Structural Pest Management IPM

BPC Structural Program, April 11 2023

Hillary Peterson, Ph.D.

Maine Department of Agriculture, Conservation and Forestry

hillary.peterson@maine.gov

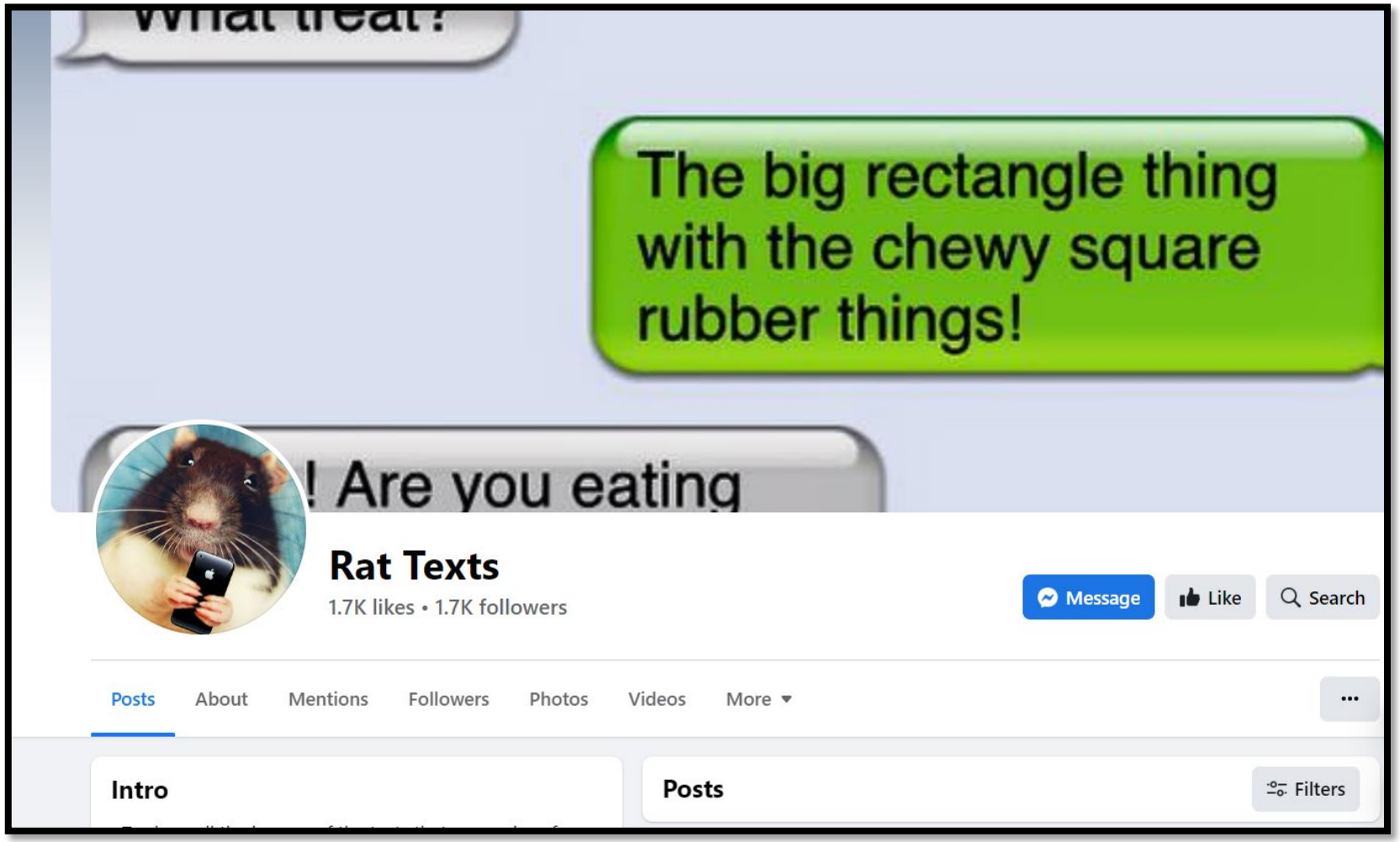
www.maine.gov/ipm

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Photo: Airwolfhound (Flickr; CC BY-SA 2.0)

Rodents: Historical, Ecological, and Human Significance…

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY



Global travelers with humans

Used in research for medicine and genetics

Beloved pets to many

Important members of many ecosystems

Pests of agriculture, structures, and disease vectors

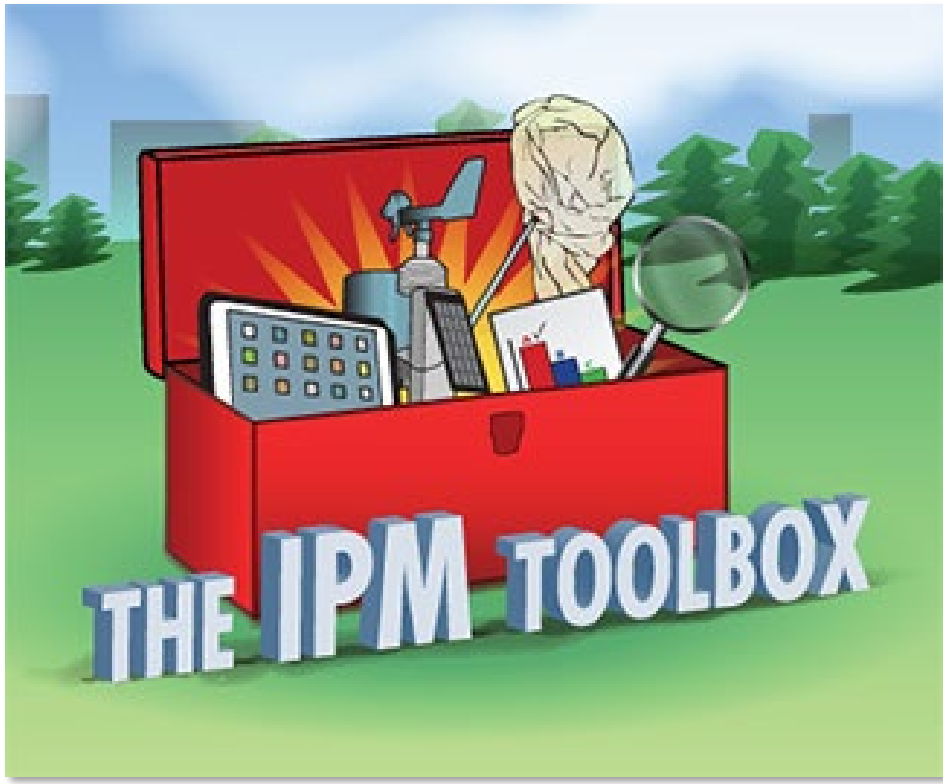
Photo: FB Group "Rat Texts"

Structural IPM Overview

- Common structural pests
- Overview of IPM concepts
- Examples of how structural pests are problematic
- Deep Dive: Rodent IPM

(I wish I had the time to deep dive them all!)

- How IPM can improve your customer relationships



Sources: Northeastern IPM Center

Species of Concern in and around Structures

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Bugs that Bite, Sting, or Spread Disease

Bedbugs

Bees, Hornets and Wasps

Cockroaches

Fleas

Mosquitoes

Ticks

Sources: All photo citations here

Species of Concern in and around Structures

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Common Destructive Bugs


Carpet Beetles


Carpenter Ants


Clothes Moths


Lesser Mealworm


Mealworm


Flour Beetles


Fruit Flies/Vinegar Flies


Fungus Gnats


Round-Headed Borer


Shore Flies


Grain Beetles


Indian Meal Moth


Larder Beetle


Powderpost Beetles

Sources: All photo citations here

Species of Concern in and around Structures

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Occasional Invader

Ants

Boxelder Bug

Carpet Beetles

Silverfish and Firebrats

Clover Mite

Cluster Flies

Earwig

Western Conifer Seed Bug

Millipede

Multicolored Asian Lady Beetle

Pseudoscorpion

Spiders

Sources: All photo citations here

Species of Concern in and around Structures

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Other Critters and Home Problems

Bats

House Mice

Indoor Mold

Raccoons

Rats

Skunks

Snakes

Squirrels

Woodpeckers

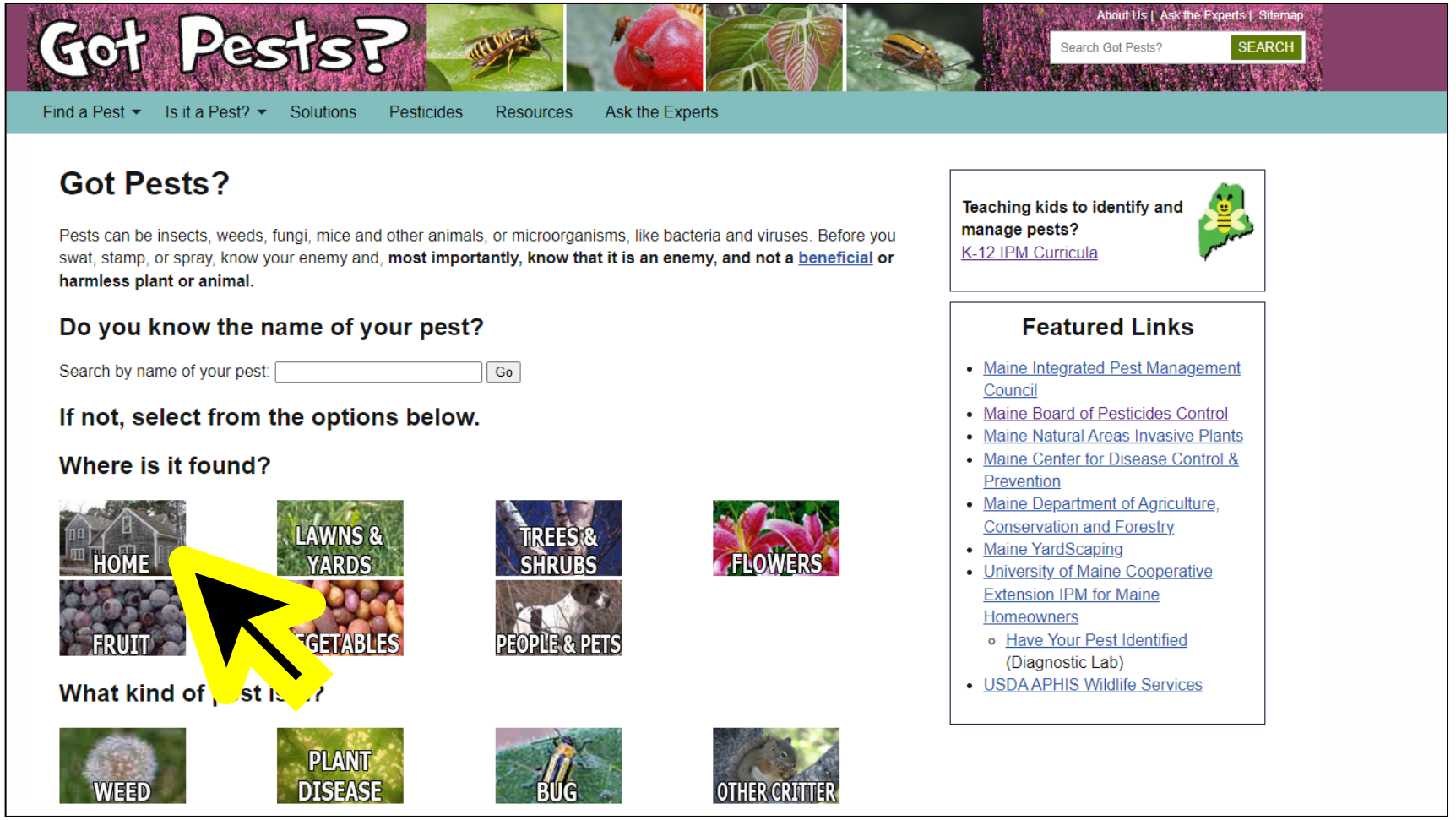
Sources: All photo citations here

Species of Concern in Structures

The GotPests website is a great resource for investigating IPM methods for pests.

Individual pages for many groups and species, with links to further reading with factsheets.

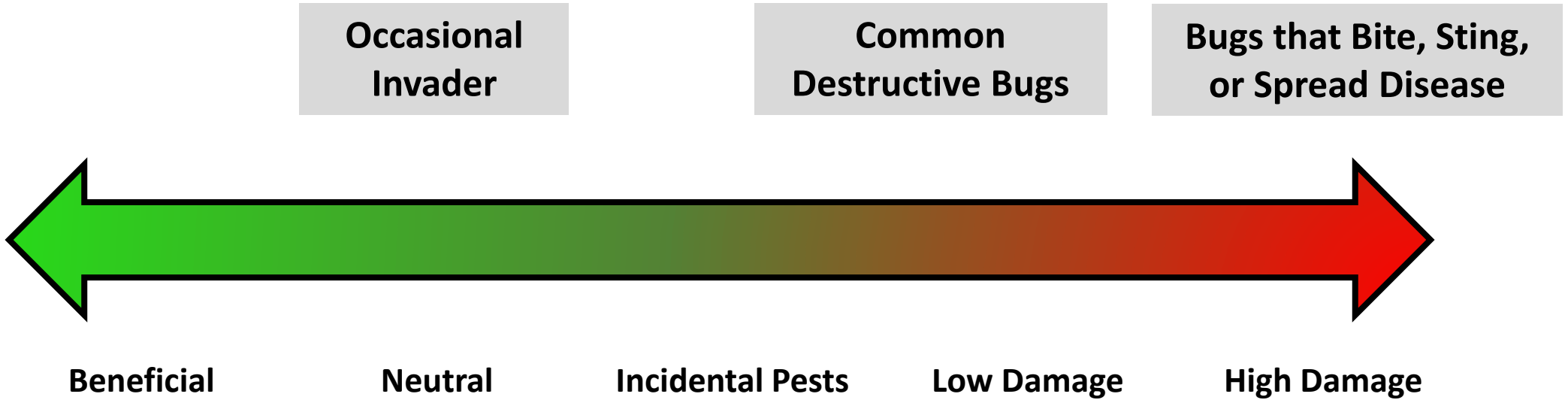
It is continuously updated with new materials as we come across them!



Sources: Gotpests.org

Why the categories?

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY



Factors:

Context, Perception, Personal Allowance, Understanding, Population Size, Health of Plants, Indoor vs. Outdoor etc.

A Yellowjacket...

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

A Yellowjacket: Nest hanging over the entrance of a school.

Beneficial | Neutral | Incidental Pests | Low Damage | High Damage

Factors:

Context, Perception, Personal Allowance, Understanding, Population Size, Health of Plants, Indoor vs. Outdoor etc.

Photo source: Entomology Today

A Yellowjacket...

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

A Yellowjacket: Nest hanging away from a home.

Beneficial | Neutral | Incidental Pests | Low Damage | High Damage

Factors:

Context, Perception, Personal Allowance, Understanding, Population Size, Health of Plants, Indoor vs. Outdoor etc.

Photo source: Entomology Today

A Yellowjacket…

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

A Yellowjacket: Nest hanging away from a home.
Family member who loves the outdoors has an allergy.

Beneficial **Neutral** **Incidental Pests** **Low Damage** **High Damage**

Factors:

Context, Perception, Personal Allowance, Understanding, Population Size, Health of Plants, Indoor vs. Outdoor etc.

Photo source: Entomology Today

A Yellowjacket…

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

A Yellowjacket: Nest hanging away from a home.
Homeowner has a flower and veggie garden.

Beneficial **Neutral** **Incidental Pests** **Low Damage** **High Damage**

Factors:

Context, Perception, Personal Allowance, Understanding, Population Size, Health of Plants, Indoor vs. Outdoor etc.

Photo source: Entomology Today

A Yellowjacket…

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

A Yellowjacket: Nest hanging away from a home. Homeowner has a flower and veggie garden.

This thought process is an important step in integrated pest management and one that should be taken with every choice to treat pests, especially when using pesticides.

BOARD OF PESTICIDES CONTROL • STATE OF MAINE • Think First… Spray Last!

Beneficial **Neutral** **Incidental Pests** **Low Damage** **High Damage**

Factors:

Context, Perception, Personal Allowance, Understanding, Population Size, Health of Plants, Indoor vs. Outdoor etc.

Photo source: Entomology Today

What is integrated pest management?

Identification & Action Thresholds

- Proper identification of pest
- Understanding the system where the pest exists

Prevention, Cultural & Mechanical Control

- Prevent and control through physical means
- Set your location up for success

Monitoring & Recordkeeping

- Monitor in a tracked and systematic way
- Make it useful for the future!

Action Thresholds

- What is the population level?
- What methods are needed at this level?

Biological and Pesticide Control

- Dynamic and flexible as methods change

IPM is the standard and many institutions are involved

What is integrated pest management?

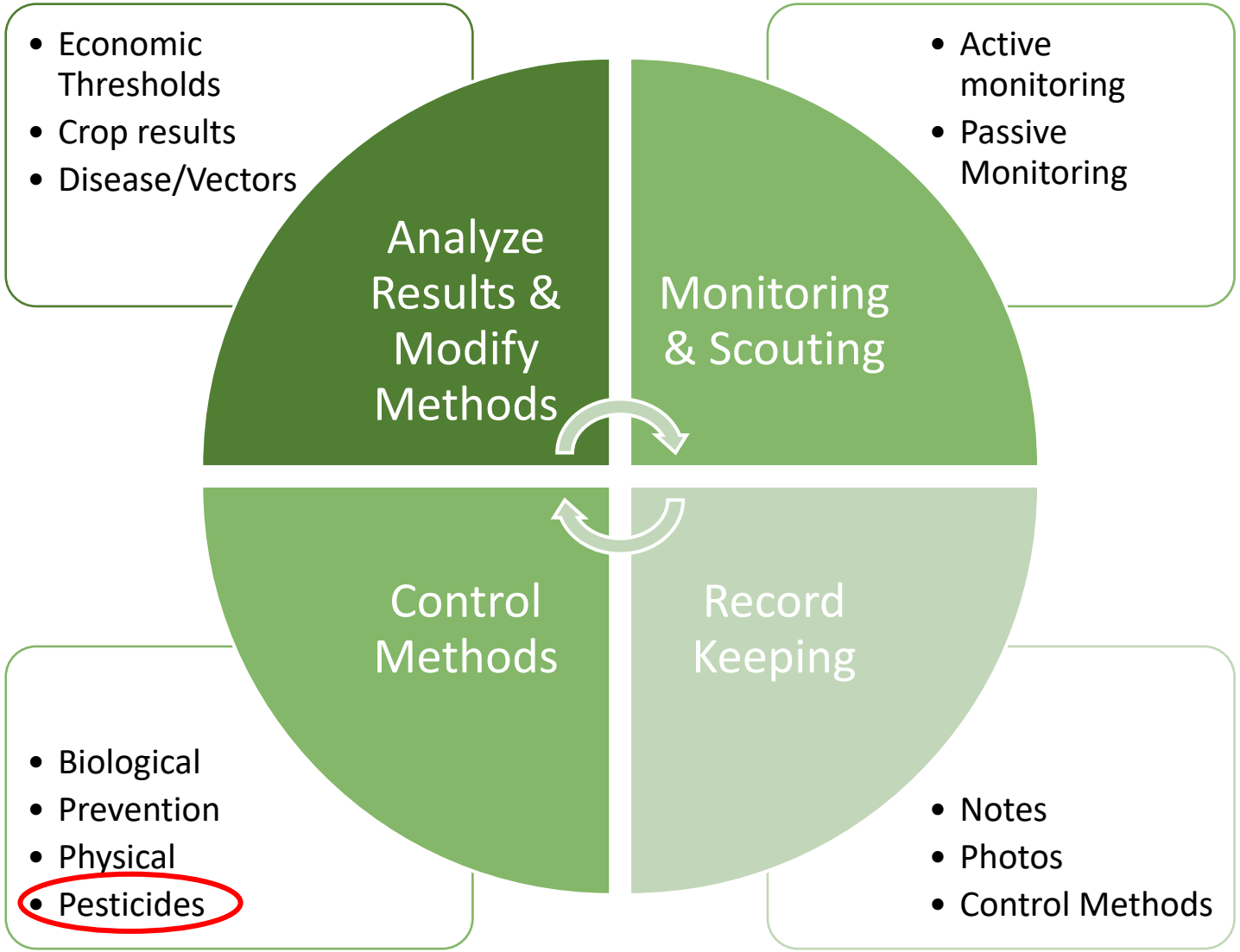
MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

IPM Concept Highlights

Mindset Framework!

The IPM Cycle

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY



IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

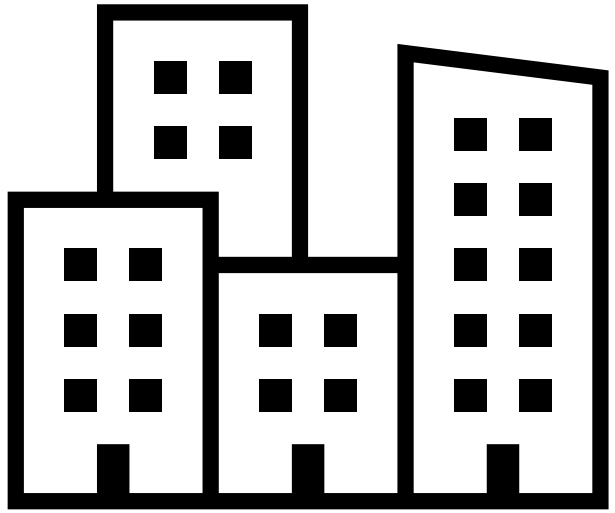
Should not be first or default solution!

Situations of Concern

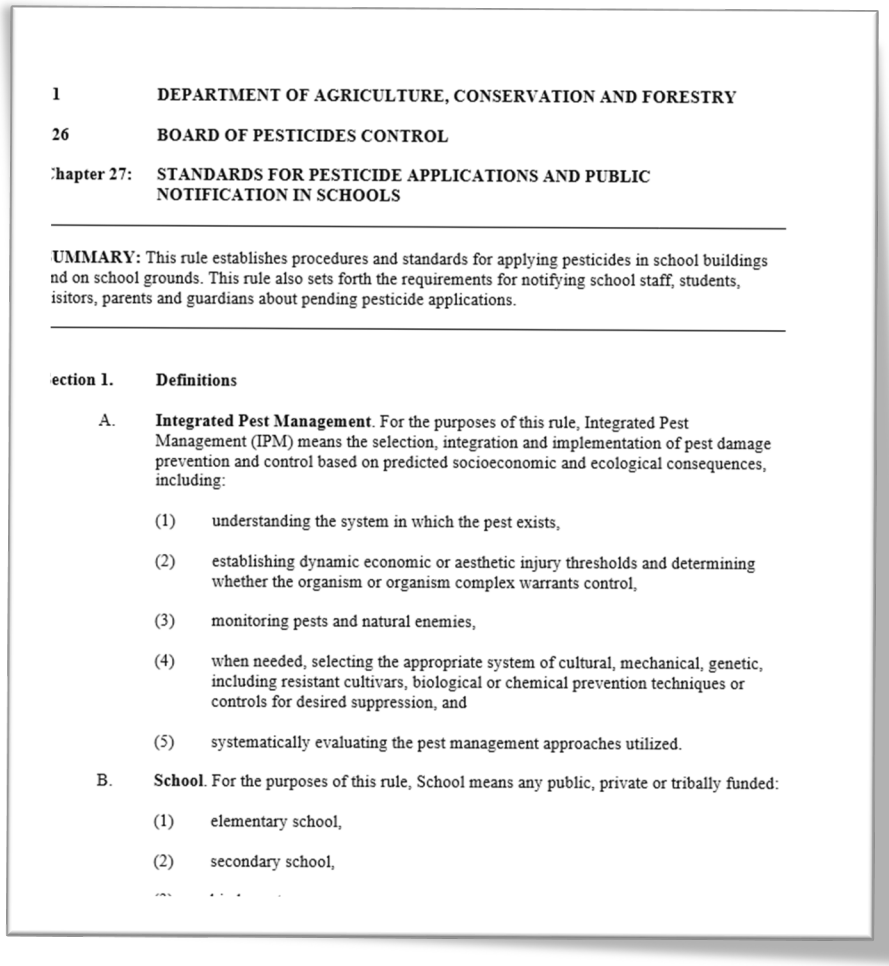
MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Each situation has unique challenges and oftentimes unique associated laws.

- Schools
- Restaurants
- Homes
- Municipalities & Ordinances
- Apartments and Shared Living Situations
- Hospitals
- Farm structures



Maine's School Pesticide Regulations



1 DEPARTMENT OF AGRICULTURE, CONSERVATION AND FORESTRY

26 BOARD OF PESTICIDES CONTROL

Chapter 27: STANDARDS FOR PESTICIDE APPLICATIONS AND PUBLIC NOTIFICATION IN SCHOOLS

UMMARY: This rule establishes procedures and standards for applying pesticides in school buildings nd on school grounds. This rule also sets forth the requirements for notifying school staff, students, isitors, parents and guardians about pending pesticide applications.

ection 1. Definitions

A. **Integrated Pest Management**. For the purposes of this rule, Integrated Pest Management (IPM) means the selection, integration and implementation of pest damage prevention and control based on predicted socioeconomic and ecological consequences, including:

(1) understanding the system in which the pest exists,

(2) establishing dynamic economic or aesthetic injury thresholds and determining whether the organism or organism complex warrants control,

(3) monitoring pests and natural enemies,

(4) when needed, selecting the appropriate system of cultural, mechanical, genetic, including resistant cultivars, biological or chemical prevention techniques or controls for desired suppression, and

(5) systematically evaluating the pest management approaches utilized.

B. **School**. For the purposes of this rule, School means any public, private or tribally funded:

(1) elementary school,

(2) secondary school,

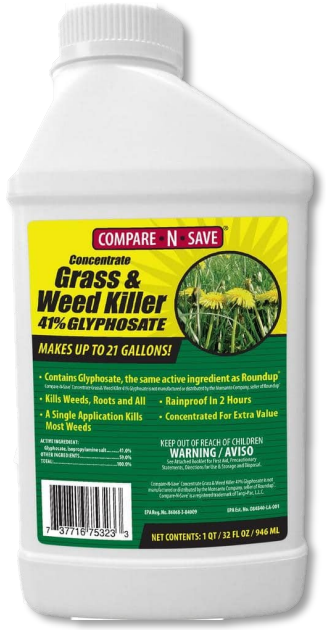
Chapter 27: STANDARDS FOR PESTICIDE APPLICATIONS AND PUBLIC NOTIFICATION IN SCHOOLS (link)

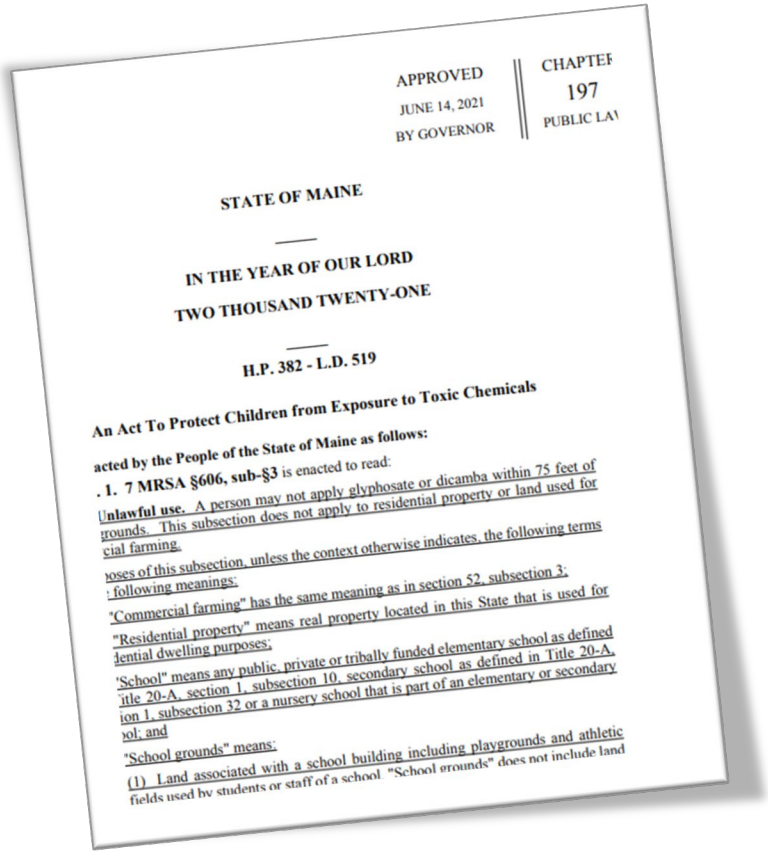
SUMMARY: This rule establishes procedures and standards for applying pesticides in school buildings and on school grounds. This rule also sets forth the requirements for notifying school staff, students, visitors, parents and guardians about pending pesticide applications.

GLYPOSATE AND DICAMBA PROHIBITED

- Beginning **October 18, 2021**, use of herbicides containing either **glyphosate or dicamba are prohibited on school grounds**. Use of glyphosate or dicamba will also be prohibited on property **within 75 feet** of school grounds.

- Two types of property are exempt from these prohibitions—farms and private residential property.





APPROVED
JUNE 14, 2021
BY GOVERNOR

CHAPTER
197
PUBLIC LAW

STATE OF MAINE

IN THE YEAR OF OUR LORD
TWO THOUSAND TWENTY-ONE

H.P. 382 - L.D. 519

An Act To Protect Children from Exposure to Toxic Chemicals

acted by the People of the State of Maine as follows:

. 1. 7 MRSA §606, sub-§3 is enacted to read:

Unlawful use. A person may not apply glyphosate or dicamba within 75 feet of rounds. This subsection does not apply to residential property or land used for cial farming.

oses of this subsection, unless the context otherwise indicates, the following terms following meanings:

"Commercial farming" has the same meaning as in section 52, subsection 3;

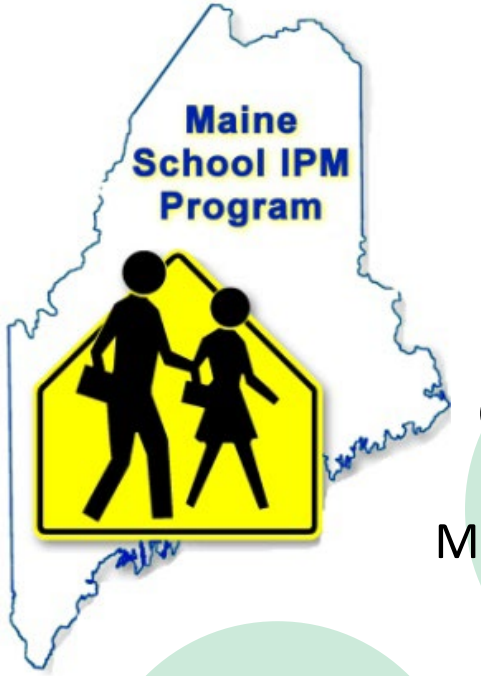
"Residential property" means real property located in this State that is used for dential dwelling purposes;

"School" means any public, private or tribally funded elementary school as defined itle 20-A, section 1, subsection 10, secondary school as defined in Title 20-A, ion 1, subsection 32 or a nursery school that is part of an elementary or secondary ol; and

"School grounds" means:

(1) Land associated with a school building including playgrounds and athletic fields used by students or staff of a school. "School grounds" does not include land

Link to [LD 519: An Act To Protect Children from Exposure to Toxic Chemicals]



MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Maintenance Staff:
Pest exclusion and monitoring

Contracted Pest Service:
Monitoring, control, communication

Custodians:
Sanitation, monitoring pests, reporting

Business Manager:
Contracts, budgeting

IPM COORDINATOR:
Captain!

Students, Nurse, and Teachers:
Education, sanitation, monitoring

Food service director and staff:
Pest prevention and monitoring

Office Staff:
Communication, records, scheduling

The most common school kitchen pests...

The most common school kitchen pests...

Maine School IPM Program

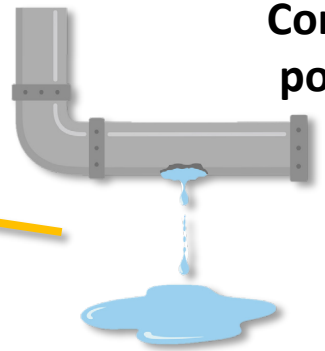
maine MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Cockroaches and mice use cardboard for hiding and nesting material

Pest friendly conditions:

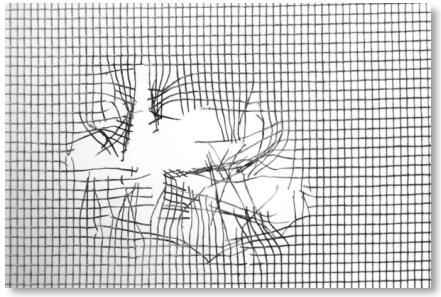
Dirty floors around and behind equipment and furniture

Condensation, leaking pipes, poor drainage and standing water



Gaps under exterior doors

Dirty floor drains

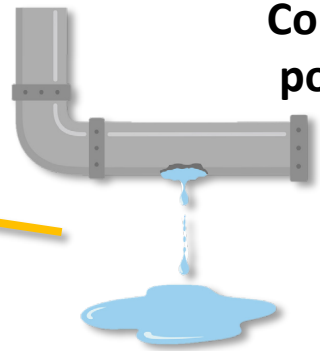


Rips in window screens

Pest friendly conditions: go beyond schools!

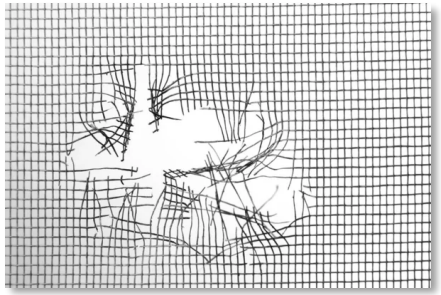
Dirty floors around and behind equipment and furniture

Condensation, leaking pipes, poor drainage and standing water



Gaps under exterior doors

Dirty floor drains



Rips in window screens

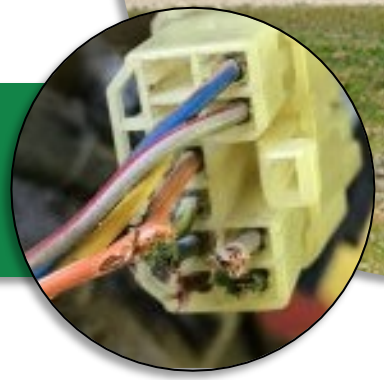
Rodent Problems: Poultry Facilities and Barns

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Can attract foxes, raccoons, and other chicken predators

Ideal rodent habitat – harborage, food, water

Gnaw on structural, mechanical, and electrical utilities



Consumes AND contaminates feed

Prefers feed to baits

Weakens concrete slabs and walkways

Photos: Source: Purdue Factsheet; Outside Farm; Inside Farm; Mouse in Feed; Rats with Eggs; Fox

Rodent Problems: Poultry Facilities and Barns

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Can attract foxes, raccoons, and other chicken predators

Gnaw on structural, mechanical, and electrical utilities

I gave a talk on that!

Ideal rodent habitat – harborage, food, water

Consumes AND contaminates feed

Prefers feed to baits

walkways

Photos: Source: Purdue Factsheet; Outside Farm; Inside Farm; Mouse in Feed; Rats with Eggs; Fox

An IPM Deep Dive: Mice and Rats

Image Source & Art Credit: ByAnyOtherName on Drawception

Need tools beyond rodenticides

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

VANCOUVER ISLAND | News

B.C.
minis

CT VIEWPOINTS

It's time for Connecticut to
ban

MASSACHUSETTS

Residents react to recent de
gre

NEWS

Rat poison is killing sn

VANCOUVER ISLAND | News

'Impossible to control': Industry says rodenticides needed to manage pest infestations in B.C. amid calls for poison ban

Concepts

tification

Monitoring & Record Keeping

Action Thresholds

Biological & Chemical Control

This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to use this product in the production of hemp. Any products without an EPA registration number have not been reviewed or registered by the EPA. The label must be strictly followed.

Identification: Sources of Evidence in Homes

Features of the organism

Droppings, Tunnels, Gnawings and Trails

Damage to Walls, Wiring, Furniture

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Photos: British Columbia Gov

Identification: Sources of Evidence at Farms

Features of the organism

Droppings, Tunnels, Gnawings and Trails

Damage, Sick Animals, Lost Yield

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Photos: British Columbia Gov

Identification: Sources of Evidence at Schools

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Features of the organism

Droppings, Tunnels, Gnawings and Trails

Damage, Foodborne Illness, Asthma Absences

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Photos: British Columbia Gov

Identification: Rats and Mice in Maine

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Norway Rat / Brown Rat *(Rattus novegicus)*

Norway Rat
Size: 30-45 cm (12-18 inches) from nose to end of tail.

DROPPINGS:
Long, Rounded Ends
Avg. Length: 15-20 mm (3/4 inch)

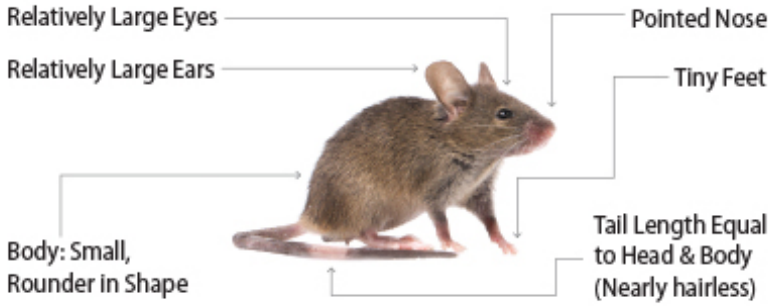
Types of Damage:
- Large gnaw marks (1/8th in.)

Location:
- Tunnels in soil disguised, 3-inch diameter

Mice (*Mus* spp.)

House Mouse
Size: 15-17 cm (6-7 inches) from nose to end of tail.

DROPPINGS:
Small with Pointed Ends
Avg. Length: 4-7 mm (1/4 inch)



Types of Damage:
- Small gnaw marks
- Insulation, wiring, baseboards

Location:
- Squeeze easily behind walls

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Photos: British Columbia Gov

Identification:

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

House Mouse *(Mus musculus)*

5–7-inch length

Large ears

Small black eyes

Tail almost naked, scaly

Overall gray coat

Types of Damage:
- Small gnaw marks

Location:
- Buildings, homes, barns

Deer Mouse *(Peromyscus maniculatus)*

7–9-inch length

Large black eyes

White underside

Tail with short hair

Types of Damage:
- Carries hantavirus

Location:
- Ground-floor walls of homes, barns

White-footed Mouse *(Peromyscus leucopus)*

7–9-inch length

Large black eyes

White underside

Tail with short hair

Types of Damage:
- Carries hantavirus

Location:
- Ground-floor walls of homes, barns

IPM Concepts

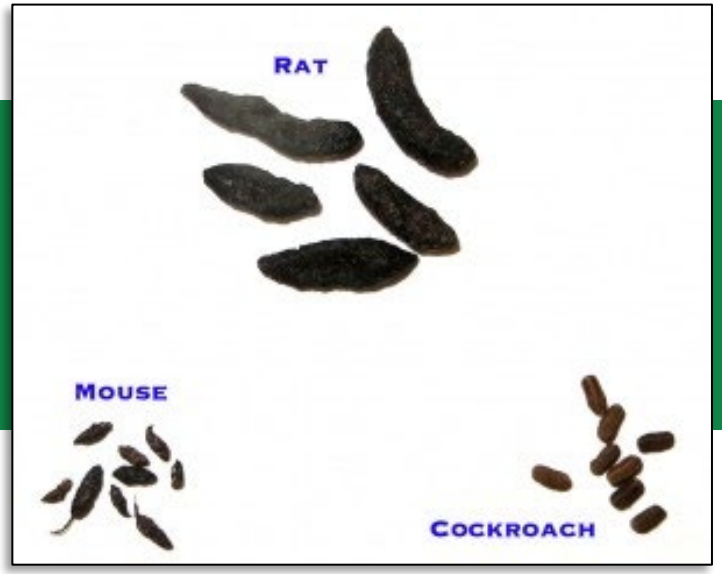
- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Photos: ***House Mouse; Deer Mouse***
ID Sources: ***UC IPM; CDC Pictorial Key***

Identification: Poop – you might be surprised!

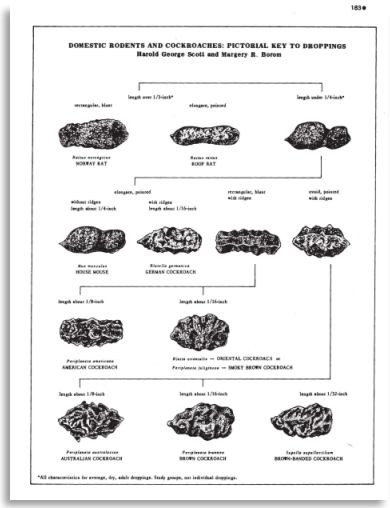
MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

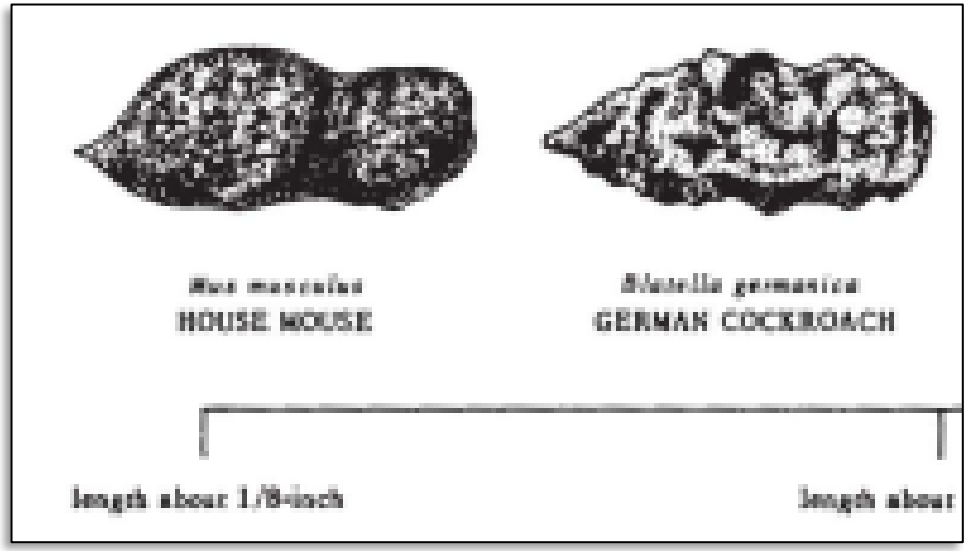
It is possible to confuse mouse and cockroach droppings!



Cockroach droppings have ridges.

There's a key for that!





IPM Concepts

- Identification
- Prevention & Physical Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Sources: Think IPM Blog (Cornell); CDC Pictorial Key

INTERNET SEARCHES – a tool you need to know how to use

- The first few links are likely to be ads
- Careful trusting information written by those will profit from it
- Just because a website claims to be "natural" or "earth friendly", information needs to be backed by research (references and citations)

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

INTERNET SEARCHES – a tool you need to know how to use

- Generally, better resources can be found under **.edu** and **.gov**
- Writing the question in a different way can help (instead of "kill rats", search for "rat prevention" or "rodent IPM")

Prevention & Cultural Control: Rodent Behavior

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

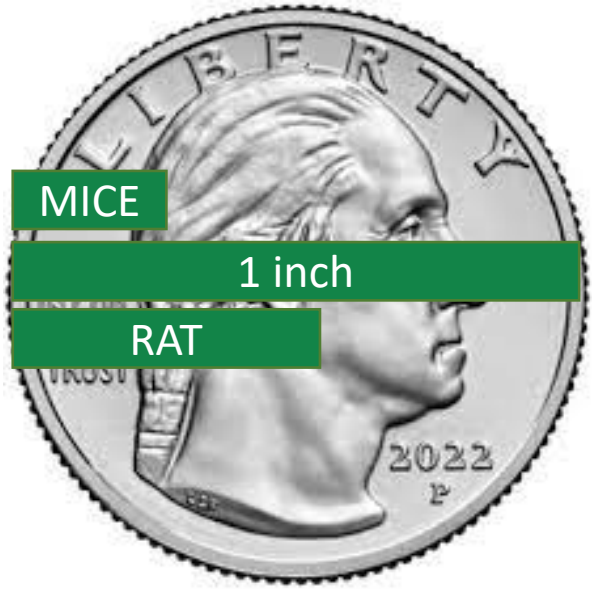
- Most rodents have a “home range” – 80% time spent in one location

- Rats are ***powerhouses***
  - Intelligent and wary
  - Can tread water for three days straight
  - Can jump vertically 3 feet and survive a 50-foot drop

- Rodents will go through if they cannot go around
  - Can gnaw lead sheathing, cinder-block, aluminum siding, glass

Rats are intelligent

Rodents can *squeeze:*



ELIMINATE entry points

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Sources: Photos: Dreamstime Stock Imagry

Prevention & Cultural Control: Sanitation

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Outside of Homes and Structures Remove:

- **Nesting materials** – clutter inside and outside
- **Water sources** – open garbage, spilled bird seed, leaky faucets, bird baths
- **Food sources** – sealed jars, tins, heavy plastic
- **Travel pathways** – trim trees and vegetation 3ft from walls/roofs

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Photos:

Prevention & Cultural Control: Rodent-Proofing

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Human Dwellings (Where We Predominately Spend Time)

- Seal gaps of 1⁄4-inch or more
  - Siliconized acrylic latex
  - Polyurethane sealant products
  - Need to stretch as gaps and cracks in buildings expand and contract due to temperature changes and other factors
- Use door sweeps to fill light “leaks”
- Outside: eliminate hiding places and food sources

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

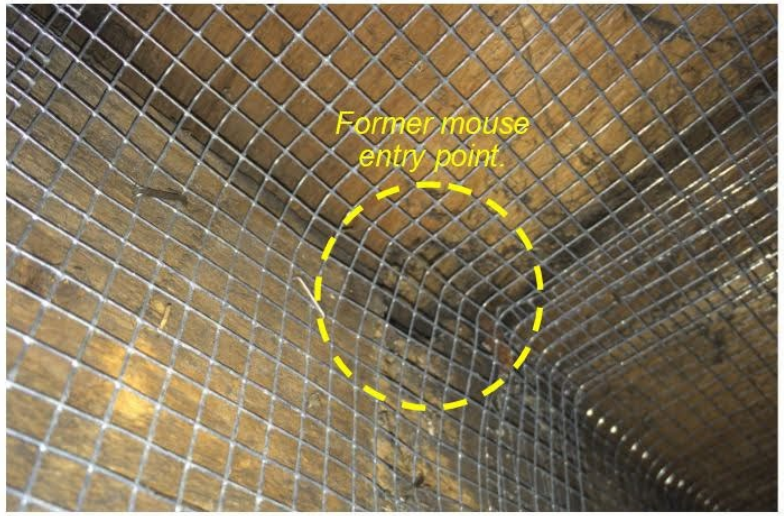
Source: Stop Pests in Housing

Prevention & Cultural Control: Rodent-Proofing

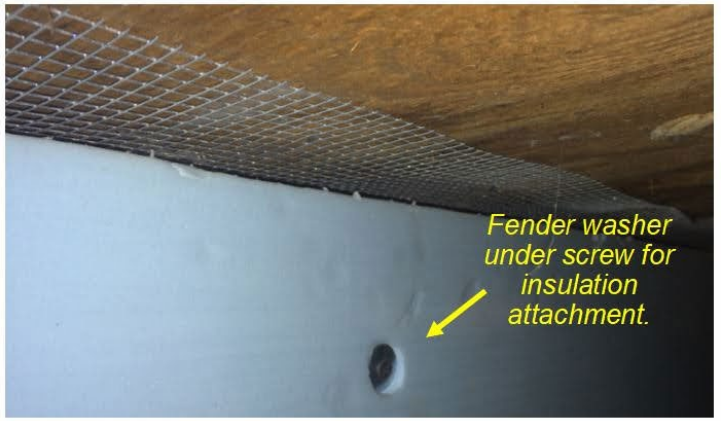
MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Animal Dwellings (Farm Buildings, etc.)

- In a barn, **ALL openings** must be closed tightly
- Check pipes, exhaust fans, and drains
- Materials for rodent-proofing: Concrete, Galvanized Sheet Metal, Brick, Hardware Cloth
- Outside: eliminate hiding places and food sources



Hardware cloth between the joist and the floor.



Finished installation, underfloor without finish surface.

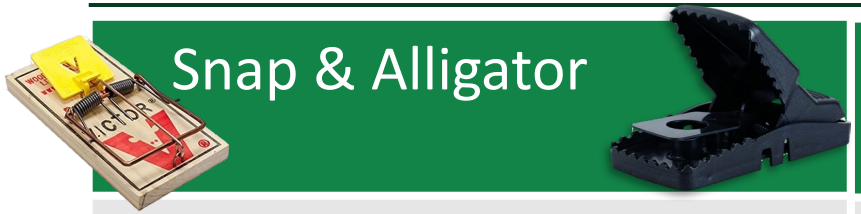
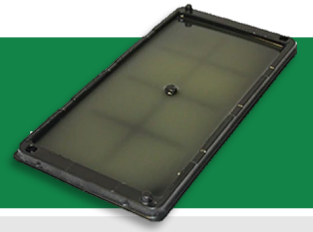
IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Photos: Chris Callahan, UVM Extension
Source: OSU Extension; Photos:

Prevention & Cultural Control: Trap-Types

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Snap & Alligator 	Multiple-Capture 	Glue Boards 
Pros: Simple, inexpensive, effective	**Pros:** Catch several rodents, do not require bait	**Pros:** No snapping mechanism, inexpensive
Cons: Ineffective alone in a large infestation; gruesome	**Cons:** More expensive, live rodents to dispose of, monitor frequently	**Cons:** Inhumane, off target capture, lose effectiveness if dirty
Styles: • Wooden snap trap • Plastic snap trap • Plastic enclosed snap trap • Plastic alligator trap	**Styles:** • Curiosity traps • Winding or trap door • Electronic instant kill	**Styles** • Different sizes • Baited or unbaited • Covered or open

Sources: Purdue Poultry Factsheet, Photos: Company Supply Photos

Prevention & Cultural Control: Tips for Effective Trapping

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

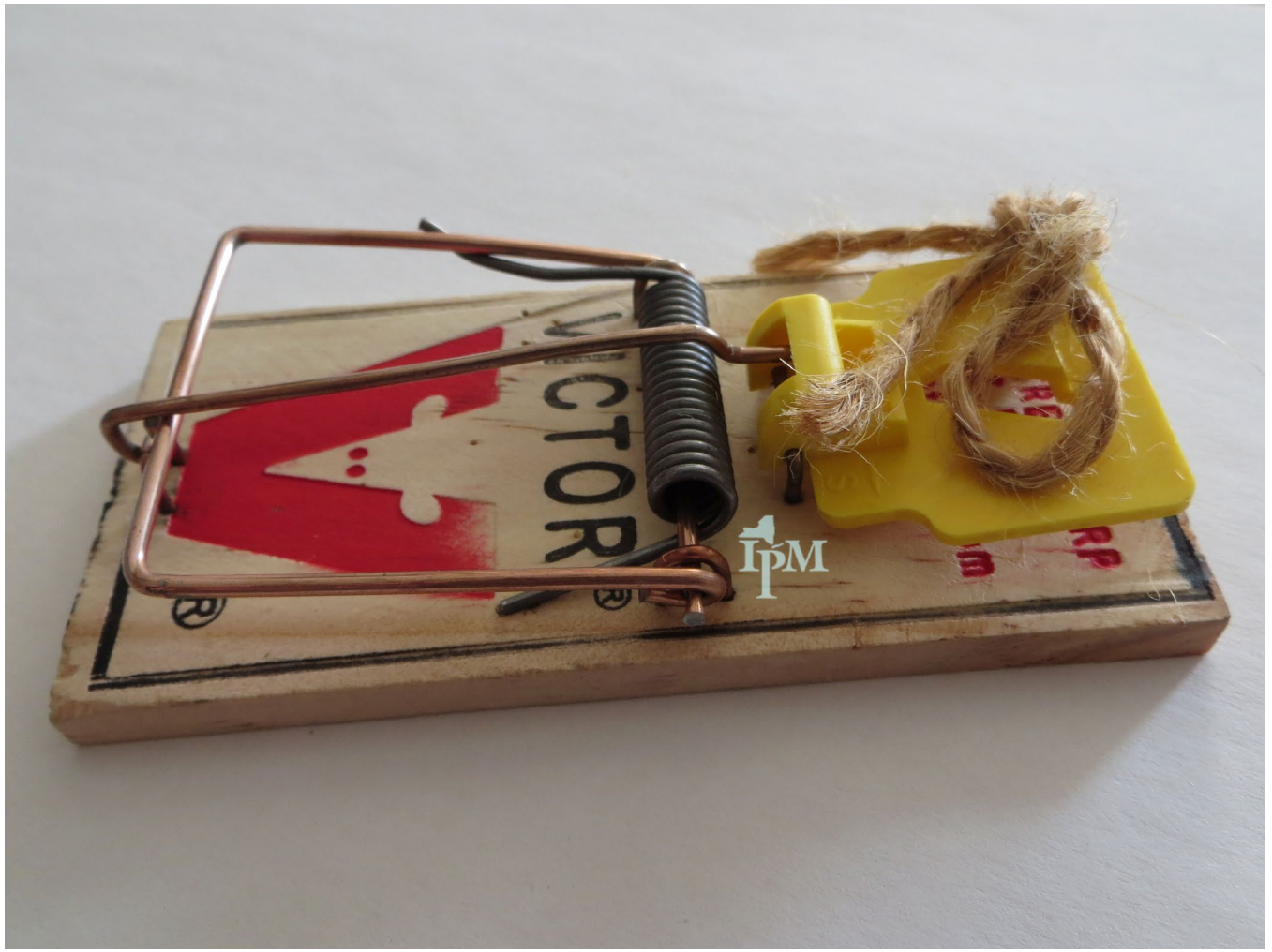
Set traps:

- Close to walls
- Behind objects
- Dark corners
- Warm spots (near motor, etc.)

Bait traps with:

- Nesting materials (secured with floss)
- The food they are eating
- DO NOT over bait!

Excellent video by Dr. Matt Frye



Sources: Purdue Poultry Factsheet, Photos: Cornell Blog

Prevention & Cultural Control: Tips for Effective Trapping

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

For rats:

- Leave traps baited (“pre-bait”) but unset until bait taken at least once
- Space 10-15 feet apart
- SMART rats may need traps hidden (cover with sawdust, pet rodent bedding, etc.)

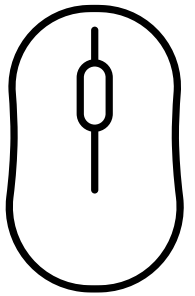
For mice:

- Space snap traps 6-8ft apart

Sources: Purdue Poultry Factsheet, Photos: Company Supply Photos

Prevention & Cultural Control: Cleaning Up

Further details here!

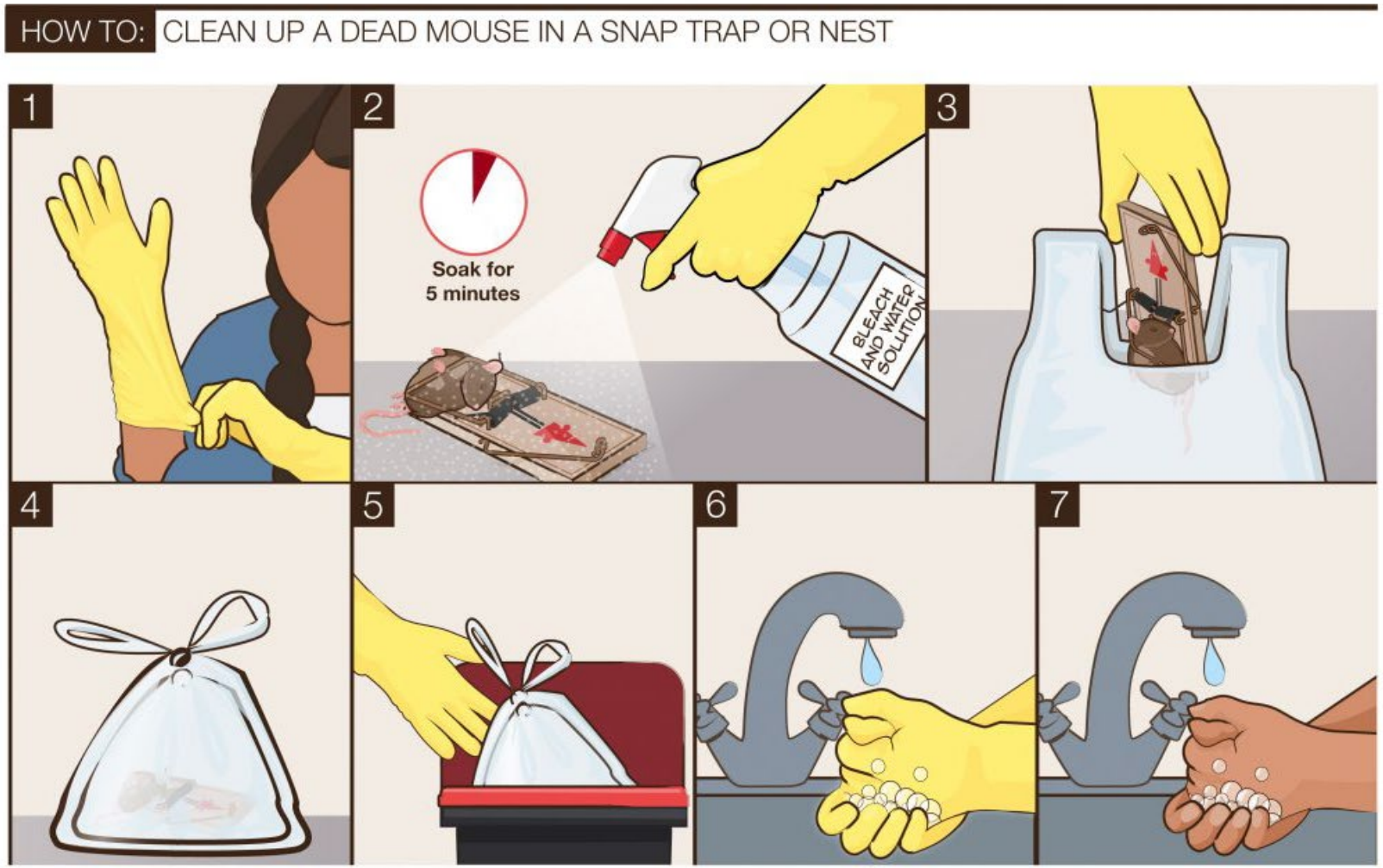


This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to use this product. Any products without an EPA registration number have not been reviewed or registered by the EPA. The label must be strictly followed.

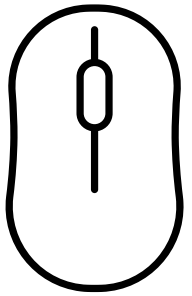
Sources: Purdue Poultry Factsheet, Photos: Company Supply Photos

Prevention & Cultural Control: Cleaning Up

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY



[Further details here!]



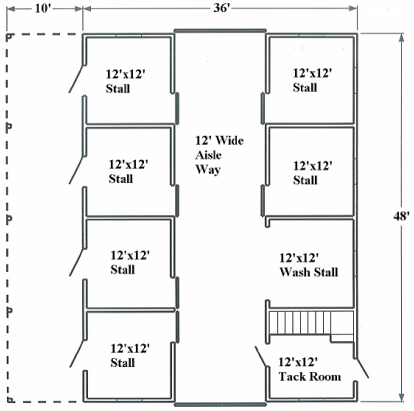
This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to use this product. Any products without an EPA registration number have not been reviewed or registered by the EPA. The label must be strictly followed.

Sources: Purdue Poultry Factsheet, Photos: Company Supply Photos

Monitoring & Record Keeping

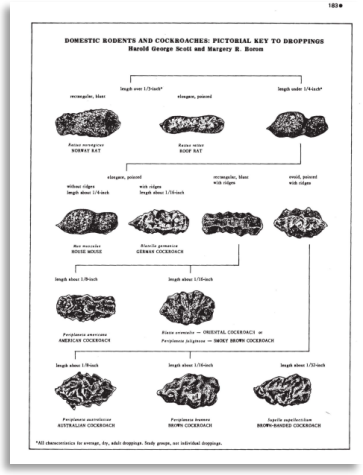
Scouting and Monitoring Tools

Logbook or System



Map / Sketched Floor Plan

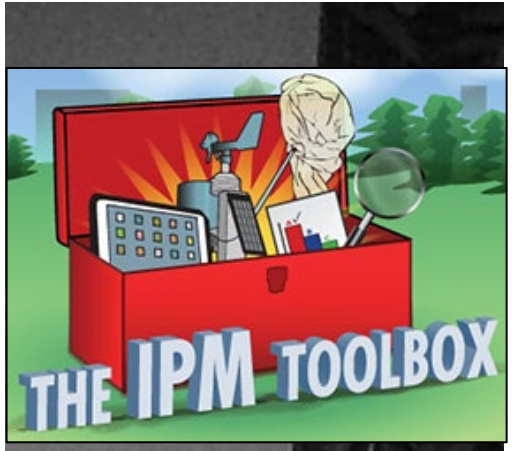
Flashlight



Identification Guides for Rodents & Evidence

Traps & Attractive Bait (Food, Nesting Materials)

Smartphone, Camera, Trail Cam!!!



Get creative with what you have!

maine DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Photos: CDC ID Guide.

Monitoring & Record Keeping

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Passive Monitoring: Mouse Trap Map

Systematic Sampling = Useful Results

Monitoring and Recordkeeping are EXTREMELY important

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Photos:

Monitoring & Record Keeping

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Active/Visual/Scouting Monitoring

Systematic Sampling = Useful Results

- Inspect for:
  - Droppings
  - Tracks
  - Burrows
  - Pathways
  - Fresh gnawing's
  - Dead rodents

- Indoors – active just after dusk and shortly before dawn. Daytime sightings mean an established infestation
- Look along walls and stationary objects as rodents prefer to move along them

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Sources: Purdue Poultry Factsheet; Photos: NYS IPM

Monitoring & Record Keeping

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Set up weekly and repeatable systems:
Creating your logbook is a great place to start!

Date	Time	Initials	Location	Observation Type	Description	*Many options…*

- Visual scouting – a big box to write in evidence *or* many columns with pest species
- Passive monitoring – traps with unique identifiers, and columns with rodent species
- Control methods – keep track of maintenance, rodenticide use, dead mice collected

IPM Concepts


Identification

Prevention & Cultural Control



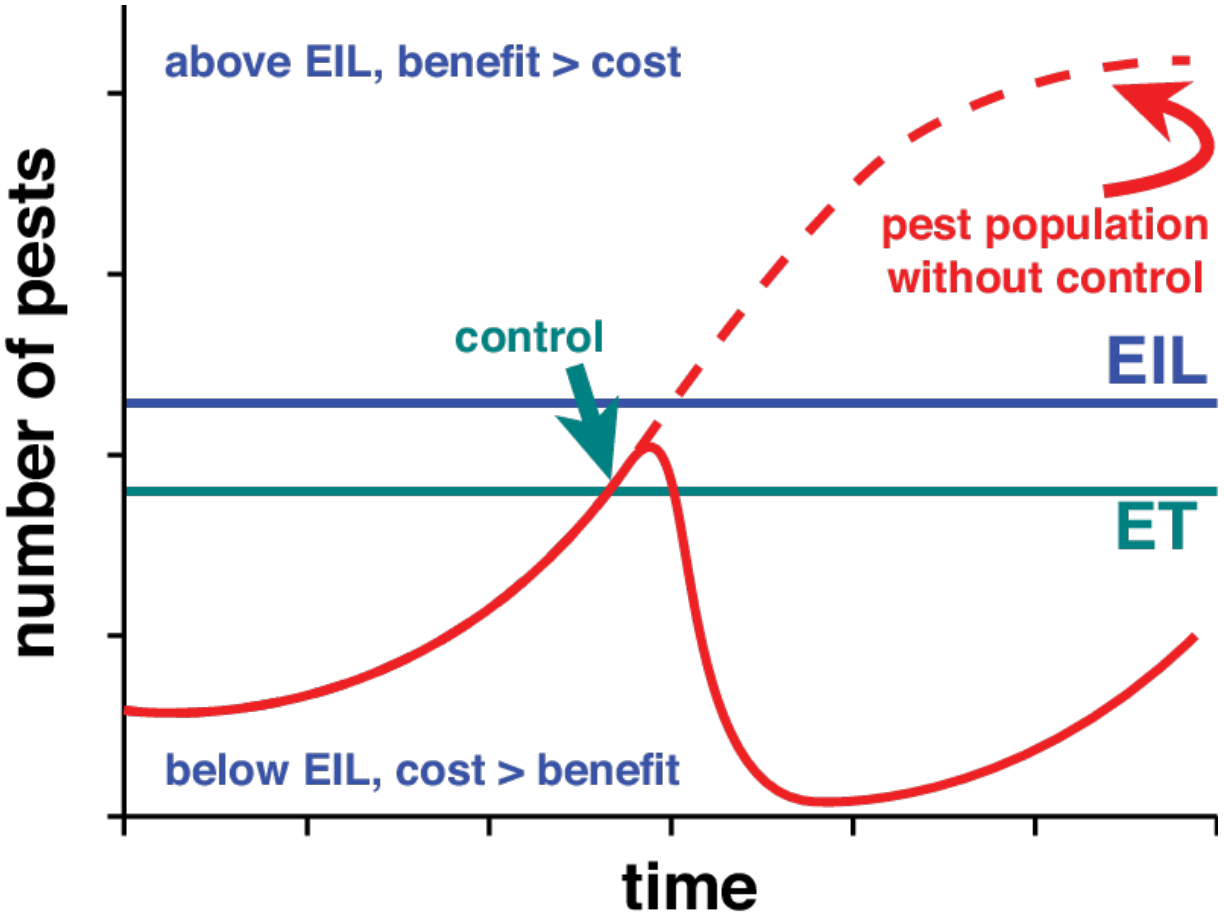
Monitoring & Record Keeping

Action Thresholds



Biological & Chemical Control

Action Thresholds



Economic Injury Level
Crop loss is more expensive than controlling the pest

Economic Threshold
Pest abundance or damage level that will exceed EIL if not treated

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Photos:

Action Thresholds: Rodent Example

- In a barn, a **minor** problem can be:
  - Possibly solved with traps
  - If bait is needed, only placed into rodent burrows

- A **major** problem could mean:
  - More baits placed strategically through a facility

IPM Concepts

Identification

Prevention & Cultural Control

Monitoring & Record Keeping

Action Thresholds

Biological & Chemical Control

Biological & Chemical Control: Rodenticide 101

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

First-Generation Anticoagulants	Second-Generation Anticoagulants	Non-anticoagulants
Pros: No bait shyness	**Pros:** Kills in single feeding; no bait shyness	**Pros:** Some kill in single dose, effective for resistant rodents
Cons: Kills in multiple feedings, resistance has developed	**Cons:** Greater risk of killing prey	**Cons:** Still a risk of killing prey
Mode of Action: Stops blood clotting	**Mode of Action:** Stops blood clotting	**Mode of Action:** Various
Used For: Controlling serious outbreak	**Used For:** Controlling serious outbreak	**Used For:** Resistant rodents

This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to use this product. Any products without an EPA registration number have not been reviewed or registered by the EPA. The label must be strictly followed.

Photos: Bait Company Websites

Biological & Chemical Control: Rodenticide Formulations

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Pellets	Wax Blocks	Feed	Packets
			
Pros: Less expensive	**Pros:** Can get damp, convenient	**Pros:** May outcompete other food sources	**Pros:** Convenient
Cons: Loose pellets easy for children and pets to find	**Cons:** Wax may be less palatable	**Cons:** Spoil quickly	**Cons:** More expensive
Used For: • Many bait placements • Container baiting methods	**Used For:** • Direct baiting of burrows and walls • Damp locations	**Used For:** • Places with highly-palatable competing food sources	**Used For:** • Direct baiting of burrows and walls

This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to use this product. Any products without an EPA registration number have not been reviewed or registered by the EPA. The label must be strictly followed.

Sources: Purdue Poultry Factsheet, Photos:

Biological & Chemical Control: Bait Containers

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

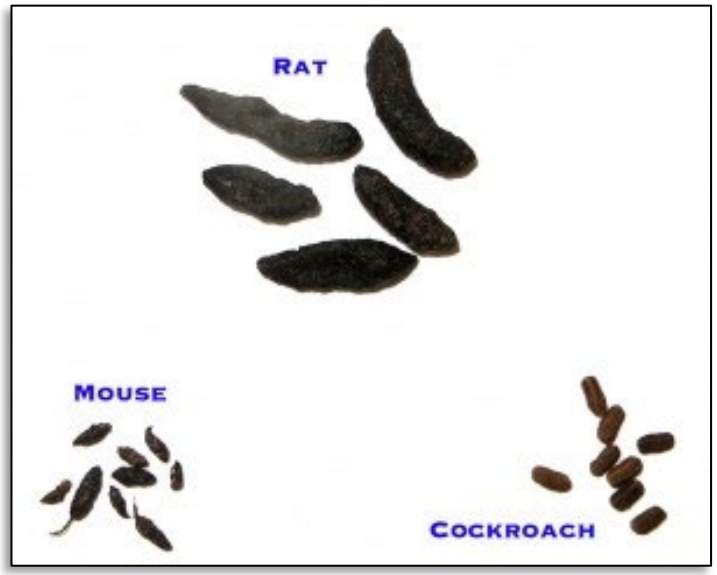
Tamper-proof plastic	Tamper-proof metal	Cardboard	Plastic & PVC Homemade
			
Pros: Durable, locking	**Pros:** Durable	**Pros:** Inexpensive	**Pros:** Inexpensive
Cons: Expensive	**Cons:** Expensive	**Cons:** Not durable, NOT SECURE	**Cons:** Exact uses, NOT SECURE
Used For: • Indoor/outdoor	**Used For:** • Indoor/outdoor	**Used For:** • Indoor	**Used For:** • Indoor

This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to use this product. Any products without an EPA registration number have not been reviewed or registered by the EPA. The label must be strictly followed.

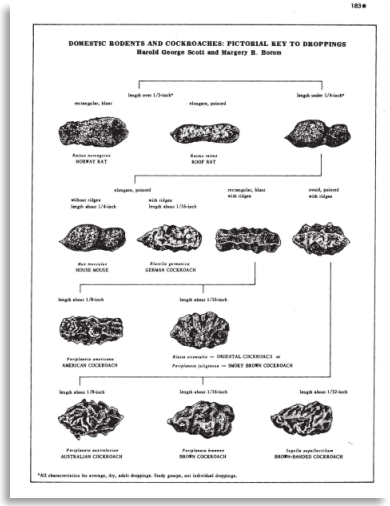
Sources: Purdue Poultry Factsheet, Photos: Company Product Pages

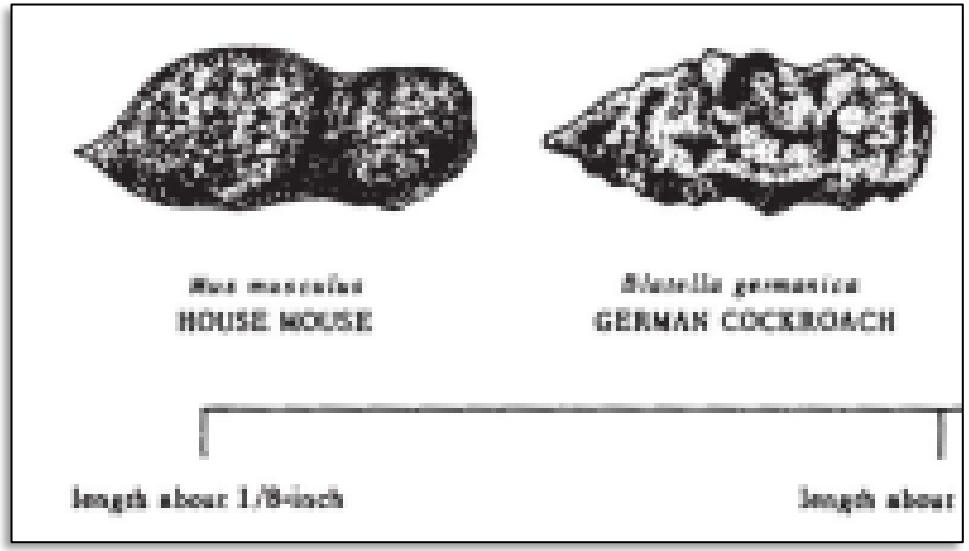
Identification: Poop – look in the bait station

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY



There's a key for that!





IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Sources: Think IPM Blog (Cornell); CDC Pictorial Key

Rodenticide Acute Toxicity

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Table 1. ACUTE TOXICITY CLASSIFICATION - RODENTICIDES

	Oral	Inhalation	Dermal	Primary Eye Irritation	Primary Skin Irritation
Warfarin[3,6]	Moderate - High toxicity	Not significant	Not significant	No data	No data
Chlorphacinone[4]	High toxicity	High toxicity	High toxicity	Non-irritating	Non-irritating
Diphacinone[4]	High toxicity	High toxicity	High toxicity	Moderate irritation	Slight irritation
Bromadiolone[4]	High toxicity	High toxicity	High toxicity	Low irritation	Minimally irritating
Difethialone[3]	High toxicity	High toxicity	High toxicity	Mild irritant	Non-irritating
Brodifacoum[4]	High toxicity	High toxicity	High toxicity	Minor irritation	Mild irritant
Bromethalin[4]	High toxicity	High toxicity	Moderate toxicity	Slight irritation	Non-irritating
Cholecalciferol[3]	High toxicity	Very low toxicity	Low toxicity	No data	No data
Zinc phosphide[5]	High toxicity	High toxicity	Low toxicity	Slight irritation	Non-irritating
Strychnine[7]	High toxicity	High toxicity	Low toxicity	Highly irritating	Non-irritating

Classification categories were modeled after the U.S. Environmental Protection Agency, Office of Pesticide Programs, Label Review Manual, Chapter 7: Precautionary Labeling. http://www.epa.gov/oppfead1/labeling/lrm/chap-07.pdf

This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to use this product. Any products without an EPA registration number have not been reviewed or registered by the EPA. The label must be strictly followed.

Table: NPIC Rodenticde Factsheet

Rodenticide Acute Toxicity

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Table 2. Summary of common rodenticides			
Rodenticide	**Type**	**Chemical class**	**Days of feeding needed**
Warfarin	Anticoagulant	Hydroxycoumarin	multiple
Chlorphacinone	Anticoagulant	Indandione	multiple
Diphacinone	Anticoagulant	Indandione	multiple
Bromadiolone	Anticoagulant	Hydroxycoumarin	single
Difethialone	Anticoagulant	Hydroxycoumarin	single
Brodifacoum	Anticoagulant	Hydroxycoumarin	single
Bromethalin	Non-anticoagulant	other	single
Cholecalciferol	Non-anticoagulant	Vitamin D3	multiple or single
Zinc phosphide	Non-anticoagulant	other	single
Strychnine	Non-anticoagulant	other	single

Single dose anticoagulants are more toxic

Also known as "second generation"

Table: NPIC Rodenticde Factsheet

Rodents are Mammals

Rodenticides may have the same type of effect when eaten by any mammal

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Photos: Maine Department of Inland Fisheries and Wildlife

Rodenticides can kill birds

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Rodenticides can also directly and indirectly kill birds

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Poster: Kate Dolamore Art. Used with permission.

Rodenticides can kill birds

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Rodenticides can also directly and indirectly kill birds

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

Poster: Kate Dolamore Art. Used with permission.

Rodenticides kill wildlife

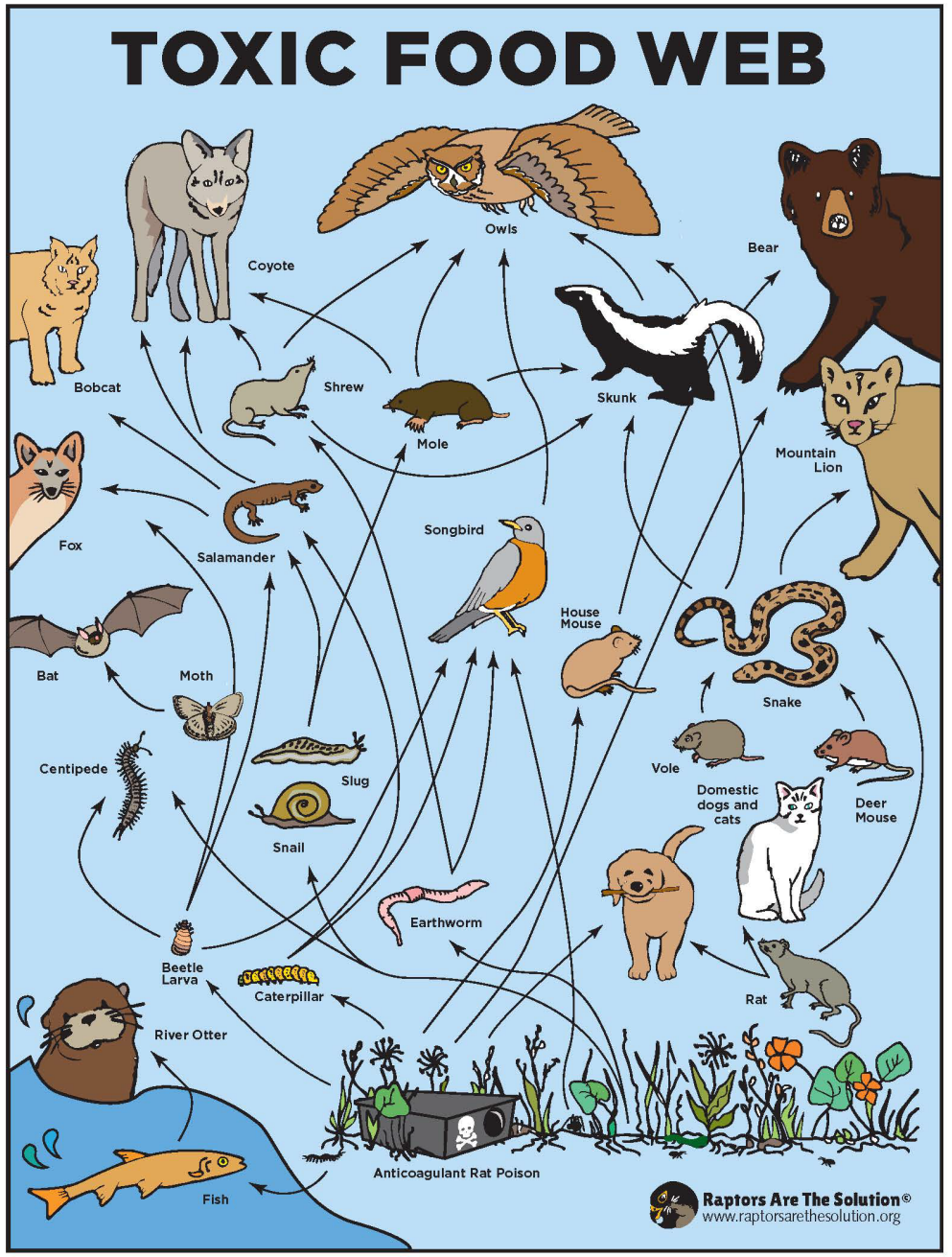
Exposure pathways of anticoagulant rodenticides to nontarget wildlife

John E. Elliott · Sofi Hindmarch · Courtney A. Albert · Jason Emery · Pierre Mineau · France Maisonneuve

Rodenticides detected in liver samples of Norway rats at **both baited and non-baited farms.**

Also detected in a vole, song sparrow, carrion beetles.

A house sparrow was seen entering bait stations and feeding on bait.



MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

The carrion beetle was from an ***unbaited*** farm.

Carrion Beetle: *University of Wisconsin*

Free Poster Download: *Raptors are the Solution*

Rodenticide Secondary Poisoning

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Table 3. Secondary poisoning risks to birds and mammals[2]		
Rodenticide	**Secondary risk to birds**	**Secondary risk to mammals**
Warfarin	slight risk	low risk
Chlorophacinone	slight risk	high risk
Diphacinone	moderate risk	high risk
Bromadiolone	moderate risk	high risk
Difethialone	high risk	high risk
Brodifacoum	high risk	high risk
Bromethalin	possible (insufficient data)	low risk
Cholecalciferol	low risk	low risk
Zinc phosphide	low risk	slight risk
Strychnine[17,24]	possible (insufficient data)	possible (insufficient data)

Secondary poisoning or relay toxicosis is caused by eating poisoned prey

Table: NPIC Rodenticde Factsheet

Rodenticides kill wildlife

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

CALIFORNIA

Death of pregnant mountain lion underscores two human-caused danger

NEWS

Poisons killed beloved owls in Tampa Bay. Can their defenders save others?

Rodenticide poisoning widespread among NY's red-tailed hawks

Barry The Owl Was Poisoned Before Central Park

Rat poison mystery: Pumas and coyotes are dying

Grad student is studying how wild carnivores are being killed by rodenticides

IPM Concepts

Identification

Prevention & Cultural Control

Monitoring & Record Keeping

Action Thresholds

Biological & Chemical Control

Rodenticide: Ways to Ensure Efficacy

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

- In facilities such as poultry operations, and in structures like pantries and restaurants, large amounts of other food opportunities will make baits less attractive
- Contaminated baits (dirt, manure, insects) are unattractive to rodents
- Follow the label

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

Pesticide Storage: Store only in original container in a cool, dry place inaccessible to children and pets. Keep containers closed and away from other chemicals.

Pesticide Disposal: Dispose of wastes resulting from the use of this product at an approved waste disposal facility or call your local solid waste agency for alternative disposal instructions. Never place unused product down any indoor or outdoor drain.

Container Handling: Nonrefillable container. Do not reuse or refill this container. When completely empty, offer for recycling if available, or dispose of empty container in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to use this product. Any products without an EPA registration number have not been reviewed or registered by the EPA. The label must be strictly followed.

Sources: Purdue Poultry Factsheet

Rodenticide: Ways to Ensure Efficacy

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

- In facilities such as poultry operations, and in structures like pantries and restaurants, large amounts of other food opportunities will make baits less attractive
- Contaminated baits (dirt, manure, insects) are unattractive to rodents
- Follow the label

APPLICATION DIRECTIONS

Norway and Roof Rats:

Apply 4 – 16 oz. of bait (usually at intervals of 15-30 ft.) per placement. Maintain an uninterrupted supply of fresh bait for 10 days or until signs of rat activity cease.

House Mice:

Apply ¼ - ½ oz. of bait per placement. Space placements at intervals of 8-12 ft. Larger placements (up to 2 oz.) may be needed at points of very high mouse activity. Maintain an uninterrupted supply of fresh bait for 15 days or until signs of mouse activity cease.

Sources: Purdue Poultry Factsheet

Reducing rodenticide risk to children, pets, livestock, & wildlife

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

Prevent exposures…

- Do not store within reach of children or pets
- Tamper resistant bait stations
- Follow the label instructions
- Dogs will dig up buried bait
- Search for, collect, and dispose of poisoned rodents
- Milk crates over traps reduce off-target kills and little fingers!

IPM Concepts

- Identification
- Prevention & Cultural Control
- Monitoring & Record Keeping
- Action Thresholds
- Biological & Chemical Control

This does not constitute an endorsement or a recommendation by the State of Maine or the Board of Pesticides Control to use this product. Any products without an EPA registration number have not been reviewed or registered by the EPA. The label must be strictly followed.

Photos: Washtenaw County Health Dept.

Demonstrate you use IPM!

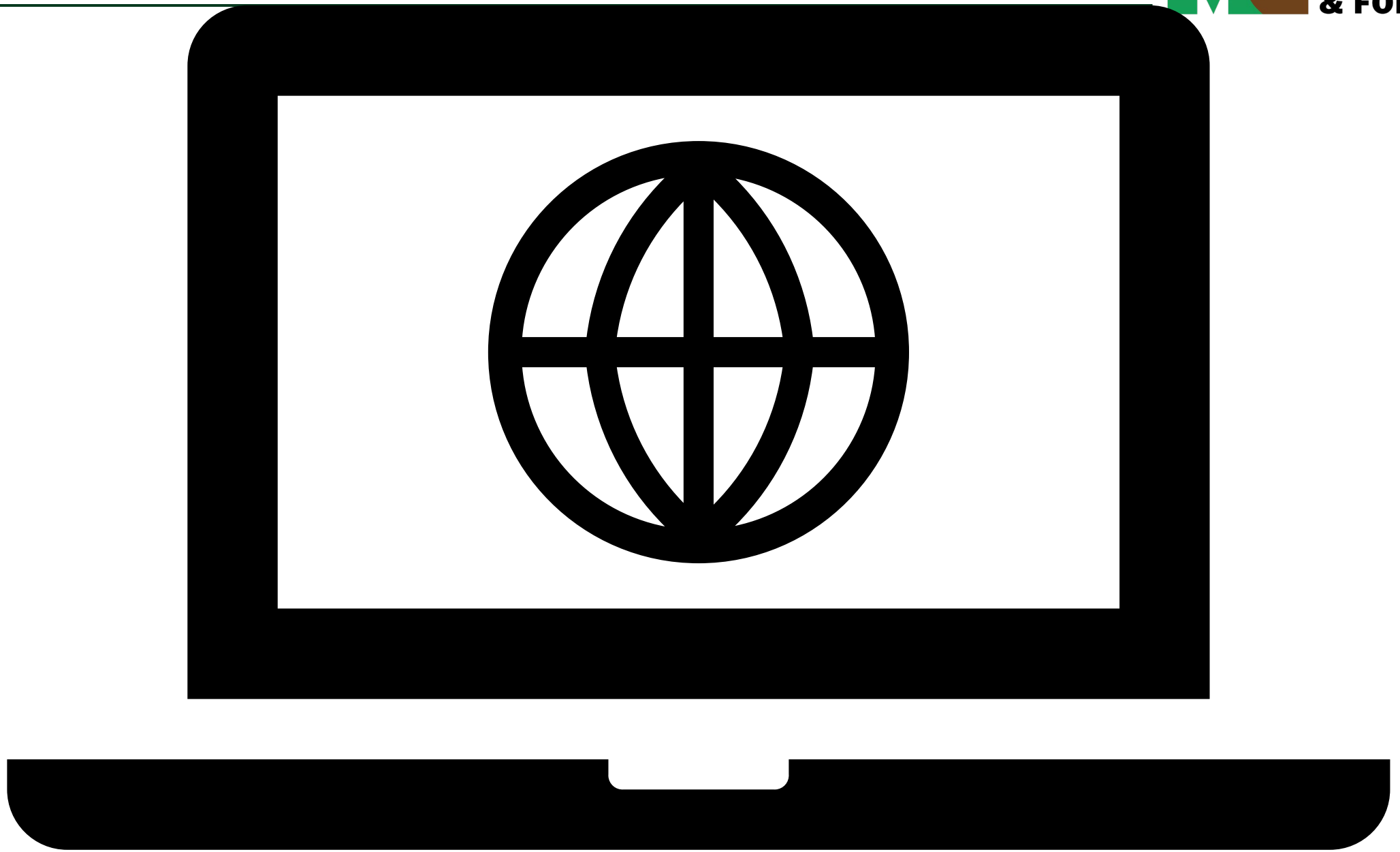
MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

IPM Concepts

- Identification
- Monitoring & Record Keeping
- Action Thresholds
- Prevention & Cultural Control
- Biological & Chemical Control

Demonstrate you use IPM!

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY



Demonstrate you use IPM!

MAINE DEPARTMENT OF AGRICULTURE CONSERVATION & FORESTRY

IPM Concepts

- Identification
- Monitoring & Record Keeping
- Action Thresholds
- Prevention & Cultural Control
- Biological & Chemical Control

- Provides educational information about species presence in Maine
- Describes process company takes to ensure pest identification

- Describes initial inspection
- Describes process for ensuring populations have decreased
- Describes improvements annually

- Mentions applicators license
- Describes to customers that they will receive a copy of the product label used
- Defines safety precautions that will be taken

- Discusses the importance of record keeping
- Surveys customers for problematic areas

- Defines tactics customers should take prior to treatment for highest efficacy
- Offers landscaping services
- Offers property walkthrough with customers
- Defines IPM & Adopts IPM Policy
- Makes realistic promises