THE AMERICAN CHESTNUT FOUNDATION

CONTENTS

NOTES

MEMORIES

SCIENCE AND NATURAL HISTORY

CASTANEA GUIDE

notes

notes

FROM THE EDITOR

As we enter the fall, members of The American Chestnut Foundation begin to harvest chestnuts. We rejoice at this fact, yet the number of individuals involved in this process is much fewer than we all would hope, because we know chestnuts, especially American chestnuts, are not near as abundant as they once were.

Only by looking at the past can we truly understand how important the American chestnut was. It was important in many ways, not just because of the tree's stature, or its importance to wildlife, or the fact that it was an important part of our once diverse ecological heritage, but also because it was important to people's ways of life. In 1980 a group of Foxfire students interviewed several individuals who remembered the American chestnut. Those interviews are excerpted in this issue of *The Journal*. After the blight, rural economies where devastated. All at once, families lost an easily obtained cash, food and fodder crop, and a source of high quality building and maintenance materials for farms.

In Tennessee and North Carolina, shortly after this devastation, President Roosevelt decided that he wanted to build a Parkway - the Blue Ridge Parkway. An agronomist for the Parkway, Bill Hooper, showed many farmers how to improve the production of their land by using conservation strategies. Perhaps his work lessened the economic blow caused by the loss of the American chestnut. William Lord who worked with Bill Hooper on the Parkway outlines Mr. Hooper's work and dedication. The article is based on a brief essay in Dr. Lord's two-volume set, *The Blue Ridge Parkway Guide*. Dr. Lord recently donated the royalties and copyright for the guides to The American Chestnut Foundation. Thank you.

In the article presented by Dr. Charles C. Rhodes and Clare Park, the abundance of American chestnut in Kentucky prior to the blight is established from various historical sources. Their research will help to delimit priority regions for reintroduction of American chestnut.

In Dr. Fred Hebard's yearly update of TACF research, he once again notes progress, thereby affirming that the reintroduction of American chestnuts will begin in the not too distant future. He, however, admits that there may be unforeseen roadblocks in that process and that there are more avenues to pursue to ensure the best preventive measures. These measures focus on introducing more American and Asian parental lines into our breeding efforts.

Patricia Goome, and Drs. Terry Tattar and Mark Mount present their research on *Bacillus megaterium,* a potential biocontrol agent Dound in soils, which can limit the growth of chestnut blight *(Cryphonectria parasitica).* This research is similar to European research. Indeed, the Italians have been marketing a commercial grafting wax formulated with biological additives since 1990 . Yet, finding an antagonistic soil microorganism appropriate to American environments has been illusive thus far, and research such as that presented in this issue of *The Journal* needs to be continued. A list of European research articles on this topic is 3-vailable from TACF.

Last is an account of my recent visit to the High Ledges Wildlife Sanctuary with Dr. Ellsworth Barnard. (Excerpts from his book, 112 *a Wild Place,* were printed in a previous edition of *The Journal.)* It was truly fascinating finding American chestnuts in the wild and learning about Dr. Barnard's lifetime relationship with the land. Perhaps this type of thoughtful stewardship of our natural environment is something we all reach for by being members of The American Chestnut Foundation.

As a final note, those among us who remember the American chestnut prior to the blight or who witnessed its dramatic and swift decline are becoming fewer each day. In this and previous issues of *The Jurnal,* TACF has reprinted several oral histories. Membership Director Gerrie Rousseau is currently collecting more. Please contact her at 802-447 -0110 or chestnut@acf.org, if you or someone you know remembers when ...

MEADOWVIEW NOTES 200-2001

By Fredrick V. Hebard, TACF Staff Pathologist

In the year 2000, Meadowview again was blessed with abundant rainfall from May until mid-September, when drought set in and persisted until March 2001; it also was quite dry in April and early May, 2001. These conditions are very similar to what we experienced in 1999-2000, although there was more rain during the summer of 2000 than 1999.

The irrigation system at the Glenn C. Price Research Farm was fully operational by late July, 2000, and we used it extensively until October. We had very good growth of new trees, with many exceeding 3 feet in height at the end of the first growing season. At the end of the first growing season, about 850 third backcross trees descended from the 'Clapper' tree measured 22.5±6.3 inches in height, while about 750 third backcross trees descended from the 'Graves' tree measured 21.4±5.5 inches in height. It is difficult to determine whether this good growth was due solely to the abundant rainfall, with no additional contribution from the irrigation, but we most certainly were not interested in seeing what would happen if we didn't irrigate some trees! (Research in France has already demonstrated clearly that irrigation improves growth of chestnut trees.) We expect the greatest benefit of irrigation will be more uniform growth of trees, leading to more precise determinations of critical traits, such as blight resistance.

Our current holdings are in Table 1 and changes from 2000 to 2001 are indicated in Table 2. Despite ripping out almost 1,000 trees with inadequate levels of blight resistance, we now have close to 16,000 trees covering more than 60 acres .

Table 3 presents the current holdings of 'Graves' and 'Clapper' third backcrosses in the various state chapters. Taking the chapters and Meadowview together, TACF now has more than 26,326 trees.

2000 HARVEST

The highlight of the 2000 harvest (Table 5) was our first crop of B3-F2 and B4 nuts! We hope the B3-F2 nuts include some highly blight-resistant individuals that will produce nuts suitable for reforestation in a few years. In 2001 we expect to produce many more B3-F2 nuts. The B4 nuts make this particular breeding line a bit more American and a bit less related to their B3 cousins. *

In 2000, we had considerable pollen contamination due to late burs set in bags after the bags had worn out. Also, the yield was down, less than one nut per pollination bag. The reasons for the decrease in yield are unclear. The late-set burs may have been more prevalent because of the abundant rains in the summer of2000. (They occurred at our Wagner Research Farm, which currently is not irrigated.) To help reduce pollen contamination from late-set burs in the future, we will no longer leave a terminal vegetative bud above the last female flower inside pollination bags. Additionally, we plan to remove developing buds at the time of pollination. The late-set burs form on the shoot developing from those buds.

The list of volunteers who helped with bagging and pollination in 2000 is long and will be published in the Bark. Thank you—this wouldn't get done without your help. If you would be interested in helping pollinate next year, plan on any time in June after the 10th. (Call 540-944-4631 around June 1). If you would be interested in the Elder Hostel program, call 617-426-8055 or write 75 Federal St., Boston MA 02110.

ADDITIONAL SOURCES OF BLIGHT RESISTANCE

The long-term goal of The American Chestnut Foundation is to give the American chestnut tree an opportunity to begin coevolving with the chestnut blight fungus. The Foundation was started to see the breeding program through the long time period required to accomplish our goal, a process that might take 100 years or so. But we can't plan on the Foundation being around for several thousand years, the time it might require for this host-pathogen system to achieve some degree of equilibrium. We can't plan on guiding the system to the same equilibrium that has been achieved in about 50 years of breeding for resistance £O black stem rust of wheat, where the current state of equilibrium has persisted now in North America for an additional 50 years.

Before equilibrium was established for black stem rust of wheat, the stem rust fungus on occasion evolved means of overcoming the genes for rust resistance that had been bred into wheat varieties. We don't know whether, similarly, the chestnut blight fungus will evolve means of overcoming the genes for blight resistance that we are breeding into American chestnut. In fact, we currently have no evidence that the chestnut blight fungus will overcome our resistance. The blight fungus differs quite a bit from the stem rust fungus, so the lessons from the stem rust fungus, and similar fungi, may not apply. However, we also have no evidence that the chestnut blight fungus will *not* evolve means of overcoming our resistance; it could happen, and we need to take all the steps we can to avoid it.

One step we have taken from the initiation of breeding at Meadowview has been to use more than one source of blight resistance. We have advanced the 'Clapper,' 'Mahogany' ('Graves') and 'Nanking' sources of resistance into about 30 lines each of American chestnut. (Our target was 20, but the small number of crosses we could achieve per American chestnut in Virginia had the net effect of increasing the number of lines.) Since 1995, we have been expanding the breeding to other states via our network of state chapters. Most of their breeding to this point has concentrated on 'Clapper' and 'Mahogany,' which are our two sources of resistance at the most advanced stage of back crossing. Since we now have backcrossing beginning or underway in Maine, Massachusetts, Pennsylvania, Kentucky, Tennessee and the Carolinas, we could increase considerably the number of sources of blight resistance being used in the overall program if each state were to advance a different Chinese or Japanese chestnut tree as their third source of blight resistance. But this is easier said than done!

HOW CHAPTERS CAN ADD SOURCES OF BLIGHT RESISTANCE

The main difficulty in adding a third source of resistance is that carrying 20 lines of American chestnut backcrosses requires about 10 acres of land at 100 trees per line, using our current guidelines. Classically, that much land is needed for each generation of crosses. A lot of effort is required to tend that many backcross trees, as our Pennsylvania Chapter knows quite well. Bob Leffel of the Pennsylvania Chapter has proposed using male sterility to decrease the amount of effort required to generate the needed number of crosses. But making the crosses using controlled pollination, in my experience, is not anywhere as difficult as growing the trees.

One way to reduce the number of trees would be to grow only one recurrent parent line through the first two generations, F1 and B1, and then grow 20 lines during the last two backcrossing generations. That is exactly what we have done thus far with 'Clapper' and 'Graves.' Additionally, the B2 generation could be reduced greatly in size if a B1 - F2 that was homozygous for blight resistance were used instead of a straight B1 Then about 5 to 10 B2s could be grown per line instead of 100. The B1-F2 trees could be bred at Meadowview or bred by the Chapters.

A Quick Guide to Chestnut Breeding Terminology

American x Chinese	=	F_1 "F-one"
$F_1 \times F_1$	=	F_2 "F-two"
$F_2 \times F_2$	=	F_3 "F-three"
F_1 x American	=	B_1 "1st backcross"
B_1 x American	=	B_2 "2nd backcross"
B_2 x American	=	B_3 "3rd backcross"
B3 x American	=	B_4 "4th backcross"
$B_1 \times B_1$	=	B_1-F_2 "1st backcross F-two"
B_1-$F_2 \times B_1$-F_2	=	B_1-F_3 "1st backcross F-three"
$B_2 \times B_2$	=	B_2-F_2 "2nd backcross F-two"
B_2-$F_2 \times B_2$-F_2	=	B_2-F_3 "2nd backcross F-three"
$B_3 \times B_3$	=	B_3-F_2 "3rd backcross F-two"
B_3-$F_2 \times B_3$-F_2	=	B_3-F_3 "3rd backcross F-three"

CHOICE OF CHINESE PARENT

One would not want to use just any old Chinese (or Japanese) chestnut tree to undertake such a long and tedious project as described on previous page. There is a fair amount of variability for blight resistance in different Chinese chestnut trees; some have better blight resistance than others. For instance, blight resistance classes for first backcross families derived from 'Nanking' and 'Meiling' are shown in Table 4. The 'Nanking' families had a few individuals with better resistance than any individuals in the 'Meiling' families and fewer individuals with poor resistance. Experiments in previous years indicated that pure 'Nanking' had better resistance than pure 'Meiling'. Likewise, in Table 4, the 'Mahogany' Chinese chestnut trees had better resistance than the seedling trees.

At this point, we are not yet certain that one can rely solely on the measured blight resistance of a Chinese chestnut tree to assess its potential to yield highly blight resistant progeny. But the above data suggest this is so, as far as 'Nanking' and 'Meiling' are concerned. Another way to assess the breeding value of a Chinese chestnut tree would be to cross it once or twice with American chestnut trees and measure their blight resistance. To make large numbers of such crosses, the male sterility method proposed by Bob Leffel might be useful. But remember that it's much harder to grow the trees than to make the crosses, no matter how they are done!

Evaluating additional Chinese chestnut trees as candidate sources of blight resistance has been a continuous undertaking at Meadowview, but the question also arises, are the genes in 'Mahogany' Chinese chestnut trees the same as those in 'Nanking?' If they are, then we are wasting our time (to some extent) using these two trees as separate sources of blight resistance, especially if there are other trees out there with good resistance coming from different genes.

If blight resistance genes were located at different regions in the chestnut genome in different trees, then resistance would map to different areas of the genome. Additionally, if trees with different locations of genes for blight resistance were mated with each other, one would expect segregation for blight resistance after one or two generations of crossing. We initiated such crosses a few years ago, but will not begin testing the progeny for blight resistance until next year.

We also have genetically mapped crosses from the 'Clapper', 'Mahogany' ('Graves') and 'Nanking' sources of blight resistance. Unfortunately, technical problems resulting in imprecise measurement of blight resistance for the 'Clapper' and 'Nanking' crosses made it impossible to conclude with certainty that the genes for blight resistance in those three trees mapped to different locations in the genome. This has been a disappointment, but we're still plugging away at the problem.

An additional dimension for examining blight resistance in Chinese chestnut is to breed the blight fungus as well as the tree. Then one might be able to make some fairly strong inferences about the blight resistance genes of a tree by inoculating it with various strains of the blight fungus and determining canker size. Up to this time, we have not pursued crosses within the blight fungus at Meadowview, primarily because of lack of time and money. But we are starting to examine canker severity on Chinese chestnut trees in the Meadowview region as a first step to assessing the variability of virulence in the fungus.

LARGE SURVIVING AMERICAN CHESTNUT TREES

The American chestnut tree itself can be a source of blight resistance. This was first documented in 1983 in some large, surviving American chestnut trees. "Large" is defined as trees in excess of 38 centimeters « 15 inches) in diameter (that's almost 50 inches in circumference).”Surviving" means they have had blight for more than 1 0 years-in some cases, for more than 70 years.

Last year, Joe James of our Carolinas Chapter found several large, surviving American chestnut trees on Wayah Bald in North Carolina. Dr. Bill Carey, who is a plant pathologist at Auburn University, studied large, surviving American chestnut trees in North Carolinas in the 1980s as part of his doctoral research at Duke University. Bill was kind enough to pass his field notes on to Paul Sisco, and personally to show Paul another large, surviving American chestnut tree (LSA) near Wayah Bald. This year (2001), our Kentucky Chapter has worked with a large, surviving American chestnut tree in that state, due to the efforts of Rex Mann and Billy Fudge (for a photo, see the Summer, 2001, issue of the Bark). Aside from being great mother trees for backcrossing, these LSAs also can merit a breeding program in their own right. As many of you know, our sister organization, the American Chestnut Cooperators' Foundation has been doing this for many years.

Our chapters can contribute significantly to this additional source of blight resistance by identifying and locating large, surviving American chestnut trees.

One caution with using large trees for pollinating is that, in general, one does not want to use more than one source of blight resistance on a single tree. Otherwise, one loses one of the benefits of having more than one source of blight resistance in the breeding program, which is to increase the number of American parents we are using. This benefit is lessened if the same American tree is bred with more than one source *of* blight resistance. Likewise, it is not good to cross a single pollen from Meadowview onto more than one American chestnut tree, if there is a reasonable expectation that one can get 100 progeny by crossing that pollen onto a single American chestnut parent. Crossing a single pollen onto a second American parent does not increase the number of lines, as that is defined by the pollen, but it eliminates the possibility of producing another breeding line on that second American tree by crossing; it with a second Meadowview pollen.

* Editor's note: A backcross generation (B) is produced by crossing a hybrid American/Chinese resistant tree to a pure American chestnut. Each backcross generation (denoted by number) recovers more of the American genotype and decreases the traction of the Chinese. Backcrossing while ensuring that we have more American-type chestnuts, however, does nothing to improve blight resistance. It is at the F2 or second intercross generation when two of the same or similar generation of backcrosses (i.e., two B3s, two B4s, or a B3 and B4) are crossed, that blight resistance is recuperated from the Chinese lineage of the tree.

The reason that backcrossing does not advance blight-resistance is that when conducting a cross with an American chestnut to recover American characteristics, the American genes for susceptibility to blight are also introduced. (Chestnuts and people both have two copies of each gene, one from their mother and one from their father). When crossing two B3s with each other to make an F2' the progeny have a chance of inheriting the genes for blight resistance from both parents, rather than only one. Intercrossing two F2s that display dominant blight resistant genes theoretically should confer 100% of the blight resistance of the Chinese parentage to the offspring, the F 3 generation.

We would like to remind all TACF members that you are welcome to visit the farms at any time. We are in a white house on the northeast side of Virginia Route 80, one-third of a mile southeast of Exit 24 on Interstate 81, the Meadowview Exit. We generally are there during normal work hours, but it might be good to call ahead (540-944-4631).

TABLE 1

Type and number of chestnut trees and planted nuts at TACF Meadowview Research Farms in May 2001, with the number of sources of blight resistance and the number of American chestnut lines in the breeding stock.

	Number of		
Type of Tree	**Nuts or Trees**	**Sources of Resistance**	**America Lines***
American	1947		101
Chinese	778	41	
Chinese x American: F_1	660	24	88
American x (Chinese x American): B_1	1209	10	25
American x [American x (Chinese x American)]: B_2	2192	8	103
American x {American x [American x (Chinese x American)]}: B_3	5525	2	64
Am x (Am x {Am x [Am x (Chin x Am)]}):B_4	100	1	1
(Chinese x American) x (Chinese x American): F_2	492	3	3
[Ch x Am) x (Ch x Am)] x [Ch x Am) x (Ch x Am)]:F_3	6	1	1
[Amer x (Chin x Amer)] x [Amer x (Chin x Amer)]: B_1-F_2	474	2	2
{Am x [Am x (Ch x Am)]} x {Am x [Am x (Ch x Am)]}:B_2-F_2	413	4	12
[A x (A x {A x [A x (C x A)]})] x [A x (A x {A x [A x (C x A)]})]:B_3-F_2	202	1	2
Chinese x (Chinese x American): Chinese B_1	142		
Chinese x [American x (Chinese x American)]	41		
Japanese	3	2	
American x Japanese: F_1	16	2	2
(American x Japanese) x American: B_1	198	2	2
Castanea seguinii	48	1	
Chinese x Castanea pumila: F_1	9		
Large, Surviving American x American: F_1	322	11	35
(Large, Surviving American x American) x American: B_1	500	5	7
Large, Surviving American x Large, Surviving American: I_1	63	4	4
Large, Surviving American: F2 = F_1xF_1, same LS parent	220	3	3
Irradiated American x American: F_1	41	1	1
Other	60		
Total	**15,661**		

TABLE 2

Changes between 2000 and 2001 in the number of chestnut trees and planted nuts of different types at TACF Meadowview Research Farms, including changes in the number of sources of blight resistance and the number of American chestnut lines in the breeding stock.

	Increase or Decrease* in Number of		
Type of Tree	Nuts or Trees	Sources of Resistance	American Lines
American	333		10
Chinese	27	4	
Chinese x American: F_1	30	2	22
American x (Chinese x American): B_1	-138	-1	**
American x [American x (Chinese x American)]: B_2	-531	-1	**
American x {American x [American x (Chinese x American)]}: B_3	724	0	**
Am x (Am x {Am x [Am x (Chin x Am)]}):B_4	100	1	1
(Chinese x American) x (Chinese x American): F_2	182	0	-1
[Ch x Am) x (Ch x Am)] x [Ch x Am) x (Ch x Am)]:F_3	-4	0	-1
[Amer x (Chin x Amer)] x [Amer x (Chin x Amer)]: B_1-F_2	12	0	0
{Am x [Am x (Ch x Am)]} x {Am x [Am x (Ch x Am)]}:B_2-F_2	-242	1	5
[A x (A x {A x [A x (C x A)]})] x [A x (A x {A x [A x (C x A)]})]:B_3-F_2	202	1	2
Chinese x (Chinese x American): Chinese B_1	0		
Chinese x [American x (Chinese x American)]	0		
Japanese	0	0	
American x Japanese: F_1	15	1	1
(American x Japanese) x American: B_1	125	1	1
Castanea seguinii	0	0	
Chinese x Castanea pumila: F_1	7		
Large, Surviving American x American: F_1	-130	1	**
(Large, Surviving American x American) x American: B_1	311	3	0
Large, Surviving American x Large, Surviving American: I_1	-30	0	0
Large, Surviving American: $F_2 = F_1 x F_1$, same LS parent	28	1	1
Irradiated American x American: F_1	-3	0	0
Other	20		
Total	**1038**		

* The decreases in B1, B2, B3, B2-F2 and Large, Surviving American F1 & I1 trees reflects roguing of trees with inadequate levels of blight resistance. The increases reflect further breeding and collecting.

**In 2001, we began calculating the number of American lines as sets of trees within a source of resistance that did not share any American grandparents in common, if the pedigree went that far back; otherwise, it was sets of trees that did not share any American parent in common. In most cases, trees that did not share American grandparents also did not share American parents. Prior to 2001, we calculated the number of American lines as sets of trees that did not have the same combination of American chestnut parents and grandparents; this method over-estimated the number of lines. Because of the difference in the method for calculating the number of American lines, comparisons between years are not meaningful.

TABLE 3

Number of third-backcross chestnut trees and harvested nuts at TACF Chapters in May 2001, with the number of sources of blight resistance and the number of American chestnut lines in the breeding stock.

	Number of		
Chapter	Nuts or Trees	Sources of Resistance	American Lines*
Maine	1238	2	20
Massachusetts	111	1	3
Pennsylvania	7594	2	29
Indiana	1099	1	6
North Carolina	623	2	4
Total	**10,665**		

TABLE 4

Number of chestnut trees in various blight resistance classes for two first backcross families, and for Chinese, American and Chinese x American checks.

	Resistance Class*								
Family	1	1.5	2	2.5	3	3.5	4	4.5	5
'Mahogany' Chinese	4	4	11	3	2				
Seedling Chinese		2	5	3	1				
'Meiling' Chinese x American					1	3			
'Nanking' B_1		1	1		9	34	23	2	10
'Meiling' B_1				1	13	32	32	3	29
American						2	2	1	4

* Class 1 is the highest level of resistance, where there is little or no canker expansion. Class five is the lowest level of resistance.

TABLE 5

The American Chestnut Foundation Meadowview Farms 2000 nut harvest from controlled pollinations and selected open pollinations.

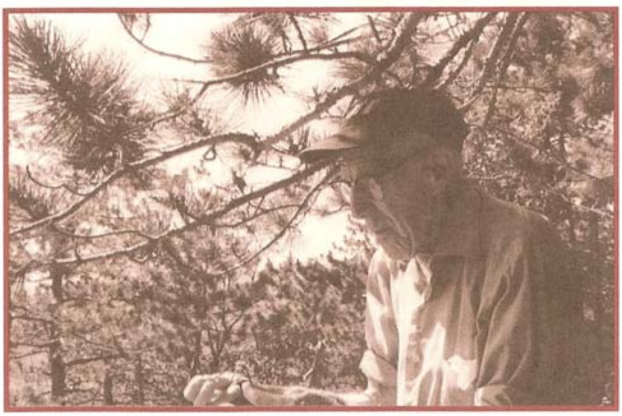
Nut Type	Female Parent	Pollen Parent	Pollinated nuts	Pollinated bags	Pollinated burs	Unpollinated Checks nuts	Unpollinated Checks bags	Unpollinated Checks burs	Number of American Chestnut Lines*
B_1	American	Miller 72-211 F_1	0	63	100	0	7	25	1
B_1	American	Meiling F_1	11	68	135	0	5	17	6
B_1	American	Nanking F_1	226	545	1473	2	51	157	11
B_2	S.LotR4T23 B_1	American	0	40	81	0	4	5	1
B_2	Nanking B_1	American	205	198	708	0	19	61	3
B_2-F_2	Clapper B_2	Clapper B_2	96	215	758	0	16	54	1
B_2-F_2	Graves B_2	Graves B_2	111	136	327	9	9	35	3
B_2-F_2	Clapper B_2	op	4355	open pollinated					7
B_3	Clapper B_2	American	671	471	1510	11	52	153	9
B_3	Graves B_2	American	870	1392	5034	6	123	551	25
B_3	American	Clapper B_2	278	309	733	6	35	77	18
B_3	American	Graves B_2	428	295	572	15	33	59	16
B_3-F_2	Graves B_3	Graves B_3	207	155	534	2	14	47	3
B_4	American	Graves B_3	368	130	245	5	12	17	6
F_1	Nanking	American	134	210	464	0	22	58	4
F_1	Dunstan	American	121	21	65	0	2	5	1
F2	Nanking F_1	Nanking F_1	173	397	1015	3	37	93	4
JpnF_1	MAJ7 Japanese	American	22	21	63	1	1	17	1
LS B_1	Weekly F_1	American	84	66	192	1	7	18	1
LS B_1	American	Dares Beach F_1	194	215	774	3	18	63	2
LS F_1	Macon	op	13	open pollinated					1
LS F_1	WyahBig	op	60	open pollinated					1
LS F_1	Dares Beach F_1	Dares Beach F_1	28	63	126	0	7	8	2
Total Controlled Pollinations			**4227**	**5010**	**14918**	**64**	**474**	**1520**	

*The number of American lines for this table is restricted to the number of American chestnut trees that were direct parents, not grand parents, of progeny.

TRAIPSING HIGH LEDGES:
In Search of American Chestnuts "In a Wild Place"

by Ana Rondros, Communications Director

After a first attempt and nearly missed possibilities, I finally stood face to face with Dr. Ellsworth Barnard and was about to go on a tour of the fabled High Ledges, a Wildlife Sanctuary in northwest Massachusetts. He donated the original 400 acres of



High Ledges to the Massachusetts Audubon Society in 1970. (It now totals over 600 acres.) Including part of what was originally the Barnard family farm, much of the property was once cleared and has slowly reverted to forest over the last half century. Though Dr. Barnard left the area to pursue a teaching career, he has always returned in the summers. A retired English professor from the University of Massachusetts, Amherst, he is also an avid naturalist with a keen interest in American chestnuts. High Ledges has in many ways been Dr. Barnard's classroom, and his detailed knowledge of and appreciation tor the plant and animal life of the sanctuary is eloquently outlined in *In a Wild Place: A Natural History of High Ledges* (excerpted in the summer 2000 issue of *The Journal).* At only an hour away from national TACF headquarters in Bennington, VT, I could not turn up the opportunity to visit and hone my fledgling chestnut identification skills.

On my first attempt to meet with Dr. Barnard, fate would not have it.

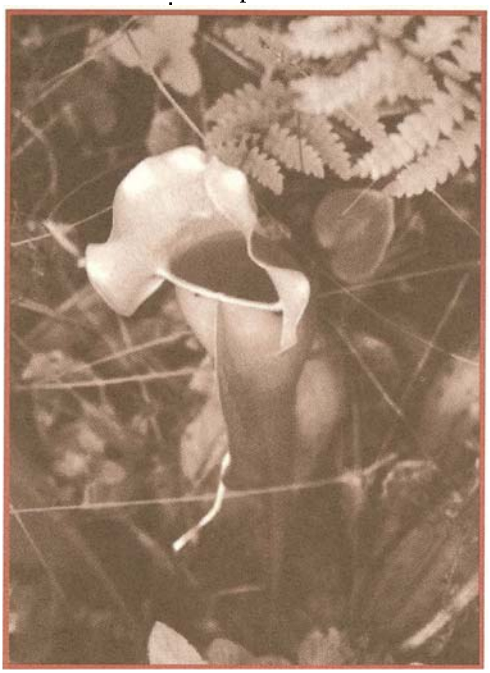
After being lost tor a half-hour in the nearby town of Shelburne Falls desperately looking for signs that I was on the right route, I turned for help. With the assistance of a visitor's bureau volunteer, extremely happy to see another human in the middle of a workday, I was set on the right course beginning from Shelburne Center, a nearby hamlet. (Who would have known that Shelburne Center was not the center of Shelburne Falls?)

In my quest to find the rendezvous point, four mailboxes in the middle of an unmarked country road, I crossed paths with a handful of people who knew Dr. Barnard, but who had not seen him that day. One of them, a forty-something, very fit woman about to hike the sanctuary, responded to my queries, "Who, Dutch? He's a wild man - got more energy than me. He's probably out in the woods planting something." I continued to meander up and down the scenic roads. An hour after our meeting time, I decided to look in the sanctuary. As I walked around the unremarkable brown cabin in the center of the sanctuary, my Lady's Slippers breath stopped. Standing on the rock outcroppings, the Deerfield River Valley stretched out to the horizon between a sea of hills. Just below sat Shelburne Falls beckoning like a town from a Grandma Moses painting. After a few moments, I continued.

The sign on the cabin door advised that the last of the season's Lady's Slippers were still in bloom. Having never seen a Lady's Slipper, off I went down the trail. It was lined with small groups of pink, very sensuous t1owers, unlike any others I had seen before. The forty-something, fit hiker passed and said, "There's one yellow one left down the way." The solitary flower was a bit crumpled, but I was ecstatic - I had seen both pink and yellow! Many consider the root to be an aphrodisiac, and others have tried to transplant it with little success. Lady's Slippers are very difficult to propagate. Apparently, the High Ledges Lady Slipper Trail provides the rare microclimate perfect for these bulbous not-quite-flower-looking t10wers to grow. In many states, it is illegal to pick Lady's Slippers.

So a week and a half later, having straightened out a mix-up about dates, when Dr. Barnard stepped out of his car at the easy-to-find church in the center of Shelburne Center, I was filled with anticipation. I had had a glimpse of High Ledges and was hooked; yet I hadn't seen a single American chestnut on the previous trip. In my search tor an illusive gentleman and my fascination with the Lady's Slippers, it is possible that the American chestnuts had been missed. And I was right.

Our first stop was along the road entering the sanctuary. Dr. Barnard proudly showed me what was left of one of the two American chestnuts he had planted back in 1969 as part of an experiment. This one had a healthy set of stump sprouts all around. He planted the second 1969 chestnut a half-mile away. At the time, he was unaware that chestnuts normal-ly need a nearby neighbor to produce viable nuts. Despite this, a healthy seedling poked out of the ground a few feet away from the dead stump of the original. Near the car, he had recently planted another chestnut to ensure propagation. It was still too young to flower, though older than the seedling.



At the second stop, we waded through a sea of tall ferns and saw the other 1969 chestnut (which had recent1y died back), and its recently planted companion. Dr. Barnard stopped and pointed at an opening in the woods across the dirt road (the Waterthrush Trail), "Down there, there are a lot more chestnuts, but at 93, I need to reserve my energy for the rest of the tour." I expected it to be a short tour.

We parked the car at the cabin. I said, "In your book you mention that there are chestnuts around the cabin, but I couldn't find them last time." As our eyes adjusted to the speckled forest light, he showed me a 6" dbh (diameter at breast height) chestnut right in front of us! We went around the cabin to gaze at the view for a few moments. He pointed out the numerous red pines surrounding the ledge and commented, "The wind makes a distinctive sound when it blows through red pine." I could almost imagine the howl they made on a windy afternoon. As we made our way back to the other side of the cabin, Dr. Barnard showed me the wild roses he had planted, along with the bunch berry, native dogwood and swamp pink. Then began the real chestnut tour.

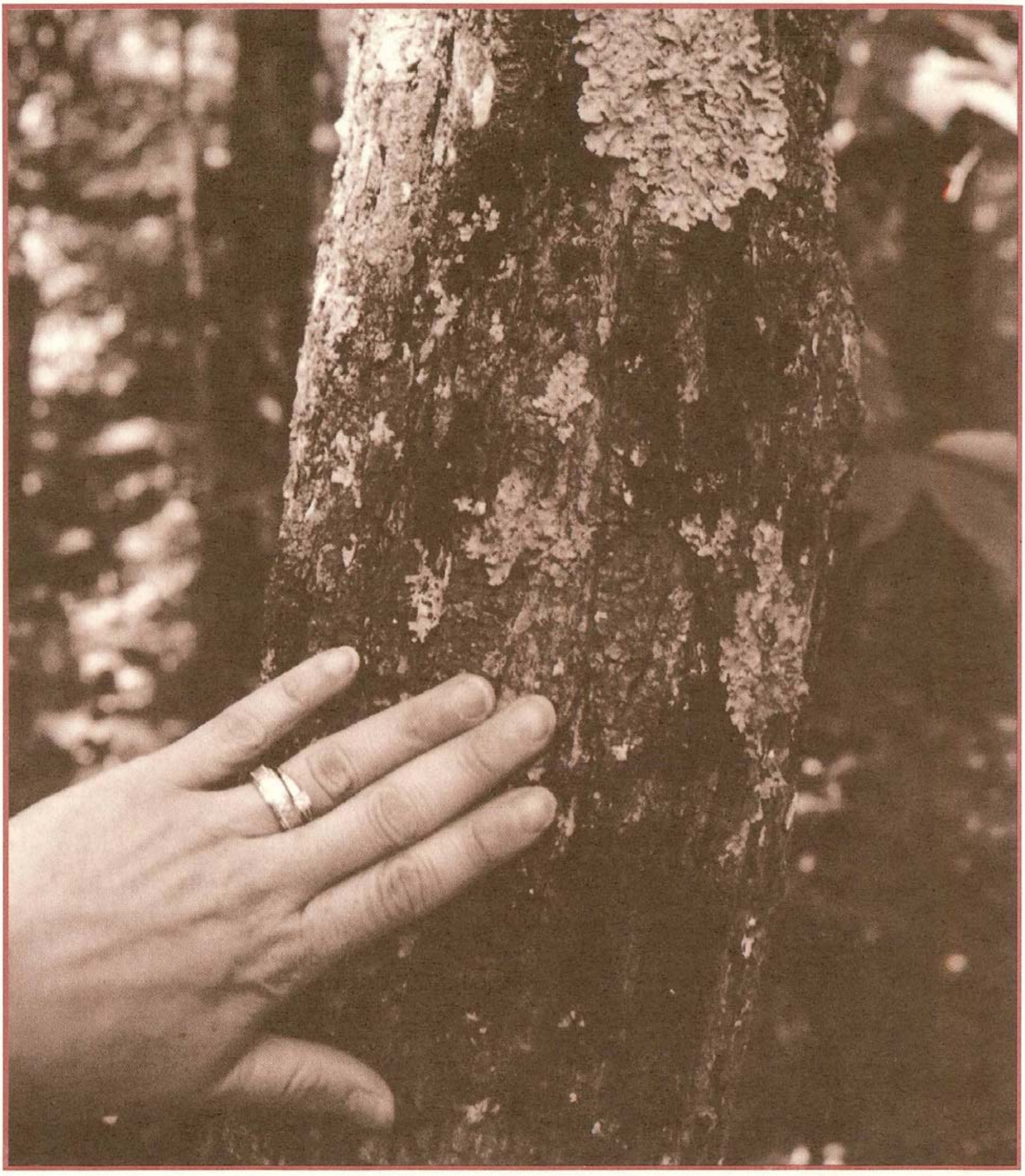
Dr. Barnard bounded over logs and passed through the brush showing me the American chestnuts near the cabin. He stopped at each and gave its history. "This is one of the bigger chestnuts," pointing out a tree approximately 60 feet high. There were a half dozen or more in this category. "This is a recent stump sprout. The tree died five years ago." "This one has an infected limb but is still thriving." Dr. Barnard explained that while the American chestnuts at High Ledges still succumb to the blight and die back, each new generation of sprouts seems more vigorous than before. When the blight first struck in the 1920s, the majestic American chestnuts of his youth were devastated. In the subsequent 80 years of his observation, he has noticed that the sprouts have been getting bigger and stronger: "Nature has a way of coming back on its own."

As we headed away from the cabin towards the Spring Brook Trail, he showed me the trailing arbutus, the ground cedar and a striped maple. He agilely negotiated the steep path, only occasionally seeking the assistance of a nearby sapling. Lower on the slope he pointed out a downy rattlesnake plant, a species of orchid with snake-like markings on its leaves. He stopped and identified the song of the blade-throated blue warbler and the flute-like song of the Wilson's thrush. At the bottom of the hill, we stopped at a boggy area. Later in the season, the bog is home to purple orchids. We inspected a shrub Dr. Barnard had transplanted from Maine, and he recited:

Rhodora! If the sages ask thee why
This charm is wasted on the earth and sky.
Tell them, dear, that if eyes were made for seeing,
Then Beauty is its own excuse for being:
Why thou wert there. **O** rival of the rose!
I never thought to ask, I never knew:
But, in my simple ignorance, suppose
The self-same Power that brought me there brought you.

From *The Rhondora: On Being Asked, Whence is the Flower?* by Ralph Waldo Emerson

We then headed on to the Gentian Swamp with cranberries, winterberry, wild orchids and cinquefoil. The last burgundy petals of the pitcher plant blossoms dung to their stems. The pitcher plant leaves appeared



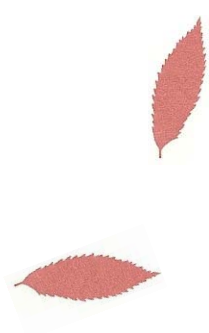
An American chestnut near cabin with hand to show size.

to be gaping mouths ready to be fed. When we left, we crossed the Wolves Den Trail, which runs past the home of the last known wolves in the area.

As we continued to hike the trails, he pointed out the American chestnuts, mostly saplings. We also came across the beetle pollinated wild ginger, the rarer dwarf rattlesnake plantain, and Maidenhair, Christmas, and New York ferns. Then he stopped and showed me perhaps the smallest chestnut sprout yet, far removed from the rest. He explained that none had been in that area before. "It's a mystery how for three quarters of a century there's not a single chestnut, and then one decides to germinate." From there, two and half-hours into the tour, we headed back.

At the top of the trail by the cabin, we again stopped at the rocky outcrop. This time not just to admire the view, but to rest. He dropped me off at my car, and as he pulled away, I knew his work at High Ledges was a work of love. In his many years at High Ledges, Dr. Barnard has tended the forest and cultivated its diversity with a great care reminiscent of native peoples. In the same vein, donating High Ledges to the Massachusetts Audubon Society has ensured that the sanctuary is for both wildlife and future generations: "It's just too beautiful for one person to own."

To purchase a copy of *In A Wild Place: A Natural History of High Ledges,* contact Kristin Eldridge at the Massachusetts Audubon Society, 781-2599506 ext. 7255.



RESULTS OF 2001 CENSUS OF AMERICAN CHESTNUTS

At High Ledges Wildlife Sanctuary
Conducted by Dr. Ellsworth Barnard

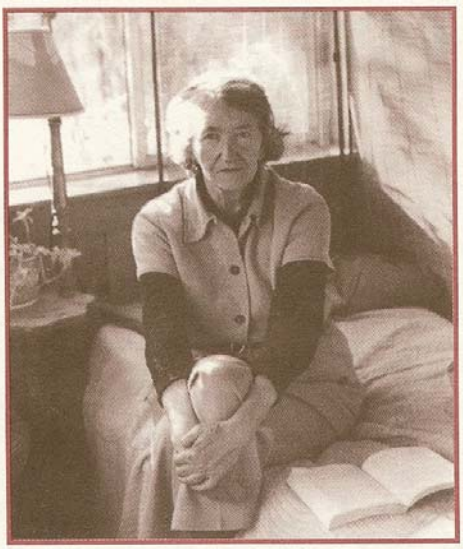
Number/ description	Diameter	Circumference
52 independent seedlings	Up to .5″	—
28 trees	.5″ - 1.3″	1.5″ - 4″
52 trees	1.6″ - 3.2″	5″-10″
15 trees	3.5″ - 4.8″	11″-15″
8 trees	5.1″ - 6″	16″-19″
1 large tree	6.4″	20″
3 large trees	6.7″	21″
2 large trees	7.6″	24″
1 large tree	8″	25″
86 stump sprouts	——	——

*Note: Numbers are of American chestnuts on the main trails of the High Ledges Wildlife Sanctuary. Others (though most likely a very small number) can be found off the trails, especially the west slope.

memories

MEMORIES OF THE AMERICAN CHESTNUT

From an article of the same title by Georganna Rice, Anita McCoy, Terri Webb, Cam Bond, and Vivian Speed with Kim Gragg and Dovie Green. *Foxftre* 6,1980. Ed., E. Wigginton. Anchor Press/Doubleday: Garden City, NY, pp. 397-421.



Marie Mellinger, a naturalist living in Rabun County.

Excerpts and photos reproduced from *Foxfire* 6 with permission from The Foxfire Fund, Inc., Mountain City, GA. The Foxfire Fund is a non-profit educational and literary organization that promotes an active, learner-centered approach to teaching and continuous interaction between students and their communities. The excerpts presented below are from 1980 student-led interviews of residents of Rabun County, Georgia, who remember the American chestnut. For more information about Foxfire visit www.foxfire.org.

CHARACTERISTICS AND USES IN SOUTHERN APPALACHIA BEFORE THE BLIGHT

MARIE MELLINGER: The American chestnut, *Castanea dentata,* was a dominant tree over most of the Appalachians. It grew to be huge, [with] a roughly uniform diameter upwards for forty or fifty feet, and that's why it was such a good source of timber. Also, the wood lasted practically forever. In 1859 an American chestnut tree somewhere on the western slope of the Great Smoky Mountains in Tennessee was reported as being thirty-three feet in circumference four feet from the ground. That's about ten or eleven feet in diameter. I was informed that in Greenbriar, North Carolina, in 1934 a large chestnut stump was found that measured thirteen feet the long way across .... Those were some giant tees. And the nuts were a tremendous source of food for people, [their] animals, and wild animals, such as turkey and deer.

Foxfire students and staff planting chesnuts in pots and placing them inthe cold frame

JAKE WALDROOP: I can show you some chestnut stumps now that are six or seven feet through, and they'd grow to be over a hundred feet tall, those chestnut trees would. Grea-aa-at big, and they'd sprangle out, have a big clustery top to 'em. They most generally grew the straightest timber of any. As the old saying goes, "straight as a gun barrel." They didn't haye too many low branches; they'd go way up without branches. On an average you could cut any-where from three to four sixteen foot logs out of chestnut tree before you got into the knots .... And it grew fast. In fifteen or twenty years you could go to cutting 'em for tele-phone poles. And them telephone poles'd be anywhere from twenty to sixty feet long. 'Bout as fast a growing timber as there was. I imagine it was as long a lifed tree as any in the forest ....

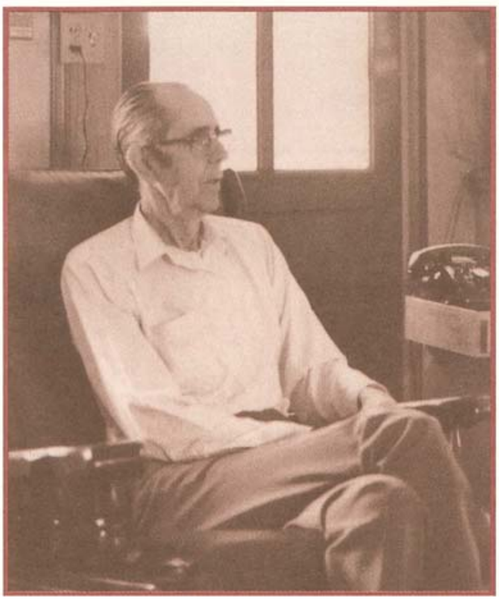
The nuts grow inside a burr, and it's a big thing, as big as your fist, and 'long about the fall of the year when it starts frosting they'll open. Then the chestnuts fall out, and later the burr itself will drop off I've seen them a time or two in the fall, it's come a dry spell of weather and the [burrs] would open, but there wouldn't be enough moisture, and [the nut] wouldn't get loose of the burr, and it'd stay in there. I've seen hundreds of bushels hanging up, and you couldn't pick one to eat. Then it'd start to cloud up, rain some, and it was a sight on earth - just in an hour or two the whole earth would be covered with chestnuts.... October was the main chestnut month.

We'd pick them up in the fall of the year, and whenever they went to falling a wagoner would [come through] and buy 'em and go South with 'em. Down around Toccoa and Lavonia and Athens, all the way to Atlanta, Georgia. Everywhere, selling them chestnuts.

A small little kid could pick up chestnuts. We'd get up before breakfast and go to these trees where a lot of chestnut had fallen overnight, beat the hogs there, and pick them up. Take them to market, sell them, and get our shoes, clothes, or other things with them. We'd take 'em and boil 'em or roast 'em or just hang them out and let them dry ....

NOEL MOORE: The chestnut was a tree that before the blight hit it, was just about immune to any kind of disease or trouble of any kind ....

In the spring when the chestnuts first came out (they would bloom a little later than any other tree), they had a light, cream-colored blossom, and a big tree that grew up a hundred feet high would have a spread at the top of it a hundred feet wide, maybe. You could see them sticking up out of the woods, and it was just like big, potted flowers standing up all over the mountains. It was really a sight to see. I was just a boy then. They all died by the time I was eighteen years old, and I can remember them just as well now. We'd talk about what a good chestnut crop we were going to have....



The nuts were real sweet, especially if they were roasted or boiled. Didn't taste like a walnut or a pecan; nothin' else tastes like them. And the blossoms gave up one of the best honey crops we ever had. We've never had a honey crop like we did since the chestnuts died, because there's not that much nectar in the wild now. Whenever chestnuts bloomed, in the morning, early, the trees looked like just the whole tops were alive with honeybees working on getting the nectar. They'd really go for it.

We put the nuts out in the sunshine and let 'em dry and that would sweeten 'em ..... We'd always gather several bags and put 'em out on a rack and let 'em dry in the sunshine. You'd have to pour boiling water over 'em, though, to kill the eggs that were laid in 'em by some kind of insect. If you didn't, the worms would eat 'em up, and you'd have a sack full of worms. [In cooking, people] used chestnuts principally for making stuffing and they made a bread out of it, too, called nut bread. They'd beat it up [couldn't grind it in the mill because it was too soft and would gum up the mill], beat it up with a wooden mallet and mix it with meal and Hour.

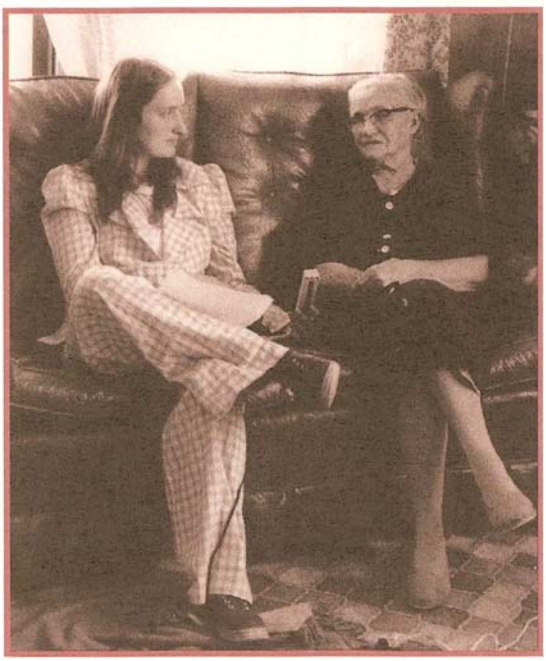
There were people who made their living picking up chestnuts and carrying them to the store. I've seen 'em coming out of the mountains [behind] where we lived over where Burton Lake is now .... We'd hardly ever see these people at all, except when they came out to go to the store, and in the fall we could see 'em coming, maybe the parents and three or four kids coming down the trail. The old man would have a big coffee sack full of chestnuts on his back, and little fellers would have smaller sacks, and even the mother would have a small sack of chestnuts caught up on her hip. They'd all trek to the store and they'd swap that for coffee and sugar and flour and things that they had to buy to live on through the winter. That's the way they made their living ....
The hogs and deer and turkeys and squirrels thrived onthe nuts. Almost every year was a good year for chestnuts. We had what you call a free range here then and you had to fence your farm and fields to keep out the stock that was turned loose in the mountains. People would let their breeding stock run free in the woods, and the hogs would live on the chestnuts and acorns that they could pick up off the ground. In the fall, after [the hogs] got fat on the mast (they'd get as fat as they could and still walk), the farmers would catch 'em with dogs. That's the way they got their meat. If they wanted to cure the meat and keep it through the winter, they'd put the hogs up and feed 'em on corn for a few weeks, then butcher 'em. But the ones that was killed in the mountains, right off the mast, you had to eat 'em then, [because] you couldn't cure [the meat]. It wouldn't keep-wouldn't take salt and cure like grain-fed meat would. It was better-flavored meat, sweet and tender. ...

They used it a lot for pulpwood when they first started to make paper-that's about the only thing they made paper out of was chestnut and poplar. They also used it for tannic acid- there's a lot of acid in the wood. Back then they would cut big enormous trees just to get the bark off 'em, and they would leave the rest of the tree just layin' there on the ground to rot. It'd be worth thousands of dollars now if we had wood like that, because it's so much better wood than anything that grows in the forest now. It made better framing lumber for building houses, [it was good] for siding because it wouldn't warp or split or rot, and it would take a finish good. Then they got to using it for furniture because it takes such a good finish; it polishes good, and the grain shows up good. It's a beautiful wood.

MRS. M. C. SPEED: We used to make medicine out of the leaves, for swelling. Boil the leaves in a pot and get the juice out of them and set [the pot] off the heat and let it cool. Then bathe [the swelled area] with it. People back then had swelled feet and they'd put that on them to get rid of the swelling ....

THE BLIGHT: HOW IT KILLED OFF THE AMERICAN CHESTNUT AND HOW PEOPLE FELT

JAKE WALDROOP: The blight hit there around 1938 and on up to '42 or '43. That's when it hit. It came from out of the East and was traveling West. Where we lived up yonder, [there] was bi-i-i-g chestnut country right across from us, we would [watch it], and it went right on and traveled West. You could just almost see [the trees] 'a dying, they died so fast. After that blight hit, the bark went to falling off of 'em. Two or three years after that the trunks began to [weaken] and a wind storm'd come up and it'd be awful to hear them trees 'a fallin' in the chestnut belt ....



NOEL MOORE: .... There was a mountain just across the valley from where we were living at the time. It was a ridge like. It wasn't very tall and it was covered up completely with chestnut trees. All of 'em were young trees. They was some of ' em as much as twenty-four inches in diameter. And that's where we'd usually go to get our crop of chestnuts. But they all died in one summer. Every one of ' em. They just quit having nuts. There weren't any more. And there [used to be] thousands of bushels of ' em shipped out of these mountains to cities. They was sold in the fruit stands and sidewalk stores in all the big cities because everybody liked them, you know. They were cheap.

That was one of the greatest losses of natural resources that this country has ever suffered It affected everybody that had anything to do with timber in any way because the best crop of mountain wood was completely destroyed ....

CHANGES AND ADJUSTMENTS

MARIE MELLINGER: When you go through the mountains you see what we call sprout forests. The sprouts grow up [from old stumps] and they grow up maybe ten to fifteen feet and then the blight gets them and they die back again.... Because of the grain and the silvery color, the [dead] chestnut trees are called ghosts.....

Several species of oak, and some hickory has come in to take the place the chestnut used to fill. Even though these trees also produce nuts, people say there are fewer squirrels and turkeys than there used to be ....

DR. JOHN BROWN: .... I do notice a lot of difference in the presence [then], and the absence [now], of the chestnut. First in the game. We used to be able to get turkeys and squirrels everywhere. I'm not certain that we had as many deer then as we do now, as you know deer forage on other things as well. But there were a lot more squirrels, and a lot more of other types of game. Turkeys in particular. I remember getting five turkeys on one hunt. You just don't see that these days. There has been a noticeable decrease in the game.

TACF IS DOCUMENTING MEMORIES OF THE AMERICAN CHESTNUT

If you or someone you know has vivid memories of the American chestnut before or during the blight, and you would like for this information to be documented for future generations, please contact Gerrie Rousseau, membership director, at 802-447-0110, chesnut@acf.org or TACF, P.O. Box 4044, Bennington, VT 05201.

THE BLUE RIDGE PARKWAY AGRONOMIST

by William Lord

The pages of the two volume set, Blue Ridge Par/may Guide, by DI'. William Lord, are filled with details of the rich history, people and environment of the scenic drive which stretches 469 *miles from Rockfish Gap, V A, in the Shenandoah National Park, to Cherokee, NC, in the Great Smoky Mountains National Park. Dr. Lord, long-time member of TACF, was a Park Ranger and Naturalist on the Parkway from 1948 to* 1955. *Recently, he donated the royalty rights to this set to The American Chestnut Foundation.*

The guides take the traveler mile by mile through the parkway. After mile-post 120.4 in the 1st volume (the guides proceed by mileposts, rather than page numbers) is a section «Ode to an Agronomist" about Bill Hooper. Dr. Lord recently explained, «Bill Hooper is a modest man, proud of his accomplishments, but never one to elaborate on them. To me, he accomplished more for the Blue Ridge region than any other employee of the Park way. He was a field soldier. In any official history of the Blue Ridge Parkway, I doubt if his name will be mentioned." Below, Dr. Lord provides details of Mr. Hooper's work for TACF members.

To order the set, send $18 *(S&H inc.) to TACF, P.O. Box 4044, Bennington, VT 05201. Include name, address, telephone and mark «Blue Ridge" on check, 01' call Globe Pequot Press, 800-243-0495. Lord, W.* 1981. *Blue Ridge Parkway Guide. Birmingham: Menasha Ridge Press. Volume* 1: *Rockfish Gap to Grandfather Mountain (ISBN 0-89732-118-9). Volume* 2: *Grandfather Mountain to Great Smoky Mountain National Park (ISBN 0-89732-119-7).*

Born in southern Appalachia in 1912, Bill Hooper knew the American chestnut in its glory days. The chestnut had been part of the folklore of his people, Each fall a man on horseback came riding through the countryside, "warning" the farmers to gather the year's harvests of nuts and have them bagged and ready. A merchant would soon follow and pay by the pound. Chestnuts were a "cash crop" in a land where coffee, salt, sugar and gingham were bartered *in* exchange for farm produce. Chestnuts were dependable and much less risky than moonshineing.

And then came the blight, a cruelty compounding the Great Depression. Commencing his career in 1946 as an agronomist on the Blue Ridge Parkway, Bill Hooper witnessed what was then believed to be the death throes of chestnut - throngs of gray, leafless skeletons, forlorn as though in the wake of a forest fire.

The States of Virginia and North Carolina purchased the land for the Blue Ridge Parkway in the mid 1930s. At the time, farmers had to sell whether they wanted to or not: on many occasions farms were divided in two. A lot of the locals were not too happy with this "very particular" road disrupting their rural scene. The Parkway had a minimum right of way of 200 feet. The planners wanted the Parkway to be a part of the local landscape.

William O. Hooper in 1946 shortly after his appointment as Agronomist with the Blue Ridge Parkway

Accordingly, Bill Hooper was hired to be in charge of a program leasing land to adjacent farmers. The terms were very reasonable, usually about a dollar an acre, bu~ the farmers had to farm according to scientifically derived land use procedures. They were required to maintain the fences, prevent or control erosion, and add lime on a scheduled basis. No row crops, such as corn or cabbage, could be grown two years in succession on the same land; nor were more than one cattle or four sheep allowed per acre of pasture.

At first Bill had to use all of his considerable patience and politeness. Many farmers did not feel kindly toward a heavy-handed government. Here was a fine, hard-surface road, and a man had to drive his pickup truck over the adjacent rough and unimproved roads because his pickup was considered to be a commercial vehicle and the Parkway banned commercial traffic.

There were plenty of other problems too, simply because many of the farmers didn't want a Parkway in the first place, especially if they couldn't use it. But Bill was patient and a good listener. He was never in a hurry. He gave his friends plenty of time to "study on it." Here and there a farmer gave it a try. Many were leasing land that was formerly theirs, and they now had its use cheaper than before. They didn't see the use of plowing on the contour. Their daddy never did it that way. But as time went by more and more farmers saw the Parkway offer as a good deal. Some would tell Bill their Parkway land looked better and did better than their own land.

Before long, the man that many a mountain farmer came to know as "Mr. Cooper" by way of faulty memory, became a desired visitor. They put the word out that the next time Mr. Cooper came by, he might drop by if he had a mind to. The Parkway also helped Bill out a lot by permitting quarter-ton pickup access to its motor road.

The Parkway became a green and fertile band of land that spread by example throughout the region. Bill Hooper's acres were a showcase of progress. Farmers that once grew nubbins of corn to feed scrawny cattle now boasted of 60 and even 100 bushels to the acre, and their pastures fed fat and healthy Angus and Hereford cattle.

All that is Bill's legacy. He did as much as any man to "green" the mountain farms. He is also a friend of the American chestnut. When he arrived on the Parkway in 1946, the skeletons of many a great chestnut haunted the forests. These were felled and many split into fence rails. By the end of Bill Hooper's tenure in 1974, the Parkway had 50 or more miles of chestnut rail fence bordering its roadside and bounding mountain pastures. Bill wanted to keep it that way. One of his last accomplishments before retiring was to scrounge high and low and acquire a reserve supply of chestnut to maintain the fences for years to come. He supports TACF and its goal of producing a blight resistant chestnut, bringing back a "summer snow" of blossoms to the forest .

science and natural history

PRE-BLIGHT ABUNDANCE OF AMERICAN CHESTNUT IN KENTUCKY

by Charles C. Rhoades, Department of Forestry, University of Kentucky, and Clare Park, Natural Resources Program, University of Kentucky

INTRODUCTION

The Commonwealth of Kentucky extends west from the Appalachian Mountains to the Mississippi River, spanning a variety of physiographic regions (Fenneman, 1938) and forest types (Braun, 1950; Smalley, 1986). American chestnut *(Castanea dentata)* was a major component of both mixed mesophytic and western mesophytic forests, the two dominant forest types in Kentucky (Braun, 1950). With the exception of the limestone-dominated Bluegrass Region in central Kentucky and portions of the western extreme of the state, chestnut was found throughout Kentucky (Saucier, 1973; Russell, 1987).

The chestnut blight fungus *(Cryphonectria parasitica)* spread across the southern Appalachians and Kentucky during the 1920's and 1930's (Cochran, 1990). By the mid- to late- 1930's, the blight had spread throughout the state; by the mid-1950's, the American chestnut as an overstory tree was virtually extinct. Forest pathologists and geneticists from various institutions currently predict that blight-resistant seedlings will be available for distribution and outplanting within five to fifteen years (Hebard, et al. 2000; S. Anagnostakis, Conn. Ag. Expt. Station, pers comm.). These predictions have spawned public interest in reintroduction of American chestnut to eastern forest ecosystems. In Kentucky, where production of hardwood lumber is a major source of financial gain, return of the chestnut combines nostalgia for the forests of the Appalachian fore-bearers, the restoration of original forest species composition and forest dynamics, and the potential of regional economic development.

Pollen analysis has confirmed the existence of American chestnut in Kentucky's forests for the past several millennia and has linked increased chestnut density with Native American burning and clearing practices (Delcourt and Delcourt, 1997 & 1998). While range maps detail the preblight distribution of American chestnut (Saucier, 1973; Russell, 1987), very little quantitative information exists regarding the tree's abundance within Kentucky forests (Braun, 1935). Such information will help focus and prioritize Kentucky's chestnut reintroduction activities.

The objective of this project was to survey information regarding the historic distribution and abundance of chestnut across Kentucky. We reviewed independent sources of historic information that each provided county-level estimates of chestnut canopy cover, relative stem density, or timber volume. The sources included land deeds, USDA chestnut blight survey notes, and a statewide inventory of standing timber. The data sources corresponded to the 30-year period leading up to the onset of chestnut blight disease in Kentucky. Taken separately, the inherent biases of historic data may weaken their ability to describe past conditions (Whitney and DeCant, 2001). Comparison between several independent sources, however, should strengthen their predictive value.

SOURCES OF HISTORIC INFORMATION

The statewide distribution and abundance of American chestnut was estimated *ftom* an inventory of standing timber resources produced in 1919 by the USDA, Forest Service, and the Kentucky Department of Geology and Forestry (Barton, 1919). This inventory ranked the board footage of the dominant forest species for the 119 Kentucky counties established at that time. One county (McCreary) was established following the data collection phase of the project. Between 7 and 18 tree species were recorded for each county. County area, forested area, and the average stand volume were also estimated. While we have been unable to locate details regarding the data collection protocol, this record provides a unique "snap-shot" of the historic importance of chestnut as a timber species at the time of the arrival of blight in Kentucky.

In Kentucky, land deed surveys were historically delineated by corner trees or distinct topographic features (i.e. stream banks, exposed rock outcrops). Individual land deeds provide a species tally based on the corner trees, along with the ownership, size, and location of the plot (Whitney and DeCant, 2001). Individual deeds were registered and archived at county land offices across the Commonwealth from the time of statehood in 1792, through the early part of the 20th century. Although some of these records have been destroyed by fire, most are still available. Each land survey provides a unique sample of tree species composition within a specific county

and time period. For parcels deeded around the turn of the 20th century (1890-1910), we tallied the corner tree species on a minimum of five deeds per county for about half the counties in Kentucky (n = 54).

As the chestnut blight disease radiated south and west from its point of introduction in New York City through the eastern deciduous forest, plant pathologists from the US Department of Agriculture tracked its progress. Between 1924 and 1931 USDA field agents traveled through Kentucky surveying the abundance and health of chestnut stands. Their systematic assessment noted local topography and overall forest cover. These county-by-county notes provide a third unique record ofKeI1tucky's forest resources, one focused specifically at the presence and abundance of chestnut. Information is available for 51 Kentucky counties, mostly located in the eastern part of the state. During the eight year survey period, nearly 300 stand assessments were recorded, 250 of which were located in the eastern mountains and Knobs region and the rest in the Bluegrass, western Knobs and south-central portions of the state.

The use of historic records as a tool for reconstructing previous forest species composition must be approached with caution and their biases recognized. The reliability of land deed records, for example, may be hampered by species misidentification or selection bias (Whitney, 1994). Surveyors often

Table 1

American chestnut and forest cover estimated during county surveys conducted by USDA forest pathologists between 1924 and 1931. Means followed by the same letter are not significantly different as determined by Tukey's means separation test (a = 0.05).

Physiographic Region	n =	Chestnut Cover Mean		Chestnut Cover Max	Forest Cover Mean		Forest Cover Max	Topography Median
		——	%	——	——	%	——	
Cumberland Mountains	50	20.3	a	50	82.9	a	100	Mountainous
Cumberland Plateau	164	6.7	b	50	65.0	b	100	Low Mountains
Eastern Knobs	41	5.4	b	20	41.2	c	90	Hilly
Western Knobs	9	2.6	bc	20	14.6	d	50	Rolling
Mississippian Plateau	8	2.0	bc	10	19.0	d	80	Rolling to Hilly
Bluegrass	20	0.5	c	2	14.5	d	45	Rolling
Total	**292**	**8.2**		**50**	**58.4**		**100**	

selected trees based on lifespan, timber value, ease in identification, and size. Land settlement patterns present an additional source of bias, which may alter the interpretation of both the land deed and chestnut blight surveys. Early land settlement was most often concentrated on the lower portions of the landscape with property boundaries corresponding to streamcourses. Chestnut, on the other hand, occurs most commonly on steep slopes and ridges. In spite of these and other shortcomings, few other alternatives exist for estimating the pre-blight abundance of chestnut. Physical evidence of chestnut abundance based on the density of stumps, logs and sprouts are becoming less reliable with time. The rate of log or stump decomposition and of chestnut sprout mortality vary across the landscape and bias abundance estimates that are based on the density of residual material.

RESULTS

Based on a 1919 timber inventory, chestnut was listed as a significant portion of the board footage in 75 of Kentucky's 119 counties (Fig. 1). Statewide, chestnut represented 8.5% of the 24,000,000 MBF tallied. Chestnut was distributed throughout the Cumberland Mountains and Plateau? the Knobs Region surrounding the Bluegrass Region, and was scattered throughout the western portion of the state. In 4 counties chestnut was the top-ranked species, representing >20% of the 1919 timber inventory. More than 80% of Kentucky's chestnut stumpage occurred in the 27 counties comprising the Cumberland Mountain and Plateau regions.

In over half the counties of the eastern mountainous counties and in about one-third of the central counties tl1e standing volume of chestnut timber ranked among tl1e top five species. West of Louisville, chestnut ranked among the top 5 species in only 2 counties and was top-ranked in none. Chestnut occurred in only 2 of 27 Bluegrass counties and in 3 of 8 Mississippi Embayment counties in extreme western Kentucky. State\vide, white oak *(Quercus alba)* was tl1e most dominant timber species. It was ranked among tl1e upper five species in 97,98, and 85% of the counties in the eastern, central and western sections of tl1e state, respectively. Similar to American chestnut, the abundance of chestnut oak *(Q. prinus)* reached its maximum within tl1e Cumberland Mountains and Plateaus and declined westword. Black oal, *(Q. velutina)* and hickory (*Carya* spp.) botl1 increased west of the Cumberlands while sugar maple (Acer saccharum) and American beech *(Fagus grandifolia)* reached their highest abundance in the central portion of the state.

American chestnut averaged 8% of the forest cover in the eastern third of Kentucky according to USDA forest pathologists (Table 1). The greatest abundance of chestnut occurred in the Cumberland Mountain region where chestnut averaged 20% and reached 50% of the forest canopy. Chestnut was significantly scarcer in the less mountainous regions and was nearly absent from the Bluegrass, according to blight survey notes. Counties with the greatest chestnut cover also supported the greatest forest cover; the five counties with the most chestnut were all more than 80% forested.

Chestnut corner markers were found on 90% of the land deeds surveyed in the Cumberland Mountain region; they represented 19% of the stems (Table 2). Chestnut stems did not exceed 44% within any region. Land deeds in the Bluegrass and western regions did not mention chestnut, confirming evidence from the other sources of data.

DISCUSSION

The three historic sources estimated the abundance of chestnut with surprising consistency considering that each source quantified different stand variables (Table 2).

The sources each partitioned Kentucky into three zones based chestnut

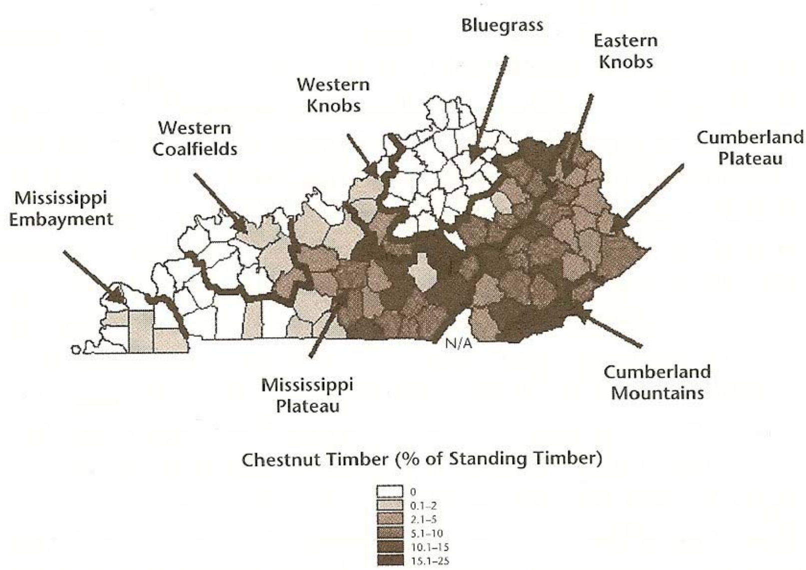


Figure 1 American chestnut as a percent of the volume of total standing timber stocks in 1919

Table 2
The pre-blight abundance of American chestnut in Kentucky estimated from independent information sources.

Physiographic Region	Deeds Records 1890-1910 Stems Mean	Deeds Records 1890-1910 Stems Max	Timber Inventory 1919 Standing Volume Mean	Timber Inventory 1919 Standing Volume Max	Blight Survey 1924-1931 Canopy Cover Mean	Blight Survey 1924-1931 Canopy Cover Max
	%					
Cumberland Mountains	19	44	17	22	20	50
Cumberland Plateau	6	43	7	15	7	50
Eastern Knobs	6	44	7	13	5	20
Western Knobs	2	36	7	19	3	20
Mississippian Plateau	7	40	5	24	2	10
Bluegrass	0	0	0	1	1	2
Western Coalfields	0	0	1	3	nd	nd
Mississippi Embayment	0	0	0	1	nd	nd

abundance. The Cumberland Mountains of extreme southeastern Kentucky contained the greatest density of chestnut. The Cumberland Plateau, Knobs and Mississippian Plateau supported intermediate chestnut abundance. Chestr1llt ,,;'as relatively rare in the Bluegrass and western extremity of the state.

The vast majority of Kentucky's chestnut timber and the highest cover and stem densities were confined to a three-county area in the extreme southeastern corner of the state. Early writings noted the great abundance of chestnut in the Cumberland Mountains. (deFreise, 1884; Braun, 1935 & 1950). The Cumberlands form the western boundary of Braun's Oak-Chestnut forest region which follows the Blue Ridge and Ridge and Valley physiographic provinces (Fenneman, 1938) and extends northwest from the Tennessee-North Carolina border to central Connecticut (Braun, 1950).

This region includes Pine and Cumberland Mountains, Kentucky's only thrust-fault mountains, where chestnut grows under a wide variety of soil, topographic and abiotic conditions. On xeric sites with shallow, rocky soils on Pine, Cumberland and Brush Mountains, chestnut was associated with a "stunted growth of hardy trees" including "mountain" chestnut oak, red oak, and various pines (deFreise, 1884). Conversely, on richer sites and deeper soils of Black Mountain, chestnut co-occurred with "yellow poplar, black walnut, white and blue ash, birch, linden (basswood), and white hickory (butternut)." A survey of Pine Mountain Braun (1935) reported that chestnut was the only overstory species present in all 21 communities situated on both the north- and south-facing slopes on soils formed from shale, sandstone, and limestone parent material. Chestnut was most abundant in Cumberland Mountain oak-chestnut forest (mean: 25% of forest canopy), but was also common in xeric pine-oak stands, mesic mixed mesophytic cove forest, and sugar maple- hemlock- and beech--dominated stands (Braun 1935, & 1950).

Chestnut abundance was intermediate for the majority of Kentucky's eastern and central counties. This region which includes 71 of Kentucky's 120 present-day counties corresponds to the mixed mesophytic forest and oak-hickory forest of the central hardwood region (Bryant, et al. 1993; Hinkle, et al. 1993). The Cumberland Plateau and Knobs of eastern Kentucky contained only about one-third as much chestnut on average as the Cumberland Mountain region; the mean combined across data types was 6% compared to 19% (Table 2). The Mississipian Plateau and western Knobs regions that cover the central third of Kentucky contained similar or only slightly less chestnut than the Cumberland Plateau area. Each data source, however, noted similar maximum values of chestnut canopy cover, standing volume, and stem density between the second-tier regions and the Cumberland Mountains. It is interesting to note that while the blight surveyors mentioned occasional clumps of pure chestnut, at the stand level, chestnut did not surpass half the canopy cover. Statewide, chestnut represented the highest percent of the standing timber stock (24%) in Larue County, directly south of Louisville on the Mississipian Plateau.

Chestnut comprised less than 1 % of the forest resources in the remainder of Kentucky: the Bluegrass Region and the western-most portion of the state. Our findings agree with original distribution maps regarding the lack of chestnut from the Bluegrass Region (Saucier, 1973; Russell, 1987). Blight survey notes indicated that chestnut's occurrence within the Bluegrass corresponded to topographic anomalies such as the rocky ledges along the Kentucky River, rather than the rolling Inner Bluegrass plain. While the paucity of chestnut in the Bluegrass is often attributed to the underlying limestone parent material, limestone is also the dominant substrate beneath the Mississipian Plateau and is common with the Knobs region (Karathanasis, 1992 & 1993). It is unclear if chestnut's absence from the Bluegrass relates to soil chemical differences between the Ordovician limestone of the Bluegrass and the Mississipian limestone sediments found elsewhere or to some other factor (i.e. high plant competition, low fire frequency or intensity). Chestnut was found as far west as Carlisle County, bordering the Mississippi River where it represented 0.1 % of the timber inventory. Deeds surveyed around 1900 noted chestnut as a corner tree no farther west than Edmonson and Barren counties near Bowling Green and Mammoth Cave National Parle

Our review of historic records verifies that American chestnut was an important part of Kentucky's pre-blight forests and helps to delimit priority regions for reintroduction. It remains uncertain how soil and climatic conditions interacted with-disturbance processes such as fire, insects, or disease to generate the pattern of chestnut abundance that the early European settlers encountered in Kentucky's forests. As the challenge of reintroducing chestnut: to the southern Appalachian region progresses it will be crucial to consider how environmental factors and disturbance events may have changed since the time when chestnut was a dominant part of the forest overstory.

Acknowledgements -The American Chestnut Foundation and the UK Department of Forestry provided financial support tor this work. Thanks to Dr. Sandra Anagnostakis tor sharing access to USDA forest pathology survey records, the UK Special Collections Library for assess to historic deed records, and to Julian Campbell of the Nature Conservancy for helpful advice and suggestions.

REFERENCES

Barton, J. E. 1919. The amount of standing timber in Kentucky. *The minem1 Cl1td forest resources of Kentucky*. The Department of Geology and Forestry, Vol 1. Series 5. Frankfort, KY.

Braun, E. 1. 1935. The vegetation of Pine Mountain, Kentucky: An analysis of the influence of soils and slope exposure as determined by geological structure. *The American Midland Naturalist* 16: 517-565.

Braun, E. 1. 1950. *Deciduous Forests of Eastern North America*. Blakiston Co., Philadelphia.

Bryant, W. 5., W. C. McComb, and J. S. Fralish. 1993. Oak-hickory forests (Western mesophytic/Oak hickory forests). Pages 143-201 in W. H. Martin, S. G. Boyce, and A. C. Echternacht, eds. *Biodiversity of the southeastern U1tited States: Upland terrestrial communities*. John Wiley and Sons, Inc., New York.

Braun, E. L. 1950. *Deciduous Forests of Eastern North America.* Blakiston Co., Philadelphia.

Cochran, M. F. 1990. Chestnuts: Making a comeback. *National Geographic* 177: 128-140.

DeFriese, L. H. 1884. Report on the timbers of the north Cumberland: Bell and Harlan counties. Kentucky Geological Survey, Frankfort, KY. pp 81-102.

Delcourt, H. R., and P. A. Delcourt. 1997. PreColombian Native American use of fire on southern Appalachian landscapes. *Conservation Biology* 11: 1010-1014.

Delcourt, P. A., and H. R. Delcourt. 1998. The influence of prehistoric human-set fires on oak-chestnut forest in the southern Appalachians. *Castanea* 63: 337-345.

Fenneman, N. M. 1938. *Physiography of eastern United States.* McGraw Hill, New York.

Hebard, F. V., P. H. Sisco, and P. A. Wood. 2000. Meadowview Notes 1999*2000. The Journal of the American Chestnut Foundation* 14: 7-15.

Hinkle, C. R., W. C. McComb, J. M. Safley Jr., and P. A. Schmalzer. 1993.

Mixed me sophy tic forests. Pages 203-253 in W. H. Martin, S. G. Boyce, and A. C. Echternacht, eds. *Biodiversity of the southeastern United States: Upland terrestrial communities.* John Wiley and Son, New York.

Karathanasis, A. D. 1992. Descriptions and laboratory data for some soils in Kentucky. 6. Knobs Region. University of Kentucky, College of Agriculture, Lexington, KY. pp. 84.

Karathanasis, A. D. 1993. Descriptions and laboratory data for some soils in Kentucky. 7. Eastern Pennyroyal Region. University of Kentucky, College of Agriculture, Lexington, KY. pp. 78

Russell, E. W. B. 1987. Pre-blight distribution of *Castanea dentata* (Marsh.) Borkh. *Bulletin of the Torrey Botanical Club* 114: 183-190.

Saucier, J. R. 1973. American chestnut ... an American wood. USDA Forest Service.

Smalley, G. W. 1986. Classification and evaluation of forest sites on the Northern Cumberland Plateau. USDA For. Servo pp 74.

Whitney, G. G. 1994. *From coastal wilderness to fruited plain.* Cambridge University Press, Cambridge.

Whitney, G. G., and J. P. DeCant. 2001. Government land office surveys and other early land surveys. Pages 147-175 in D. Egan and E. A. Howell, eds. *The historical ecology handbook.* Island Press, Washington, DC.

BACILLUS MEGATERIUM:
A Potential Biocontrol Agent Against Chestnut Blight

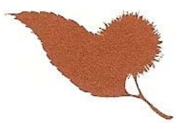
by Patricia C. Groome, Terry A. Tattar, and Mark S. Mount Department of Microbiology, University of Massachusetts, Amherst 01003

INTRODUCTION

The American chestnut (*Castanea dentata* [Marsh.] Borkh.) was once one of the most magnificent and significant tree species in the forests of the northeastern United States, commonly comprising up to 25% of some forests (Holt, 1970). In the Appalachian Mountains they could grow up to 100 feet in height and six feet in diameter (Collingwood, 1947). Besides. its intrinsic beauty, the tree was valued for its wood, which was light, durable, and decay resistant, making it an ideal construction material, and for its nuts, which were sweet, plentiful and nutritious.

In the 1870s, thirty years before disaster actually struck, the American chestnut was doomed by the inadvertent importation of *Cryphonectria parasitica* [Murr.] Barr, a fungus carried into the United States on chestnut seedlings from Asia, to which the American chestnut had no resistance (Tattar *et at.*, 1996). In 1906, C. *parasitica* was discovered in New York City on chestnut trees in the Bronx Zoological Park and the battle was engaged. Forty years later, the American chestnut was virtually gone. All attempts to eradicate or control the disease, both then and now, have met with limited success at best, and more often than not, total failure.

In a society increasingly aware of the dangers inherent in chemical usage, alternate approaches to disease control are eagerly sought. One such approach to chestnut blight control has been the use of microorganisms antagonistic to C. *parasitica*. In 1963 in Massachusetts, W. H. Weidlich (1978) noticed cankers developing on American chestnut roots exposed by a logging road. Ordinarily, though cankers may form at the base of chestnuts, they do not grow more than a centimeter below ground level, and Weidlich wondered if the soil itself might not have some inhibitory effect on C. *parasitica*. He found that muddy soil compresses not only greatly inhibited canker growth,



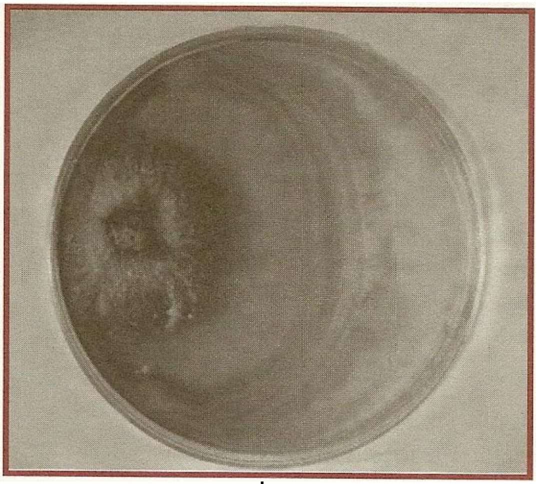


Figure 1
Zone of inhibition between C. parisitica (on left) and B. megaterium ten days after inoculation with the bacteria onto YMEA containing a three day old plug of C. parisitica

but often 'healed' the canker. As autoclaved soil failed to provide similar results, it was deduced that the mechanism was biotic rather than abiotic in nature. McCabe (1974) found that compost applications had the same curative effect on C. *parasitica* cankers. He postulated that some of the bacteria commonly present in compost and soil might be antagonistic to C. *parasitica.*

The goals of this study were to evaluate bacteria isolated from the bark of Castanea spp. that are (1) antagonistic to C. *parasitica* and (2) can survive an extensive period on the bark of American chestnut. Previous isolations from bark samples of forest trees had yielded very few bacterial cultures, none of which proved to be antagonistic. From the bark of several American chestnut trees on a farm in Walpole, New Hampshire, however, antagonistic bacteria were recovered. These trees had been planted in the 1930s as shade and nut trees, and the owner of this farm had been pruning and spraying these chestnut trees for most of his life. After reading the McCabe (1974) article, he began applying moist soil compresses to active cankers, which subsequently 'healed'. These trees, while still infected with C. *parasitica*, survive with little further treatment since that time.

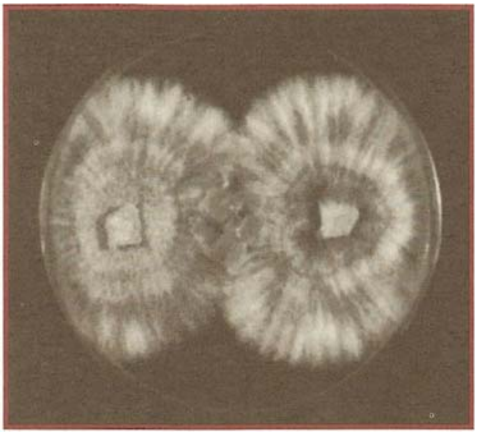
RESULTS

Identification and Antagonism to C. *parasitica in vitro* Three bacterial strains were cultured from bark samples from the NH site and identified as *Bacillus megaterium.* When the bacterial isolates were each streaked onto plates previously inoculated with virulent strains of C. *parasitica,* fungal growth slowed to a halt and a clear zone of inhibition developed between the two cultures (fig 1). Mycelium of C. *parasitica* grew to an average of 18mm from the edge of the bacterial isolates when growth was stopped. When mycelial growth had halted, agar was removed from this zone of inhibition and placed into a well made in the middle of a plate of yeast malt agar previously inoculated with a virulent strain of C. *parasitica.* The wells filled with agar from the zone of inhibition stopped the hyphae of the advancing C. *parasitica,* while the fungus grew unimpeded into wells filled with plain agar cubes (fig. 2).

Field Survival of the Strains of *Antagonistic B. megaterium*

The three strains of *B. megaterium* were field tested at three different sites: Cadwell Forest; an orchard at the South Deerfield Research Facility; and a sheltered courtyard on the campus of the University of Massachusetts at Amherst. A suspension of bacteria at a concentration of approximately 1010 colony forming units per ml was applied using hand-held mist sprayers on August 15, 1998. Each tree was sprayed with 15mls. A control group was sprayed with only distilled water. The first re-isolation attempt was made two weeks later. The recovery technique included a bark wetting step with approximately 2-3 ml of sterile distilled water, which was applied using the same hand-held mist sprayer just prior to swabbing with a sterile cotton swab. For the following 12 weeks, recovery rates were 100% for the three bacterial treatments at all sites and 0% for the control from all sites (fig.3).

In July of l999, 11 months following initial field inoculation, the Cadwell Forest site was revisited and swabbings were taken as before. From the control group, the recovery rate remained at 0%, and from the other three treatments, recovery had dropped to 44% for strain 2A, 24% for strain 2C, and 26% for strain 3A. Statistical analysis of the survival rates showed not only highly significant differences in survivability between the control treatment and the three bacterial strains, but also a highly significant difference between the three bacterial strains themselves.



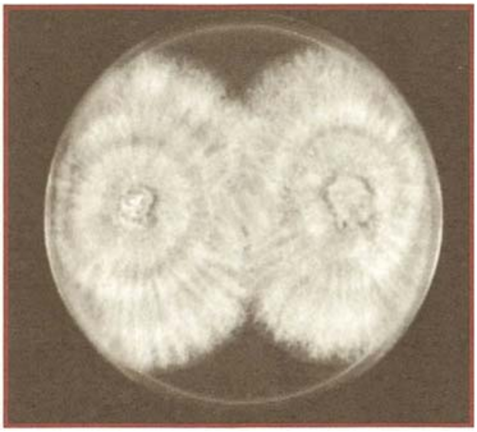


Figure 2
Central well filed with agar from the zone of inhibition is free from mycelial growth of *C. parisitica* (top)

DISCUSSION

None of the bark samples from American chestnut trees in the forest sites ever yielded bacteria with the frequency found in the NH plot, and none had yielded *B. megaterium.* The *B. megaterium* isolates recovered from these trees may have been initially introduced to the bark as a result of the soil compress treatments in 1975.

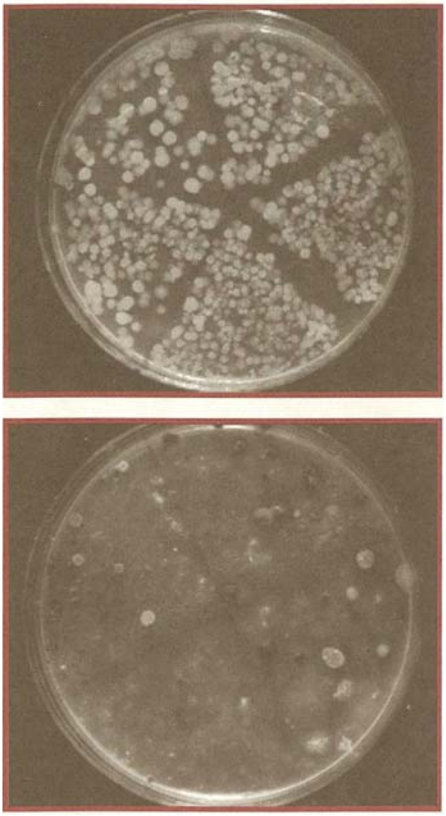


Figure 3
Results of bacterial recovery from a bark swabbing of a tree inoculated with B. megitarium and streaked onto streptomycin media (top) amd a swabbing from a tree treated with the control (uninoculated media)

This theory is supported by the results of frequent field isolations of *B. megaterium* at the South Deerfield orchard research site. It should be noted that the ground beneath these trees lacked vegetation and was predominantly bare soil. Bacteria isolated from the bark of untreated trees in South Deerfield may be a result of wind and rain splash of soil and its accompanying microorganisms onto the lover stems.

The *ill vitro* studies of the antagonism between the *B. megaterium* isolates and C. *parasitica* suggest that the *B. megaterium* strains used in this study produce compound(s) inhibitory to the growth of C. *parasitica.* Dual cultures of the two organisms resulted in a 15mm wide zone of inhibition developing between the bacteria and the fungus. Agar cubes removed from this zone of inhibition and placed onto plates previously inoculated with C. *parasitica* remained uncolonized by the mycelium which did grow around, but not on, the agar cubes.

This study also found that the three *B. megaterium* isolates can survive at least 1 year on American chestnut bark in the field and are antagonistic to C. *parasitica in vitro.* This demonstrates the potential of these *B. megaterium* isolates for biological control of chestnut blight. Our results also provide one explanation for the success of mud packs in 'healing' cankers. *In vivo* antagonism studies are now needed to critically assess the potential of *B. megaterium* as a biocontrol agent.

ACKNOWLEMENTS

This research is based upon work supported by the Cooperative State Research, Extension Service, U. S. Department of Agriculture, Massachusetts Agricultural Experiment Station, under Project No. NE140, Manuscript No. 3279.

LITERATURE CITED

Collingwood, G.H. and W.D. Brush. 1947. Knowing Your Trees. The American Forest. Assoc., Washington, D.e. pp. 182-183.

Holt, G.C. 1970. The Distributional History of the Biota of the S. Appalachians, Monograph 2. Virginia Polytechnic and State University, Blacksburg, VA.

McCabe, E. 1974. New hope for American chestnuts organically. Organic Gardening and Farming 21:117.

Tattar, T.A., Berman, P.M., Gonzalez, E.Y., Mount, M.S., and A.J. Dollof. 1996. Biocontrol of the chestnut blight fungus *Cryphonectria parasitica.* Arboricultural Journal 20:449-469.

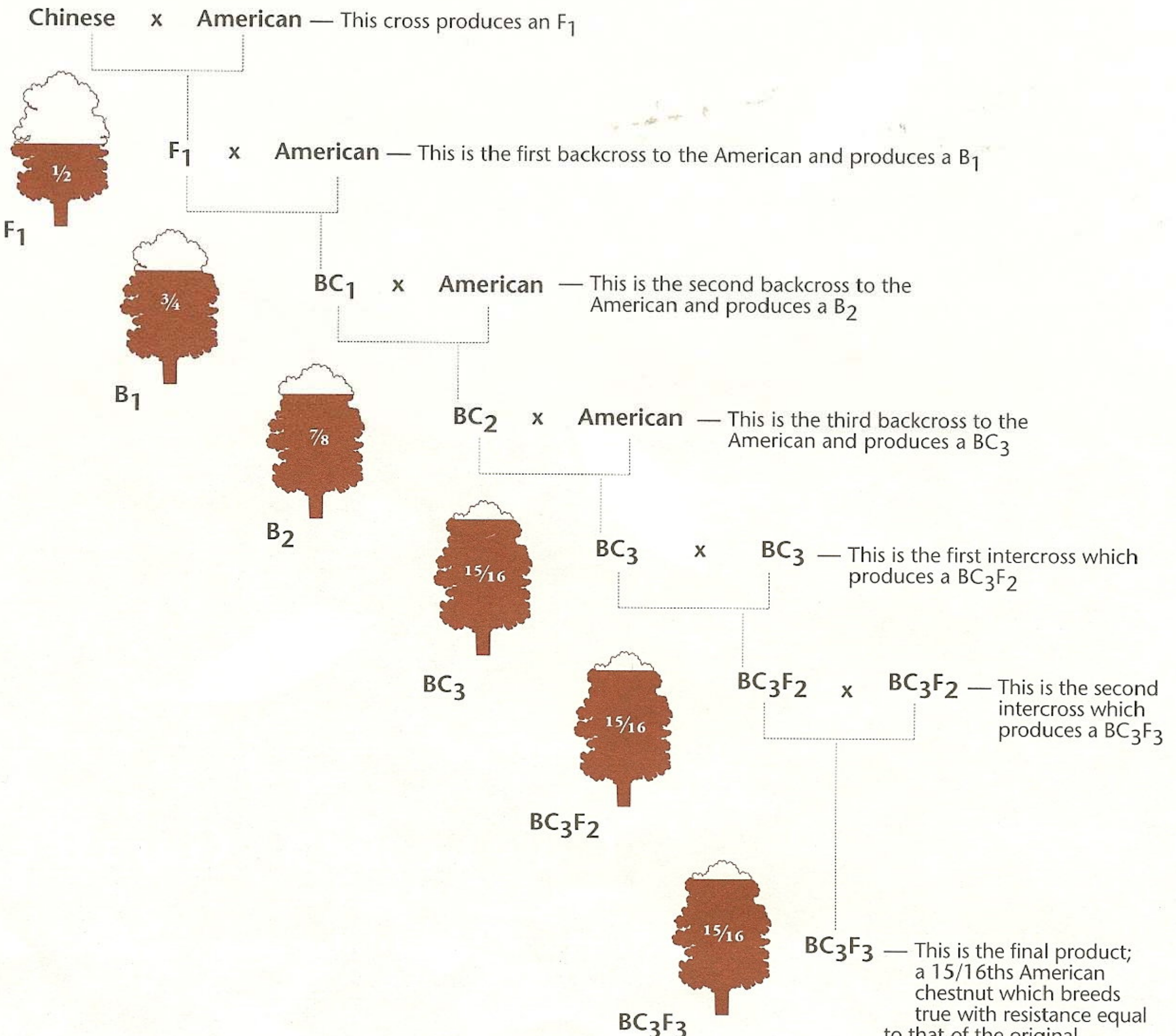
Weidlicl1, W.H. 1978. A preliminary report on a method of biological control of the Chestnut blight not involving the use of a hypovirulent strain of *Endothia parasitica.* In: Proceedings of the American Chestnut Symposium. Eds. W.E. McDonald, F.E. Cech, J. Luclok, and e. Smith. West Virginia University Books. Morgantown, West Virginia. Pgs. 79-83.

Castanea Guide

An Insiders Guide to the American Chestnut And TACF Science

THE AMERICAN CHESTNUT FOUNDATION'S BACKCROSS BREEDING PROGRAM

With each cross, additional American chestnut characteristics are regained. Only at the final cross, however, is blight resistance equal to that of the Chinese parent again reintroduced.



Note: In each step, the Backcross is selected for resistance.
Trees indicate fraction of American genes.

The American Chestnut Foundation is incorporated in the District of Columbia. It is exempt from tax under §501(c)(3) of the Internal Revenue Code, and is qualified as a public supported organization under §(a)(1) and §170(b)(1)(a)(iv) of the Code. Donors to The American Chestnut Foundation may deduct contributions as provided in §170 of the Code.

The Journal of The American Chestnut Foundation is published twice a year by The American Chestnut Foundation. Submissions to *The Journal* are solicited from members and others interested in the history and future of the American chestnut tree. Letters and manuscripts to be considered for publication in *The Journal* should be sent to:

Editor
The Journal of The American Chestnut Foundation
P.O. Box 4044
Bennington, VT 05201-4044

THE AMERICAN CHESTNUT FOUNDATION

469 Main St., P.O. Box 4044
Bennington, VT 05201-4044
www.acf.org

Enclosed is my membership support of:

❒ $1000 Gold Leaf

❒ $500 Silver Leaf

❒ $250 Bronze Leaf

❒ $100 Green Leaf

❒ $40 Regular Member

❒ $15 Student

❒ Other $___

(We would be happy to talk to members regarding their philanthropic interests including major gifts, memorials, and endowments.)

Please make check payable to: *The American Chestnut Foundation.*

Name ______________________________

Address ______________________________

City/State/Zip ______________________________

Telephone ______________________________

E-mail address______________________________