



Restoring the American Chestnut

Considerations on the
Reintroduction of a Species
Effectively Removed for Over a
Century

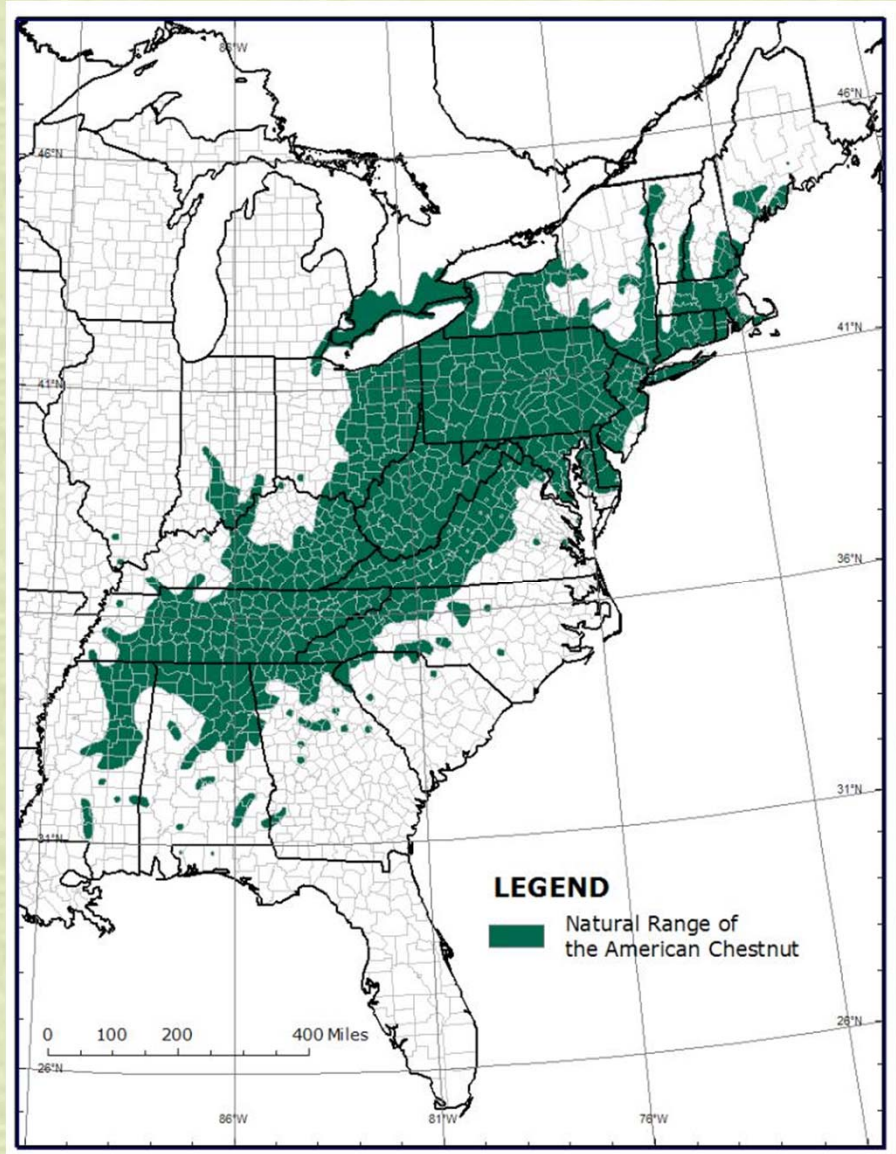


Mission

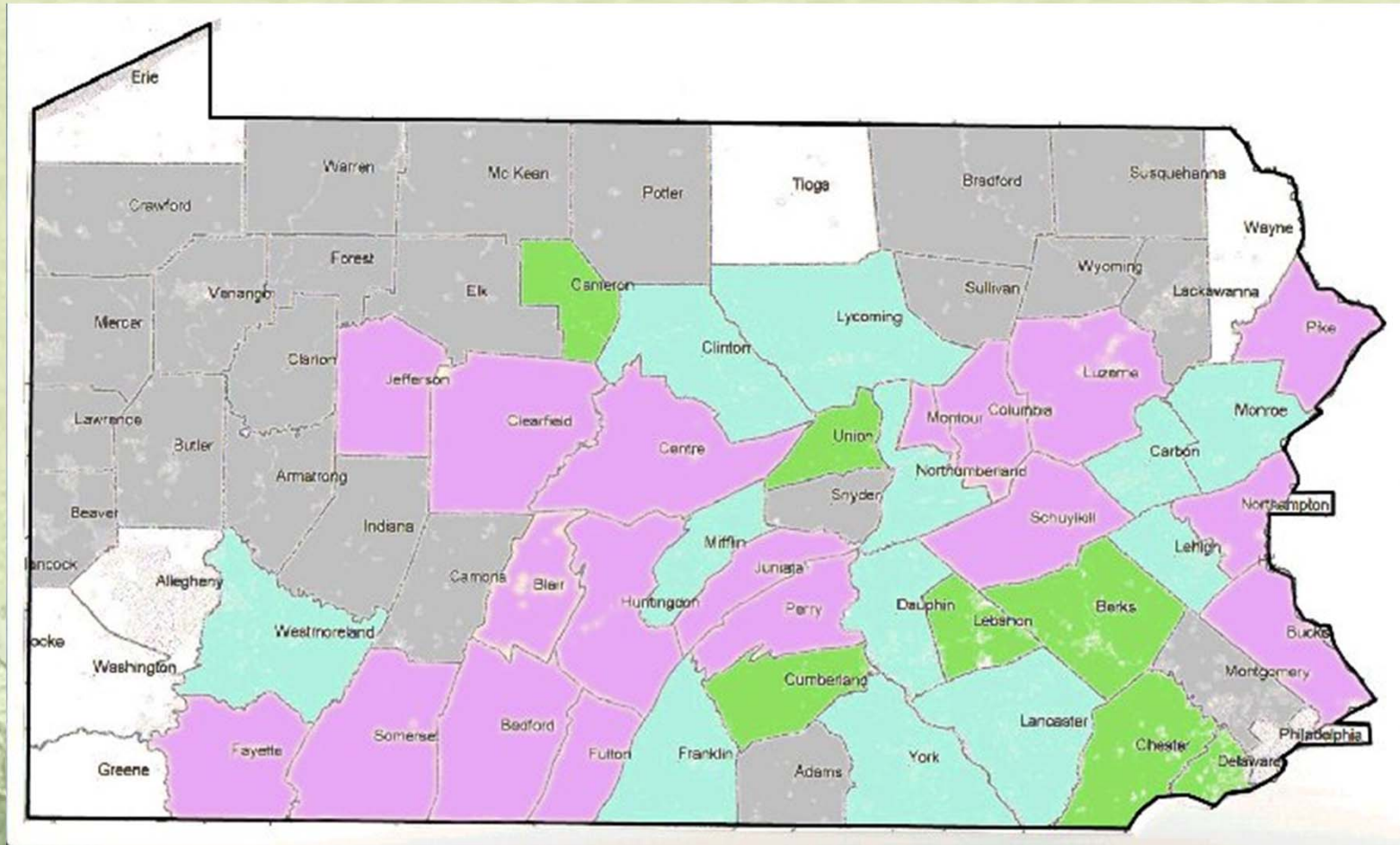
to restore the American chestnut tree to its original range

In The Beginning

The American chestnut tree reigned over **200 million acres** of eastern woodlands from Maine to Florida. By the late 1800's, there was an estimated **4 billion American chestnuts**. In addition, the species composed $\frac{1}{4}$ of the hardwood canopy.



Chestnut Density in PA



40% - 50% Chestnut

30% - 40% Chestnut

20% - 30% Chestnut

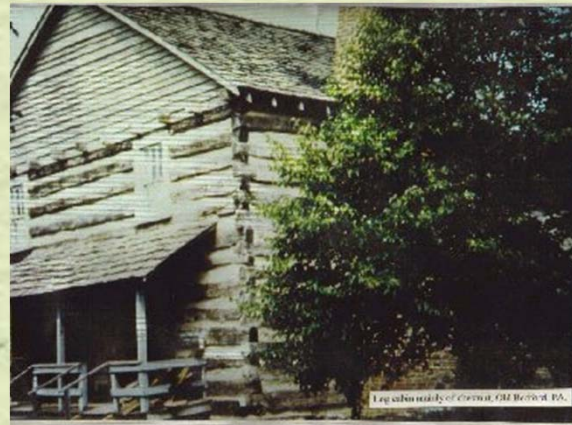
10% - 20% Chestnut

Historic Uses of American Chestnut

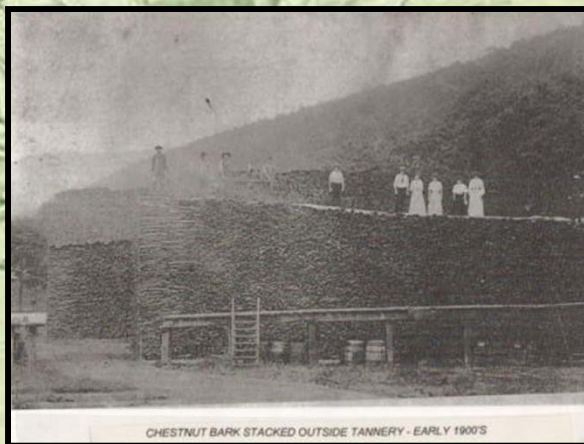
WILDLIFE



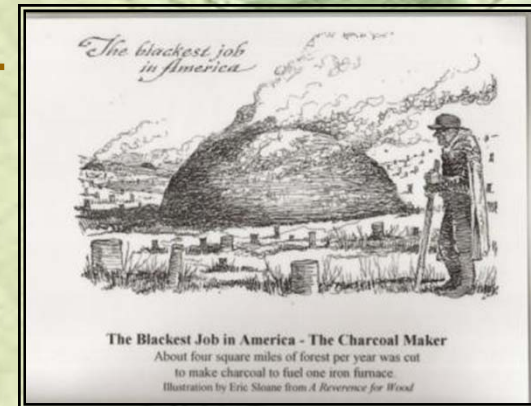
LUMBER



FOOD



CHARCOAL



TANNERY

Chestnut Blight (*Cryphonectria parasitica*)



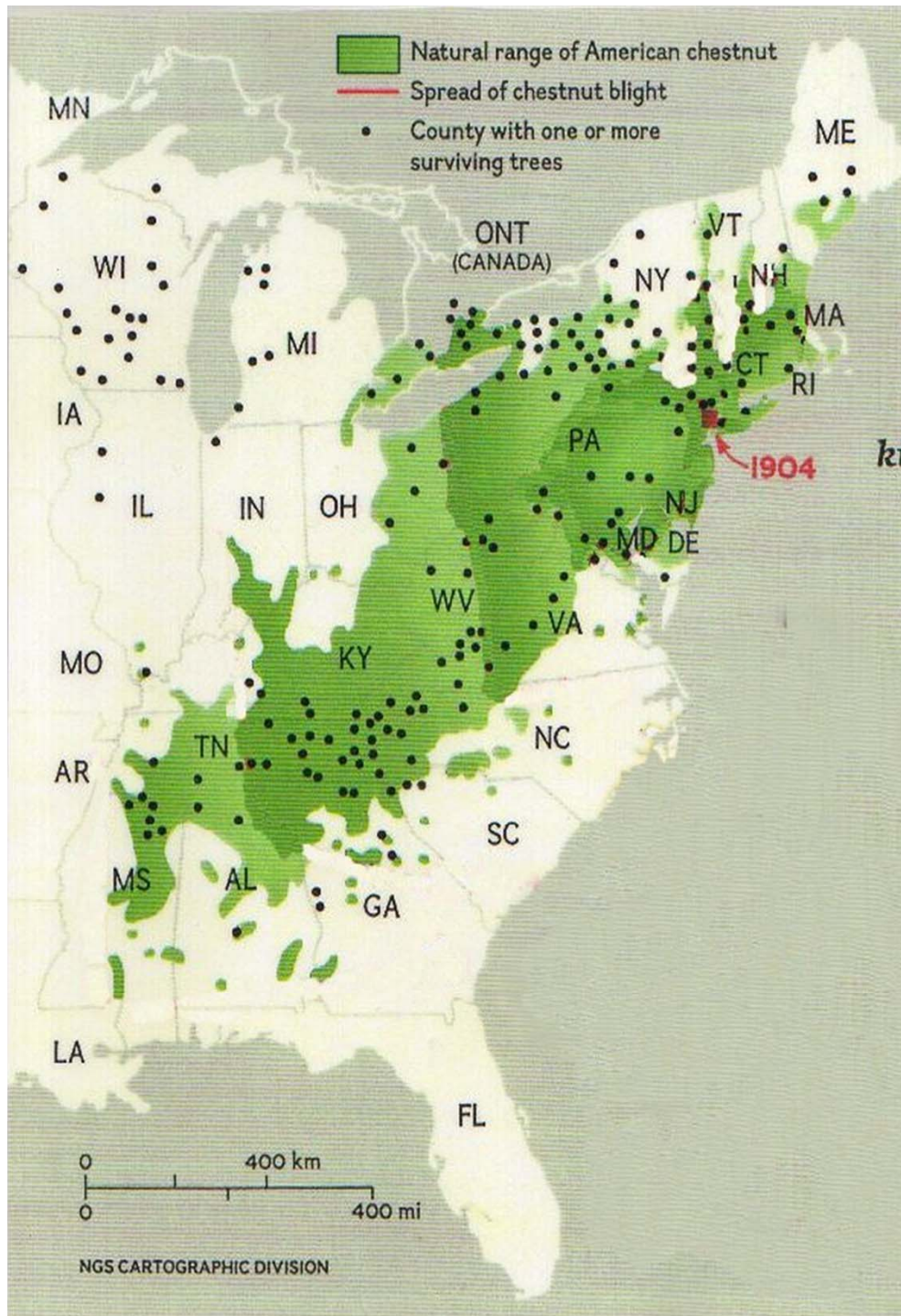
Blight Canker Surrounded by
Fruiting Bodies (Spores) of the Fungus



Photo courtesy of Dr. Tom Volk, UW

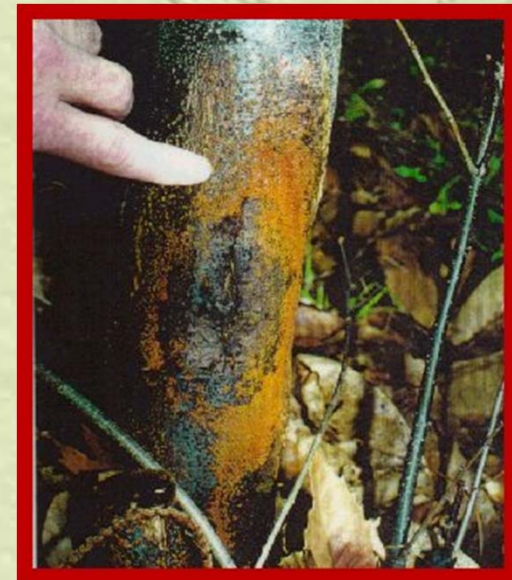


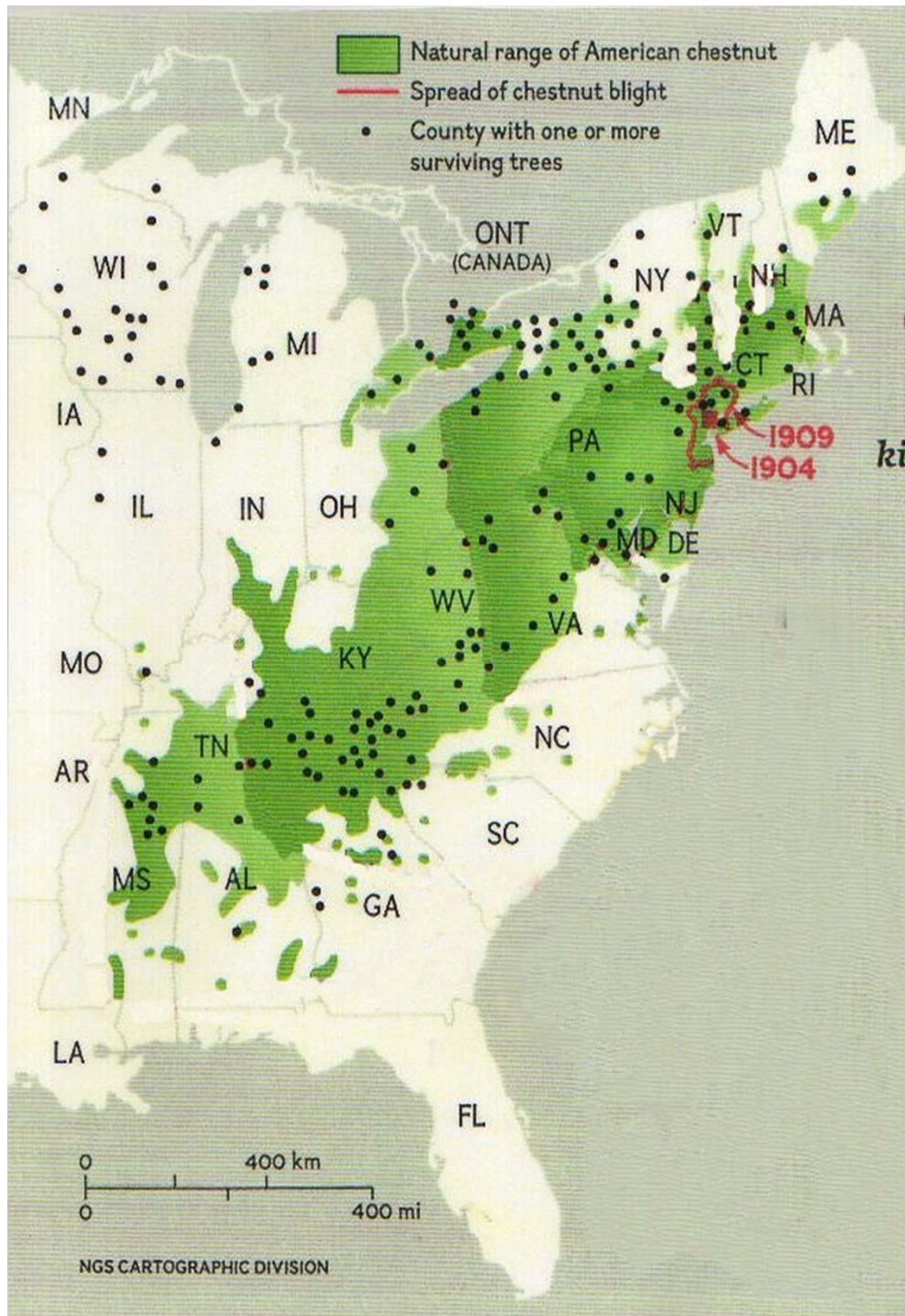
A fungus disease that attacks the bark of the chestnut, eventually reaching the cambium. This results in a girdling of the attacked region.



For thousands of years, the American chestnut tree covered the Appalachian Mountains

In 1904, the blight was discovered on the chestnut trees at the Bronx Zoo, NYC

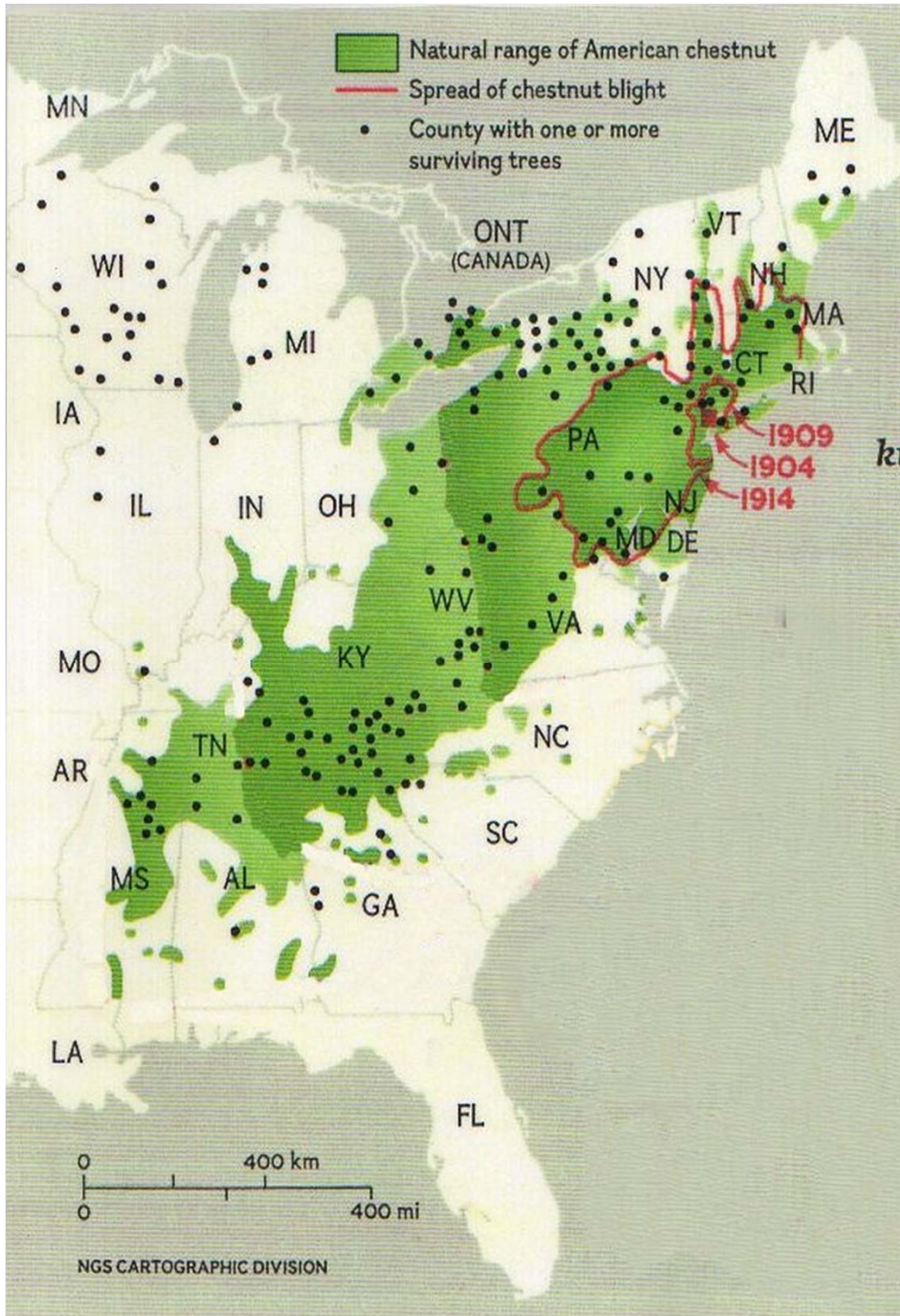




For thousands of years, the American chestnut tree covered the Appalachian Mountains

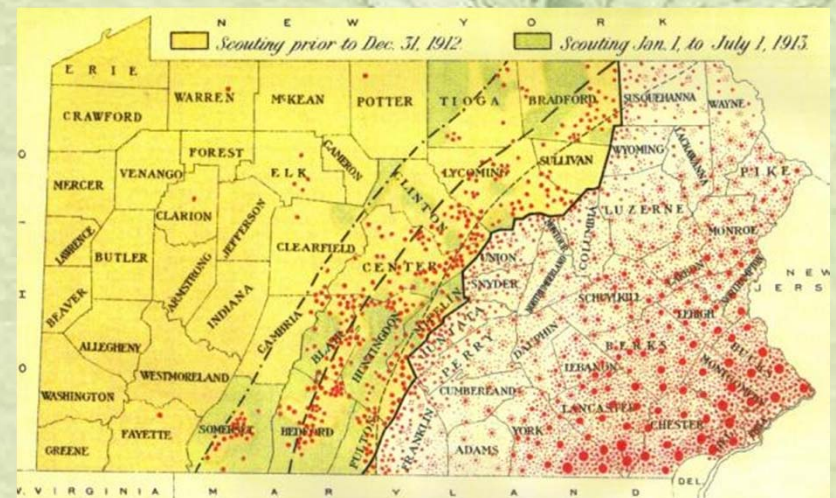
The blight moved rapidly, about 20 to 50 miles per year due to the tree's lack of resistance

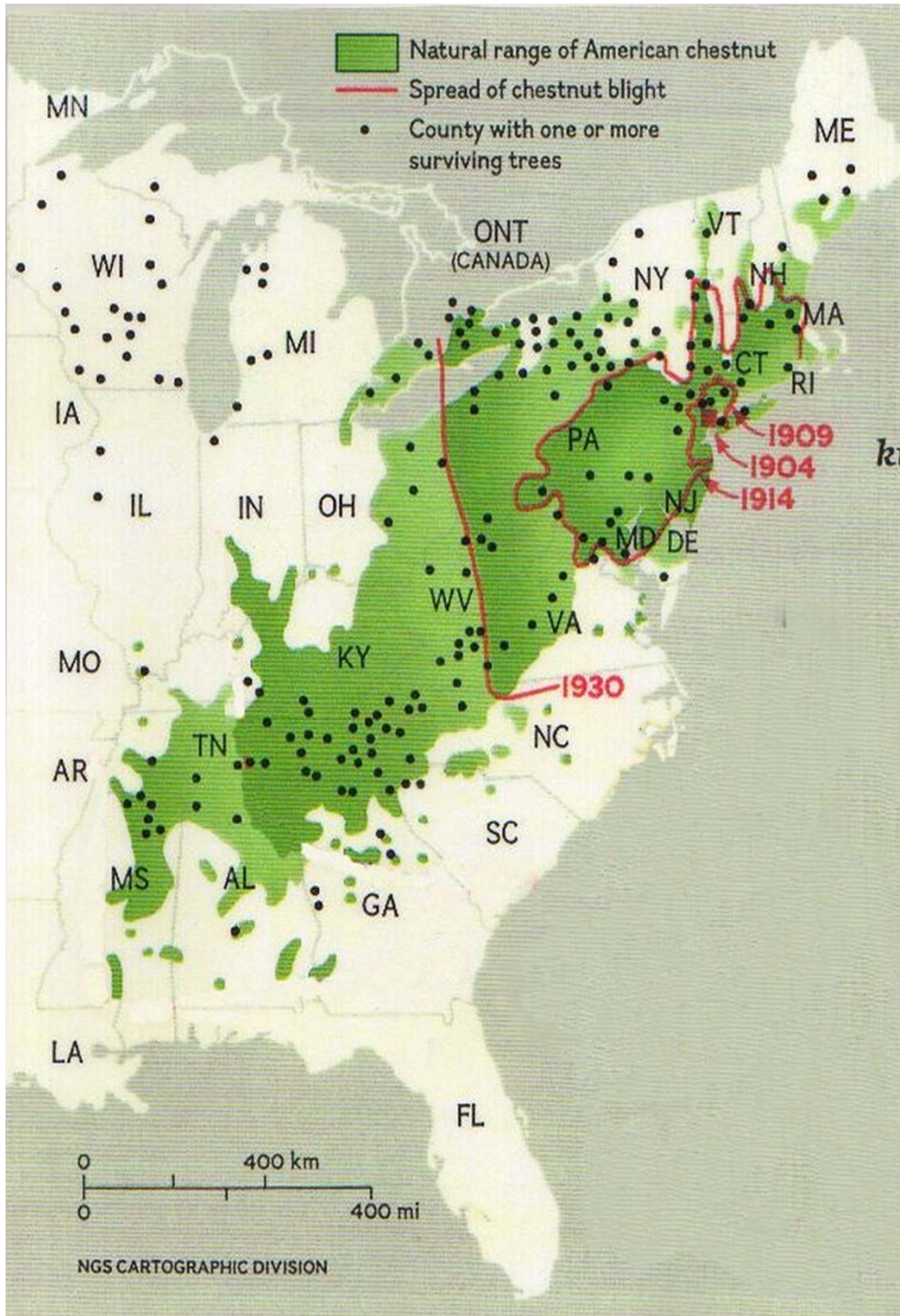




For thousands of years, the American chestnut tree covered the Appalachian Mountains

By 1914, over half of Pennsylvania's chestnut trees were destroyed

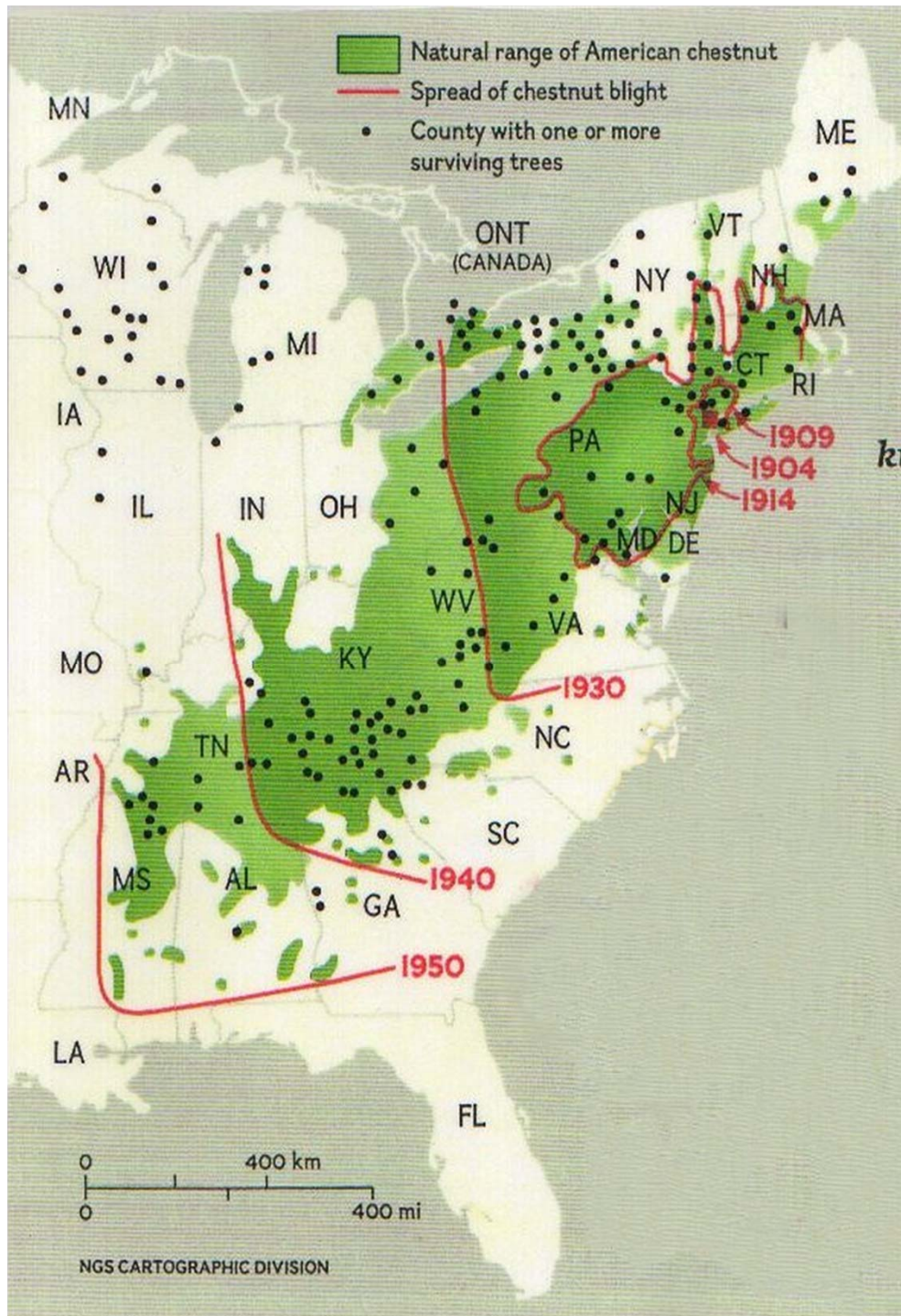




For thousands of years, the American chestnut tree covered the Appalachian Mountains

As the American trees were lost, Chinese, Japanese and European chestnuts were imported to replace them.



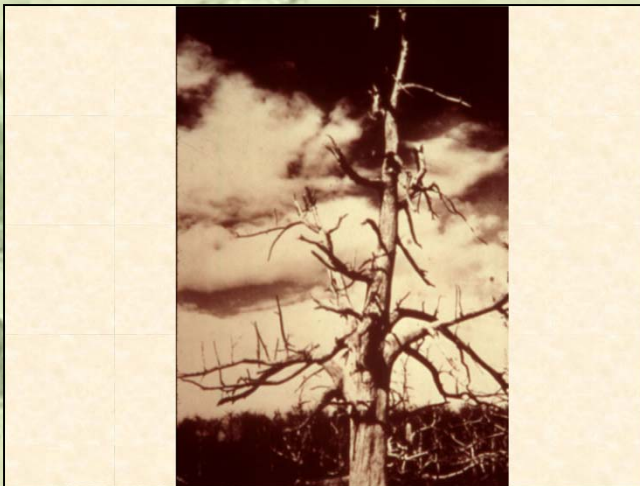


For thousands of years, the American chestnut tree covered the Appalachian Mountains

By 1950 the devastation was complete. Only a few lone American chestnut survivors and stump sprouts remained.



One-Quarter of Hardwood Forests



All other photos from Shenandoah National Forest

American Environmental
Photographs Collection, [AEP
Image Number, e.g., AEP-
MIN73], Department of Special
Collections, University of
Chicago Library.

Sprouts

Grow for about 15-20 years and then
get knocked back by the blight



Cicero, Washington
6.23' dbh, 106' tall

Carson, Washington,
6.55' dbh, 86' tall

Sherwood, Oregon
5.12' dbh, 87' tall

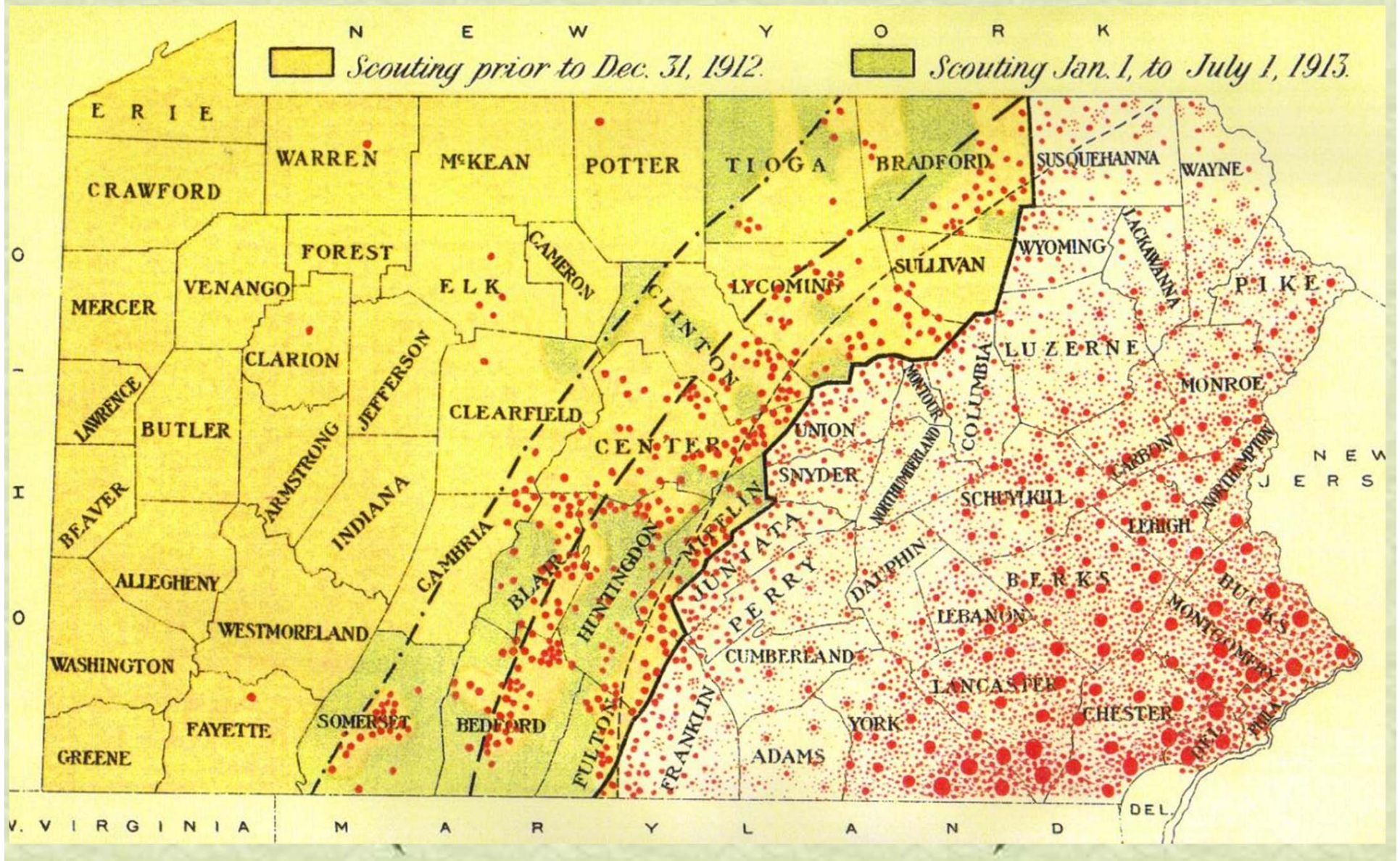
Large Trees

Adair County, Kentucky

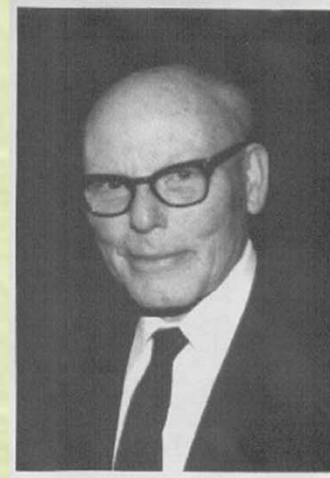
36" dbh, 45' tall



Blight Progress in Pennsylvania by 1913



The American Chestnut Foundation (TACF)



Dr. Charles Burnham, a geneticist from the University of Minnesota was one of the principal founders of TACF.

Characteristics of Chestnut Species

American chestnut
(Castanea dentata)

Not resistant to blight

Height: 80 – 100 feet ★

Form: Dominant canopy tree
straight trunk ★
few lower branches



Chinese/Japanese chestnut
(Castanea mollissima/crenata)

Resistant to blight ★

Height: 40 – 60 feet

Form: Orchard tree
many branches



Hybridization

One Generation (F1)

American

100% American
No Resistance

x

Chinese

0% American
Full Resistance

F1

50% American
Moderate Resistance



Controlled Pollination



Controlled Pollination

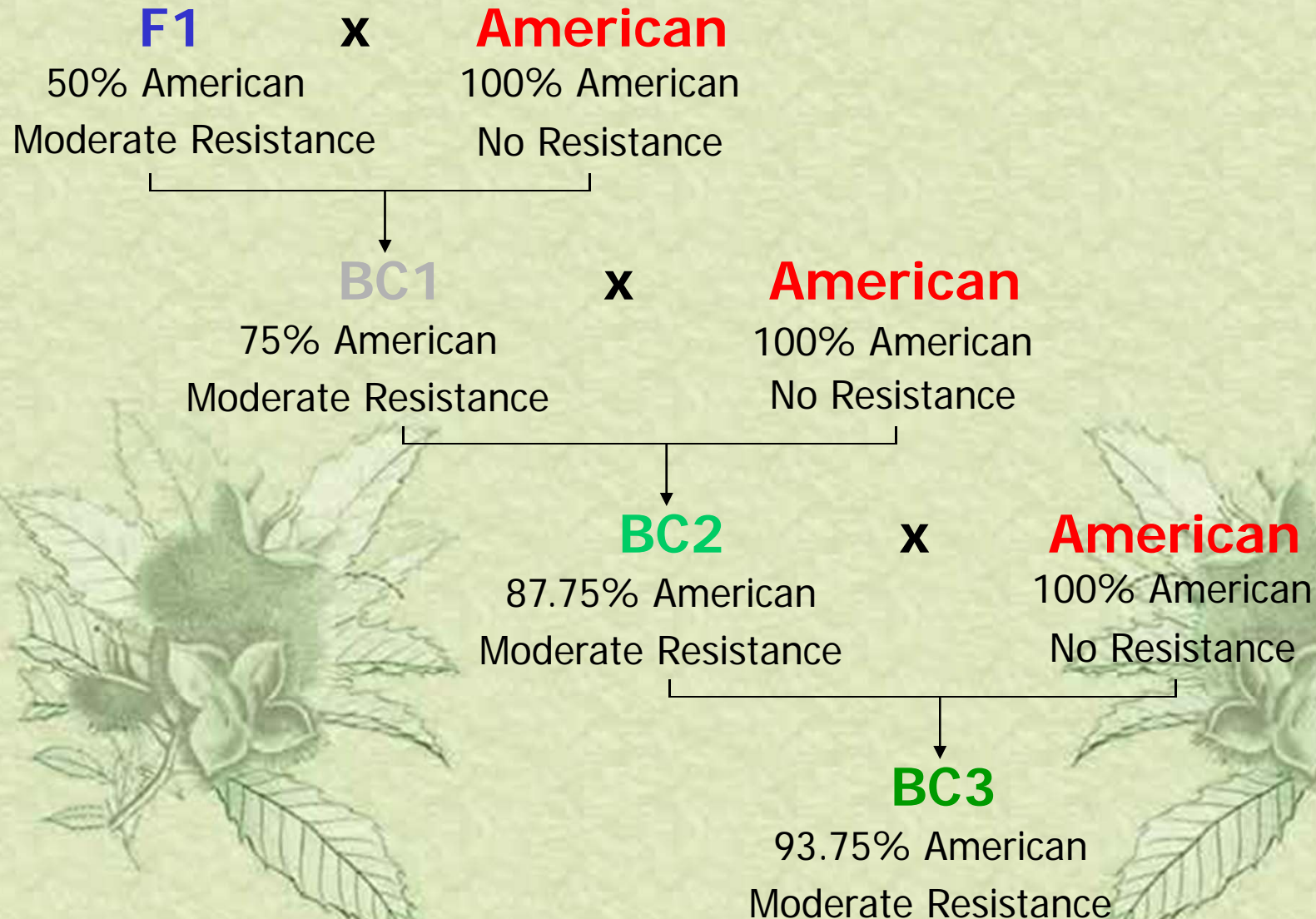


June – July



September - October

Backcrossing



Final Stages

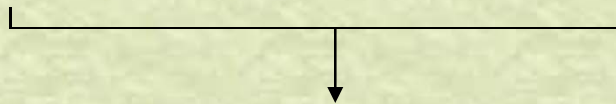
BC3

x

BC3

93.75% American
Moderate Resistance

93.75% American
Moderate Resistance



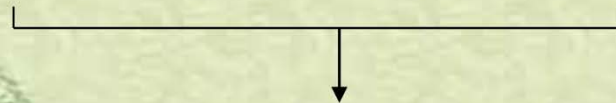
BC3F2

x

BC3F2

93.75% American
Fully Resistant

93.75% American
Fully Resistant



BC3F3

93.75% American
Fully Resistant

Goal for Reforestation
and Distribution

Just Starting

RrRrRr × RrRrRr

- 64 possible combinations
- 1 with all Dominant alleles

	RRR	RRr	rRR	RrR	Rrr	rrR	rRr	rrr
RRR	RRRRRR	RRRRRr	RrRRRR	RRRrRR	RRRrRr	RrRrRR	RrRRRr	RrRrRr
RRr	RRRRrR	RRRRrr	RrRRrR	RRRrrR	RRRrrr	RrRrrR	RrRRrr	RrRrrr
rRR	rRRRRR	rRRRRr	rrRRRR	rRRrRR	rRRrRr	rrRrRR	rrRRRr	RrRrRr
RrR	RRrRRR	RRrRRr	RrrRRR	RRrrRR	RRrrRr	RrrrRR	RrrRRr	RrrrRr
Rrr	RRrRrR	RRrRrr	RrrRrR	RRrrrR	RRrrrr	RrrrrR	RrrRrr	Rrrrrr
rrR	rRrRRR	rRrRRr	rrrRRR	rRrrRR	rRrrRr	rrrrRR	rrrRRr	rrrrRr
rRr	rRRRrR	rRRRrr	rrRRrR	rRRrrR	rRRrrr	rrRrrR	rrRRrr	rrRrrr
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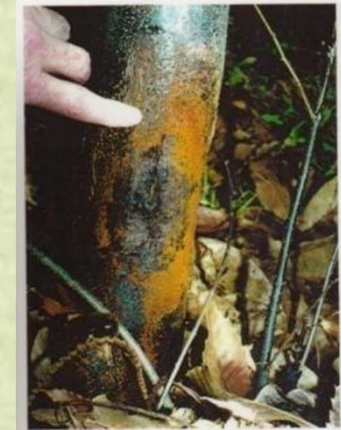
Inoculation and Selection



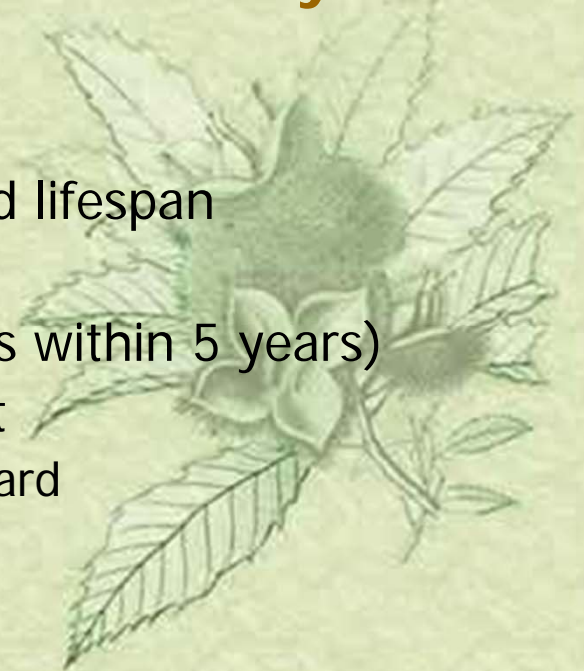


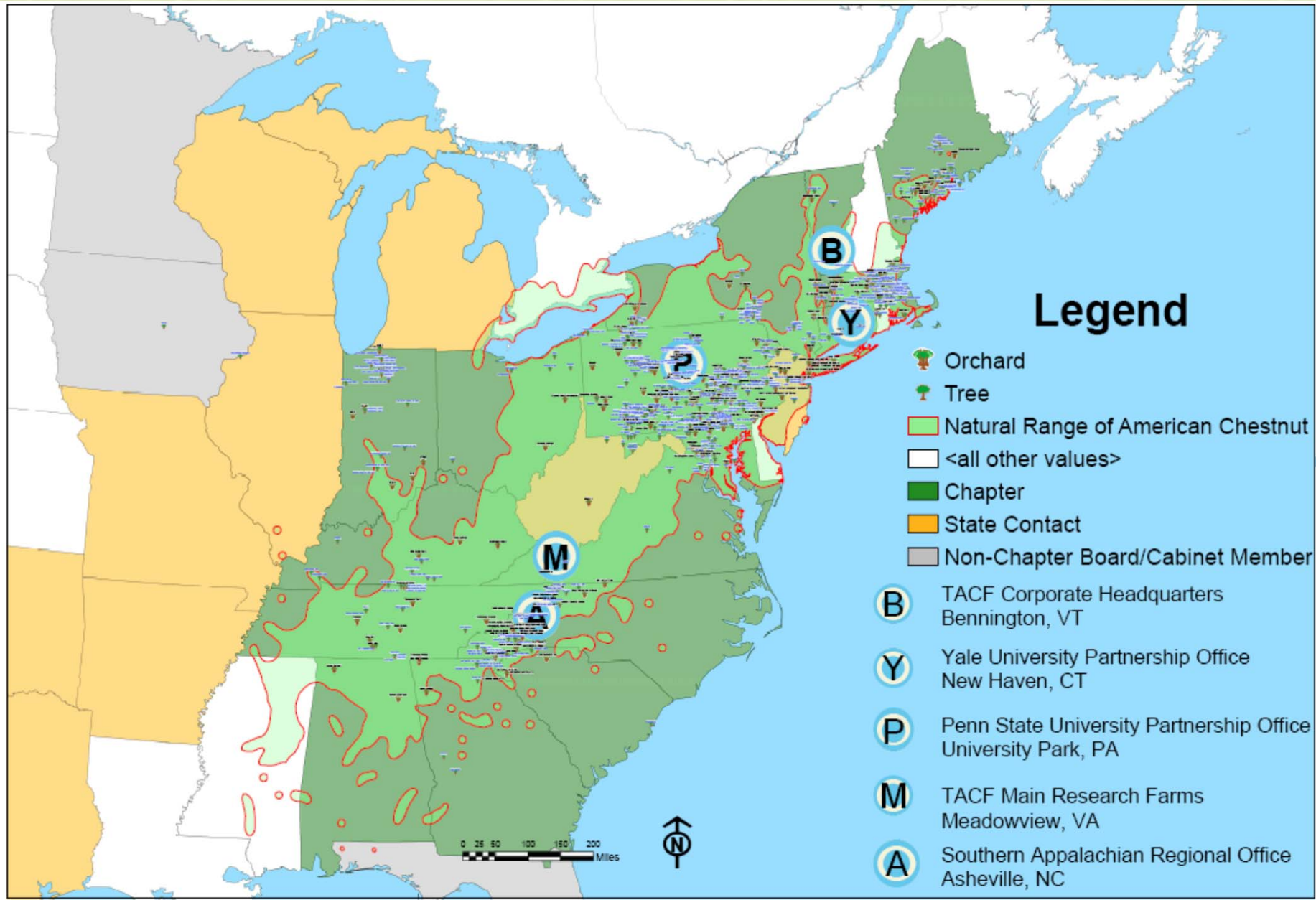
The Blight

(Cryphonectria parasticia)



- **For American chestnut plantings, you can be assured that the blight will affect your plantings**
- **But don't fret!!**
 - Mudpack → Extend lifespan
 - Large trees
 - Lots of nuts (1000s within 5 years)
 - Chestnuts resprout
 - "perpetual" orchard





Regional Breeding Program

Locate flowering American Chestnut trees for pollination and nuts.

Identify prospective “mother trees” for American characteristics.

Pollinate native American chestnut trees using hybrid A-C pollen.

Harvest open pollinated Americans and hand pollinated hybrids.

Seed storage and winter stratification.

Planning orchard locations and selecting prospective growers.

Spring Planting American, hybrid, and experimental orchards.

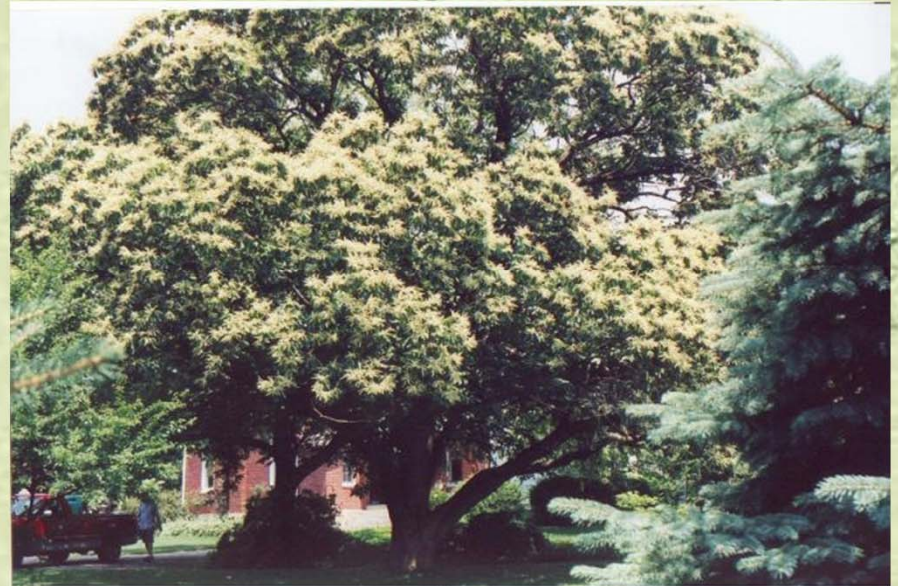
Orchard Maintenance fertilizing, weeding, watering, protecting inoculation and selecting.

Documentation “We always finish the paperwork!”

All Done by Volunteers

Finding Chestnuts

- **The best time is during blooming season, particularly when male flowers are in full bloom**
 - Smell
 - Wet rags; bleach
 - Sight
 - Drive around forest roads
 - Stand on top of a ridge to look for bloom in valleys and on other ridges
- **Tree Locator Form**
 - Leaf and twig



Identification

- **Several species**

- American, European, Chinese, Japanese
 - Chinkapin – Allegheny (also Ozark)

- Primarily will find American and Chinese chestnuts



Locating American Chestnut Trees

- **Tree Locator Form**

- Document location as well as possible.

- **Finding trees**
- **Proper Identification**

<p>Tree Locator Form Pennsylvania Chapter The American Chestnut Foundation PA-TACF 691 Pumping Station Road Hanover, PA 17331 (717) 632-8669 E-mail: darm@blazenet.net</p>	<p>Purpose. This form is to help PA-TACF record, map, and analyze Chestnut trees across Pennsylvania and the Mid-Atlantic Region. This form should be printed and filled out with as much information as available and submitted with a leaf and twig sample to the York, PA office shown. An analysis of the characteristics and microscopics will be completed by PA-TACF and the results will be sent to the submitter.</p> <p>Leaf and Twig Sample. Please cut a mature leaf that has been growing in the full sun and a twig with some leaf buds and place them in an envelope. Do not use plastic due to the molding effect. Wrap the samples in a single paper towel to cushion in the mail. We appreciate your participation!</p>
<p>Submitted by: _____ Telephone: <u>732-671-7287</u></p> <p>Name: <u>Tony Rosati</u> Telephone: <u>732-673-1440</u> <i>cell</i></p> <p>Address: <u>3 Scenic Way</u> E mail: <u>@r728@comcast.net</u></p> <p>City: <u>Middletown</u> State: <u>NJ</u> Zip: <u>07748</u></p>	
<p>Tree Information:</p> <p><input checked="" type="checkbox"/> Single Tree or <input type="checkbox"/> Group of Trees (#): _____</p> <p>Size: Diameter at Breast Height (4 1/2 Feet from Ground): <u>10"</u> Height: <u>30 ft</u></p> <p>Producing: <input checked="" type="checkbox"/> Flowers or <input checked="" type="checkbox"/> Nuts Estimated number of nuts <u>100</u></p> <p><input checked="" type="checkbox"/> Blight is Present on the tree (s) Size of largest Cankers: <u>6 inches</u></p> <p>PA-TACF may use the tree for: <input checked="" type="checkbox"/> Pollinating <input checked="" type="checkbox"/> Harvesting</p>	
<p>Location:</p> <p>Nearest Town/State: <u>Sussex, NJ</u> County: <u>Sussex</u></p> <p>GPS Location: _____</p> <p>If no GPS Location is available, describe location or attach a map: <u>High Point State Park, N.J.</u></p>	
<p>Owner Information: Name of Owner if other than Submitter: <u>N.J. State Forestry Service</u></p> <p>Address: <u>1480 Route 23</u> Telephone: <u>978-875-4800</u></p> <p>City: <u>Sussex</u> State: <u>NJ</u> Zip: <u>07461</u></p> <p>Permission to harvest granted by: <u>N.J. DDP</u></p>	
<p>PA-TACF Analysis and Information:</p> <p>Tree Name: _____ Checker: _____ Date: _____</p> <p>Classification: <input type="checkbox"/> A—Classic American <input type="checkbox"/> B—Am. Hybrid (Acceptable)</p> <p><input type="checkbox"/> C—Am. Hybrid (Unacceptable) <input type="checkbox"/> D—Non-Am. _____</p> <p>Comments: _____</p>	

Pollinate



- Collection of Open-Pollinated seed from various species of chestnut.
- Pollination of surviving Americans with various pollens
 - Other Americans
 - Chinese
 - Advanced backcross pollen



Harvest



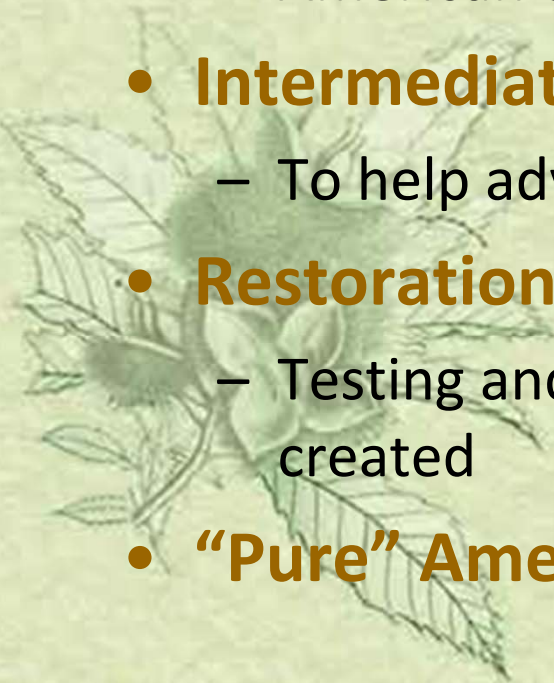
Plant





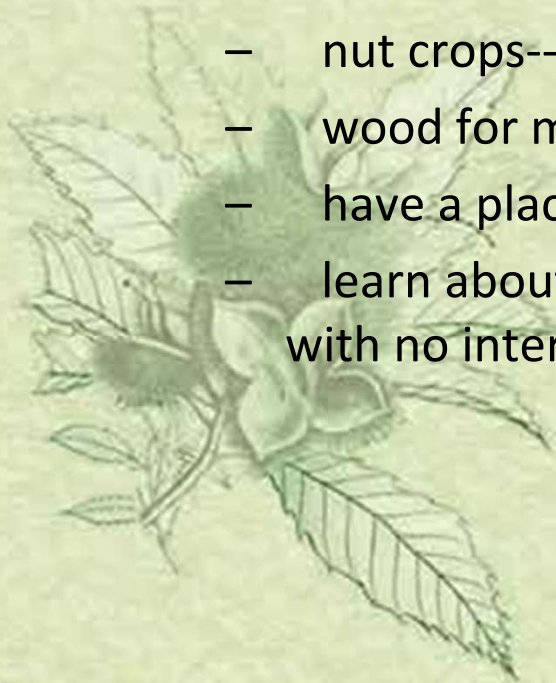
What to Plant?

- **Demonstration Orchards**
 - Many different species to educate the public about chestnuts, their differences, and why to restore the American chestnut
- **Intermediate Research Orchards**
 - To help advance blight-resistance research effort
- **Restoration Chestnut Plots**
 - Testing and evaluating the most advanced material created
- **“Pure” American chestnuts**



Why Plant American Chestnuts?

1. To preserve native germplasm
2. To accustom oneself to the care and maintenance that chestnut trees require. Side effects of planting and growing chestnuts can be several:
 - nut crops--yummy!;
 - wood for making stuff;
 - have a place where people can learn about the tree and,
 - learn about how quickly the fungus can attack and kill a tree with no intervention.



Haun Orchard Project



Haun Harvests



Site selection



- Clearcuts



- Old Fields

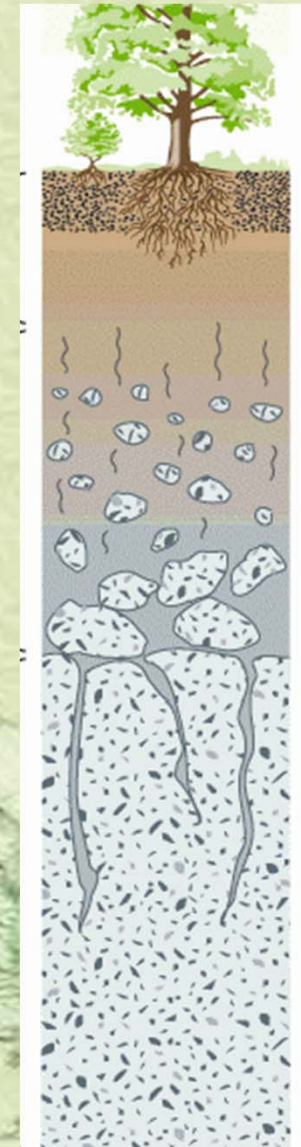
Site Selection

- **Low pH: 4.5-6.5; aim for 5.5**
 - A soil test may give you the best recommendation for amending the pH.
- **Look at other species growing on the property**
 - White oak, chestnut oak
 - Rhododendron, mountain laurel, and blueberries.
- **Well-drained!!**



All images: www.plants.usda.gov

Well-Drained Soils



NRCS maps – soil type descriptions

Web Soil Survey

Official Soils Descriptions from NRCS

<http://www.geology.fsu.edu/faculty/parker/1000/weather/1000weath.html>

How many trees and Spacing

- More trees => more difficulty
- With about 10-20 trees, give them as much space as you can allow.
- If you want nut production, be sure to plant at least 2 chestnuts reasonably close together
 - chestnuts are self-infertile



Spacing

- **Depends on several factors**
 - Generation of planting
- **Know your equipment**







Site Prep

- **Fall/spring prior to planting**
 - Till ground
 - Optional, but makes for easy planting
 - Lay fabric/plastic



OR

- **Round up about two weeks prior to planting**

Direct Seeding vs. Planting Seedlings



- Planting seeds is much easier than planting seedlings. If the seed and site are good, germination rates average about 90%.

- Planting seedlings requires a bit more effort



Varmints



- **Make sure to sink protection into the ground**
- **Protect seed when direct-seeding**
 - Short plastic tubes
 - Blue-X tubes
 - Aluminum flashing
 - Tin cans





groundhogs, mice, and voles, oh my!

- Protect stems with short tree tubes, hardware cloth, aluminum cylinders.
- Groundhogs and raccoons:
 - Traps, bubble gum, lead



Planting Chestnuts Indoors



- Plant inside as early as February
- Outplant after danger of frost has passed.
- Be sure to harden off seedlings

Planting out Seedlings



- Be sure to harden off seedlings between setting them out in the cruel world
- Dig hole about 1.5-2 times as large as root ball
- Water!!

Non-chestnut Vegetation Control



Organic Weed Control Options

- **Landscape fabric**
 - Please don't buy the cheap stuff
 - Shaw Fabrics (Lumite)
- **Black plastic wrap**
 - Robert has good supplier
- **Experimental?**
 - Vinegar and lemon juice
 - Corn gluten





D'oh! A Deer!



- Deer are greater problems in some areas more than others
- 10-20 trees: use wire cages – about 4' in diameter and 4' in height. ACCF website has instructions on building cages.
 - Narrower diameter will require higher cages.
- Highly recommend against using plastic tree shelters greater than 2.5' to 3' in height.

Museum of Tube Horrors



Other options

- Protection from deer should stand about 5-6 feet in height.



- Some mesh type tubes are available.



More About Deer

- Deer repellents

- Fencing options



Response to Release and Fertilization Input



Pennsylvania Chapter Cooperators

**Reineman Wildlife Sanctuary –
Natural Lands Trust**

Tyler Arboretum

**Penn State University
College Of Ag Sciences**

Audubon Wildlife Sanctuary

Longwood Gardens

PA Game Commission

Renfrew Historical Park

White Haven Sportsman Club

Little Schuylkill Conservation Club

Hardwood Forest Fund, Reston, VA

**Northern Nut Growers
Pennsylvania Nut Growers**

Exxon / Mobile Corporation

Alcoa Corporation

News Printing Company

Wild Turkey Federation

**PA Department of Conservation & Natural
Resources:**

**Moshannon State Forest, Michaux
State Forest, Tuscarora State Park,
Codus State Park, Little Buffalo
State Park, Penn Nursery**

**PA Department of Agriculture
Hardwoods Forest Council**

Juniata College

Milton R. Hershey School

Red Clay Reservation, DE

Merle Thorpe Charitable Trust, MD

The National Tree Trust, DC

Allegheny County - Dept of Parks

NJ Conservation Foundation

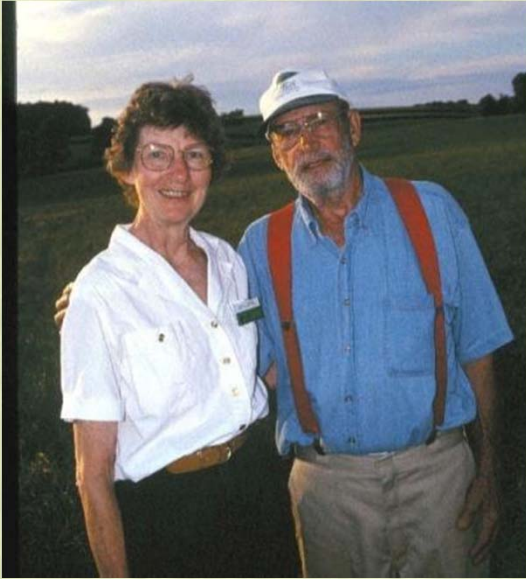
Morris County, NJ

Chestnut Grove Foundation

AMES True Temper Tools

Getting Involved

- Contact the Leffel Chestnut Center



sko2@psu.edu



sara@acf.org



- Visit our websites to see what activities are going on:
 - <http://www.patacf.org>
 - <http://chestnut.cas.psu.edu>
 - Join our mailing lists!



Contact Us!

The Pennsylvania Chapter The American Chestnut Foundation

The Pennsylvania State University
206 Forest Resources Laboratory
University Park, PA 16802

www.patacf.org

|||

814-863-7192

email: mail@patacf.org