# INTEGRATED PEST MANAGEMENT

**Arbor 101, CTPA 2015 Allan Fenner**

**The Connecticut Tree Protective Association, Inc.**

*We Advance the Care of Connecticut's Trees*

# LEARNING OBJECTIVES:

- Have an understanding of the principles of IPM.
- Understand the IPM decision-making process and how it relates to managing pests of trees & shrubs.
- Understand how pest biology and behavior affects the success of management practices.
- Know the components as they relate to a successful plan.
- Know where to find information & resources regarding IPM.

# WHAT IS INTEGRATED PEST MANAGEMENT?


**A balanced use of cultural, biological & chemical procedures that are environmentally compatible and economically feasible to reduce pest populations to tolerable levels.**

# *WHAT DOES IPM DO?*

- Employs a Sustainable Approach: Goal is to minimize risks to human health and the environment from the pest management actions implemented.
- Integrates Multiple Tactics in a Variety of Settings: Promotes the use and integration of multiple tactics such as biological control, use of resistant varieties, behavioral modification, and mechanical and cultural controls for pest management.
- Selects the Proper Tools: Tools to manage the pest are selected so that they pose the least risk to the environment and to human health.
- Employs Many Methods:
- Cultural controls: Sanitation,
- Physical and mechanical controls: Sticky traps, fences, row covers
- Host plant resistance: Use of resistant varieties.
- Behavioral modification: Use of insect pheromones, use of scare tactics
- Biological control: Use of beneficial organisms like insect predators, insect pathogens and antagonists of plant pathogens.
- Pesticides: Use of conventional chemical pesticides and biorational pesticides

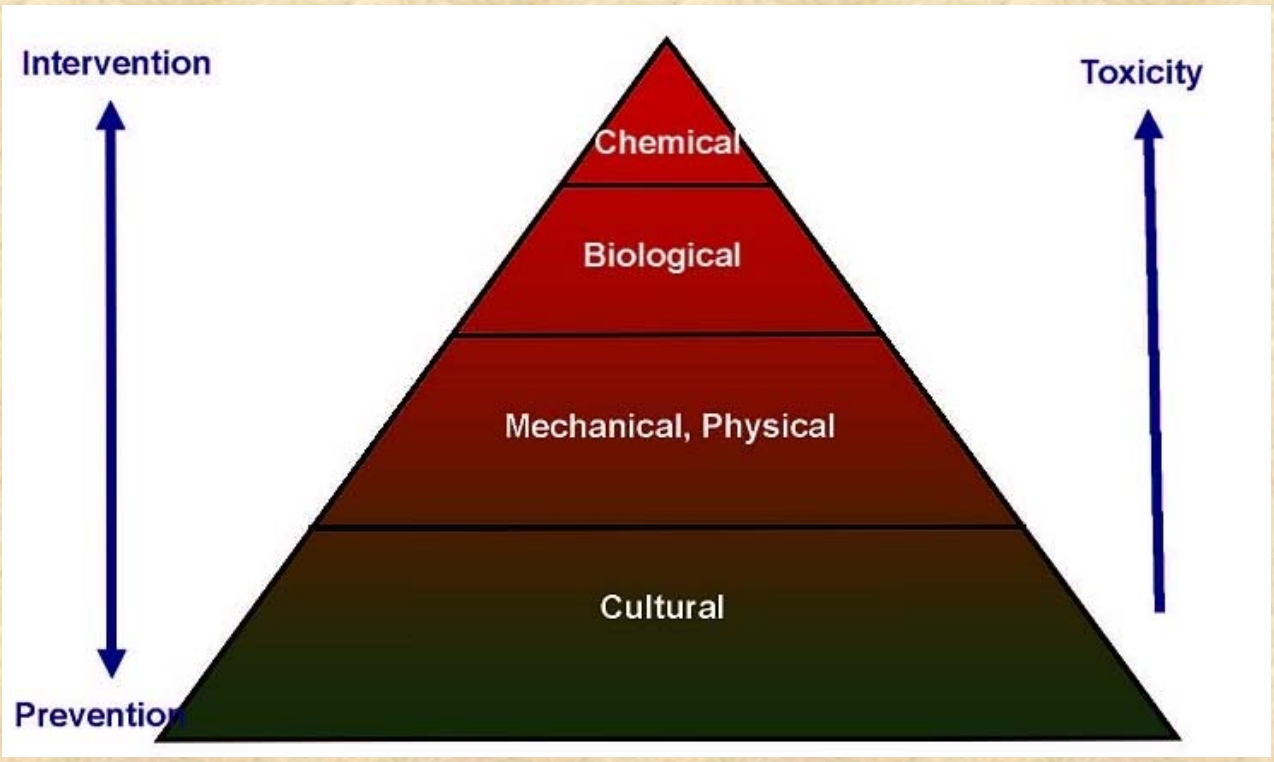
# HOW DID IPM COME INTO PRACTICE?

- IPM has its roots in Agricultural production.
- Based upon concepts of applied ecology or an “Eco-System”

- Eco-System: The system of interactions between living organisms and their environment.
- Every component in an ecosystem is connected to everything else.


If you change one component of an ecosystem (e.g.,
apply a pesticide, caulk a crack, allow garbage to
overflow containers) other parts of the system will be
impacted—either positively
or negatively.

# WHAT ARE THE PRINCIPALS OF IPM




A balanced use of cultural, biological & chemical procedures that are environmentally compatible and economically feasible to reduce pest populations to tolerable levels.

# HOW & WHY DOES IT WORK:

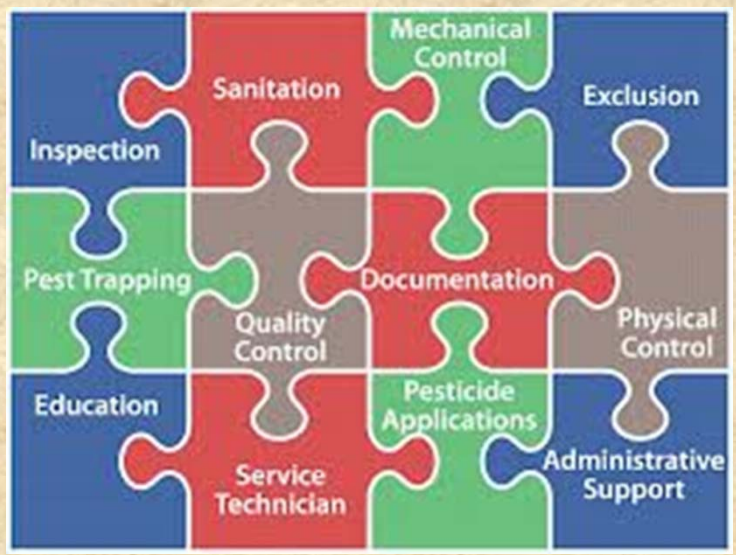
- Uses knowledge of the pest and its life cycle to determine the most appropriate management
- Selection of best practices to keep pests and/or the damage they cause at or below an acceptable level.
- IPM is not a repetitious method but a dynamic decision-making process that requires you to look at the situation before taking action.
- Its flexibility to adapt to any pest problem is what makes it a success.

# POSSIBLE POSITIVE BENEFITS:

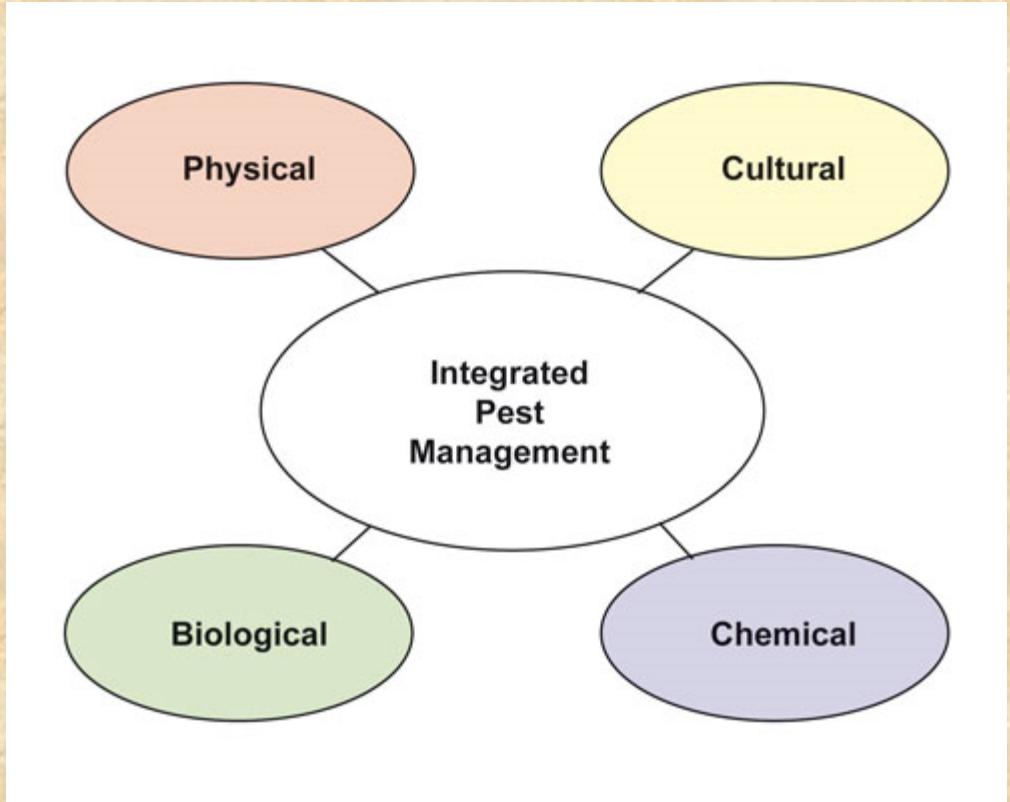
- Reduced pesticide resistance.
- Less disruption of natural biological control.
- Less reliance on one particular control method.
- Less hazardous to human health.
- Most likely to produce effective pest suppression and be cost-effective.

# THE PIECES OF THE PUZZLE


DEVELOPING A PLAN THAT FITS…



# AN INTEGRATED APPROACH



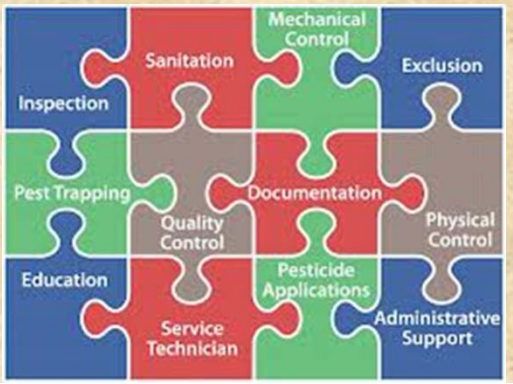
# A PEST MANAGEMENT PHILOSOPHY

- Recognizes that there is no “One Shot to Cure All”
- Dependence on any one pest management method will have undesirable effects.
- Determine and correct the cause of the pest problem.
- Understanding Pest biology and ecology is essential.
- Manipulate the environment to the plants advantage and to the detriment of the pest.
- Recognizes that eradication of a pest may not be necessary or even desirable, and potentially not possible.
- Some damage may be unavoidable and acceptable.

# “HOW TO” STEPS OF IPM (FOR ANY PEST)

- Identify and monitor the problem by gathering information.
- Set an “action level”.
- Determine what to do.
- Take notes and evaluate results.

- Now let’s begin “solving the puzzle” by



# IDENTIFY THE PROBLEM (KEEP ASKING QUESTIONS)

- Gathering information - It is important to collect as much information as possible to make a well informed decision. Do NOT be afraid to get dirty….
- Identify the cause of the problem.
  - You may have found insect damage; why was it there; was it found on other plants of the same species; why or why not?
- Remember: Prescription without proper diagnosis is MALPRACTICE

- When using any management approach, you must identify the most vulnerable life stage of the pest you want to manage. This includes the following:
- • Know the biology of the pest and/or any natural enemies of the pest which may be present.
- • When will treatment be the most effective?

# INFORMATION GATHERING

- When using any management approach, you must identify the most vulnerable life stage of the pest you want to manage.
- Know the biology of the pest and/or any natural enemies of the pest which may be present.
- When will treatment be the most effective? What life stage?
- Can the problem be treated right now or will you have to wait until the pest is in an active stage?
- Are there other considerations I need to take into account? (Pets; Child play area; Pool; Stream; obstacles; etc.
- What measures, if any, have been taken prior to your service?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When do we know when to react and how?
UGA3057088

# DETERMINE AN ACTION LEVEL:

- Action Level is the number of pests that can be tolerated before treatment is necessary.
- It may be based on health concerns, aesthetics, pest visibility, nuisance factor or some other indicator.
- Set an action level which is practical.
- Know the biology of the pest and/or any natural enemies of the pest which may be present.


# WHAT IF WE....

**Instead of focusing simply on how to kill pests in a specific location,**

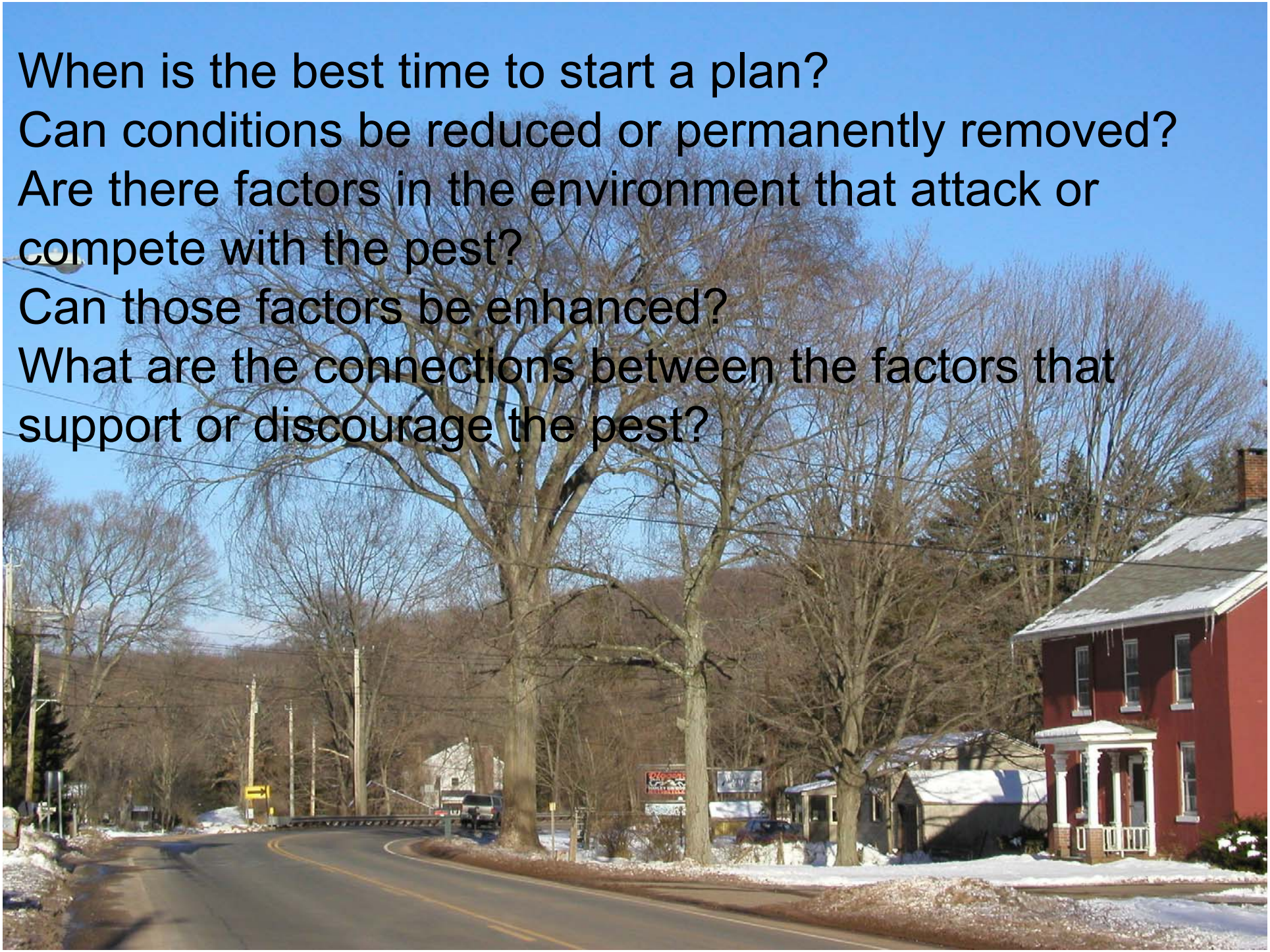
**look for all the factors in the pest's environment that enable it to survive (the limiting factors)**

**Look for factors that attack or compete with the pests (natural diseases, predators, etc.)**

**Look for factors that may be causing the stress in the plant?**

Limiting factors denote the amount of a substance or condition that is either least abundant or over abundant in relation to the need of the living organism. Limiting Factors can be density dependent or independent.


What are the conditions in the immediate environment that support the pest?


When is the best time to start a plan?
Can conditions be reduced or permanently removed?
Are there factors in the environment that attack or compete with the pest?
Can those factors be enhanced?
What are the connections between the factors that support or discourage the pest?

Should we wait?

Is it important to know existing conditions?

So what are the basic steps?


Take preventative measures to limit pest build up.

Monitoring the property

Assessment of the pest situation

Determining the best course of Action

Pest Control

Integrated Pest Management

Plant Health Care

# I. P. M. Definitions:

**When an integrated pest management (IPM) program is implemented, important pests are monitored, all suitable pest control methods are considered, and decisions on what methods to use are based on ecological, economic, and sociological values. The task is to integrate cultural practices, plant resistance, biological control, and pesticide application to best manage the pest problem. …all IPM practices need to be compatible with tree maintenance and pest management objectives.**

***Pirone's Tree Maintenance,***
**seventh edition, page 293**

# I. P. M. Definitions:

**Integrated Pest Management (IPM) is the use of a variety of methods designed to achieve the needed level of pest control with the most judicious use of pesticides. Wherever applicable, IPM uses scouting, pest trapping, pest-resistant plant varieties, sanitation, various cultural control methods, physical and mechanical controls, biological controls, and precise timing and application of needed pesticides. With IPM, pesticides should be applied only when needed, and no other control method will provide effective management. When a decision has been made to use a pesticide, the safest and most effective product should be selected for use. The goals of IPM are to achieve the needed level of pest control with the least and safest amount of pesticides.**

**Adams and Packauskas, *UConn Book***

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**Adams and Packauskas, *UConn Book***

# I. P. M. Definitions:

**Integrated Pest Management means a comprehensive strategy of pest control whose major objective is to maintain high crop quality with a minimum use of pesticides and includes, but is not limited to, the following methods: pest trapping, crop scouting, pest-resistant crop varieties, increased use of biological control, cultural controls, and judicious use of certain pesticides.**

**Connecticut General Statutes, Section 22-11a**

# I. P. M. DEFINITIONS:

**Integrated pest management (IPM) is a term used to describe a systematic method of managing pests using non-chemical pest management methods and the judicious use of pesticides when pest populations exceed acceptable levels. When pesticide applications are necessary, priority is given to using the least toxic pesticide as first choice. The implementation of integrated pest management is recommended as a common sense approach to pest control in all environments from residential to municipal, commercial and campus settings for both interior and exterior applications.**

**CT DEEP IPM Definition**

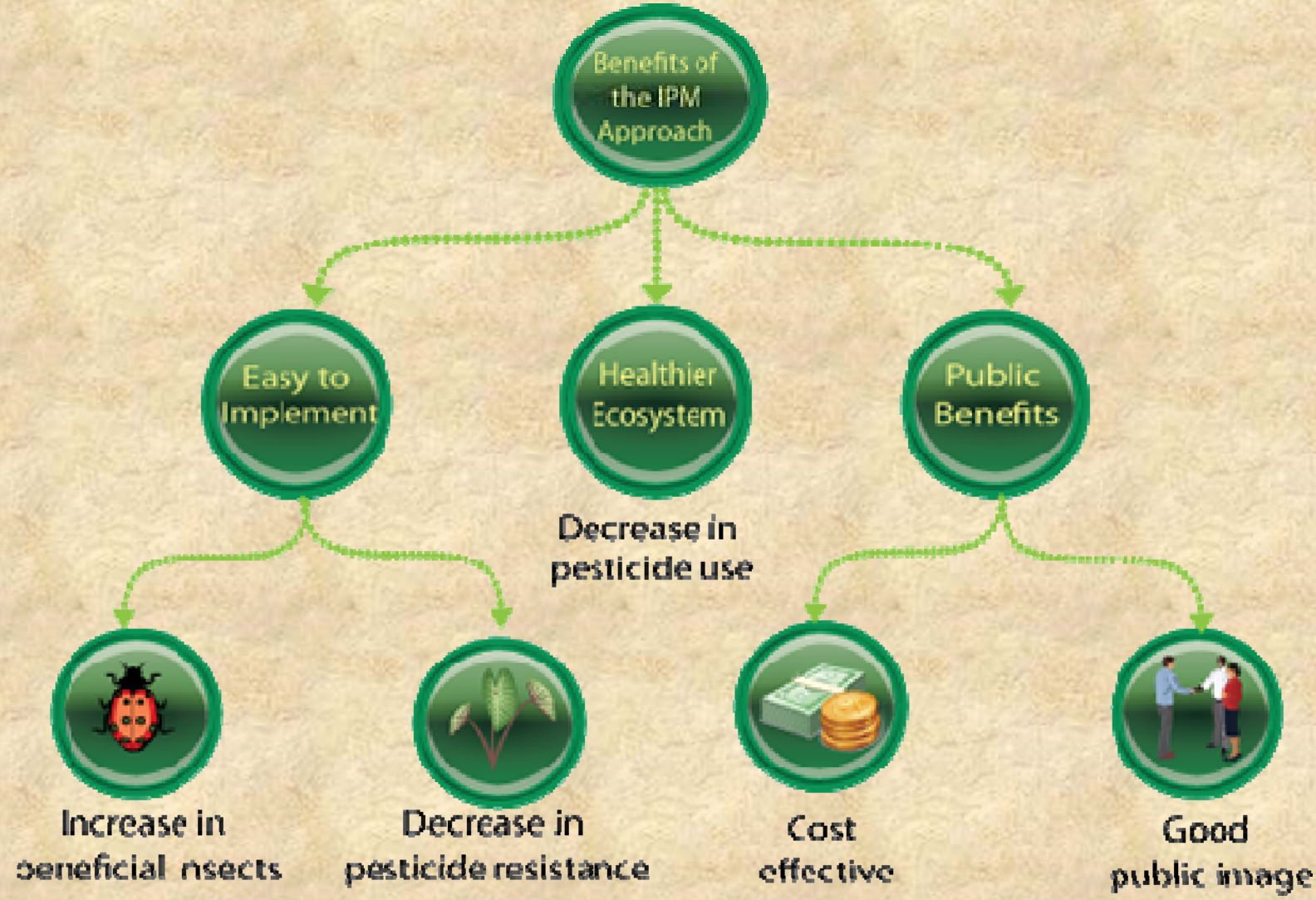
# I. P. M. Definitions:

**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**

"Integrated Pest Management (IPM) is the coordinated use of pest and environmental information to design and implement pest control methods that are economically, environmentally and socially sound. IPM promotes prevention over remediation and advocates integration of at least two or more strategies to achieve long-term solutions."

# LONG-TERM BENEFITS



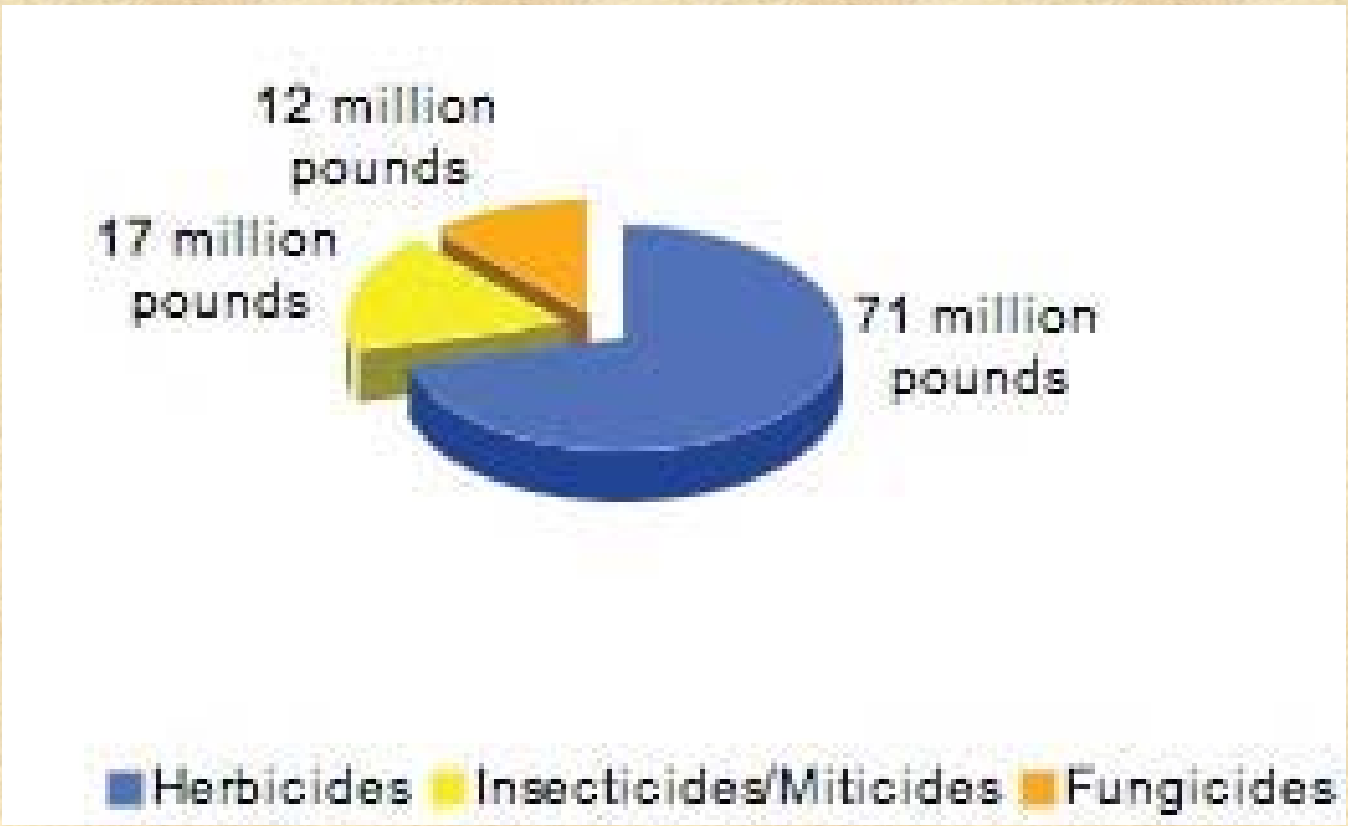



Figure 1. Usage of pesticide active ingredient in U.S. homes and gardens in 2001. These numbers do not include applications of pesticides by professional applicators (e.g. commercial lawn services) to homes, lawns and gardens

# Insects and Trees

# Signs of Feeding

*stipple marks on black cherry leaves*

# Diseases and Trees

# *Not all problems are by other organisms*

*Some are caused by one organism in particular*

*What are we controlling?*
*Why are controlling them?*


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

*AND FEATURING:*

*E. Leopold Trouvelot*

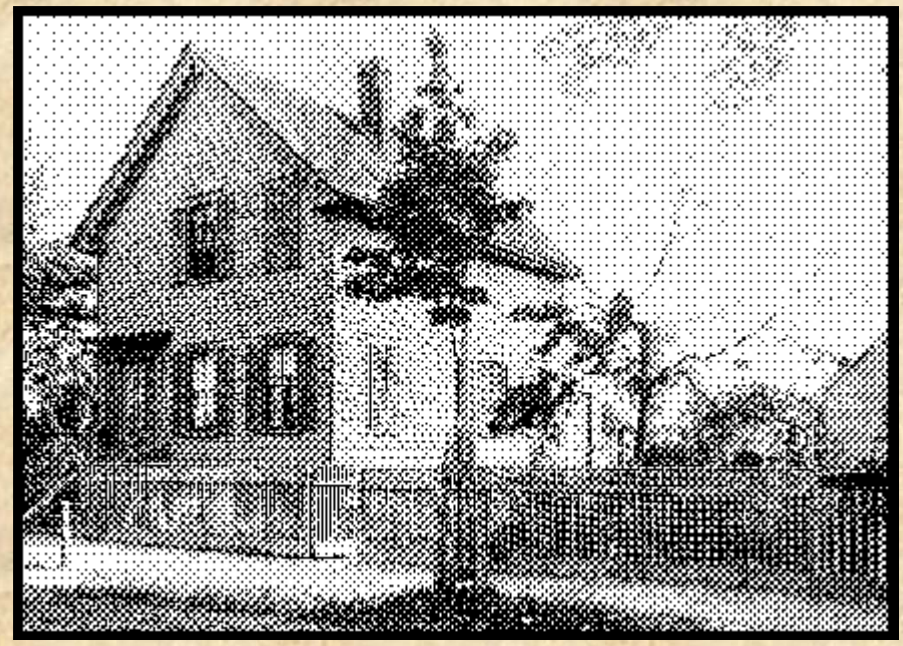
- *The Chestnut Blight*
- *Dutch Elm Disease*
- *Arsenate of Lead*
- *DDT & Sevin*
- *The US Forest Service*
- *Rachel Carson*
- *NPV*
- *BT*
- *Foliar Spraying*
- *Alotta Money*

***And Special Appearance by:***
***the maimaiga fungus***

# CADAVER OF GYPSY MOTH CATERPILLAR KILLED BY ENTOMOPHAGA MAIMAIGA

# E. Leopold Trouvelot, Perpetrator of the Gypsy Moth Problem in US

Ettiene Leopold Trouvelot was born on Dec. 26, 1827 in Aisne, France. He fled France during the coup d'etat in 1852 and settled in Medford, Massachusetts, a working-class suburb of Boston. He lived with his wife and family in his house at 27 Myrtle St. in Medford. Trouvelot made a living as an artist, painting mostly portraits, but he had an amateur interest in entomology. *His main interest was in identifying native silkworms that might be used for silk production.*



The exact reasons or circumstances are unknown, but in the late 1860's he returned from a trip to France with some gypsy moth egg masses. He was apparently culturing them on trees in back of his house when some of the larvae escaped. Trouvelot understood the potential magnitude of this accident and notified local entomologists but no action was taken.

After this accident, Trouvelot apparently lost interest in entomology and became interested in Astronomy. He became famous for his illustrations of astronomical details of the sun and of Venus and was eventually given a faculty position at Harvard University in Astronomy. A crater on the moon was named in honor of Trouvelot and he won the French Academy's Valz prize for his astronomical research.

In 1882 Trouvelot returned to live in France; the timing of this move coincided with the appearance of the first gypsy moth outbreak on his street. Trouvelot died in 1895.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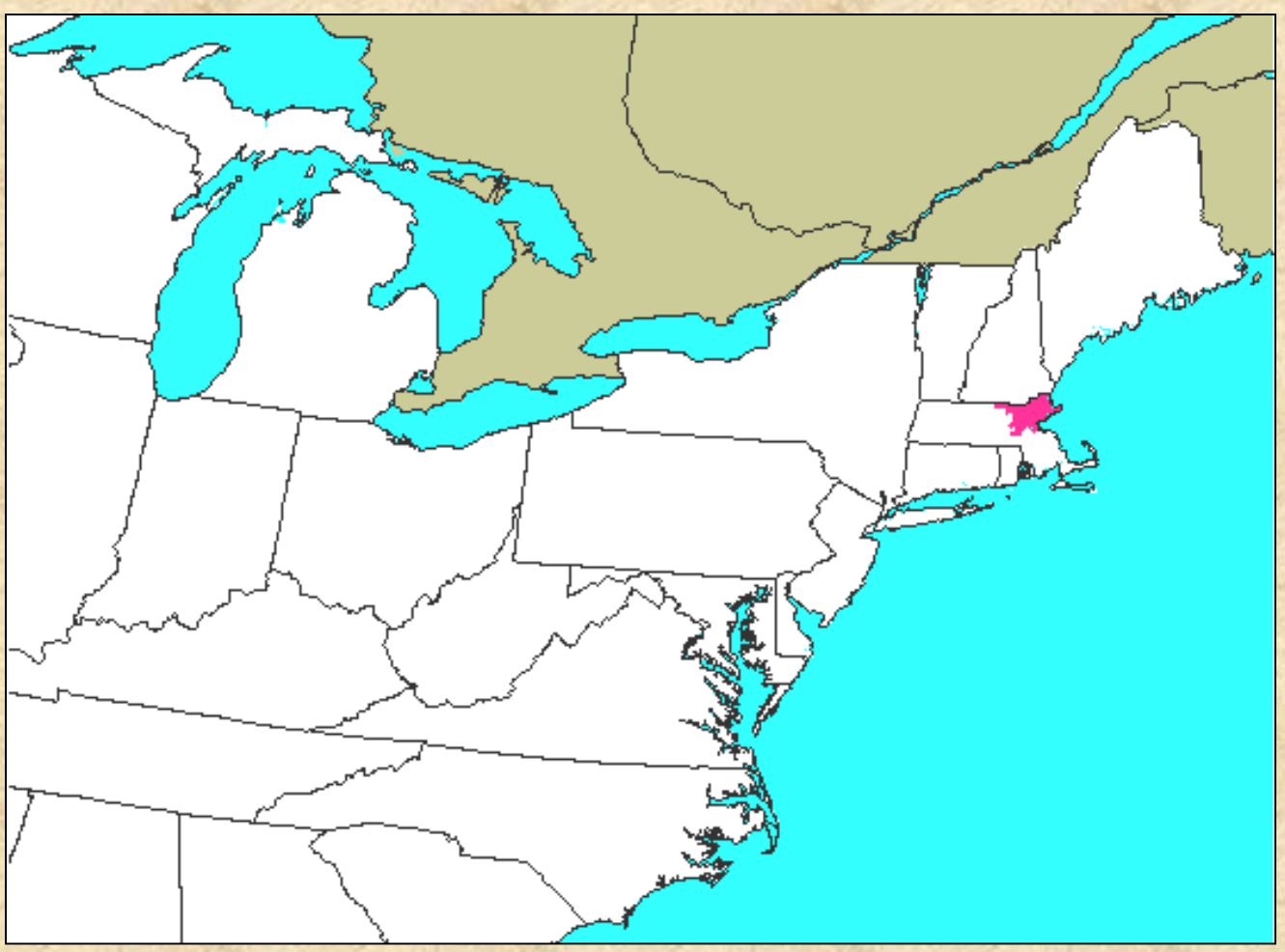
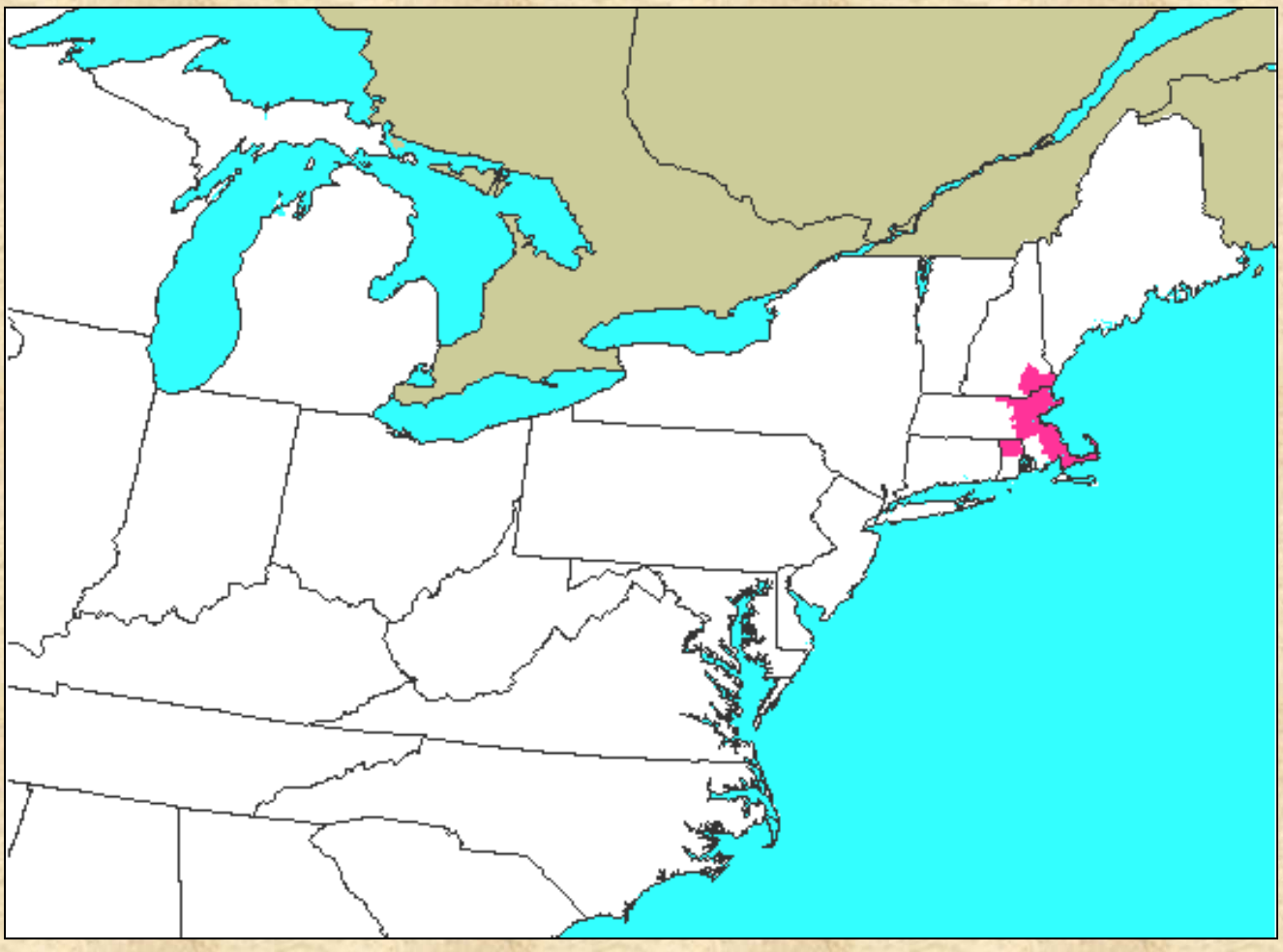
## *Gypsy Moth Spread - 1900*



## *localized in Massachusetts*

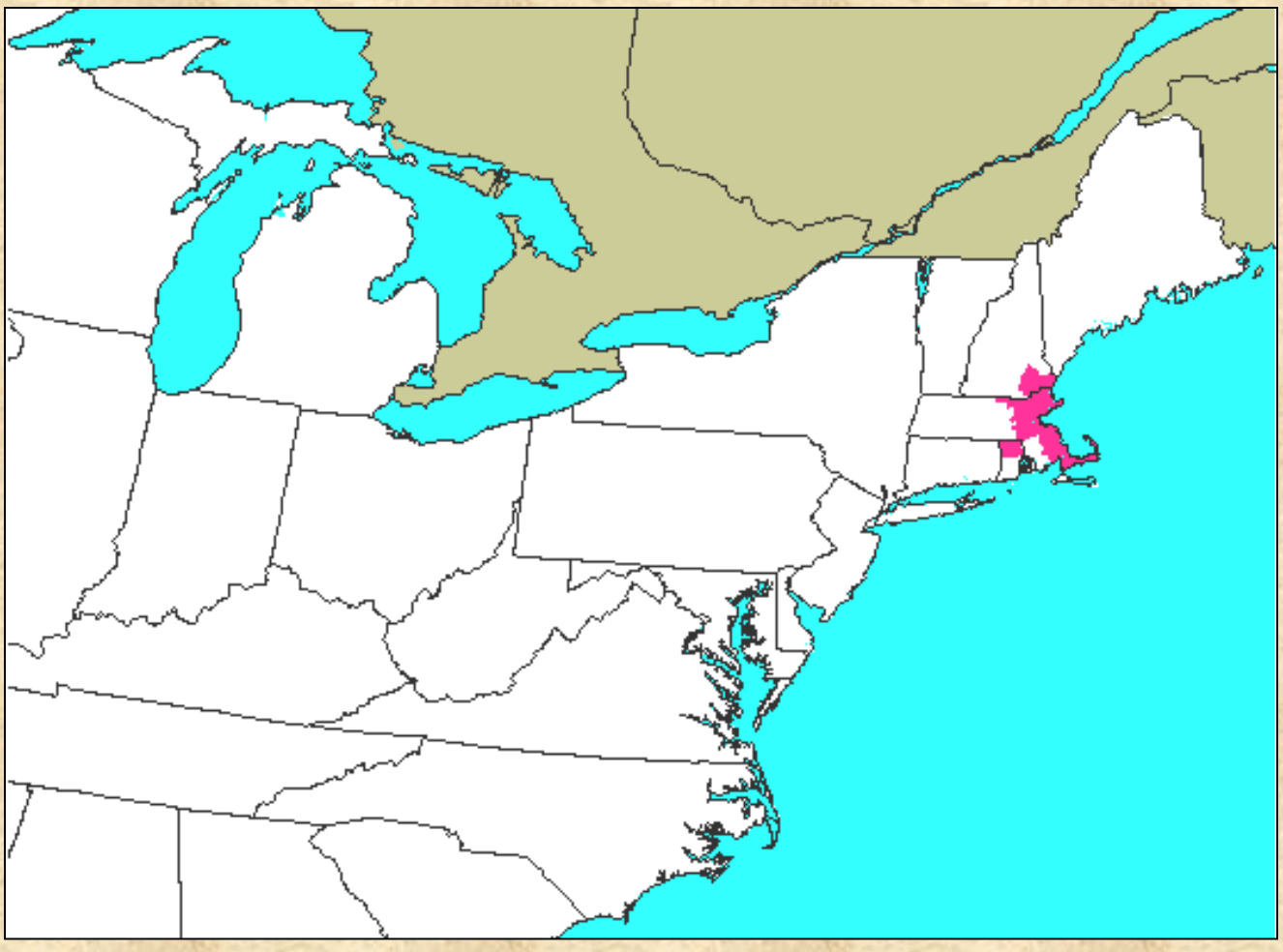
*1905*



*hand picking of larvae*

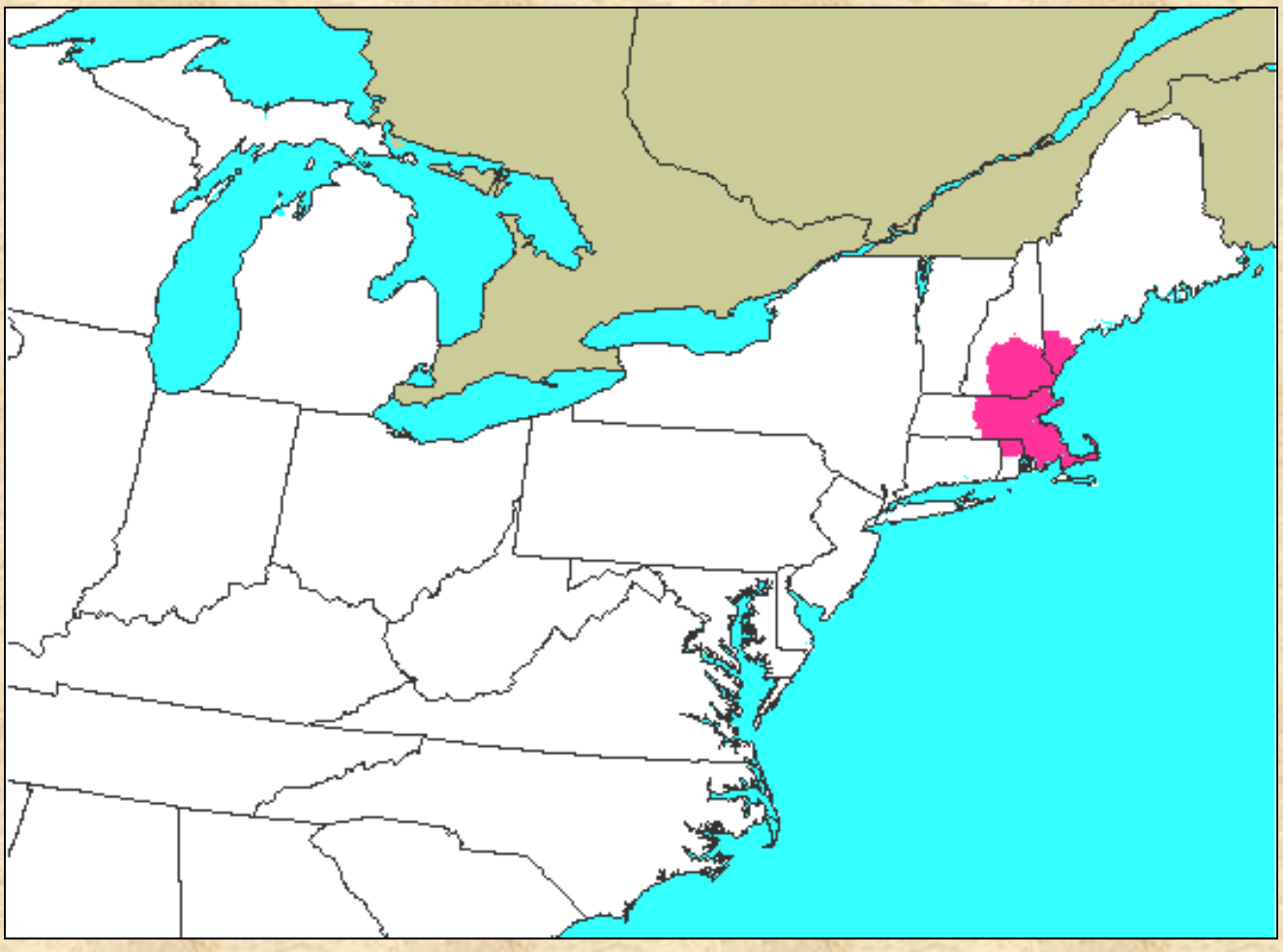
***early IPM***

*1905*



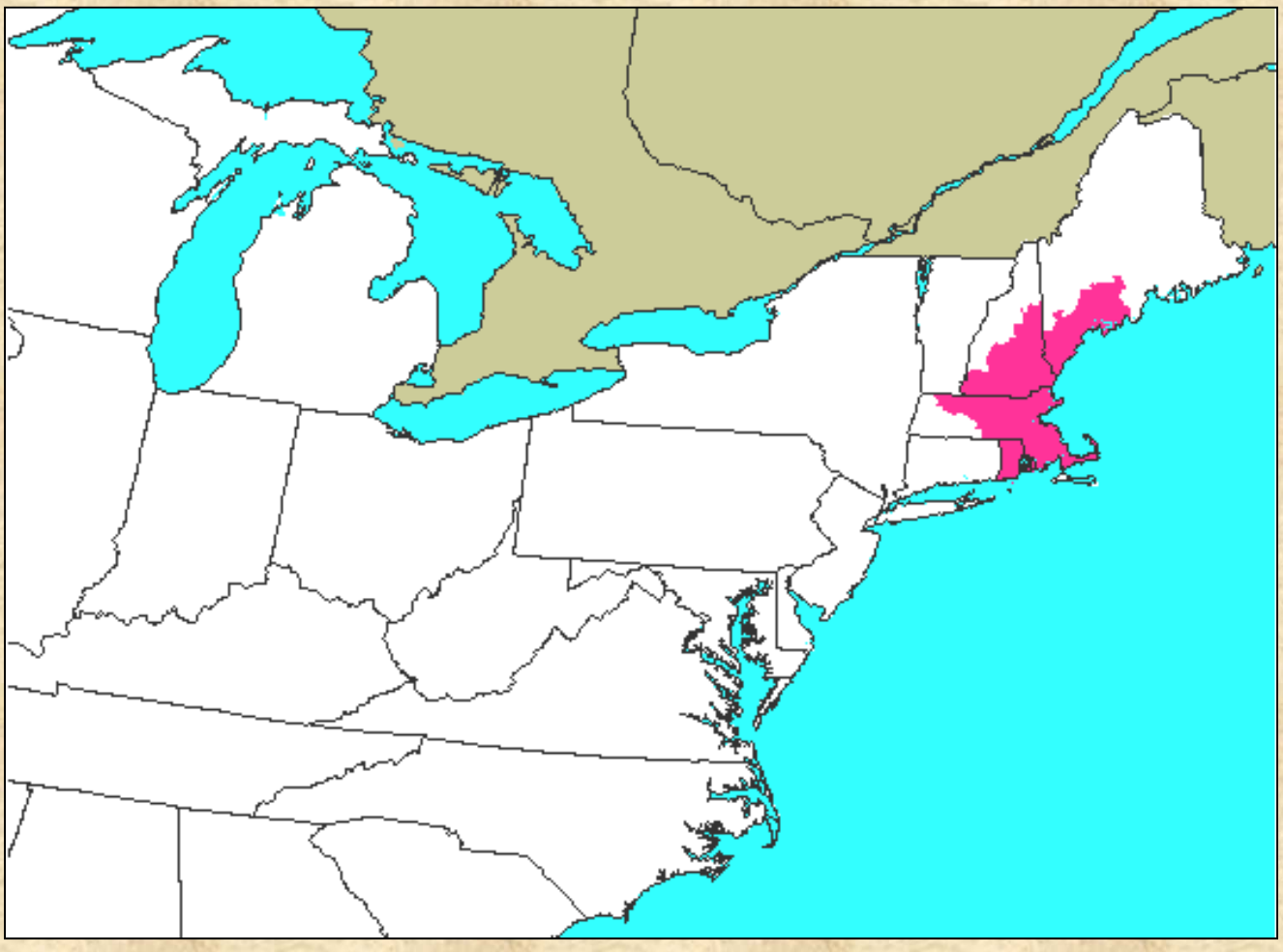
*hand picking of larvae*

*1909*



*chestnut blight beginning to spread*

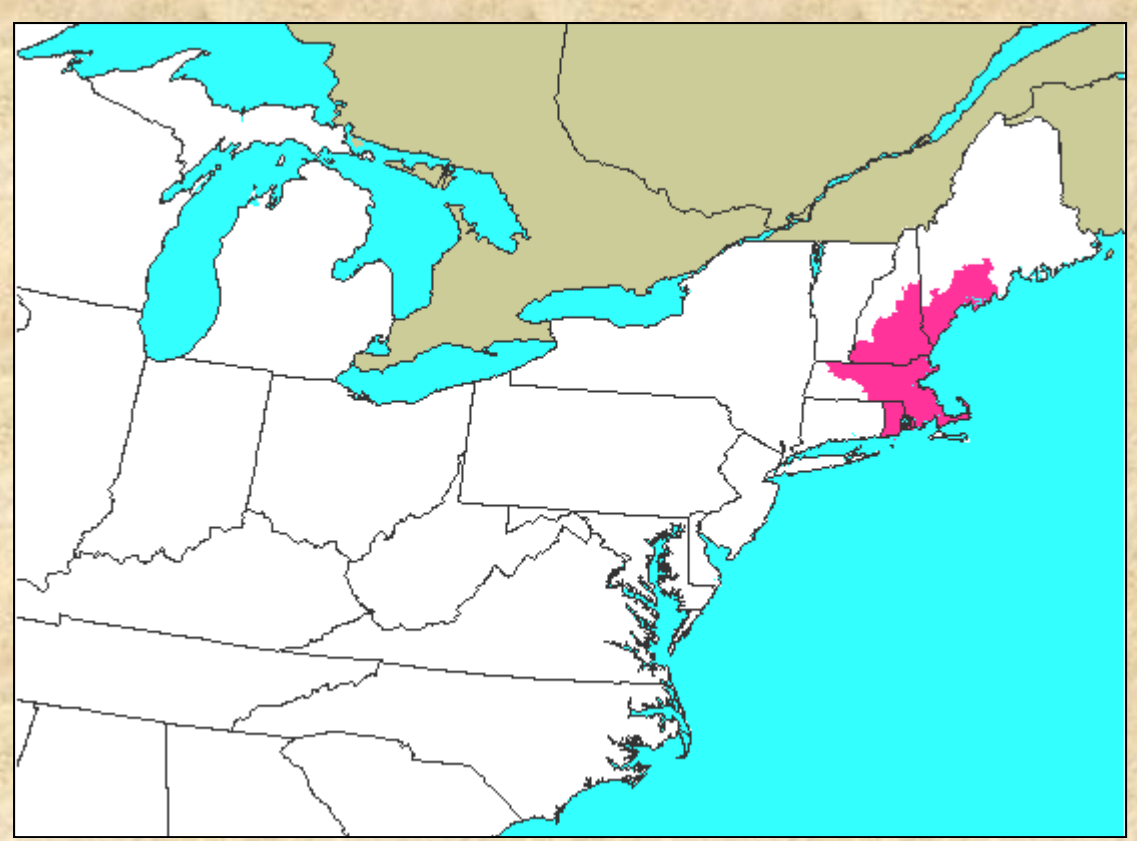
*1912*



*lead arsenate*

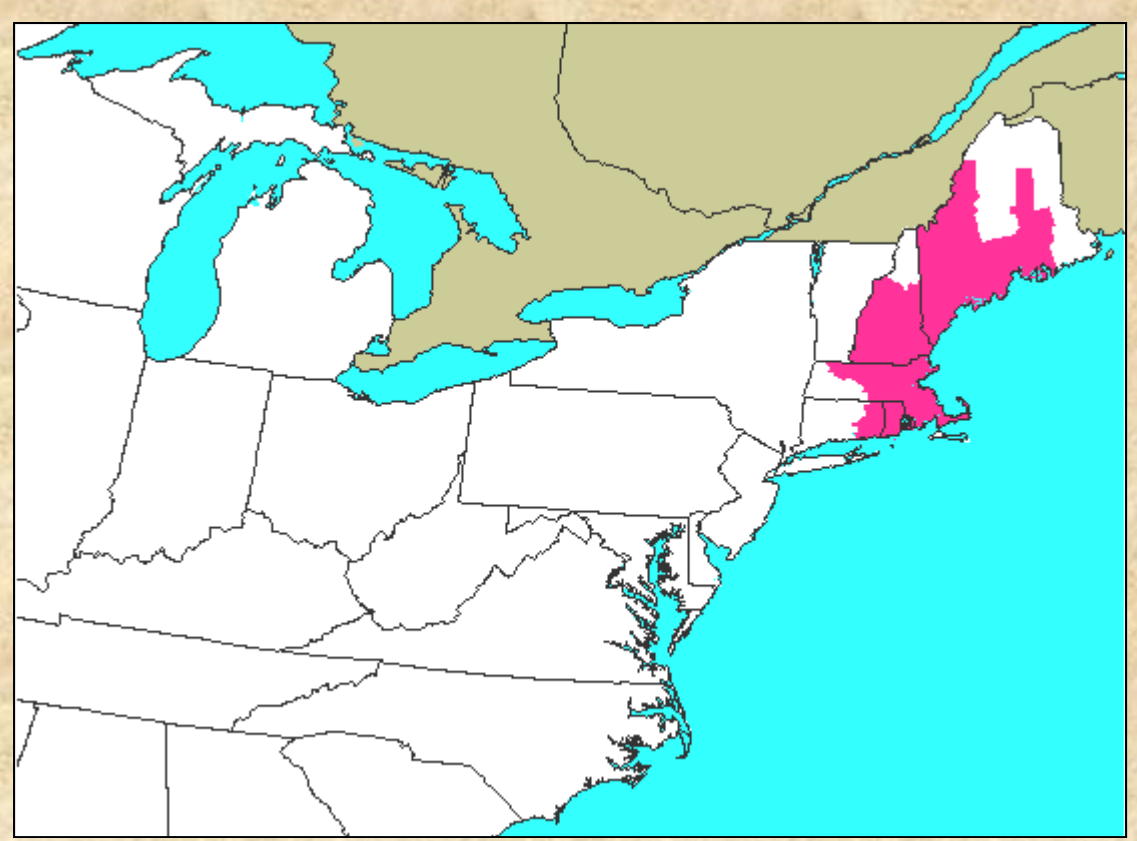

STATE of CONNECTICUT.
MOTH WORK
No 1

*1912*



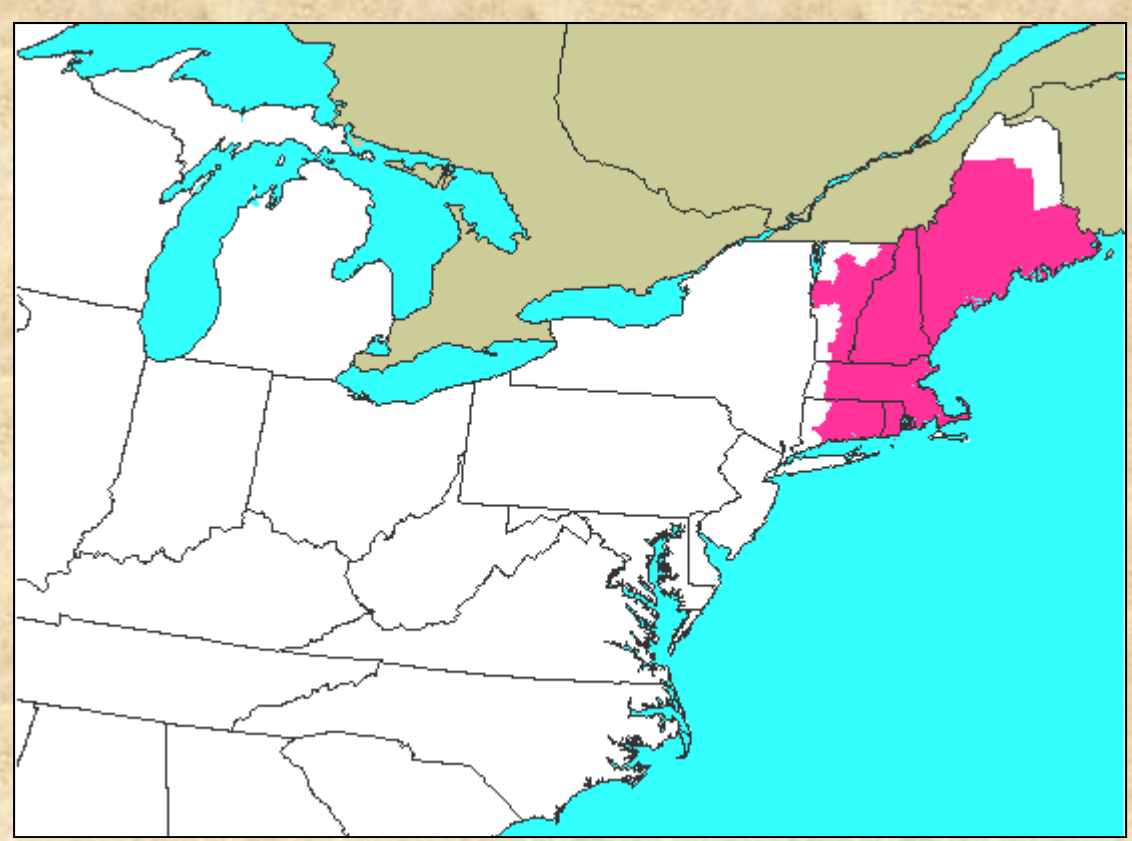
*lead arsenate*

*1914*



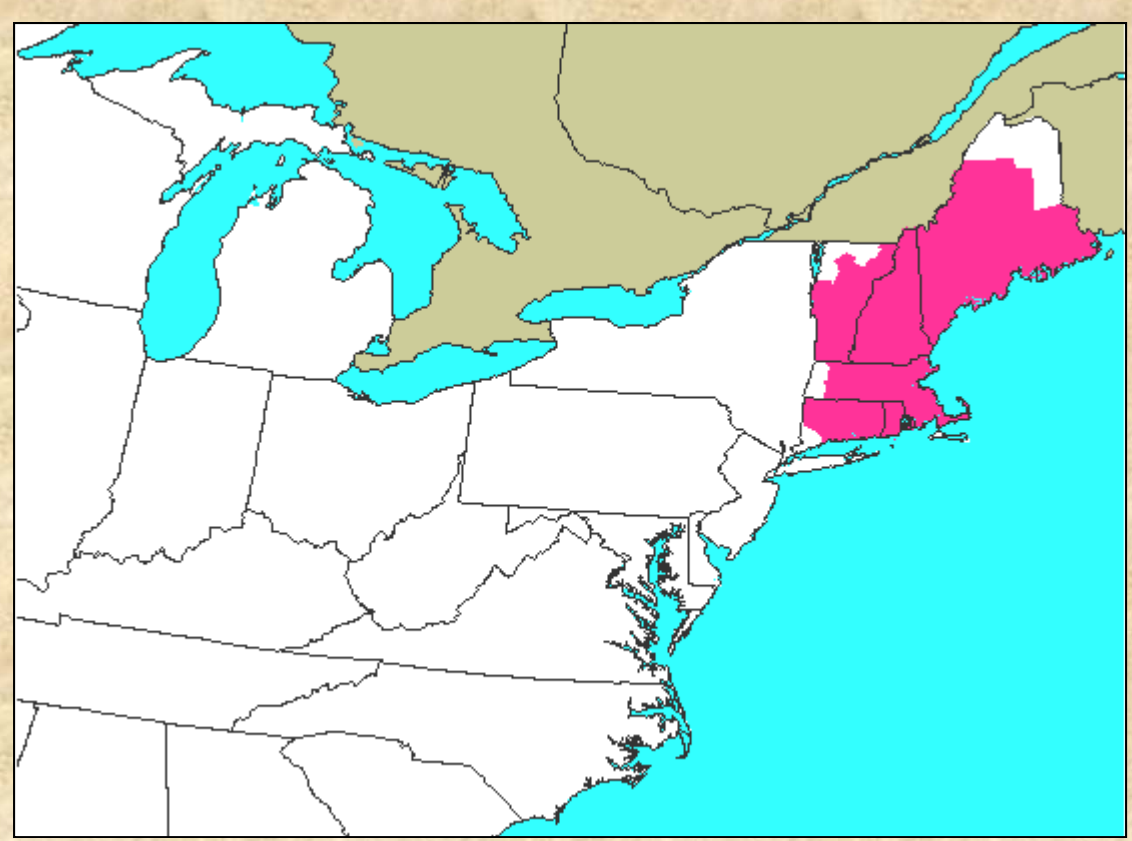
*entry into Connecticut*

*1934*



*Dutch elm disease*

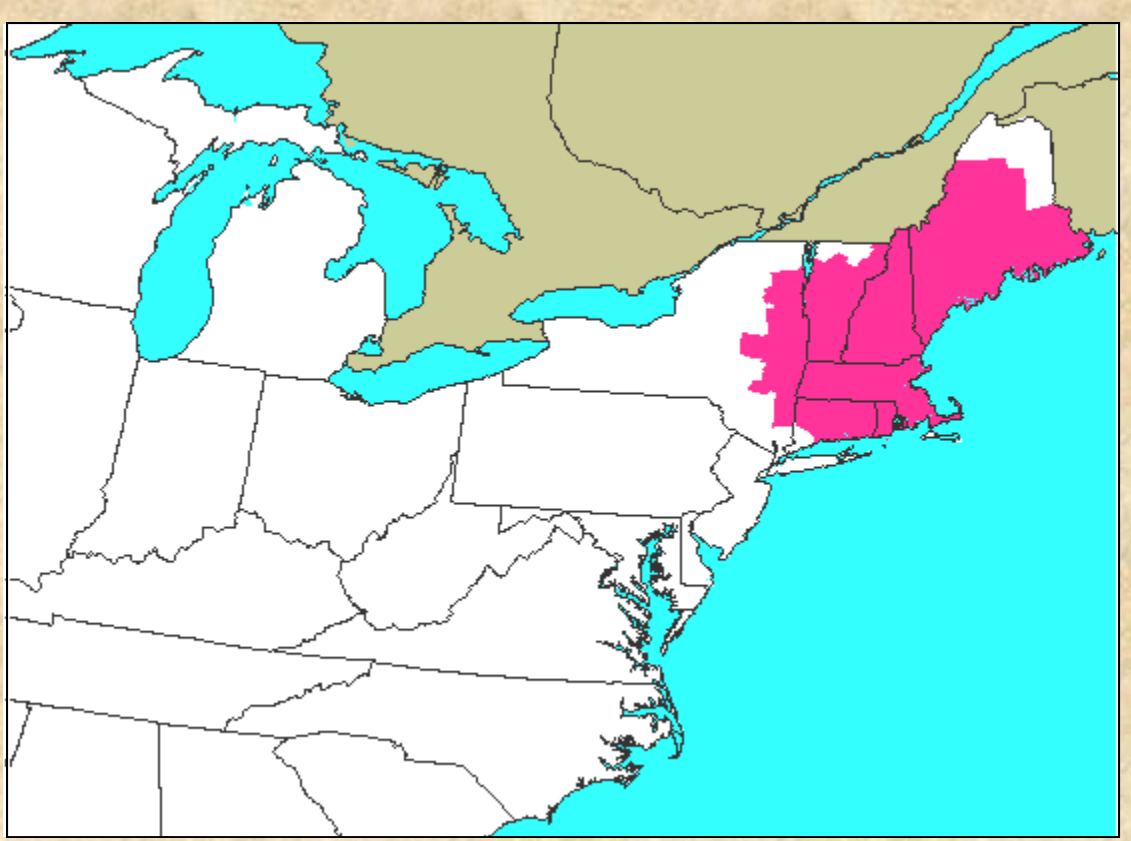
*1938*



*continued use of harsh chemicals*

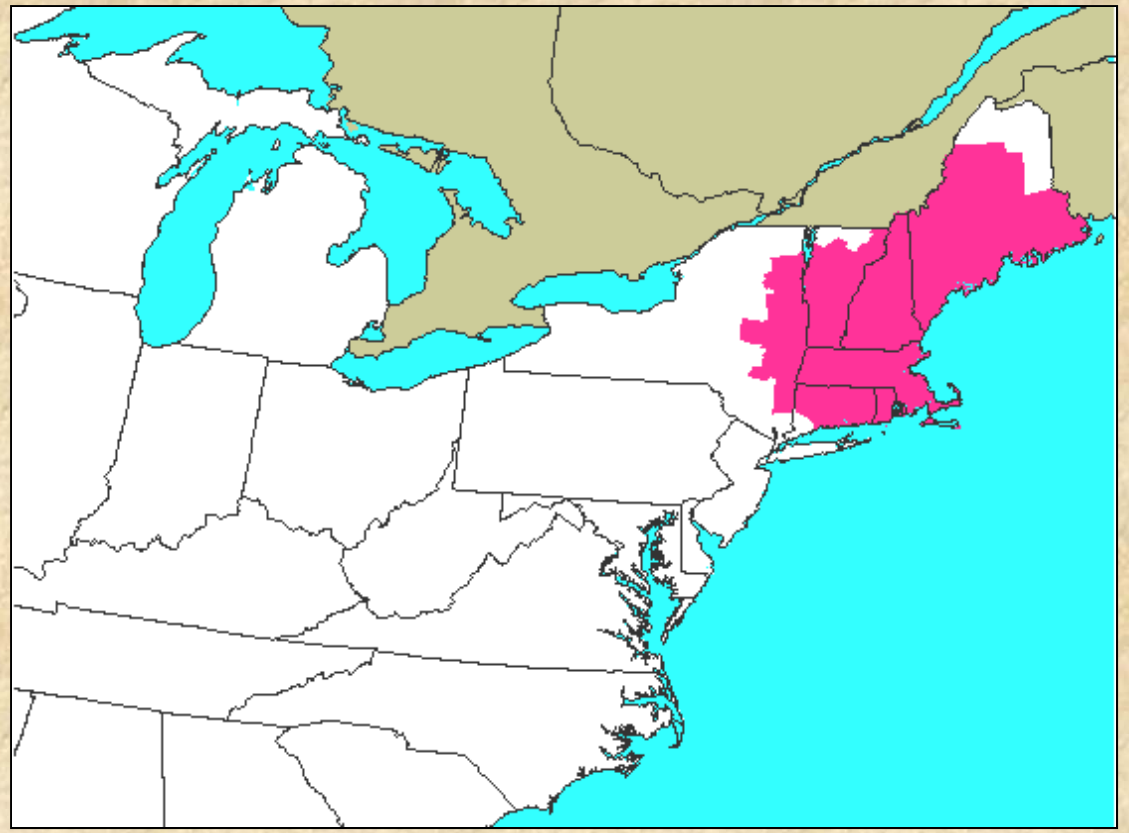
*continued use of harsh chemicals*

*1945*



*end of World War II*

***1949***

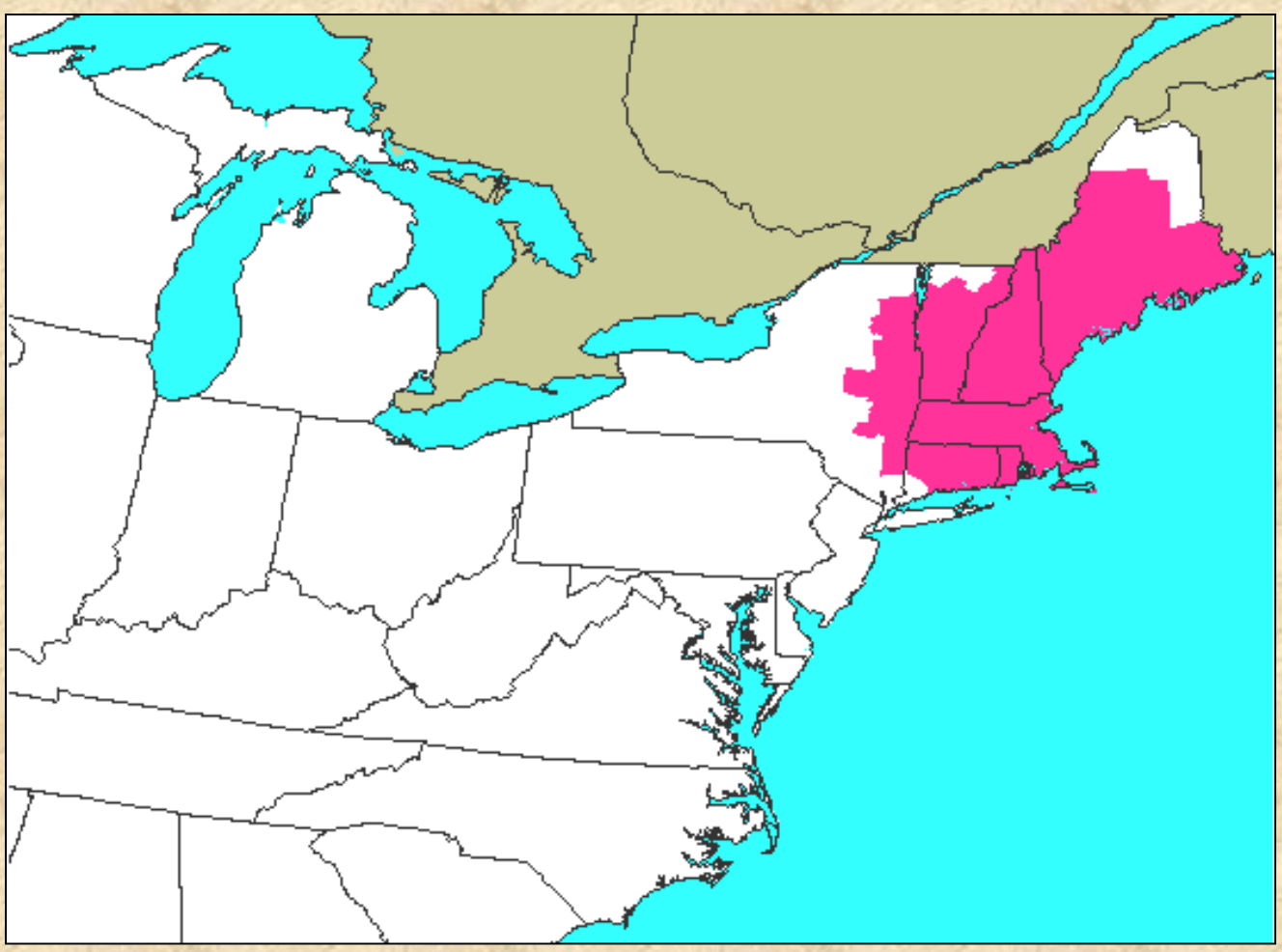


*DDT*

***1951***

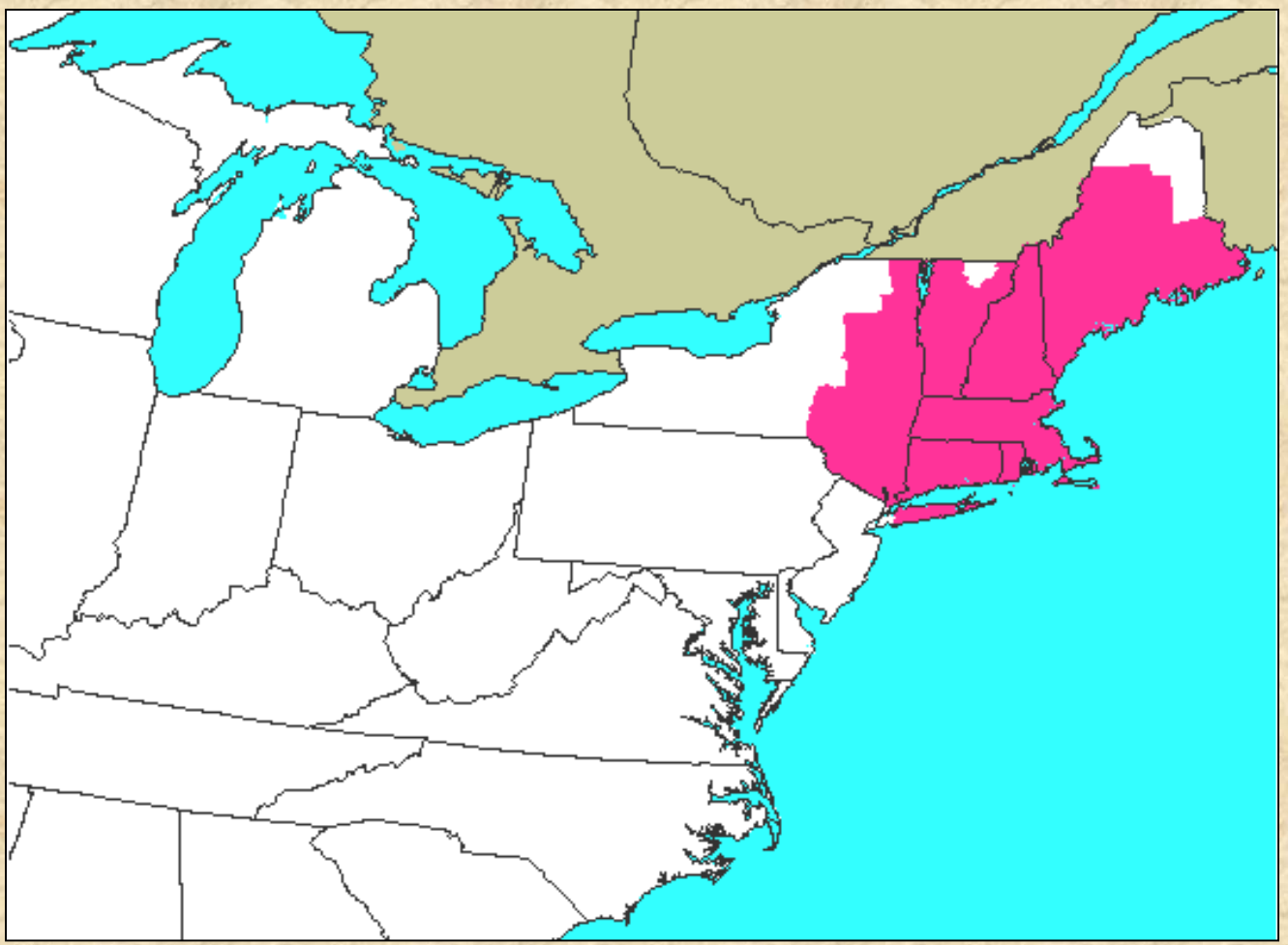
*Elm Spraying*

*1955*



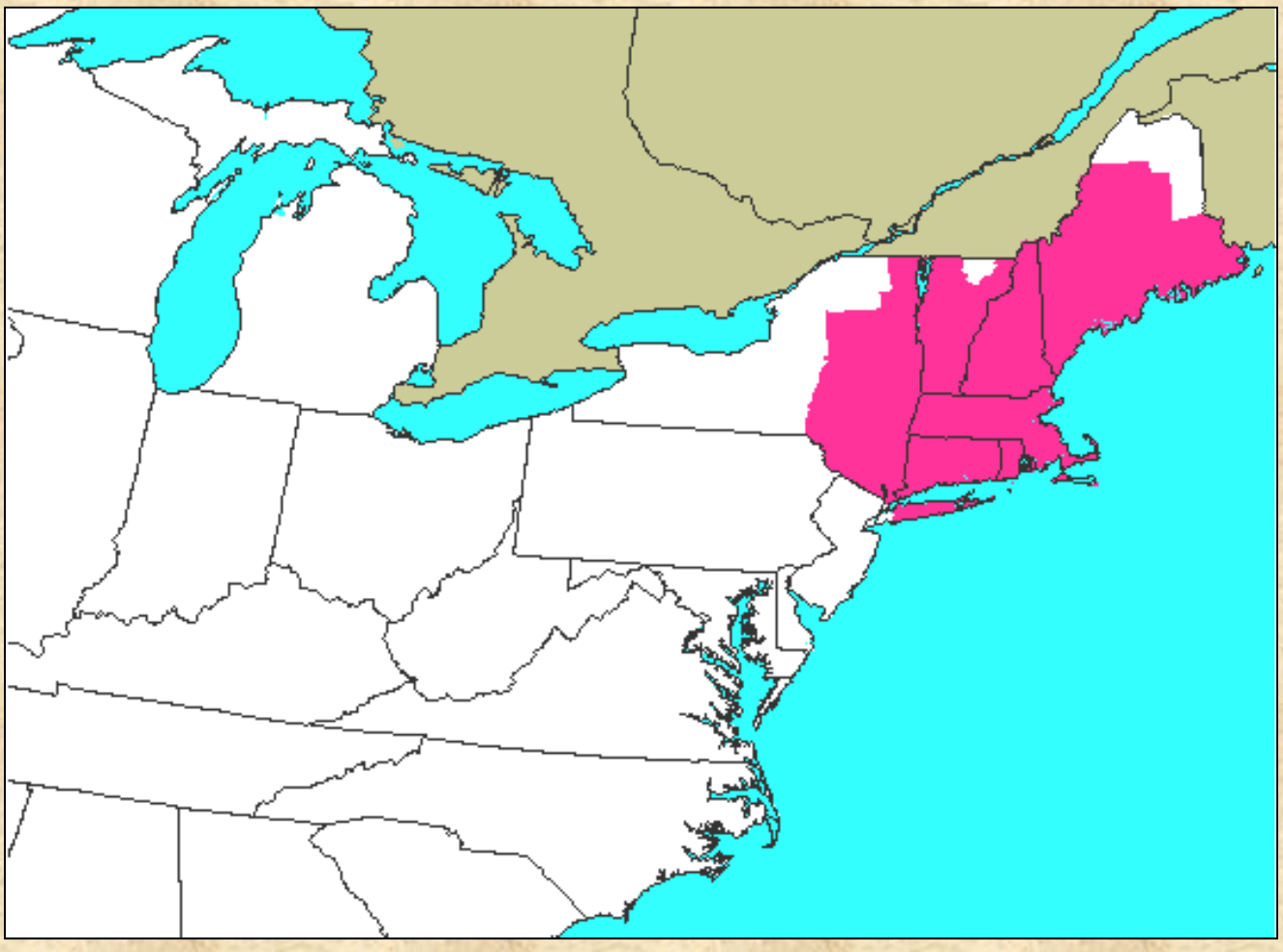
*holding the line at the Hudson River*

***1960***



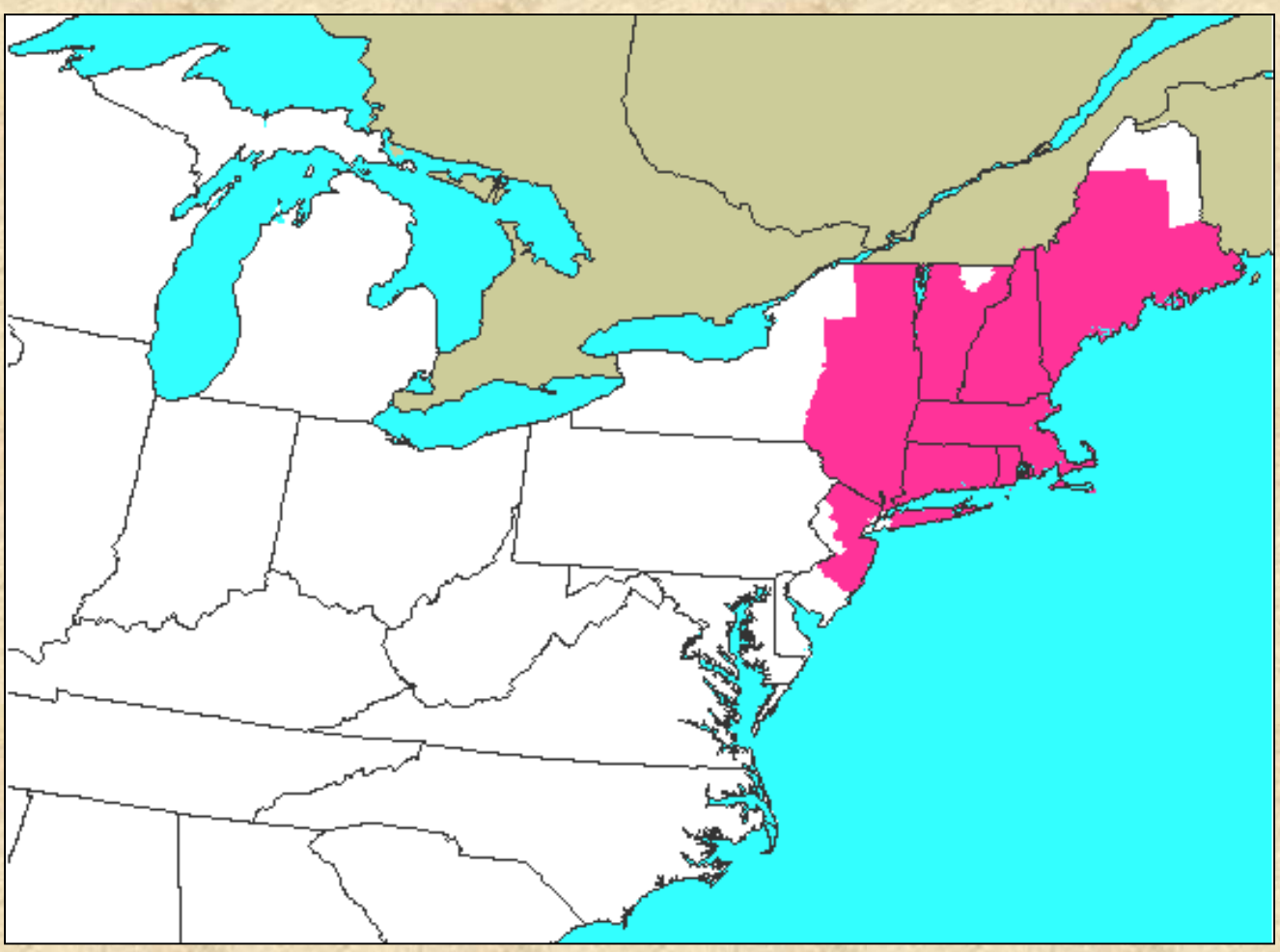
***<u>Silent Spring</u> by Rachel Carson***

*1965*



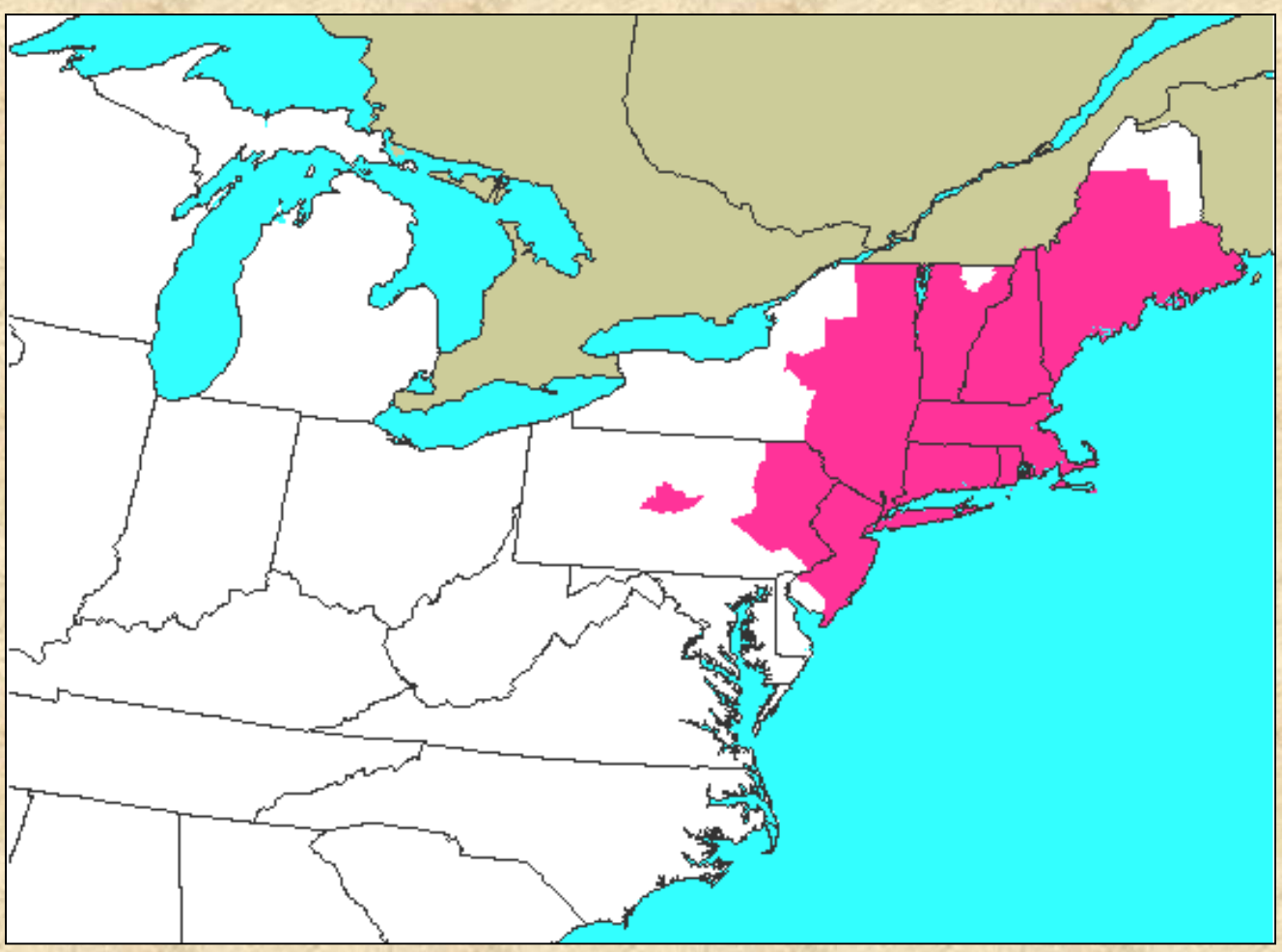
*new generation of pesticides*

*1967*



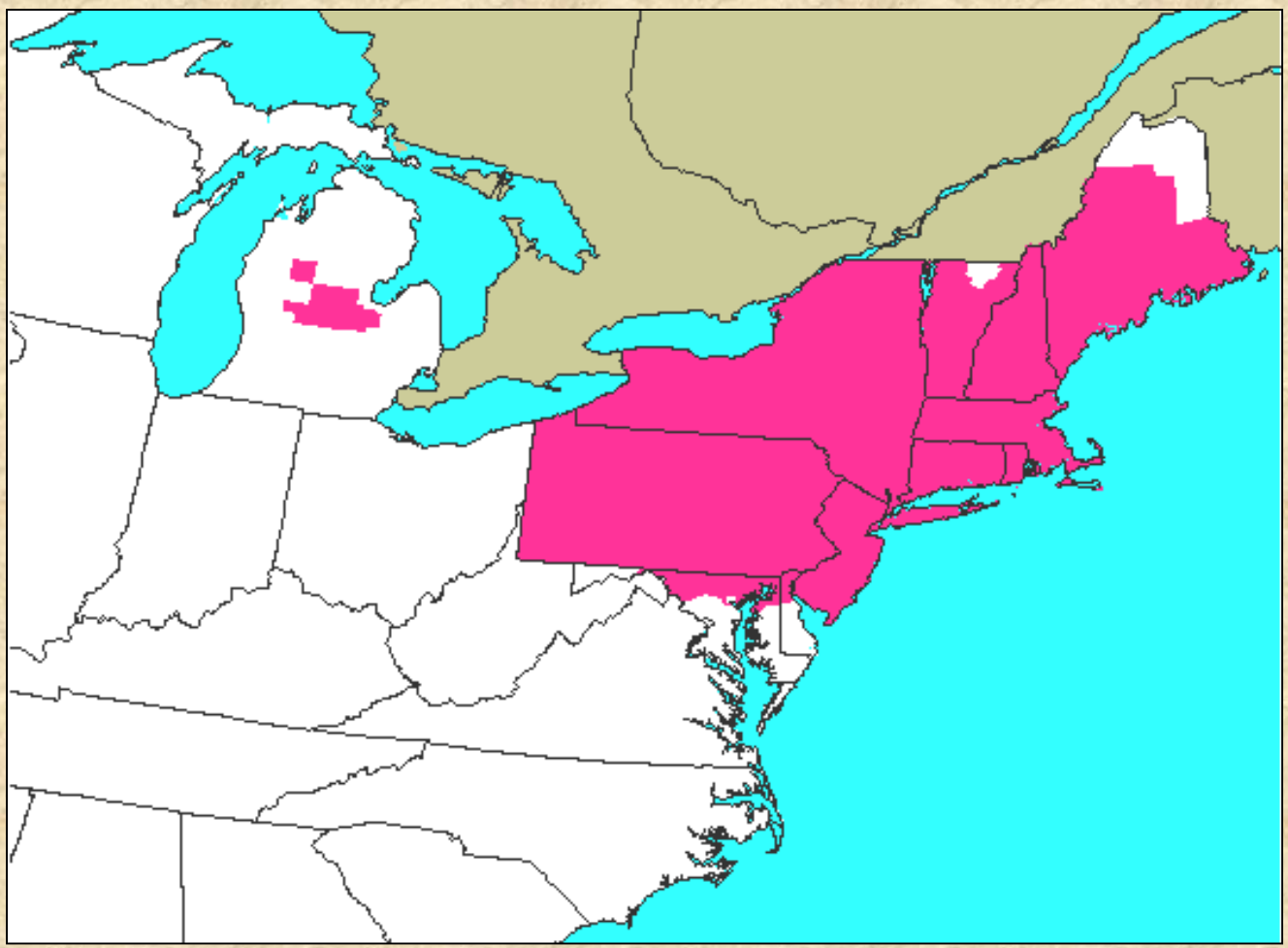
*increasing severity of outbreaks*

*1971*



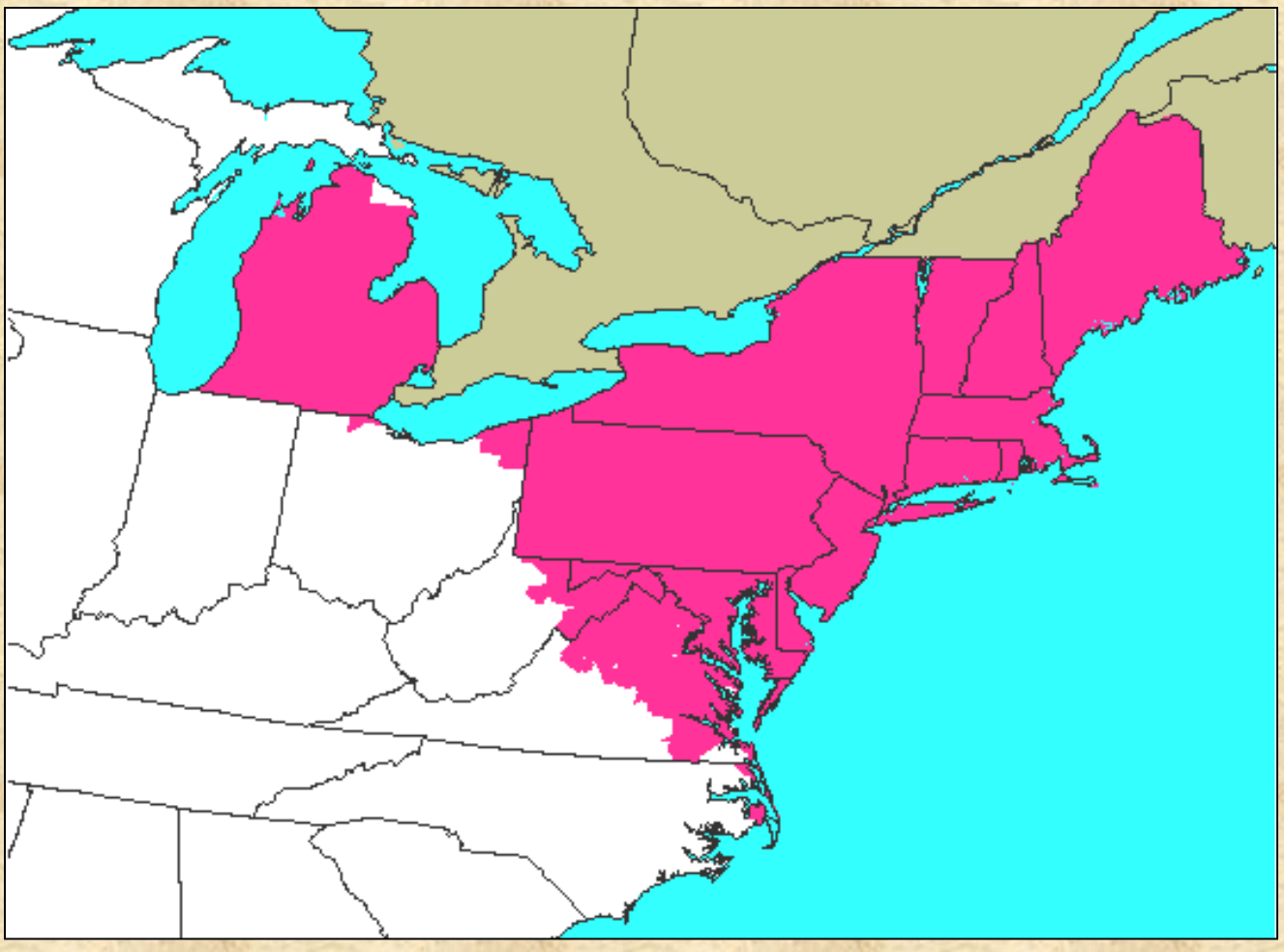
*peak year in Connecticut*

*1981*



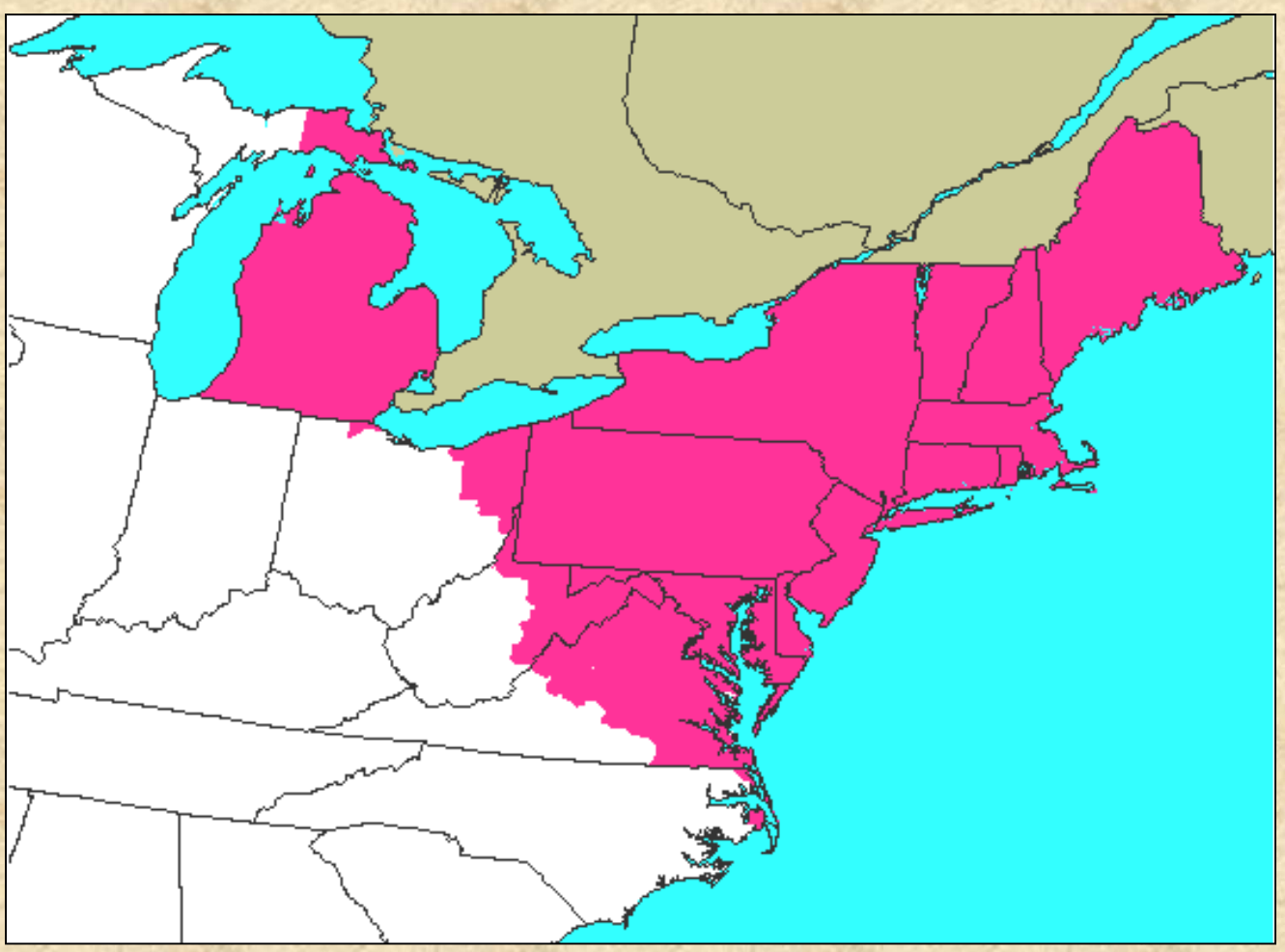
*peak year for defoliation in Connecticut*

*1991*

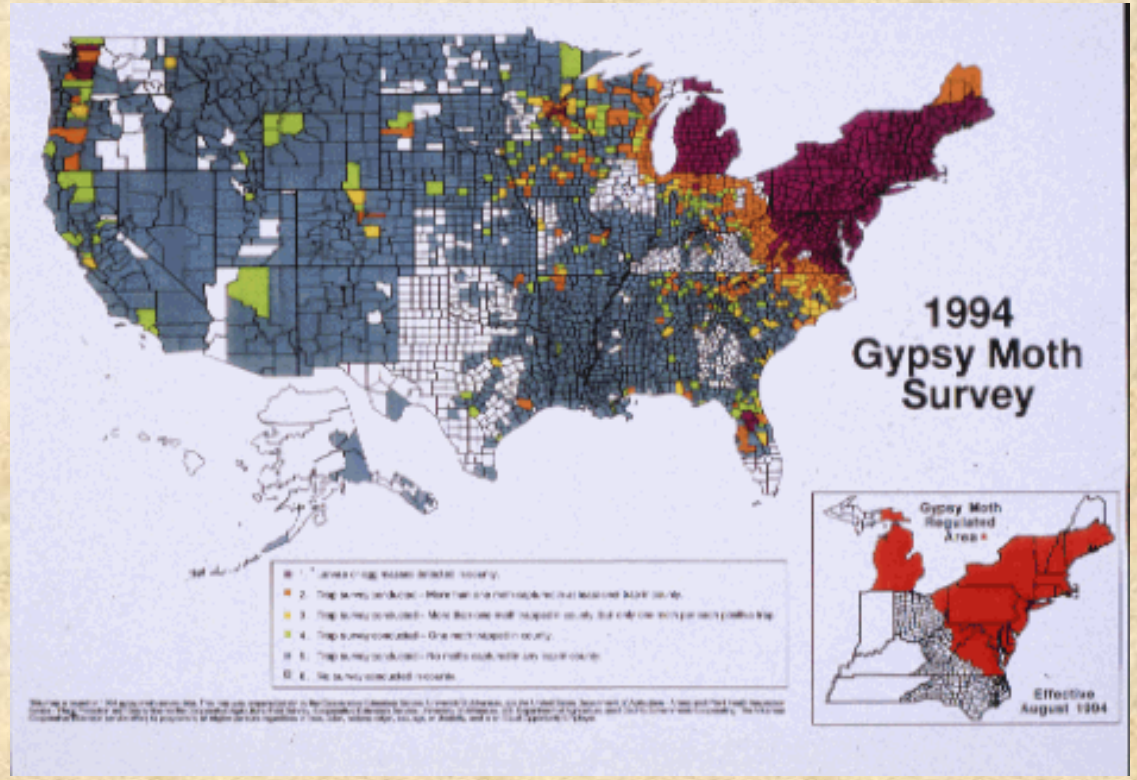


*predicted peak year in Connecticut*

*1994*



*still spreading throughout the country*




The spread and legacy continue…..

# OLD TIME SPRAY PROGRAM

- Heavily weighted towards chemicals
- Elimination of pest often sought as goal
- Pest more often the focus of the effort, rather than the plant
- Prescriptive sprays, often planned well in advance of growing season
- Volume oriented spraying (with price determined by amount sprayed, and spray amounts consistent year to year)
- Spraying often viewed independently of other tree care activities

Be on the lookout for the sequel


"DEATH TO ALL INSECTS"


AND
ADULTERATED
CROPS
&
CLIMATES
STIMULATES
VEGETATION
IMPROVES
INSECTS
ON TREES
OR OTHER
VEGETATION
THE BEST
TOP-DRESSING
KNOWN
FOR
GRASS
OR
GRAIN
CROPS
A TRIAL
SITS BEST
GUARANTEE
ATTENTION
FRUIT
GROWERS
A PERFECT
INSECTICIDE
Kidz
Warehouse
Amazement
SQUARE

# GOALS ASSOCIATED WITH AN IPM PROGRAM

- Reduced Use of Pesticides
- Reduced Environmental Burdens (Ecologically)
- Reduced Environmental Burdens (Human Health)
- Healthy Trees
- Happy Customers
- Increased Awareness of Various Pest Control Options
- Educated Customers
- Educated Arborists
- For each Tree, all Tree Care Activities are considered together, as part of a unified goal.
- IPM = Intelligent Pest Management


**What Dr. Sharon Douglas said:**

*Rake and remove fallen leaves; prune and remove infected limbs or tips; maintain vigor by fertilizing or watering; select resistant cultivars; fungicide sprays can be applied at bud break and repeated at label intervals until leaves are fully expanded*

What Spray Guy heard:

*blah, blah, blah; blah, blah, blah; blah, blah, blah; blah, blah, blah; fungicide sprays can be applied;blah, blah, blah; blah, blah, blah; blah, blah, blah; blah, blah, blah*

# Why do we treat trees?

Do trees really need the help?

# What's wrong with the tree?

What's right with the tree?

# What Does a Healthy Tree Do???

*Photosynthesis*

Carbon Dioxide + Water ➔ Oxygen + Sugar

energy in = sunlight

*Photosynthesis*

Carbon Dioxide + Water ➔ Oxygen + Sugar

energy in = sunlight

*Respiration*

Oxygen + Sugar ➔ Carbon Dioxide + Water

energy out = metabolism

*Trees photosynthesize to produce sugars. Sugars are both a fuel and a building block. (Trees have a bank account!!!)*

*What the tree uses its sugars for:*

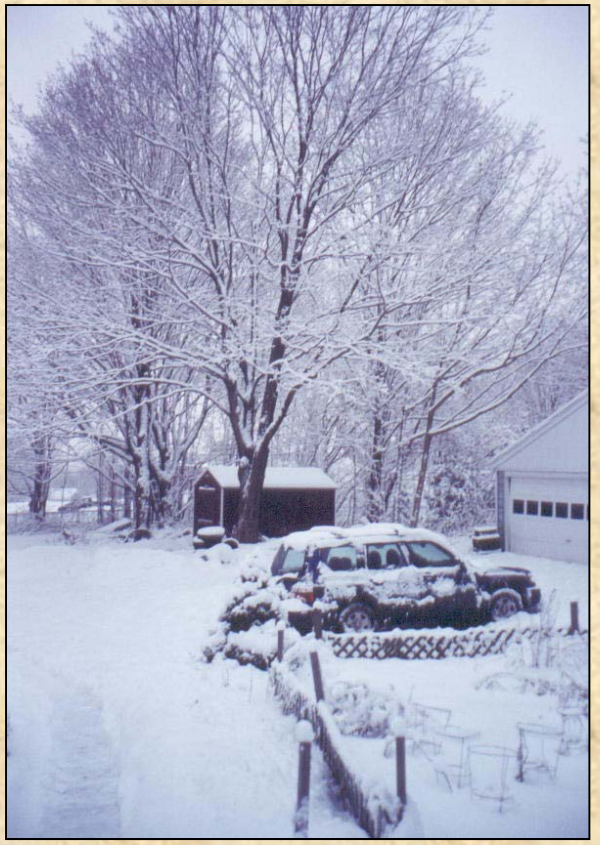
- *energy*

*What the tree uses its sugars for:*

- *energy*
- *growth*

*What the tree uses its sugars for:*

- *energy*
- *growth*
- *tissue repair/replacement*



*What the tree uses its sugars for:*

- *energy*
- *growth*
- *tissue repair/replacement*
- *wound response (compartmentalization)*

*What the tree uses its sugars for:*

- *energy*
- *growth*
- *tissue repair/replacement*
- *wound response (compartmentalizing)*
- *sex, including flowers and fruit*

*What the tree uses its sugars for:*

- *energy*
- *growth*
- *tissue repair/replacement*
- *wound response (compartmentalizing)*
- *sex, including flowers and fruit*
- *self-protection*

*Self-Protection:*

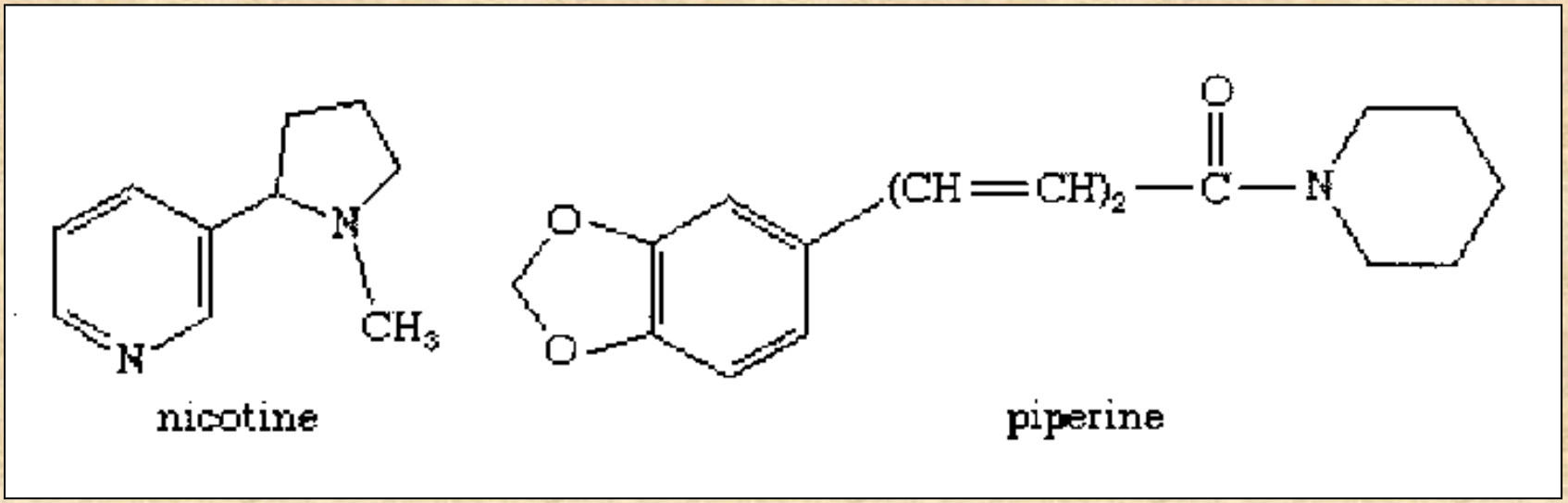
- *physical protection:*

*waxes, hairs, bark*

*Self-Protection:*

- *chemical protection*

*e.g. pharmaceuticals*



*Self-Protection:*

- *compartmentalization*


*(trees also compartmentalize to retain structural*

# *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 (Economic or Aesthetic Injury levels)*

# All Trees Have Many Different Pests That May Harm It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# *Balance of Nature*

# *Balance of Nature*

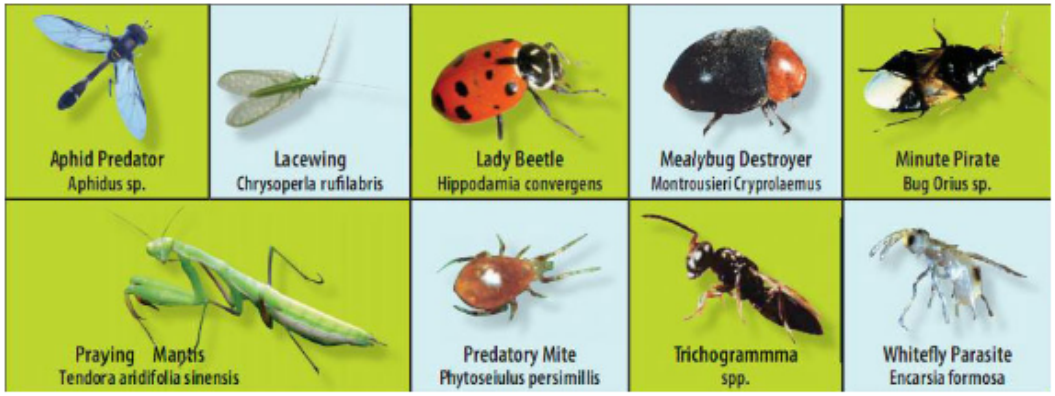
No pests means no lady bugs - the tree is defenseless should a pest come along.


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

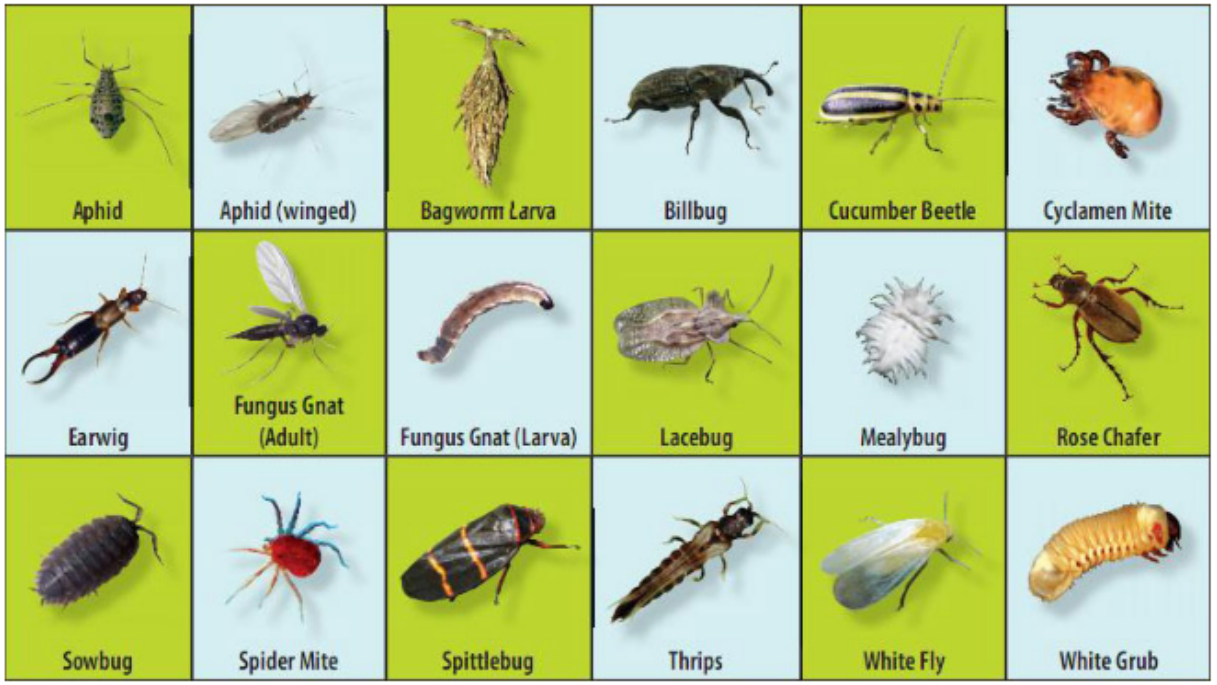
# *Balance of Nature*

The web of life is very large and complex.

## Beneficial Insects (Predators)

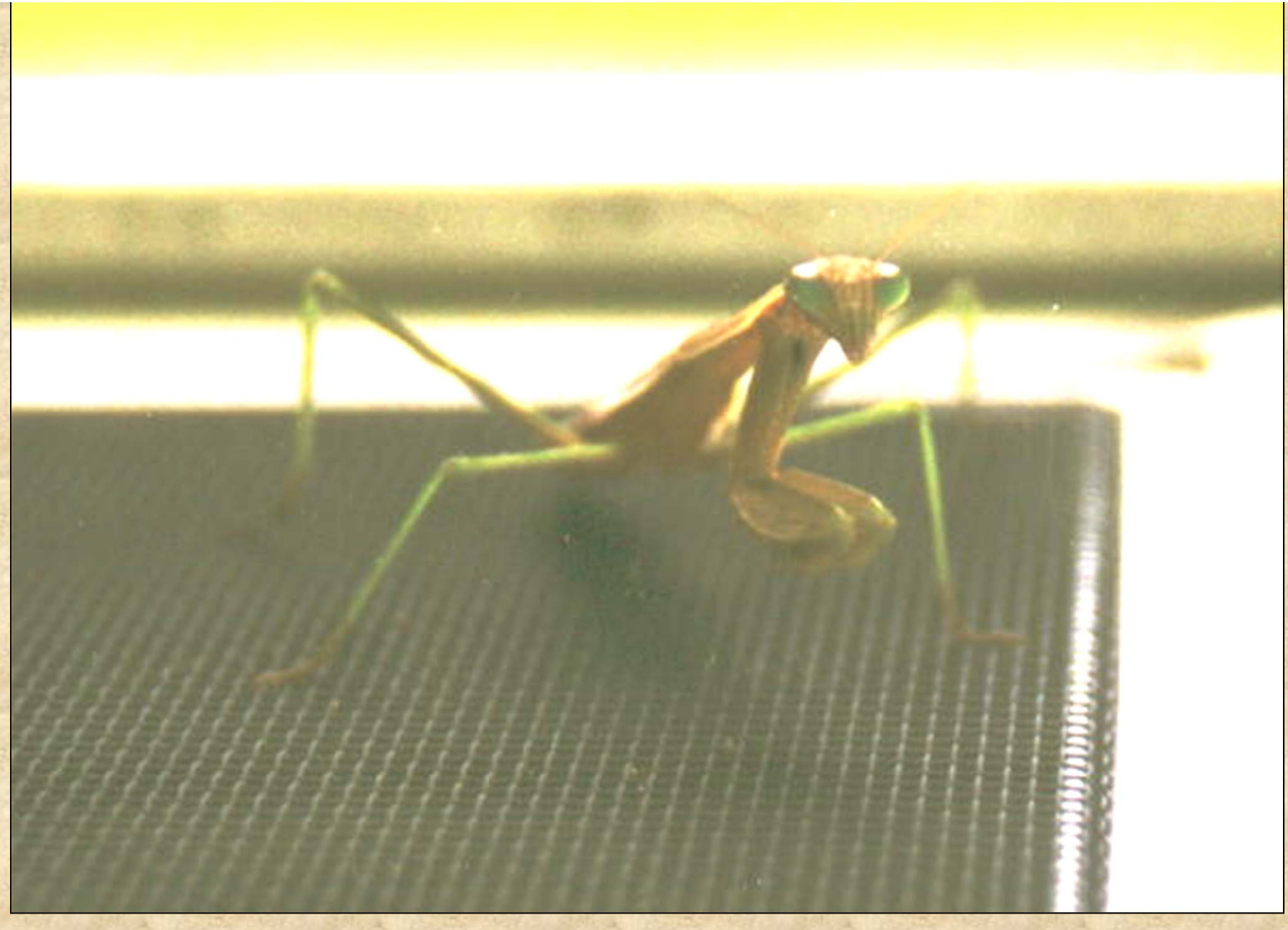



## Destructive Insects, Spider Mites



# *Some of Your Friends in the Arthropod World:*

- *Assassin Bug*
- *Wolf Spider*
- *Stiletto Fly*
- *Aphid Lion*
- *Twice Stabbed Lady Beetle*
- *Fiery Hunter*
- *Robber Fly*
- *Minute Pirate Bug*
- *Preying Mantis*



*Your Friend*

# Two Things:

- Trees need some degree of insects and diseases to toughen them up
- “Good Looks” are not particularly important to a tree

# *Imbalance in Nature*

# *The Asian Longhorned Beetle*

# *The Asian Longhorned Beetle*

# *Emerald Ash Borer*

# *Sudden Oak Death (Ramorum Blight)*

**In California** ***Phytophthora ramorumcauses*** **crown symptoms and tree mortality.**

*Key Points:*

- *In a native system, trees, pests and predators all co-evolved*
- *Non-native species and, especially, invasive exotics are special cases*
- *Condition of the tree often a key factor*
- *Timing; pest life cycle; growth stage; weather and part of the tree are also key factors.*

# REVIEW:

- Explain the principles of IPM.

A balanced use of cultural, biological & chemical procedures that are environmentally compatible and economically feasible to reduce pest populations to tolerable levels.

- Explain what is meant by the IPM decision making process?

Monitoring; Identify; Sanitation; Exclusion; Treatment Strategy; Evaluation

- How does knowledge of pest biology, behavior and ecology effect the outcome of an IPM strategy?

Stage of pest development; type of treatment; availability of predators; resistance to pest; etc.

- What are the Key components to a successful plan?

A combination of Cultural; Biological; Physical and Chemical (if necessary) strategies based upon ecological and physiological characteristics of the pest or threat.

- Where do you find resources regarding IPM?

# IPM RESOURCES

http://ipm.uconn.edu/root/ IPM UConn

Listing of all Available Insect-Pest, Plant, and Miscellaneous Fact Sheets:
http://www.ct.gov/caes/cwp/view.asp?A=2826&Q=378162

Plant Disease Information Office:
http://www.ct.gov/caes/cwp/view.asp?a=3756&q=442800&caesNav=|

Plant Pest Handbook:
http://www.ct.gov/caes/cwp/view.asp?a=2826&q=378182&caesNav=|

How to Identify & Control Non Infectious Diseases of Trees
http://www.na.fs.fed.us/spfo/pubs/howtos/ht_non/non_all.htm

Managing Pests in Landscapes & Homes
http://www.mda.state.mn.us/Global/MDADocs/pestsplants/ipm/home-ipm-guide.aspx


# *The Legends of Arboriculture Video*

*Available from the International Society of Arboriculture*

*www.isa-arbor.com*

*Go to the Web Store*

# SOME QUESTIONS TO CONSIDER:

**Has the problem been positively identified?**

**Have you read the pesticide label?**

**Is use of a pesticide warranted – does this pest pose a serious threat to plant health or is the problem merely cosmetic?**

**What are the expected risks and benefits of a pesticide application?**

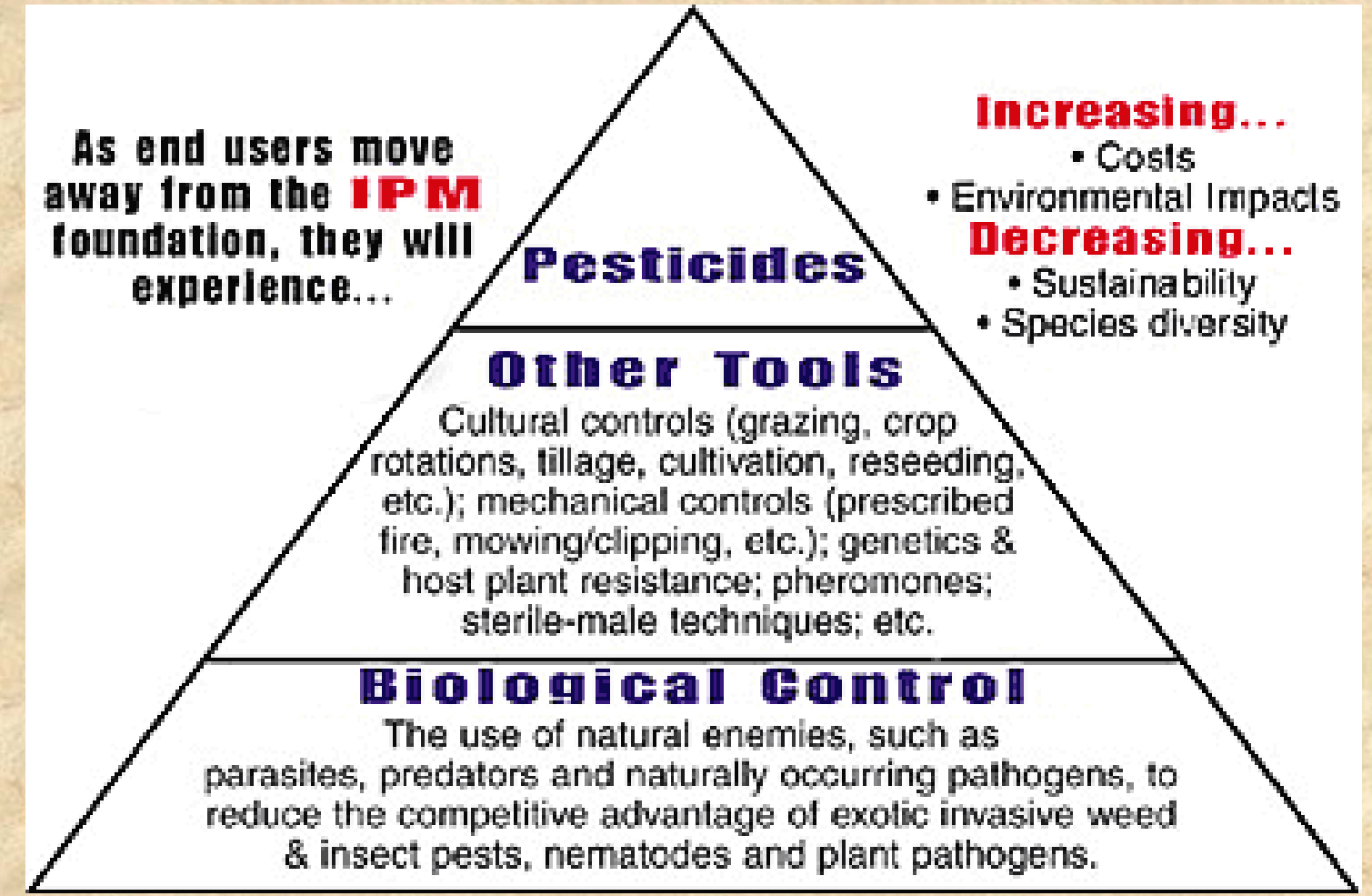
**Are low-risk pesticide alternatives available for control of the pest?**

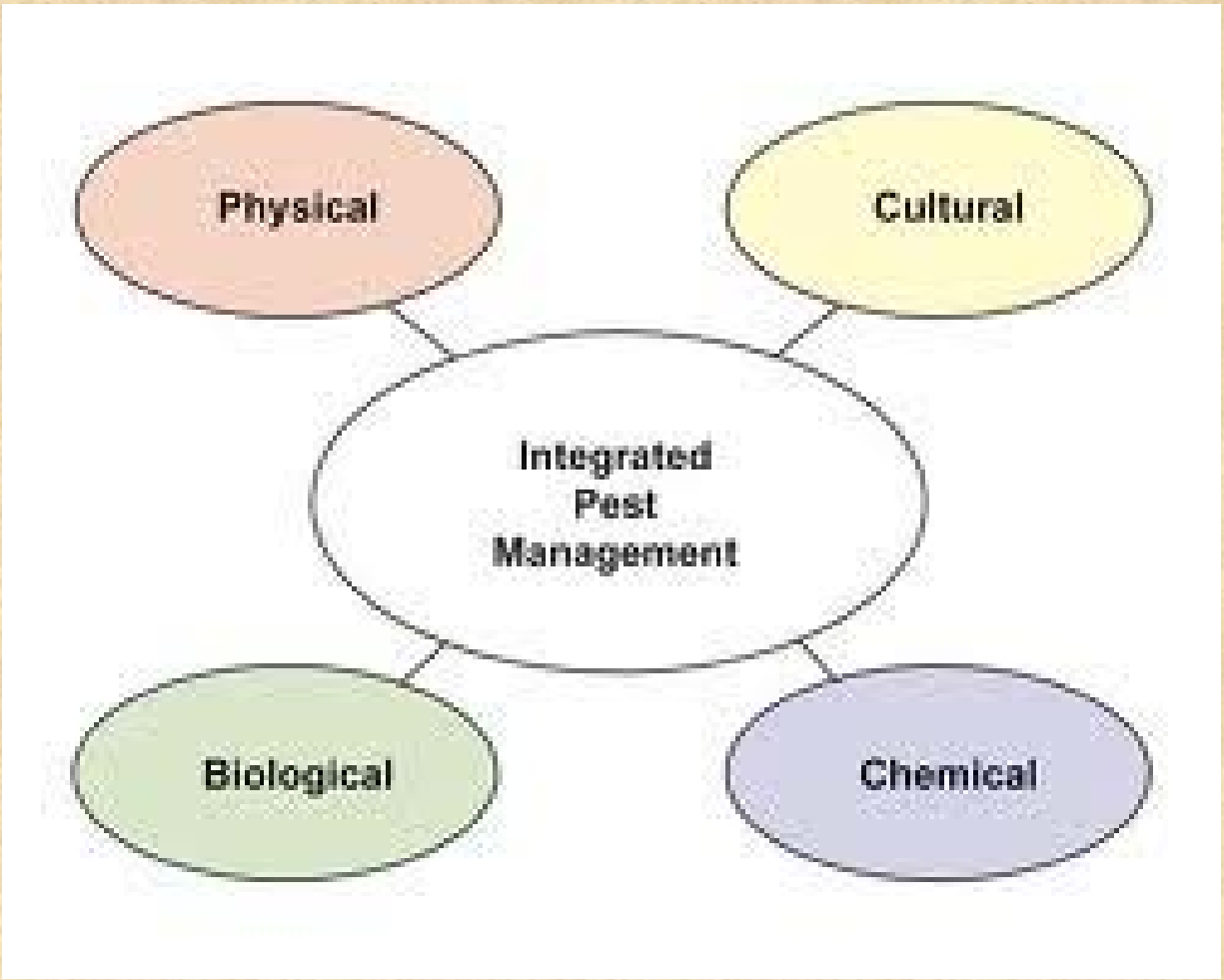
**If I have to use a pesticide, at what time will an application be most effective?**

**If this is one in a series of applications, are repeated applications of the pesticide resulting in reduced efficacy against the target species?**

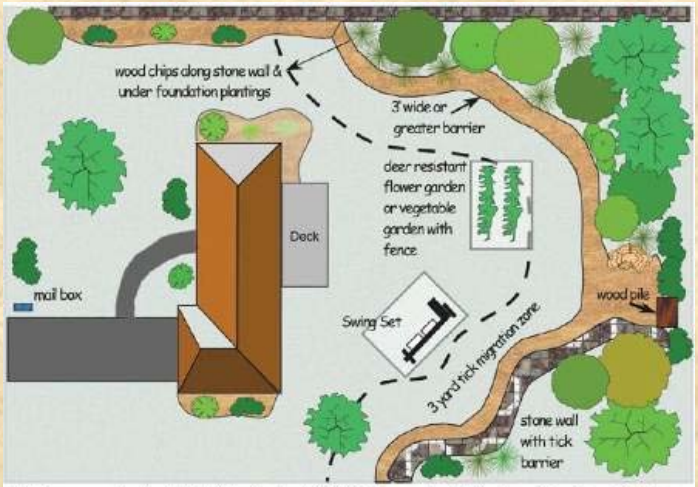
# ALWAYS SEEK A LONG TERM, ENVIRONMENTALLY SOUND SOLUTION.

**"Integrated Pest Management (IPM) is the coordinated use of pest and environmental information to design and implement pest control methods that are economically, environmentally and socially sound. IPM promotes prevention over remediation and advocates integration of at least two or more strategies to achieve long-term solutions."**


As end users move away from the IPM foundation, they will experience...
Increasing...
• Costs
• Environmental Impacts
Decreasing...
• Sustainability
• Species diversity
Pesticides
Other Tools
Cultural controls (grazing, crop rotations, tillage, cultivation, reseeding, etc.); mechanical controls (prescribed fire, mowing/clipping, etc.); genetics & host plant resistance; pheromones; sterile-male techniques; etc.
Biological Control
The use of natural enemies, such as parasites, predators and naturally occurring pathogens, to reduce the competitive advantage of exotic invasive weed & insect pests, nematodes and plant pathogens.


Physical
Cultural
Integrated
Pest
Management
Biological
Chemical

# IS IPM IMPORTANT?



Tick free zone. Illustrated by Kirby Stafford, III PhD. Connecticut Agricultural Experiment Station.