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An Evaluation of Burrow Destruction As a Ground Squirrel Control Method

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Several researchers have suggested that the presence of burrows is a limiting factor for ground squirrel populations and that the destruction of these burrow systems can reduce the rate of reinvasion following control. However, no one has yet tested the potential value of burrow destruction as a control method.

In April, 1983, a population of California ground squirrels (Spermophilus beecheyi) was trapped and removed from a 6.5 acre (2.6 ha) area on the U. C. Davis campus. On a part of the plot from which one-half of the squirrels (70) were removed, all burrow openings (189) were destroyed by digging down to a depth of 1 foot (0.3 m). The other portion of the plot was left intact and served as a control. Reinvasion was monitored from May to September by trapping, marking, and releasing squirrels; all burrow systems were mapped as they were re-opened.

Reinvasion and population growth on the 2 halves of the study plot were nearly identical. At the end of the study, slightly more than the original number of burrows were re-opened, and the rates of growth for both populations were nearly identical; there were 32 squirrels in the burrow-destruction population and 28 in the control population. Observations on the treatment plot and the mapped distribution of opened burrows in September indicated that ground squirrels mainly opened old systems instead of digging new ones. It was concluded that burrow destruction was not an effective control method under the conditions of this study.
Gray squirrel (*Sciurus carolinensis*) damage to roofs is becoming a major concern to homeowners especially with the steadily increasing construction of houses with wood shingles. Besides causing roof damage (rain leaks), electrical wires are often gnawed. The gray squirrel is finding excellent nesting area's in attics and overhang voids.

Bird feeders and dog leash laws also contribute to squirrel population increasing almost unchecked. During the past 5 years, calls from homeowners have been increasing on squirrel damage to homes.

In an attempt to control squirrel damage, the following procedure has been developed. Some of the steps may be familiar to the average squirrel fighter, but the sequence of steps as well as the importance of each is the secret to success. To date, this method has been 100% successful when followed exactly as given:

1) Trap, or by some other means, remove all squirrels living in the house or attic. This is usually accomplished by trapping and removing squirrels until a 2 week inactive period is obtained. At that point, it can be assumed that all the persistent squirrels have been removed. Release the squirrels at least 5 miles (8 km) from the house.

2) Clean out the area where squirrels have been nesting. Vacuum or sweep up all nesting materials and droppings. Scatter Naphthalene crystals (moth balls) in the areas that squirrels inhabited. The objective is to remove all odors which will draw future problem squirrels.

3) Patch entry holes with heavy gage screen or sheet metal flashing and finish as desired.

4) Apply squirrel repellent around the hole and along areas where squirrels run. If the pests are gaining access to the roof by powerlines or phonelines, apply the repellent to these lines. If access is from a tree, apply repellent to the trunk of the tree, or preferably trim branches back from the structure.

By following these steps, squirrel problems can be eliminated both now and for a long time in the future.
Rodent damage on the Northern High Plains has caused estimated economic losses of millions of dollars per year. The Columbian ground squirrel (Citellus columbianus) caused $800,000 damage in Montana during 1973, whereas prairie dogs (Cynomys ludovicianus) caused a loss of $2 million in South Dakota during 1980. Initial control of prairie dogs in South Dakota would cost approximately $1.2 million dollars and maintenance measures would be needed about every third to fifth year depending on percentage success of the initial control and management practices thereafter. Results of a cost-benefit study in South Dakota indicated that the annual maintenance control rate (equal to repopulation of the site) must be below 10% or prairie dog control will not be economically feasible. Realistic projections of annual prairie dog repopulation rates of 30% are intolerable. Thus, emphasis on well-planned range management after prairie dog control is extremely important for successful and economically sound rodent management on the Northern High Plains. This can be achieved through proper stocking and distribution of livestock, and appropriate selection and application of rodenticides.
No-till and disced cropfields were examined in southwest Iowa to determine small mammal population densities, movements, and impacts of rodent depredations on corn seedlings. Two replicates of the treatments corn planted into corn stubble, corn planted into chemically treated sod, and corn planted into spring-disked fields were studied during the 1982 and 1983 growing seasons. Grids of 100 Sherman live traps were established at the edge and middle of each field to determine rodent densities and document possible encroachment of small mammals from nearby habitats. Trapping experiments were conducted for 6 consecutive days during May, August, and November. To assess crop damage, 5 164 ft. (50 m) transects were established in the edge and middle of each field. Corn seedlings were examined every other day for the first 10 days post-emergence.

Deer mice (peromyscus maniculatus) dominated communities of small mammals comprising 71 and 69% of all captures in 1982 and 1983, respectively. Thirteen-lined ground squirrels (Spermophilus tridecemlineatus) composed 14 and 12% of all captures in the respective years. Total individuals captured in both years were 199, 182, and 223 at edge locations on corn-corn, corn-sod and spring-disked fields, respectively. At middle grid locations, 180, 150, and 216 individuals were captured for these respective fields. A total of 9 species were represented on the 3 tillage treatments; 8 on corn-corn fields, 7 on corn-sod fields, and 6 on spring-disked fields. Shannon's diversity values (H') for rodent communities in corn-corn treatments were 0.32 and 0.52 (middle and edge, respectively) 0.43 and 0.45 for corn-sod, and 0.21 and 0.42 for spring-disked fields.

Rodent damage resulted in complete mortality to plants damaged because detected damage was from digging. Overall, damage caused by rodents (0.0%) was less frequent than insect (12.1%), weather (9.5%), and mechanically related (4.5%) damages.
Acreage in reduced- and no-tillage farming systems has increased markedly in recent years, a trend that is expected to continue. However, small rodent populations thrive in these fields and at times dig and consume newly planted seeds and seedlings.

During 1983, no-tillage corn, wheat and grain sorghum fields in western (Red Willow Co.) and eastern (Saline and Jefferson Cos.) Nebraska were evaluated to determine the distribution and food habits of the rodent species present, the damage to crops, and the availability of alternate rodent food sources. During June (post-emergence) and August (maximum corn height), 676 rodents were captured in 11 corn fields, and during July, 105 rodents were captured in 2 wheat and 2 sorghum fields. Species captured included thirteen-lined ground squirrels *Spermophilus tridecemlineatus*, Ord’s kangaroo rats *Diopodomys ordii*, deer mice (*Peromyscus maniculatus*), short-haired grasshopper mice (*Onychomys leucogaster*), voles (*Microtus spp.*), hispid pocket mice (*Perognathus hispidus*), western harvest mice (*Reithrodontomys megalotis*), house mice (*Mus musculus*) and short-tailed shrews (*Blarina brevicauda*). Rodents were distributed throughout study fields although the sample size of several species was not great enough to determine patterns.

Damage to newly-planted corn seeds and seedlings was greater in the western area than in the eastern area, and was more severe on terraces than between terraces. Because of excessive rainfall, sampling was delayed in the eastern area and may have caused the amount of damage to be underestimated. Foods other than corn available to rodents in the study fields included wheat and pigweed (*Amaranthus sp.*) as well as various other seeds, insects and insect larvae.

Knowledge of the foods eaten and foods available to rodents in reduced- and no-tillage fields will permit better evaluation of their beneficial and harmful aspects and will enhance predictability of rodent responses to such damage control measures as toxic baits or repellents. The economic impact of small rodents on reduced- and no-tillage farming systems will increase in the years to come; information about these rodents and the damage they cause will be of increasing importance.
Efficacy Evaluations of Ultrasonic Rodent Repellent Devices
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Efficacy tests involving the use of simulated field and field structures have been developed to assess repellency of commercial ultrasonic rodent repellent devices. The simulated field structure consisted of a 740 square feet (68.7 m²) building that was partitioned into two 350 square feet (32.5 m²) rooms and a 38 square feet (3.7 m²) central harborage area containing 12 wild Norway rats (Rattus norvegicus). Animals were allowed to enter either room to obtain rolled oats in 30 small paper packets glued to the floor at a density of 1 per 10.75 square feet (1/m²). Each room was also instrumented with 4 photocell sensors to measure rate traffic as the test progressed. A single ultrasonic device was typically attached to the far end of 1 room and measures (oat consumption, packet damage, photocell counts) were taken during 1 week baseline and 2.5 week test periods. Field test structures varied in floor area from 96.7 to 2,472.5 square feet (9-230 m²) and were of metal or wood construction. All contained existing Norway rat, house mouse (Mus musculus) or field mouse (Peromyscus maniculatus) infestations. No rodent control was conducted at these sites other than the application of selected sample devices. Rodent activity (packet destruction, food consumption, rodent tracks) was measured during 3 successive 3-week-intervals (twice/week) with the sample devices operating during the middle interval. Repellency effects were evaluated with 20, 25, and 40 kilohertz (KHz) devices in both simulated and field test structures. Distribution of efficacy test data are currently restricted pending enforcement actions by the Environmental Protection Agency and the Federal Trade Commission.
A method using glue boards to remove rattlesnakes (Crotalus spp.) is being tested. Preliminary results of tests conducted in controlled situations indicate the method may be very effective. The glue boards are cardboard or plastic rectangles covered with a sticky material similar to fly-paper glue. The glue boards are tacked on anchored plywood approximately 24 x 16 x 1/4 inches (61 x 40.6 x 0.6 cm). The glue boards are arranged to form a minimum area of 12 x 6 inches (30.5 x 15.2 cm). It is important to avoid attaching anything the snake can use for leverage that might allow it to exert enough pressure to overcome the glue. A small hole should be made in the plywood to allow retrieval of the board with a hook. The glue board is placed tightly against the wall because snakes tend to follow walls rather than proceed across an open area. So far, this method has been tested on 2 bullsnakes (Pituophis melanoleucus) and 7 diamondback rattlesnakes (C. atrox) that were put in a 4 x 15 foot (1.2 x 4.6 m) water though. Lengths of the diamondbacks tested were 5.5 feet (1.7 m), 5 feet (1.5 m), 4.5 feet (1.4 m), 4.7 feet (1.4 m), 5.2 feet (1.6 m), 5.3 feet (1.6 m) and 4.2 feet (1.3 m). The 2 bullsnakes were 5 feet (1.5 m) and 5.4 feet (1.6 m). Initial contact time was a function of the activity of the snake but varied from 10 minutes to 12 hours. All snakes were left on the glue boards for at least 2 hours to be sure they could not escape. In all cases, however, their struggling ceased within 15 minutes. Size of the snake does not seem to affect the chance of success because of correspondingly increasing surface area. Field tests are presently being conducted to determine considerations in less controlled situations.
The viability of rabies virus in carrion is a major factor in affecting the chances that a scavenging animal could contact the disease. The purpose of this study was to determine the viability of rabies virus in brains and salivary glands of rabid striped skunk (*Mephitis mephitis*) carcasses exposed to different controlled temperatures. Brain samples from skunks that exhibited furious symptoms had a higher mean titer (9.58 ± 1.97 log MICLD50/0-03 ml, N = 5) than did those from nonfurious skunks (7.18 ± 0.66 log MICLD50/0-03 ml, N = 20, F = 13.9, df = 1,23, p < 0.005). Rabies virus remained viable at 10°C throughout the 22-day study period in carcasses of skunks that had shown either furious or paralytic rabies. No significant correlations were found between viral-titer and time in these 2 groups (t = 0.053, df = 17, furious; and t = 1.61, df = 22, paralytic). A strong inverse relationship between time and stability of virus was shown with carcasses exposed to 240°C (11 paralytic and 1 naturally furious, t = 13.66, df = 21). The virus was still viable at 2 weeks (240°C), but its strength was greatly diminished. Rabies virus was detected in only a few salivary gland samples. A probable explanation for this could be that the highly concentrated inoculant dosage caused rapid death which did not allow the virus sufficient time to infect the salivary glands. These data suggest that oral transmission of rabies virus among scavenger species may be a common occurrence.
Ideas For Reducing Cattle Losses to Mountain Lions

Harley G. Shaw, Arizona Game and Fish Department, P.O. Box 370, Chino Valley, AZ 86323

The wolf (Canis lupus) and grizzly bear (Ursus horribilis) were eliminated from Arizona's fauna early in the 20th century. Black bears (Ursus americanus) have never been a serious problem in cattle depredation. Coyotes (Canis yatrans) were perhaps reduced in numbers during the 1080 era, but they still remained abundant. Over a half century of efforts to control mountain lions (Felis concolor) via hunting and trapping have been relatively unsuccessful. With the possible exception of temporary reductions on the North Kaibab, no evidence exists that lions have been reduced greatly in numbers anywhere in the state.

Recent research has reconfirmed heavy calf losses to lions in parts of Arizona. They are probably the greatest single source of mule deer (Odocoileus hemionus) mortality in the state. Conversely, they have become a prized big game trophy animal and have assumed a positive economic value of their own. Members of the populace at large probably view them as a desirable part of the state's fauna.

To date, I believe, we can conclude:

1) With existing techniques, lion control is economically unfeasible in Arizona.

2) Sporting harvest does little to reduce lion populations in Arizona.

This suggests strongly that we should look for means other than direct control for reducing lion losses. These possibly include:

1) Modified cattle management: where possible, keeping calves out of lion habitat until they reach about 400 pounds (181 kg).

2) Improved management of native prey: increasing densities of mule deer to absorb more of the lion predation.

3) Manipulation of habitat: opening dense chaparral or pinyon-juniper stands to make them less desirable as lion habitat.

We are designing studies in Arizona to test these options in hope of easing strain between ranchers, deer hunters, lion hunters, and preservationists.
The changing complexion of modern animal damage control, coupled with the lack of funding available to government, has created the need for innovative methods of conducting control programs. Ultralight aircraft are presently being tested to determine their effectiveness, efficiency and safety for aerial gunning coyotes. It is hoped that this project will determine if the Ultralight is capable of functioning as an economical method of aerially shooting coyotes (canis latrans) The initial investment normally required ($5000) and the minimal operating costs ($2.00/hour) give the Ultralight a potential advantage of saving thousands of dollars over more traditional aerial control methods. The Ultralight requires less than 75 feet (22.9 m) to become airborne and climbs at 850 feet (259.1m) per minute. Once aloft, the aircraft has favorable low speed handling characteristics as well as fast cruise capabilities. Normal aerial control speed would be 20 to 27 miles (32.2 to 43.5 km) per hour. Landings are made at approximately 24 miles (38.6 km) per hour, and with a slight headwind, touchdown occurs at little more than* normal walking speed, so the pilot has the ability to land in extremely small areas with or without the use of the engine.

A 12 gauge shotgun is mounted to the front of the airframe. The gun is primarily aimed by moving the aircraft but allowance for crab and pitch is made by movement of pedals. Firing is accomplished through an enclosed cable connected to the steering crossbar.

The formal testing of the Ultralight will take place in February. Part of the study area will be aerial gunned using a helicopter and other parts will be aerial gunned using the Ultralight. Efficiency will be analyzed regarding cost, time, and harvest per unit of effort.
Occurrence and Behavior of Wild Dogs in Newly Established Agricultural Areas
Philip S. Gipson, Alaska Cooperative Wildlife Research Unit, University of Alaska, Fairbanks, AK 99701

The 1976 Alaska State Legislature initiated a program to make substantial amounts of state land available for agricultural development. Approximately 150,000 acres (60,729 ha) were used for agriculture in Alaska during 1982. The state’s goal is to have 500,000 acres (202,429 ha) in agricultural production by 1992. The largest agricultural development to date is the Delta Grain Project which opened approximately 60,000 acres (24,291 ha) of wilderness lands to barley production. Agricultural developments have far reaching impacts on native and feral wildlife. Wild dogs have responded positively to land clearing and the removal of wolves (Canis lupus) from newly settled lands.

A statewide mail survey of biologists, hunting guides, and farmers asking for information about the distribution and abundance of wild and free-ranging dogs indicated that populations of wild dogs may have existed in 26 areas of the state. Eight of the reported wild dog populations were in or adjacent to new agricultural developments.

A population of wild dogs in the Delta Barley Project was intensively studied from 1979 through 1983 by direct observation, radio telemetry and tracking in snow. Packs of 4 to 7 wild dogs were observed foraging and socializing at the Delta Junction garbage dump for periods of 10 to 50 minutes. Pack members were also observed hunting in barley fields and overgrown pastures, along the Delta River and on the right-of-way of the Alaska Oil Pipeline. Five pups and their mother were fitted with radio transmitters at a den near the Delta Junction dump. Wild dogs traveled over areas of 5 to 25 square miles (8 to 40 km2). Sign in snow indicated wild dogs often encountered and marked trails and scent posts of tame dogs, foxes (Vulpes vulpes), coyotes (Canis latrans), and occasionally wolves. On 2 occasions wild dogs approached cabins where domestic dogs in heat were penned. The owner of a tame female dog was bitten by a wild male after approaching them while they were tied. Complaints were received of dogs killing domestic sheep and harassing cattle and moose (Alces alces). Extreme cold did not appear to effect behavior of wild dogs. Adults and pups were commonly active when temperatures were between -100 and -30oC and on occasion, pups were away from the den when temperatures were below -450C.
Awards

STATE WILDLIFE DAMAGE CONTROL AWARD
RECIPIENTS

Colorado - - - - - KATHLEEN A. FAGERSTONE, U.S. Fish and Wildlife Service, Denver Wildlife Research Center, Building 16, Denver Federal Center, Denver, CO 80225

Kansas - - - - - JOHNNY RAY, Kansas Fish and Game Commission, Sunrise Mobile Home Park, Lot 2, Ottawa, KS 66067

Montana - - - - - WILLIAM PERRY, U.S. Fish and Wildlife Service, Cascade, MT

Nebraska - - - - - ROBERT M. TIMM, Department of Forestry, Fisheries and Wildlife, University of Nebraska, Lincoln, NE 68583

North Dakota - - WILLIAM K. PFEIFER, 1603 N. 18th, Bismark, ND 58501

New Mexico - - - - WILLIAM D. FITZWATER, bioLOGIC Consultants, 3919 Alta Monte, NE, Albuquerque, NM 87110

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South Dakota - - - - JERRY REIDEL, Department of Game, Fish and Parks, Waterton, SD

Texas - - - - - - - DALE WADE, Texas Agricultural Extension Service, Research and Extension Center, Box 950, Route 2, San Angelo, TX 76901

Wyoming - - - - - CRAIG MAYCOCK, U.S. Fish and Wildlife Service, Rock Springs, WY

GREAT PLAINS WILDLIFE DAMAGE CONTROL AWARD
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Workshop Participants

A total of 89 people registered for the workshop. They arrived from 19 states and the District of Columbia.

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