Why Integrated Pest Management?

First – the Legal Fine Print

Sec. 23-61b. Licensing for arboriculture; examination; fees; renewal; suspension; revocation. Nonresidents. Records. Pesticides.

(a) No person shall advertise, solicit or contract to do arboriculture within this state at any time without a license issued in accordance with the provisions of this section,.... (exception for one's own or one's employer's property)

(h) Any licensed arborist shall be considered to be a certified applicator under section 22a-54 with respect to the use of pesticides.

Connecticut Commercial Pesticide Supervisor Category 3D: Arborist

Identification, Diagnosis and Tree Biology

The applicant should:

a. be able to identify all common trees found in the region in their summer and winter condition, including but not limited to, those listed below;

b. know the normal healthy form of the tree, and its appearance and rate of growth under normal and abnormal conditions;

c. know the suitability of trees to different sites;

d. know the factors involved in maintaining tree health and appearance and how to anticipate and control or prevent damage from various causes;

e. understand the functions of the various parts of the tree, such as leaves, bark, wood, roots, etc. and be able to determine if these functions are being properly performed;

f. recognize the symptoms and causal agents responsible for injuries, abnormalities and weaknesses, including, but not limited to, those listed below; and

g. know the relative susceptibility of different tree species to injurious agents.

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Treatment

The applicant should be able to determine and perform the correct and proper treatment to improve the conditions of any tree. The applicant should know the currently accepted standard practices of arboriculture. This requires knowledge of:

- **Tree surgery.** *(to be covered in pruning class)*
- **Tree nutrition.** *(covered in soils class)*
- **Control of insects, diseases and disorders.** The applicant should know precisely when and how to control and treat the insects, diseases and disorders listed in the above tables. When pesticides are to be applied, an applicant should know the proper use and type of material to use consistent with state and federal pesticide laws. An applicant must know the basic safety and handling rules for pesticide use contained in the Pesticide Applicator Training Manual, as well as restrictions on pesticide use imposed by the Department of Energy and Environmental Protection (DEEP). The applicant should know the basic principles of Integrated Pest Management (IPM) and how to apply these principles to plant health care in arboriculture.

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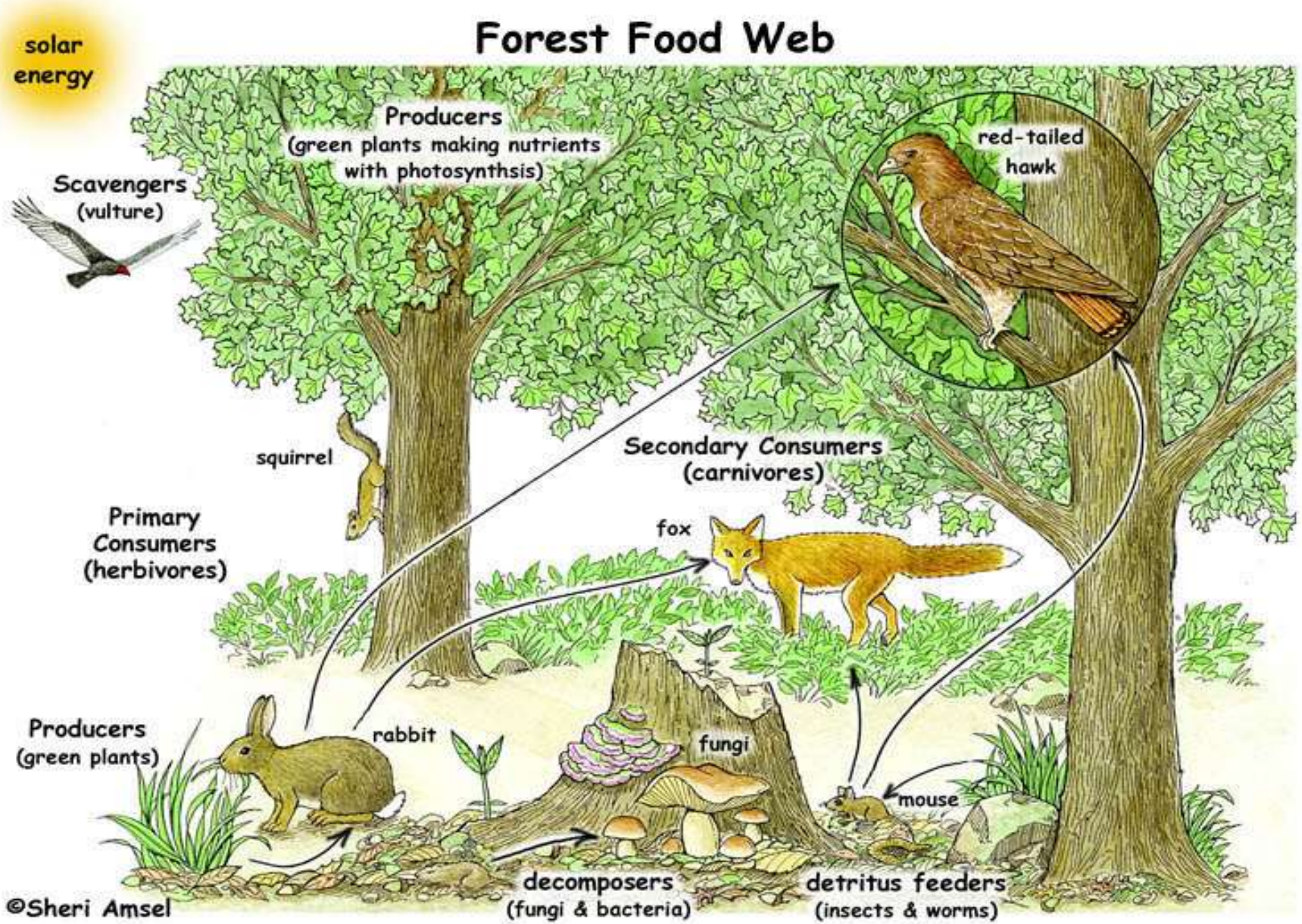
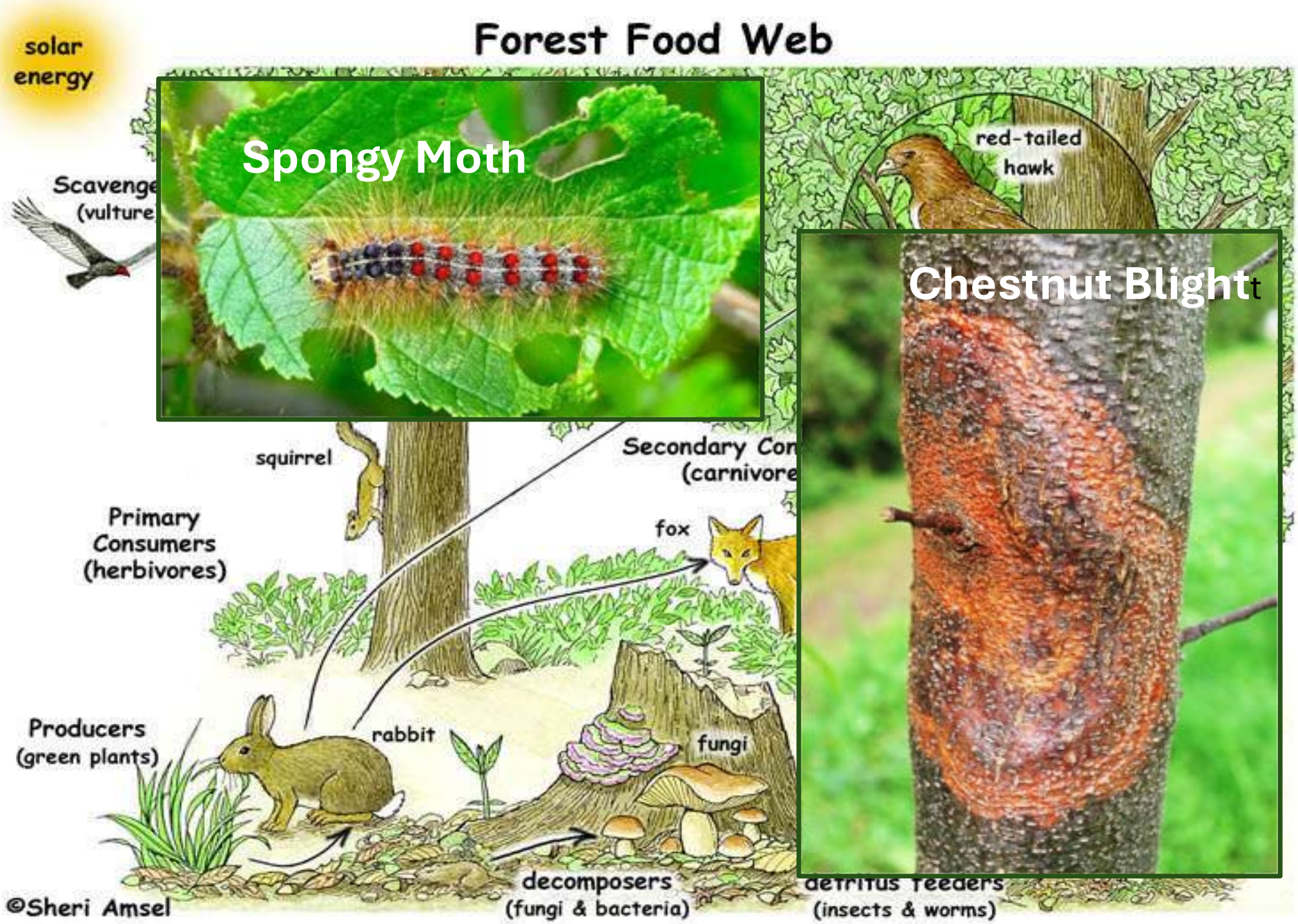
Forest Food Web





Specialized Consumers of Trees / Tree Parts


UGA3057088


UGA2733033


UGA0355036

What we will cover in tonight's class:

- Integrated Pest Management – what is it?
- How does IPM fit in with a Tree Care program?
- What do you need to know to practice IPM?
- What are some examples of IPM practices?

Integrated Pest Management Definition:

IPM is a sustainable approach to managing pests by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health, and environmental risks.

National Coalition on IPM

· biological control

· cultural control

· *physical control*

· *chemical control*

Pest Control

The Historical Timeline of Caring for Tree Health

Integrated Pest Management

Plant Health Care

Pest Control

ANNOUNCING:

soon to be a

A MAJOR MOTION PICTURE

THE GYPSY MOTH STORY

and how it influenced pest control in the 20th century

starring

Lymantria dispar

ANNOUNCING:

soon to be a

A MAJOR MOTION PICTURE

THE SPONGY MOTH STORY

and how it influenced pest control
in the 20th century

starring

Lymantria dispar

The Spongy Moth

female moths laying eggs

gypsy moth caterpillar

pupae

adult male

THE SPONGY MOTH STORY

and how it influenced pest control
in the 20th century

starring

Lymantria dispar

and featuring:

E. Leopold Trouvelot
The Chestnut Blight
Dutch Elm Disease
Arsenate of Lead
DDT
the US Forest Service
Rachel Carson
Sevin
Bt
Foliar Spraying
lotsa money
and
the maimaiga fungus

The insect was brought here from somewhere else and became established.

1869

E. Leopold Trouvelot

Medford, MA

Because there were no natural controls, the pest spread steadily if not always rapidly.

1869 – released in Medford, MA (just outside Boston)

1889 – first major outbreak (in the greater Boston area)

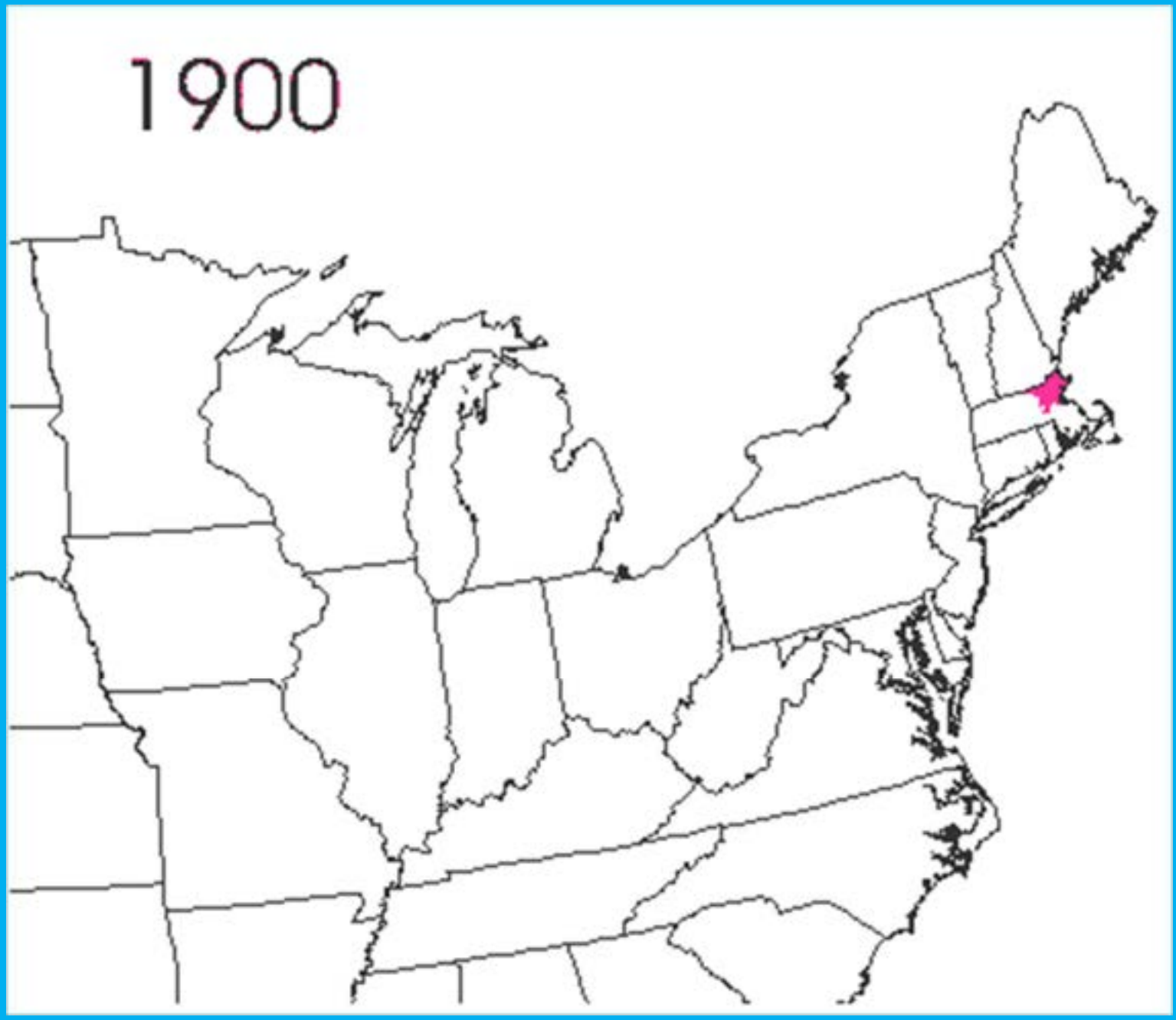
1890's – First major efforts to combat the spongy moth

1912 – first found in Connecticut

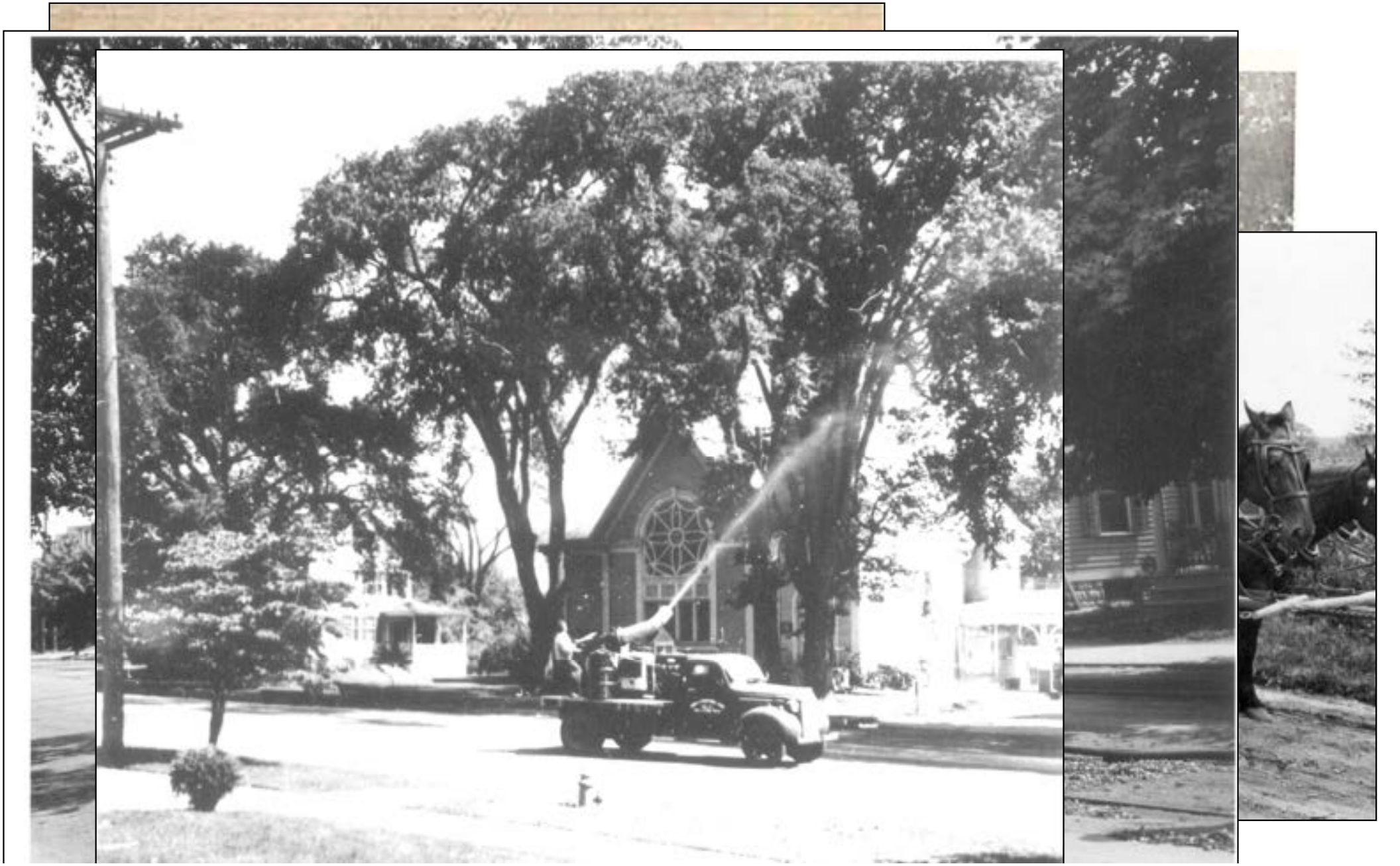
1950's – efforts ongoing to keep it east of the Hudson River

2000's – found through the Upper Midwest US

Spread of the Spongy Moth – illustrated by the US Forest Service



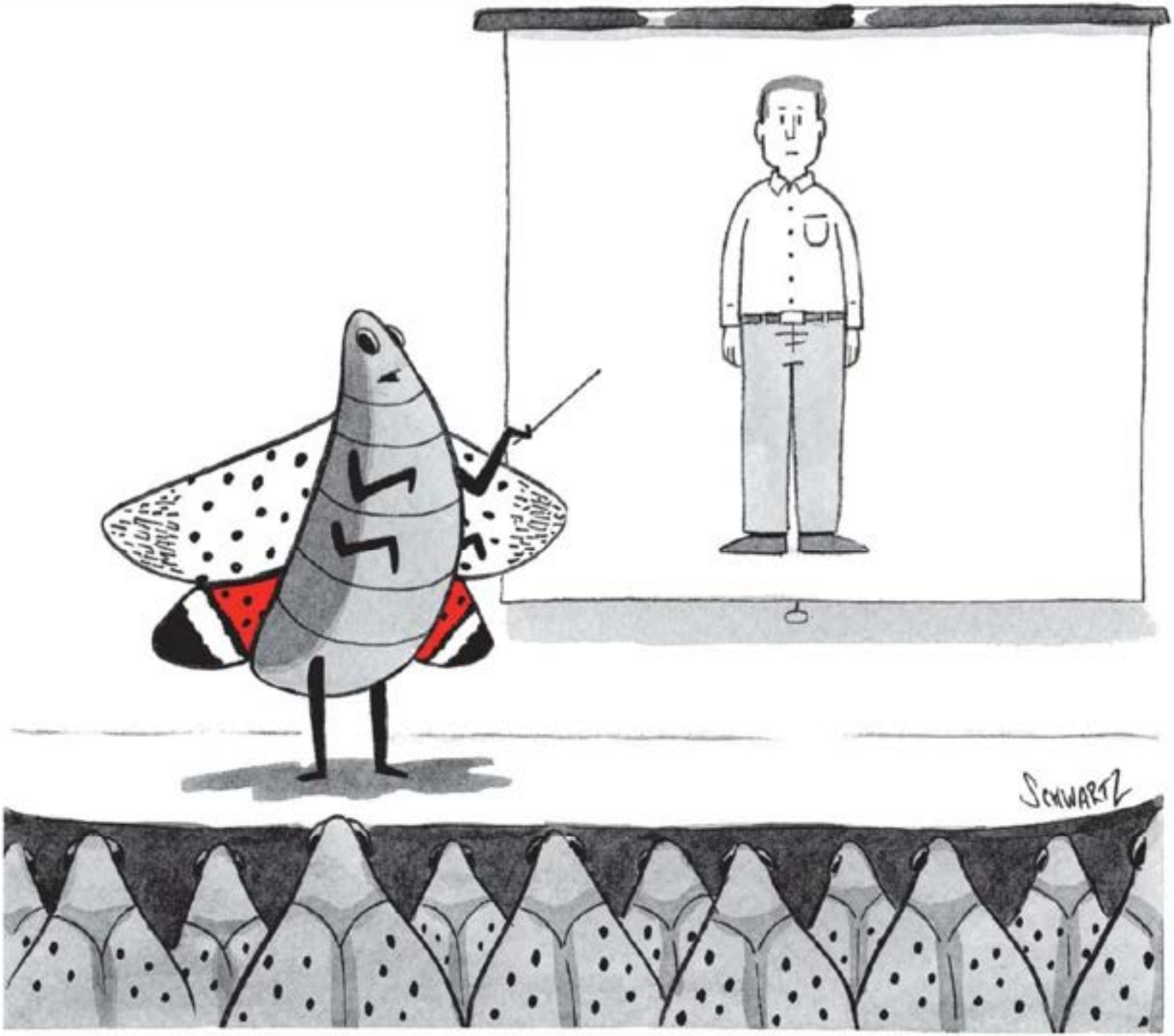
To defeat the spongy moth, we kept looking for bigger and better treatments.



The spongy moth was the first of a whole wave of similar insects and diseases that continues to this day.

The list includes:

- Chestnut blight (1905)
- White pine blister rust (1906)
- The Japanese beetle (1916)
- Dutch elm disease(1928)
- Hemlock woolly adelgid (1951 / 1985)
- Asian longhorned beetle (1996)
- Emerald ash borer (2002 / 2012)
- Beech leaf disease (2012 / 2019)
- The spotted lanternfly (2014 / 2022)

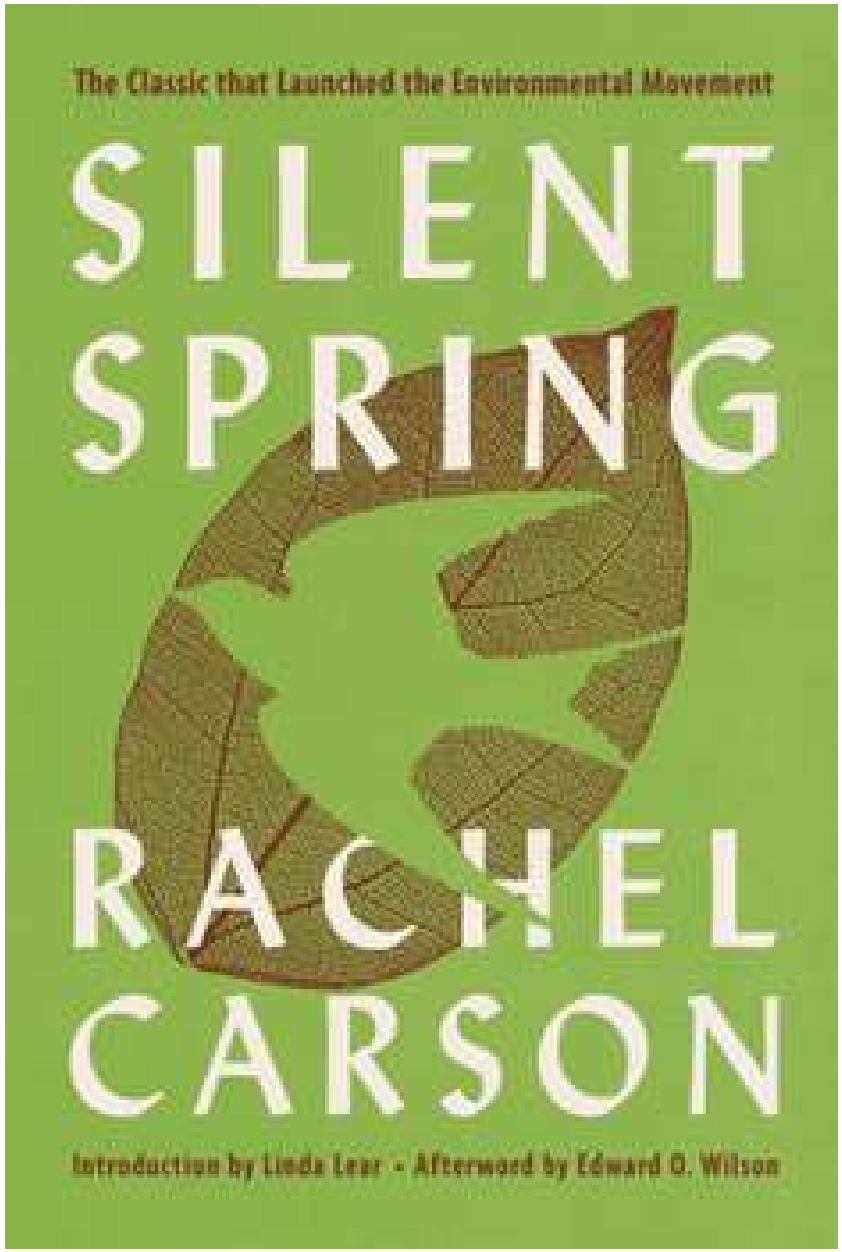


"They're an invasive species that will destroy the environment if left unchecked."

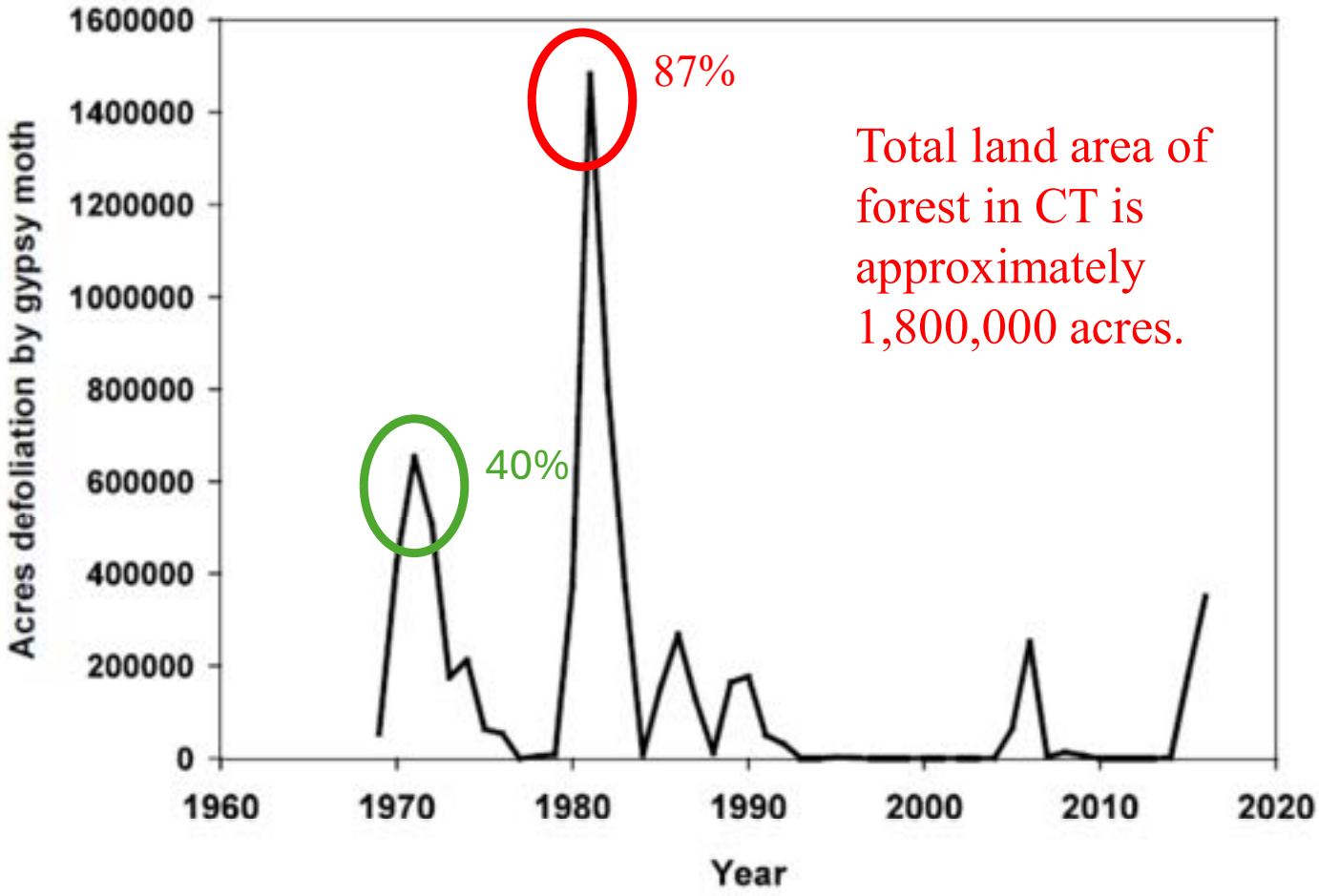
Until we came to *Silent Spring*.

First Published 1962

Focused the public discussion on the use of DDT and of pesticides in general



Spongy Moth Defoliation, CT
1969-2016 (acres)



CAES
The Connecticut Agricultural Experiment Station
Putting Science to Work for Society since 1875

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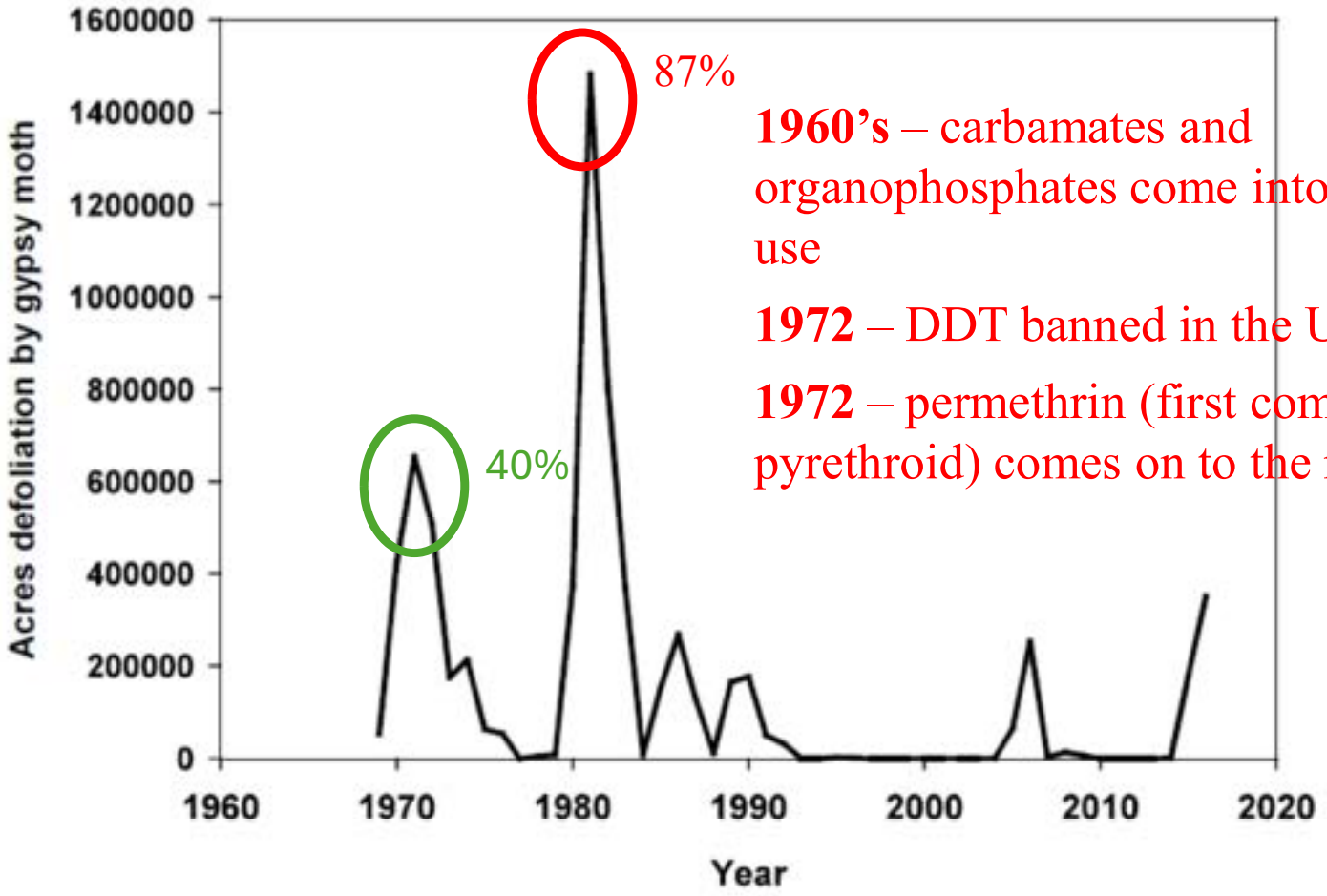

1960's – carbamates and organophosphates come into common use

1972 – DDT banned in the US.

1972 – permethrin (first commercial pyrethroid) comes on to the market

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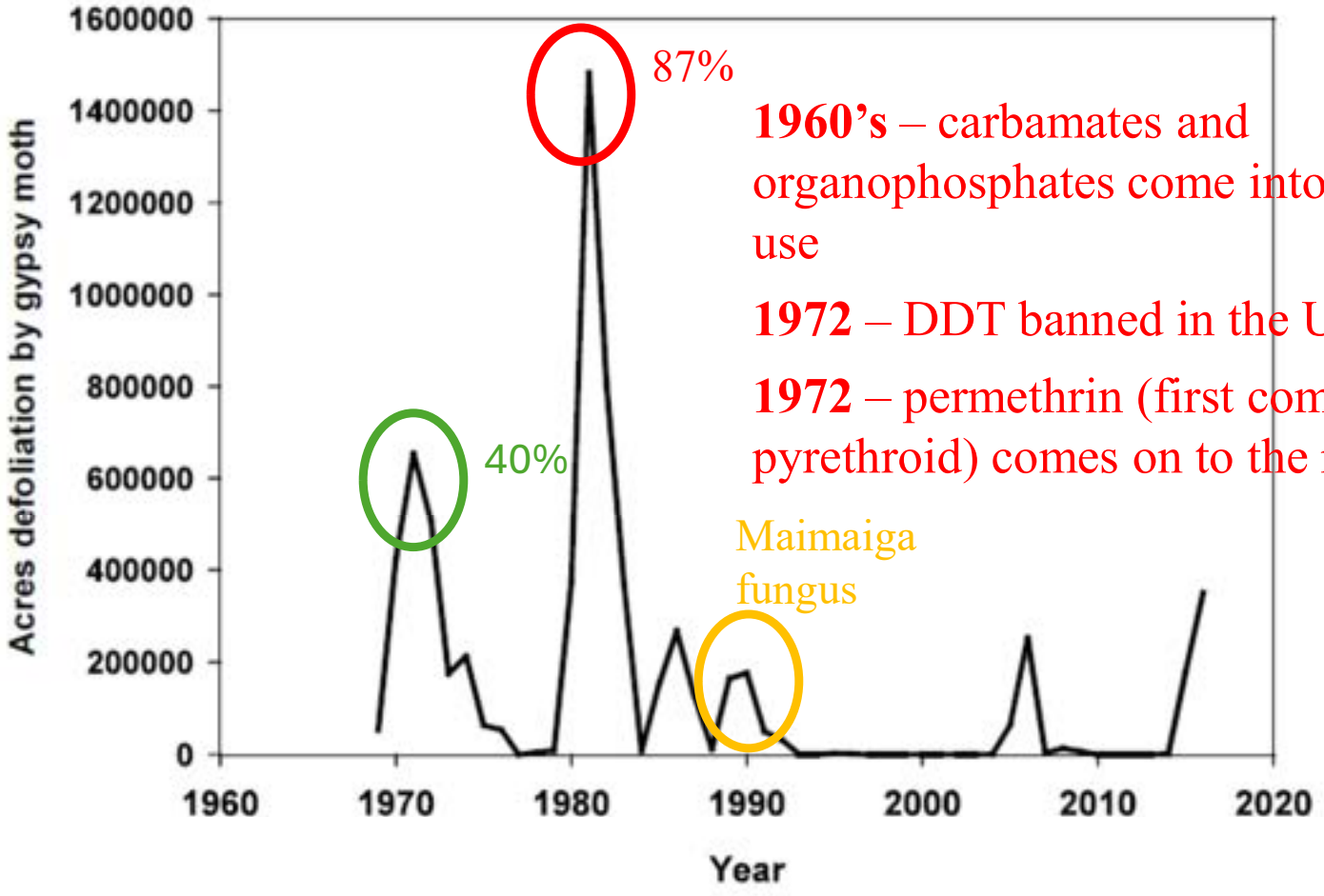

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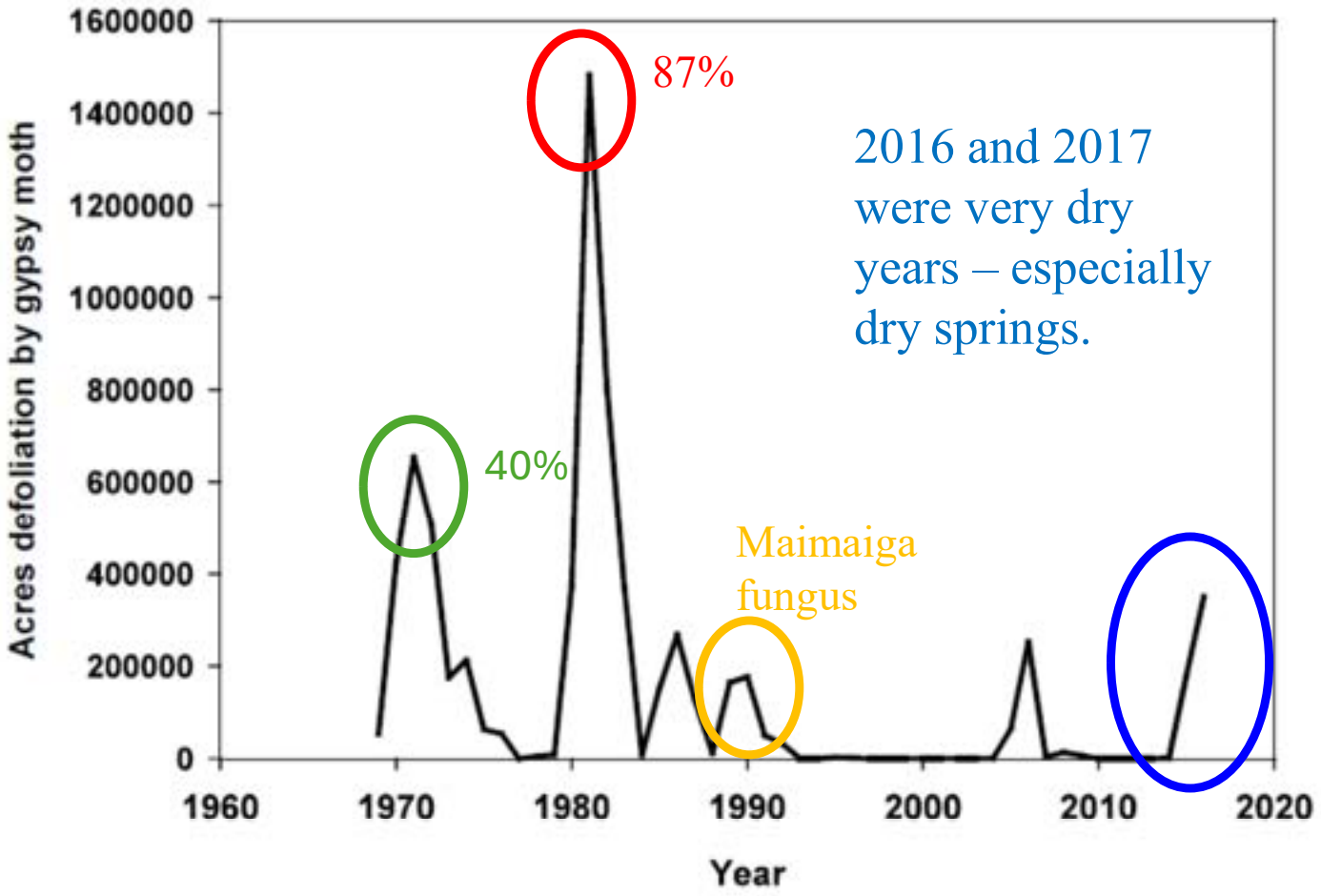
The Maimaiga Fungus

- Native to Japan
- Deliberately introduced several times as a bio-control – the first time in 1910, as recently as 1986
- Each time it flopped as a control – but it never went away
- 1990 and 1991 were wet springs in Connecticut
- Conditions were right and it exploded
- Starting in 1991, the maimaiga fungus became established and never went away
- Remains dependent on wet springs to keep it active

Spongy Moth Defoliation, CT

1969-2016 (acres)



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What is Integrated Pest Management?

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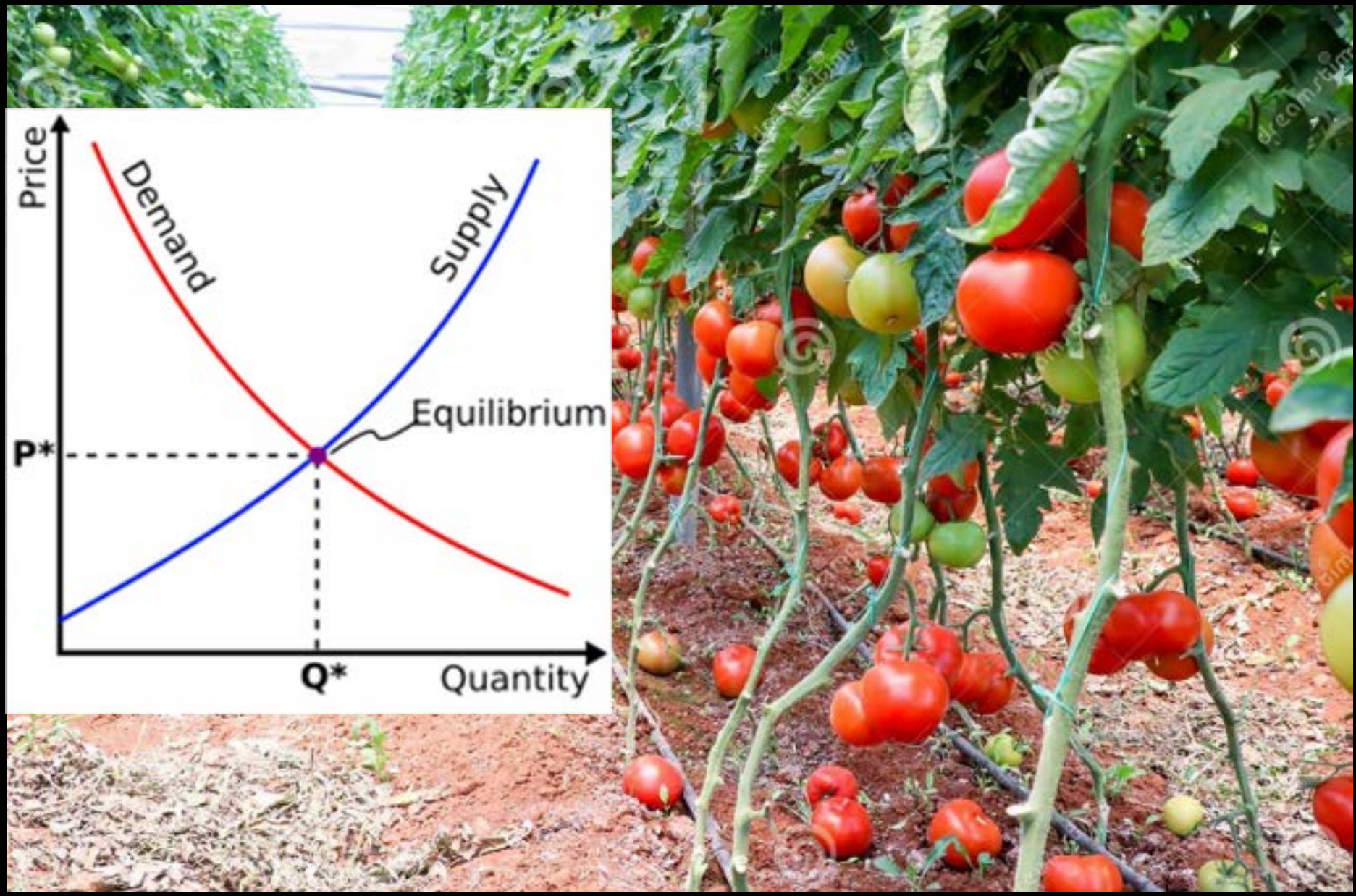

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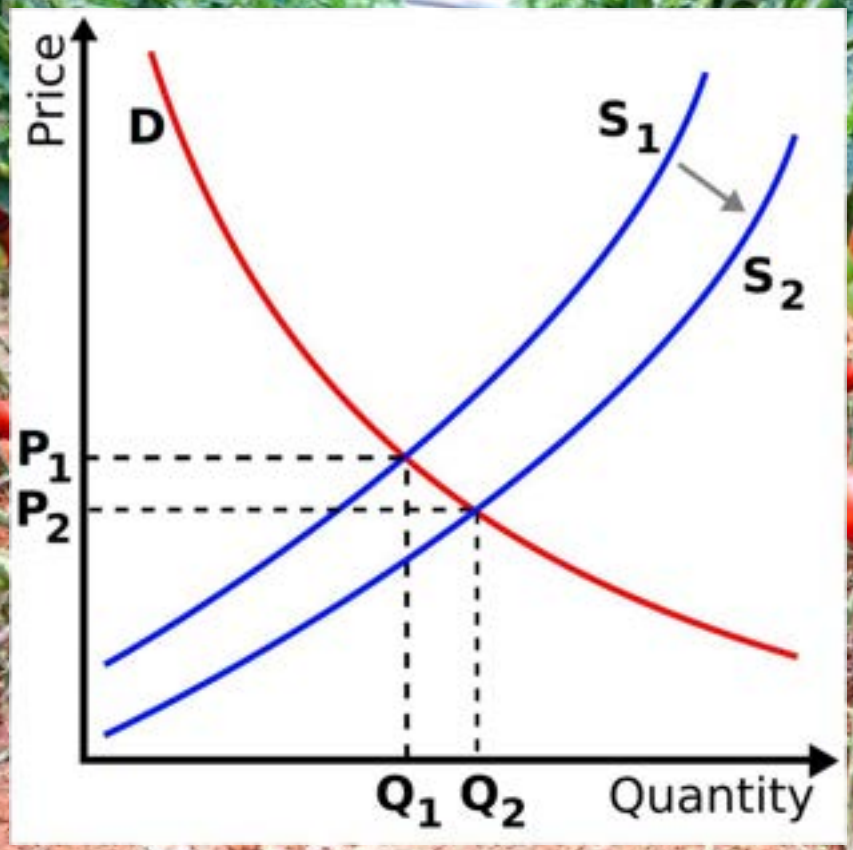

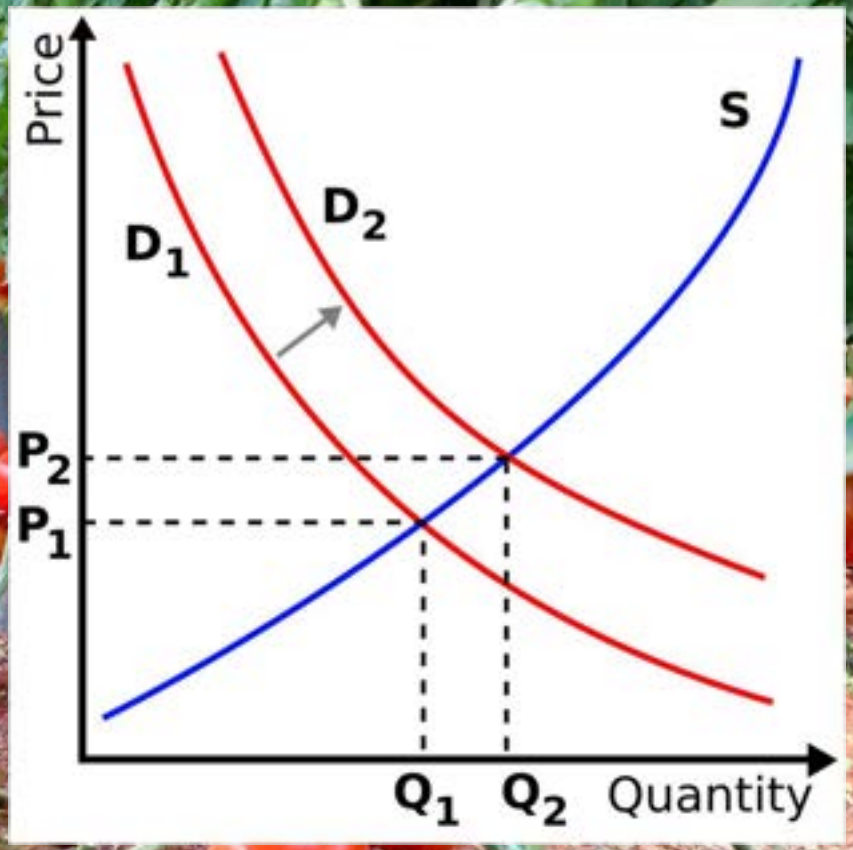

An increase in quantity tends to lead to a decrease in price.

Sometimes, an increase in demand leads to a decrease in price, even through quantity has also increased.

What is Integrated Pest Management?

40 bushels of tomatoes @ $50/bushel = $200

50 bushels of tomatoes @ $50/bushel = $250

50 bushels of tomatoes @ $40/bushel = $200

But what if it costs you $10 in pesticides to get that extra 10 bushels?

(50 bushels of tomatoes @ $40/bushel)
- $10 pesticides = $190

But – what does the price of tomatoes have to do with arboriculture?

A brief discussion of the economics of arboriculture – what is tree work worth?

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In IPM, in arboriculture, you are largely being paid based on :

- Your ability to provide peace of mind
- Your ability to do quality work
- Whether you have the knowledge of the right way / best way to get the job done
- **Your client's belief in what you are doing!**

The Historical Timeline of Caring for Tree Health

Pest Control

Very reactive

Integrated Pest Management

Much more proactive

Plant Health Care

The Historical Timeline of Caring for Tree Health

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In 1997 – the section of the Connecticut General Statutes known as “Connecticut Pesticide Control Act” was amended to include the following:

Sec. 22a-47. Definitions. For purposes of this part, subsection (a) of section 23-61a and sections 23-61b and 23-61f:

…

(dd) “Integrated pest management” means use of all available pest control techniques including judicious use of pesticides, when warranted, to maintain a pest population at or below an acceptable level, while decreasing the unnecessary use of pesticides.

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Why do we treat trees?

Do trees really need the help?

Is something wrong with this tree?

Or, is something right with this tree?

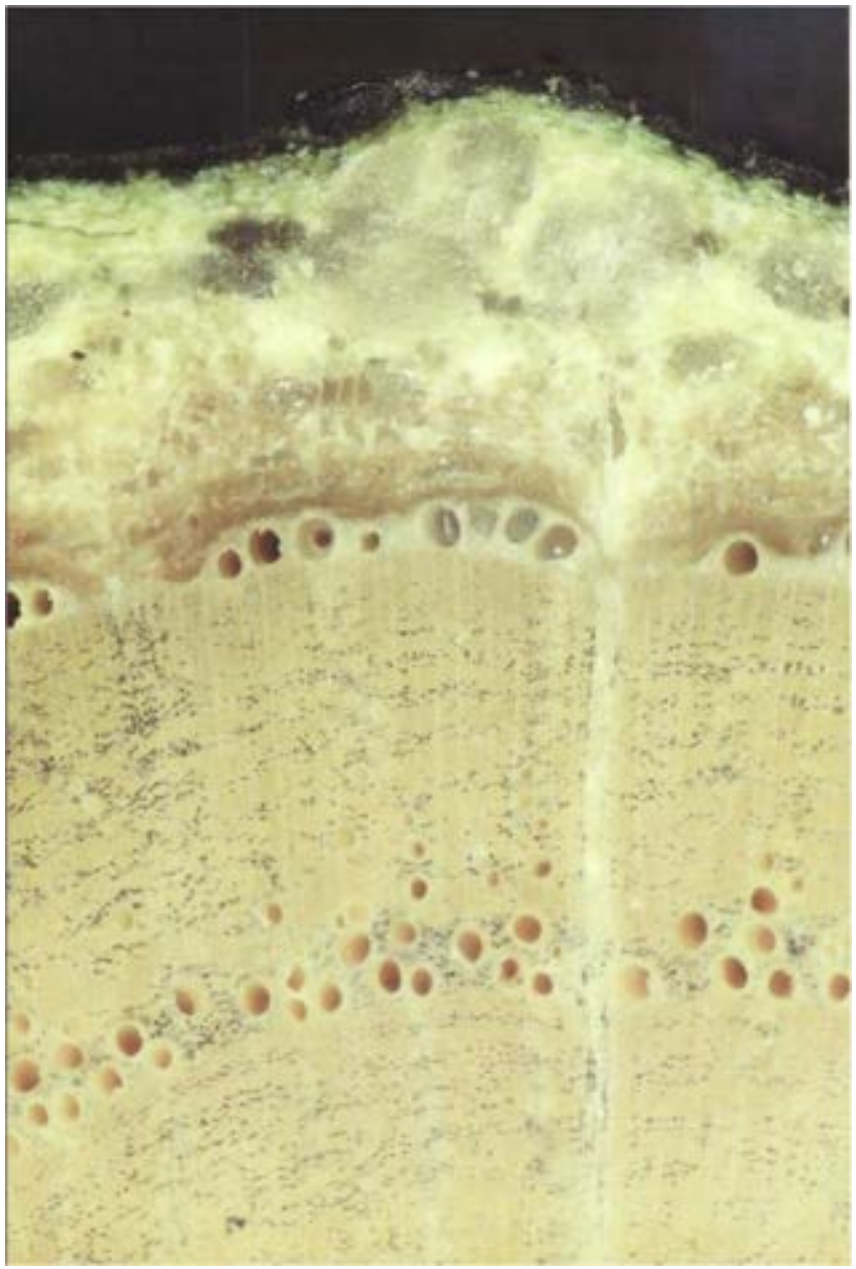
What Does a Healthy Tree Do???

Photosynthesis

Carbon Dioxide + Water ➔ Oxygen + Sugar

What the tree uses its sugars for:

- *energy storage*



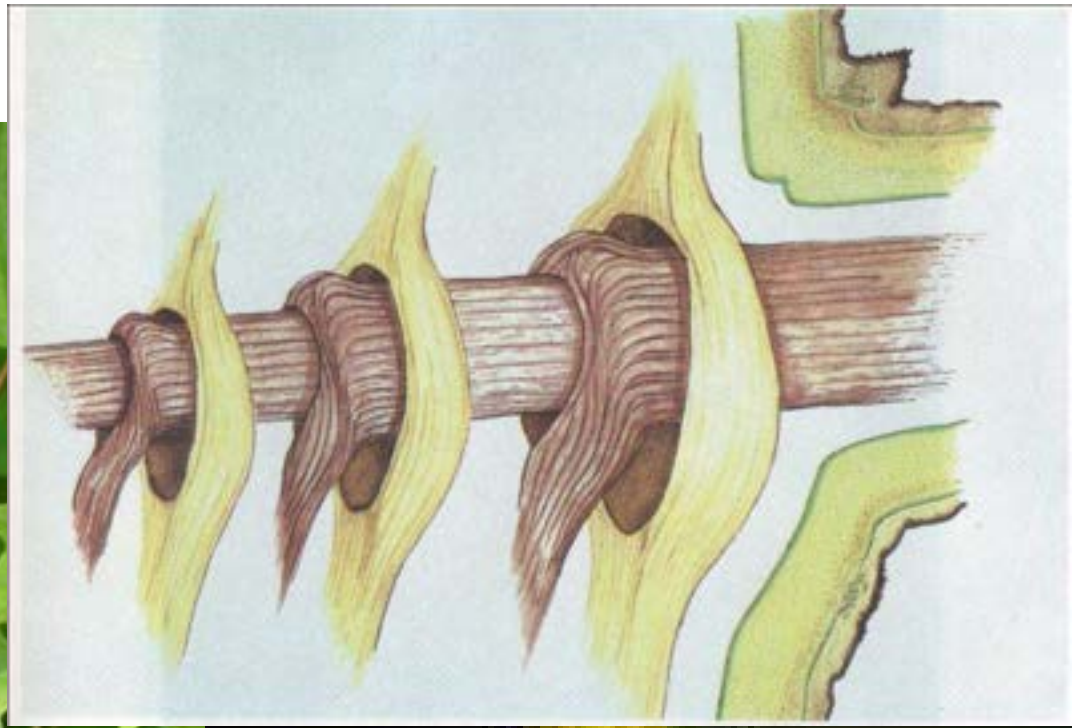
This photo by Alex Shigo shows a section of red oak that has been treated with iodine. The black specks that you see throughout the wood are starches – iodine turns starches black or dark blue.

This is another major function of wood – it helps store the food supply of the tree – starches and fats (oils). The ray cells aid with transportation within the living part of the wood.

The Tree's Bank Account

What the tree uses its sugars for:

- *growth of essential tissues and structures*



- *Response growth*

What the tree uses its sugars for:

- *unusual environmental conditions*

What the tree uses its sugars for:

- *wound response (compartmentalization)*

What the tree uses its sugars for:

- *sex, including flowers and fruit*

What the tree uses its sugars for:

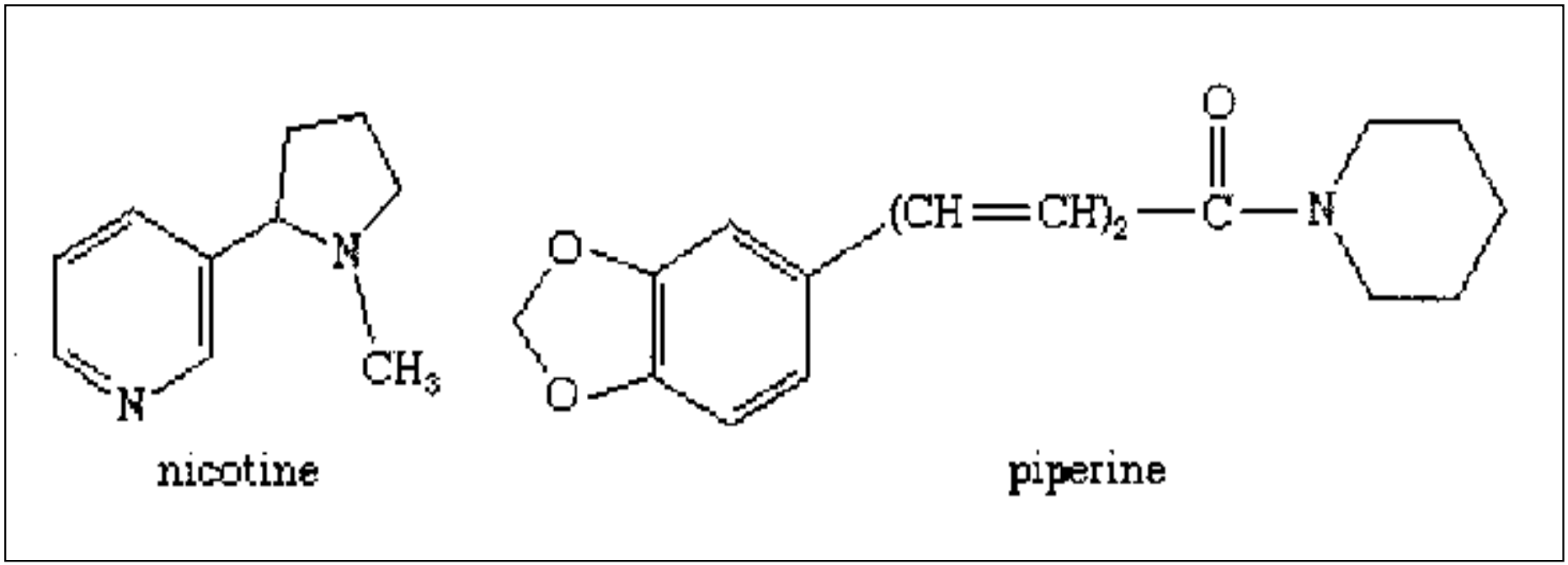
- *protection*

Self-Protection:

- *physical protection – hairs, waxes, etc.*

Self-Protection:

- *chemical protection*



Systemic Acquired Response – a whole plant immune response following exposure to a pathogen, often involving a build-up of metabolites or genetic reprogramming.

Important Points:

Trees have a Budget!

Self-Protection is Expensive!!

Only Healthy Trees do it well.

Tree Strategy:

The

Bend, Don't Break

Approach

To Pests

All Trees Have Many Different Pests That May Harm It


UGA1326221

Balance of Nature

Balance of Nature

No pests means no lady bugs - the tree is defenseless should a pest come along.

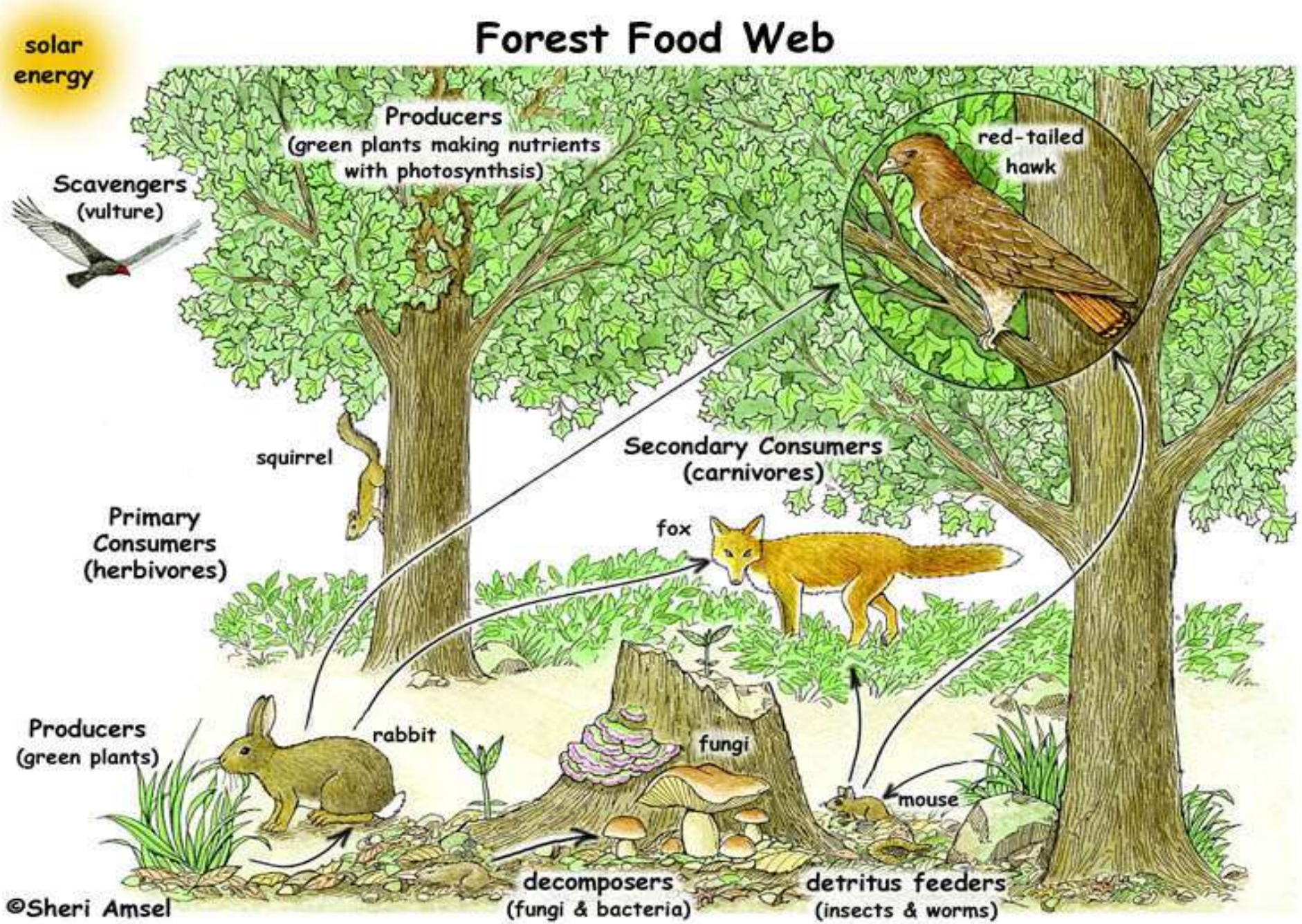
The tree relies on the ladybugs to keep the aphids in check.

Balance of Nature

The web of life is very large and complex.


Balance of Nature:
Evolution

Forest Food Web



Imbalance in Nature

Emerald Ash Borer

Asian Longhorned Beetle

Worcester MA - Before

Worcester MA - After

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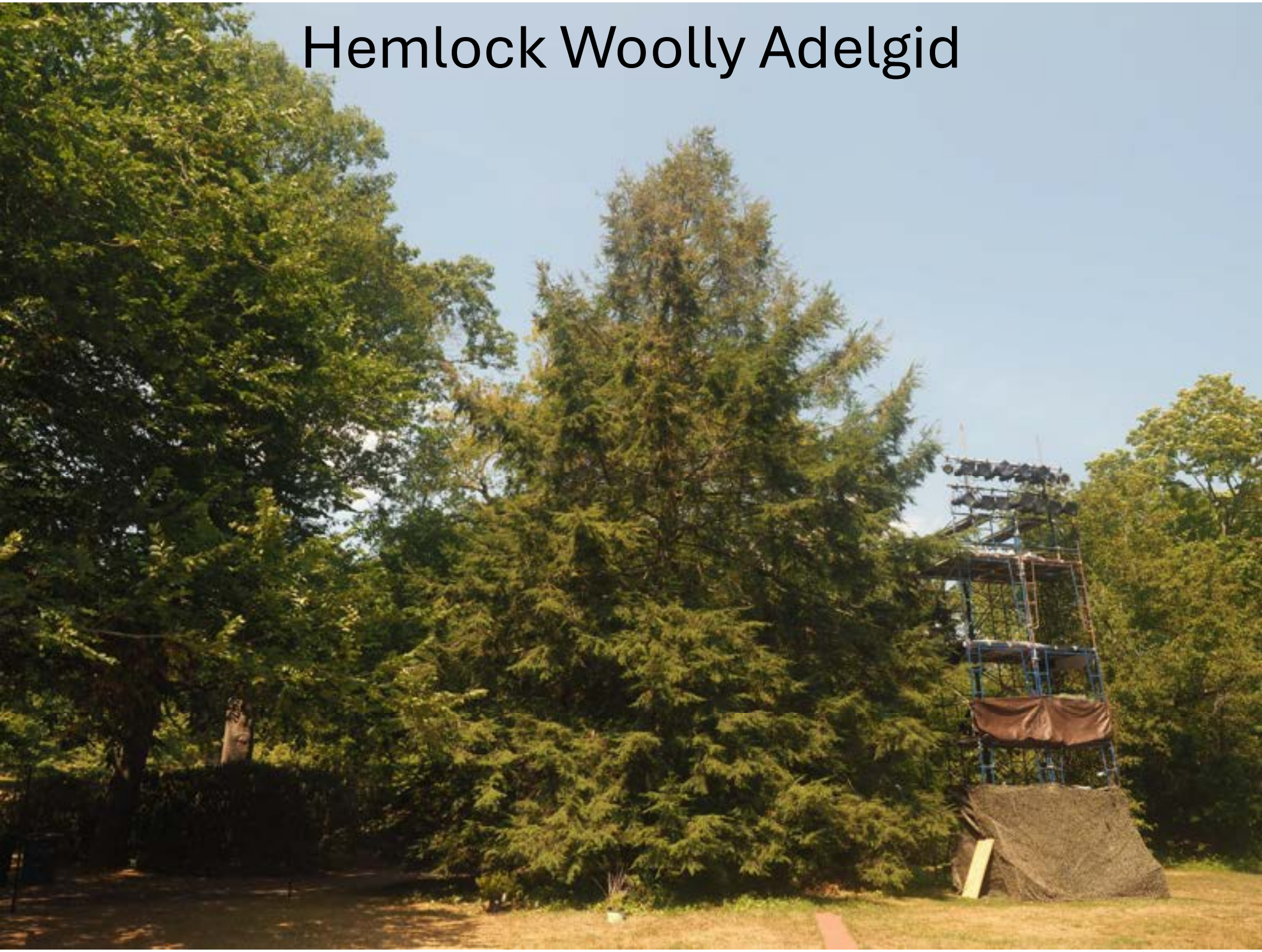
Hemlock Woolly Adelgid

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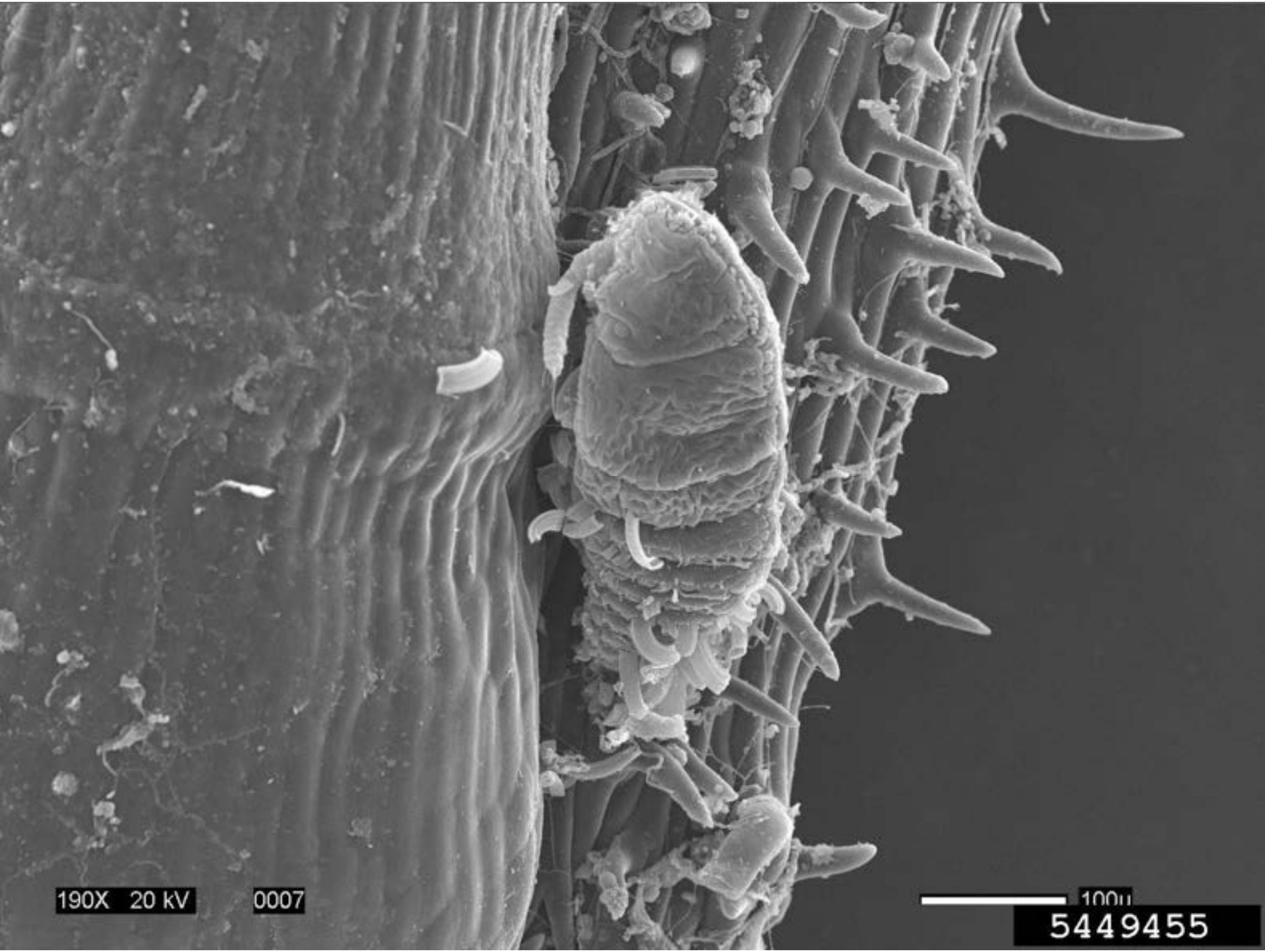
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biocontrol


chemical
control

Chemical Control (most common for landscape trees)

- **Foliar sprays**
  - Contact insecticides (**horticultural oil, insecticidal soap, or registered pyrethroids**) can be sprayed directly on smaller trees. These kill exposed adelgids but do not provide long-term control, so they are usually considered a short-term or supplemental method.

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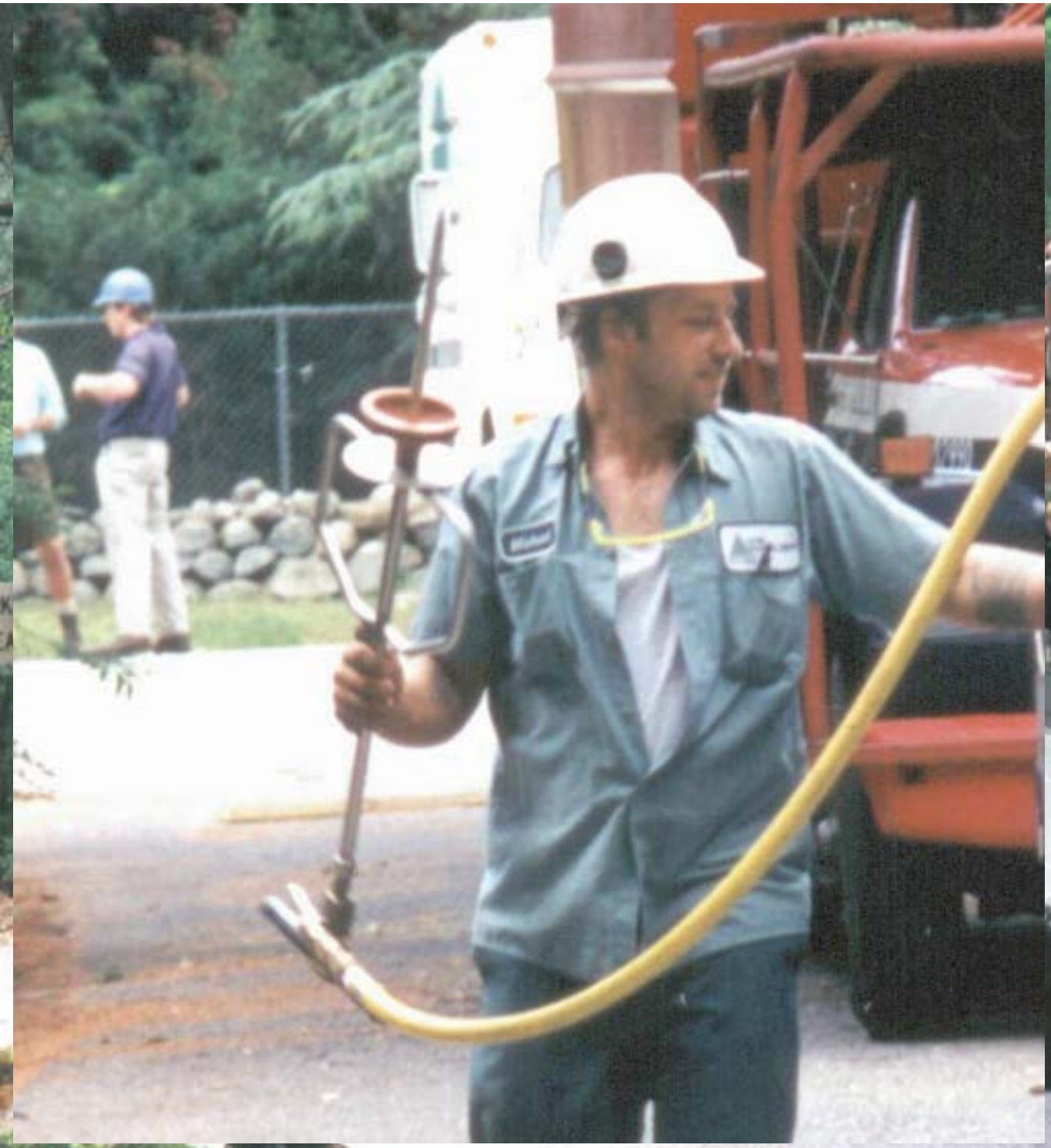
•Systemic insecticides

•**Imidacloprid** (Merit®, Xytect®): applied as a soil drench, soil injection, trunk injection, or trunk basal spray. Provides multi-year protection (often 4–7 years). Works best for long-term suppression.

•**Dinotefuran** (Safari®, Transect®): applied as a bark spray, soil drench, or injection. Acts more quickly than imidacloprid but protection lasts a shorter time (usually 1–2 years). Often used when a tree is in decline and needs rapid relief.

•Often, arborists use **dinotefuran first** for quick knockdown, followed by **imidacloprid** for longer protection.




ARBORJET

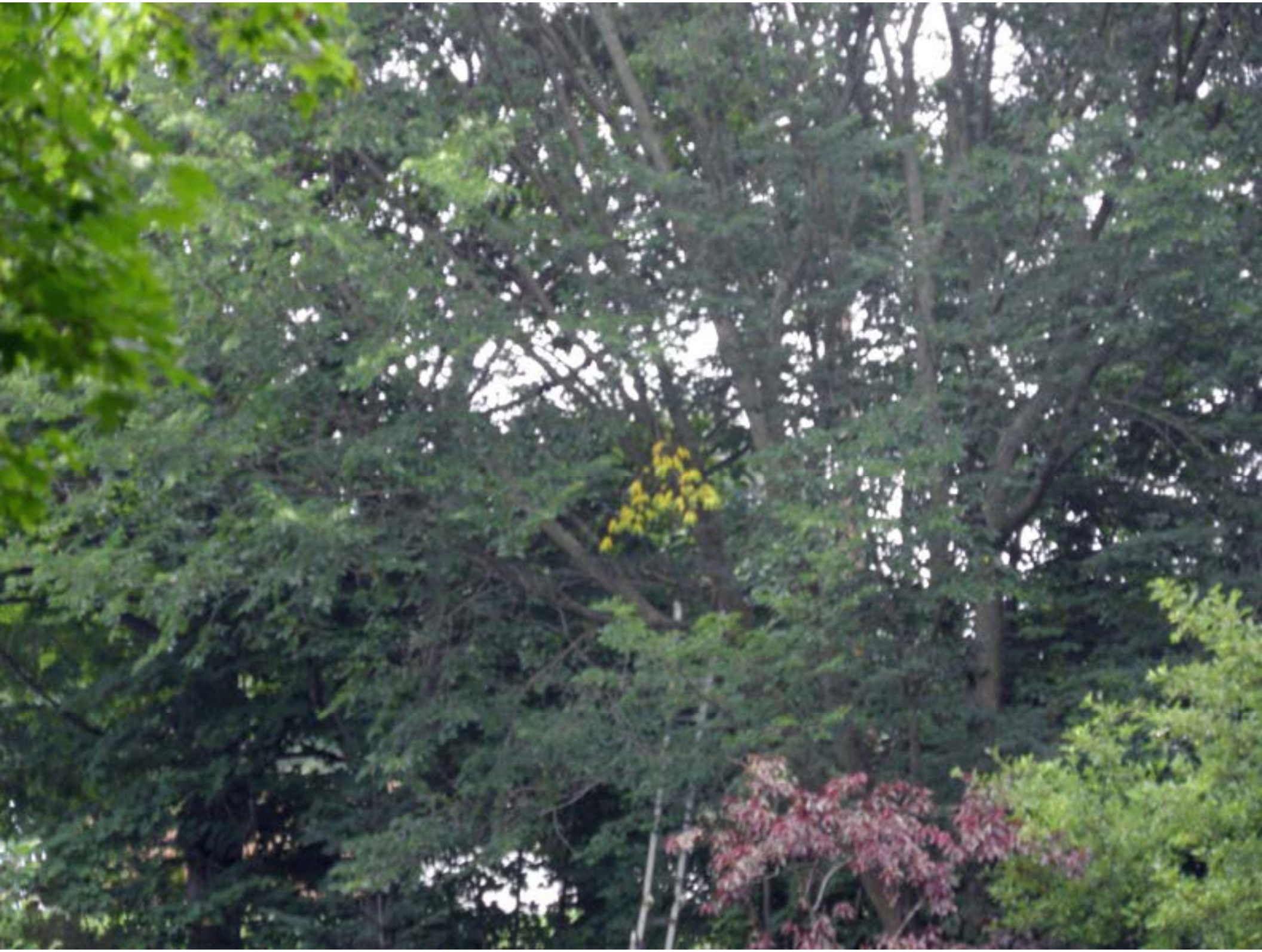
Neonicotinoids

Any of a class of synthetic systemic insecticides that are chemically related to nicotine. Neonicotinoids are used especially in agriculture to control destructive pests such as aphids and mites. Since their introduction in the late 1980s, the chemicals have become the most widely used pesticides in the world.

The prophylactic use of neonicotinoids has had a negative impact on a broad range of nontarget organisms, including pollinators and soil and aquatic invertebrates, raising environmental concerns. Consequently, their use has been heavily restricted in some countries.

Neonicotinoids are already considered ‘restricted use’ pesticides under Connecticut law. They will become more so in 2027, when a law passed in 2025 will take effect.

Dutch Elm Disease

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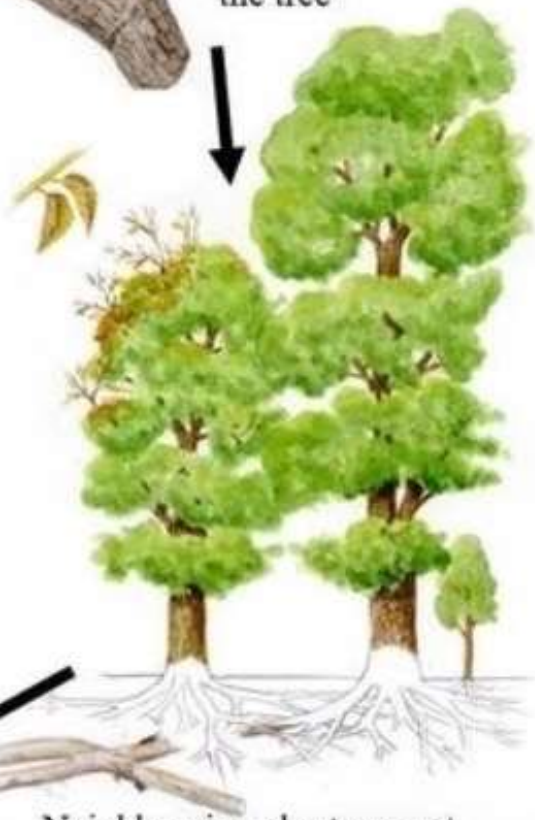
The native elm bark beetle, side view.

Photo by J. R. Baker & S. B. Bambara, North Carolina State University, Bugwood.org

The adult beetles relocate to healthy elm trees transferring the disease to a new tree.

The large elm bark beetle feeds on an elm twig, depositing spores of Dutch Elm Disease

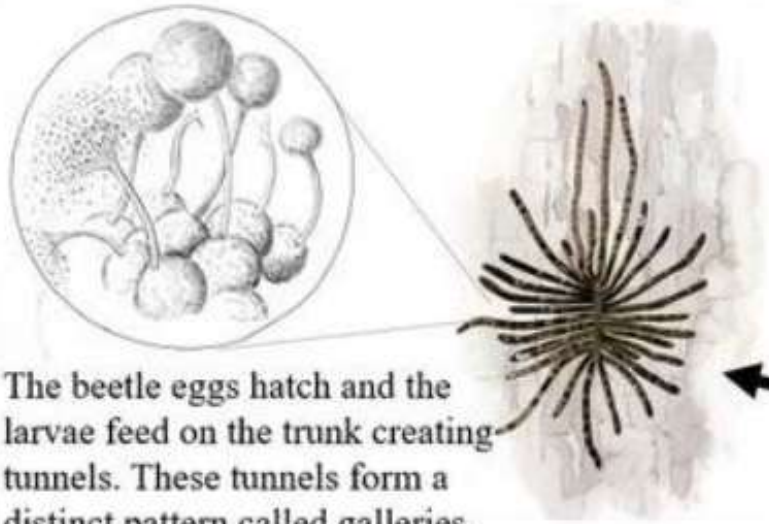
The disease spreads from the feeding wound throughout the tree



Neighbouring elm trees get contaminated through their natural root graft

The female beetles lay eggs in the bark of dead and dying elm trees.

The beetle eggs hatch and the larvae feed on the trunk creating tunnels. These tunnels form a distinct pattern called galleries.



The pathogen starts to produce spores in the tunnels. Emerging adult beetles are covered in spores

Elm Spraying

Spraying to Control Elm Bark Beetles

- Foliar contact sprays most often used (systemics won't work)
- Pyrethroids are most often the insecticide of choice
- Timing is important -
- May to June for the first spray to catch the beetles that have overwintered.
- July to August to catch the second, in-season generation.
- Especially, get the spray onto the the twigs where the insects are expected to be feeding.

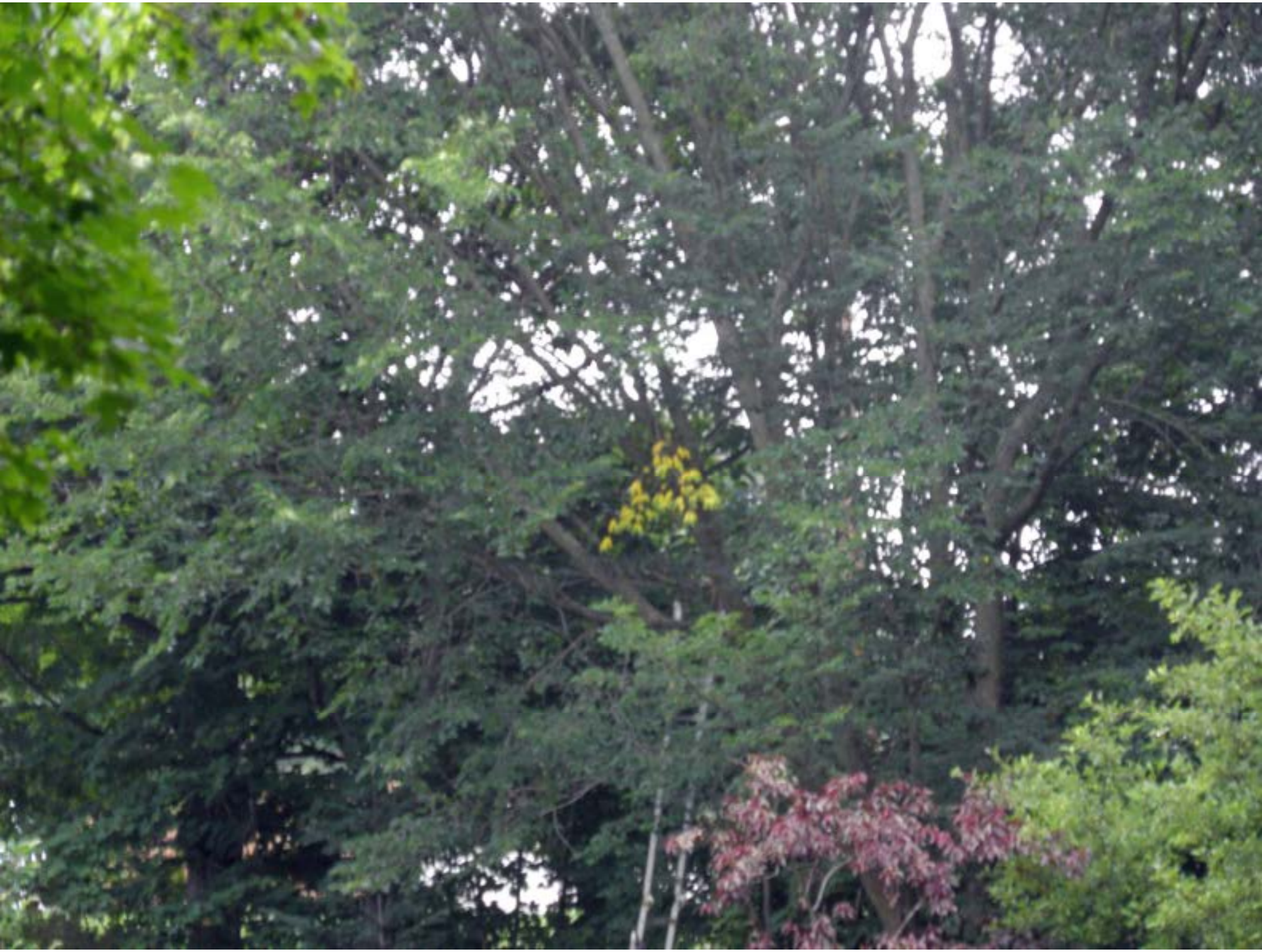
Systemic Fungicides

Preventative Fungicides versus Therapeutic Fungicides

Thiabendazole hypophosphite (*Arbotect 20-S*®) – largely preventative

Propiconazole (*Alamo*®, *Propizol*®) – preventative and therapeutic

Physical control



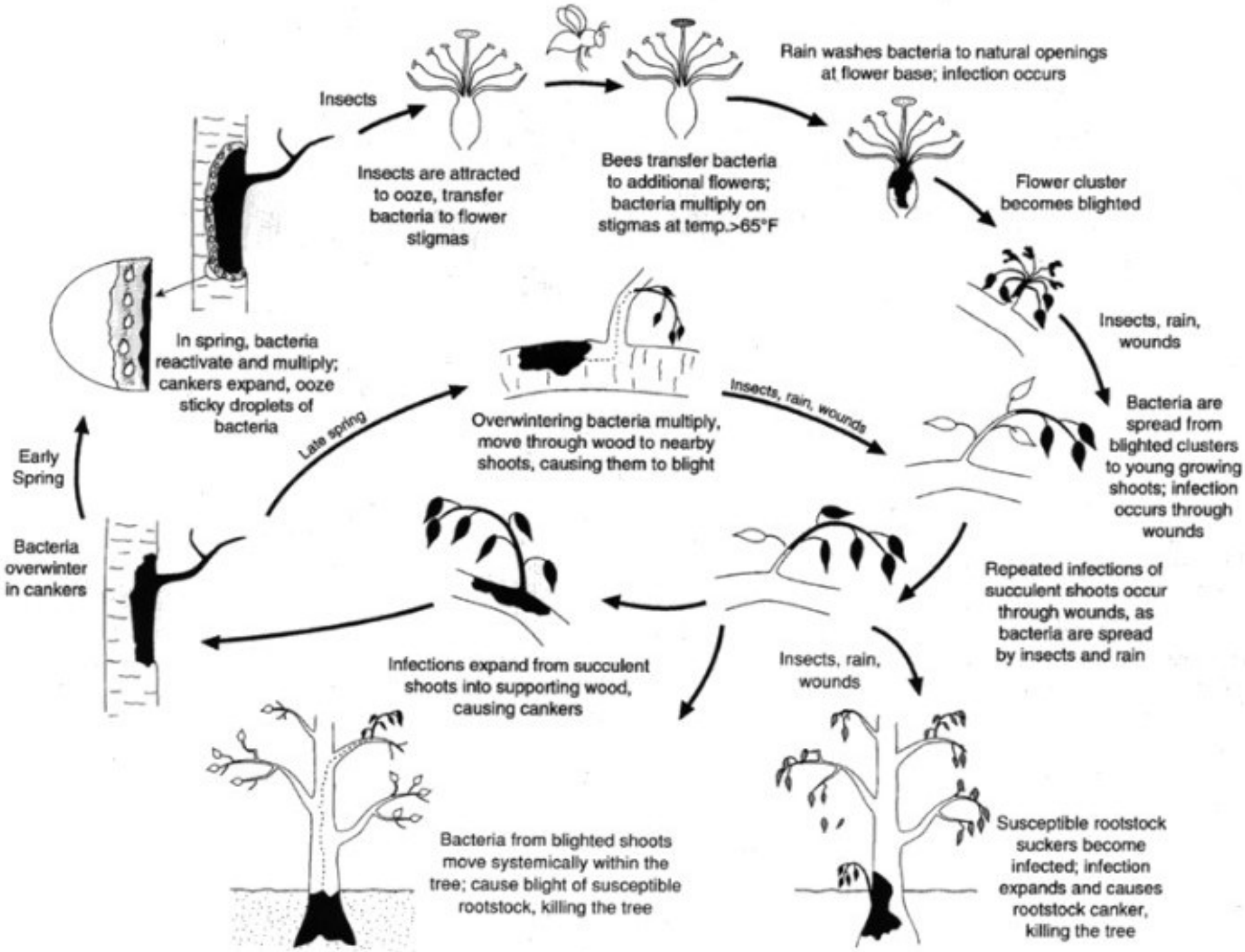
Isolate the Root System of any Infested Trees

American Elm Cultivars Considered Good Choices for Dutch Elm Disease Resistance – cultural control

Cultivar	Origin	DED Resistance	
Valley Forge	US National Arboretum (1995)	High	Classic vase shape; fast growth; widely trialed
New Harmony	US National Arboretum (1995)	High	Upright vase; strong central leader; widely trialed
Princeton	Princeton Nursery selection (1920s; renewed use 1990s)	High	Vase-shaped; fast growth; watch branch angles; proven in streetscapes
Jefferson	USDA ARS joint intro (2005)	High	Expansive crown; triploid; extensively planted in DC
Lewis & Clark	North Dakota State Univ. (NDSU)	High	Cold-hardy; fast growth; selected from a survivor tree
St. Croix	Selected in MN	High (reported)	Large, spreading canopy; fast-growing; nursery reports highlight resistance
American Liberty (multi-clonal series)	Elm Research Institute:6 different clones	Variable	Group name; resistance varies by clone; mixed trial results

Fire Blight

FIRE BLIGHT DISEASE CYCLE



From "Common Diseases of Crabapples" by Sharon Douglas

- Sanitation is a ***very*** important aspect of control.
- Any cankered or infected branches or twigs should be cut back to healthy wood during the dormant season. All pruning cuts should be made at least 8-12" below visible symptoms.
- All tools should be disinfested with 10% household bleach (1 part bleach: 9 parts water) or 70% alcohol.
- Prunings should be removed from the vicinity of the tree.
- The effects of this disease can also be minimized by maintaining overall tree health by following proper cultural practices that avoid excessive vigor.
- It is especially important to avoid heavy applications of nitrogen in the spring.
- The most effective method for control of this disease is to select and plant crabapple varieties that are resistant to fire blight.


Apple scab
Powdery Mildew
Cedar apple rust
Sooty blotch / fly speck
Fire Blight

JOANA CARNEIRO