Oregon State University Extension Service

ask Extension

THE VEXATION OF (CYCLING) VOLES

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https://ask2.extension.org/

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1

Ecological roles of burrowing animals

- Aid soil formation, aeration, and nutrient mixing
- Move nutrients from leach zone to root zone
- Aid water infiltration – reduces erosion
- Add soil nutrients, organic & inorganic matter
- Food for predator species
- Provide habitat for other species
- Promote fine- and landscape-scale vegetation and ecosystem diversity through eating some plant species and helping others compete
- Promote and enable animal biodiversity
- *Often play keystone roles as ecosystem engineers*

2

Core tactics on the human-wildlife interface

- Anticipate and manage to avoid/prevent a problem
  Accurate Species ID
- Modify habitat to reduce carrying capacity
  ↓ Food ↑ Predation/mortality
- Block entry/exclude
- Remove the animal(s)
- >>Coordinate with other humans!

3

Learning "who" we're dealing with

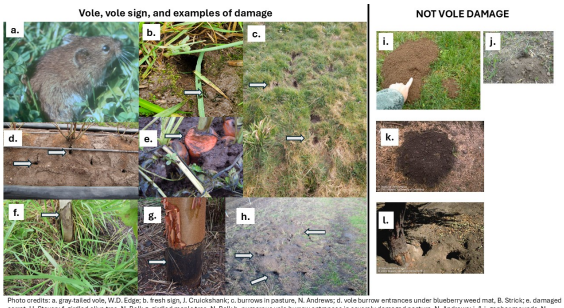


Photo credits: a. gray-tailed vole, W.D. Edge; b. fresh sign, J. Cruickshank; c. burrows in pasture, N. Andrews; d. vole burrow entrances under blueberry weed mat, B. Strick; e. damaged carrot, H. Stoven; f. girdled olive tree, N. Bell; g. girdled maple tree, N. Bell; h. numerous vole burrow entrances in severely damaged pasture, N. Andrews; i. & j. gopher mounds, N. Taylor; k. molehill, round with divot in middle, L.L. Strand for U.California; l. burrows of California ground squirrels, U. California.

4

Hantavirus: Know your rodents

Four kinds of rodents are known to carry hantavirus, according to the Centers for Disease Control and Prevention (CDC): the cotton rat, white-footed mouse, rice rat and deer mouse. Of those, **only the deer mouse is found in Washington state**. Three rodents common in Washington **do not** carry hantavirus and they are shown below for comparison.

The deer mouse prefers woodland and desert areas. It is smaller than some rodents in our area, such as the Norway rat. Its fur tends to be lighter in color than the house mouse, and unlike the house mouse, the deer mouse has two-toned fur with a white belly.

CAN CARRY HANTAVIRUSES

Deer mouse
Peromyscus maniculatus
Body size: 2 to 3 inches
Distinguishable from the house mouse by its two-toned fur and larger eyes and ears.

NOT KNOWN TO CARRY HANTAVIRUSES

House mouse
Mus musculus
Body size: 3 to 4 inches
Usually living closely with humans, this species of mouse has been domesticated and bred as pets.

Roof/black rat
Rattus rattus
Body size: 7 inches
These medium-sized blackish-to-brown rats live among humans. They are commonly found in the attic and rafters of buildings.

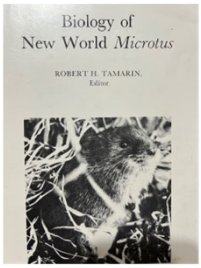
Norway/brown rat
Rattus norvegicus
Body size: 9.25 inches
Larger than the roof rat, these rats live at ground level in basements or burrows under sidewalks.

ources: Centers for Disease Control and Prevention; The Mammals of Texas EMILY M. ENG / THE SEATTLE TIMES

5

Voles in the Northern hemisphere

- Subfamily Arvicolinae
  - Subfamily includes lemmings, voles, & muskrats
  - Worldwide, >70 vole species
  - Diversity in diets, species ecology, natural history, habitats occupied
  - Some burrow, others don't
  - Active year-round
  - *Some noted for severe population cycles*



6

Across U.S., vole species commonly involved in conflicts

- Meadow (*Microtus pennsylvanicus*)
  - Vast geographic range
- Prairie (*Microtus ochrogaster)*
- Pine or woodland (*Microtus pinetorum)*
- California (*Microtus californicus*)

7

Voles in Oregon

- Oregon: 13 vole species

- Oregon's vole species range from tree-dwellers to fungi-eaters and include some which never build burrows, and a couple of which we know very little…
- But the gray-tailed vole is the Willamette Valley's *very own* endemic species…*& it cycles*

8

Voles east of the Cascades crest in Oregon, suspects implicated in agricultural conflicts

- Heather (*Phenacomys intermedius*)
  - Limited tunnels, diet from grasses to shrub bark
- Sagebrush (*Lemmiscus curtatus)*
  - Grasses & fungi in sagebrush areas – Uses other critters' burrows, possibly irruptive..?
- Long-tailed (*Microtus longicaudus)*
  - Broad diet; broad distribution; likely (?) cycles
- Montana (*Microtus montanus)*
  - Forbs & grasses (expands during peaks)
  - Burrows
  - known to cycle
    - e.g., 1957 S OR "mouse plague"

9

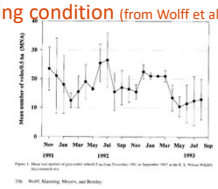
Vole populations fluctuate worldwide: Boom-bust-simmer across years…

Andreassen et al. 2021 Oecologia 195:601-622

Within-year opportunity?

% adult female gray-tailed voles in breeding condition (from Wolff et al. 1994)

- May-Oct: 78-92%
- Nov: 68%
- Dec: 18%
- **Jan-Feb: 0%**
- Mar: 38%



10

Gray-tailed vole

- Short lifespan: 2 to 16 months, but high reproductive potential (Mar-Oct/Nov/Dec?) Wolff et al. 1994
- Many litters/year; 3 weeks to mature! Mean litter size 4.4 +/- 1.4 individuals
- (In)famous for achieving near-exponential population growth in some years

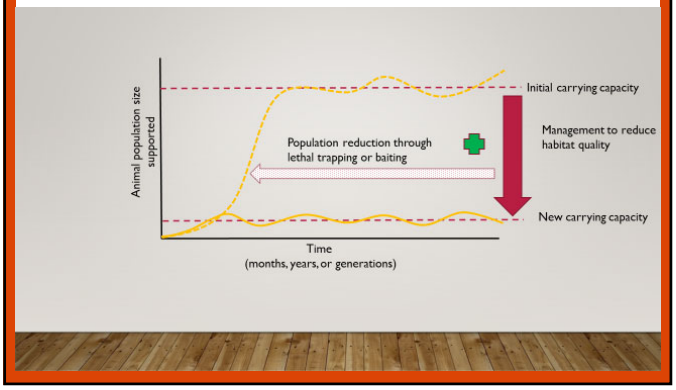
11

Core tactics on the human-wildlife interface

- Anticipate and manage to avoid/prevent a problem
  - *Accurate Species ID*
- Modify habitat to reduce carrying capacity
  - ↓ Food ↑ Predation/mortality
- Block entry/exclude
- Remove the animal(s)
- >>Coordinate with other humans!

12

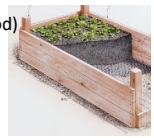
Reducing carrying capacity: Typically a vital part of breaking a conflict cycle



13

Reducing via reducing food or via exclusion/blocking the damage:

- Native plants
- Remove subsidies (e.g., bird food)
- Block access, where feasible

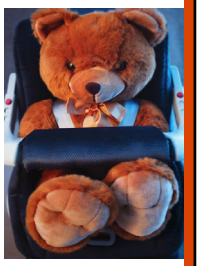





14

Reducing populations: Why not just move them?

- Low survival
  - Intra-specific aggression
  - Vulnerable to predation
  - Homing behavior = risks along the way
  - Likely to starve, do poorly
  - Humans unlikely to select sites that = habitat
- Disrupt resident population
- **Illegal in most cases**
- Disease transmission
- Ethical issue of "moving the problem"
- **>>>Increases immigration into the newly-opened opportunity!**



15

Reducing populations via lethal removal

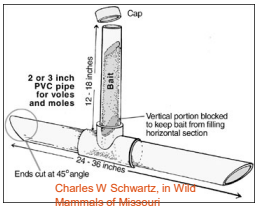
Species ecology informs:

- Trap* selection
- Trap placement
- To bait or not to bait
- When to trap
  - Minding annual, seasonal, environmental conditions

*Trapping is not legal in all states

16

- Flood irrigation*
- Crop rotation
- Burning/remove cover
- Traps*
- Toxicants/rodenticides*
  - Retail
  - Restricted use
- Natural predation*



Charles W Schwartz, in Wild Mammals of Missouri

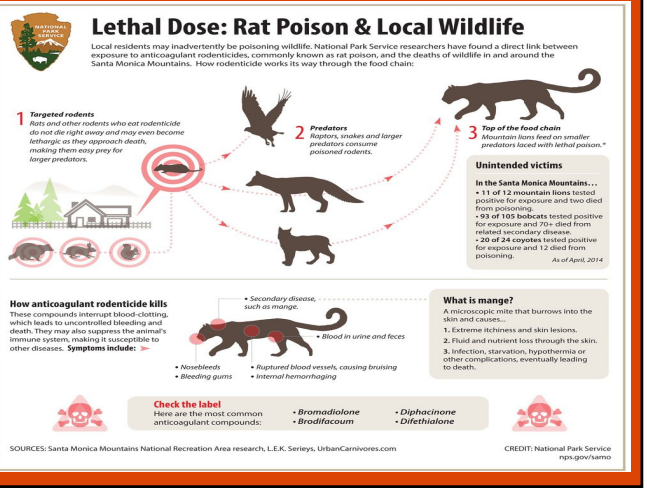
17

Toxicants as tools to lethally reduce population

READ THE LABEL. FOLLOW THE LABEL. LABEL IS THE LAW.

- Responsibility to prevent non-target kills – including humans
- Retail (on the shelf) products vs. Restricted use products
- Keep in mind secondary and non-target impacts of toxicants
- **Like traps, chemicals have no knowledge of what has encountered them**.
  - Improper application of zinc phosphide bait for voles kills 1000s to >10,000 geese per event – Usually 1-2 events per year in OR

18



19

Natural predators include the quiet ground force: Snakes

- Rubber boa
- Gopher snake
- Western terrestrial garden snake (2 subspecies)
- Northwestern garter snake
- Common garter snake
- Western rattlesnake

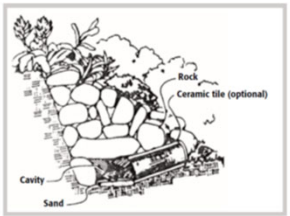


Figure 1. Example for constructing a rock pile.
(From: *Landscaping for Wildlife in the Pacific Northwest*, University of Washington Press and Washington Department of Wildlife.)

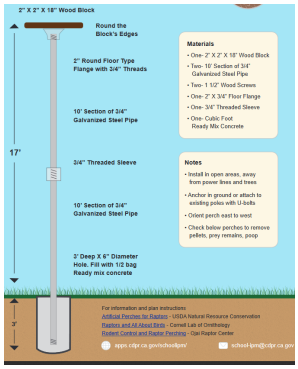
20

More predators: The air force(s)

- Diurnal
  - Great blue herons
  - Red-shouldered hawk (wooded wetlands & **perches**)
  - Red-tailed hawk (open country, primarily mammals; soars and perches)
  - White-tailed kite (winter; rodents; hover "kite")
  - Rough-legged hawk (non-breeding range; voles, mice, shrews; hovers & **perches**)
  - American kestrel (mostly inverts but some small rodents; **perches**)
  - {Cooper's hawk will take some mammals)
  - {prairie falcon}
- Nocturnal (many owls are cavity nesters)
  - Barn owl (open areas, nocturnal mammal hunter; cavity and box nester)
  - Short-eared owls (all hours, favor dusk & dawn; rodents; *ground-nesters)
  - Western screech owl (nocturnal, open woodlands, mammals, cavity + some box)
  - Great horned owl (generally nocturnal, up to treeline, mammals)

21

Habitat additions for perching raptors



https://nestwatch.org/learn/all-about-birdhouses/

22

Common mammalian predators, in brief

- coyote — Ubiquitous & omnivorous
- bobcat — Widespread, less in highly cultivated; pure carnivores
- red fox — Many habitat types; *lots of voles*,
- grey fox — Brushy, "old fields" some urban; seasonal omnivory
- weasels — Predominantly carnivorous
- spotted skunks — Likely heavily depend on rodents in winter
- raccoon — Ubiquitous & omnivorous

23

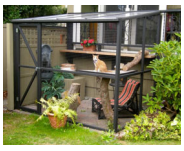
Cats on "rat patrol"? Not so fast.

- Cats directly cause or significantly contributed to 14% of recent extinctions on island ecosystems (mammals, reptiles, birds)
- In the contiguous U.S., cats kill 1.3-4.0 Billion birds annually.

Loss S.R. et al. The impact of free-ranging domestic cats on wildlife of the United States. Nat. Commun. 4:1396 doi: 10.1038/ncomms2380 (2012).

Humane Solutions for cats to "experience the wild"

- https://abcbirds.org/program/cats-indoors/
- https://abcbirds.org/catio-solutions-cats/

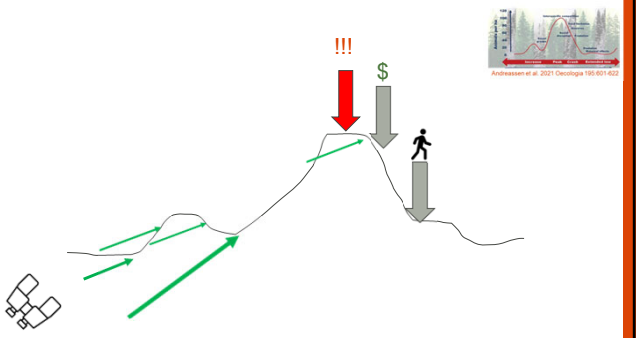


24

Pursuing management horizons

25

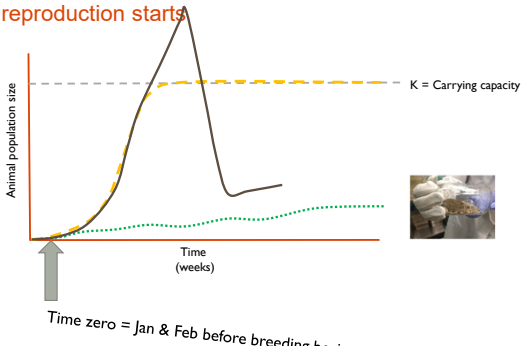
Tricky (human) parts of researching cyclic critters in order to discover keys to management



26

Strategy: Remove potential breeders when

1. Population is low
2. Before reproduction starts

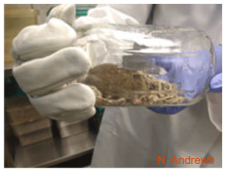


Time zero = Jan & Feb before breeding begins in earnest

27

Strategy: Reduce population at its lowest point to reduce number of breeders, thereby limiting the population's reproductive capacity

- Challenge – Few animals out there >> Harder to locate and trap "rarities"
- Challenge – Thousands of holes, but which have voles RIGHT NOW?
- Opportunity - Use dogs to locate those few active holes WITH animals near them RIGHT NOW & maximize trapping efficiency



28

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WESTERN SARE Sustainable Agriculture Research & Education

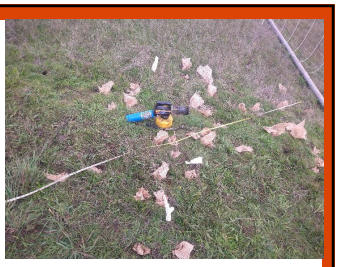
CANINE-ASSISTANCE TO INCREASE VOLE-TRAPPING EFFICIENCY AND EFFECTIVENESS

Dr. Dana Sanchez, co-PI

With
Co-PI Mr. Nick Andrews
Co-I Dr. Jenifer Cruickshank
Dr. Nik Wiman
Mr. Tim Stock

Oregon State University

29

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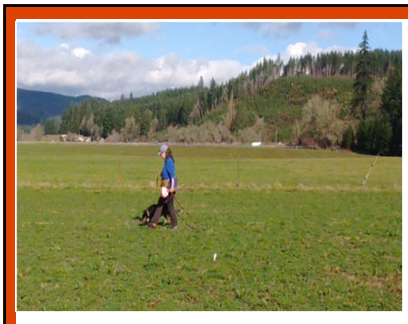


Dr. Susie Dunham and Reacher

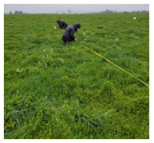
Canine assistance to increase efficiency and effectiveness of vole-trapping 2021-2024

- 2021 Initiation, then Leptospirosis
- 2022 Late (!), short pilot season
- 2023 Popn crash:
  - Trap **success**: vole/trap: 0.03 (dog) vs 0.05 (human)
  - Trap **efficiency**: voles/min searched 0.11 (dog) vs. 0.05 (human)
  - **Search time, total** all season:
    593 min (2141 traps)
    vs. 1207 min (1276 traps)
- 2024: trapped vs untrapped: biomass analysis inprogress

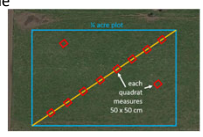
OSU Project team: N. Andrews, D. Sanchez, J. Cruickshank, N. Wiman, T. Stock
Lepto Landscape collaborators: B. Beechler, DVM and K. Hayes, OSU Vet School

31

Last chapter of the canine project:



- 2024: Biomass comparison: trapped vs untrapped
  - Pre- trap, immediately post-trap, peak growing in June



- Main conclusions:
  - Dogs rule
    - Less search time
    - Greater kill/search minute
  - Work yet to be done
    - Variations in vole behavior
      - Weather? Vulnerability/anti-predator behavior?
      - Population phase?
    - Much to learn about behavior/movement of in-burrow scent
  - Question of feasibility vs. impacts yet remain

32

33

Vole patrol:
First steps to an early warning system

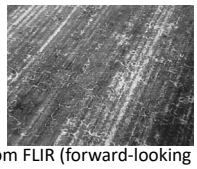
Predict an impending "big year"

- Estimate abundance/rate of increase indicating an irruptive event
- Counting voles up till now $$$:
  - Need something fast, relatively cheap, with regional relevance
- Tricky parts (there are many)

34

Vole patrol:
Non-invasive methods, competing candidates

- Develop genetic markers
  - ➢mtDNA to ID vole species
  - ➢Can we ID INDIVIDUAL voles?
    - ❑*Allow population estimation?*
    - ❑*Can we count voles with scat?*



- Estimate from FLIR (forward-looking infrared)
  - Drone- vs. truck-mounted
  - Determine optimal conditions/seasons/moon/weather
  - Develop and test estimates from counts
  - Test estimating power across growth stages

- Many thanks to Dr. Christy Tanner and new collaborator, Dr. Josh Twining
  - Additional thanks, Laurence Schafer, USDA-APHIS

35

Meadowfoam moat:
Prospecting for a barrier crop

- Awaiting its opportunity, 2025
  - Effective width?
  - Add mint option?
  - Inter-crop option for some crops?

36

Earliest days…

➢**Seed saber**: Use behavior to inform targeted repellents

➢First ask, 2024: Can we catch one in the act???

➢**Moonshot**: Prospect for glandular hormones to reduce repro

➢Collect fresh brains for cell extraction & immortalization

➢Collecting animals in 2025

37

Building capacity to achieve the big goals and expand our focus

- Dr. Josh Twining, international mammalogist & premier population modeler;
  - Focus: system-wide sensing from plants to predators (including humans)
- Dr. Christy Tanner, agronomist already involved in finding new sensing and chemical solutions

38

Do you farm in the Willamette Valley? You can get involved!

- If you are a grower or producer in the Willamette, tell us about your experiences with vole damage in this survey! (Follow link or scan QR code)

https://myopinion.oregonstate.edu/voles

- Have your voice heard! Sign up to join the **Willamette Vole Management working group** – email: joshua.twining@oregonstate.edu

OSU Extension Service

39

Let's build a multi-state vole working group in the U.S.

- Similar groups:
  - National mouse group (Australia)
  - Working Group, Common Vole Management (Germany)
  - FREDON network for vole management (France)

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40