



Townsend's Mole

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Townsend's Mole
at risk.*





Why are Townsend's Moles at risk?

Townsend's Mole is one of Canada's rarest small mammals. The only place it occurs in Canada is in British Columbia, where its very restricted range falls within the most heavily populated region of the province – the Lower Mainland. Townsend's Moles live in a small area along the international border near Huntingdon in the lower Fraser Valley and have likely always been uncommon. Urban development and intensive agriculture have reduced, fragmented and altered their habitat, and jeopardize their long term persistence.

Agriculture threatens the survival of Townsend's Mole in several ways. In the 1860s, the mole's natural habitat was dyked, drained and cleared to create farm land. The manured pastures and hayfields of dairy farms can provide ideal mole habitat, but increasingly popular cash crops, such as raspberries and vegetables, generally provide poor habitat. The average size of farms in the Abbotsford/Huntingdon area is only 25 hectares, which results in fragmentation of favourable habitat and isolation of breeding populations.

New threats are emerging as prime agricultural land is routinely converted to urban uses. The human population of the lower Fraser Valley is growing rapidly and industrial activities have increased significantly. The service industry now exceeds agriculture as the dominant employer in this region, ensuring more habitat will be lost to commercial interests in the future.

Townsend's Mole has been designated as threatened by COSEWIC.

Residential property owners are often unwilling to share their lawns and gardens with moles because of the mounds they produce. Control methods such as flooding and kill traps are routinely used by landowners in this region. Most people are unaware that there are two very similar mole species in the lower Fraser Valley. The widespread Coast Mole is the cause of most human-mole conflict, but land-owners rarely discriminate when eradicating unwanted moles. It is unknown how many Townsend's Moles are killed annually in British Columbia.

Because Townsend's Moles live underground they have few natural predators, although weasels, coyotes, hawks and owls will prey upon juveniles as they disperse above ground from the birth nest. Domestic dogs and cats are thought to be their most important predators, but they rarely consume captured moles, possibly because of their strong smell and unpleasant taste.

In the 1920s and 1930s, moles were commercially trapped and their pelts were used for such products as caps, purses, vests and garment trimmings.

What is their status?

There is little information on Townsend's Mole population sizes or trends in British Columbia. Where they are found in Oregon, the density of Townsend's Moles is about 12 moles per hectare, but densities are believed to be lower here. Biologists estimate that there are probably less than 1000 Townsend's Moles in British Columbia. Townsend's Mole has been placed on the provincial Red List of species being considered for legal designation as Endangered or Threatened. It is not considered at risk in California, Oregon or Washington.

In 1994 and 1995, BC Environment

sponsored extensive surveys for Townsend's Mole in the lower Fraser Valley. Before these surveys, knowledge of their distribution was based primarily on 23 museum specimens, all of which had been collected near Huntingdon.

Moles can produce an average of four mounds per day.

The recent surveys covered 383 sites and resulted in 30 new Townsend's Mole records, mostly from the Huntingdon area. For the first time, this species was found in east Abbotsford, eight kilometres north of any previous record.

There were no records from the surrounding communities of Agassiz, Aldergrove, Chilliwack or Mission.

Some authors suggest that introduced earthworm species and cultivation of the lower Fraser Valley are responsible for an increase in the numbers of moles. While the widespread Coast Mole may have benefited, Townsend's Mole remains very rare and localized in British Columbia.

Due to its rarity and restricted range in Canada, and the continuing loss of habitat within this range, Townsend's Mole was designated Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1996.

What do they look like?

Townsend's Mole (*Scapanus townsendii*) is the largest mole in North America, ranging from 18 to 24 centimetres in length. The average weight of females is 120 grams, while males average 140 g. Their thick, velvety fur varies from grey to black and often has a pronounced sheen. Unlike the fur of most mammals, mole hair can move in any direction without standing on end, an adaptation that allows them to move in either direction in their tunnels with relative ease. Mole hair is also very plush, with over 3000 hairs per square centimetre.



Like most moles, Townsend's Moles are *fossorial*, meaning they spend much of their lives burrowing through the soil. Their stocky, cylindrical bodies are specifically designed for this lifestyle, as are many of their other features. They have no visible ears and it is unlikely that their minute, blue eyes, which are hidden by fur, can distinguish much more than shades of light. Their short, whitish tail and their conical, flexible snout are sparsely covered with sensitive tactile hairs. Their proficiency as tunnellers and mound builders owes much to their broad, flat forefeet, each one equipped with five strong claws. Their hind feet are small and narrow.

Adult Townsend's Moles closely resemble Coast Moles, but Townsend's

One pair would produce fewer than 10 offspring in their lifetime.

Moles have longer bodies and longer hind feet. The two related species can be further distinguished by the fact that the average Townsend's Mole mound height (18 cm), width (44 cm) and tunnel diameter (5.2 cm) are significantly larger than those of the Coast Mole. Because Northern Pocket Gophers also construct extensive underground burrow systems and mounds, they are often confused with moles in British Columbia. However, Pocket Gophers are not found west of Manning Park and their small, fan-shaped mounds differ from the large, conical and cloddy molehills found in the Lower Mainland.

What makes them unique?

Moles are primitive animals that have changed very little in the past 130 million years. They retain many traits of the first mammals that inhabited the earth, such as their

plantigrade (flat-footed) walking style, and small, smooth brains that lack the convolutions found in more advanced mammals. Moles live in a simple social order: they are solitary creatures and fiercely defend their home range from intruders, sometimes to the death.

Despite retaining some primitive characteristics, Townsend's Moles are very successful and specialized animals. Their forefeet are oriented permanently outwards from the body so they can swim through soft soil, much like a human swimmer using the breast-stroke. When they encounter harder soil, first one forelimb is used to shear the soil for a few strokes, then the other, while the body is firmly held in the tunnel by the inactive forelimb and the splayed hind limbs. When a suitable amount of soil has been loosened, the mole turns sideways or somersaults in the tight tunnel. Then, using its broad forefeet like a bulldozer, it pushes the dirt through the tunnel and up to the surface to form a molehill. This task is Herculean from both a physical and a physiological perspective. Not only are kilograms of earth moved for every mound created, but this feat is accomplished in an atmosphere with very low oxygen levels and extremely high levels of carbon dioxide compared to those aboveground. Mound density can exceed 800 per hectare in heavily populated areas. During the spring when their activity levels peak and the soil is moist, they will produce an average of four mounds per day.

Townsend's Moles will leave the security of their tunnels during floods and swim to higher ground to avoid drowning. Temporarily displaced moles that survive a flood will return home when the ground begins to dry and re-inhabit their vacated encampments. There are few obstacles they cannot negotiate. They can swim across rivers and canals, and burrow beneath highways and buildings. It is

therefore somewhat of a mystery why this mole is so localized in the lower Fraser Valley, unlike the far-ranging Coast Mole.

It is believed that populations at the edge of a species' range, like Townsend's Mole in British Columbia, have a high evolutionary significance to their species and are instrumental in the maintenance of genetic diversity.

How do they reproduce?

Our understanding of the reproductive life of Townsend's Mole in Canada comes from research conducted in Oregon. The peak breeding period is in January and early February. During this time females excavate spherical underground cavities which are about 1700 cubic centimetres in size. They are usually located in elevated areas to prevent the nest from being flooded by late-winter or early-spring rains. An ingenious natal nest is then constructed. The female fills the cavity with green grass and then lines the inside with dry grass so that the heat of fermentation will add warmth to the inner core. Solar radiation is also important, as most nests are less than 20 cm from the surface. Nests can sometimes be located by the presence of a single large "fortress" mound more than 76 cm in diameter and up to 45 cm high, or by a cluster of smaller mounds. Males also expend considerable amounts of energy during the breeding season. They must leave the safety of

their tunnels and burrow throughout the surrounding area in search of receptive females.

Females produce only one litter a year. After a gestation period of four to six weeks, from one to six (usually three) young are born in

The diet of the Townsend's Mole is primarily soil invertebrates.

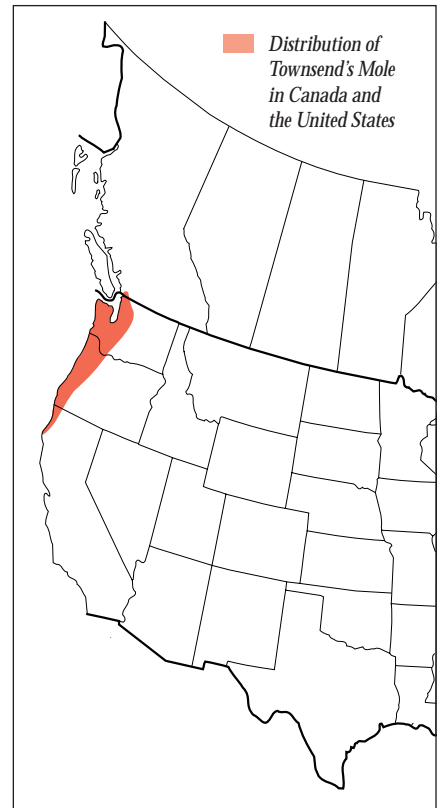
late March or April. Moles are born pink and naked, weighing about 5 g and measuring roughly 60 mm in length. They lack distinguishable eyes, but already have pronounced

paddle-like front feet and soft claws. The young moles grow rapidly and are ready to leave the nest in four to six weeks. By then they possess sleek coats, exceed 115 mm in length and weigh 60 to 80 g.

Townsend's Moles mature before one year of age and are usually capable of breeding during their first winter. If they have the same life expectancy as Coast Moles, then they are probably limited to three breeding seasons. One pair would produce fewer than 10 offspring in their lifetime.

What do they eat?

Earthworms are their primary food source and comprise over 70 percent of their diet in most cases. Earthworm cocoons, insect larvae and pupae, centipedes, beetles, spiders and slugs are also consumed by Townsend's



Mole. Numerous damaging soil invertebrates such as leather-jackets and cutworms are included in their diet. Small quantities of plant matter such as bulbs, grain and grass roots are also eaten.

Townsend's Moles require a daily intake of food roughly equal to 70 percent of their body weight. In one year an adult male will consume over 35 kilograms of food, while a female will consume over 30 kg. To satisfy their voracious appetites, Townsend's Moles must hunt continuously within their extensive underground tunnel systems.

Each mole digs hundreds of metres of tunnels that cover an irregularly shaped area of about 2500 square metres, depending upon habitat suitability. This tunnel system comprises the mole's home range. The borders of the home range are dynamic and will be constantly altered by the mole as it hunts and exploits new areas. Tunnel depth is determined by the vertical distribution and seasonal migration of prey such as earthworms. When the soil temperature is high, earthworms will migrate two metres or more below the





TOWNSEND'S MOLES LINE THEIR NESTS WITH GRASS.
Timothy Sheehan photo



TYPICAL LARGE MOUNDS PRODUCED BY TOWNSEND'S MOLES. Timothy Sheehan photo

surface and Townsend's Mole tunnels may extend to depths of three metres.

Townsend's Moles have poor eyesight, but vision is of little use for locating prey in the underground darkness of their tunnels. Instead they rely on a highly developed sense of touch, particularly the thousands of touch-sensitive structures on their snouts known as Eimer's organs. Their long jaws are designed for rapid biting and are armed with 44 teeth for cracking hard exoskeletons. When a mole captures an earthworm it will skilfully and speedily orient it using its teeth, nose and forefeet, so that the head-end is consumed first. The mole then threads the worm between its forefeet, tearing it into pieces with quick, jerky movements of the head and swallowing each morsel immediately. This method of eating facilitates the "stripping out" of gritty organic material found in the worm's digestive tract and prevents the worm's angled, bristle-like setae from interfering with swallowing.

Where do they live?

Townsend's Mole is found along the west side of the Coast Range from northern California to the extreme southern edge of British Columbia. This region is characterized by a moist,

temperate climate and coniferous forests. Natural habitats where Townsend's Moles live include moist meadows, river flood plains, prairie and shrub habitats and Douglas-fir forests. Their abundance can vary dramatically within an area depending upon the availability of earthworms, type of vegetation, amount of humus, drainage and soil type. Museum records and recent fieldwork indicate this species prefers silt loam soils that are

Moles improve the aeration and drainage of the soil.

moist and well-drained with no water table. This soil type is suitable for year-round tunnelling and mound construction, and supports greater populations of earthworms than heavier clays or more sandy and alluvial soils.

In Canada, Townsend's Mole has only been found within a small area of the lower Fraser Valley, where much of the original habitat has been lost to agriculture and urbanization. Meadows, bogs and woodlands have been converted into farm fields and subdivisions, forcing Townsend's Mole to adapt to a modified landscape. Grasslands provide favourable habitat because they are highly structured and provide a stable environment for tunnelling.

The grass cover also insulates the ground from extreme temperatures, protecting prey species, such as earthworms, and allowing them to flourish. Townsend's Moles can thrive in manured pastures and hayfields, which resemble grasslands. They also frequent lawns, golf courses and playing fields, but their tunnelling activities interfere with human interests and attract an onslaught of control measures. They avoid areas of intensive cash-cropping because the constant tilling and application of pesticides create an inhospitable environment.

Researchers sponsored by BC Environment recently discovered a population of Townsend's Moles in relatively rugged terrain on Sumas Mountain, east of Abbotsford. Here, they exist in a habitat dominated by red alder and Douglas-fir forests with an undergrowth of salal, bracken, Pacific dogwood and trailing blackberry. Their presence here is difficult to detect because their mounds are usually concealed by forest litter and vegetation. Also, they are often able to press the relatively loose forest soil against the tunnel walls alleviating the need for mounds. Because there are fewer earthworms in forests, Townsend's Mole densities in this area are probably lower than in nearby grasslands.


What can we do?

The creation of a Townsend's Mole refuge in British Columbia is unlikely because there are no significant parcels of Crown land where this species occurs and farmland in this area is very costly. The only feasible alternative to creating a refuge is to educate farmers and landowners about the rarity of this mole and provide them with habitat protection recommendations. Because Townsend's Moles inhabit land that can have slopes of more than 15 degrees, grass should be included as a cover or forage crop wherever possible. This is sound soil conservation and will increase earthworm numbers, improve soil structure and reduce soil erosion, benefiting both farmers and moles. Pesticide use should be limited and grass buffer strips and perimeters should be added to cash crops such as blueberries, raspberries and vegetables. If edges are left along fence lines when fields are ploughed, they will help maintain connectivity between populations. Relatively permanent habitat such as fir, hemlock and alder woodlands and their complimentary undergrowth should not be cleared because they provide Townsend's Moles with a natural refuge.

Convincing landowners to tolerate Townsend's Moles is a formidable task and may be complicated by some common misconceptions. Although a mole will occasionally eat grass roots, their diet is predominantly soil invertebrates. Most of the damage to plant roots and garden vegetables that people assign to moles is the work of incidental species like mice and voles that enter their tunnels. Landowners may be surprised to learn that moles improve the aeration and drainage of the soil, circulate soil minerals and consume harmful soil invertebrates. To many, these benefits are eclipsed by the damage molehills cause to lawns, crops and machinery. However, farmers can level the mounds in their fields

by chain-harrowing during the spring and home owners can rake out any molehills that sprout on their lawns with minimal effort.

Despite recent surveys to determine the distribution of Townsend's Mole, questions still remain. A communication link between professional mole trappers in the lower Fraser Valley and BC Environment should be established so that "large" mole specimens can be brought to a biologist for identification. Members of the public are also urged to become familiar with this rare species. Any mole found in this region that exceeds 18 cm in length is probably a Townsend's Mole. It should be reported to the Ministry of Environment, Lands and Parks office in Surrey or the BC Conservation Data Centre, which maintains a database on this and other rare species.

With your support and tolerance, this unique mammal will continue to "dig" British Columbia. 



GROUND SQUIRRELS DO NOT PRODUCE MOUNDS WHEN BURROWING.

Timothy Sheehan photo



POCKET GOPHERS PRODUCE SMALL FAN-SHAPED MOUNDS.

Timothy Sheehan photo

FOR MORE INFORMATION ON TOWNSEND'S MOLE, CONTACT:

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