Chestnut Research at The Connecticut Agricultural Experiment Station

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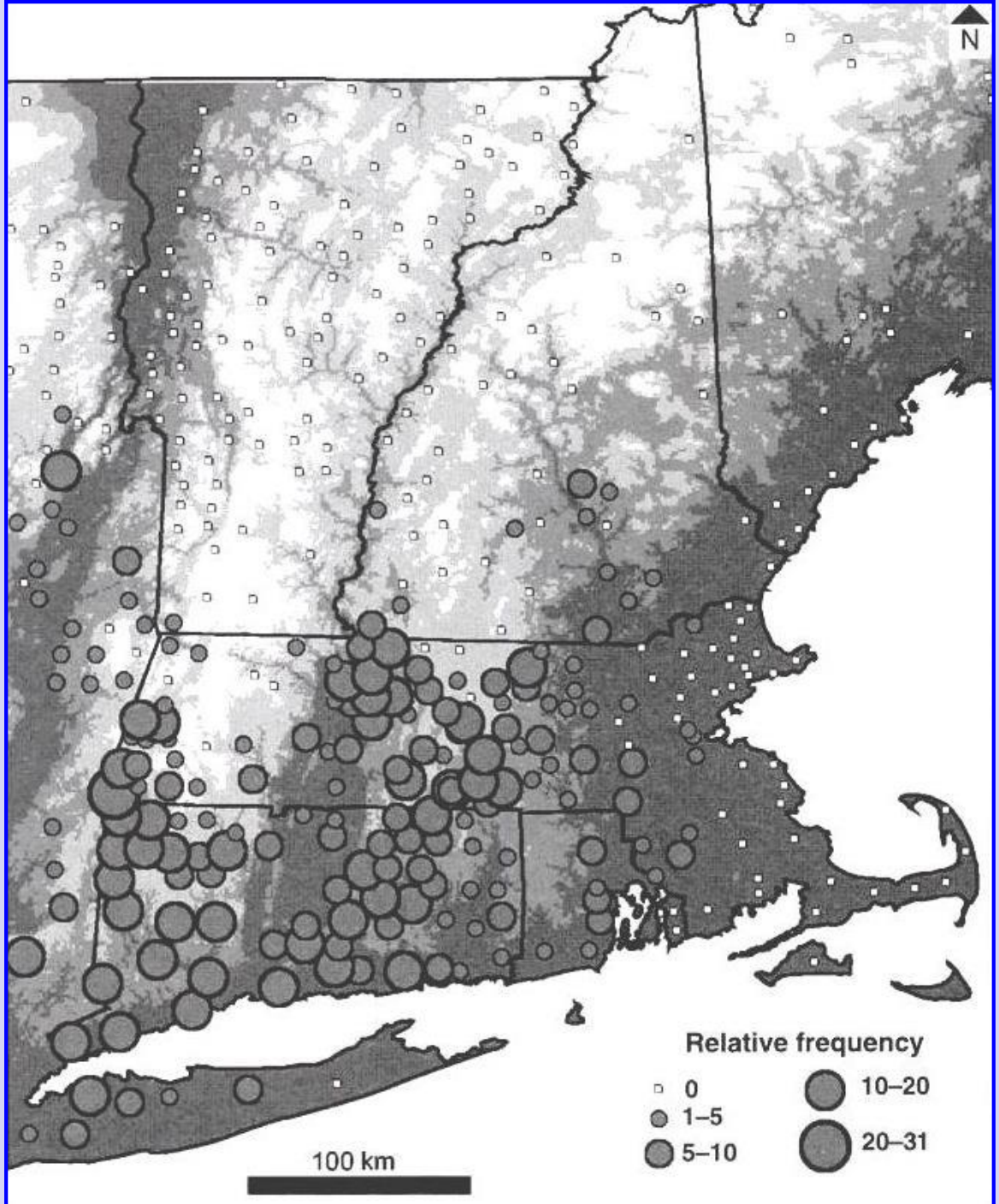
The Connecticut Agricultural Experiment Station
New Haven, CT

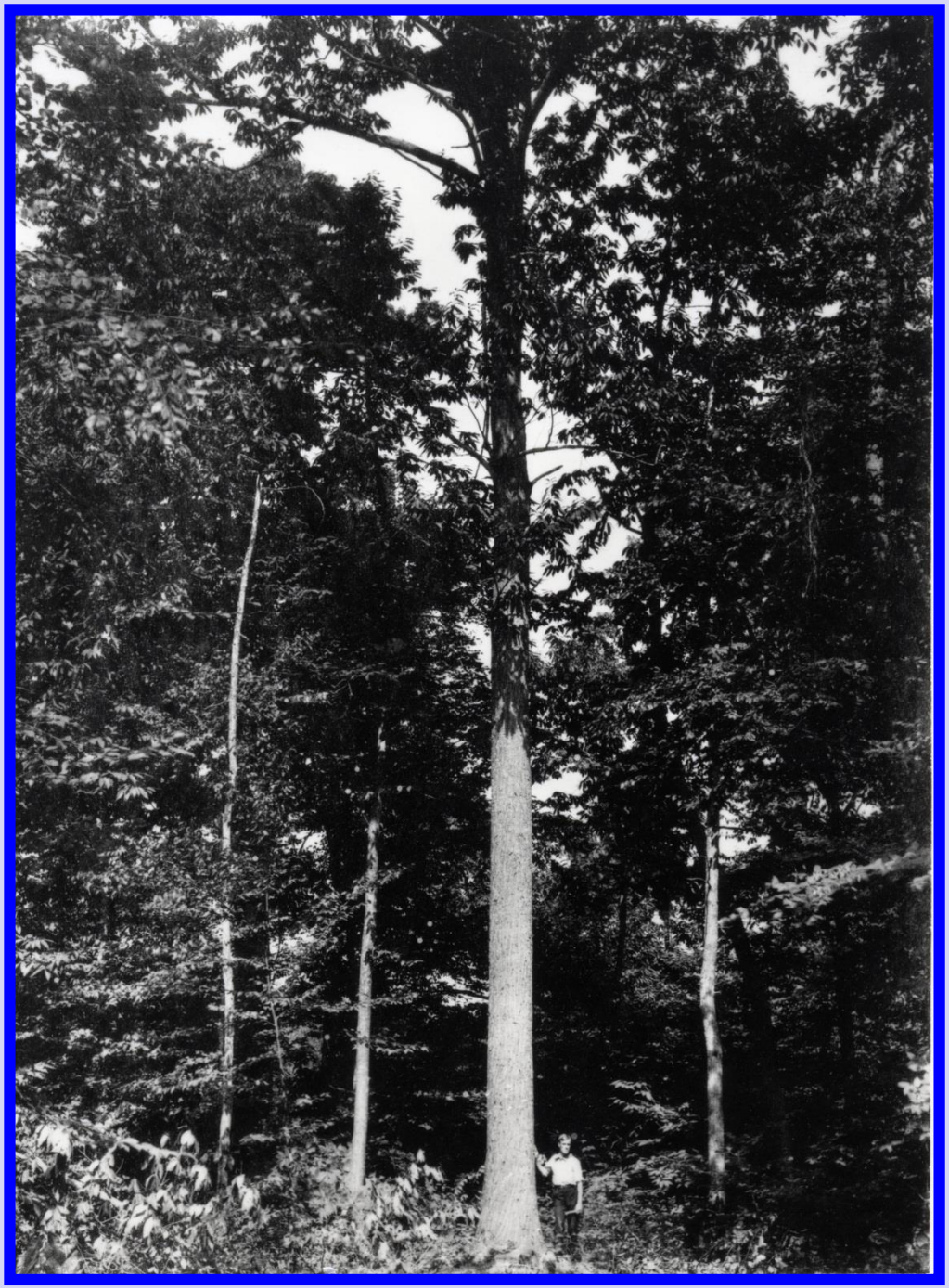
10.15.2



American chestnut trees were growing in Connecticut and Massachusetts in the 1800's and the early residents used some of the large ones to mark the boundaries of their properties.

F. L. Paillet
"Chestnut witness trees In New England"

published 2002



American chestnut

This tree in Scotland, Connecticut (1905) was 103 years old, 83 feet tall, and 27 inches in diameter

“In Connecticut, chestnut is more used than any other hardwood, and more than one-third of the supply is State-grown.” 1913

58,810,000 board-feet was cut in 1910

Table IV. Connecticut Industries Using Chestnut. 1910

NAME OF INDUSTRY	Quantity		Cost	
	Feet b. m.	Per cent.	Average per 1000	Total
Musical instruments	3,559,000	49.1	$21.58	$76,815.50
Planing mill products	839,500	11.6	46.48	39,017.00
Sash, doors, blinds and general mill work	683,480	9.4	37.61	25,704.15
Ships and boats	546,645	7.6	23.54	12,866.71
Miscellaneous	440,000	6.1	22.68	9,980.00
Clocks	285,000	3.9	19.02	5,420.00
Fixtures	245,500	3.4	23.20	5,696.50
Prof. and scientific instruments	161,000	2.2	18.07	2,910.00
Boxes and crates	142,500	2.0	14.82	2,111.50
Wooden ware	135,000	1.9	13.56	1,830.00
Furniture	78,000	1.1	22.27	1,737,00
Machinery and apparatus, not electrical	44,975	.6	23.84	1,072.30
Patterns	20,000	.3	22.00	440.00
Laundry appliances	17,500	.2	22.29	390.00
Agricultural implements	15,000	.2	20.00	300.00
Vehicles and vehicle parts	12,800	.2	25.00	320.00
Handles	10,000	.1	18.00	180.00
Printing materials	5,800	.1	35.00	203.00
Electrical machinery and apparatus	3,000	*	20.00	60.00
	7,244,700	100.0	$25.82	$187,053.66

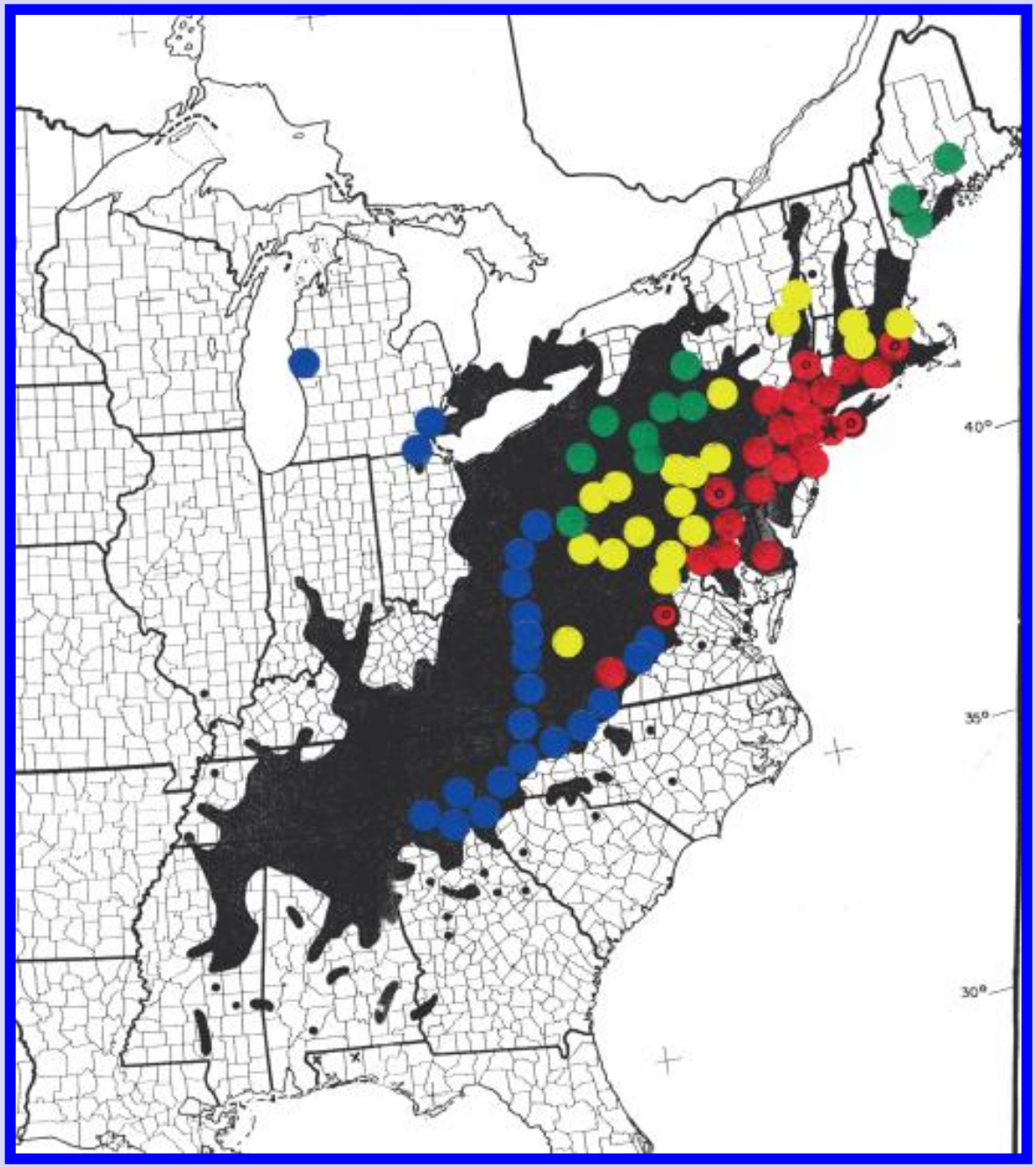
* Less than .1 of 1%.

CHESTNUT BLIGHT DISEASE

The fungus entered the U.S. from Japan in the late 1800'S on imported Japanese chestnut trees, which were resistant to the disease.

It spread initially on nursery stock, moved by people and sold by mail-order.

It then spread from tree to tree by rain splash, wind, and every creature that walked up and down the tree.



Chestnut Blight

When detected:

(late 1800's)

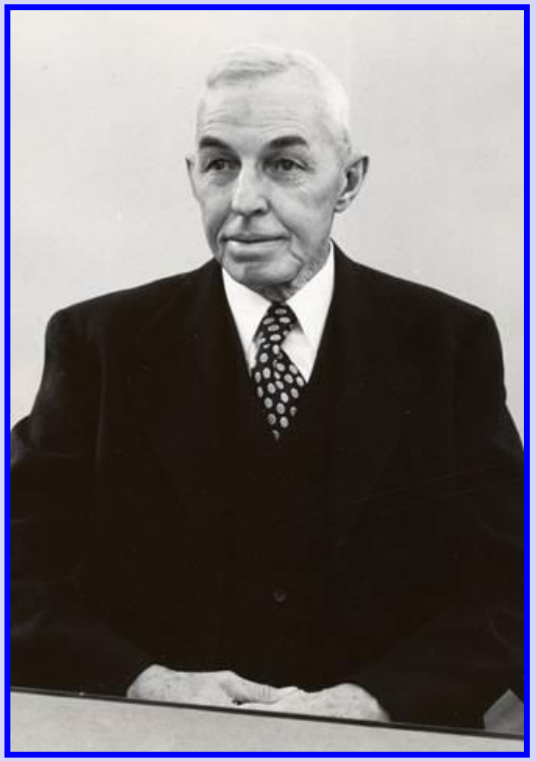
1904

1908

1911

1913

1930



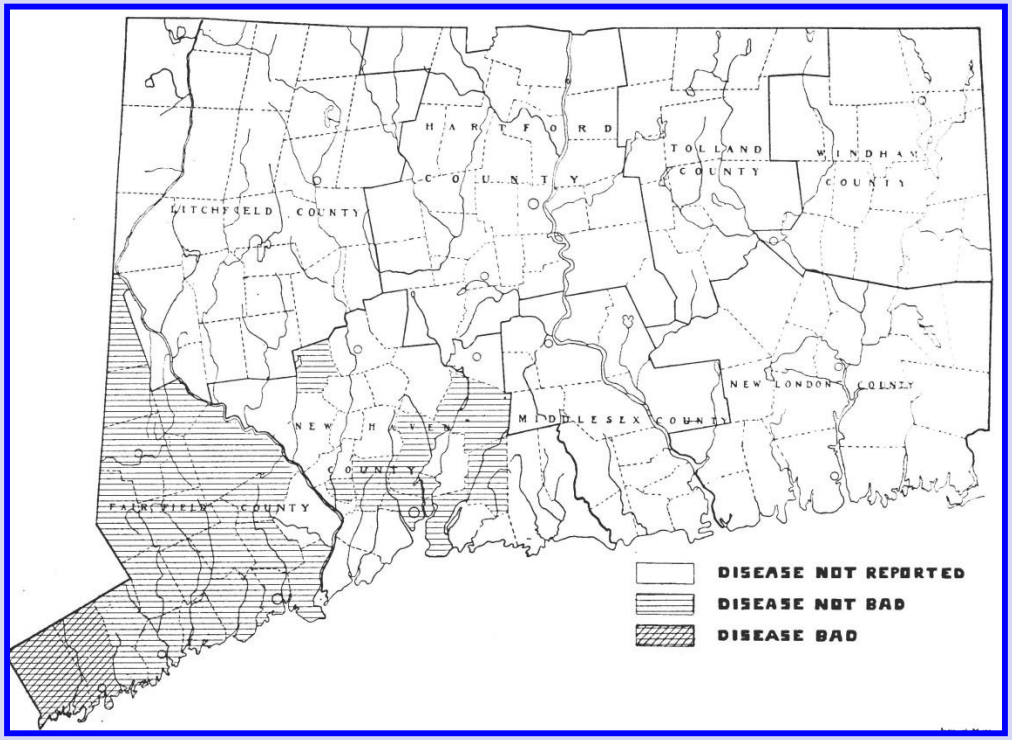
Paul J. Anderson

Worked for the PA Blight Commission,
PhD (Cornell) 1913
at CAES 1925 - 1953

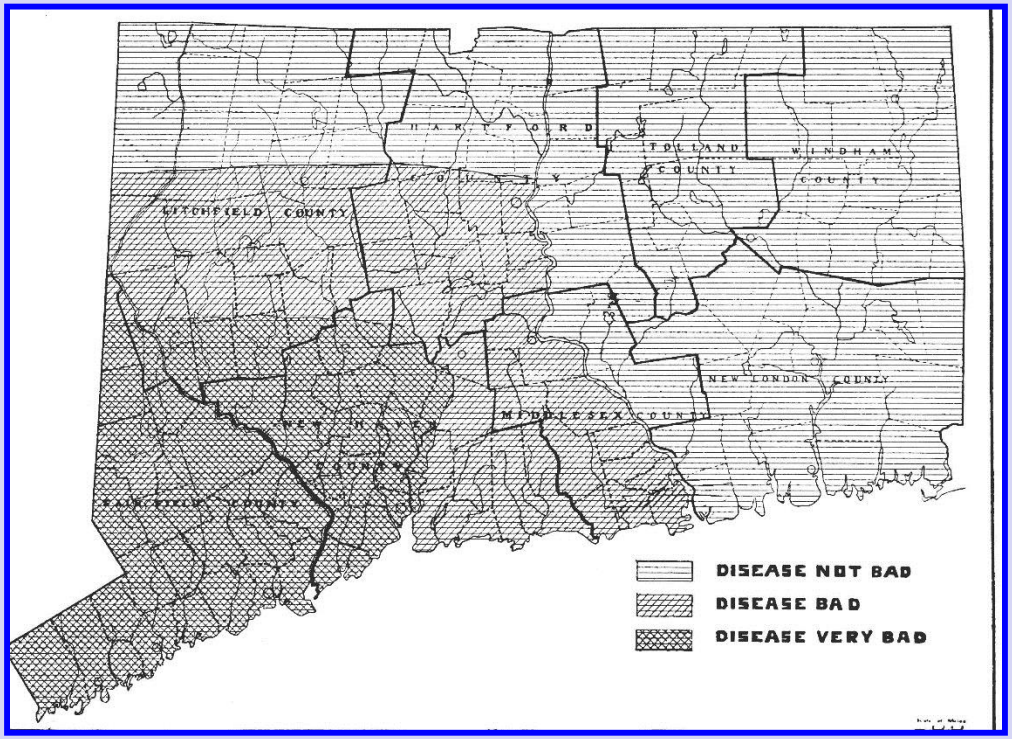
George P. Clinton

Plant Pathologist at CAES 1902 - 1937

Surveyed Connecticut for blight



1908



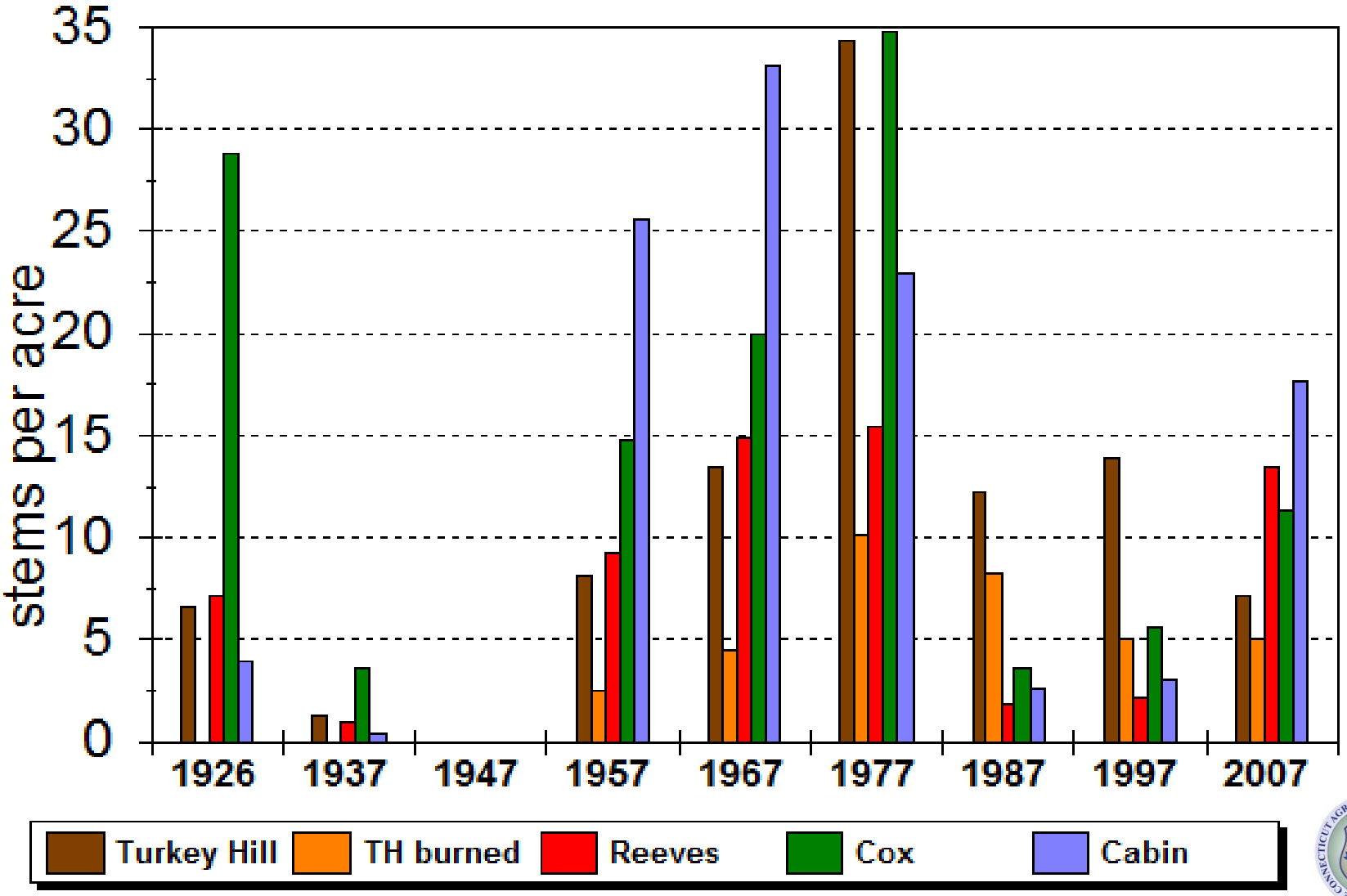
1912

Clinton's surveys of chestnut blight disease in Connecticut

CAES forester Walter O. Filey

Established transects (each 2.5 – 3 acres) through CT forests in 1926. Since then, every live woody stem in the transects has been measured by CAES foresters every 10 years.

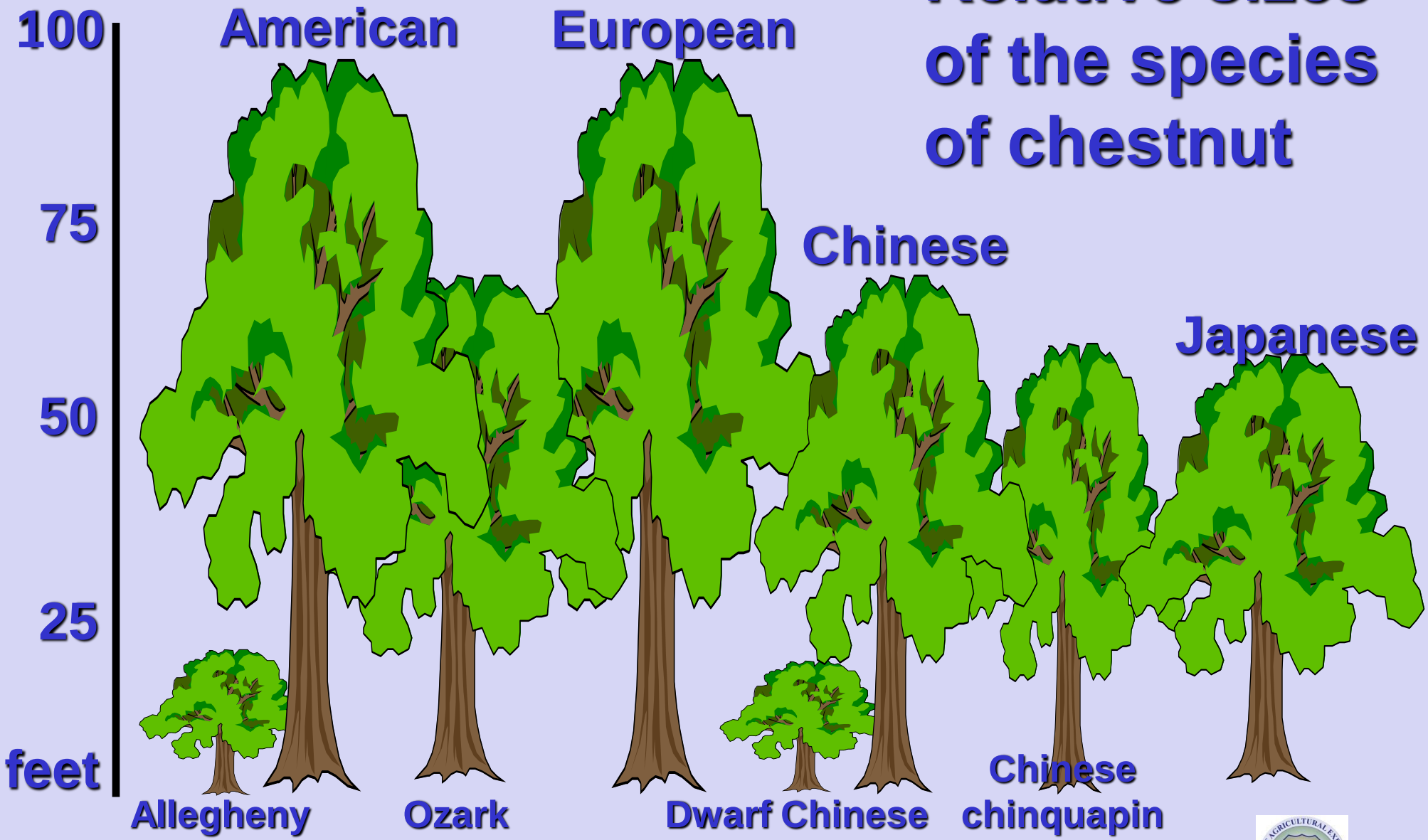
Live Chestnut Stems In Filey's Connecticut Old Forest Plots



Arthur H. Graves

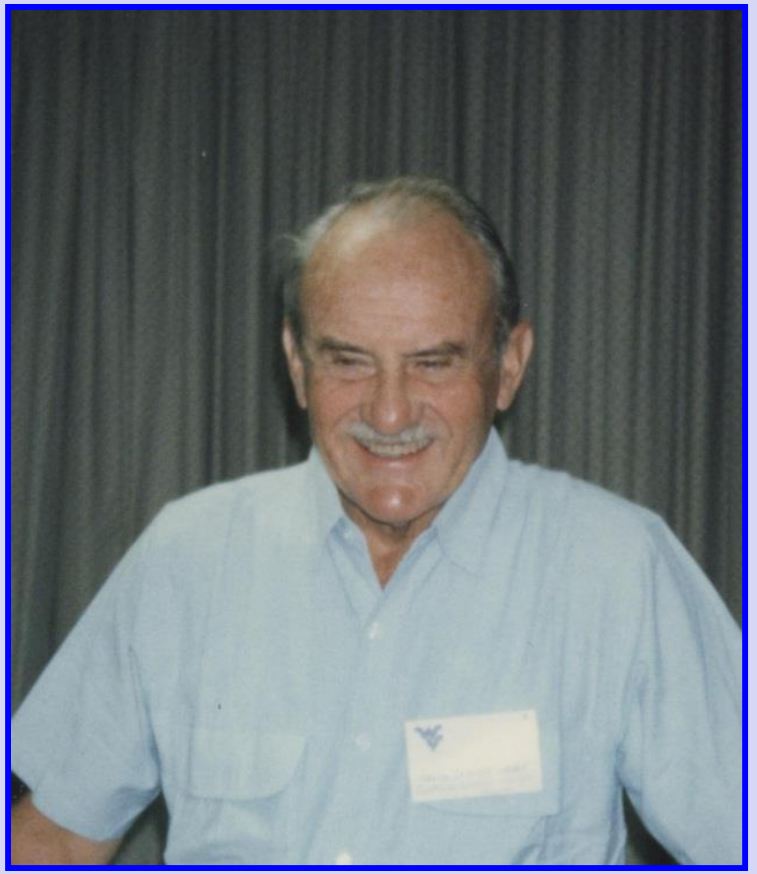
A plant pathologist working at the Botanical Garden in New York, planted chestnut trees on his family's land in Hamden, CT and worked with CAES from 1930 until 1962.

Relative sizes of the species of chestnut



Donald F. Jones, CAES geneticist (famous for his work on hybrid corn), worked with Arthur Graves on chestnut breeding until his death in 1963,

Jones and Graves supervised Yale graduate students Hans Nienstaedt and Richard A. Jaynes



Hans Nienstaedt, now known for his work in Mexico on pines

M.A. Yale 1948, PhD. Yale 1951

Richard A. Jaynes

M.A. Yale, PhD. Yale 1961

Besides his work with chestnuts, Jaynes edited the Northern Nut Growers 1969 and 1979 Handbooks, bred mountain laurel plants and has written two books about them.

Worked at CAES until 1983

Sandra Anagnostakis

Now Emeritus

CAES from 1966 –2012

The first big break-through

Jean Grente, in Clermont-Ferrand, France

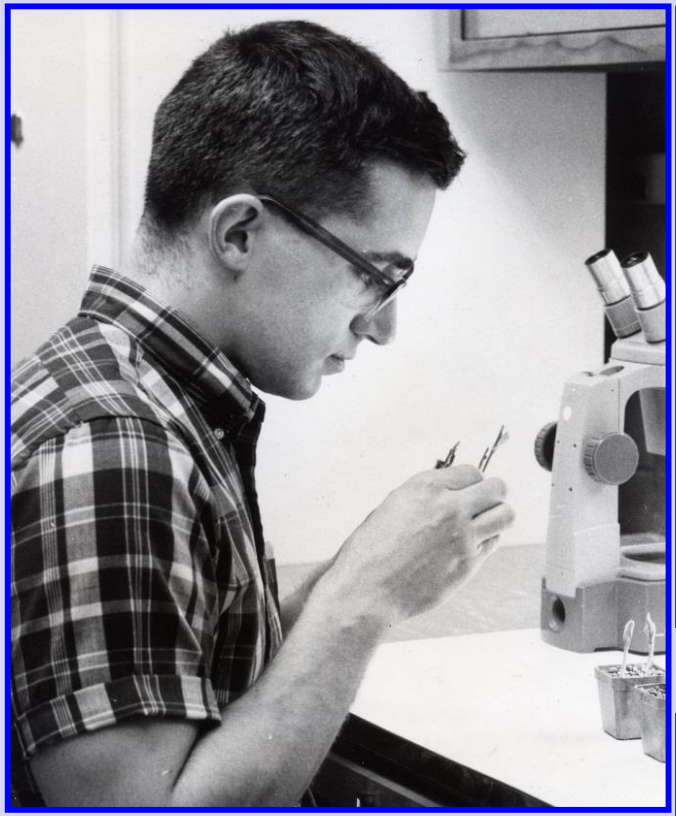
In 1969, reported low-virulent blight strains that could keep blight infected chestnut trees alive

CAES imported cultures of these "curing" blight strains from Grente in 1972.

Grente called them "hypovirulent" because they did not kill the chestnut trees and could spread their cure to killing cankers.

Hypovirulent cankers on American chestnut trees

Peter R. Day

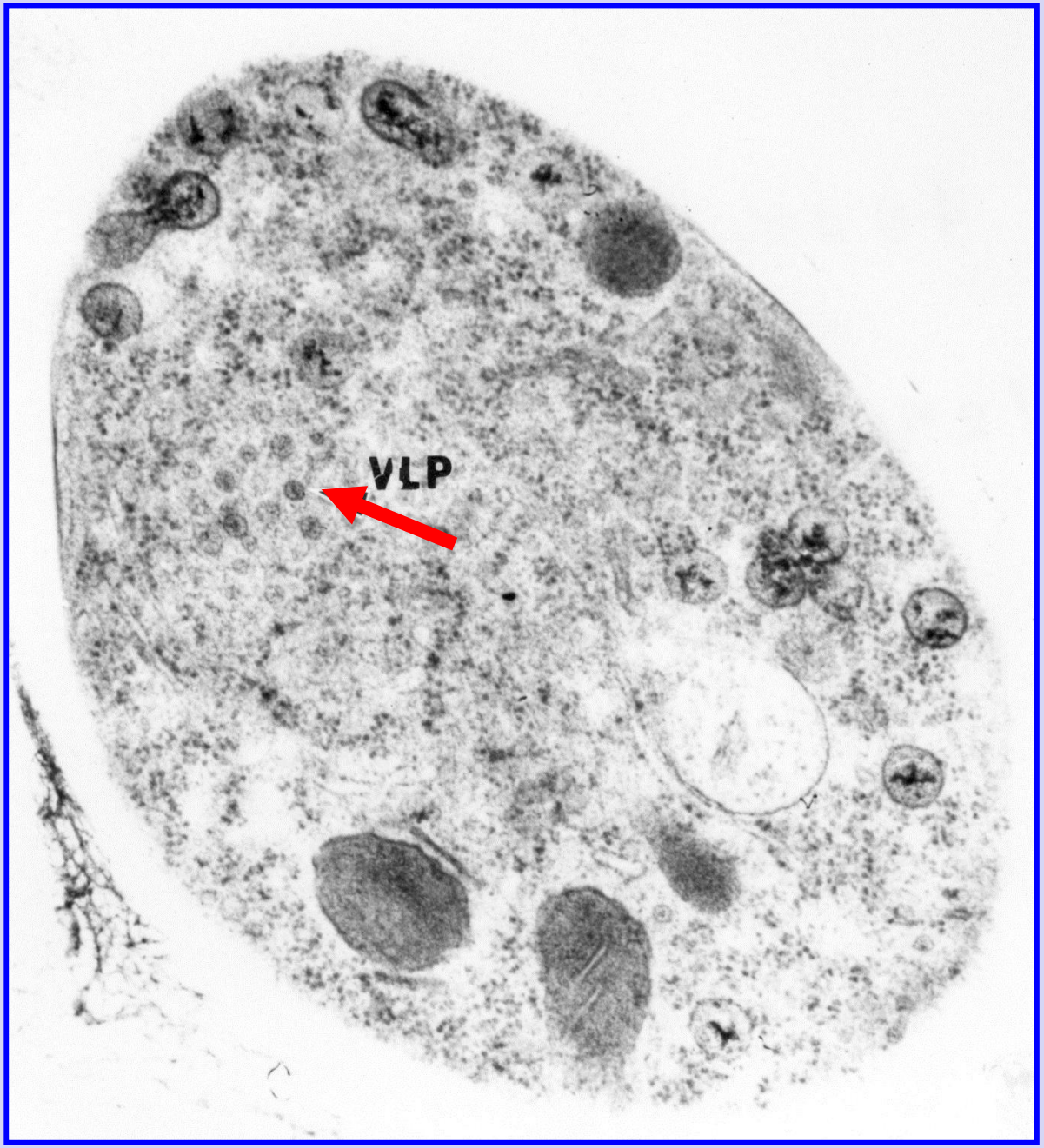


John E. Puhalla

John E. Elliston

The staff in the Genetics Department at CAES all worked on this disease complex for several years

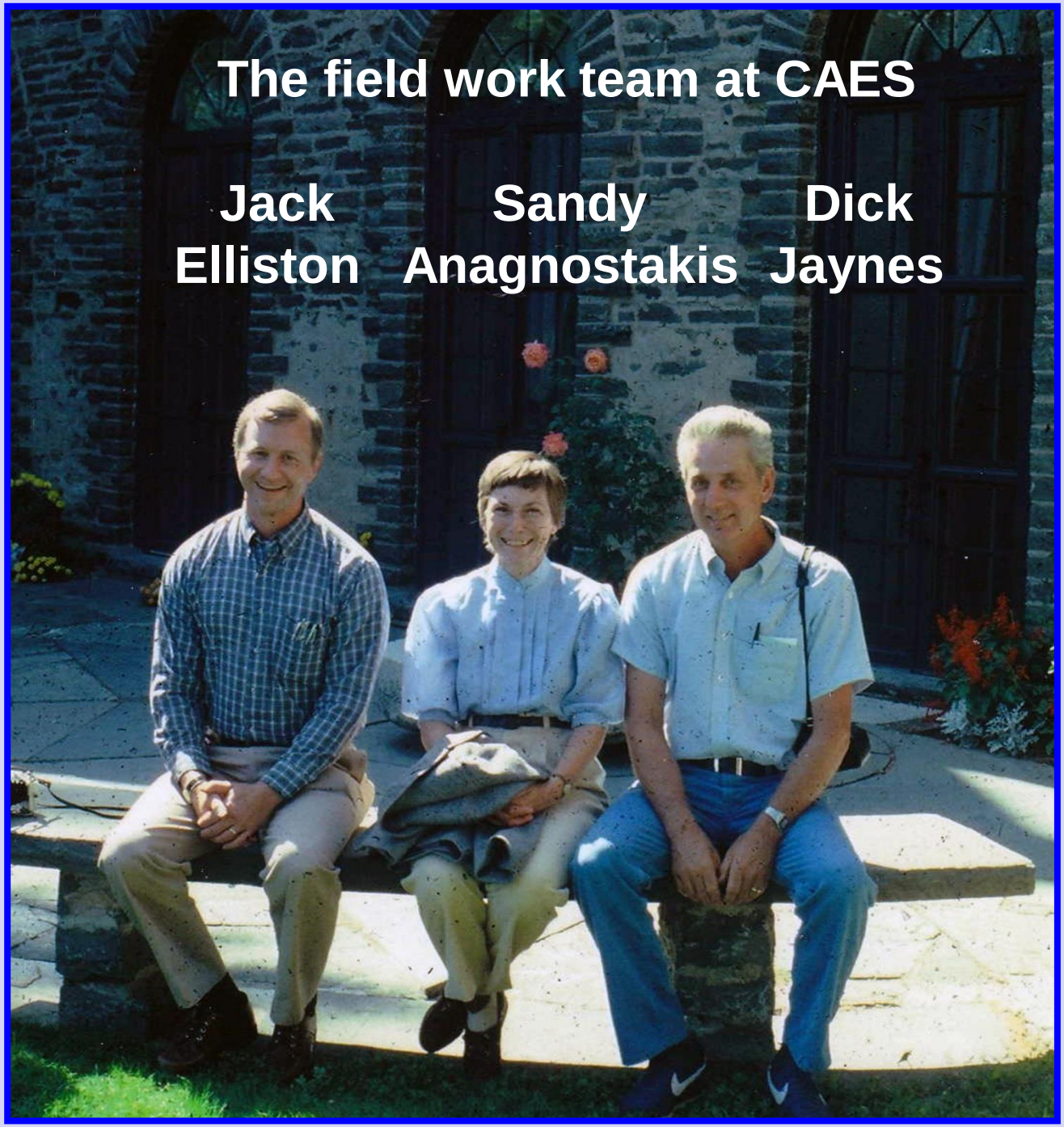
Neil Van Alfen

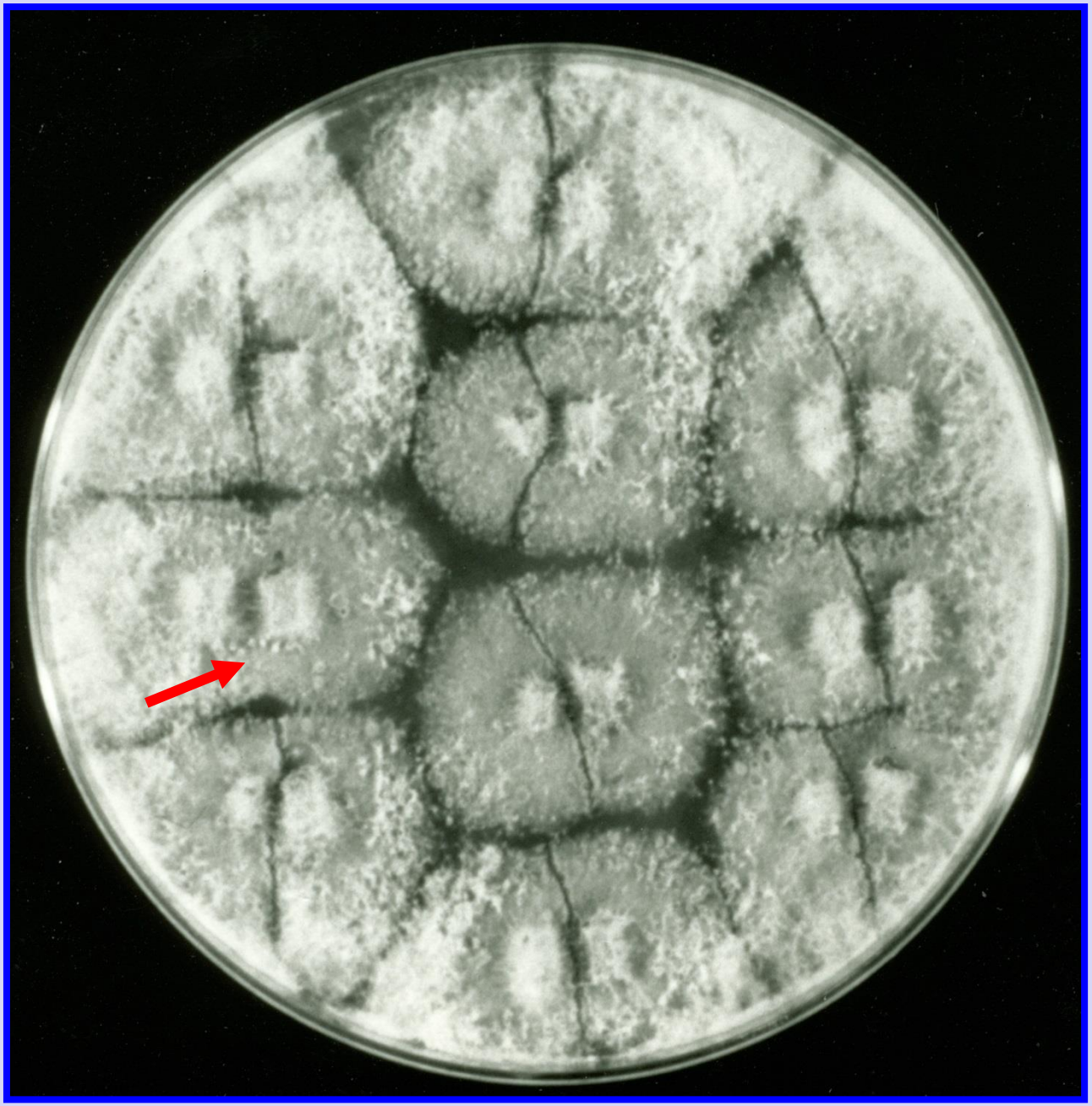


With J. Allan Dodds, we showed that a virus in the blight fungus was responsible for hypovirulence.

1977 electron micrograph of the fungus showing viruses

The field work team at CAES





Vegetative incompatibility in the blight fungus is controlled by many genes, and can restrict virus transmission. The virus can only be transferred if the strains fuse.

Anagnostakis, 1977

We used mixtures of H strains to treat chestnut blight cankers to overcome vegetative incompatibility.

Photo by Gary Braasch

American chestnut trees, 40 years old
32 years since last H treatment

1978 First International Chestnut Meeting
Morgantown, West Virginia

In 1978, McCaroll and Thor reported on the role of oxalic acid, produced by the blight fungus, in causing cankers.

In 1983, Havir and Anagnostakis showed that virulent strains of the fungus produced oxalic acid, and hypovirulent strains produced very little. We suggested that this was the way the virus kept the fungus from being able to kill trees

THE TREE BREEDING GOES ON

Bag female flowers on selected, mother trees, add pollen from selected father trees, harvest the nuts, and plant them to select the offspring.

P. Sletten and S. Anagnostakis

HYBRID ORCHARD IN WINDSOR, CT

With chestnuts growing as Timber or Orchard trees


Orchard Chestnut Tree
Work

American chestnuts **Japanese hybrid chestnuts**

When chestnuts are grown for food, size, flavor, and nutrient content are important.

Nutrients in Chestnuts
Senter, et al. 1974

Species	Total lipids	Oleic acid	Linoleic acid	Linolenic acid
Chinese	21.7	9.1	7.7	0.8
European	29.5	8.8	12.6	1.7
Allegheny chinquapin	40.1	16.8	12.2	1.8
American	95	57.3	9.1	1.6

Asian chestnut gall wasp (*Dryocosmus kuriphilus*) on chestnut trees.

This insect was first found at the CAES Lockwood Farm in Hamden, CT in 2010

Ozark chinquapins (*C. ozarkensis*) are resistant to gall wasp infestation

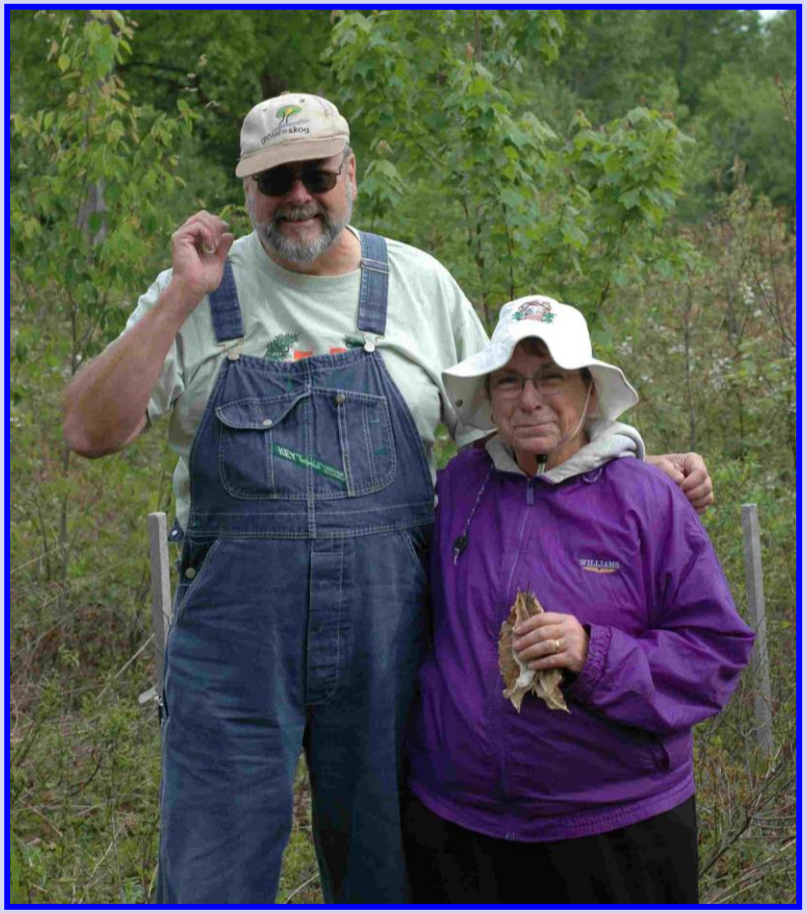
‘Eaton’ x *ozarkensis* **‘Colossal’ x *ozarkensis***

Commercial cultivars crossed with Ozark chinquapins yield seedlings that grow past galls, and continue to fruit


Timber Chestnut Tree
Work
02.20.2

A 22 year old back-crossed hybrid with good timber form. In about 20 years we will know whether it can grow tall enough to compete in the CT forest.

With A Little Help From My Friends



Scott Schlarbaum
University of Tennessee

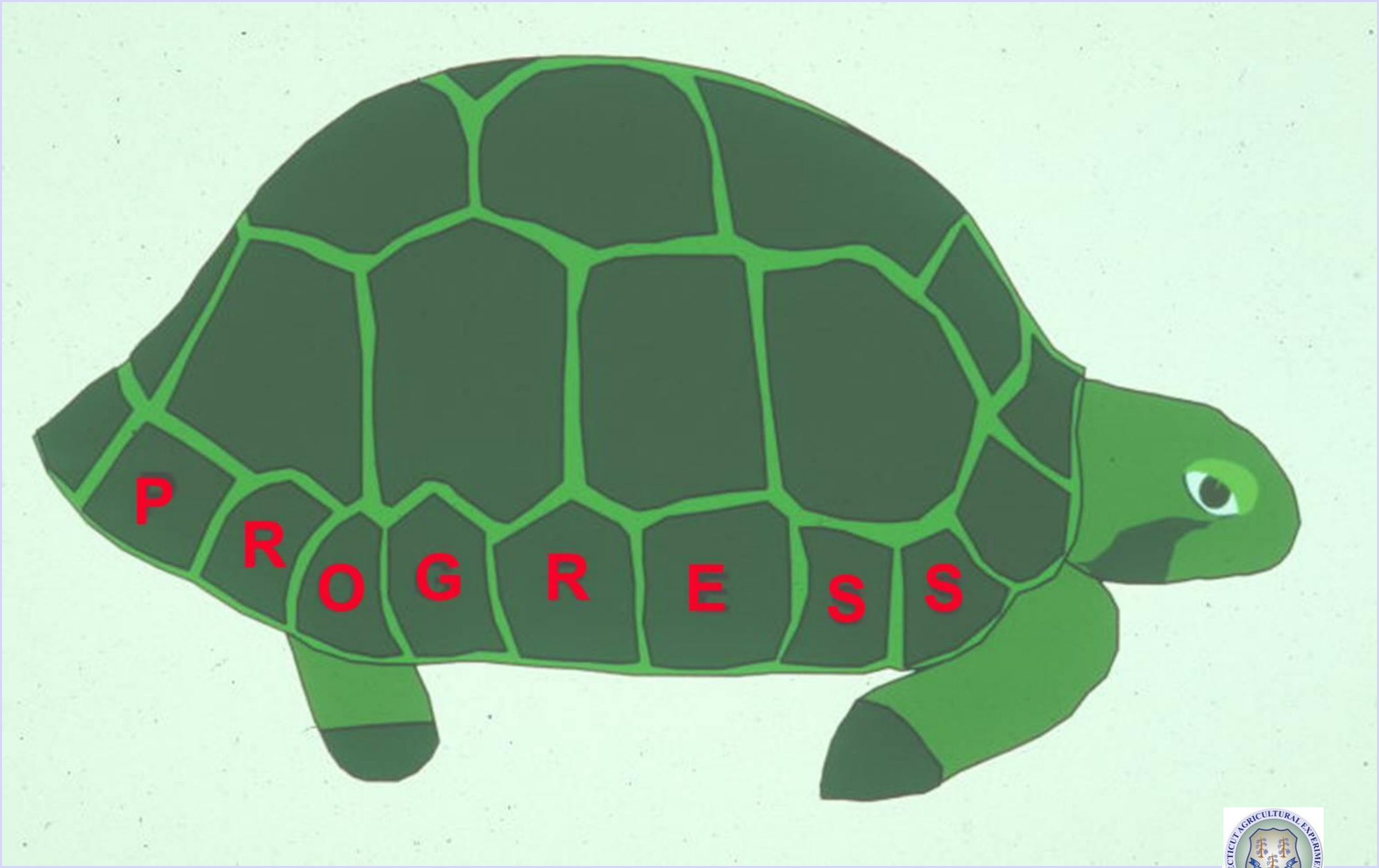
Philip Gordon Old Lyme, CT
1919-2010

2003

Pamela Sletten
Assistant, 1985 to 2012

Cornelia Pinchot, MA Yale,
PhD Univ. Tenn. 2011,
now with the U.S. Forest Service
in Ohio

Timber hybrids planted in the forest in Connecticut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The Work Goes On

1. Cross commercial chestnut cultivars with new Japanese chestnut trees to improve blight resistance, and Phytophthora root rot resistance

2. Plant hybrid, timber chestnut trees in forest trials (with tree shelters and with hypovirulence) in different soil and competition environments

3. Cross commercial orchard chestnut trees with chinquapins to get new hybrid trees with resistance to gall wasp, and improved flavor and nutrient content

It's Not Over Yet