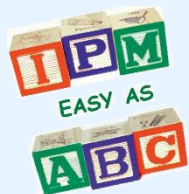


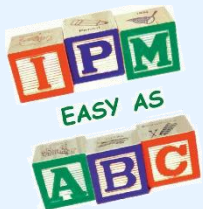
Mice and Rats in and around Sensitive Environments

Nebraska Extension

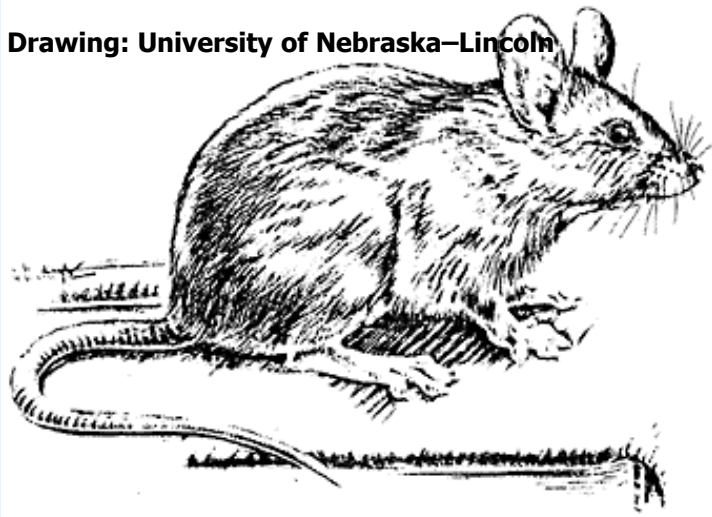


To Know Your Enemy is to Control Your Enemy

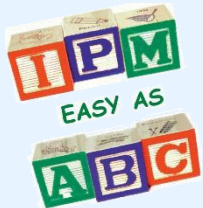
- ❖ Identification (Morphology)
- ❖ Know Abilities (Physiology)
- ❖ Know Habits (Behavior)
- ❖ Know Life History (Biology)



House Mouse-ID

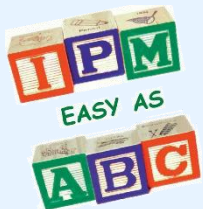


- ❖ Normally gray to brown fur
- ❖ Domesticated, could be almost any color
- ❖ Grayish underside
- ❖ Long single colored tail
- ❖ Large ears that stand up
- ❖ 2.5-3.75" body length

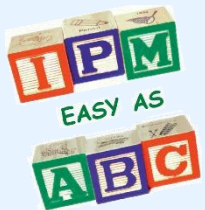


Rodent Damage

- ❖ Mice leave two teeth marks from their incisors: each is about 1mm wide and adjacent to each other in a parallel line with a small ridge between.
- ❖ Mice teeth are extremely hard and capable of penetrating many hard materials.



Rodent Damage



House Mouse Contamination

- ❖ Each mouse can leave 50-75 droppings a day
- ❖ Their urine can contaminate dozens of pounds of product in a day

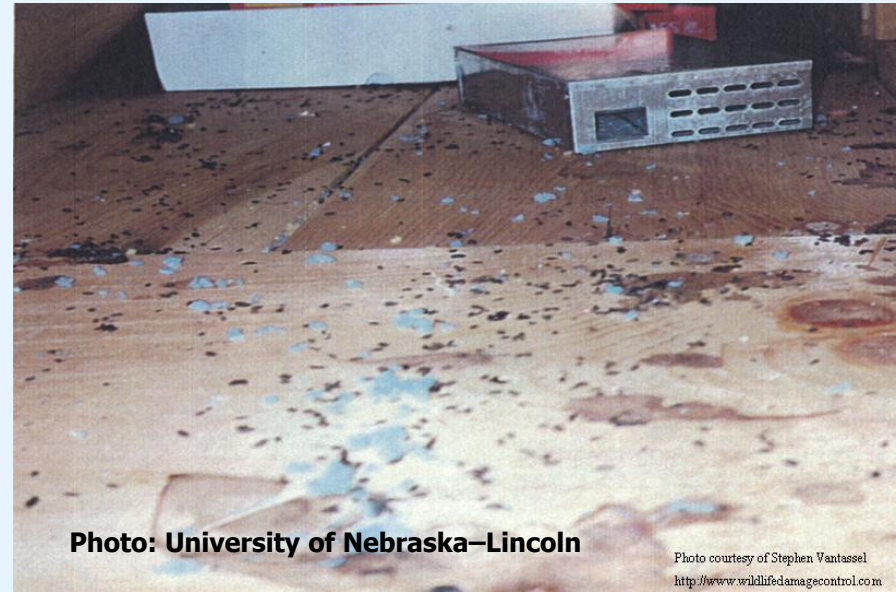
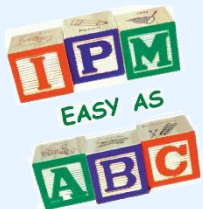


Photo: University of Nebraska–Lincoln

Photo courtesy of Stephen Vantassel
<http://www.wildlifedamagecontrol.com>



Mouse vs. Bat Droppings

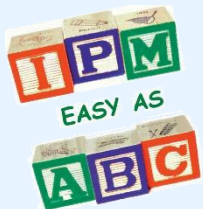
- Mouse Droppings

- Scattered
- Hard-when dry
- Smooth



- Bat Droppings

- Piled
- Soft/crumbly-when dry
- Rough & speckled



House Mouse Senses

❖ Vision

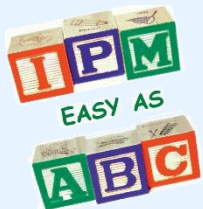
- Color blind, no red
- 1-2 ft. only for objects
- Up to 45' for movement

❖ Hearing

- Average < 45 KHz
- Semi-functional sonar



Photo: Jack Kelly Clark, courtesy University of California Statewide IPM Program



House Mouse Senses

❖ Taste

- Not very good, more learned

❖ Smell

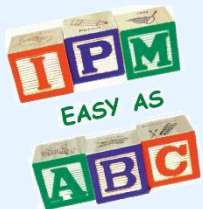
- Best sense; > 250 ppb

❖ Touch

- Very good; use whiskers and guard hairs

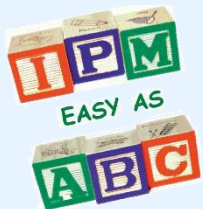
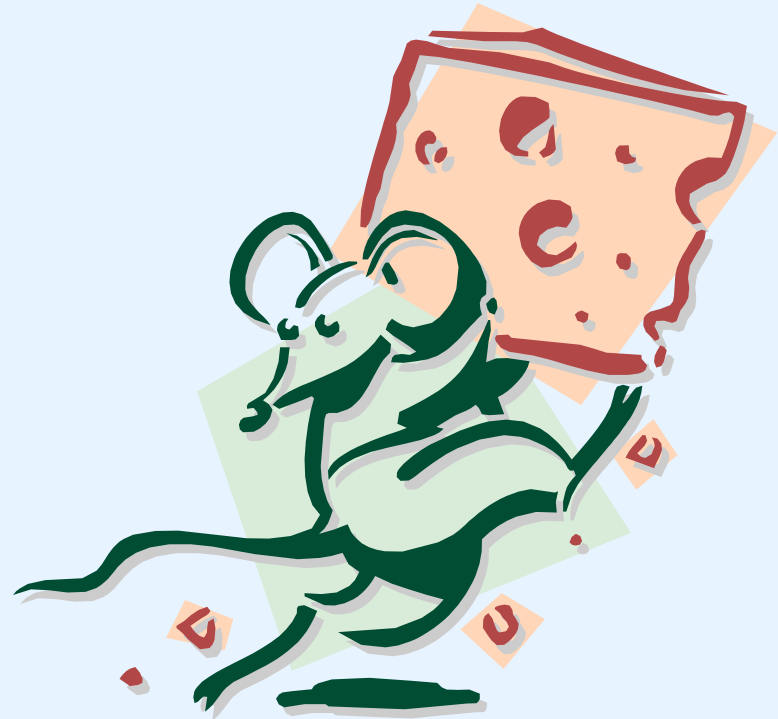


Photo: Jack Kelly Clark, courtesy University of California Statewide IPM Program



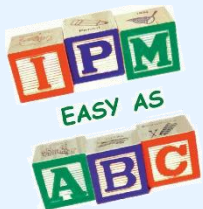
House Mouse Physical Abilities

- ❖ Speed
 - 4-6 mph
- ❖ Vertical jump
 - 1.0-1.8 ft
- ❖ Leap across
 - 2.5-3.0 ft
- ❖ Vertical Drop
 - 8-9 ft



House Mouse Physical Abilities

- ❖ Climbs:
 - Any rough surface
- ❖ Tight rope:
 - Walks on a 10g wire
- ❖ Swims:
 - Poor swimmer
- ❖ Young can squeeze through a $\frac{1}{4}$ " opening



House Mouse Behavior

❖ Home Range

- 20' radius

❖ Territory

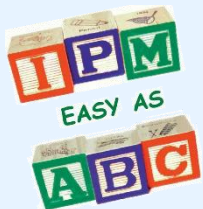
- 6-8' radius

❖ Exploration

- Curious; always exploring

❖ Migrations

- Move when overcrowded, or if there are changes in environmental conditions



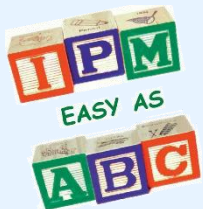
House Mouse Behavior

❖ Water



Photo: USDA-APHIS

- Only need .01/oz per day
- Can go 4 months without free water
- Get most from food
 - ✓ Eat protein=need water
 - ✓ Eat sugar/carbs=make water



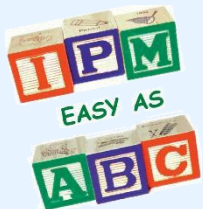
House Mouse Behavior

❖ Omnivorous

- Eat 10% of body weight/day
- Wide variety of foods
- Learn what is available and search

❖ Food Preferences

- What they are used to in that area



House Mouse Foraging Behavior

❖ Natural Strategy

- Nibblers
- Eat most at site
- Store small amounts

❖ Activity Peaks

- Pre-Dawn
- Post-Dusk

❖ Frequency

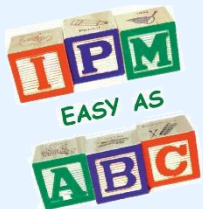
- 30-40 short trips/day



House Mouse Reproduction



- ❖ Mature at one month
- ❖ 18-21 days gestation
- ❖ 6-12 in each litter
- ❖ Each female: up to 10 litters/year

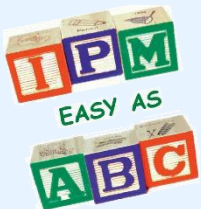


Norway Rat

- ❖ Grayish brown; can be light gray to black
- ❖ Light cream to tan underside
- ❖ Long hairless tail
- ❖ 16 inches long
- ❖ Average adult is 12-16 oz.



Photo: USDA-APHIS



Rat Senses

❖ Vision

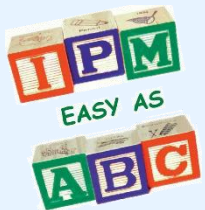
- Poor; mainly movement
- Color blind

❖ Hearing

- Average; close to ours



Photo: Iron Clad Pest Control



Rat Senses

❖ Taste

- Learned

❖ Smell

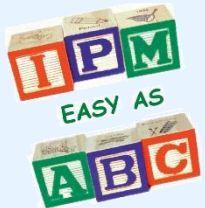
- Excellent; most important

❖ Touch

- Many whiskers and guard hairs



Photo: Iron Clad Pest Control



Rat Physical Abilities

- ❖ Speed

- 5-6 mph

- ❖ Vertical Jump

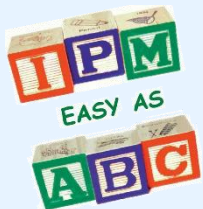
- 3 ft up

- ❖ Horizontal Jump

- 8-10 ft across

- ❖ Survive a Vertical Drop

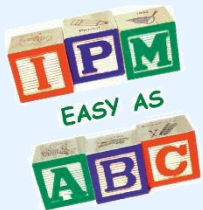
- Easily 12-20 ft



Rat Physical Abilities

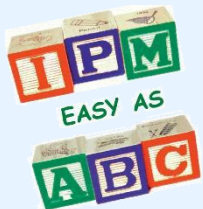


- ❖ Tight rope
 - Any pipe or $\frac{1}{4}$ " wire
- ❖ Swims
 - Excellent swimmer
- ❖ Squeeze
 - Young can fit into $\frac{1}{2}$ " slot



Rat Behavior

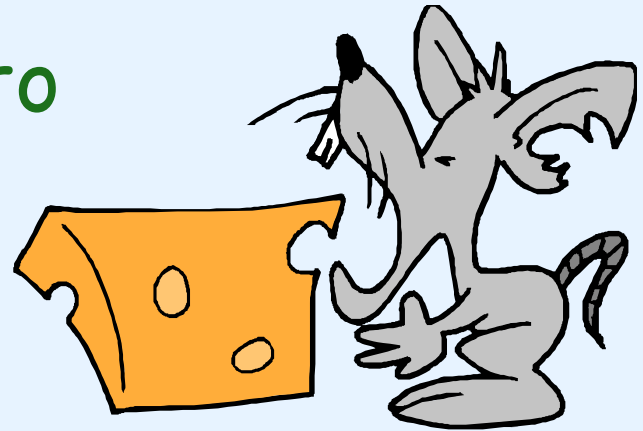
- ❖ Home Range
 - 500 ft radius
- ❖ Territory
 - 100 ft radius
- ❖ Exploration
 - Very leery, seldom explore
- ❖ Migrations
 - Move when pushed out by others



Rat Foraging and Feeding Behavior

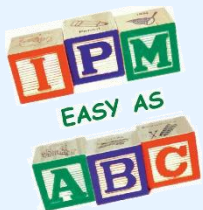
❖ Natural Strategy

- Gather food; bring to nest
- Eat at nest site
- Store food



❖ Frequency

- Search only as needed



Rat Foraging and Feeding Behavior

❖ Water

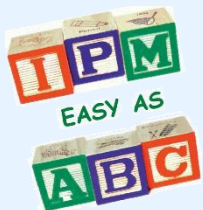
➤ Must drink water approx. 2 oz./day

❖ Omnivorous - *eats both animal & vegetable products*

➤ Approx 110 cal/day

➤ Variety of foods (seeks nutritional balance)

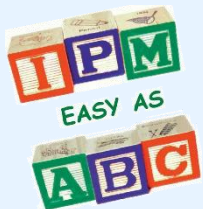
➤ Wants high quality protein



Rat Reproduction



- ❖ Mature at 12 weeks
- ❖ 22 days to gestation
- ❖ 8-12 in a litter
- ❖ Numbers of litters determined by amount of food/water



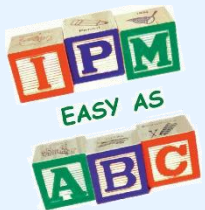
Rat Signs

- ❖ Burrow entrances approx. 2-inches wide
 - Presence of hairs means the hole is active



Photo: University of Nebraska–Lincoln

Rat burrow entrance



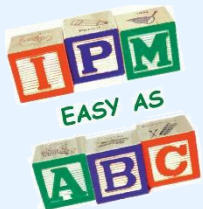
Rat Signs

- ❖ Look for small tear marks in trash bags around the opening
- ❖ Small items may be present on bag



Photo: University of Nebraska–Lincoln

Nibbling on bag



Droppings

- Norway Rat

- $\frac{1}{2}$ - $\frac{3}{4}$ " long $\frac{1}{4}$ " dia
- Often grouped
- 40-50/day

- House Mouse

- $\frac{1}{8}$ - $\frac{1}{4}$ " long
- Often scattered
- 50-75/day

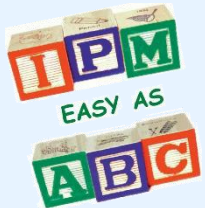
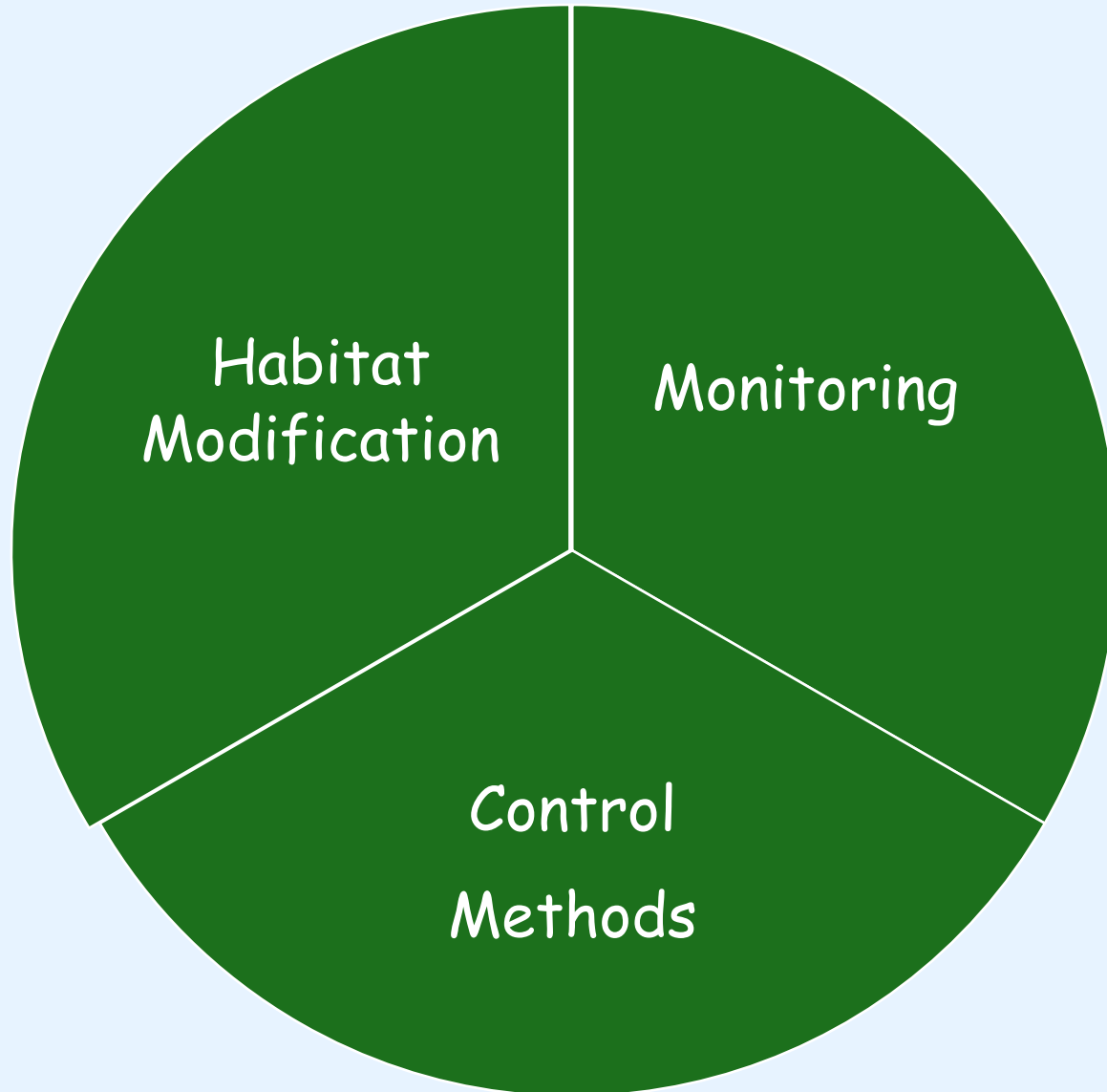
Photo: University of Nebraska–Lincoln



Photo: University of Nebraska–Lincoln



Rodent IPM

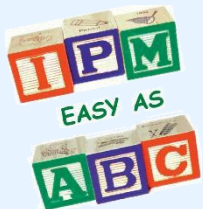


Habitat Modification



❖ Food Reduction

- Clean up crumbs
- Wash dishes and counters to reduce build up of food on surfaces
- Mop floors
- Place food in Tupperware® or metal containers



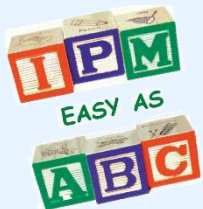
Modify Bird Feeders

- ❖ Squirrel proof bird feeders
- ❖ Prevent bird seed from reaching ground
- ❖ Additional info at <http://www.ianrpubs.unl.edu/> (search for title: *Selective Bird Feeding*)

Squirrel proofed bird feeder



Photo: University of Nebraska–Lincoln



Habitat Modification

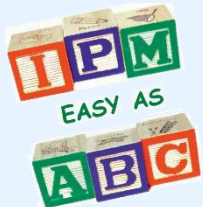
❖ Landscape

- Keep grass trimmed
- Create weed-free zone
- Remove clutter
- Eliminate woodpiles and other sites that provide rodents shelter



Photo: University of Nebraska–Lincoln

Weed-free zone



Habitat Modification

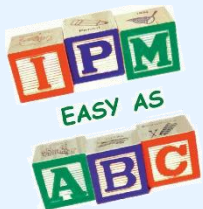


Photo: University of Nebraska–Lincoln

Dumpsters too close to the structure

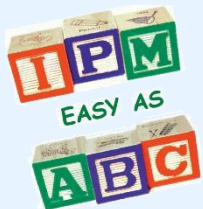
❖ Dumpsters

- Keep them away from buildings
- Keep covers closed
- Screen drain vents with $\frac{1}{4}$ -inch mesh



Remove Their Access

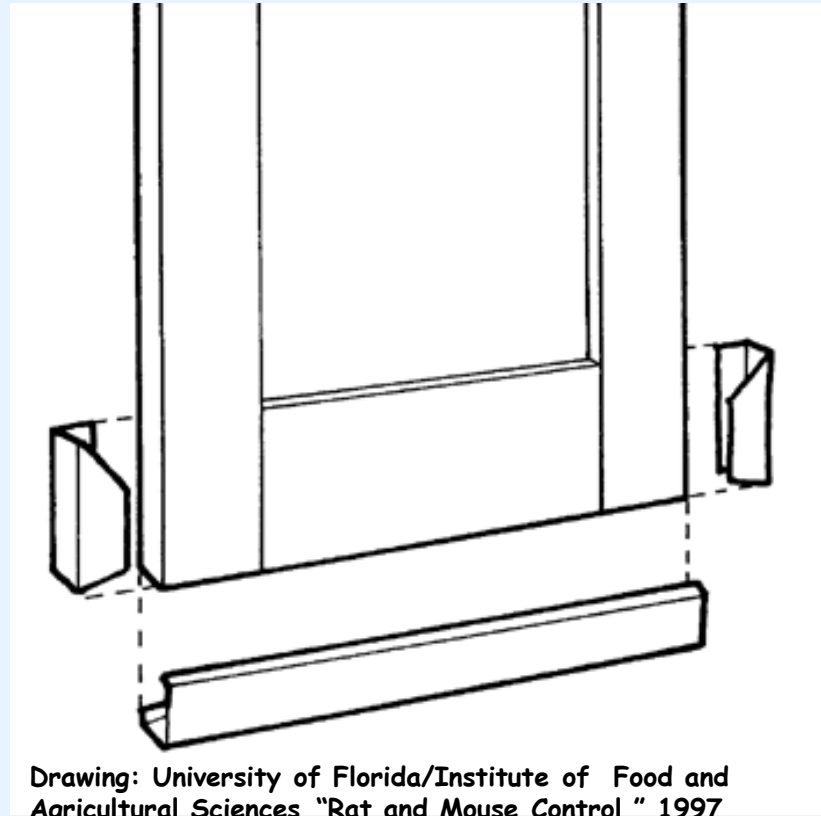
- ❖ Seal up holes/cracks
- ❖ $\frac{1}{4}$ " or larger!!
- ❖ Provided not active!



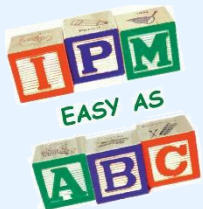
Mouse Integrated Pest Management (I.P.M.)

❖ Exclusion

- Place strips around doors

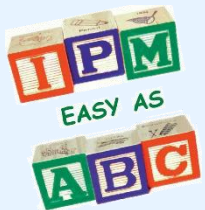


Drawing: University of Florida/Institute of Food and Agricultural Sciences, "Rat and Mouse Control," 1997.



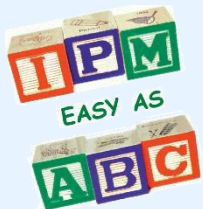
Look High

Caulk or secure metal plates around pipes



Avoid Using Expanding Foams

- ❖ Not UV stabilized
- ❖ Can be gnawed through
- ❖ Use in conjunction with other methods
- ❖ Paint or keep out of sunlight



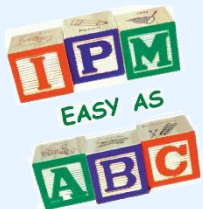
Exclusion Tools

- ❖ Caulk better than foam
- ❖ Match caulk to situation
 - Indoor/outdoor
 - Temp
 - Moisture



Photo: University of Nebraska–Lincoln

Stuff-It (left) and Xcluder (right)



Frightening Devices

Photo: University of Nebraska–Lincoln



Effigy

Photo: University of Nebraska–Lincoln



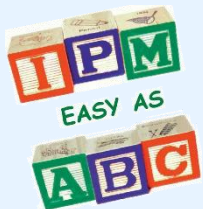
Motion sensor water spray



Photo: University of Nebraska–Lincoln

Ultrasound

Don't waste your time
with these methods.



Repellents

❖ Predator Urine

- Fox and Coyote

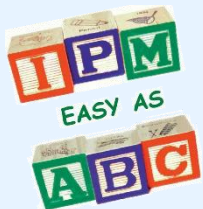
❖ Taste Repellents

- DeTour-White pepper/Garlic oil
- Use where rodents gnaw
- Capsaicin, Black pepper, Piperidine
 - ✓ E.g. Havahart Critter Ridder

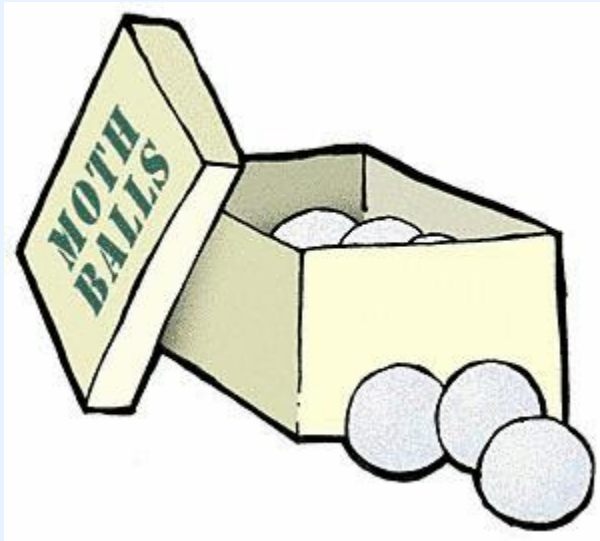
❖ Denatonium saccharide

- E.g. Ropel

**No evidence any
are effective in
real situations**

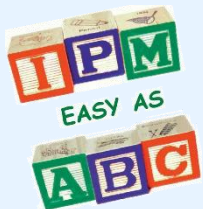


No Mothballs!



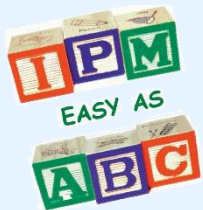
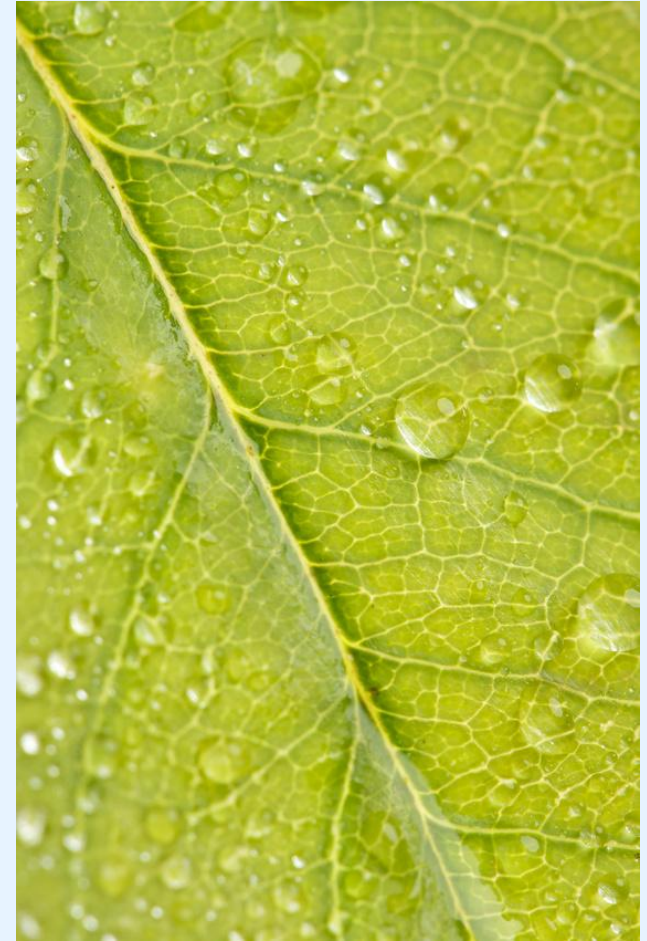
Mothballs

- ❖ Naphthalene-anticipated carcinogen
- ❖ Paradichlorobenzene-possible carcinogen
- ❖ Injurious to animals
 - Abdominal pain, vomiting, seizures, & tremors
 - Kidney damage
 - Liver damage



Problem with Repellents

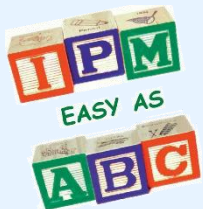
- ❖ What stops animal from running past it?
- ❖ Rain often requires reapplication
- ❖ Can't use products on food plants
- ❖ Do they even work?
- ❖ If they do, how well?



Trapping Safety

- ❖ Wear appropriate safety equipment, e.g. gloves when handling traps and animals
- ❖ Avoid setting traps in areas with high human/pet traffic
- ❖ Check traps daily. Don't set them if you can't check them the next day

Photo: University of Nebraska–Lincoln

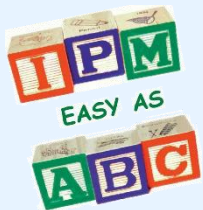


Remove Populations

❖ Trapping

- Multiple catch
- Snap trap
- Electric traps

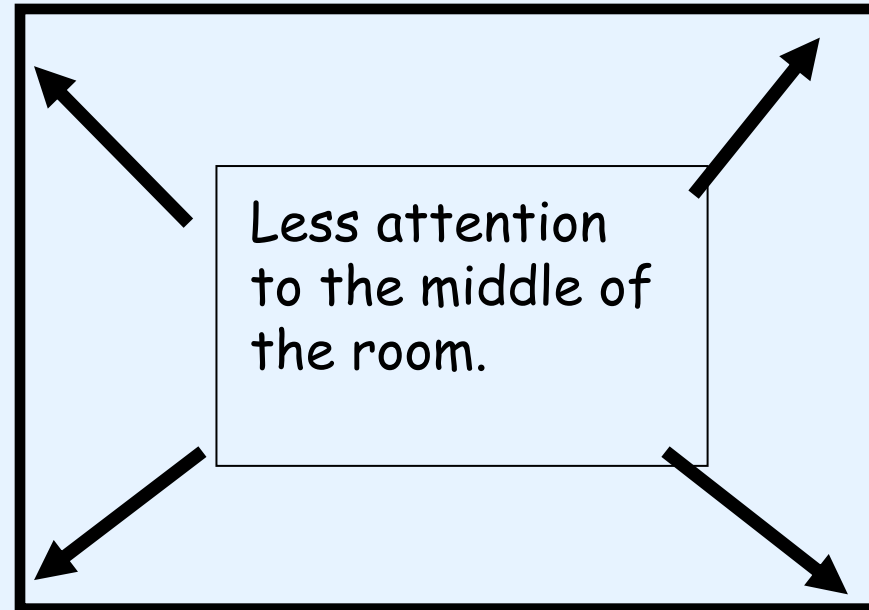
❖ Use Plenty: Think dozens



Location, Location, Location

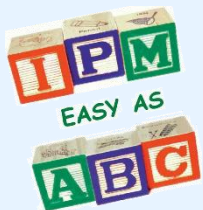
❖ Identify activity areas

- Droppings
- Sightings
- Rub marks
- Food sources
- Water sources



Less attention
to the middle of
the room.

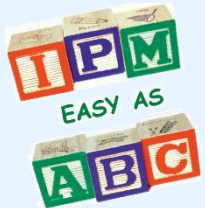
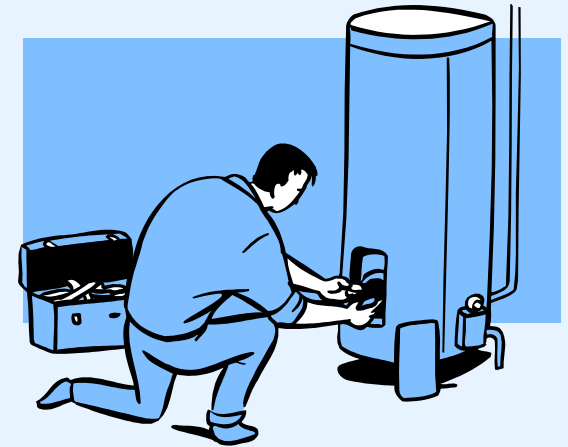
Focus on dark walls, corners and out of the way places where rodents feel safe!!



Location, Location, Location

❖ Identify Heat Sources

- Dishwashers
- Refrigerators
- Freezers
- Hot water heaters
- Lights

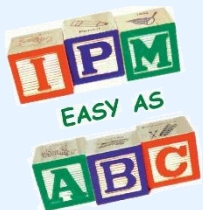


Bait-Pre-bait first

- ❖ Use combinations of sets (unbaited and baited)
 - Peanut butter (watch out for allergies)
 - Caramel
 - Chocolate (mice)
 - Cotton, twine
 - Bacon (rats)
 - Pepperoni (rats)



No bait works too

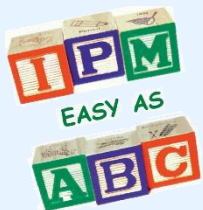


How NOT to Trap

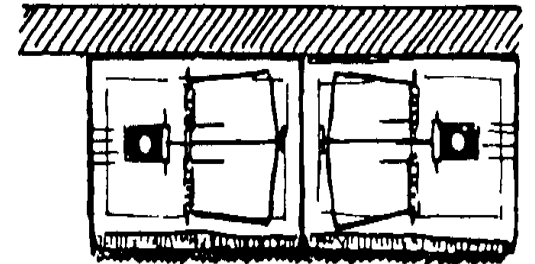
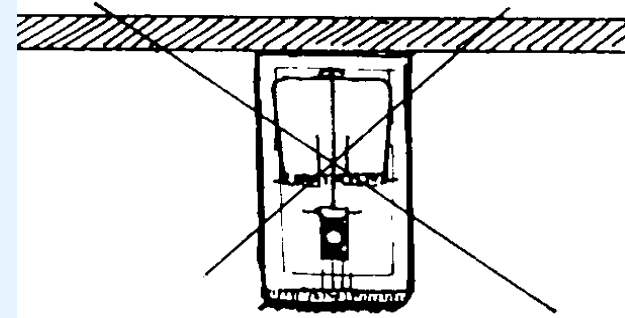
Bait end should be against the wall.

Traps too close together. If one triggers, the other will fire too.

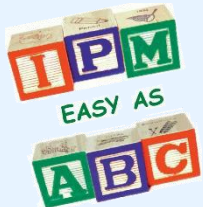
Box traps should not be used with house mice or Norway rats. They are invasive species and should be killed.



Photos: University of Nebraska–Lincoln



Use Proper Setting Technique

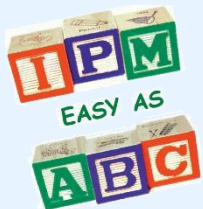


Put Traps Out of Reach

Trap inside a
tamper-resistant
bait-station



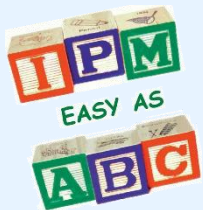
T-Rex Rat Snap Trap inside a rat-sized bait station



Glueboards-not great for rodents

- ❖ Only effective in catching young/naive rodents
- ❖ Educates adults
- ❖ Great for bugs
- ❖ Humane concerns

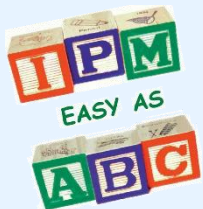
Photo: University of Nebraska–Lincoln



Pesticides—Toxicants

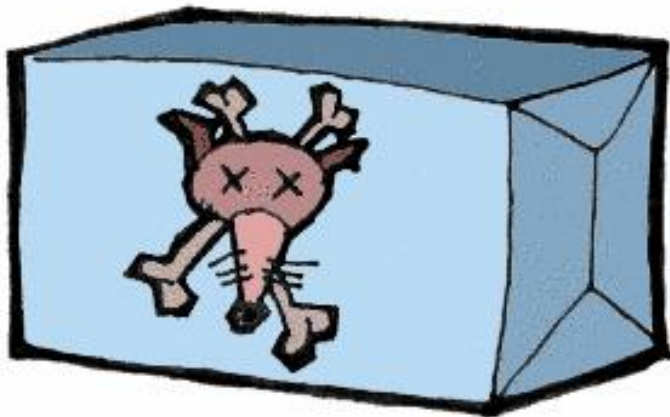


- ❖ Follow Label Instructions
- ❖ THE LABEL IS THE LAW!
- ❖ What kills them can kill you!

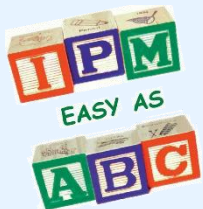


Toxicants

- Non-anticoagulant
 - Bromethalin
 - Cholecaliferol
 - Zinc phosphide

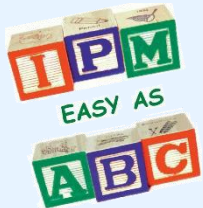


- Anticoagulant
 - First gen (multi-feed)
 - Chlorophacinone
 - Diphacinone
 - Warfarin
 - 2nd gen (1-feed)
 - Brodifacoum
 - Bromadiolone
 - Difenacoum
 - Difethialone



Toxicant Best Practices

- ❖ Follow the label
- ❖ Use 1st Generation Toxicants
- ❖ Keep bait fresh
- ❖ Keep stations full



Secondary Poisoning

- ❖ Secondary-poisoning (esp. 2nd Gen. Anticoagulants)
- ❖ Research & concern is growing

Anticoagulant



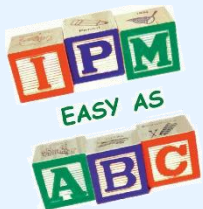
Primary Hazard



Secondary Hazard



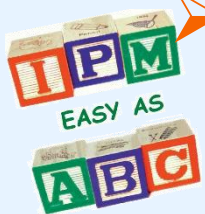
Photos: University of Nebraska–Lincoln



Prevention of Non-Target Exposure

- ❖ Reduce access
- ❖ Employ habitat modification
- ❖ Trap before poison
- ❖ Use safer baiting practices
 - Bait stations
 - Select formulations
 - Block vs. pellet
 - Use 1st gen. before 2nd

Photo: University of Nebraska–Lincoln



Safe Handling of Traps and Toxicants

❖ Protect Yourself

➤ Gloves

➤ Hand washing

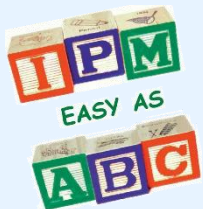


Photo:s University of Nebraska–Lincoln

Disposing of Dead Rodents

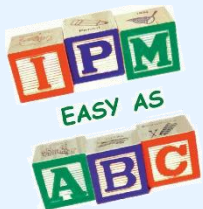
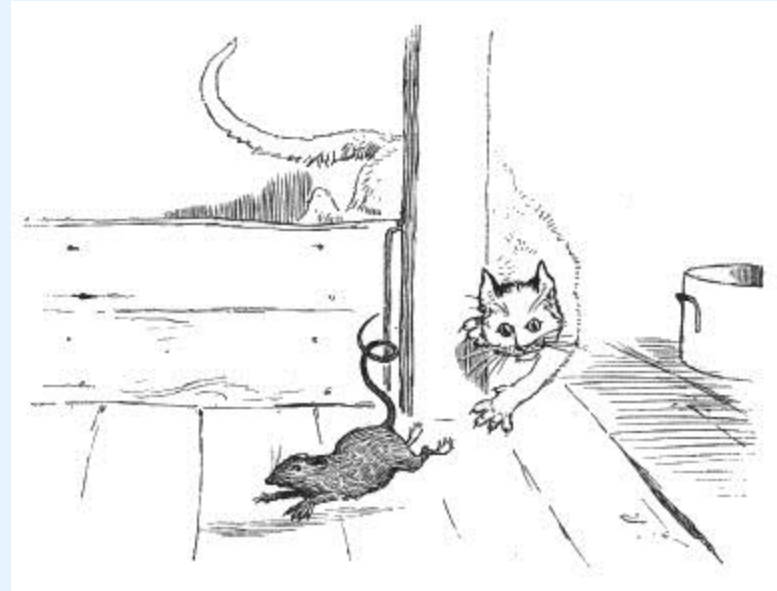
- ❖ Spray carcass with disinfectant
- ❖ Secure in plastic bag
- ❖ Dispose in a covered garbage can

Photos: University of Nebraska–Lincoln



Cats

- ❖ Not species specific
- ❖ Useless against rodents inside walls
- ❖ No evidence they are effective in controlling rodents
- ❖ Cats devastate the natural fauna



Post Treatment Monitoring

- ❖ Look for and remove dead and dying rodents

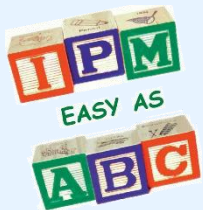
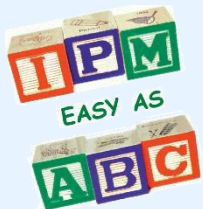


Photo: University of Nebraska—Lincoln

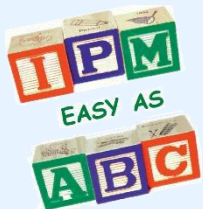
Rodents can Transmit Disease

- ❖ Rodent droppings, urine, carcasses, and nesting materials can release allergens and potential disease pathogens into the air.
- ❖ Also handling of live animals carelessly could result in bites from infected rodents.



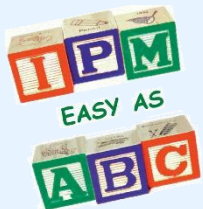
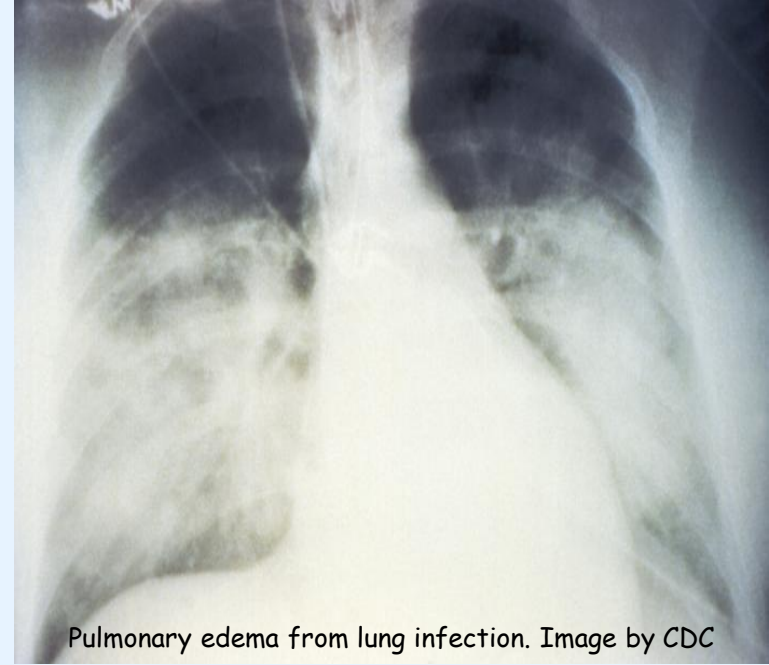
Diseases Associated with Rodents

- ❖ Hantavirus, murine typhus, scrub typhus, rickettsial pox, leptospirosis, rat bite fever, lymphocytic choriomeningitis, salmonellosis, trichinosis, plague



Hantavirus

- ❖ On-set “unknown” possibly 1-5 wks
- ❖ Symptoms
 - Early--Flu-like symptoms
 - Late—Coughing, difficulty breathing



Hantavirus Prevention

- ❖ Avoid feces contaminated areas
- ❖ Avoid breathing dust
- ❖ Open windows & ventilate
- ❖ Spray droppings with bleach or Lysol® before cleaning
- ❖ Never vacuum or sweep up dry droppings.

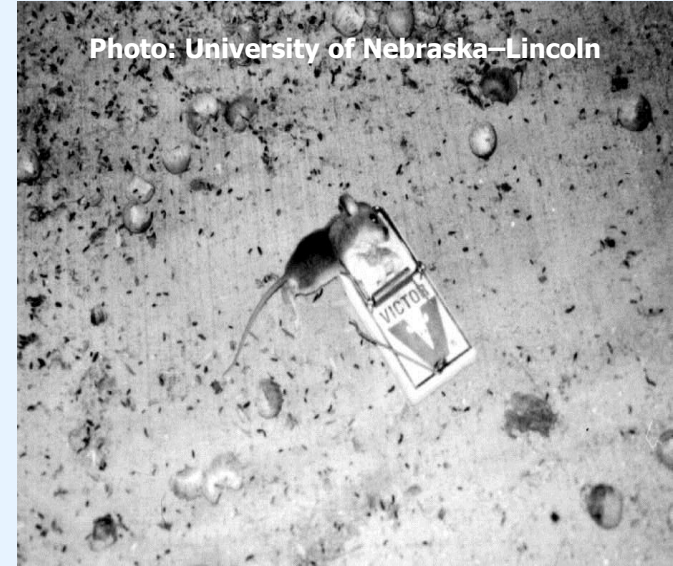
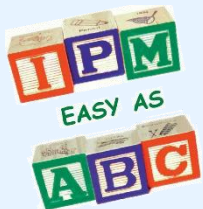


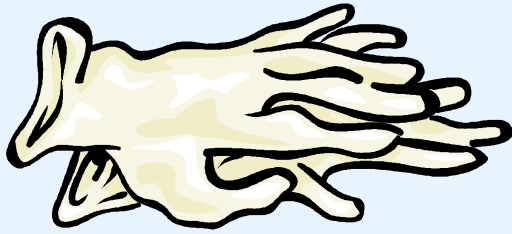
Photo: University of Nebraska–Lincoln

Black specs are rodent droppings



Cleaning Up After Rodents: Protect Yourself

❖ Protective clothing

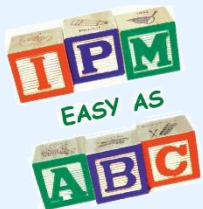


➤ Latex gloves

- ✓ Latex can cause allergic reaction in some individuals; vinyl gloves an alternative

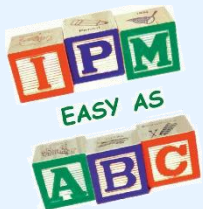
➤ Respirator in high risk areas

- ✓ HEPA filter mask that can filter down to 0.3 microns



How to Fail in Rodent Control

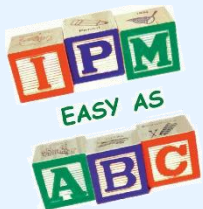
- ❖ Lack of modification—don't remove food, harborage or access
- ❖ Lack patience—quit too soon
- ❖ Lack of care—let bait rot
- ❖ Lack of effort—only control where it's convenient
- ❖ Lack of coordination—ignore public assistance



Keep in Mind

Controlling Rodents NEVER, NEVER ENDS

You are either winning or losing but there is no Detente.

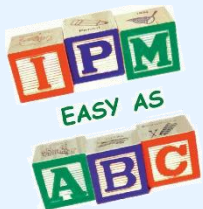


Resources/Information

❖ Internet Center for Wildlife Damage Management

➤ <http://icwdm.org>

➤ <http://ianrpubs.unl.edu/> (search for "Wildlife Management")



Credits

❖ Content Specialist

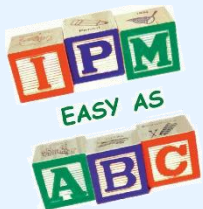
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- Dennis Ferraro, Nebraska Extension

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- Erin Bauer, Nebraska Extension

❖ Photos

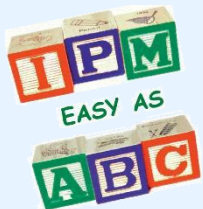
- Dennis Ferraro, Nebraska Extension
- Dallas Virchow, USDA-APHIS Wildlife Services



Credits

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- John Paterson, Australian Wildlife
- Christos Kambanis, Iron Clad Pest Control
- Jack Kelly Clark, University of California (<http://www.ipm.ucdavis.edu>)
- University of Florida
- University of Florida, Institute of Food and Agricultural Sciences
- Nebraska Extension



Credits

❖ Photos cont.

- Wildlife Services Image Collection, USDA-APHIS
- CDC

❖ Artwork/Graphics

- Nebraska Extension

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