

Richardson's Ground Squirrel

Spermophilus richardsonii

Gail R. Michener

Biological Sciences

University of Lethbridge, Alberta T1K 3M4

Josef K. Schmutz

Important Bird Areas Program/Nature Saskatchewan

University of Saskatchewan, Saskatoon, SK, S7N 5A8

WHAT ARE RICHARDSON'S GROUND SQUIRRELS?

Although Richardson's ground squirrels are commonly called gophers, flickertails, or picketpins in various parts of their geographic range, they are indeed squirrels that live on and in the ground rather than in trees. Ground squirrels are rodents that belong in the same family as tree squirrels, flying squirrels, chipmunks, prairie dogs, and marmots. Richardson's ground squirrels bear a superficial resemblance to their larger cousins, the black-tailed prairie dog, but the two species have different behavioural and physiological ecology. In Canada, Richardson's ground squirrels are ubiquitous throughout the mixed-grass and fescue prairies of Alberta, Saskatchewan, and Manitoba, whereas black-tailed prairie dogs are found only in the vicinity of Grasslands National Park in Saskatchewan. Because Richardson's ground squirrels are widespread members of the Canadian prairies, they fulfill an essential role in the prairie ecosystem, most particularly as prey for predatory species and by providing underground refuges for many native species.

HOW LONG HAVE RICHARDSON'S GROUND SQUIRRELS INHABITED THE PRAIRIE?

Fossil evidence indicates that Richardson's ground squirrels evolved in North America over 10,000 years ago, so they have long been an integral part of the grassland ecosystem and a well-

established component of prairie biodiversity. John Richardson was the first European naturalist to collect specimens, in 1820, and send them back to Britain for scientific description. The species was subsequently named in Richardson's honour. Settlers arriving on the prairies from forested regions of eastern Canada and Europe were unfamiliar with squirrels that lived on the ground and were unaware of the scientific description of the species, so they borrowed the term "gopher" which is now the common vernacular for Richardson's ground squirrels in the Canadian prairies. In some localities in the US, Richardson's ground squirrels are colloquially called flickertails and picketpins, names that reflect the tail flicking used for communication and the tendency to stand upright to assess approaching danger.

Although native Americans shared the prairies with Richardson's ground squirrels and many other species, the advent of European settlement and agriculture on the prairies changed the relationship between humans and endemic species of animals and plants. In the case of Richardson's ground squirrels, much of their natural prairie habitat was either converted to crop land or was co-opted for grazing by domestic livestock. Although species such as bison and swift fox reached the brink of extinction on the prairies as a result of such human activity, Richardson's ground squirrels continue to survive in human-modified habitats such as grazed pastures, edges of cultivated fields, perennial crop fields, and city parks.

WHAT ROLE DO RICHARDSON'S GROUND SQUIRRELS PLAY IN PRAIRIE BIODIVERSITY?

Richardson's ground squirrels are the favoured prey of many native species on the prairie. For the predators indicated in boldface in the following list, Richardson's ground squirrels can account for as much as 80% of the diet.

Type of predator

Preferred ground squirrel prey

AERIAL

Swainson's hawk

adults and juveniles

ferruginous hawk

adults and juveniles

red-tailed hawk	adults and juveniles
prairie falcon	adults in spring; juveniles in summer
bald eagle	adults and juveniles
great horned owl	adult males and estrous females in mating season

TERRESTRIAL

long-tailed weasel	infants and juveniles
North American badger	infants and hibernating animals underground
coyote	adults and juveniles
red fox	adults and juveniles
prairie rattle snake	juveniles

For those predators that depend on Richardson's ground squirrels as a major food source, especially for feeding offspring, ground squirrels dictate how well and how often the predators breed. For example, the number of nesting pairs of ferruginous hawks depends on the availability of ground squirrels as prey (see Schmutz and Hungle 1989).

The importance of Richardson's ground squirrels for prairie species can sometimes be indirect. Burrowing owls nest in ground squirrel burrows that have been enlarged by animals such as badgers, so the best habitats for burrowing owls are large tracts of prairie occupied by both Richardson's ground squirrels and badgers. Other animals that seek refuge in ground squirrel burrow systems include mammals such as field mice and voles, other vertebrates such as salamanders, and many invertebrates. Bumblebees, important pollinators of prairie plants, often nest in ground squirrel burrows.

WHEN ARE RICHARDSON'S GROUND SQUIRRELS ACTIVE?

Richardson's ground squirrels can be seen aboveground during daylight hours from February to October, but no individual animal is active for this entire time. Dates of annual events vary by several weeks from year to year, depending on the lateness of the winter, and vary with geographic

region, occurring later in more northerly and easterly locations. The following dates give the typical periods of activity in the chinook region of southwestern Alberta.

	<u>Emerge above ground</u>	<u>Enter hibernation</u>
Adult males	mid-February to early March	mid-June to early July
Adult females	early to mid-March	early to late July
Juvenile females	early to mid-May	early to mid-August
Juvenile males	early to mid-May	mid-September to October

As these dates indicate, Richardson's ground squirrels actually spend the majority of their life in hibernation. They hibernate for 5-7 months as juveniles and for 7-8 months as adults.

Furthermore, they come above ground in the morning about 75 minutes after sunrise, they retire for the night about 75 minutes before sunset, and they stay underground in the middle of the day during summer. Consequently, even in the active season, Richardson's ground squirrels are only above ground for about 8-10 hours a day. In total, Richardson's ground squirrels spend only about 15% of their lifetime above ground.

HOW LONG DO RICHARDSON'S GROUND SQUIRRELS LIVE?

Both sexes are reproductively mature at one year old. Mating occurs only in spring, shortly after females emerge from hibernation, and each female can produce only one litter per year. The litter, usually of 6 or 7 infants, is born underground after a 23-day pregnancy and juveniles first appear above ground when 28-30 days old.

Because all females emerge from hibernation over a period of about 2 weeks, their litters all subsequently appear above ground at about the same time resulting in a dramatic increase in the population density. However, natural mortality is high, especially for males. Only 10-20% of juvenile males survive to adulthood, and only 15-30% of adult males survive a further year.

Although potential life span for males is 3 years, less than 1% of males survive to this age. Only 40-50% of juvenile females survive to adulthood, and about 50% of adult females survive each

further year thereafter. Potential life span for females is 5 years, but most live only 2 to 4 years (see Michener 1998).

WHAT DO RICHARDSON'S GROUND SQUIRRELS EAT?

Beyond the fact that they normally eat leaves, flowers, and seeds, relatively little is known about the natural diet of Richardson's ground squirrels. Where prairie vegetation has been altered by agricultural practices, Richardson's ground squirrels eat forage crops and cereal crops but these may not be the preferred diet. Richardson's ground squirrels are primarily herbivores that eat whatever vegetation is readily available. They normally do not eat eggs of ground-nesting birds (see Sargent et al. 1987). Richardson's ground squirrels do opportunistically scavenge meat, such as roadkills, but they do not kill either their own species or other species for food.

HOW DO HUMANS VIEW

RICHARDSON'S GROUND SQUIRRELS?

When settlers converted the prairies to new uses, certain species were seen as undesirable competitors. In particular, Richardson's ground squirrels were viewed as problems both on cropland, where they ate newly germinated crops once the native prairie had been plowed under, and on pastureland, where they were seen as direct competitors for forage as well as a threat to livestock through their burrowing activity. No recent scientific or economic studies are available to establish the extent of damage to crops and pasture or the frequency with which livestock are lamed. Consequently, there is no good measure to assess how much time, energy, and money a farmer or rancher should invest on controlling Richardson's ground squirrels to ensure an appropriate return on that investment. Furthermore, given the annual cycle of activity and hibernation of Richardson's ground squirrels, control measures are likely to be effective only if they are implemented at appropriate times of year.

The effect of burrowing rodents such as ground squirrels and prairie dogs in a ranching economy is complex. By maintaining a diversity of grazing species, such as cattle, rodents, and other wildlife, virtually all plant species are cropped in a complementary grazing strategy that may improve range

productivity in the long term. The estimate that burrowing rodents reduce range productivity significantly apparently goes back to a study published 100 years ago, whereas recent research indicates only 4-7% competition between burrowing rodents and cattle, with market weight of steers unaffected (see Miller et al. 1994). One way to look at the possible relationship between cattle and Richardson's ground squirrels is to compare size (500 kg for a cow versus 0.35 kg for an average ground squirrel) and time on pasture each year (8 months for a cow versus 5 months for the average active season of a ground squirrel). This simple comparison suggests that the intake of one cow approximates that of about 2275 ground squirrels. Because of differences between cattle and ground squirrels in how they pull up vegetation, their choice of plant species and plant parts, and how vegetation is digested (in the rumen in cattle and in the cecum in ground squirrels), careful studies are needed to compare the impact of each on grazing land.

Richardson's ground squirrels are one of the few native grassland mammals that are readily seen by the casual observer. They habituate to the presence of humans and can become quite bold about seeking handouts from picnic tables, so some people gain pleasure from watching them. People who are concerned about raptor populations have an interest in maintaining and even expanding populations of Richardson's ground squirrels to ensure the well-being of species such as prairie falcons, ferruginous hawks, and burrowing owls. People with a general interest in prairie diversity and survival of the native plant and animal species of the prairie recognize the importance of Richardson's ground squirrels in the prairie ecosystem.

HOW COMMON ARE RICHARDSON'S GROUND SQUIRRELS?

Because no monitoring programmes are in place, no scientific data are available on population numbers or long-term trends at the level of the prairies as a whole. In a given year, population densities can vary markedly across the prairies, as in 2001 when Richardson' ground squirrels were common in many parts of Alberta and Saskatchewan but rare in some regions of Manitoba. One study of a small isolated population in an irrigation district near Lethbridge indicated that population density can fluctuate up and down by 10-fold over the span of a decade or more (see Michener 1996). When populations become dense, predators move in and reduce the numbers,

after which several years are required for populations to increase again.

When humans seek to reduce populations rapidly over a large area, techniques such as shooting or distributing poisoned bait are more likely to be used than fumigation or flooding of burrows. Chemicals such as strychnine, a poison which causes nerves to send inappropriate signals to muscles (see Savarie 1991), can kill any vertebrate, including humans, if a sufficient quantity is ingested. Above-ground broadcasting of poisoned bait leads to inadvertent ingestion by unintended victims, including mallard ducks, mourning doves, and native sparrows (see Hegdal and Gatz 1977; Schmutz et al. 1989). Little is known about the impact on non-target species of poisoned bait placed in ground squirrel burrows.

Richardson's ground squirrels appear to thrive in very open habitats with short vegetative cover, probably because they can more easily detect approaching predators. Consequently, land management that encourages vegetative cover to make an area less suitable and less attractive to ground squirrels may provide a long-term method of maintaining populations at acceptable levels. Additionally, land management practices that encourage predators to settle nearby, such as installing nesting platforms for raptors (Schmutz et al. 1984), may contribute to controlling numbers of ground squirrels.

PRIVATE ENTERPRISE VERSUS PUBLIC GOOD?

Canadians pay less for food than do people in many other countries, and this expectation that food should be cheap necessitates cost efficiency in the food sector. Whether the losses are due to weather or pests, farmers and ranchers bear the costs of reduced yields. Most Canadians (83% in a survey) report that "maintaining abundant wildlife is very or fairly important" (see Filion et al. 1993). Ground squirrels are integral members of wildlife biodiversity, so they are a "public good", but if maintenance of biodiversity involves costs, who should bear these costs?

In Canada's grassland ecoregion, 80% of the grassland is now used for agriculture, industry, and urbanization. Many native prairie species will continue to survive at sustainable levels provided a variety of land management approaches are used to ensure that adequate landscapes are maintained

through a combination of deeded and public lands.

THE FUTURE FOR RICHARDSON'S GROUND SQUIRRELS?

Although most of the original prairie no longer exists and despite decades of control measures, Richardson's ground squirrels have persisted, sometimes even thriving in human-modified habitats, whereas other species have been brought to the brink of extinction. Richardson's ground squirrels are a food source for many prairie species and their burrows serve as refuges for yet other species, so the continued presence of Richardson's ground squirrels will help to guarantee the rich biodiversity of the prairies.

For further information on Richardson's ground squirrels go to <http://home.uleth.ca/~michener>

Filion, F. L., E. DuWors, P. Boxall, P. Bouchard, R. Reid, P. A. Gray, A. Bath, A. Jacquemot, and G. Legare. 1993. The importance of wildlife to Canadians: Highlights of the 1991 survey. Environment Canada, Supplies and Services, Ottawa. See also

<http://www.ec.gc.ca/nature/survey.htm>www.ec.gc.ca/nature

Hegdal, P. L. and T.A. Gatz. 1977. Hazards to seed-eating birds and other wildlife associated with surface strychnine baiting for Richardson's ground squirrels. Unpublished Report, U.S. Fish and Wildlife Service, Denver Wildlife Research Center, Denver, Colorado.

Michener, G. R. 1996. Establishment of a colony of Richardson's ground squirrels in southern Alberta. Pp. 303-308 in Proceedings of the fourth prairie conservation and endangered species workshop. Edited by W.D. Willms and J.F. Dormaar. Provincial Museum of Alberta Natural History Occasional Paper 23:1-337.

Michener, G. R. 1998. Sexual differences in reproductive effort of Richardson's ground squirrels. Journal of Mammalogy 79:1-19.

Miller, B., G. Ceballos, and R. Reading. 1994. The prairie dog and biotic diversity. Conservation Biology 8:677-681.

Sargeant, A.B., M. A. Sovada, and R. J. Greenwood. 1987. Responses of three prairie ground

squirrel species, *Spermophilus franklinii*, *S. richardsonii*, and *S. tridecemlineatus*, to duck eggs. *The Canadian Field-Naturalist* 101:95-97.

Savarie, P.J. 1991. The nature, modes of action, and toxicity of rodenticides. Pp. 589-598 in *CRC Handbook of Pest Management in Agriculture, Volume 2*, D. Pimental, editor., CRC Press Inc., Boca Raton.

Schmutz, J. K., K. A. Rose, and R. G. Johnson. 1989. Hazards to raptors from strychnine poisoned ground squirrels. *Journal of Raptor Research* 23:147-151.

Schmutz, J. K., R.W. Fyfe, D.A. Moore, and A.R. Smith. 1984. Artificial nests for ferruginous and Swainson's hawks. *Journal of Wildlife Management* 48:1009-1013.

Schmutz, J.K., and D. J. Hungle. 1989. Populations of ferruginous and Swainson's hawks increase in synchrony with ground squirrels. *Canadian Journal of Zoology* 67:2596-2601.