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PRESERVING CHESTNUT MEMORIES

Are you one of the fortunate few who was around to witness the majesty of forests full of towering chestnut? Or perhaps you have a parent or grandparent who regaled you with stories that featured this mighty giant? Whatever your story, we want to hear it! Please send articles you would like to be considered for publication to:

TACF Publications Director
The American Chestnut Foundation
469 Main St., P.O. Box 4044
Bennington, VT 05201
Or e-mail publications@acf.org.

Are you more the talkative type? Please let us call you to record your story. You can leave your name and telephone number with our main office, at 802-447-0110.

FROM THE EDITOR

I have recently been reviewing the keynote speech from our 2005 annual meeting, in which President Case recounted 22 years of the trials and tribulations of The American Chestnut Foundation. It is amazing to follow the course the Foundation has taken, and more amazing to think that we have come so far in "only" 23 years. What is important to remember, however, is that our work began where others' work left off. Without the contributions of "chestnut pioneers," including the extensive work done by the USDA, several chestnut blight commissions, and experimental stations including the Connecticut Agricultural Experiment Station--still in the chestnut research business today—the successes of TACF could not have occurred.

Although those efforts were largely unsuccessful, they laid the groundwork for those who came after—our founder, Dr. Charles Burnham, in particular. This issue of *The Journal of The American Chestnut Foundation* is dedicated to those early pioneers, and in it we will introduce the men who gave their names to the two founding lines of TACF's breeding program, Arthur Harmount Graves and Russell B. Clapper.

One of the pleasures of my role as editor of *The Journal of TACF* is receiving stories from our readers about their memories of the American chestnut tree. In this issue, I have included a letter from a Georgia member that captures the memories of her 83-year-old neighbor, Oliver Holloway. A second inclusion, *Chestnut Dreams*, written by Pennsylvania member Dan Snyder, gives us a hopeful glimpse of some "memories" from the future in 2070.

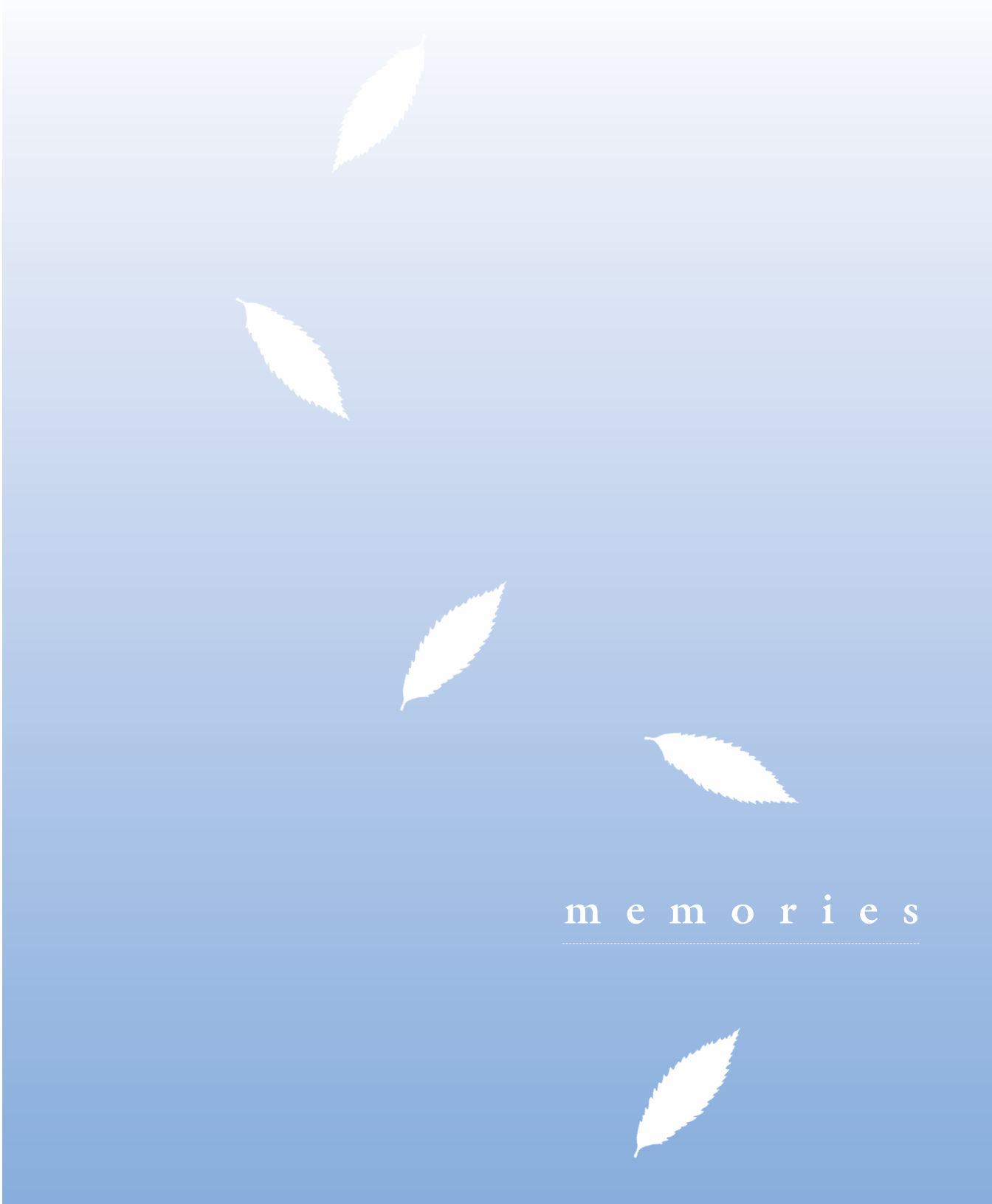
In early 2006, I received a thoughtful letter from Mr. Richard Johnson, former forester at the Crab Orchard National Wildlife Refuge in Carterville, Illinois, where the original Clapper line was established. A picture of Mr. Johnson alongside B26:3146, a. k. a., the now-famous 'Clapper' tree, is included in our *From Then to Now* section, along with excerpts of *Diary of the Clapper Tree* from our Summer 1997 *Journal of TACF*, in which Mr. Johnson—while still active in his work at the Crab Orchard Refuge—shared seeds from the tree's last harvest. First, however, I will allow Mr. Clapper to introduce himself, through his *A Promising New Forest-Type Tree*, written in 1963 for the *Journal of Forestry*. Last in *Then to Now*, Dr. Bill Lord pays tribute to Arthur Harmount Graves in *Old Soldiers Never Die*.

In our *Science and Natural History* section, we are please to announce the first installment of the *Regional Breeding and Science Report*. An extension of the *Notes from Meadowview*, presented in each fall issue by Dr. Fred Hebard, the *Regional Report* will appear annually in the spring *Journal*, and will update our members on the work being accomplished in our chapter programs.

Finally, in *The Chestnut Plantation at Sleeping Giant: the Legacy of Arthur Harmount Graves*, Dr. Sandra Anagnostakis, of the Connecticut Agricultural Experiment Station, details the roots of TACF's breeding program, as it was begun by Graves at the plantation.

By the way, I got a good laugh out of commentator Willem Lange's description of our journal in a November issue of *The Times Argus* and *Rutland Herald*, in which he states, "With my rifle across my knees, I've been reading (with as few movements as possible) some fairly esoteric stuff: *The Journal of (T)he American Chestnut Foundation*. It describes the efforts of the foundation to develop blight-resistant strains and restore the American chestnut to North American forests. If they ever get it right, I'd love to plant a few dozen in this part of the woods."

Let's hope we can accommodate him soon! You can read the whole commentary at our newsroom, www.acf.org/tacfinnews. Scroll down to November 2006.


memories

July 2006

I am writing for an elderly man, Oliver, who does yard work for me. He is 83 years old and can outwork almost anyone half his age. He is part Cherokee and grew up in the woods, living off the land. Oliver remembers:

> He was 5 or 6 years old maybe, "old enough to get around on your own." He remembers being up in Union County, Georgia (Northern Georgia) and there being lots of chestnut trees. His older cousin would find the trees that he could climb. He would get up there and start shaking the tree. Oliver would be on the ground ducking because the burs would hurt. They would look for the ones that were popping out, open them, and eat them raw. He said they were good. I asked if they ever cooked them and he said that they boiled them. He remembers the trees being between 14 to 24 inches in diameter. He said his uncle made money selling the bark from the dead chestnut trees. His Uncle Joe would gather the bark in a wagon and bring them somewhere in NC where they would use the bark for tanning cowhide. And he remembers them dying.

Oliver loves trees and although sometimes he does not remember the proper names, he knows them all by bark and leaf. We work in the woods a lot together, and he tells me the many ways the different plants and trees are used, from toothbrushes with the Black gum tree to cooking and eating Poke Salad.

Oliver Holloway served in the army during WWII, raised two children, and, in his younger days, worked as a lumber man. He cleared a lot of what is now Lake Lanier.

Oliver is the reason I joined The American Chestnut Foundation.

Christine Holcomb
Georgia Chapter Member

Christine Holcomb & Oliver Holloway

CHESTNUT DREAMS

By Dan Snyder, Service Forester, Gallitzin (PA) Forest District

Originally published in the May/June 2006 issue of the Pennsylvania Forest Steward News

It is the second week of the Pennsylvania deer season, 2070, and Joe is hunting in a remote section of the State Game Lands 108 in northern Cambria County, PA. A chilly December wind teases the back of his neck as he peers through the scope of his immaculately-maintained 2005 Browning rifle. Not much for the fancy new magnum calibers, Joe sticks to the time-tested standard of deer hunters throughout Pennsylvania, the good old "Thirty-Ought-Six."

The fat eight-pointer on the bench below is unaware of Joe's presence. As he hunkers in his rocky blind just below the crest of the ridge, the deer munches hungrily on the shiny brown chestnuts that cover the forest floor. The buck raises his head to test the wind; Joe's Browning barks, and the deer falls.

As he picks his way down the slope to his fallen prize, Joe reflects on his good fortune, and marvels at the many small miracles that led to this moment. Joe is lucky, yes, but other factors are at work here. The bushels of American chestnuts that the deer was feasting on were gone from Pennsylvania's forests for over 100 years. Thanks to dedicated volunteers, and a backcross-breeding program initiated in the 1930s, the American chestnut was brought back from the brink of extinction to become a major species in our eastern forests once again.

A dedicated volunteer for the Pennsylvania chapter of The American Chestnut Foundation, Joe spent countless hours of his free time helping with pollinations, inoculations, planting, harvesting nuts, and a whole host of chores associated with the chestnut breeding

program. Now, just days away from his 75th birthday, he rejoices in the buck, and the fact that the forest is once again providing the critical mast crop that was missing for so long.

After nearly 80 years of effort, and the dedication and hard work of hundreds of volunteers like Joe, the blight-resistant American chestnut trees on this bench were planted in 2020 in cooperation with the Pennsylvania Bureau of Forestry, Penn State University, and the Pennsylvania Game Commission. The program involved site selection, harvesting existing overstory trees, direct seeding and planting of chestnut seedlings, and installing deer fencing to protect the young trees from browsing. The trees grew rapidly and, after just 30 years, began to produce a reliable crop of nuts every fall. These trees will easily reach three to four feet in diameter at maturity, and will provide valuable timber products in addition to their wildlife food. Deer, turkeys, grouse, squirrels, black bear—almost every kind of game animal—feed on the nutritious nuts, and the health and vitality of Penn's Woods moves up another notch.

As Joe crouches beside the fallen deer, a spiny chestnut bur pokes through his thin cotton glove and pierces his finger. Joe just smiles—he knows that every good thing has its price.


from then to now

A PROMISING NEW FOREST-TYPE CHESTNUT TREE[1]

JOURNAL OF FORESTRY BY R.B. CLAPPER

Abstract. Of the thousands of forest-type chestnut hybridizations attempted by the U. S. Department of Agriculture, the most promising seems to be an American X Chinese backcrossed onto an American. This hybrid appears to posses all the fine qualities of our American species, plus the blight resistance of the Chinese species.

Every plant breeder hopes that eventually one or more of his selections or hybrids will turn up with all the characteristics he had sought in his breeding. The writer, with various assistants, carried on chestnut breeding work in the former Division of Forest Pathology, U.S. Department of Agriculture in 1925-1949. The objective during the first several years was to develop blight-resistant chestnut trees. and to accept whatever favorable Characteristics, such as productivity, nut quality, and tree form that the hybrids displayed. It was thought that the proper way to obtain these new blight-resistant hybrids was to cross the blight-resistant oriental species of chestnut (*Castanea mollissima and C. crenata*) with each other and with a few thriving hybrids developed by Walter Van Fleet.

From 1932 to the present we have concentrated more on using the blight-susceptible American chestnut (*C. dentata*) as one parent, and the Chinese chestnut or the cultivated variety of Japanese chestnut as the other parent. Various American chestnut sprouts were available in the vicinity of Glenn Dale, Md., where most of this work was carried on. In the first-generation offspring from these crosses, we looked for high blight resis-

[1] The author, a plant pathologist and chestnut tree breeder, had a leading role in research projects that in the period 1925-1948 developed more than 10,000 chestnut and chinkapin hybrids for the U. S. Department of Agriculture. Since his retirement in 1953 he has maintained his interest in chestnut tree hybridization and has published a 200-page book, Glossary of Genetics.

tance, rapid rate of growth, and forest-tree form.

One fortunate combination of parents used in 1932 was a Chinese chestnut, M16, P. I. 34517, introduced from Tientsin, China, in 1912, and an American chestnut sprout growing in the woods near the test orchard. The first generation trees were uniformly upright and rapid-growing. All were attacked by the blight; some of them died, no doubt from a combination of blight, poor soil, and close planting. However, three or four trees survived these unfavorable conditions until the test plot was abandoned in 1955.

In 1935, we used the same Chinese parent, M16, in combination with another American chestnut that consisted of multiple sprouts from an old stump growing on a private lawn. This parent, FP. 555, grew in the open and was about 300 feet from one of our chestnut test plots. The first-generation hybrids from this cross were uniformly more blight-resistant, and showed better tree form and a higher growth rate than the previous hybrids.

After 1935. we crossed this American chestnut with selections of the Chinese chestnut which had recently been introduced in the form of scions, in the hope of finding still more promising first-generation hybrids. The breeding work was abandoned before these hybrids could be evaluated.

To obtain increased blight resistance in the Chinese-American hybrids, we backcrossed the first-generation trees to various selections of the Chinese chestnut, including the tree M16. Blight resistance in the backcross generation was generally increased to that of the Chinese parent trees; tree form was poor to good, and rate of growth was less than in the first-generation trees.

In 1946 we backcrossed some of the first-generation hybrids to the American chestnut, FP. 555, using the latter as a pollen parent as well as a pistillate parent. The object was to compare the blight resistance, growth rate, and tree form of these backcross-generation trees with similar traits of the backcrosses to the Chinese parents. The writer transferred to other work in Florida in 1948, and did not observe the later development of these hybrids.

In 1947-1955, Jesse D. DiIler, formerly of the Division of Forest Pathology and now of the Forest Service, established chestnut and hybrid chestnut test plots within forested areas from Arkansas to Maine and from Alabama to Michigan. Included in each plot were various chestnut hybrid seedlings from Glenn Dale, Md., and from Hamden, Conn. (Hybrids from the latter place were made by the late Prof. A. H. Graves.) Also included were seedlings of the Chinese chestnut, mostly of the introduction P. I. 58602.

In the summer of 1963, Dr. Diller and the writer inspected most of these plantings and recorded the d. b. h., and other significant data for each of the best 25 trees in each plot. We were pleasantly surprised to find in the test plot near Carterville, Ill., the largest, blight-free, forest-type hybrid either of us had ever seen (Fig. 1).

FIG. 1. Chestnut Hybrid is blight-resistant after 17 years.

This tree, B26:3146, measured 7.3 inches d. b. h. and 45 feet in height—an increase in d. b. h. of 0.43 inch per year and an increase in height of nearly 2 feet 8 inches per year since the cross was made in 1946—(M16 *C. mollissima* X FP. 555 *C. dentata*) X FP. 555.

We saw no burrs on the tree or on the ground. However, natural reproduction of a chestnut hybrid, forest-type tree such as B26:3146 is of small concern; more important are its high degree of blight resistance, rapid growth rate, and excellent tree form. Certainly, a tree of such high quality as this one should be vegetatively propagated so that it may be established in forest plots under various climatic and soil conditions. However, the tree is still young, and overly enthusiastic cutting of scion wood at this time might jeopardize its growth and life.

The writer has no explanation why this hybrid, whose putative parents are a first-generation hybrid (*C. mollissima X C. dentata*) and the same individual *C. dentata* as the other parent, should display such an apparently high degree of blight resistance after 17 years, and where blight is present in the plot on at least one other tree. Also, there was nothing about the site environment to account for its rapid growth. The great growth vigor may be explained by the accumulated major genes for growth which are present in both species of chestnut involved in this cross.

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The following pages are reprinted from The Journal of TACF Volume XI. No. 1 (Summer 1997) pages 15-24.

The U.S. Department of Agriculture spent decades breeding and testing chestnuts for blight resistance before canceling the program in defeat. Although failure was the norm, for a time USDA breeders and even the general public had high hopes. Those hopes rested on a single chestnut growing at one of six research sites established by USDA plant pathologist Jesse D. Diller and others.

The tree, a Chinese/American hybrid backcrossed to its American parent, was created in 1946 at the Department of Agriculture's Beltsville, Maryland laboratories by plant pathologist Russell B. Clapper. In 1949, the tree was planted on the U.S. Fish & Wildlife Service's Crab Orchard National Wildlife Refuge in southern Illinois. The 'Clapper' hybrid, as it was eventually called, was unusually vigorous and, despite the presence of the blight in the research plot, strangely safe from infection. As you will read in the following history of the tree drawn directly from the Crab Orchard files, it was not, however, in the end resistant to the blight fungus, although scions collected from the tree still live. In 1996, 'Clapper' clones were part of the parentage of more than 11,000 nuts harvested at The ACF's Meadowview research farms.

Thanks to refuge forester Tom Palmer for sharing the Crab Orchard chestnut files. And thanks to the editor's father, Harry E. Stiles, former Crab Orchard refuge manager since retired from the Fish & Wildlife Service, whose idea this story was.

Crab Orchard National Wildlife Refuge was established in 1947 and covers some 43,000 acres not far from the confluence of the Mississippi and the Ohio Rivers. The refuge is part of the Mississippi flyway, and hosts upwards of 120,000 Canada geese each winter. Like the Clapper tree, this editor found it a great place to grow up. Readers might find it a great place to someday visit.

MARCH 1949

9

The request for a research location went first to nearby Southern Illinois University. Notice how researchers defined the perfect chestnut planting site.

from Dr. Jesse D. Diller, plant pathologist, USDA to Dr. Lowell Tucker, Southern Illinois University (SIU), Carbondale, Illinois

The Division of Forest Pathology is interested in establishing approximately 100 blight-resistant hybrid chestnuts in an experimental plot in southwestern Illinois.

... The hybrid chestnuts are trees ranging from 1- to 4-feet in height, and would be furnished by the Dept. of Agriculture and by Professor A. H. Graves.... At various and sundry times we would inspect

these planted trees, take growth measurements and other pertinent data regarding them, and furnish the University with reports on our findings.

...The University would have to furnish a suitable planting site of approximately 0.4 acre, preferably a pole-sized, fully stocked stand of the following hardwood species: yellow poplar, northern red oak, white ash, dogwood, mulberry, American elm; lesser woody species such as papaw or spicewood; and the following herbaceous species: maidenhair fern, bloodroot, Solomon's seal, May apple. Such an association of plants is usually found in a protected site, as at the head of a draw, or slight ravine, generally on a north or northeast aspect, with a slope of 5 to 15%. The University would have to under-plant the pole-sized over-story trees with the chestnut planting stock (10 by 10 spacing), then girdle all woody growth five feet in height or taller. After furnishing the Division an establishment map, showing the location of every planted chestnut tree, the University's responsibility would be completed.

MARCH 1949

16

When no University site would do, the refuge agrees to cooperate.

from the refuge manager to the Fish & Wildlife Service regional director, Minneapolis

...Mr. Diller made an inspection of University-owned lands near the college and was unable to find the soil cover and planting type desired by the USDA for this rather specialized planting. Messrs. Tucker and Marberry of the University then brought Mr. Diller to the refuge.

... Mr. Diller was very much pleased with one site.... The site involved would occupy 0.4 of an acre in a 10-acre mixed hardwood stand.

...It is the recommendation of this office, in the encouragement of research, to go along on this experimental project.

The first batch of seedlings is delivered.
From J. D. Diller's office to Dr. Lowell Tucker, SIU

MARCH 1949
18

In accordance with the enclosed wire ... [we] are shipping you today 75 Chinese chestnut trees for an experimental planting in accordance with arrangements made by Dr. Jesse D. Diller.... Dr. Diller's instructions left with us were to the effect that you are to plant three of our chestnuts and then one of Dr. Graves', and continue on through the planting in this way...[*Arthur Graves of the Brooklyn Botanic Garden and, later, the Connecticut Agricultural Experiment Station, contributed a great deal of material to the USDA breeding program.*]

These two lots of trees include some of the more promising hybrids from Mr. Clapper's breeding work and from Dr. Arthur H. Graves' breeding work, and we hope that the planting will turn out well.

A report on the progress of the trees.
From J. D. Diller's field notes on the 1949 Crab Orchard plot

NOVEMBER 1952
16

15 Best Trees	
Tree #	**[Tree code]**
[B]26	RBC-3146

An update on the tree's progress four years later.
From a note to the refuge file

MARCH 1956
21

Twenty Five Best Trees in Hybrid Chestnut Plots		
Tag no.	**DBH**	**Height**
26	1.2"	13'

JANUARY 1959
12

About three years later, another progress report on B26.
From the refuge manager to Albert G. Snow, Jr., US Forest Service

The attached measurements were taken on January 9, 1959. Several of the larger trees produced a crop of nuts this year.

Tree Tag No.	d.b.h. (inches)	Height (feet)
B 26	3	30

JULY 1962
1

This next correspondent , who visits the tree for the first time thirteen years after it was planted, will eventually save the Clapper for posterity.
From Dr. Richard A. Jaynes, Connecticut Agricultural Experiment Station, to the refuge manager

I am planning a trip out to the Northern Nut Growers Meeting in Evansville… and would like to visit the Hybrid Chestnut Plot established at Carterville in 1949. As you are probably aware, approximately fifty hybrids developed at the Connecticut Station were included in this plot.

FEBRUARY 1963
5

Jaynes requests scions for the Connecticut Experiment Station.
From Richard A. Jaynes to Dr. Ernest Kurmes, Department of Forestry, SIU:

... Could you send me scions from three or four of the best trees in the hybrid plot? My notes indicate that B26 and B59 are two of the best trees. Four seven-inch sticks from each tree would be fine.

FEBRUARY 1963
18

The scions are safe.
From Ernest Kurmes to Richard A. Jaynes:

I have checked with the refuge personnel, and they will be happy to have me collect scions and take measurements on the hybrid plot...To that end I have already collected scions from four trees on the plot, as you requested...

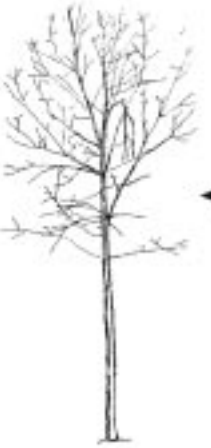
B26 is, of course, the outstanding tree on the plot. The other three are considerably smaller but of good form and not cankered.

News of encouragingly vigorous B26 goes out to the world.
from a Forest Service press release

NOVEMBER 1963
29

During August and September 1963, R. B. Clapper and J. D. Diller inspected 12 of the 15 hybrid chestnut test plots established during the period 1947 to 1955...

The largest, blight-free, forest-type hybrid, B26:#3146 USDA, occurs in the test plot near Carterville, Illinois. It is an American x Chinese backcrossed on to an American; the cross was made by R. B. Clapper in 1946. After 17 growing seasons, this tree measured 7.3 inches d.b.h. and 45 feet in height — an increase of 0.43 d.b.h. per year, and a height of nearly 2 feet 8 inches per year. It apparently has a high degree of blight resistance, as chestnut blight is present in the plot.



◀ The November 1963 Forest Service press release included a drawing of the then 45-foot-tall hybrid chestnut.

One of the first references to the "Clapper" tree rhymes, but Longfellow it isn't!
from an article on the Clapper tree entitled "Chestnut Coming Back Strong" in the Herrin, Illinois Spokesman

AUGUST 1964
22

...While the village blacksmith may never return, hybridized or otherwise, the imminent revival of the tree undoubtedly will uncork a rash of parodies on a poetic classic that already has been parodied to death. So we offer the first:

Under the Clapper's chestnut tree
The refuge turkey stands
A strong and husky bird is he
With hybrids in his glands.

SUMMER 1968

The last entirely good news.

from notes on a survey of B26 by a refuge employee

1) good crop of burs
2) 11.3" diameter...
3) 63' height...
4) some damage by leaf cutter or miners on lower leaves - not serious. No sign of blight that I could see.
5) overall appearance - very good

OCTOBER 1968

22

The first bad news.

from the acting refuge project manager to J.D. Diller

It is my sad duty to tell you that the Clapper chestnut, B-26, shows definite signs of blight infestation....

I can appreciate your disappointment as we all had high hopes for this tree. We will continue to observe the tree and report any changes to you.

MAY 1969

14

There is still hope.

from the refuge project manager to J. D. Diller

We are happy to report that the Clapper chestnut is in full leaf now and appears to have the vigorous health that it had last year at this time. The blight symptoms are still evident but show little, if any, increase in either area or vigor. We sincerely hope this favorable trend continues.

OCTOBER 1970

8

Back East in Connecticut, 'Clapper' scions rescued in 1963 produce seed.

from Richard A. Jaynes to the refuge forester

... I had a graft of Clapper produce about 20 burs this fall.

An update on blighted B26.
from the refuge forester to Russell B. Clapper

OCTOBER 1971
4

...Although the blight damage is becoming more noticeable, the Clapper (B-26) is still looking good. It now measures 13.0" DBH and 68' tall, compared to 12.5" and 66' a year ago.

Though blighted, B26 continues to put on girth and height.
from the refuge forester to Robert P. Clapper [Dr. Clapper's son]

MAY 1974
2

I will be leaving shortly for a new assignment...One of the jobs I will miss most at Crab Orchard will be working with the chestnut plots and with #B-26, the Clapper Chestnut. It has been a pleasure and a privilege to have been a part of its history.

I checked the tree today. B-26 does not seem to be as extensively leafed out as in past years. There also seems to be a greater lower limb loss than I have noticed before. And for the first time, there is quite a lot of bole leafing taking place. I don't know whether or not these conditions are significant or just normal responses to the severe weather fluctuations experienced here since February...

The main stem succumbs.
from refuge forestry technician to Robert P. Clapper

JANUARY 1977
27

Because of your past interest in the Crab Orchard Refuge B-26 Clapper chestnut, you may be interested to learn that the tree is dead.

In the spring and early summer of 1976 the foliage showed that the tree was dying, and by late fall it was dead. There are, however, live sprouts at the base of the tree, and we are thinking of removing the tree and later selecting the best sprout to see how long it will survive.

The last entry in the refuge file, thirty-two years after the first.

LAST ENTRY

Chestnuts alive as of 12-8-81 [in chronological order]
B1 (151B44), B22 (147B44), B23 (4546), B27 (145B44), B43 (4944)

ROY J. OWEN'S LETTERS ON THE CLAPPER TREE

After news of the Clapper tree appeared, the Crab Orchard chestnut file began to fill with letters from landowners interested in growing some of their own Clapper progeny. The most moving pieces of correspondence were those between Roy J. Owen of Terre Haute, Indiana and Richard Johnson, then refuge forester. We tried to track down Mr. Owen's descendants, with no success. We hope that if they do read his letters, which we print admittedly without permission, they'll see them as a tribute to an obviously wonderful man.

FEBRUARY 1973

To the Postmaster (Carterville, Illinois)

I am writing you, as the only person whom I could think of for a little information.

I was looking through some old magazines yesterday, and in a 1965 magazine I came across a story I had read and was much interested in (but the magazine was misplaced and I had forgotten it).

The story was in regard to the activities of two scientists from the East, Dr. Jesse Diller and Russell B. Clapper, who had undertaken through cross-breeding, etc. to produce a strain of chestnuts which would be immune to the chestnut blight which had killed all the chestnut trees in the U.S.A.

... This story said these two fine men had planted one of their young trees close to the shore of Crab Orchard Lake near Carterville, and that the young tree, 18 years old, was 45 feet tall, and perfectly healthy, and was making a beautiful spreading top.

Now I would like to make a trip to your city to see this tree if it is still alive and healthy. Maybe I could make arrangement to get some seed and see some trees growing again on my premises before I leave this world. I am 84 years young.

Roy J. Owen

FEBRUARY 1973

Dear Mr. Owen:

Thank you for your interesting letter. Although it has a bad case of blight, the Clapper chestnut is still with us and doing remarkably well.

I'm enclosing a map of the refuge and some spare literature describing the hybrid chestnut planting program for you.

I also happen to have a few nuts from the Clapper that I will send to you within a few days. These nuts were gathered last fall and have been refrigerated all winter. They should be germinated in …

I hope you have good luck with the seedlings. If you should decide to visit us to see the Clapper, please let me know by mail a few days ahead. I will be happy to show it to you.

Richard J. Johnson
Refuge Forester

MARCH 1973

Dear Mr. Johnson:

I was amazed and overjoyed to receive today the precious chestnuts from the famous Clapper tree. A week ago I had thought if I could ever receive a few nuts from this famous tree it would not be before fall, and then not without a lot of red tape, etc. Imagine if you can how I felt this p.m. as I planted the little beauties, seven of them, in six-inch pots, and buried them in a cold frame. If they had been diamonds or gold nuggets I wouldn't have enjoyed it more.

… I expect to grow seven young trees, and have the location picked out for them, and hope to make a grove out of them. It is fertile ground and has plenty of sun. If they do well (and I expect them to), they will be named the "Richard Johnson" grove, for the fine man who made this possible.

Roy J. Owen

SEPTEMBER 1973

Dear Mr. Owen:

I managed to cheat the squirrels out of 25 nuts from the Clapper today and am sending them to you. Sincerely hope that you have good luck with these. Would be interested in your results.

Richard J. Johnson
Refuge Forester

OCTOBER 1973

Dear Friend:

This is to acknowledge receipt of the Clapper chestnuts, which arrived in good condition. I thank you for being so kind to me.

Do you know life is a strange thing? Here I am 85 years old, and I have met - no, not met, I should say have had dealings with a fine man like you, who if this had been years ago I am sure we would now be fast friends.

My friends are mostly all gone, and I feel sure that we will never meet in this life, but who knows, maybe there will be a place for people like you and me, who love to work with and see growing things.

Today I planted them and I hope it has been the best way. I thought if these nuts had been left for nature to care for them and they had not been eaten by squirrels, etc. they would have lain where they fell, and become covered with leaves, and the rains and snow of winter would keep them moist, and when spring came they would be ready to start to grow. Now why couldn't I try to simulate nature as far as possible?

So I enclosed them or rather wrapped some half-inch woven wire around them for protection, and buried them in a cold frame without the glass over them. Thanks again, good friend.

Roy J. Owen

p.s. I will write you in the spring about how they went through the winter. If anything should happen to me, my grandson, who is familiar with this, will take over.

Last hope for the variety

Crab Orchard Refuge cherishes chestnut tree

By Pete Brown
For The Southern Illinoisan

"Under the spreading chestnut-tree
The village smithy stands;
The smith a mighty man is he
With large and sinewy hands."
- When Henry Wadsworth Longfellow wrote "The Village Blacksmith" in 1842, the American chestnut tree was as cherished a part of the national landscape as the blacksmith himself.

Elegant, stately, its tapering, 80 to 100-foot trunk crowned in spring with ivory blossoms, the chestnut was regarded as a Provider — of shade, food, timber, and plain old visual delight.

Harnesses were produced with chestnut vegetable tannin and practically all the early telephone poles were made from chestnut. The trees proliferated in the billions.

But in 1904, a mysterious fungal blight struck the prize chestnuts at the New York Zoological Garden. No one knew it at the time, but the disease had arrived in the U.S. with a load of imported trees from China.

The sickness spread like the bubonic plague and was equally as devastating. In 40 years time there were only a few hundred remaining chestnuts in America. They all died before reaching maturity and their survivors were cut down from infancy.

There is one American chestnut that may become the most distinguished tree in the land.

It was put there with its brothers by Russell Clapper, a scientist and chestnut lover who with former U.S. Forest Service official Dr. Jesse Diller led a long campaign to revive the chestnut.

Clapper bred more than 10,000 hybrids over a period of coming

In this 1973 article from the *Southern Illinoisan*, Forester Richard Johnson measures the 'Clapper' tree. Asked what was his first order of business for the 44,000 acre refuge, he answered, "I got out the Clapper chestnut file. I wanted to be sure that tree is well taken care of.

OLD SOLDIERS NEVER DIE

By Dr. William Lord

When our soldiers die in combat, we vow that their sacrifice will not be in vain. Historians describe campaigns in hallowed tones lest we forget. Arthur Harcourt Graves was a soldier who campaigned with the armament of a plant breeder to defeat the blight and produce a blight-resistant, timber-type chestnut tree. He made progress, but final victory eluded him.

Graves sought to replace the American chestnut rather than to resurrect it. He observed the different species of chestnut and sought to combine specific traits to produce the desired trees. To produce a timber-type chestnut, he worked primarily with the Japanese, Chinese, and American species.

Graves arrived on the chestnut horizon in 1910, a total Yale man; graduate, PhD, and now a professor at the Yale School of Forestry. The blight had spread into Connecticut from points of origin in and around Long Island, New York, and grabbed the attention of the 31-year-old professor. He became a campaigner for the chestnut for the rest of his life.

Graves was an early motorcycle enthusiast and found cycling an ideal way to cover the country side. He could leave the road and traverse lanes and paths no Model T would dare. He reconnoitered areas around his Connecticut acreage and observed the blight invader decimating the chestnut.

In 1911, F. W. Rane, the State Forester of Massachusetts, arranged to have Graves do a motorcycle chestnut reconnaissance. Graves scouted the entire state, June through August, and found the invader to be more prevalent than anyone had realized (PA Blight Commission, 1912).

In February 1912, Graves attended the Pennsylvania "Conference for Preventing the Spread of the Chestnut Bark Disease," in Harrisburg. The principal speaker from Connecticut was George P. Clinton. The Pennsylvania hosts had recently begun an ambitious program to combat the blight and were seeking to construct a concerted attack, involving all the chestnut states from Maine to Georgia. Clinton demurred. The blight was so omnipresent in his state that combat was not an option. He believed that the blight was a normally harmless fungus that was opportunistically pillaging a tree weakened by an unnatural sequence of severe

winters and droughts. The chestnut would recover with the return of milder weather (PA blight Commission, 1912).

The PA Blight Commission produced a series of bulletins describing the Blight and the work that was being done in an effort to contain the fungus.

Whether or not he agreed with his chief, Graves made no comment published in the transcript of the conference. He did comment on a Pennsylvania proposal to stop the spread of the invader by eliminating all chestnut trees within a 10-20 mile-wide zone bordering the main line of advance (Metcalf & Collins, 1911). He also mentioned his motorcycle scouting with deserved pride. "If this sort of work is going to be taken up by the State, it seems to me it would be a good plan to delimit all areas which contain no chestnuts. I have the honor, Mr. Chairman, to be the gentleman who went through the State of Massachusetts on a motor cycle ... and I found a great many areas there which had no chestnut at all, and some such areas I am sure occur in Pennsylvania, so if you are going to take up this method, it seems to me such areas ought to be marked out and then start west of those" (PA Blight Commission, 1912).

In this regard, Graves had not motorcycled through Pennsylvania. Chestnut was present in every county. The buffer zone was partially cut, but then abandoned because the blight had already jumped over it. The blight was so overwhelming in its advance that the Blight Commission stopped field operations in 1913 (PA Blight Commission, 1912 & Carleton, 1913).

In this photo (Figure 1), the two-year-old John's Creek tree shows a "normal" canker, with no swelling. The second photo, the Skulls Gap survivor, shows a large, swollen canker which will take much longer, if at all, to kill that tree than the canker in the John's Creek photo.

From the onset of his call to duty, Graves was ever on the lookout for the appearance of trees showing resistance to the blight. In 1918, a bright hope faded. "About 75 trees were found situated on the island of Manhattan itself, also some near Jamaica, L. I., and some near Valley Stream, L. I., which showed unmistakable resistance to the blight ... in many cases showing Endothia cankers with healed margins, and often with swollen areas where lesions had formed on branches, indicating a struggle on the part of the host tissue to overcome and occlude the parasitic

growth. Furthermore, inoculations with the fungus in these trees showed that the parasite grew at a much slower rate than in ordinary non-resistant trees, a result which was based on data from hundreds of inoculations ... Vigorous seedlings from these trees are now growing at the USDA at Bell, Maryland ... So far, however, no especial resistance has been shown by these seedlings nor the grafts." Graves concluded that the resistance of the trees was due to their, "...favorable environment coupled with their inherent vigor, rather than any other specific inherent character of resistance." Nonetheless, "This ... does not explain the fact that the fungus when inoculated into these trees grew more slowly that in ordinary trees" (Graves, 1929). Graves never gave up the hope that resistance would occur by mutation.

ROBERT STRASSER

A more exaggerated example of blight-induced morphology

In 1929, Graves presented a paper at the 20th annual meeting of the Northern Nut Growers Association (NNGA). He reviewed intelligence acquired about the enemy and revealed his desire to engage it in the field as a plant breeder.

He noted the ability of apparently dead trees to produce sprouts from the root collar, "...the region where the trunk and roots join ... It would seem ... that the tissues of the root collar and of the roots as well, are more resistant to the growth of the fungus than the parts above the ground. Inoculations of the roots, and at the same time of shoots of the same diameter, have proved...that the growth of the fungus is much slower in the root tissues ... Just why the growth is slower here is not so clear" (Graves, 1929).

He discussed his breeding objective. "To produce a forest tree it is necessary to cross our native tall-growing and timber-producing *C. dentata* with the resistant Japanese and Chinese stock, on the chance that some of the off spring will inherit the timber-producing quality of one parent joined to the resistant quality of the other parent" (Graves, 1929).

The fifty year old Graves was itching to engage the enemy. But did he have the time? "Well, I wish I wasn't quite so old. It seems that if one had time he could get this result. It is going to be a wonderful thing when it is done, and it can be done ... and it is going to be done some day" (Graves, 1929).

Graves decided he wasn't too old and commenced his campaign to develop a blight-resistant forest-type chestnut in 1930—a mission he conducted with ever-increasing effort for 32 more years. His presenta-

tions at several NNGA annual meetings through 1949 are optimistic reports of a goal to be achieved whatever the difficulty.

Nuts were planted on his plantation on Sleeping Giant Mountain and other nearby sites in Connecticut. He began by making crosses on mature Japanese chestnut on Long Island estates with pollen from American trees provided by the USDA in Washington, D. C. These hybrids were later crossed with Chinese and with each other. The harvest was taken to the Brooklyn Botanical Garden where Graves was a curator. The seeds were planted in the fall and the seedlings then transplanted in Connecticut the following spring.

Each was surrounded with a wire cage to protect from rodents and deer. A copper tag identified the parentage (Graves, 1937). The breeding objective expanded to include "... cold or frost resistance, resistance to insect attack, quality and quantity of fruit, precocity, and prolificness" (Graves, 1937). In this regard, the genes of the European chestnut, the Allegheny chinquapin, and the dwarf chestnut were allied to the mission.

The blight prevailed among surviving chestnut sprouts in the surrounding woods and provided a "passive" test for his hybrids. Graves, however, determined blight resistance by inoculating the young trees with cultures of the blight grown in his laboratory. Each tree was inoculated for three successive years. American sprouts were inoculated as checks (Graves, 1937).

Seedling sprouting from root collar.

The blight was the principal enemy but drought and severe winters weakened the trees and their harvest. Canker worms devoured the newly emerging leaves in spring, followed by Japanese beetles. In mid summer aphids concentrated along the mid-veins, sucking the juice and causing the leaves to curl into a roll. Crowds of mites gave the leaves a distinctive grayish cast from the refuse of their molting. A pestilence of 17-year cicadas seemed to prefer chestnut for their egg laying, puncturing lengthwise slits along the outer growth. "One young American chestnut, 12' high had 14 of its branches ruined" (Graves, 1945).

Following a drought year, squirrels made ravenous for lack of acorns, gnawed off twigs bearing burs in early September, dropping them to the ground. Carrying them to a place of safety, they defied the spiny burs to devour the green nuts (Graves, 1945).

Graves described his adversities but never faltered in optimism. "For

it is the ultimate aim of this work to develop a race of tall, hardy, blight resistant individuals which will breed true and thus of themselves reestablish the chestnut tree in the forests of eastern North America" (Graves, 1947).

In 1947, he resigned as Curator for the Brooklyn Botanical Garden and applied himself full-time to his chestnut campaign in cooperation with the Connecticut Agricultural Experiment Station. This was also the year that Graves began providing hybrids for test plantings of Chinese chestnut and blight-resistant hybrids in a project headed by Jesse D. Diller of the U. S. Forest Service. In 1949, Diller approved a site at the Crab Orchard National Wildlife Refuge in southwest Illinois. The USDA and Graves each contributed seedlings.

In 1962, Richard A. Jaynes visited the Refuge and brought news home to Graves of hybrid B-26. Although it was not one of those contributed by Graves, it was blight-free after 17 growing seasons, 45' tall, and 7.3 inches in diameter at breast height (Stiles, 1977). One of the last requests Graves made before he died, on December 31,1962, was for scions from B-26; now well known as the 'Clapper' tree.

In 1989, scions from the 'Clapper' tree, and from the 'Graves' BC1 (a first backcross, descended from the Chinese tree, 'Mahogany'), were used to provide a jumpstart to TACF's breeding program at Meadowview Research Farms. Measured in years, the two generations gained the program a decade.

Graves' campaign was not a failure. He never surrendered.

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science and natural history

THE CHESTNUT PLANTATION AT SLEEPING GIANT:
Legacy of Arthur Harmount Graves

By Dr. Sandra Anagnostakis,
The Connecticut Agricultural Experiment Station

Taken in part from the 53rd Annual Report of the Northern Nut Growers Association

Figure 1. Arthur Harmount Graves at the Chestnut Plantation at Sleeping Giant in 1952.

Arthur H. Graves (1879 - 1962) was a native of New Haven, Connecticut, and earned his Ph.D. from Yale in 1907 (Fig. 1). He taught at Yale and at Connecticut College before taking the position of Curator of Public Instruction at the Brooklyn Botanic Garden in 1921. He wrote more than 200 papers on botanical subjects, many of them about breeding disease resistant chestnut trees. His "Illustrated Guide to Trees and Shrubs" (1952, revised 1956), with illustrations by Maud H. Purdy, remains a standard for tree identification. In 1914 he wrote: "The most hopeful indications for chestnut in North America in the future lie along the line of breeding experiments ... Work of this kind is extremely valuable and, although slow in yielding results, may eventually prove to be the only means of continuing the existence in our land of a greatly esteemed tree."

In 1930, Graves undertook such a breeding project, using the land that he had retained in Connecticut where he eventually planted more than 2,000 chestnut trees. This became The Chestnut Plantation at Sleeping Giant (Fig. 2). He got many trees from the U.S.D.A., planting them first on the land south of his house, and many of those first trees are still alive (Table 1, page 39). The Plantation is not a prototype of a commercial orchard. There are specimens of all of the species of chestnut, and numerous hybrids represented, and this is probably the finest collection of *Castanea* in the world. I took over the chestnut breeding project in 1983 and made new labels for the trees in the planting. This breeding program is the longest-continuing chestnut breeding project in the U.S., and many people have added and removed trees from the Plantation. Fortunately, they all wrote it down.

The Plantation is located in Hamden, CT, next to the Sleeping Giant

Figure 2. This photograph was taken in 1936, and shows young trees in the South Lot of the Chestnut Plantation at Sleeping Giant on the east side of Chestnut Lane, looking towards Mt. Carmel Ave. The small tree with bagged flowers in the foreground is *Castanea seguinii* at South Lot Row 3 Tree 8. At the far end of the second row to the right of this is 'Mahogany', Row 1 Tree 15, which was also used in crosses that year.

State Park (Fig. 3). The piece of land on the east side of Chestnut Lane, next to the Graves family house, contains the South Lot, Spring Lot, Hybrid Slope, and Chinquapin Corner (Fig. 4). On the west side of the road are the West Lot, the West Red Pine Lot, and my new planting area (Fig. 5). The trees are all recorded by lot, row, and tree with cross number and year where appropriate (i.e. SL R4T7, #86-31).

When he retired in 1947, Graves moved back to Connecticut to work full time with The Connecticut Agricultural Experiment Station on chestnut breeding. In 1949, Graves sold 8.3 acres of his land to the Sleeping Giant Park Association, who then gave it to the State of Connecticut, stipulating that the property was to be for the Experiment Station for tree breeding experiments. In 1962, Graves reported that he and his associates had made more than 250 combinations of all of the species of chestnuts, resulting in over 20,000 nuts.

Graves worked with geneticist Donald F. Jones at the Experiment Station, and together, from 1948 to 1951, they supervised the Doctoral Thesis of Hans Nienstaedt (who went on to work on pines). Richard Jaynes began working with them as a college student during the summers, and was their Ph.D. student from 1957 to 1961. Jaynes worked on chestnuts when he was hired by the Experiment Station in 1961, but also initiated a breeding program with mountain laurel that has won him international recognition.

One of Nienstaedt's 1953 crosses used a *C. mollissima X C. dentata* hybrid that was one of two seedlings from Graves' 1934 cross of the Chinese tree that he called 'Mahogany' (Plant Introduction #70315) with pollen sent to him from Bell, MD from a *C. dentata* tree called Forest

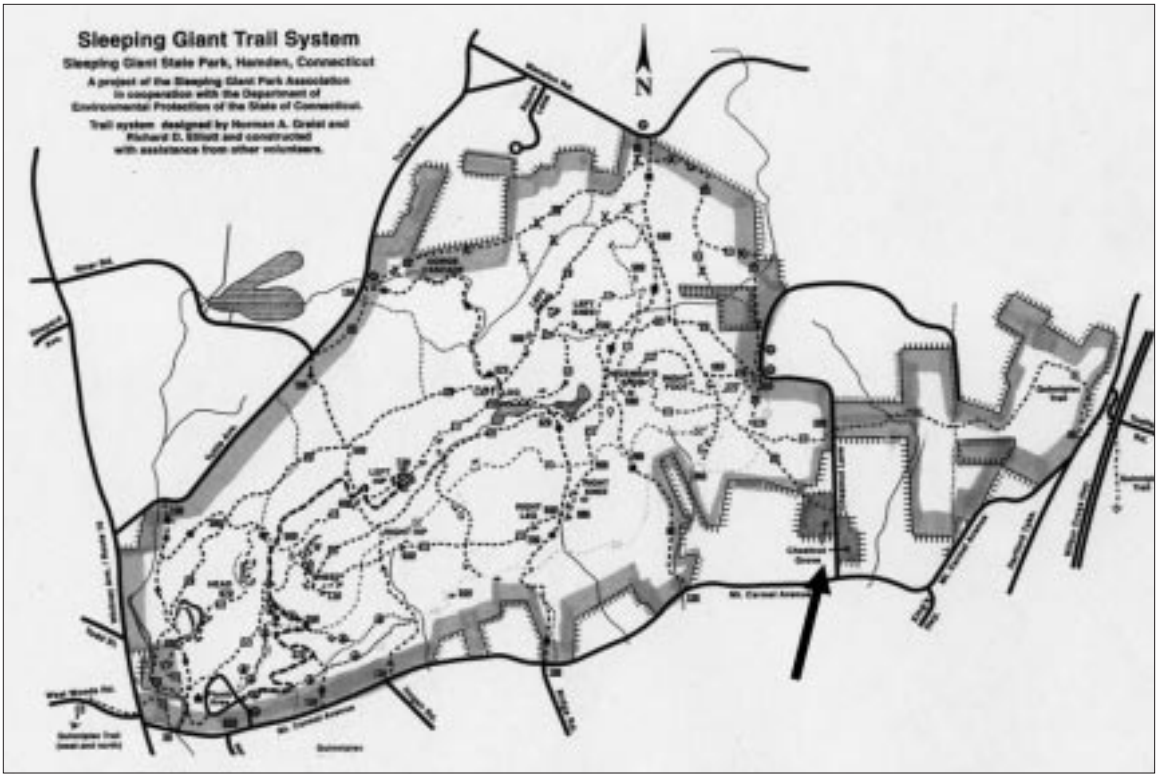

Figure 3. Map of Sleeping Giant State Park, showing the location of The Chestnut Plantation at Sleeping Giant in Hamden, CT

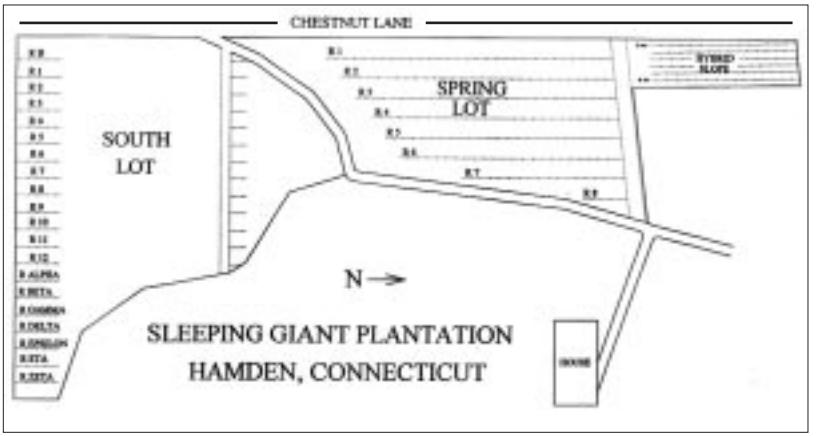

Figure 4. Map of the South Lot, Spring Lot, and Hybrid Slope at the Chestnut Plantation at Sleeping Giant

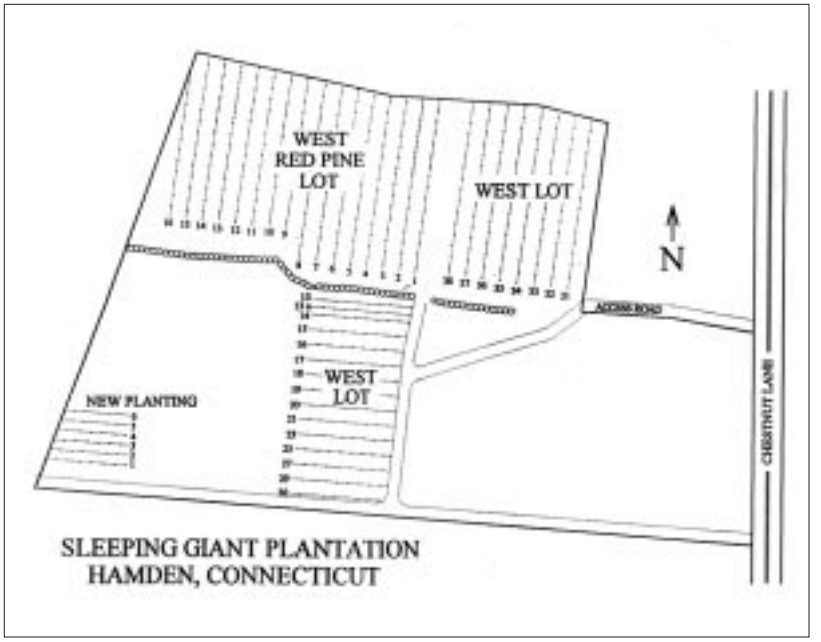

Figure 5. Map of the West Lot and West Red Pine Lot at the Chestnut Plantation at Sleeping Giant

Pathology #551. Nienstaedt used Graves' hybrid as the female parent and *C. dentata* pollen from a Mr. Bowman in Clinton Corners, NY. Of the nine resulting seedlings, one had enough resistance to survive in the West Red Pine Lot of the Chestnut Plantation. We have called the tree 'Graves', and it has been used in many recent crosses by the Experiment Station and by The American Chestnut Foundation.

Graves divided chestnuts into twelve species, and had representatives of all of them in his plantings. He released many cultivars that are still grown today for their nuts, and provided a solid basis for the continued breeding of timber chestnut trees. His hybrids and species are still being used for producing orchard and timber trees with resistance to Chestnut Blight Disease, Ink Disease, and Oriental Chestnut Gall Wasp. The Experiment Station is also using trees at the Plantation in a back-cross breeding project to move resistance genes into Ozark chinquapins (*C. ozarkensis*), because that species, native to the Ozark Plateau, is now threatened by Chestnut Blight Disease.

New trees are still being planted at the Plantation, as those which don't live up to expectations are removed. I know that chestnut workers all over

the world are aware of our plantation, but I continue to be surprised at the requests for cuttings and seeds that come in every year. The year 2001 was the busiest recently, with requests from scientists in France, Denmark, South Africa, and Turkey, and from Tennessee and Virginia in the U.S. Several hundred crosses were made this spring, in cooperation with The American Chestnut Foundation, for a study of chestnut genetics.

We are as far along as we are today because of the foresight of A. H. Graves and because the State of Connecticut chooses to support a project with a long history and great potential for the future.

Selected Publications of Arthur Graves

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TABLE 1.

Trees sent to Arthur Graves by the U.S.D.A. from the Plant Introduction Station in Bell, MD in 1929, 1930, and 1931.

1929	25 *C. seguinii*	P.I. #70317, F. A. McClure #700, Chiuhwashaan, Anhwei, east-central China, "Mo lut tsz."
	22 *C. mollissima*	P.I. #70315, hardy trees from northeastern China, seed purchased 1926 by J.H. Reisner, Nanking University
	10 *C. henryi*	P.I. #78505, Plant Introduction Garden, Bell, MD #7824, grafted (1928) plants.
	5 S-8, *C. pumila X crenata*	Van Fleet hybrid, grafted onto *C. crenata*.
1930	5 *C. crenata*	F.P. row BX, P.I. #75818, R. K. Beattie #228 and #229, from Hokkaido Imperial University, Hokkaido, wild trees growing at Ishikari, Ishiyama Province.
	10 *C. crenata*	F.P. row UU, P.I. #78004, R. K. Beattie #704 to #711, Iwate Ken forester at Morioka, from Takizawa, Takizawa Mura, Iwate Gun, Iwate Ken.
	10 *C. crenata*	F.P. row I, P.I. #78626, R. K. Beattie #748, Oguriyama, Chitose Mura, Naka Tsugaru Gun, Aomori Ken.
	10 *C. crenata*	F.P. row D, P.I. #78627, R. K. Beattie #749, Hisashi Hoden, Osawayama National Forest, Hisashi Oguni Mura, Mogami Gun, Yamagata Ken.
	10 *C. crenata*	F.P. row CC, P.I. #78634, R. K. Beattie #756, Mr. O. Ito, Hokkaido, from Makoma Nai, near Sopporo, Hokusu.
	10 *C. crenata*	F.P. row P, P.I. #78635, R. K. Beattie #757, Mr. O. Ito, Hokkaido, from Atsubetsu, Hokushu.
	10 *C. crenata*	F.P. row BB, P.I. #78636, R. K. Beattie #758, Mr. S. Kondo, Hokkaido, from Kamiteine, Teine Mura, Sapporo Gun, Hokushu.
1931	10 *C. mollissima*	F.P. row MI, P.I. #86872, purchased by Dorsett and Morse in Tokyo, Japan.
	10 *C. crenata*	F.P. row MJ, P.I #86873, called "Mammoth," purchased by Dorsett and Morse in Tokyo, Japan.
	10 *C. mollissima*	F.P. row MCH, PI #78744, Peter Liu from the Fa Hua Ssu Temple near Beijing, Hopei, called "Tiger Paw."
	3 S-8, *C. pumila X crenata*	Van Fleet hybrid, grafted onto *crenata*.
	5 hybrids	F.P. #146, Gravett #1, *mollissima* X chinquapin o.p. or possibly the Van Fleet hybrid (above).
	5 hybrids	F.P. #147, Gravett #2, chinquapin hybrid o.p.
	5 *crenata* hybrids	F.P. row M38, listed only as "*crenata* hybrid".

2006 REGIONAL BREEDING AND SCIENCE REPORT

By TACF Regional Science Coordinators:
Leila Pinchot, New England; Sara Fern Fitzsimmons, Northern Appalachian;
& Dr. Paul Sisco, Southern Appalachian

In 2006, The American Chestnut Foundation fulfilled its goal of creating three major breeding regions in the natural range of the American chestnut, each staffed with a regional science coordinator. The dual roles of the coordinators are to help state chapters in fulfilling their breeding goals as part of the TACF regional breeding program[1], and to create a more cohesive network of communication among chapters. Each chapter and region brings a different amalgam of expertise and enthusiasm to TACF. This is the first installment of what we plan to be an annual regional update.

Each of the following sections was submitted in November 2006 by TACF's Regional Science Coordinators. In New England, Leila Pinchot oversees Connecticut, Maine, Massachusetts and Rhode Island, and the Vermont initiative. Sara Fitzsimmons oversees the Northern Appalachian Region, including New York, Pennsylvania (with New Jersey and Delaware), Maryland, Ohio, and Indiana. Dr. Paul Sisco's Southern Appalachian Region includes North and South Carolina, Kentucky, Tennessee, Georgia, and Alabama. The Ozark Initiative of Arkansas, Oklahoma, and Missouri may be included in this region in the future.

Chapter members and volunteers were critical to the formation of this network. The following pages of this inaugural Regional Breeding Report are dedicated to all those throughout the TACF system who have worked to bring the Regional Breeding Program to the heights it has achieved. We hope the following report will help showcase your successes and establish a baseline for future reporting.

The tables following each regional report summarize the breeding efforts to date for TACF's state chapter-driven Regional Breeding Program. These tables do not include seed created or harvested during the 2006 pollinating season.

[1] The full text of the backcross breeding program of The American Chestnut Foundation can be found in *The Journal of TACF, 19*(2): 55-78.

2006 NEW ENGLAND REGIONAL BREEDING REPORT

Leila Pinchot, New England Regional Science Coordinator

The New England state chapters have made great progress in the past year. Cumulatively, the region created 17 B_3 lines and 10 orchards this year. Connecticut and Vermont are busy tracking down new mother trees, while Maine and Massachusetts are planning to begin inoculating in the summer of 2007 and will soon plan the establishment of B_3-F_2 seed orchards. Two collaborations between TACF, the US Forest Service, and state universities were formed, and Northeast Utilities has the potential to become a major donor through a novel program. This progress is the result of the hard work volunteered by dedicated and passionate TACF members. Let it continue in 2007!

CONNECTICUT (CT-TACF)

The Connecticut chapter has made great strides in the past year, thanks to President Bill Adamsen, Breeding Coordinator Gayle Kida, a dedicated board of directors, and many volunteers. The chapter established its first two breeding orchards in Salem and Woodbridge. Each orchard received one line[2] of advanced breeding material. In a collaborative effort with the Northern Connecticut Land Trust, a test orchard was established in Suffield. All three orchards mentioned above will receive new lines this spring. Connecticut has added five 'Clapper' lines this year to the two lines created last year and has found, as of October, five more mother trees to pollinate in 2007. To further its goal of establishing two new test orchards this spring, CT-TACF is currently discussing potential breeding orchards with Great Mountain Forest and several land trusts throughout the state.

The Suffield orchard site is located on old farmland, which had been treated with lime for years to increase alkalinity. The soil pH in 2006 was 6.7, generally considered too high to grow chestnut. In an experiment to reduce pH, half of the planting plots were treated with iron sulfate and half were left untreated. Amazingly, only one of the 10 nuts planted in the untreated soil germinated, and seven of the 10 nuts planted in treated soil germinated. Because of the small scope of the study, it is much

[2] Here, a backcross "line" is defined as a cross between one American parent and one advanced backcross parent. Typically, one aims to create about 100 seeds from any controlled cross of this type in order to create a "full line" for planting in the following year.

too early to make generalizations as to the effectiveness of this treatment. But further testing will be performed over the next few years. In 2007, iron sulfate will be applied to a large portion of the site and advanced backcross material will be planted.

To test the effect of different mycorrhizae on germination and survival of planted nuts in the Salem orchard, half of the rows were treated with soil from under an American chestnut and half with soil from under a white oak. 52% of the seedlings in rows treated with chestnut soil failed to germinate or died, compared to 42% of seedlings in rows treated with oak soil. Soil from under the chestnut tree may have contained chestnut blight, accounting for the higher mortality in the nuts treated with this soil.

The Norcross Wildlife Foundation granted the Connecticut chapter $4,000 to cover deer fencing costs for the Salem and Woodbridge orchards. In addition, Northeast Utilities has named TACF as the beneficiary of a shareholder program in which the company will donate $5 for each of their 50,000 shareholders who agree to receive the company's annual report electronically rather than in paper form. The Connecticut chapter will receive the majority of funds raised through this program.

MASSACHUSETTS (MA-TACF)

MA-TACF is close to completing the 20 required advanced backcross lines from each of the 'Clapper' and 'Graves' sources of resistance. The B_3 trees are spread out between 26 orchards, located mostly in the eastern part of the state. Some of these are replication orchards, into which extra B_3 nuts were planted to supplement excessive loss in a particular line. MA-TACF has pollinated over 30 mother trees, though not all of these pollinations represent unique lines[3]. Some mother trees that produced large numbers of flowers were pollinated with pollen from both 'Clapper' and 'Graves' sources as back-up in the event that progeny produced from one of the crosses died.

Ten mother trees were pollinated this year, six of which produced enough seed to constitute a line. One of these trees is located in the Quabbin Forest, and was pollinated with the help of retired forester Bruce Spencer. The nuts from this pollination were planted in the newly-established Quabbin Reservoir orchard. The chapter also established five other new orchards this year.

[3] A unique line is defined as a cross between two parents where neither parent is repeated in another cross. If one mother tree is crossed with two different pollen parents, two crosses will be made, but they will not be unique and cannot constitute a unique line. The "line" definition as above still holds.

MA-TACF is preparing to make its first inoculation at the Tower Hill orchard, established in 1999, in the spring of 2007. The chapter will soon begin planting a B_3-F_2 seed orchard. Other interests include researching the reintroduction of chestnut to the forest. A reforestation subcommittee within the chapter is currently being formed to research this initiative.

COURTESY OF BRAD SMITH

Fig. 1. The Quabbin Reservoir Tree

MAINE (ME-TACF)

ME-TACF is also close to completing the 40 required fourth generation lines. The chapter has created 18 'Graves' lines and 22 'Clapper' lines, the first of which were planted in 1999. Trees produced from these crosses are growing in 11 orchards located in the southern part of the state. Two new orchards, Penobscot and Veazie, were established, and three new lines were created this year. Winter mortality is a problem for chestnut seedlings grown in Maine orchards. Frost heave, a common occurrence in the region, exposes the seedlings' roots and may even kill larger trees.

ME-TACF is planning its first inoculation in the spring of 2007. The Merryspring orchard, established in 1999, contains trees from four B_3 lines, some of which are over three inches in diameter. Additionally, the chapter will soon begin planning B_3-F_2 seed orchards.

In a new initiative this year, the Maine chapter joined forces with the University of Maine, Orono, and the US Forest Service to establish the Penobscot Orchard in the USFS Penobscot Experiment Forest, into which two new lines were planted. In addition, ME-TACF collaborated with the University of Maine to establish a cold tolerance/adaptability study of its B_3 material in the Veazie Orchard. Backcross chestnuts exhibited late bud break in the spring, which is beneficial for trees growing in the cold Maine climate. However buds also went dormant late, which increases chance of frost damage. Other interests include creating additional Maine B_4 trees.

VERMONT

In Vermont, a group of dedicated chestnut enthusiasts has been working to create advanced breeding material in the state for several years. This

year volunteers have collaborated with the US Forest Service, working with Paul Shaberg, Research Plant Physiologist at the Northern Research Station, and the University of Vermont's Professor Gary Hawley and graduate student Kendra Gurney, to move the breeding program forward. Four trees were pollinated in 2006, which, when added to the one line previously completed, total four unique Vermont lines. Vermont has one breeding orchard, located at Shelburne Farms, near Burlington. The 2007 TACF annual meeting will be held in Burlington, at which an official Vermont/New Hampshire TACF chapter is expected to be formed.

Fig. 2. Intern Kendra Gurney hugs the 'Berlin' mother tree, located in northern Vermont. Kendra, along with Vermont member Ed Toth, has helped organize 2006 Vermont pollinations and harvests, and has taken the lead in the search for new mother trees.

TABLE 1 New England Region Breeding Summary 2006

State	Trees Living	Generation of Breeding	Seed/ Seedlings Planted	Trees Alive	Resistance Source	Americans Used	Meadowview Parents Used
ME	2033	American	40	21			
		F_1	43	19			
		B_3	3724	1962	2	41	42
		Chinese	64	31			
MA	4502	B_3	6087	4502	2	62	53
VT	134	American	7	7			
		F_1	10	10			
		B_3	110	110	Graves	2	2
		Chinese	7	7			
CT	426	American	46	46			
		F_1	21	21			
		B_3	289	289	Clapper	2	2
		B_2-F_2	150	50			
		Chinese	20	20			

2006 NORTHERN APPALACHIAN REGIONAL BREEDING REPORT

Sara Fern Fitzsimmons,
Northern Appalachian Regional Science Coordinator

The Northern Appalachian Region has enjoyed reaching several milestones, including the selection of its first planted B_3-F_2 material at the Pennsylvania State Arboretum, the planting of TACF-NY's first transgenic chestnut trees, and the welcoming of a new state chapter, Ohio.

But with those successes have also come some setbacks, including the recent discovery of active *Phytophthora cinnamomi* infection in the Sugarloaf Orchard site in Maryland and the introduction of the chestnut gall wasp into northern Maryland and the Reels Corner Orchard in southwestern Pennsylvania.

Typically, *P. cinnamomi* does not adversely affect many areas of higher northern latitude as the spores cannot survive freezing soil temperatures. Such a discovery, however, increases the importance of the *P. cinnamomi* screening program being conducted with collaboration from the Carolinas chapter. As for the gall wasp, the general control protocol is relatively easy—just wait! Although seed crops may decrease significantly due to infestation, parasitoid wasps usually start to control the gall wasp within two to three years after initial infection. As Dr. Sisco relates below, areas formerly infected in the Southern Appalachian region are now experiencing significant drops in gall wasp infestations.

NEW YORK (NY-TACF)

The most exciting development within the New York chapter was the planting of the first transgenic seedlings out in the real world! On June 7, 2006, the chapter held a small planting ceremony at the State University of New York College of Environmental Science and Forestry (SUNY-ESF) to memorialize the event. Two seedlings transformed with the oxalate-oxidase gene from wheat were planted (Powell, et al, 2004). Oxalate-oxidase should neutralize the oxalic acid produced by chestnut blight fungus. The fungus uses this acid to kill cells in advance of its growth. It is hoped that the neutralization of oxalic acid by the introduced wheat gene will halt the growth of the blight fungus. Approximately 2,000 similar transgenic trees

wait on the shelves in the SUNY-ESF labs to be planted in the future.

In support of that transgenic work by Dr. Chuck Maynard and Dr. Bill Powell, the New York chapter continues its efforts to collect and raise a diverse stock of native New York materials. In 2005, several thousand seeds were distributed throughout New York and beyond from these efforts. Thousands of seeds were sent for use in the TACF seed/seedling distribution program. Seeds were also distributed to Vermont in order to observe potential differences in winter hardiness, and to Ohio for use in various strip mine planting projects.

New orchard establishment within the chapter has slowed, but plantings within established orchards continue. Likewise, identification of new trees from which seed may be collected has slowed. The chapter has continued to request significant efforts be made toward locating unique New York seed sources, particularly in underrepresented regions throughout the state.

The addition of an orchard in Stephentown, NY, a donation of land and planting stock from E. Kenneth James, will add significantly to the diversity of the chapter's native American chestnut stock. Planted in the 1990s, the Stephentown orchard represents a large repository of material, both seed propagated and grafted (mainly a modified inlay bark graft), from heretofore novel stock from areas near the Vermont/New York border.

The chapter has also been making significant strides toward creating efficient American chestnut grafting methods. NY-TACF members and growers Craig Hibben and Allen Nichols have spearheaded the chapter's efforts of grafting scion onto large American chestnut trees in established mother tree orchards. Eventually, the chapter hopes to graft propagate blight-resistant, transgenic material into the mother tree orchards, allowing for open-pollination between the native New York stock and blight-resistant stock.

OHIO (OH-TACF)

Since Ohio gained full chapter status in October 2005, its members have been hard at work, tracking down native flowering chestnut stock and making advanced backcross seed. They have made great progress!

In 2006, OH-TACF created their first line of advanced backcross material and released its first chapter newsletter. Most breeding efforts took place in the northeastern quadrant of the state, facilitating easy

communication and cooperation between those members and experienced PA-TACF pollinators from western Pennsylvania.

One of two scheduled pollinations was successful. Ohio chapter president Dr. Greg Miller assisted member Ray Gargano with the creation of 120 advance backcross seeds from the Nanking source of resistance. Ray and Greg also took initiative to create F_1 material from the named cultivar 'Crane'; those F_1s were created toward the establishment of F_1 controls[4] for a backcross orchard.

The chapter has tracked almost 20 flowering, native trees throughout the state. Efforts to match pollinators to these trees will be a priority in the 2007 breeding season. The chapter intends to graft native Ohio stock in order to facilitate the creation of control pollinated, advanced backcross seeds. In addition, recommendations toward the establishment of a native mother tree orchard were made at the chapter's 2006 annual meeting.

The Vice-President and Secretary of the chapter, Drs. Carolyn Keiffer and Brian McCarthy respectively, continue to make significant contributions toward the establishment of American chestnuts and derived backcrosses on strip mined lands in Ohio and Kentucky. Some of their work has been presented in the past few issues of *The Journal of TACF.*

[4] When backcross orchards are established, control or check trees are put in place in order to facilitate ease of resistance phenotype rating. These trees include unhybridized American chestnuts, Chinese chestnuts, and members of the F_1 generation.

INDIANA (IN-TACF)

The Indiana chapter is one of the first chapters to have joined the TACF Regional Adaptability program. Through extraordinary efforts from several members, including Bruce Wakeland, former IN-TACF chapter president; Jim McKenna, Operational Tree Breeder at Purdue's Hardwood Tree Improvement and Regeneration Center (HTIRC); and Sally Weeks, IN-TACF's current president.

Much silvicultural[5] work has been undertaken by the IN-TACF chapter, a majority of which has been spearheaded by Jim McKenna and Dr. Douglas Jacobs, both from Purdue University's Hardwood Tree Improvement and Regeneration Center.

Future sites for two B_3-F_2 seed orchards have been identified, with one in northern Indiana and a second in southern Indiana. IN-TACF is among the first of TACF's state chapters to have inoculated its advanced backcross orchards, but only had one unique cross represented that year. More diverse lines will need to be selected before creation of B_3-F_2 material can be created from the chapter's breeding material.

[5] A branch of forestry dealing with the development and care of forests

PENNSYLVANIA (PA-TACF)

Pennsylvania continues to focus strongly on both the Regional Adaptability program, through the inoculation of established advanced backcross stock, and on the chapter's novel approach to backcross breeding utilizing cytoplasmic male sterility (CMS) as a tool to facilitate seed production (Leffel, 2004).

Inoculations and Selections

The chapter made selections of its first planted 'Clapper' B_3-F_2 stock at the Pennsylvania State University Arboretum in the summer of 2006. Although none of the selections show extremely high levels of resistance, one family in particular, CH271, stood out as the most resistant among the four families tested.

Of particular interest for the chapter are differences in resistance among various Meadowview-derived lines. Figure 3 shows the relative differences in resistance among two different B_3 lines in comparison to the planted control trees. The usual hypothesis is that the American parent contributes nothing toward resistance, but that has been debated (Hebard and Sisco, 1999). PA-TACF will eagerly await the continued inoculation of more advanced backcross lines so that results can be further evaluated.

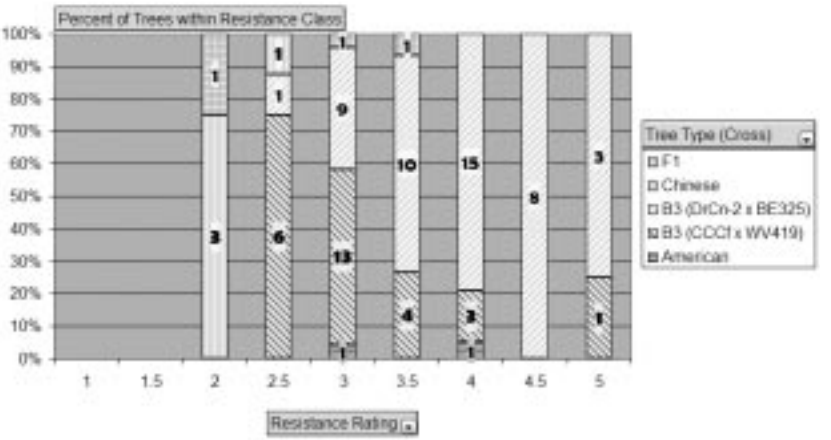

Fig. 3. The relative resistance of two advanced backcross lines at the Riegelsville orchard in eastern Pennsylvania. These resistance ratings were given one year following inoculation, and are on a scale from 1 - 5 where 1 represents high levels of blight resistance and 5 represents full susceptibility to blight infection. Note that straight backcrosses can only harbor moderate amounts of blight resistance.

TABLE 2. Summary of 2006 PA-TACF Inoculations

Orchard*	Number of Unique Lines	Number BC Trees Planted	Number Inoculated	Percent Inoculated
Codorus	2	84	72	90%
Brogue**	3	84	29	35%
Thorpewood	2	191	123	64%
Kuhns***	8	1155	160	14%

*All orchards were established in the year 2000.
**The Brogue orchard suffered heavy losses due to continued deer browse.
***The Kuhns orchard was inoculated in order to thin out the orchard, as it was planted on a 5′ x 5′ grid. The rest of the orchard is to be inoculated in the summer of 2007.

In the summer of 2007, PA-TACF will take on the staggered inoculation procedure for B_3-F_2 material as proposed by Staff Pathologist Dr. Fred Hebard (Hebard 2005). Some of the material to be inoculated are open-pollinated lines from Meadowview, but a majority will be PA-TACF's first $_3$-F_2 lines created from crossing selected trees from PA-TACF's B_3 orchards.

Inoculations took place at four locations in Pennsylvania and Maryland in 2006; all material was planted in the spring of 2000. Table 2 shows a summary of stock inoculated at various orchards, and Table 3 shows the Meadowview-derived lines from material inoculated at those orchards. Preliminary evaluations for resistance took place in November 2006, and final selections will be made in May 2007.

Inoculations for 2007 are planned at seven separate locations and will represent material from the 'Clapper', 'Graves', and 'Douglas' sources of resistance. Year of establishment for orchards to be inoculated in 2007 ranges from 1995–2000. Two orchards established in 1997 and 1998, were postponed due to poor growth rates—mostly the effect of unsuitable site selection and lack of proper management.

Pollinations

Production of 'Clapper' B_3-F_2 seed continued at Brogue (est. 1996/1997) and Reels Corner (est. 1997) this season. New lines of 'Clapper' B_3-F_2 seed were created at Hummelstown (est. 1997), Red Clay (est. 1999), and Riegelsville (est. 2000) orchards. 'Clapper' x 'Graves' B_3-F_2 seed were created at the Hummelstown orchard.

TABLE 3. 2006 PA-TACF LINES INOCULATED

AB393
AB427
BE325
BE400
CL53
GR331
VA307
WV1
WV419

In the 2006 pollination season, PA-TACF attempted 15 lines of breeding material derived from advanced backcross 'Graves' and 'Clapper' material from Meadowview. The goal of this stock is to screen progeny quickly with Carolinas chapter member Joe James in order to identify lines with potential resistance to *Phytophthora cinnamomi*. Over 1,000 seeds were gathered from PA-TACF mother tree orchards—the Mill Grove Orchard in Audubon and the Armstrong Orchard in Hanover—toward this effort. Pollinations of American x American trees were also completed to facilitate the production of American clonal lines through Dr. Scott Merkle's embryogenesis work at the University of Georgia.

In the 2006 planting season, work at three advance backcross orchards was undertaken. One new 'Clapper' backcross orchard was established in association with the Blooming Grove Hunt Club in Pike County. Two 'Graves' backcross orchards were established in the spring of 2005 and replants of one additional line at each location was performed to increase diversity of planted stock at both locations.

Three new 'Clapper' B_3 or B_4 pollinations were attempted for the chapter's own planting, but only two were successful. All seed from the successful plantings will be put into the Blooming Grove orchard (est. 2006).

Steady work on the chapter's CMS program continued and, in 2006, five orchards were established in Pennsylvania and New Jersey. Two of the orchards represent new locations; others are replants or converted American testing orchards into F_1 orchards.

The chapter planted two new lines of 'Douglas' B_2 material in 2005, and continued production within that source in 2006 with the creation of two additional lines.

Unfortunately, the chapter missed out on the collection of the thousands of open-pollinated American chestnut seeds it ordinarily harvests. This year, the large surplus of seeds is in selected B_3-F_2 and unselected B_2-F_3 stock.

NEW JERSEY

Work and membership in New Jersey continues to increase, with the continued help of PA-TACF volunteers and the strong support from the New Jersey Forest Service, Morris County Park system, the Wanaque Reservoir, and Monmouth County Park system.

Monmouth County has a large number of surviving trees; despite high levels of blight infection, many of these trees are over 10" dbh and have survived infection for several consecutive years with little more than a cosmetic effect. There is significant potential for work on hypovirulence at these stands, especially around Hartshorne County Park in Monmouth County.

Planting of several test plots took place at Lark Nursery near Stockton, NJ, and in the Stokes State Forest. The latter was established using seeds collected from an old adaptability plot originally established in the 1930s.

CMS F_1 orchard establishment continues to be the focus in New Jersey. All seeds control pollinated and collected within the state will be put toward the continued establishment of these New Jersey orchards.

MARYLAND (MD-TACF)

The chapter enjoyed fantastic success from controlled pollinations in 2006. With well over 2,700 control pollinated seeds collected this year, the chapter has completed creation of over half its complement of 'Clapper' lines. Eight unique Meadowview pollens were applied to trees throughout the state. Pollinations toward the creation of check trees were also completed. In addition, the chapter is pursuing the progression of the 'Musick' source of resistance. In 2006, four 'Musick' B_2 lines were created.

Currently, MD-TACF houses three advance backcross orchards of 'Clapper' material—the Dickey Orchard near Baltimore, the Thorpewood Orchard in Thurmont, and the Foxhaven Orchard in Jefferson. All three orchards will be filled to capacity after planting in the spring of 2007, and efforts to identify new planting sites will be of first priority.

Survival rates from last year's plantings averaged approximately 80% across all MD-TACF orchards. The chapter's largest planting, the Foxhaven Orchard, now houses five advanced backcross 'Clapper' lines and, through organic growing techniques, enjoys average growth with above-average survival.

A new American chestnut mother tree and germplasm reserve orchard, established in cooperation with the Rockville chapter of the Izaak Walton League, enjoyed great success despite high pH levels. An eight foot tall, wire deer fence at that one acre site was built for only $260 through hard work and clever materials acquisition efforts.

The chapter also continues its work with students of all ages, encouraging chestnut research at both the high school and collegiate level through planting and growing projects, several of which have been published in past issues of *The Bark*. Of potential benefit to many members is the chapter's continued collaboration with MdBioLab. With financial contributions through MD-TACF's fundraising efforts, the lab was able to add a second chestnut molecular biology kit to their offerings. The kit is set up to teach students molecular techniques such as Polymerase Chain Reaction (PCR) and gel electrophoresis by having the students extract hypovirus RNA from isolated chestnut blight fungi. To date, almost 450 high school student have had the opportunity to experience this unique program. The lab and very informative teaching manual may be found at: http://www.mdbiolab.org/curriculum.html

TABLE 4. Northern Appalachian Region Breeding Summary 2006

State	Trees Living	Generation of Breeding	Seed/ Seedlings Planted	Trees Alive	Resistance Source	Americans Used	Meadowview Parents Used
NY	7243	American	12873	7243		240	
OH	50	B_2F_3	50	50	Clapper		
IN	3931	B_3		3931	Clapper	27	25
PA	10238	American	7543	15		86	
		B_1	783	504	4	7	3
		B_2	742	241	2	4	2
		B_2F_2	1672	1093	Clapper		8
		B_3	9418	4591	2	53	40
		B_3F_2	3442	2326	Clapper		14
		B_4	733	246	2	9	
		Chinese	1943	317	17		
		F_1	2259	834	37	41	
		Misc	731	71			
MD	805	American	45	45		4	
		B_3	774	689	Clapper	11	11
		F_1	24	20	Burnworth	1	
		B_1	110	51	Musick	1	1

SOUTHERN APPALACHIAN REGIONAL BREEDING SUMMARY

Paul H. Sisco, Ph.D.,
Southern Appalachian Regional Science Coordinator

The chapters in the Southern Appalachian Region are encountering similar problems in their breeding efforts, and they have made major strides in increasing communication and cooperation among themselves. We have been very fortunate to be supported by grants from the National Forest Foundation for the past five years. These grants have provided summer internships and funds for travel and field supplies. The NFF interns for 2006 were: David Flood and Zachary Lesch-Huie in the Carolinas, Shannon Cagle and Lloyd Fly in Tennessee, and Michael French in Kentucky. Summer salary was provided to Professor Joe Schibig of Volunteer State Community College in Tennessee for his work studying the ecology of American chestnut in middle Tennessee and Kentucky.

Two major problems that are hampering efforts in the South are:

1. Difficulties in getting to mother trees, many of which are in relatively inaccessible sites. The Kentucky chapter is now experimenting with a "father-tree" breeding approach to help solve this problem.

2. Pests and pathogens introduced to the Southern region, particularly *Phytophthora cinnamomi*, the Asian ambrosia beetle, and the Oriental chestnut gall wasp.

Cooperation increases among the southern chapters

The southern chapters have met together twice this past year, once for a Regional Science Meeting and once for a Regional Presidents' Meeting.

The Regional Science meeting was held at Bendabout Farms in McDonald, Tennessee, on February 25, 2006. Dr. Kim Steiner, Chair of the TACF Science Cabinet; Dr. Fred Hebard, TACF Staff Pathologist; and Dr. Bob Paris, TACF Staff Geneticist, attended the meeting of members of five southern chapters (Alabama, the Carolinas, Georgia, Kentucky, and Tennessee). Dr. Hill Craddock of the University of Tennessee, Chattanooga, acted as local host. Dr. Joe James, President of the Carolinas

Fig. 4. Southern regional science meeting at Bendabout Farms, McDonald, TN, Feb. 25, 2006.

chapter, distributed his data on which backcross family lines were providing resistance to root-rot disease, and Professor Joe Schibig, forest ecologist from Volunteer State Community College in Gallatin, TN, presented his data on the ecology of American chestnut in Tennessee and Kentucky. Dr. Hebard distributed a handout on morphological trait differences between American chestnut and Allegheny chinkapin samples from Alabama and Tennessee, and Clint Neel, Tennessee chapter President, displayed maps showing the distribution of chestnut and chinkapin chloroplast types within American chestnut samples. Mike French of the Kentucky chapter reported the chapter's results on growing American chestnut on reclaimed mine land, and Dr. Jimmy Maddox of Alabama reported results on screening of B_2-F_2 hybrids for resistance. Dr. Paris discussed his role in future chestnut research at Meadowview including screening for additional lines of resistance. Chapter reports were given by Alabama chapter President David Morris and then-Georgia chapter President Dr. Mark Stallings. A large entourage of Georgia members included Dr. Martin Cipollini of Berry College, who is taking the lead in GA-TACF breeding efforts. Dr. Craddock's former students Lisa Worthen and Mark Alexander also took the opportunity to return to the Chattanooga area from their graduate programs at Purdue and Mississippi State Universities, and Lisa presented an Indiana report.

On August 19, 2006, a Regional Presidents' Meeting was held at the Pot Point Biological Field Station in the Tennessee River Gorge near Chattanooga. Carolyn Hill, the newly-elected President of the Georgia chapter, chaired the meeting, which was also attended by David Morris of AL-TACF, K.O. Summerville and Dr. Joe James of Carolinas-TACF, and Clint Neel and Dr. Hill Craddock of TN-TACF.

Breeding for Resistance to *Phytophthora cinnamomi*

Dr. Joe James of the Carolinas chapter, in close cooperation with Dr. Steve Jeffers, *Phytophthora* expert from Clemson University, has undertaken a multi-year experiment to determine which TACF backcross families have resistance to *Phytophthora cinnamomi*, an organism that can destroy the root systems of American chestnut trees. Both Chinese and Japanese chestnut trees are resistant to this pathogen, while American and European chestnut trees as well as Allegheny and Ozark chinkapins are susceptible.

TABLE 5. *Phytophthora cinnamomi* screening results through 2005

SOURCES OF RESISTANCE			
'GRAVES'		'CLAPPER'	
Resistance Segregating	No Resistance	Resistance Segregating	No Resistance
AB247[a]	BE138[a]		GL96[a]
GL94[b]	BX39[a]		
GR252[c]	GL239[d]		
JB575[a]	GL356[a]		
	WV480[e]		

a 2005 James/Jeffers Tub Trials
b Surviving Mebane x GL94 trees at Joe James Seneca, SC, farm
c Surviving tree in Warren Wilson College orchard, Asheville, NC
d John Frampton / Mollie Bowles test of Adair County x GL239 seedlings
e Wayah James tree x WV480 (half at Warren Wilson, half at James farm)

Fig. 5. Bill Hascher of the Biltmore Estate stands next to a dead nine-year-old B2-F2 chestnut tree at the Deer Park planting. Two more dead trees are to his right. *Phytophthora cinnamomi* was recovered from the roots of this tree and from surrounding soil samples.

These initial results (Table 5) are suggestive, though not conclusive, that a single, partially dominant gene from Chinese chestnut confers resistance. It is only partially dominant, because Drs. James and Jeffers have found that the roots of F_1 seedlings show lesions, even though there is a high rate of survival of these seedlings. More families that were grown out in tub trials in 2006 will be rated later this winter, and additional families will be tested in 2007. The southern chapters owe a debt of gratitude to Sara Fitzsimmons, Dave Armstrong, Fran Lawn, and other cooperators in PA-TACF, for creating backcross families for the 2007 tests. The Tennessee chapter also made a special effort to create 10 families for *Phytophthora* screening.

The southern chapters are concerned about *Phytophthora cinnamomi* because of its presence in several of the chapter orchards. It is more likely to be a problem at lower elevations (below 3500 feet) and in poorly drained soils. In 2006, it was discovered in several new places, including the Deer Park planting at the Biltmore Estate (Figure 5) and at some of the plantings at Sugarloaf Mountain in Maryland. At the Biltmore Estate, it is killing nine-year-old trees.

The Asian ambrosia beetle and Oriental chestnut gall wasp are introduced pests moving northwards

The Asian Ambrosia beetle, *Xylosandrus crassiusculus*, is causing mortality among Chinese and American chestnut trees in the Chattanooga area and in American Chestnut Cooperator Foundation orchards in Virginia. The beetle bores into trees, bringing along a fungus that will eventually kill the trees. This is another introduced pest that is working its way northward. More information is at:

www.ces.ncsu.edu/depts/ent/notes/Fruits/NoteP-3.html

The Oriental chestnut gall wasp, *Dryocosmus kuriphilus*, is infesting trees at the Alabama chapter chestnut orchard in Muscle Shoals. This insect was introduced into Georgia in the 1970's. It reached our Meadowview Research Farms in 2001, and has "leaped" into the Cleveland, Ohio, area, perhaps transported on nursery stock. The wasp can dramatically reduce leaf area and flowering in badly-infested trees. Predator wasps introduced from Asia and native to the United States seem to be the best means of

control. The gall wasps are now rare in Asheville and Chattanooga, where they were very prevalent eight years ago.

Genetic studies are underway to discover the relationship between American chestnut and Allegheny and Ozark chinkapins

Dr. Fenny Dane and her colleagues at Auburn University, and Drs. Joey Shaw and Hill Craddock at the University of Tennessee, Chattanooga, have been funded by grants from TACF to study the chloroplast and nuclear DNA of American chestnuts and Allegheny and Ozark chinkapins. The Georgia, Alabama, and Tennessee chapters are finding that some of their chestnut trees have chloroplasts that are more often found in chinkapins. Conversely, some chinkapins in northeast Georgia have chestnut-type chloroplasts. In some areas, such as "The Pocket" in northwest Georgia and on Lookout Mountain, it has been difficult to distinguish chestnuts from chinkapins on the basis of their leaf morphology. Chinkapins have burs that split into two parts and that contain one nut, whereas chestnuts have burs that split into four parts and have up to three nuts. But since the two species can interbreed and have existed close together for thousands of years in the South, it is not unreasonable to assume that hybrids of all types exist.

Fig. 6. Burs, leaves, and nuts of Allegheny chinkapin (left) and American chestnut (right). Note that chinkapin burs open into two parts, while American chestnut burs open into four parts. Chinkapins usually have only one nut per bur, while chestnuts usually have three. Chinkapin leaves are very hairy on the underside, while American chestnut leaves are nearly hairless.

Ozark Initiative to breed Ozark chinkapins resistant to blight

Gerry and Susan Cormier, founders of TACF's Ozark Initiative, are heading up an effort to breed Ozark chinkapins that are resistant to chestnut blight. The Ozark chinkapin, *Castanea ozarkensis*, is a tree-type chinkapin found in eastern Oklahoma, northwestern Arkansas, and southwestern Missouri. It has been severely impacted by both chestnut blight and *Phytophthora* root rot. It is potentially more important as a lumber species than Allegheny chinkapins, which tend to be multi-branched shrubs.

KENTUCKY (KY-TACF)

KY-TACF experimenting with a "father-tree" breeding approach

Mike French, Kentucky chapter Vice-President, spent several weeks in Meadowview this summer experimenting with a "father-tree" breeding

approach. Mike used pollen from hard-to-reach Kentucky American chestnut trees to pollinate B_2 trees at the Meadowview Research Farms. This helped the Kentucky chapter to create several new backcross families for planting in Kentucky in the spring of 2007.

TENNESSEE (TN-TACF)

Banner year for nut production

This year the Tennessee chapter had an outstanding season in terms of mother tree pollinations. A record 19 trees were pollinated, including 12 new mother trees that were crossed with Meadowview backcross pollen. Dr. Hill Craddock grafted over 100 American chestnut trees from Tennessee and Alabama. This will help capture the genetics of otherwise inaccessible mother trees. Dr. Craddock also made 200 grafts from scionwood collected by Dr. Mahn-Jo Kim of the Korea Forest Research Institute. TN-TACF continues to send leaf and nut samples of American chestnut and chinquapin trees to TACF grant recipients, Dr. Fenny Dane of Auburn and Dr. Joey Shaw of UT Chattanooga, for their nuclear and chloroplast DNA research.

ALABAMA (AL-TACF)

AL-TACF spends Earth Day working on the Muscle Shoals orchard and uses "father-tree" breeding approach

The Alabama chapter spent Earth Day putting in many hours of work on Dr. Jimmy Maddox' orchard at Muscle Shoals. The orchard was completely mapped and irrigation lines were installed. The chapter mother trees are difficult to reach, so pollen was sent from several of them to other southern chapters to put on selected backcross trees in the chapter orchards. This is in line with Kentucky's "father-tree" breeding approach. Pollen from Alabama trees was also used to pollinate selected B_2-F_2 trees at the Muscle Shoals orchard.

GEORGIA (GA-TACF)

GA-TACF signs agreements with several new institutional cooperators

The Georgia chapter is excited about the signing of Germplasm Agreements with several new cooperators: The University of Georgia's Mountain Research and Education Center in Blairsville, The Southern Company (Georgia Power), Berry College, and The Preserve at Callaway Gardens. The chapter got great publicity from an Associated Press news

story about the discovery of surviving American chestnut trees at FDR State Park in south-central Georgia. The story was reprinted in newspapers as far away as Cape Town, South Africa!

THE CAROLINAS (CC-TACF)

CC-TACF establish an endowment fund for long-term research efforts

The Carolinas chapter established a research endowment with the North Carolina State University Forestry Foundation, using funds collected from Charter Memberships and from special gifts. For a deposit of $15,000 or more, the Forestry Foundation will administer the endowment for a very small annual fee. The chapter will receive 4% of the principal each year to use for its breeding efforts.

TABLE 6. Southern Appalachian Region Breeding Summary as of October 2006

State	Trees Living	Generation of Breeding	Seed/ Seedlings Planted	Trees Alive	Resistance Source	Americans Used	Meadowview Parents Used
KY	802	B_3		802	2	7	
		American		165		17	
		F_1		249	23	11	
TN	2269	F_2		66	2	2	
		B_1		502	3	10	
		B_3		1105	Clapper	12	11
		B_4		182	Clapper	2	2
		American		162		34	
		B_3		950	2	22	18
CC	1790	B_4		267	Clapper	11	7
		B_2-F_2		375	Clapper		7
		B_2-F_2		36	Clapper		3
		B_3		211	Clapper	3	3
		B_4		15	Clapper	1	1
AL	275	B_2-F_2		12	Clapper	3	
		B_2-F_3		17	Clapper		
		B_2-F_2		20	Clapper		3
GA	203	B_3		200	Graves	1	1
		B_4		3	Graves	1	1

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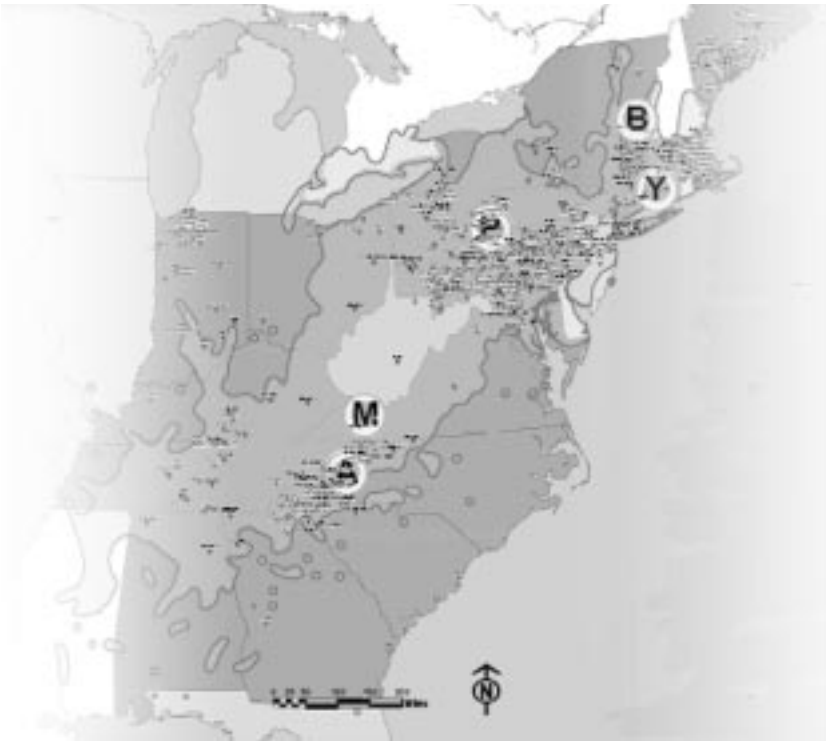
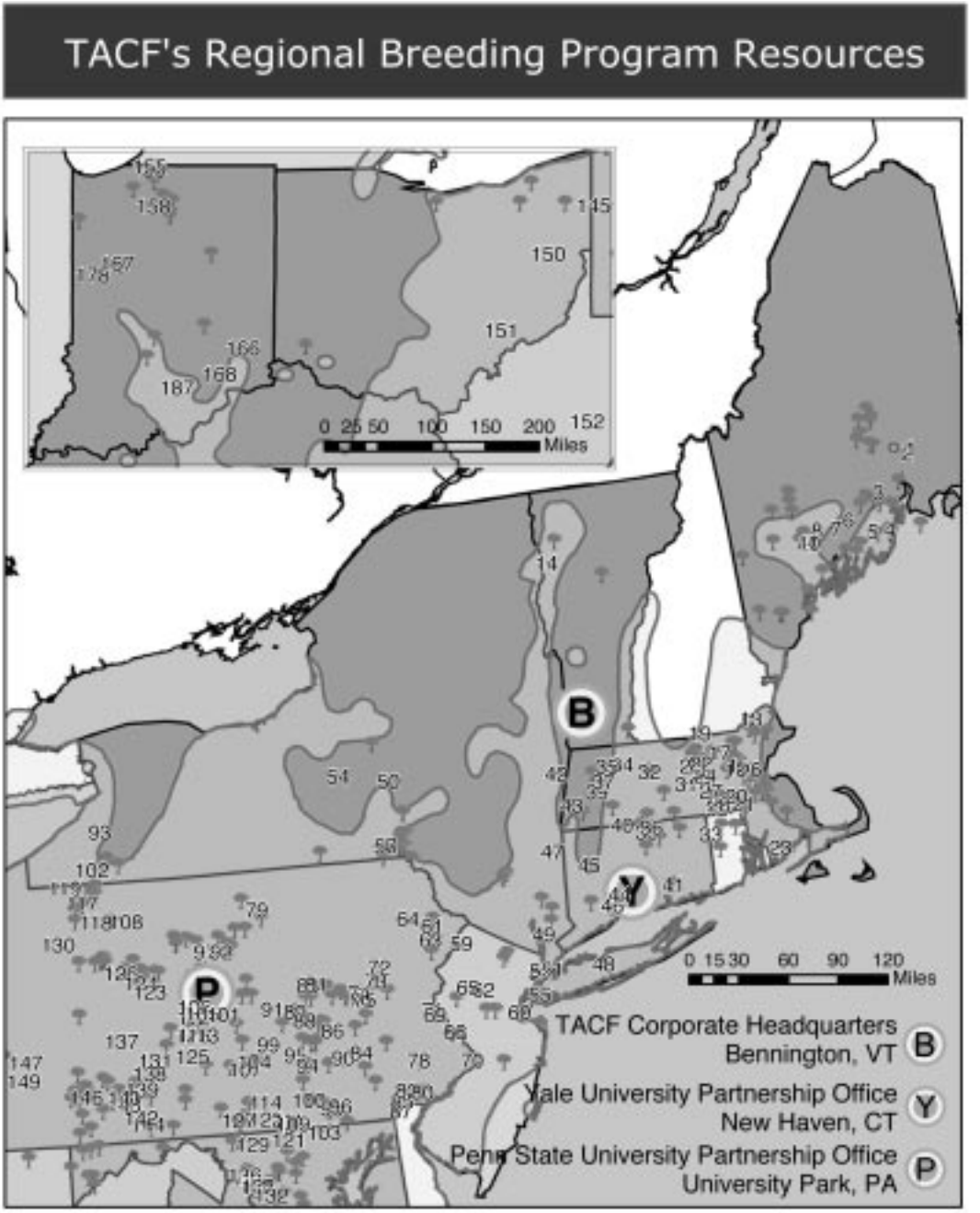
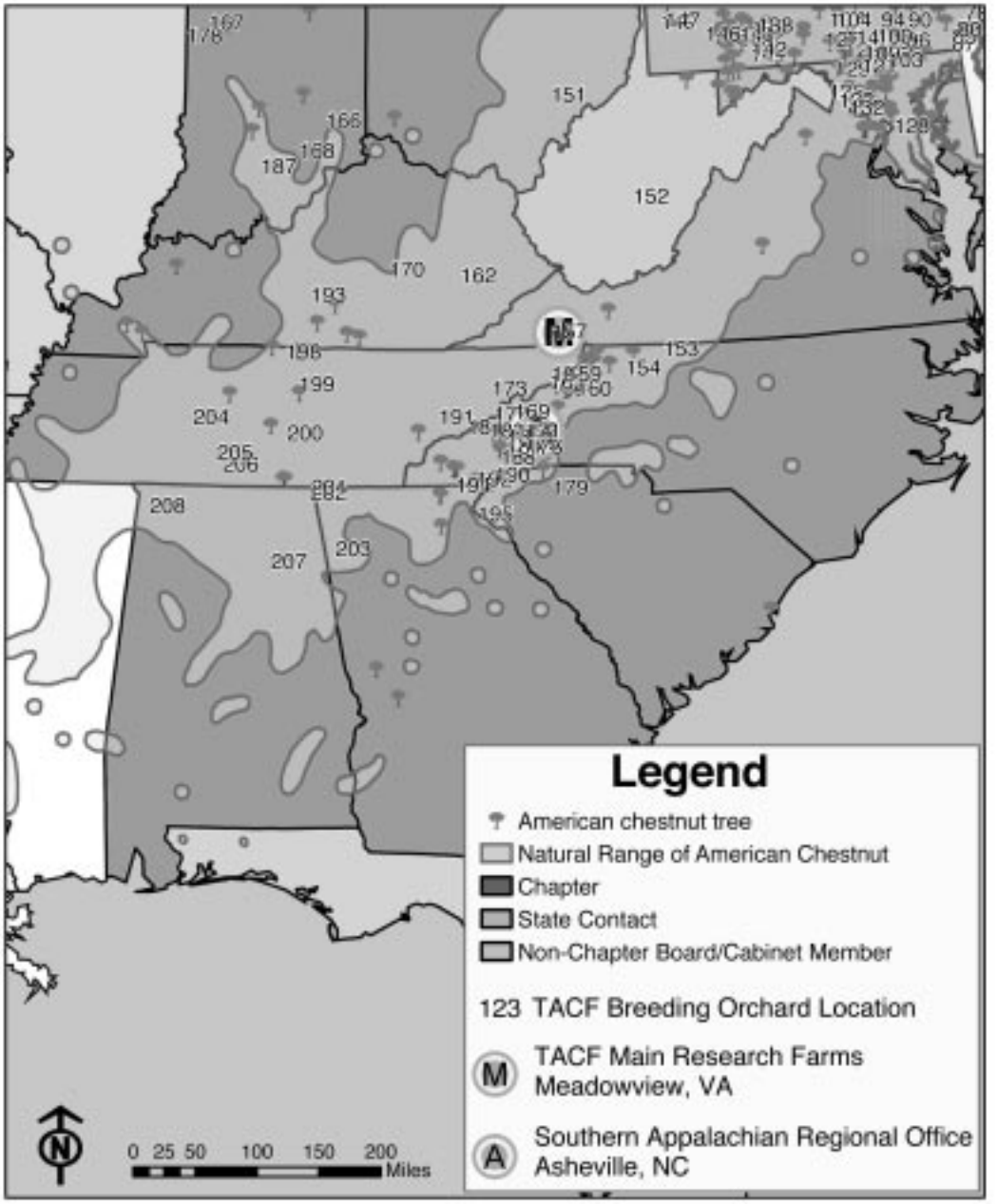
TACF BREEDING PROGRAM RESOURCES

As part of TACF's efforts to track its breeding efforts, a map of all known breeding locations, both established orchards and state chapter mother trees, was devised for reporting at the 2006 TACF Science Audit. The map, and chapter-specific statistics, is available in color, and with zooming capabilities, at this website:
http://chestnut.cas.psu.edu/Default.html#map



Tree and orchard names become visible as one zooms in on the PDF version. Former editions of this map, created by University of Tennessee at Chattanooga student Eric Wolfe, are also available on the site. Now that data for this project are housed within TACF, updates of the map and underlying data can be performed on an as-needed basis, and we will attempt to do so annually.


TACF's Regional Breeding Program Resources
0 25 50 100 150 200 Miles
0 15 30 60 90 120 Miles
TACF Corporate Headquarters
Bennington, VT
B
Yale University Partnership Office
New Haven, CT
Y
Penn State University Partnership Office
University Park, PA
P


Legend
American chestnut tree
Natural Range of American Chestnut
Chapter
State Contact
Non-Chapter Board/Cabinet Member
123 TACF Breeding Orchard Location
M
TACF Main Research Farms
Meadowview, VA
A
Southern Appalachian Regional Office
Asheville, NC
N
0 25 50 100 150 200
Miles