, or 'back to', American chestnut only in subsequent generations. The term 'Cross breeding' should be avoided because it implies multi-generation crosses between species, varities, or breeds. In cross breeding, selected offspring of the first cross may again be crossed with other species, varites, or breeds in subsequent generations. The term 'breeding' may be used, as it refers to more generally to crossing within species, varities, or breeds.

Escaped infection: preferred usage for uninfected wild-growth trees rather than 'survived'.

Scientific Names: please visit www.acf.org/TACFWritingGuide.pdf for a list of scientific names and their spellings.