



Integrated Pest Management
And the ecology that makes it necessary and effective

New York State IPM Program
Joellen Lampman, School and Turfgrass IPM Extension Support Specialist




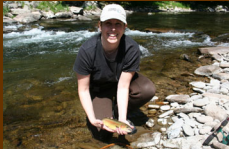
About me

- Life-long environmental educator



About me

- Life-long environmental educator
- Garden dabbler and lawn minimalist
- Prefer set-it-and-forget-it methods – I'd rather be fishing!

About me

- Life-long environmental educator
- Garden dabbler and lawn minimalist
- Prefer set-it-and-forget-it methods – I'd rather be fishing!
- New favorite plant - mountain mint





Book Recommendation

- A natural history of the wilderness in our homes, from the microbes in our showers to the crickets in our basements.



NEVER HOME ALONE
From MICROBES to MILLIPEDES, CARABID CRICKETS, and HONEYBEES
the NATURAL HISTORY OF WHERE WE LIVE
ROB DUNN

About where I work

New York State IPM Program Mission:
“We develop and deliver sustainable ways to manage pests that are cost-effective and pose minimal risks to human health and the environment.”



www.nysipm.cornell.edu



NYSIPM – Community IPM Team



Alejandro Calixto
NYSIPM Director



Jody Gangloff-Kaufmann
Community IPM
Coordinator



Matt Frye
Community IPM Extension
Area Educator



Joellen Lampman
School and Turfgrass IPM
Extension Support



Debra Marvin
Community IPM Program
Assistant



Amara Dunn
Biocontrol Specialist



Elizabeth Lamb
Ornamentals IPM
Coordinator



Brian Eshenaur
Sr. Extension Associate in
Ornamental Crops

Your Turn!

- County?
- Favorite Master Gardener Program activity?
- Recent plant discovery?

IPM

Integrated **PEST** Management

What is a pest?

WHAT IS A PEST?

- Living organism

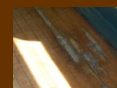


Chris Isherwood, flickr



WHAT IS A PEST?

- Living organism
- Not what it is; but what it does:
 - Property damage



WHAT IS A PEST?

- Living organism
- Not what it is; but what it does:
 - Property damage
 - Eats and/or contaminates our food



Chris Isherwood, flickr

WHAT IS A PEST?

- Living organism
- Not what it is; but what it does:
 - Property damage
 - Eats and/or contaminates our food
 - Health risks



Chris Isherwood, flickr

WHAT IS A PEST?

- Living organism
- Not what it is; but what it does:
 - Property damage
 - Eats and/or contaminates our food
 - Health risks
 - Detracts from our aesthetics & comfort
 - Provides habitat for other pests



Chris Isherwood, flickr

Pest?



Wildlife Terry, flickr

How about now?



Ken, flickr



Carosaurus, flickr

Pests?



Pest?



Pest?



I found a bug!

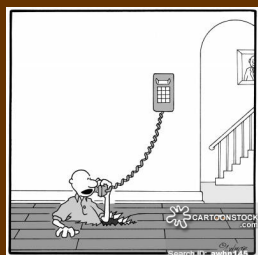


I Found a bug! What do I do?



Today's plan

- Integrated Pest Management Overview
- Ecology 101
- What's Bugging You?



Your Turn!

- What does IPM mean to you?
- Let us know if you have never heard of it before.

Integrated Pest Management

- Goal: manage pests while minimizing the human health, environmental, and economic risks of pests and pest management.



Photo USDA, flickr

Integrated Pest Management

- Is a science-based, decision-making process
- Relies on knowledge of:
 - pest biology
 - environmental information, and
 - available technology

National Road Map for Integrated Pest Management, 2013

Integrated Pest Management

- IPM **integrates** all aspects of pest control.
- Use multiple strategies or “many small hammers”



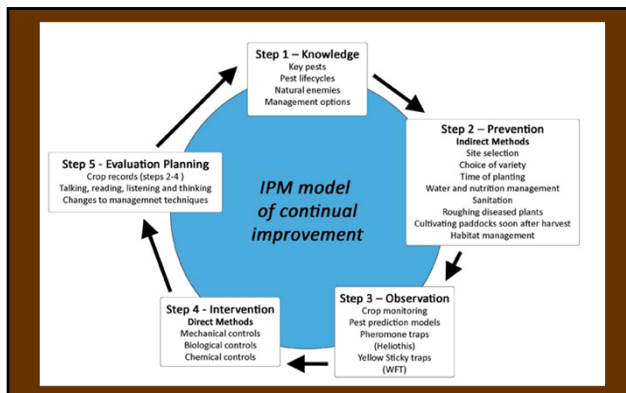
<http://www.props.eric-hart.com/tools/>

IPM versus organic

- Organic food production is regulated by the USDA National Organic Program.
- Both IPM and organic approaches seek to minimize the environmental impacts of pest management practices.
- **Organic is** IPM, but with less hammers in the tool chest (mostly synthetic chemical pesticides).

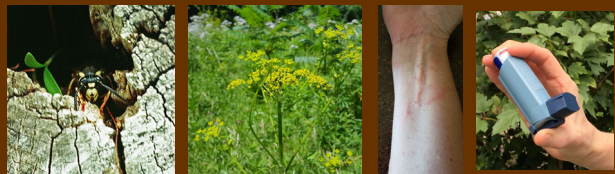
Integrated Pest Management

- IPM integrates all aspects of pest control.
- IPM does include the prevention of problems before they happen.



Why is IPM important?

- There are health concerns and risks from pests, pest allergens, and pesticides.



Steven Katovich, USDA Forest Service, Bugwood.org

NIAID, flickr

What is a Pesticide?

- A pesticide is any substance or mixture of substances intended for:
 - Preventing,
 - Destroying,
 - Repelling, or
 - Mitigating any pest.



What is a Pesticide?

- Pesticides include:
 - Insecticides
 - Rodenticides
 - Herbicides
 - Bactericides
 - Repellants
 - Insect repellants – can be an insecticide
 - Biopesticides – made from microorganisms or natural products



Pesticides impact targets and non-targets by:

- Lethal poisoning
 - Of individuals
 - Of food
 - Of beneficial and other off-target organisms
- Sublethal poisoning
 - Increases chance of dying from other stresses
 - Decreases ability to attract a mate, defend a territory, or feed young
 - Lessens ability to escape from predators

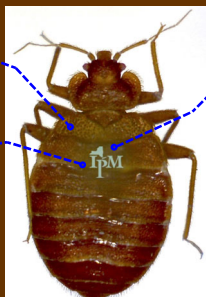
Pesticide Resistance – Evolution!

Target Site

pesticide no longer binds to the target site

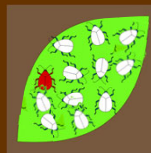
Metabolic

insect detoxifies pesticide to less harmful substance

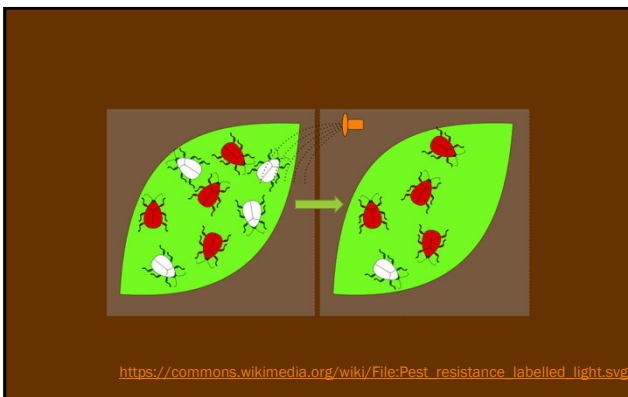
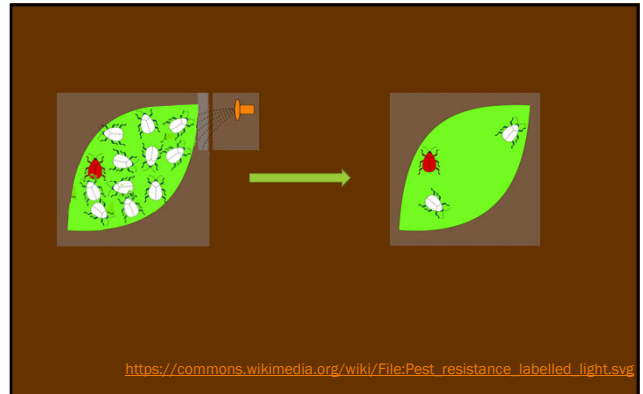
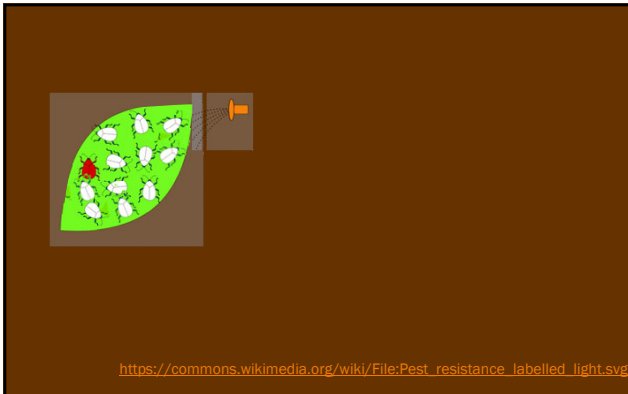


Penetration

thicker cuticles prevent pesticide penetration



https://commons.wikimedia.org/wiki/File:Pest_resistance_labelled_light.svg



Pesticides and Sub-Lethal Off-Target Impacts

- Kill food plants
- Reduce insect populations through loss of food plants
- Reduce berry and nut crops through stress or killing of beneficial pollinators
- Degrade shelter

How to Minimize Off-Target Impacts?

- Read the label
- Choose pesticides based on environmental impacts

NYS IPM Program Resource

- Environmental Impact Quotient - <https://nysipm.cornell.edu/eiq>



What about home remedies?

- If used to kill or repel, it is a pesticide. We CANNOT recommend!
- A story of an idea: Would adding a surfactant make a yellow jacket trap more efficient or would the soap be a pesticide?



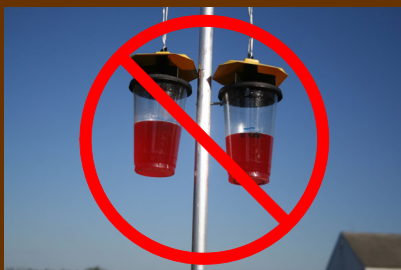
DEC Decision – surfactants can be used for mechanical efficiency – let the testing begin!



DEC Decision – surfactants can be used for mechanical efficiency – let the testing begin!



DEC Decision – surfactants can be used for mechanical efficiency – data doesn't support




Your Turn!

- Let's check what recommendations you have heard and whether they are legal.

Questions about IPM process or pesticides?

Ecology 101

- Ecology is the study of living things in relation to each other and their environment.
- IPM Assessment
 - What is it?
 - Why is it here?
 - How does it survive?
 - How many are there?




Levels of Ecology

- Species
- Population
- Community
- Ecosystem




Species


- A single type of organism, such as a white-tailed deer, Asian tiger mosquito, or spinach



Odocoileus virginianus
Jeff Camilleri flickr



Aedes albopictus
frankieleon flickr




Spinacia oleracea

Species

- Identification
- Life history
- Behavior



White-footed Mouse



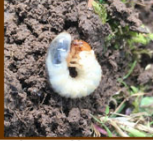
Patrick Coin flickr

```

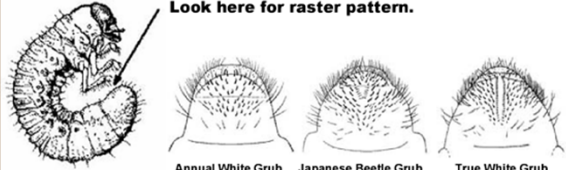
    graph TD
      A["Fast and Flexible  
Litter is ~3-5 young, 2-4x/year  
Sexually mature at 7-8 weeks"] --> B[Low immune investment]
      B --> C[High reservoir/high competence for  
pathogens that cause disease]
      A --> D["Eats seeds, nuts, acorns, fruits,  
insects, fungi, and possibly  
some green vegetation"]
      D --> E[Resilience to disturbance/  
diversity loss]
    
```

Lyme Disease: The Ecology of a Complex System, Richard S. Ostfeld, 2011

White Grub Diversity



Look here for raster pattern.



Annual White Grub (S. Masked Chafer) Japanese Beetle Grub True White Grub (May Beetle)

[Line drawings – USDA/Cornell]

Cornell Resource – Soil Arthropod Ecology Lab

• Grub ID – <http://grubid.cals.cornell.edu>





Grub Species Life Cycles

Insect	Jan-Mar	Apr	May	June	July	Aug	Sep	Oct	Nov-Dec
European Chafer	3 rd instar larvae	3 rd star larvae	Adults emerge, mate & lay eggs	1 st instar larvae	2 nd instar larvae	3 rd instar larvae	3 rd instar larvae	3 rd instar larvae	3 rd instar larvae
June Beetle	Year 1: Adults overwintering in soil	Adults emerge, mate & lay eggs	1 st instar larvae	2 nd instar larvae	2 nd instar larvae	2 nd instar larvae	2 nd instar larvae	2 nd instar larvae	2 nd instar larvae
June Beetle	Year 2: 2 nd instar larvae	3 rd instar larvae	3 rd instar larvae	3 rd instar larvae	3 rd instar larvae	3 rd instar larvae	3 rd instar larvae	3 rd instar larvae	3 rd instar larvae
June Beetle	Year 3: 3 rd instar larvae	3 rd instar larvae	Pupation and adults remain in soil to hibernate and overwinter						
Japanese Beetle	3 rd instar larvae	3 rd star larvae	Adults emerge, mate & lay eggs	1 st instar larvae	2 nd instar larvae	3 rd instar larvae	3 rd instar larvae	3 rd instar larvae	3 rd instar larvae

Adapted from Ontario Ministry of Agriculture, Food and Rural Affairs

Identification



Stinging Insect Identification



Identification



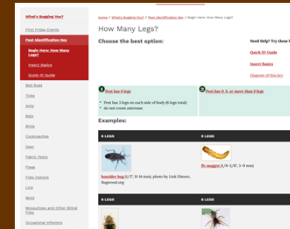
NYS IPM Program Resource

- What's Bugging You?
www.nysipm.cornell.edu/whats_bugging_you



NYS IPM Program Resources

- Pest Identification Key
www.nysipm.cornell.edu/pest_key/default.asp



Population

- A group of the same species, such as a bale of turtles, herd of deer or swarm of mosquitoes.



Population

- Intraspecies Competition
- Density
- Distribution
- Behavior



Garen Meguerian, flickr

IPM Implications – IPM Thresholds

- There is a big difference between an incident and an infestation.
- Individuals rarely give us problems.
- Population size matters.
- The goal is not to kill every individual but to manage populations at tolerable levels.
- Thresholds tell us when its time to take action

Threshold Example

- White Grubs
 - Sample 1 square foot
 - Count Grubs
 - Threshold Levels
 - 8-10 grubs per square foot
 - If irrigated and well fertilized lawn, then 12-15 per square foot



We often can't stop introductions



Community

- An ecological community is made up of *different* populations of species.



Community

- Interspecific competition
- Food Web
- Species diversity



Mark Freeth, flickr



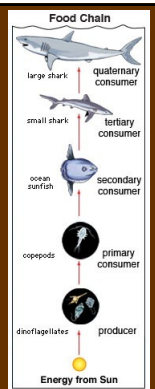
IPM Implications

- Give the desired species the edge.



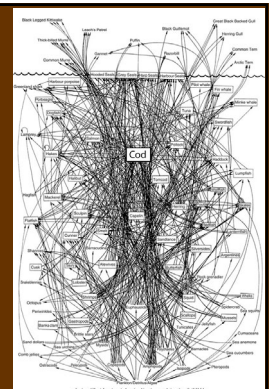
Food Chain

- Looking at Community-based Ecology
- Very simple
- Arrows point in one direction
- If true, highly susceptible to disruption




Food Web

- Very Complex
- Rich biodiversity
- Copious connections
- Significant overlap
- High resistance to disruptions




Mast Year

2019



2020



2021


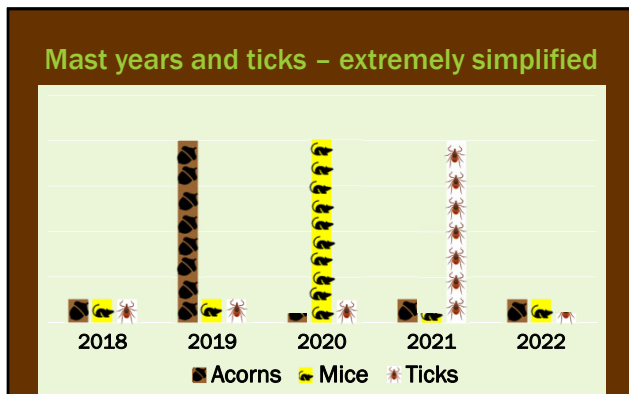


Photo: Jesse Brunner

Red arrows point from the 2019 acorns to the 2020 acorns, and from the 2020 acorns to the 2021 mouse.




IPM Implications

- Simple systems are vulnerable systems
- Diversity is a casualty of control




IPM Implications

- Whenever possible, manage for diversity
- NYSIPM Research - Increasing plant diversity on Christmas tree farms



NYSIPM/CCE Research

- Increasing plant diversity in lawns



NYS IPM Program Resources

- Blog - <https://blogs.cornell.edu/biocontrolbytes>

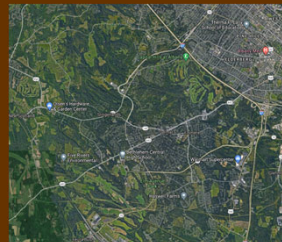


IPM Implications

- Crop rotation or skipping years can prevent crop specific pests from increasing year to year



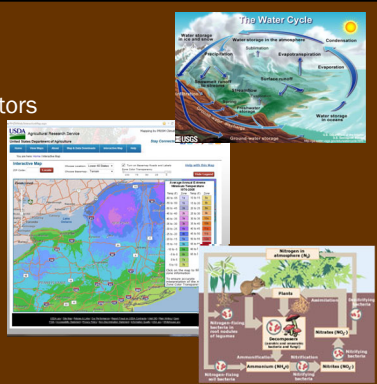
Ecosystems



- All living organisms, their physical environment, and all their connections in a particular unit of space

Ecosystems

- Include Abiotic Factors
 - Geology
 - Precipitation
 - Sun
 - Wind
 - Water
 - Soil
 - Climate
 - Microclimate



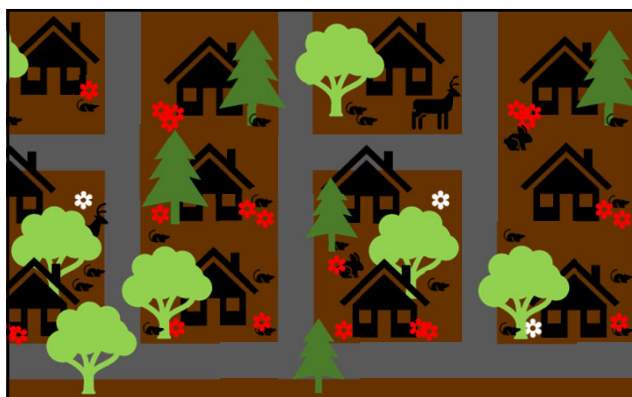


IPM Implications

- Populations interact with each other and the physical environment in obvious, and not so obvious, ways.



Photo: Jesse Brunner



IPM Implications

- Populations interact with each other and the physical environment in obvious, and not so obvious, ways.



• Long-Term Effects of *Berberis thunbergii* Management on *Ixodes scapularis* Abundance and *Borrelia burgdorferi* Prevalence in Connecticut, USA
 • Effects of Japanese Barberry (*Berberis thunbergii*) Removal and Resulting Microclimatic Changes on *Ixodes scapularis* (Acari: Ixodidae) Abundances in Connecticut, USA

Your turn

- What pest issues are we bringing on ourselves?

Ecosystems versus Habitat


- Ecosystems - All living organisms, their physical environment, and all their connections in a particular unit of space
- Habitat - a place where a species naturally lives; its address

Ecology 101 - Habitat

- Consists of four basic needs

Ecology 101 - Habitat

- Consists of four basic needs
 - Food



Ecology 101 - Habitat


- Consists of four basic needs
 - Food
 - Water



Terry Soivey, USDA Forest Service, Bugwood.org
UCA1374032

Ecology 101 - Habitat

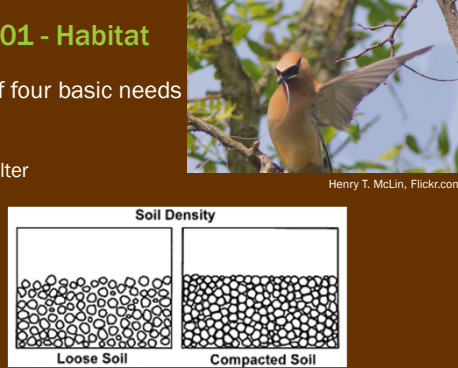
- Consists of four basic needs
 - Food
 - Water
 - Cover/Shelter



Dan Dzursin, Flickr.com

Ecology 101 - Habitat

- Consists of four basic needs
 - Food
 - Water
 - Cover/Shelter
 - Space



Henry T. McLin, Flickr.com

Soil Density

Loose Soil Compacted Soil

IPM Implications

- We can manage the landscape to:
 - Prevent problems
 - Provide the best possible habitat for the desired species
 - Degrade the habitat for undesirable species
 - Enhance beneficials' habitat

Habitat

- Food
- Water
- Cover
- Space



Monocultures increase pest pressure



One man's trash is another critter's treasure



IPM Implications – Sanitation

- Remove pest food sources



IPM Implications – Exclusion

- Exclude pests from food sources



IPM Implications – Exclusion

- Deer
 - 8-foot barrier fences
 - Individual plant protection
 - Electric fences



IPM Implications - Increase competition

- Grow healthy plants that can tolerate pest pressure



IPM Implications

- Use food as bait to capture pests.



Habitat

- Food
- **Water**
- Cover
- Space



Will C. Flickr

IPM Implications

- Too much or too little water damages roots
 - Is it pest damage or drought damage?
 - Yellow color attractive to insects



Water – Unintended sources



IPM Implications

- Look for standing water and dump it out.



Water – Poor Maintenance



IPM Implications

- Too much water



Fungus gnat habitat

Habitat

- Food
- Water
- Cover/Shelter
- Space



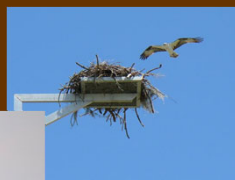
Shelter – Nesting Sites



Shelter – Supplemental Structures



naturalhistoryman, flickr



Audra, flickr



lpfearn, flickr

Shelter – Mulch

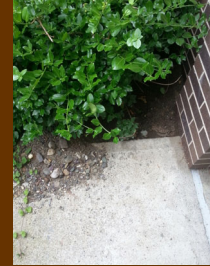


Shelter - Leaves

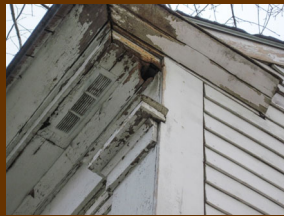


Penn State, flickr

Shelter - Vegetation near buildings



Shelter - Poor maintenance



IPM Implications – Remove shelter

- We can degrade pests' habitat.



IPM Implications – look for entryways

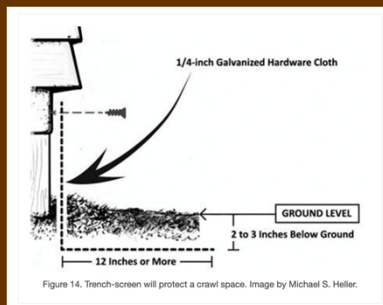


IPM Implications – Exclusion

- We can manage pests by excluding them from shelter.



IPM Implications – Exclusion



Habitat

- Food
- Water
- Cover/Shelter
- Space



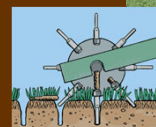
Space



Weeds are the result of poor turf, not the cause of poor turf.
- Randy Prostak, UMass Extension

IPM Implications - Cultivate

- Cultivating Benefits:
 - Remediate compacted soils
 - Aid in overseeding
 - Help manage thatch

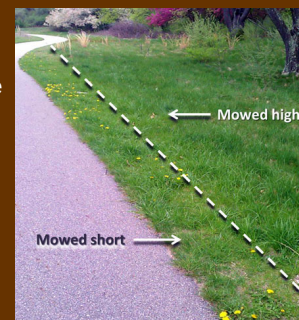


Additional Needs - Sunlight



Sunlight

- Raising mowing heights decreases the light available to weeds.



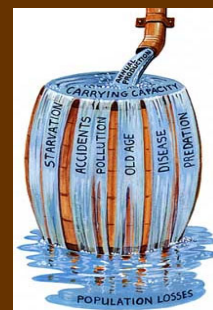
IPM Implications

- We can put cultural practices into place to benefit plants and discourage pests.



Ecology 101

- Each **Species** has a habitat (barrel)
- Each **Population** has a **Carrying Capacity** for a given area (water)
- Short term solution – mimic natural population reduction
- Long term solution – change available habitat



Michigan Department of Natural Resources

Mimicking accidents

- Most mechanical pest control methods fall under this category



Mimicking Accidents



Mimicking Accidents

IPM New York State Integrated Pest Management Program

Presents:
Managing Mosquito Breeding Sites

www.nysipm.cornell.edu/buildings

Mimicking Accidents



Mimicking Accidents



Top 3 Weeding Tips for Organic Gardens and Small Farms – Bryan Brown, Weed Specialist:
<https://www.youtube.com/watch?v=Ujk7kqAoHA>

Starvation

- Sanitation
- Buckthorn bags – stop sprouting of cut stumps

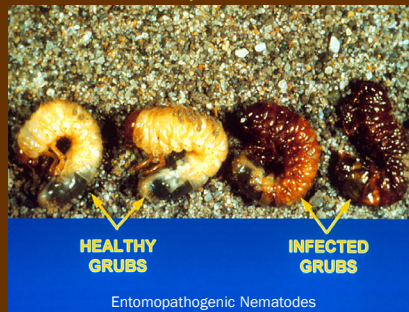


Marco Verch Professional Photographer, flickr

Starvation



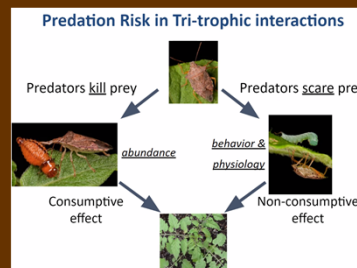
Introduce Disease/Parasites



Attract/Introduce Predators



Predators don't even need to kill!



Fear as a Biological Control? How Scaring Farm and Garden Pests Could Lessen Plant Damage, Jennifer Thaler and Nicholas Aflitto, NYSIPM Academic Seminar Series

Predators don't even need to kill!



Predators don't even need to be real!

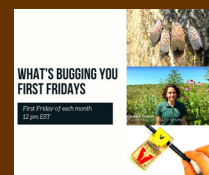


IPM Components

- Planning & Prevention
- Monitoring, thresholds
- Diversity of control options
- Pesticides can be a tool, but does not have to be
- Minimizes economic, health and environmental risks

More learning opportunities

- Annual NYS IPM Conference
 - Past Conferences
 - Protecting Pollinators
 - Climate and Weather
 - Invasive Species
 - Ticks and Mosquitoes
 - Spotted Lanternfly
 - School IPM
 - Coming Soon to a Screen in Your Home!
 - Vegetable Gardening IPM from the Ground Up
- NYSIPM Seminars
 - NYSIPM Academic Seminar Series



www.nysipm.cornell.edu

In Summary:

- The yard, garden, school, business, community is part of a larger whole.
- Each part is connected to every other part.
- Understanding the parts will lead to greater management choices and successes.
- Keep learning!
- Keep asking good questions!
- Be creative!

The real voyage of discovery consists not in seeking new lands, but in seeing with new eyes.

Marcel Proust



www.nysipm.cornell.edu



The Community IPM Team
New York State IPM Program
Cornell University

*Cornell Cooperative Extension provides equal program and employment opportunity