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Voles

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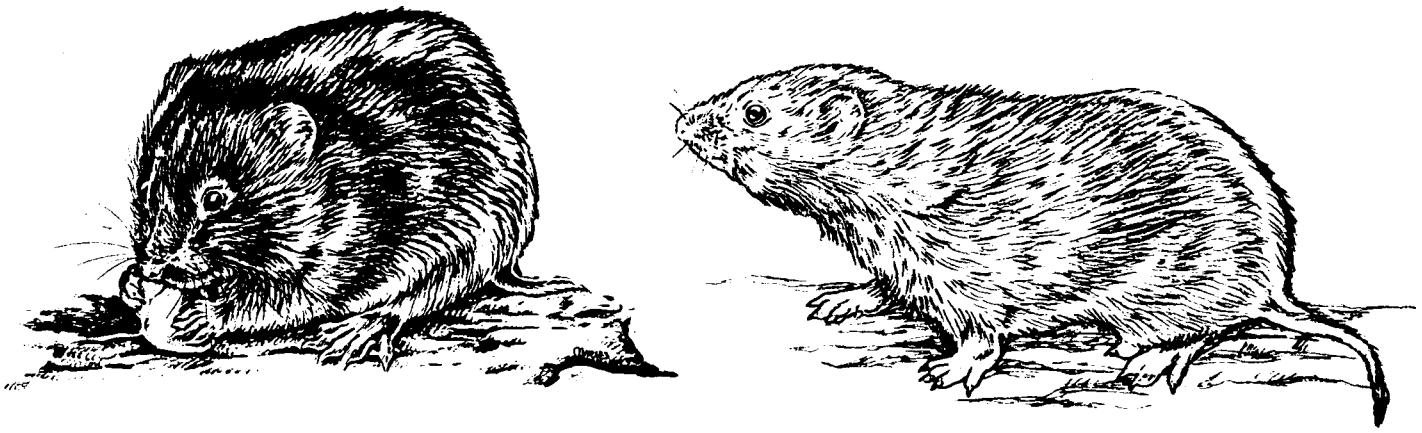
VOLES

Fig. 1. Pine vole, *Microtus pinetorum* (left), and prairie vole, *M. ochrogaster* (right).



Damage Prevention and Control Methods

Exclusion

Recommended to protect trees, ornamental plants, and small areas.

Habitat Modification

Eliminating ground cover reduces populations.

Soil cultivation destroys burrows and reduces cover.

Frightening

Not effective.

Repellents

Effectiveness uncertain.

Toxicants

Zinc phosphide.

Anticoagulants (registered in most states).

Fumigants

Not usually effective.

Trapping

Mouse snap traps.

Live traps (Sherman or box-type traps).

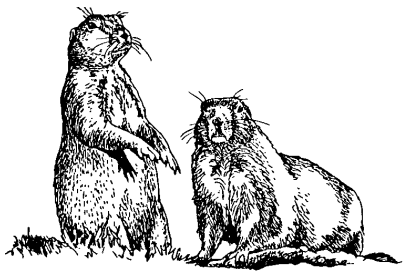
Shooting

Not practical or effective.

Identification

Voles, also called meadow mice or field mice, belong to the genus *Microtus.* Voles are compact rodents with stocky bodies, short legs, and short tails. Their eyes are small and their ears partially hidden. Their underfur is generally dense and covered with thicker, longer guard hairs. They usually are brown or gray, though many color variations exist.

There are 23 vole species in the United States. This chapter provides range maps, descriptions, and habitat characteristics for seven species that are widespread or cause significant economic damage. Tentative identification of a particular animal may be made using this information. For positive identification, use a field guide or contact an expert.



PREVENTION AND CONTROL OF WILDLIFE DAMAGE — 1994

Cooperative Extension Division
Institute of Agriculture and Natural Resources
University of Nebraska - Lincoln

United States Department of Agriculture
Animal and Plant Health Inspection Service
Animal Damage Control

Great Plains Agricultural Council
Wildlife Committee

B-177

Prairie Vole (*Microtus ochrogaster*). The prairie vole is 5 to 7 inches (13 to 18 cm) in total length (nose to tip of tail). Its fur is gray to dark brown and mixed with gray, yellow, or hazel-tipped hairs, giving it a "peppery" appearance. Underparts are gray to yellow-gray. It is the most common vole in prairie habitats.

Meadow Vole (*M. pennsylvanicus*). The meadow vole is the most widely distributed *Microtus* species in the United States. Its total length is 5 1/2 to 7 1/2 inches (14 to 19 cm) and its fur is gray to yellow-brown, obscured by black-tipped hairs. Northern subspecies may also have some red in their fur. Its underparts are gray, at times washed with silver or buff. The tail is bicolored.

Long-tailed Vole (*M. longicaudus*). The long-tailed vole can be distinguished from other *Microtus* species by its tail, which comprises 30% or more of its total length of 6 to 8 1/2 inches (15 to 21 cm). The long-tailed vole has gray to dark brown fur with many black-tipped hairs. The underparts are gray mixed with some white or yellow. The tail is indistinctly to sharply bicolored.

Pine or Woodland Vole (*M. pinetorum*). The pine vole is a small vole. Its total length is 4 to 6 inches (10 to 15 cm). Its brown fur is soft and dense. The underparts are gray mixed with some yellow to cinnamon. The tail is barely bicolored or unicolored.

Montane (or Mountain) Vole (*M. montanus*). The montane vole is 5 1/2 to 8 1/2 inches (15 to 20 cm) in total length. Its fur is brown, washed with gray or yellow, and mixed with some black-tipped hairs. Its feet are usually silver-gray and its body underparts are whitish. The tail is bicolored.

Oregon Vole (*M. oregoni*). The Oregon vole is 5 1/2 to 6 1/2 inches (14 to 16 cm) in length. Its fur is gray to brown or yellow-brown. Underparts are darkish, washed with yellow to white. The tail is indistinctly bicolored.

California Vole (*M. californicus*). The California vole is 6 to 8 1/2 inches (15 to 20 cm) in total length. Its fur is tawny olive to cinnamon brown with brown to black overhairs. The underparts are grayish. The tail is bicolored.

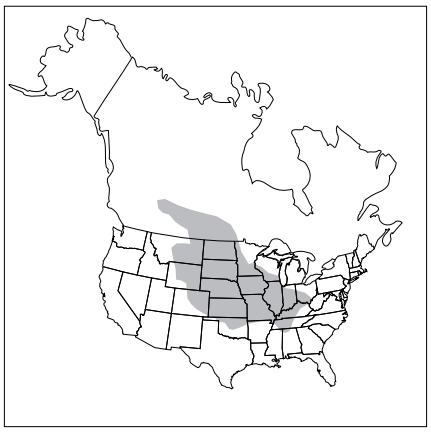


Fig. 2. Distribution of the prairie vole in North America.

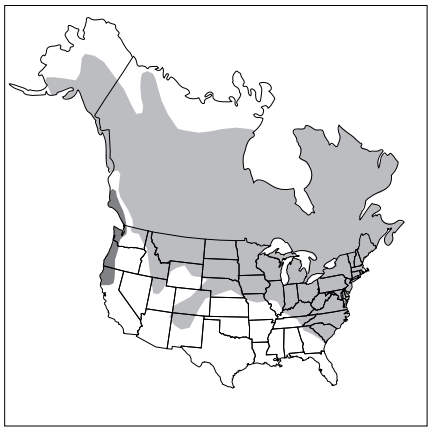


Fig. 3. Distribution of the meadow (light) and California voles (dark) in North America.

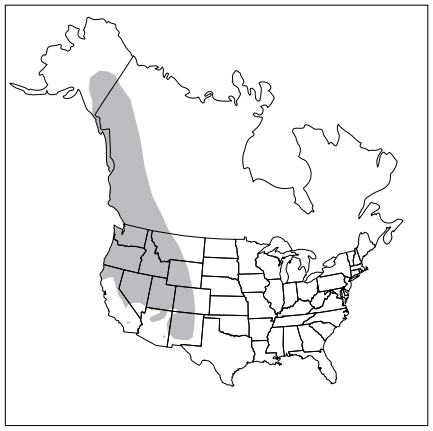


Fig. 4. Distribution of the long-tailed vole in North America.

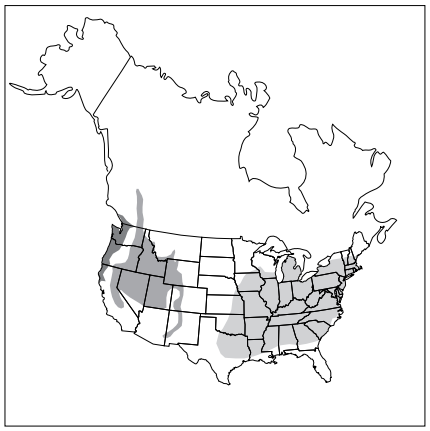


Fig. 5. Distribution of the pine (light), montane (medium), and Oregon voles (dark) in North America.

Range

Figures 2, 3, 4, and 5 show the approximate ranges of these species.

Habitat

Voles occupy a wide variety of habitats. They prefer areas with heavy ground cover of grasses, grasslike plants, or litter. When two species are found together in an area, they usually occupy different habitats. Though voles evolved in "natural" habitats, they also use habitats modified by humans, such as orchards, windbreaks, and cultivated fields, especially when vole populations are high. Characteristic habitat descriptions for the seven described species follow.

Prairie Vole. The prairie vole, as the name suggests, is the most common vole of the Great Plains grasslands. It is found in a variety of habitats, such as old fields, marshlands, and grass prairies. When in association with the meadow vole, it is generally in drier habitats.

Meadow Vole. The meadow vole is found in the northern United States and Canada. It prefers wet meadows and grassland habitats. When in association with the montane vole or prairie vole, it is generally in moister habitats.

Long-tailed Vole. The long-tailed vole is found in a wide variety of habitats (for example, sagebrush grasslands, forests, mountain meadows, and stream banks) in the western United States and Canada.

Pine Vole. The pine vole is found in the eastern United States. It inhabits a variety of habitats such as deciduous and pine forests, abandoned fields, and orchards. Heavy ground cover is characteristic of these habitats.

Montane Vole. The montane vole is found primarily in mountainous regions of the western United States. It is found in alpine meadows, dry grasslands, and sagebrush grasslands. It avoids forests. When in association with the meadow vole, it is generally in drier habitats.

Oregon Vole. The Oregon vole is most often found in forested areas of northern California, Oregon, and Washington where there is an understory of forbs and grasses such as in burned or clear-cut areas.

California Vole. The California vole inhabits the chaparral woodland shrubland of California. It is found in both wet and well-drained areas.

Food Habits

Voles eat a wide variety of plants, most frequently grasses and forbs. In late summer and fall, they store seeds, tubers, bulbs, and rhizomes. They eat bark at times, primarily in fall and winter, and will eat crops, especially when their populations are high. Occasional food items include snails, insects, and animal remains.

General Biology, Reproduction, and Behavior

Voles are active day and night, year-round. They do not hibernate. Home range is usually 1/4 acre (0.1 ha) or less but varies with season, population density, habitat, food supply, and other factors. Voles are semifossorial and construct many tunnels and surface runways with numerous burrow entrances. A single burrow system may contain several adults and young.

Voles may breed throughout the year, but most commonly in spring and summer. In the field, they have 1 to 5 litters per year. They have produced up to 17 litters per year in a laboratory. Litter sizes range from 1 to 11, but usually average 3 to 6. The gestation period is about 21 days. Young are weaned by the time they are 21 days old, and females mature in 35 to 40 days. Lifespans are short, probably ranging from 2 to 16 months. In one population, there was 88% mortality during the first month of life.

Large population fluctuations are characteristic of voles. Population levels generally peak every 2 to 5 years; however, these cycles are not predictable. Occasionally during population irruptions, extremely high vole densities are reached. Dispersal, food quality, climate, predation, physiological stress, and genetics have been shown to influence population levels. Other factors probably also play a part.

Population densities are variable. Smolen and Keller (1987) list densities of long-tailed vole populations. A California population ranged from about 2 to 7 voles per acre (5 to 16/ha) and a New Mexico population ranged from around 8 to 49 voles per acre (20 to 121/ha). Cole and Batzli (1979) found that prairie vole populations averaged 15 per acre (38/ha) in prairie, 52 per acre (128/ha) in bluegrass, and 99 per acre (244/ha) in alfalfa. Another vole population ranged from 1 to 14 per acre (2 to 35/ha) over 3 years in western mixed prairie. Variability in meadow vole population density was reported by Taitt and Krebs (1985). An Ontario, Canada population ranged from 32 to 162 per acre (80 to 400/ha) over 1 year while an Illinois population ranged from 2 to 6 per acre (5 to 15/ha) also over 1 year. Other populations show similar year-to-year variability. Much higher densities may be reached during population irruptions. In Klamath Basin, Oregon, montane vole densities ranged from 200 to 500 per acre (500 to 1,250/ha) and may have reached 4,000 per acre (10,000/ha) in some instances during a 1957 to 1958 irruption.

Many voles are excellent swimmers. The water vole, in fact, escapes predators by swimming and diving. The climbing ability of voles varies. The long-tailed vole, for example, is a good climber (Johnson and Johnson 1982) while the pine vole is a bit clumsy in this regard.

Voles are prey for many predators (for example, coyotes, snakes, hawks, owls, and weasels); however, predators do not normally control vole populations.

Damage and Damage Identification

Voles may cause extensive damage to orchards, ornamentals, and tree plantings due to their girdling of seedlings and mature trees. Girdling damage usually occurs in fall and winter. Field crops (for example, alfalfa, clover, grain, potatoes, and sugar beets) may be damaged or completely destroyed by voles. Voles eat crops and also damage them when they build extensive runway and tunnel systems. These systems interfere with crop irrigation by displacing water and causing levees and checks to wash out. Voles also can ruin lawns, golf courses, and ground covers.

Girdling and gnaw marks alone are not necessarily indicative of the presence of voles, since other animals, such as rabbits, may cause similar damage. Vole girdling can be differentiated from girdling by other animals by the non-uniform gnaw marks. They occur at various angles and in irregular patches. Marks are about 1/8 inch (0.3 cm) wide, 3/8 inch (1.0 cm) long, and 1/16 inch (0.2 cm) or more deep. Rabbit gnaw marks are larger and not distinct. Rabbits neatly clip branches with oblique clean cuts. Examine girdling damage and accompanying signs (feces, tracks, and burrow systems) to identify the animal causing the damage.

The most easily identifiable sign of voles is an extensive surface runway system with numerous burrow

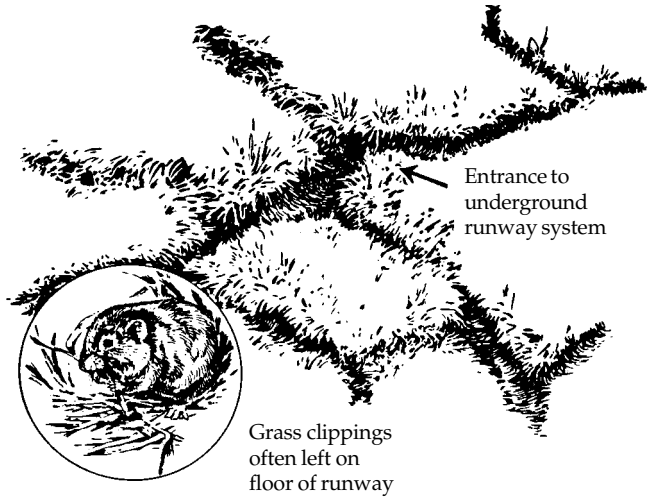


Fig. 6. Surface runway system of the prairie vole.

opening (Fig. 6). Runways are 1 to 2 inches (2.5 to 5 cm) in width. Vegetation near well-traveled runways may be clipped close to the ground. Feces and small pieces of vegetation are found in the runways.

The pine vole does not use surface runways. It builds an extensive system of underground tunnels. The surface runways of long-tailed voles are not as extensive as those of most other voles.

Voles pose no major public health hazard because of their infrequent contact with humans; however, they are capable of carrying disease organisms, such as plague (*Yersinia pestis*) and tularemia (*Francisilla tularensis*). Be careful and use protective clothing when handling voles.

Legal Status

Voles are classified as nongame mammals and can be controlled when causing damage. Contact your local state wildlife agency for details regarding applicable codes and regulations.

Damage Prevention and Control Methods

Exclusion

Hardware cloth cylinders exclude voles from seedlings and young trees. The mesh should be 1/4 inch (0.6 cm) or less in size. Bury the wire 6 inches (15 cm) to keep voles from burrowing under the cylinder. Large scale fencing of areas is probably not cost-effective. Drift fences with pit traps may be used to monitor populations and can indicate when voles are immigrating to crops, orchards, or other cultivated areas.

Cultural Methods and Habitat Modification

Cultural and habitat modification practices can reduce the likelihood and severity of vole damage. Eliminate weeds, ground cover, and litter in and around crops, lawns, and cultivated areas to reduce the capacity of these areas to support voles. Lawn and turf should be mowed regularly. Mulch should be cleared 3 feet (1 m) or more from the bases of trees.

Voles can live in dense populations in ditch banks, rights-of-way, and water ways that are unmanaged. Adjacent crop fields can be cost-effectively protected by controlling vegetation through mowing, spraying, or grazing.

Soil tillage is effective in reducing vole damage as it removes cover, destroys existing runway-burrow systems and kills some voles outright. Because of tillage, annual crops tend to have lower vole population levels than perennial crops. Voles are nevertheless capable of invading and damaging annual crops, especially those that provide them with cover for extended periods of time.

Frightening

Frightening agents are not effective in reducing vole damage.

Repellents

Repellents utilizing thiram (also a fungicide) or capsaicin (the "hot" in chilis) as an active ingredient are registered for meadow voles (see **Supplies and Materials**). These products (or repellents registered for other species) may afford short-term protection, but this has not been demonstrated. Check with your state pesticide regulatory agency for availability.

Toxicants

Zinc phosphide is the most commonly used toxicant for vole control. It is a single-dose toxicant available in pelleted and grain bait formulations and as a concentrate. Zinc phosphide baits generally are broadcast at rates of 6 to 10 pounds per acre (7 to 11 kg/ha), or are placed by hand in runways and burrow openings. Although prebaiting (application of similar nontreated bait prior to applying toxic bait) is not usually needed to obtain good control, it may be required in some situations, such as when a population has been baited several times and bait shyness has developed. Zinc phosphide baits are potentially hazardous to ground-feeding birds, especially waterfowl. Placing bait into burrow openings may reduce this hazard.

Anticoagulant baits are also effective in controlling voles. Anticoagulants are slow-acting toxicants requiring from 5 to 15 days to take effect. Multiple feedings are needed for most anticoagulants to be effective. In many states, one or more anticoagulant baits are registered for controlling voles.

In addition to broadcast and hand placement, anticoagulant baits also can be placed in various types of bait containers (Byers and Merson 1982, Radvanyi 1980). Water repellent paper tubes with an anticoagulant bait glued to the inside surface make effective, disposable bait containers. Tube size is about 5 inches (12 cm) long by 1 1/2 inches (4 cm) in diameter (Libby and Abrams 1966, Marsh et al. 1967). Bait

containers protect bait from moisture and reduce the likelihood of nontarget animals and small children consuming bait.

Fumigants

Fumigants usually are not effective because the complexity and shallowness of vole burrow systems allow the fumigant to escape. They may work in new, small burrow systems with only one or two entrances.

Trapping

Trapping is not effective in controlling large vole populations because time and labor costs are prohibitive. Mouse snap traps can be used to control a small population by placing the trap perpendicular to the runway with the trigger end in the runway. A peanut butter-oatmeal mixture or apple slices make good baits. Fall and late winter are periods when many vole species are easiest to trap.

Although voles rarely invade houses, in the event that they do, they can be controlled by setting snap traps or live traps (Sherman or box-type) as you would for house mice (see Trapping in the **House Mice** chapter).

Shooting

Shooting is not practical or effective in controlling voles.

Other Methods

A wide variety of predators feed on voles. Voles are relatively easy for most predators to catch and are active, and therefore available, day and night year-round. Despite their vulnerability and availability, voles are not usually "controlled" by predators. This is because voles have a high reproductive potential. Postpartum breeding is common and females may breed as early as 2 weeks of age. Synchronous breeding also occurs. These factors enable voles to increase at a faster rate than predators (Pearson 1985).

Economics of Damage and Control

Jameson (1958) calculated that 100 meadow voles per acre destroyed about 4% of an alfalfa crop, which amounted to about 1,000 pounds per acre (1,136 kg/ha) over 7 months.

Populations of 1,700 voles per acre (4,250 voles/ha) in Washington State apple orchards decreased production by 35%. This amounted to a loss of $3,036 per acre ($7,590/ha) due to reduced fruit quality and quantity. One year after eliminating voles, the production in the orchard increased but was still below the production of orchards that had not incurred vole damage. Total losses for the 2-year period were estimated at $6,100 per acre ($15,250/ha) (Askham 1988). Similar apple orchard loss figures were calculated for pine voles in New York. Known densities of voles (0, 109, 218, and 436 per acre [0, 273, 545, and 1,090/ha]) were stocked in fenced blocks of McIntosh trees for 2 years. There was little impact the first year. The second year, the highest vole population reduced fruit yield 65.5% and increased undersized fruit from 3.1% to 57.5%. These factors caused a $2,745 per acre ($6,863/ha) reduction in income. In addition, survival of the trees through a third year was considered unlikely. The worst vole outbreak in the United States probably occurred in Nevada in 1908 and 1909. Ten thousand acres (400 ha) of alfalfa were completely destroyed. Vole populations were estimated at 25,000 per acre (62,500/ha).

Often a control program may not appear to be justified in comparison to the damage being incurred. It should be remembered, however, that the "ounce of prevention" rule frequently applies in vertebrate pest control. Preventive control measures that at first appear too costly may eventually prove to be a bargain.

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Figures 1 and 5 from Schwartz and Schwartz (1981).

Figures 2 through 4 adapted from Johnson and Johnson (1982) by Dave Thornhill, University of Nebraska-Lincoln.

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