

Plant It and They Will  
Come:

Vertebrate Pest  
Management in the  
Garden, Landscape,  
and Home



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Specialist

Which animals have not fared  
well with European settlement?  
Which have prospered?



What is that noise in or under  
the house?



The noisemakers could be

- Birds
- Regular mice
- Deer mice
- Wood rats (aka pack rats)
- Rats (two types)
- Ground squirrels
- Tree squirrels
- Chipmunks
- Raccoons
- Opossums
- Skunks
- Lizards
- Bats
- Insects



## Why is any animal there???

- Food
- Water
- Shelter



## Vertebrate pest concerns

- Damage to crops and plantings
- Disease issues
- Aggressive behaviors to pets and people
- Structural damage



Photo: Birdguard.com

## Diseases of concern

- E. coli OH157:H7 (STEC)
- Listeria
- Giardia
- Camphylobacter
- Cryptosporidium
- Salmonella
- Cyclospora
- Others



## Role of animals

- Cattle are the main carriers of E. coli OH157:H7 (a Shiga Toxin producing E. coli or STEC for short). Deer also carry it.
- Manure or feces are the point source
- Fruit and vegetables (in direct soil contact) eaten fresh or with minimal cooking ("No kill step") are most likely to cause problems for the consumer.
- **Rodent contamination of stored food**



Photo: Konrad Fair North

Not good for so many reasons

## How do you prevent wildlife damage?

- Learn about the life cycle of wildlife species
- Assess your level of tolerance, resources, and consider possible neighborhood solutions
- Think ahead and implement exclusionary measures for long-term success
- Use multiple tools tailored to your situation



## Basic tactics

- Block
- Deter
- Remove the animal(s)
- Change the game –
  - Remove the “draw” or increase the risks/costs to the animal
- Most of these send the animals to your neighbors



## General control strategies

- Physical exclusion
- Aversion strategies like repellents
- Landscape management to change behavior
- Predator encouragement
- Non-lethal removal
- Lethal removal





## Deer alter natural or domestic landscapes



## Deer nibbling

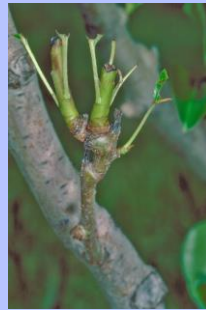




## More deer damage



Photos: Growing the Home Garden.com



## Conifer damage



UGA2113036

## E. coli O157:H7 event with likely deer connections: Odwalla Juice

- Odwalla had been producing non-pasteurized juice.
- Juice was linked to a major E. coli outbreak.
- 65+ people affected, 12+ got kidney damage, and a child died.
- Source was contaminated fruit juiced at the Dinuba plant.
- Deer were suspected of contaminating windfall apples.
- They now flash pasteurize their juice products.



Photo: Business Insider

## E. coli O157:H7 event with deer connections: Oregon strawberries

- In 2011, fresh strawberries produced near Newberg sickened 16+ people. One death & 4 with kidney damage
- Deer implicated in contamination
- Very challenging trace-back issues



## A deer resistant landscape??

Available on-line for free – type exact title into search engine

Other lists e.g. in Sunset Garden Book

But deer don't read!!



Deer resistant gardens:

Lot's of nice plants but not much to for us to eat.

[www.hiller.com.uk](http://www.hiller.com.uk)

## Edible plants deer (maybe) won't eat

- Winter squash plants (??)
- Potato foliage
- Fig leaves (but will eat figs)
- Persimmons
- Garlic story

Implications: These can be planted outside a deer fence



## Herbs deer won't eat

- Rosemary
- Thyme
- Oregano & marjoram
- Mints
- Catnip
- Lavender
- Bay



## Native plants deer won't eat

- Sitka spruce
- Grand fir (?)
- Cascara
- Vine maple
- Red elderberry
- Wild hazel
- Indian plum
- Pacific wax myrtle
- Rhododendron
- Red flowering currant (?)
- Salal
- Oregon grape
- Nootka/bald hip rose
- Wild strawberry
- Lupine
- Sword fern

## More native plants

- Native columbine (?)
- Iris tenax
- Oxalis oregana
- Trillium
- Wild ginger
- Oregon ash
- Pacific yew
- Ceanothus (? but antler rubbing)
- Coyote brush (antler rubbing)
- Manzanita
- Madrone
- Bearberry



## Other plants generally deer safe

- Smoke tree
- Japanese maple
- Korean dogwood
- Liquidamber
- Beech
- Some birch sp.
- Spruce
- Some oak sp
- Forsythia
- Honeysuckle sp.
- Clematis
- Rhododendrons
- Lilac
- Spirea
- Kerria
- English ivy (too bad!)

## So what about roses?

- Most are preferred deer food
- Rugosa roses are less browsed
- It's all in the breeding (cultivars matter).



*Hansa*: top

*Therese Bugnet*: bottom



Temporary fish line fences rarely work very long

## Backyard deer fence

- Deer won't jump something that they can't see through or has a complex cluttered appearance. Gate has to be equally tall (>6')



## Urban welded wire fence





## Conventional deer fencing

- Effective (if you close the gates)
- Long-lasting
- Expensive
- People/equipment movement slowed
- May lose some crop area
- Usually 7' tall
- Watch for ground dips that deer can slither under (6" or more)



## Electric fencing

- Much cheaper
- More active maintenance
- Psychological deterrent that some deer will breach
- Usually 6' tall
- Moveable/expandable
- Don't work without power
- Not guest friendly – can't be used in towns



## More electric fences



## Repellents

- Rotten things (rotten eggs, blood meal, ammonium fatty acids)
- Bitter or burn (capsaicin, quinine)
- Where the wild things are (cougar scat, etc.): complications can ensue

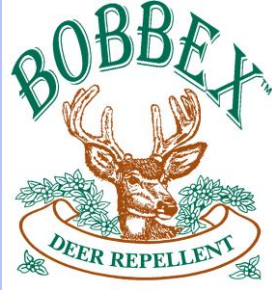


## Using repellents

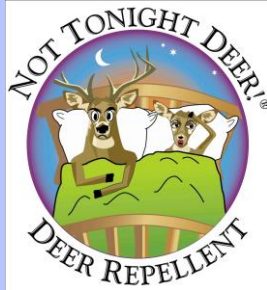
- Early and often
- Rotation of types
- Send animals to the neighbors as you change their behavior



## More “rotten” repellents



Good results



Mixed results

## Can you confuse deer?

- Radios- not useful
- Lights – not useful
- Sprinklers – yes with good planning



## “Scarecrows”



- Motion activated water deterrent
- Element of surprise
- \*\*Can be effective against birds, deer, turkeys
- May need multiple scarecrows to cover your garden area
- Assess foot traffic and wind...
- Must maintain battery

## Mole heaven



[www.molehunters.com](http://www.molehunters.com)



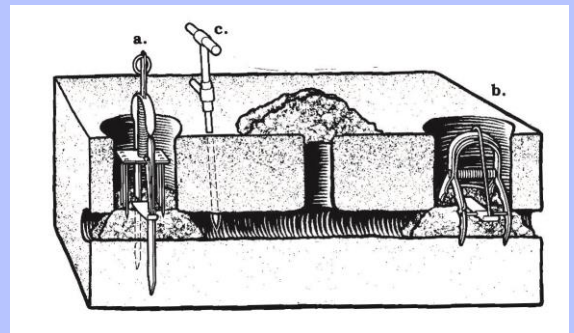
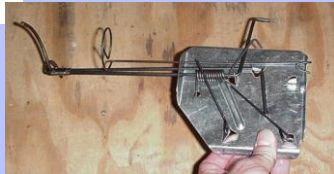
Moles are not rodents!!  
They have sharp, earthworm slashing teeth. They rarely eat plants.



Mole damage:  
Excessive aeration  
Mounds  
Access for voles



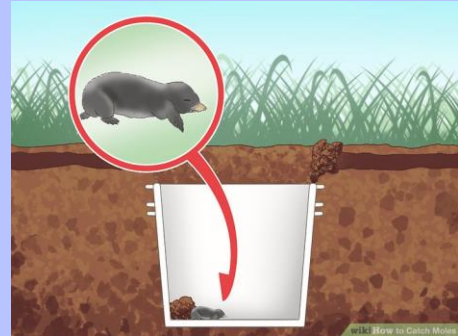
Trapping moles  
(don't try this  
in Washington?)







## Live trapping moles



## Baits for moles

- Inconsistent results in Oregon (western). Possible issues with distribution of various baits
- Some evidence that this bait formulation is more effective. Uses bromethalin in a worm-like base with an attractant. Follow all label placement instructions!!



## Mole Exclusion



Exclude with welded wire cloth with holes  $< 1/2$ " attached **under** solid-sided raised beds.

Both moles and gophers come onto soil surface so any barrier above the surface needs to be 6+ inches tall.

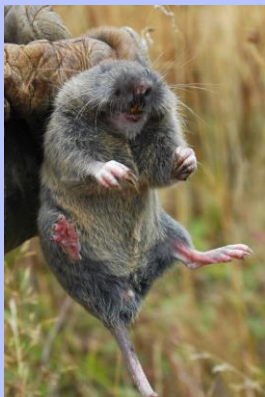
## Less (or non) effective mole controls

- Gassing/flooding (rarely)
- Gum (any flavor)
- Mole plant (Euphorbia)
- Sharp objects
- Cat feces ??? Human health issues
- Sonic devices

Photo: TNC



Shrew mole *Neurotrichus gibbsii* Photo: J. Regan



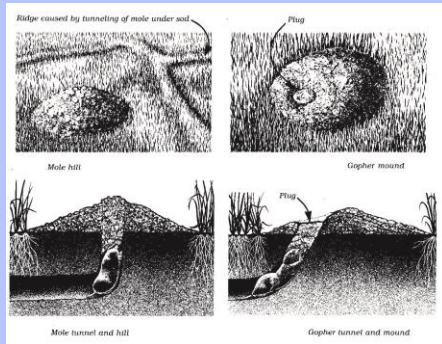
Pocket gophers



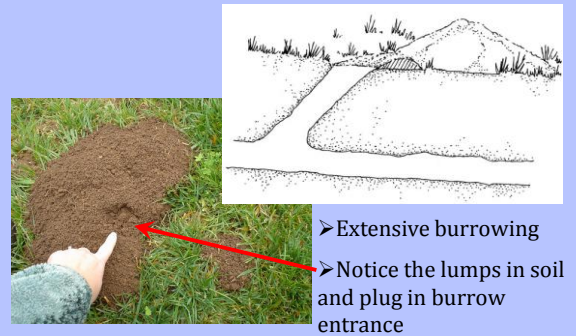
## Mole or Gopher mounds?



## Gopher vs mole



## Pocket gopher mounds



### Northern Pocket Gopher

- Burrowing rodent
- Herbivores that prefer roots, bulbs, tubers
- Does not hibernate
- Young born Feb. to June



Gophers are rodents-note teeth.

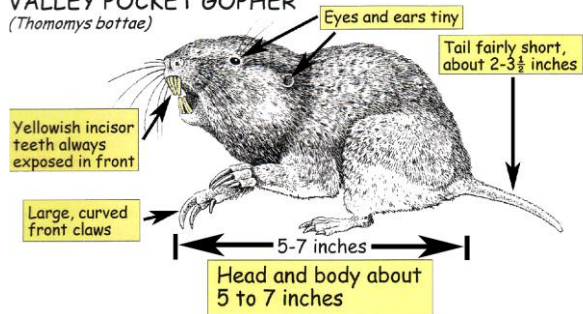
They eat plants! Also irrigation systems.

They are a pain.

Photo: Marinrose.org



## VALLEY POCKET GOPHER (*Thomomys bottae*)



## Gopher damage



Roots are chewed off. Gophers are vegetarians!!

Certain plants are favored and gophers may move down the rows.

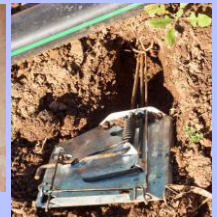
Will go through plastic irrigation pipe and T-tape.



## Gopher control



Cinch trap



Other controls:  
Gopher "gassers"  
Gopher baits



The **vole**, also known as the meadow mouse



## Vole facts

- Very high reproductive rate
- Field voles are not good climbers
- Move in tunnels they create or mole tunnels. Also active on the surface of the ground
- Average 25-100/acre but can exceed 1000-2000 in ideal conditions
- They don't hibernate and are active day and night



## Vole damage

- Gnawed roots and bark of trees 6-8" above the soil line or below the ground.
- Like Malus, Prunus, roses and Emerald Green Thuja
- Worse after periods of snow.
- Edges near fields worse.
- Rodent tooth marks often evident.



## Vole damage





## Vole management

- **Keep cover/vegetation down to aid predation**
- Issues with mulch and landscape fabrics
- Tillage to destroy tunnels
- Plant vulnerable species away from field edges.
- Traps
- Baits (not many labeled & last resort)



## First-generation Anticoagulants:

- Warfarin, diphacinone, chlorphacinine
- Less acutely toxic than 2nd gen+
- More rapidly metabolized and/or excreted
- Multiple feedings needed
- Baits directly toxic to non-target animals. Can be moved by mice to unsafe locations. **Any rodenticide label must cover intended use – i.e. garden and/or residential. Read and follow label instructions.**

## Bait stations

- Must keep non-target animals out. Pin down so it can't move. Dogs most at risk.
- Check often





### The non-anticoagulant rodenticides (2 different chemical classes):

- Bromethalin
- Cholecalciferol
- Lethal dose from a single feeding
- Less likely to be retained in body tissues, therefore lower secondary risks to birds and mammals than anticoagulants.
- **Read and follow all label instructions!**



### Vole predators



### Coyotes



Photos by John Rakestraw

### Coyotes in town

- Far more common than you might realize
- Good rodent control
- Pet problems
- Incredible capacity to stand injury and pain
- Exceptional sense of smell (and hearing and eyesight)
- Mostly nocturnal
- Varied diet





## Coyote management

- Lethal controls impossible to use in town
- Reduce prey base
- Disease takes some toll



Ground squirrel (aka "grey digger")



## Ground squirrels

- Prefer succulent vegetation and seeds. Will eat road-kill and insects
- Can eat roots
- **Live underground – don't come into houses**
- Tunnels and holes undermine construction
- Will climb and create damage like tree squirrels



## Ground squirrel management

- Reduce cover
- Bait (same cautions as for voles and gophers) plus problems with feeding locations.
- Trap
- Encourage predators



## Rabbits

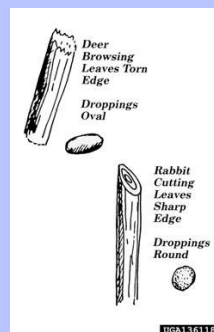
Includes jack rabbits, brush rabbits and feral domestic rabbits



## The Cannon Beach Bunnies



## Rabbit damage



## More rabbit damage



Photo: Tracy Ellis, UC IPM Program

## Still more rabbit damage



Photo: Tracy Ellis, UC IPM Program

## Rabbit biology

- Like dense cover – holes/burrows usually close to where you see them active
- Sort of territorial
- Prefer succulent vegetation. Eat a lot of “weeds”.
- Generally one litter per year



- **Cyclic populations.** Predators: Coyotes, bobcats, house cats, weasels, dogs, larger hawks and eagles, cougar, disease

## Slowing rabbits

- Repellents based on rotten egg mixes seem to work the best e.g. Deer Away and others.
- Fencing has to go fairly deep into the ground or “aproned out” out about 18”+ to work.



## Rabbit fencing

- Can be added to an existing deer fence as chicken wire or similar small opening wire fencing.
- Often trenched 18-24 inches down to prevent tunneling



## More rabbit fences



## A rabbit deterrent?



## Beaver





## Beaver damage



## Beaver management

- Plant trees they don't eat
- Protective wraps around trees
- Beaver on private property are now considered a nuisance rodent and can be removed without a permit.
- However, beaver create salmon smolt resting pools so work around them if at all possible.



## Mountain beaver aka "Boomers"

- Not beavers
- Native
- Like miners lettuce, sword fern, branches of young fir trees, and some ornamentals
- Burrows
- To me, interesting



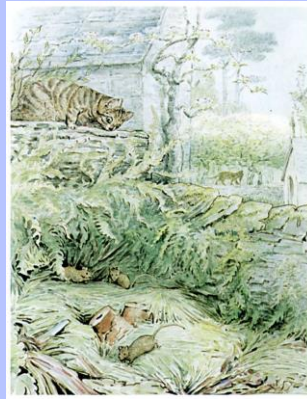
## Keeping animals out of homes and buildings, Plan A

- Prevent your house/structure from being a shelter opportunity
  - Plan blocking efforts with particular species in mind
- Do not provide food that "advertises" your place

## Keeping animals out of homes and buildings, Plan B

Once you have unwanted visitors –

- Evict
  - Physically trap & remove live animals
  - Drive out & Deter – Make your home unbearable to them
  - Lethal trap or poison
  - If seasonal visitors, wait until they (and their kids) leave
- Once clear, go back to Plan A to exclude



## Rats and house mice



Beatrix Potter

## European house mouse

- Native of India
- Followed agricultural spread to Mediterranean (8000 B.C.), Europe, North America, and rest of world
- Damage crops
- Spread disease
- Damage wiring -fires
- Cat domestication



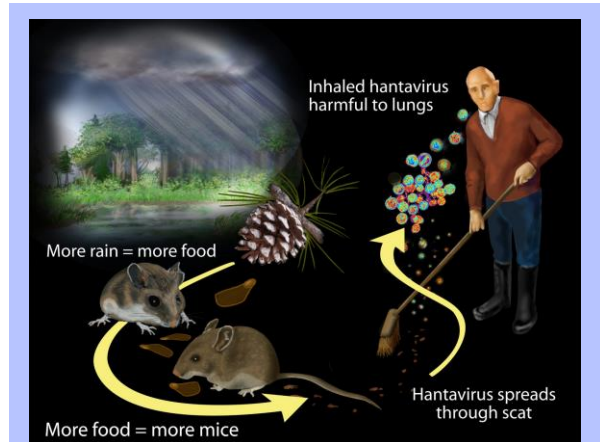
## House mouse

- Mature at about 6 weeks
- Can breed all year if warm
- Pheromones and ultrasonic communication
- Strong olfactory
- Fair climbers
- Use existing holes
- Don't like rats
- **Easy to trap**
- Exclusion!!



### Deer mouse (*Peromyscus maniculatus*)

- Very common in Oregon, especially in rural areas
- Similar behaviors to the house mouse
- **Vector of the hanta virus (inhaled viral particles from feces)**
- Easy to trap
- Exclusion



### Rat facts

- Major public health problem
- Vector a number of diseases
- Disrupt natural systems
- Direct injury by biting
- Damage to electrical wiring
- Very smart!



### Norway rat (*Rattus norvegicus*)

- Largest of our rats
- Most widely found mammal in the world
- Adapted to cooler climates: N. China origin
- Well-adapted to urban environments.
- Very smart!!!
- Omnivorous
- Disease vector



## More on Norway rats

- Not a great climber (in comparison to the roof rat)
- Ultrasonic calls
- Preferred foods: Mac & cheese, cooked corn, and scrambled eggs
- Least favorite foods: peaches, raw beets, raw celery
- 1.3 Norway rats/person in Great Britain

## Roof or black rat (*Rattus rattus*)

- May have been in prehistoric Europe, then disappeared in the Ice age.
- Thought to have originated in Southeast Asia
- Got to Italy via trade with India and/or Egypt



## More black rat biology

- Preference for fruits and nuts but are generalists
- A danger to nesting birds
- Disease vectors
- Preference for warmer areas or cities (West and SE)
- More rural than Norway rats
- Great climbers
- Very damaging in some native landscape

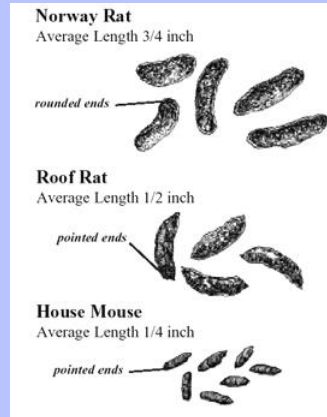
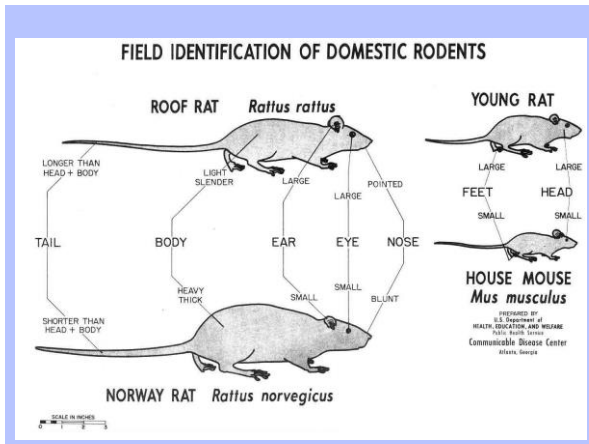


## Bushy-tailed woodrat (also known as the pack rat)

- Native species
- Normally nests in trees
- Will nest in houses and outbuildings
- Collects shiny objects and food from houses







## Rat Olympics

- Can get through .5 inch opening
- Climb inside of pipes 1.5-4 inches diameter
- Climb outside of pipes 3 inches or less
- Climb outside of any pipe if against a wall
- There's more.....

## More rat Olympics

- Jump vertically 36"
- Jump horizontally 48"
- Jump horizontally 8 feet if 15 feet up
- Drop 50 feet without injury
- Burrow > 4 feet
- Swim 1/2 mile
- Come up through pipes in houses

## Still more

- Somewhat odd eyesight (independent eye movement)
- Incredible sense of
  - Smell
  - Hearing
  - Touch
  - Balance



## Rat reproduction

- Mature in five weeks
- Peak breeding in spring and fall
- Estrus every three days until bred
- Generally 5-12 young
- Born 21-23 days after breeding
- No nursing estrus depression -which means she can rebreed within 3 days of giving birth



## It takes a village to raise some rats



## Rat holes

- Generally 2.5-3.0 inches
- May connect to a shallow runway system with multiple openings.



## Remove cover for rats

- Ivy
- Juniper
- Other “bulky” ground covers
- Debris piles
- Structures



## Rats+cover+food = trouble



## Rats/mice and compost



Compost pile with snakes as rodent control agents.

## Rat gnawing

- Can get behind cabinets or into interior walls to expand access to your house.
- Can get through some metal and wire given time. Still, metal and **steel wool** is a barrier to entrance.



## Rats and wiring

- Can be a major fire risk with electrical and cable connections
- Mice and squirrels also chew wiring



Exclusion is the best control (after you take away the food).

Mice can get through a hole the size of a penny.







## Rat trapping

- Have the body – no smell!
- Bait traps but don't set for several days. Then set all of them!
- Use lots of traps
- Some tie traps off with drilled holes in base, wire and eyebolts
- Rats are smart!!



### Bait issues:

Mice/rats die in wall or under house

Non-target injury

However, rats get trap shy and baits may need to be part of the solution.

Bait must be labeled for home use! Follow label instructions!!

## Bait stations



Douglas squirrel (aka Chickaree)  
Native



## Two squirrels: one is native



Western grey squirrel



Eastern grey squirrel

## Squirrel damage



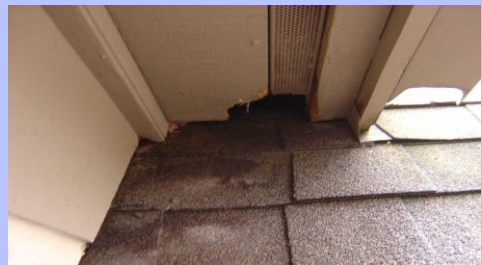
## More squirrel damage



## Ground squirrel damage



You don't want squirrels in a house for all the reasons you don't want rats: structural damage, wiring damage/fire, disease, and annoying noise.



## Raccoons

- Don't feed them!
- Very adapted to humans
- Nocturnal
- Vector diseases
  - Rabies
  - Balyascaris
  - Others
- Hurt pets
- Trash your house
- Dine from your garden, compost bin, hen house, or koi pond



## Raccoon management

- Remove feed
- Tighten foundation, pet doors, and other spaces with wire mesh
- Live trap?
- Motion detecting sprinklers
- Electric fencing??
- Ammonia soaked rags?



The timeline for production of raccoon juveniles OR: Why it pays to exclude and prevent occupation!

- Most young born March-June
- Weaning occurs 3-4 months of age
  - Juveniles may start moving out July-Sept



## Non-lethal removal

The basic live trap







## Why not just move them?

- Low survival
  - Intra-specific aggression
  - Vulnerable to predation
  - Homing behavior = risks
  - Likely to starve, do poorly
- Disrupt resident population of natives
- \*Moving non-native invasives
- Illegal in many cases
- Disease transmission
- Ethical issue of “moving the problem”

## Skunks

- Two species: spotted and striped
- Nocturnal
- Can be beneficial
- Management like raccoons:
  - Tighten structures
  - Food sources?
  - **Smell deterrents:** ammonia soaked rags, others?
  - Sprinklers
  - Live trapping??



## Excluding the diggers



Wire mesh dug at least 1.5 feet into ground

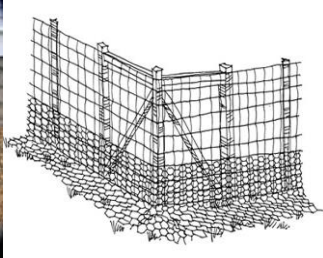
Create an apron bent at 90 degrees and facing outwards

## Skunk Exclusion

Skunks don't climb high fences



Seal off foundation openings



Use wire mesh fence around garden and bury 1-2 feet in ground

## Skunk odor removal

- 1 quart hydrogen peroxide
- 1/4 cup baking soda
- 1-2 teaspoons liquid dish soap

Work thoroughly into dog or cat fur and then rinse. Not useful on insulation. Removal the only option.



## Opossums

- Mainly nocturnal
- Not native to Oregon - moved from east of Rockies through California to Oregon by the early 1900's.
- Manage feed and cover
- Cyclic populations





## Nutria

- Vegetarians
- Destroy native aquatic species
- Compete with other mammals like muskrats
- Degrade water control structures like ponds and dikes



## Birds

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>• Starlings</li> <li>• House sparrows</li> <li>• Finches</li> <li>• Swallows</li> <li>• Pigeons and doves</li> <li>• Woodpeckers</li> </ul> | <ul style="list-style-type: none"> <li>• Concerns             <ul style="list-style-type: none"> <li>– Droppings from roosts/nests</li> <li>– Disease and external parasites</li> <li>– Structural damage</li> <li>– Fruit loss</li> <li>– Strange noises</li> </ul> </li> </ul> |
|--|--|





## Starlings

- Introduced to NYC in 1880's. Moved across N. America
- Colonial roosting
- Fruit eaters
- Huge dropping load if nesting in street trees
- Prey on native birds
- Management
  - Try to run them from roosts (send them to the next town)
  - Cover fruit w/ nets
  - Encourage predators
  - Reduce other food sources (hard to do)



## Bird Management Options

- Netting
- Propane cannons
- Bird alarms
- Repellents (no good ones, yet)









## Swallows

- Very beneficial - great mosquito control
- Droppings
- Build specific places for them to nest
- Migratory



## Crows and ravens

- Native and protected
- Very smart!
- Some predation of native songbird nests
- Eat corn and bean seed & seedlings
- Protect seeds with row covers
- Hazing not allowed



Pileated woodpecker



Sapsucker

## Bats

- Bats are in trouble from habitat loss and issues with a deadly fungus disease.
- Like warm spaces
- Migrate mid-Nov through early March
- Tighten houses
- Hard to repel
- Health concerns



As with rats and mice, exclusion is the best control

Bats next to chimney

Photo: [www.batguys.com](http://www.batguys.com)



## Bat Boxes

- Bat boxes need to be 11-12 feet or more above ground and placed in the warmest spot possible.

