

Geomys bursarius
or Pocket gopher of Kansas.

by
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Introduction.

In the preparation of this little work the author has endeavored to set forth, in a clear and concise manner, his experiences and observations of the *Geomys* series.

As to its usefulness, the author sees none except in special soils as described under that head.

The Gopher's destructiveness, however by far exceeds that which generally calculated by the average tiller of the soil. This is principally due to the gopher's work is so much underground that much of its depredations are hidden from the eyes of man.

In giving the amounts, as paid in bounties, in certain states, the author gives thanks to the Agricultural Department at Washington D. C. for the information given in bulletin # 4 of the division of Ornithology and mammalogy for 93. and the author would advise everyone interested in the subject, to consult the above bulletin and see the vast amounts that have been spent in contesting against the gopher.

The author's experience in killing the gopher extends over a period of eight years, during which time all the methods herein described have been tried and his success and opinions of each method are given under each respective method.

C. W. P.

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The "*Geomys bursarius* a Pocket gopher" belongs to the Subkingdom Vertebrata.

Province — mammalia

Order — Rodentia.

Description of "*Geomys bursarius*."

The *Geomys bursarius* is from 8 to 8½ inches in length exclusive of the tail, which is about 1¾ inches long. The ^{gopher} is the size of a large rat. The color is dark reddish brown. The hair short fine and thick upon the pelt. The legs are short. The hind legs resemble those of a rat very closely, while the front feet are very strong, and armed with 3 long curved claws fitted for digging their excavations. The claws often measure ¾ of an inch in length and are well set in their strong palms.

The claws are curved downward. They are smooth and round on the upper surface and convex on the under-side.

The front legs are well supplied with firm strong muscles, as the strength lies in the fore part of the animal. On the whole the front legs closely resemble those of a mole.

The neck is so short that it is nearly imperceptible and the animal looks as if the head were placed against the body.

The head is large and nearly cylindrical and as large at the base as the body of the animal. The skull is low and flat, but broad and heavy. The jaws are strong firm and well hinged. The muscles of the jaws are large and very strong. The teeth are 20 in number 4 molars

and 1. incisor on each side of each jaw. The molars are composed of enamel plates and dentino. The incisors are long and curved. The lower ones are about $\frac{3}{4}$ of an inch long and smooth. The upper incisors are $\frac{3}{8}$ of an inch in length and have, each, a deep groove running along the centre on the outer curve, while near the inner edge of the tooth is a second but small groove. The teeth have a chisel-like cutting edge and are very sharp. They are of a deep straw color.

The teeth of the Genus, *Geomys* are very characteristic in distinguishing several of the species.

The eyes are small, black and out of much use in daylight. The ears are small and stand erect.

From the front of the mouth to the shoulders, the skin folds in and under forming a pouch or pocket, from whence its common name "Pocket gopher." The pouches are used for collecting and conveying food to their place of abode.

The "Gopher" has a slow irregular girking-like gait when on a smooth hard surface, as the front claws are so long and curved, they are compelled to walk on the side of the front feet, turning the claws inward; on soft ground or in their burrows they can run quite rapidly and are very active.

The senses of sight and hearing seem to be poorly developed as they do not seem to notice a noise nor move if a stick ~~is~~ thrust towards them, while the sense of touch seems to be highly developed for they will snap

ferociously when touched with the hand or a stick,
 When caught, they fight and bite viciously. If caught in
 a trap they often break their incisors by biting the trap.

Distribution

The *Geomys bursarius* is found throughout the entire Eastern $\frac{2}{3}$ of the State of Kansas. They, however, are most numerous along the streams, in the sandy soils or timbered lands, occasionally they are found on the high prairies. In general they follow the tiller of the soil, to live upon the crops which he may plant.

The soil best suited for them is a loose porous one, in which it is easy to work and at the same time is rich in vegetation as the gopher is principally vegetarian.

Habitat

The "Pocket gopher" is strictly subterranean in its habit, in fact no other rodent spends so much of its life underground as does the gopher. It spends by far the greater portion of its life underground. In his burrows the gopher is very industrious and energetic in his work. The gopher is at work from early spring till late into the fall. He is at work about the entire time the soil is not frozen. Its work is done mostly at night, late in the evening or early morning. The "gopher" is quite shy and will not venture out if he suspects that a person

is near.

The hole excavated by the gopher is about $2\frac{1}{2}$ inches in diameter and of indefinite length. The soil loosened, in making its excavations is taken to the surface and deposited in small mounds, commonly known as gopher hills. They vary in size from a pint to hills containing 5 to 6 bushels of dirt. On an average, however, a mound of dirt is about 3 pecks. These mounds are placed at short intervals along the main line of work. Each gopher, generally, has one or several main lines or channels and many short or auxiliary ones. The main channel generally takes a zig zag course following vegetation or the easiest route of work. The main channel's course can generally be traced by the rows of dirt hills thrown up on either side of it.

The "gopher hills" are never, or seldom, directly above the main channel; but are placed a short distance to one side, and connected with the main gangway by a short slanting hole. There are two very good reasons why this should be so.

1st The gopher could not bring the loosened dirt to the surface if the hole, of exit, were directly above the main channel, for the gopher scratches and pushes the dirt to the surface, and does not carry it out in its pouches as is commonly believed, therefore it can be readily seen, that there must be an incline to one side, along

which to scratch or push the loosened soil.

2nd It seems that the gopher, through instinct, knows how to conceal and protect his main channel from man by placing these hills several feet to one side and then tightly pack the hole with earth so in digging for the channel no hole can be found leading from the hill to it. If the gopher hills were directly above the main channel it could easily be found and obstructed, or something placed therein which would be destructive to the gopher.

This may seem plausible; but all who have ever given the matter attention or who have dug for the burrow in order to place ^{a trap} a poison therein, will readily bear me out in the statement, for the gopher will, invariably, fill the shot auxiliary hole up solid and tight, and when digging for the channel much labor must often be expended before finding it. However, a person who is acquainted with their habits and methods of working can readily tell about where the main channel is located, as the mounds are placed on both sides of it, and by drawing an imaginary line midway between the mounds, you can generally find the channel without much trouble.

The burrows are generally from 4 to 10 inches below the surface. In deep plowing they are mostly destroyed. The place of nesting is from 3 to 5 feet under

ground and is generally located at the meeting of several main channels. This also serves as a store house, food being stored therein for future use or for the winter when they are unable to obtain food outside. It is here that the young are born during the early spring. Two young are generally born at a birth.

The young gophers begin to make burrows and shift for themselves about the middle of summer. During the early fall the young fellows are very busy making burrows and gathering food, later on, for the winter. During the late summer or early fall the young gophers are very destructive to the crops surrounding their place of working.

Usefulness of the Gopher

Generally speaking, the usefulness of the 'Pocket' gopher is very limited and is restricted to the soil it inhabits. If the soil is of a wet tenacious sticky kind, so drainage is poor, the gopher may help very materially in bettering the conditions of it, as follows

1st By their burrows, the soil becomes disturbed much deeper, than by plowing in such soil, thereby bringing soil from quite a depth to the surface and causing it to become intermingled with the top soil. This, in fact, acts as a slow process of subsoiling.

2nd The burrows in wet lands act as drainage channels through which the water passes off. Some air will also enter these channels, causing a ventilation

and drying of the soil, which, then, becomes more friable and better adapted for agriculture.

3^d They are of some use by eating the roots and seeds of obnoxious weeds. A few insects are also eaten.

4th If the top soil is loamy and the subsoil sandy, the gopher, in bringing the sandy soil to the surface, will in time convert the loam to a good agricultural soil. It is here where the gopher may be of the greatest benefit to man.

Destructiveness of the Gopher.

That the gopher is very destructive to all kinds of crops, wherever he is at work, cannot be denied. The ways in which the gopher is destructive to crops can readily be placed under three general divisions, each of which may again be subdivided. Viz. 1st By throwing soil on growing crops: 2nd By destroying the roots of crops, in making its channels: 3^d By consuming a large amount of crops for its livelihood.

It may seem but a small item to have a few gopher hills scattered over your fields or through your meadow: But if you will give the matter a second thought or see a place where the little mounds are but a few feet apart and are thus scattered over an area of acres or even whole fields you will at once realize what an inestimable amount of damage and mischief they do, in a comparatively

shot time. Each little mound will cover, on an average at least 2 square feet of surface. It is a very small estimate to say that each gopher will throw up but 3 hills per week, and giving him 8 months per year to work, which is about the average time of his working, and he will have covered about 216 square feet of soil per year. This however is a very low estimate, and on an average each gopher will cover more than twice that area for a gopher will about average 1 mound per day and often more.

I once saw where a single gopher had thrown up a row of mounds over a distance of 47 yards, in one night. The average distance between the hills was 12 feet. Thus giving us over 15 hills thrown out by one gopher during a night. 4 of these hills were small not measuring over 2 quarts of dirt while the rest were large and covered fully 2 square feet each in area.

The above, however, is quite above the average. This also the longest distance tunneled, in such a short time, and in as straight a line, that I have as yet observed.

The channel must have been quite straight for the hills of dirt, at least, were in a comparatively straight line and extended from a meadow of Clover and Timothy, through a corn field and into a sweet-potato-patch, much to his sorrow for I at once set a trap for him and succeeded in catching

him, the second night in his new quarters.

The above shows the amount of work or mischief that can be done by a single gopher in so short a time. Had all those hills, been thrown on garden plants, instead of in the cornfield, the damage of this single gopher would have been considerable.

The gopher loves to work in truck patches and meadows for there he finds easy working and a plenty food to appease his greedy appetite, and if but a few gophers are at work in a garden or truck patch, they will, in a very short time, destroy many dollars worth of vegetables, by covering up the plant with their excavated dirt. And to the truck grower, it is often quite a problem; how best to rid his fields from those destructive little rodents.

Again, in the meadow, their destructiveness, by the means of their dirt hills, ranges in value next to the vegetable field. Here it is not only the area covered up by the hills of dirt; but in cutting the grass for hay, the mowing machine often becomes choked and refuses to cut the grass for several feet beyond the hill. The grass, thus left standing, goes to waste. Not only is the hay wasted, but many breaks of the machine often occur, especially that of the sickle bar, and we all know that a breakdown of the machine causes such delay that many dollars worth of hay or grass is lost, which of course

goes out of the farmer's pocket.

Aside from break downs, cutting through these gopher hills quickly dulls the knife which again takes up unnecessary time to sharpen. This, often, is of much cost to the busy farmer in hay-time.

In connection with the above we must bear another fact in mind, and one which is of vital importance which is, that a greater or less amount of dirt will become intermingled with the hay, in harvesting it from a meadow containing gopher hills, and I am confident that no wise and intelligent person desires to feed dirty hay to his stock, especially if he be a raiser of fine stock.

In timothy and clover meadows, the amount of dirt that gets into the hay, from fields infested by the gopher, is by far greater than many persons have an idea

Clover is the worst of the tame grasses to take up dirt from this source. All who have ever fed dirty clover hay, know full well its ill effects upon the stock eating it.

Not only are crops destroyed by being covered over with dirt; but the subsoil may may be of a clayey, sandy or gravel nature which would be detrimental to profitable agriculture. This may be carried on to such an extent that what once was a good field for the truck grower may, after being infested for years by the gopher, become utterly worthless for truck growing.

The second phase of the destructiveness is by the channels or subterranean gangways.

Damages by burrows of the gopher. This is another serious phase of the subject and no one can doubt the inestimable amount of loss the farmer annually sustains on account of the underground channels made by the gopher beneath growing crops.

We have seen above, the amount of dirt thrown up by these little rodents and as it comes from beneath the surface some 6 to 10 inches we cannot readily see the amount of it in chief they do; But suffice it to say, that where the gopher works in the meadow, truck-patch, nursery, orchard or vineyard, the roots he bites off in making his excavations, are not a few by any means.

I have seen, where they made channels lengthwise of a potato row, the vines all wilted and dead for a rod in length in a single place, not leaving a single hill alive. This is by no means uncommon in potato fields.

A gopher will often follow a row for several yards, then cross over to the next row, and so on generally destroying the entire crop along his line of work.

Again, should the gopher enter a vegetable patch he would in a very short time destroy vegetables, such as carrots, beets, cabbage, parsnips, onion vines and etc., to such an extent that their value could not be calculated.

by a few dollars and cents.

The meadow and the truck-patch are not the only places where the gopher is destructive for here enters the horticulturist or fruit grower. With some horticulturist and nurserymen the problem how best to rid their orchards and nurseries of the gopher is one of no small importance for the loss they sustain is often a very great one, and has cost some pomologists a considerable sum of money.

The gopher, if coming in contact with a root, in making his burrow will bite it off. The gopher is also fond of the roots of some trees, for food, and will follow row after row in the nursery, eating the roots.

In the vineyard they are very destructive, for it is but a part of a night's work, to bite off the roots of a large grape-vine, which has cost much care and several years of culture, and anyone who is a grape grower fully realizes what a loss a few vines per acre amounts to when he comes to harvest his crop.

Another, but of minor importance, is a loss sustained in arid countries by draining the water off rapidly, thus drying out the soil somewhat faster than it naturally would.

The last phase that we shall consider under destructiveness is the amount of grain and vegetables eaten and stored by the gopher.

The gopher is a very ravenous eater, for it takes a

comparatively large amount of food to appease his appetite over summer. He lives both on roots and cereals and is very fond of nearly all kinds of tuberous vegetables, such as carrots, beets, parsnips, rutabagas and etc.,

He will dig a burrow along under a vegetable row and eat off the roots from below upwards till near the surface. He will also lay in a large supply for winter consisting of grains, potatoes and herbaceous roots. I have found over a peck of beets of potatoes and over a gallon of corn in the store-house of a single gopher.

Methods of Destroying the Gopher.

How best to destroy the "Pocket gopher" with the least labor and expense, is a problem of great importance. Many and various methods have been employed with a greater or less success. In some states large sums of money have been spent trying to rid the country of this depredations little rodent.

In some states or counties thousands of dollars have been paid for gopher scalps or tails, as bounties. In 1890 Kansas thus spent "\$5000" while ~~Minnesota~~ ^{Minnesota}, from 1887 to 1889, paid \$39,000.13 ⁱⁿ gopher scalp bounties, and yet these states are over-run with the gopher.

If in the near future, the farmers will not put forth greater efforts to rid the country of the gophers, they will become an enemy more troublesome and harder to contest with than the chinch-bug or army worm ever was.

when there are but a few in a field they can soon be got rid of, while in certain localities, where they are abundant a vigorous effort should be made to, entirely, rid the lands of them.

The methods of destroying the gopher with the least cost and labor will vary greatly with the condition of the soil and surrounding country. The Pocket gopher is not so easily destroyed as the *Spermophile* or striped gopher, on account of its inhabiting, generally, the loose or sandy soils, where many of the methods are not practical or will not work at all, while they will work to perfection in heavy or clayey soils.

The reasons for the difference in soils, as being suited for one method of destruction and not for another will be explained under each method below.

Some of the various methods which have been tried are as follows, Shooting with fire-arms: Browning them with water: Placing snakes in their holes: Poisoning with strychnine: Fumigation: Poisoning with carbon-disulphide: and Trapping.

1st method: Shooting them with fire-arms. This is a fairly good method if there are but a few in a field and a person has ample time to, patiently, watch for them. It is, however, a slow and tiresome method because it requires a person to watch at the open hole until the gopher makes his appearance, and if you are not a

quick and accurate shot the gopher will have disappeared by the time you shoot: thereby wasting your time and ammunition, also causing the gopher to become more shy and cautious, and it is not likely that he will make a second appearance.

2nd Method is drowning them out with water. This also is a fairly good method of destroying them if water is plentiful and the soil a loam or a clay.

In our sandy river bottoms this method is entirely out of the question as the water would not fill the burrow because it would sink into the soil as fast as applied.

3^d Method is by placing snakes into their holes.

The majority of people have a dread and horror for the serpent; but they are of great value to the farmer in many ways and this is one of them, I am speaking of non-venomous snakes, especially bull snakes commonly so called, also known as gopher snakes but scientifically known as *Pituophis*. These and the Black snakes are very fond of young animals. They also love to live underground and will follow the channels of the gopher until he is found when the snake makes a good meal of him. The snakes have this advantage that they can so easily follow up the gopher in his excavations, and should they find the nest of young none would be left. Therefore if you protect these snakes found in fields infested by the gopher

many of them will gain entrance to the gopher burrows and destroy them. If you are not afraid to catch and handle these snakes, catch everyone you find and place them in a gopher hole. If, however, you cannot bear to handle the snakes protect them by all means for they destroy many rats, mice and other vermin as well as gophers.

4th Method is Poisoning with Strychnine.

This is somewhat dangerous and should be done with the utmost of care and caution, and only by a very careful person, as carelessness may result in the destruction of some other and valuable animals. However if judicious care be exercised it is a very good method and good results may be obtained. The manner of using it as I deem best is as follows. Take a few apples or carrots and cut them into pieces about $\frac{3}{8}$ inch cubes and with a toothpick or small wire push a single crystal of strychnine into each piece till near its centre. Having the pieces all prepared place them in a small pail or large tin can with a bail attached, and with a wire hook hang the pail on your plow handles. Also prepare yourself with a piece of fence wire some 18 or 20 inches long, sharpened at one end, and a hook bent on the other.

Place this wire on your plow along with your pail. Now as you plow along and strike a gopher's hole, take the wire, stick the point into a poisoned piece of apple or carrot and shove it into the hole the full length

of the wire and go on. The object of shoving it into the hole so far is this. The gopher soon discovers that his channel has been broken into and at once sets out to close it up. Now if the poisoned bait lies near the mouth of the opening the Gopher, likely as not, will cover it up in closing the hole; But if it is some distance within the chances are that he will find it and eat it and will soon die from its poisoning effects.

By this mode of using it no time will be lost and the destruction of the Gopher will go on at a slight cost. It is not necessary, however, that this method should be used only in connection with the plowing of the field for it may also be used with good results by digging for the burrows and dropping in a piece or two of poisoned bait. This can easily be done in orchards, vineyards, truck-patches and in meadows. In whatever way this method is used too much caution cannot be exercised as the strychnine is a very deadly poison and when the pail of poisoned bait is not in use, or when stopping to plow at noon or evening, it should be well cared for so no animals or children can get hold of it.

5th Method is by Fumigation.

This consists in forcing the fumes of some chemicals or smoke of rubbish into the Gopher's burrows, with some apparatus made especially for the purpose. There are various kinds of fumigating appliances on the market, some

of which are cheap while others are quite expensive. After examining several different fumigating machines but finding none to suit or too expensive I had one made as follows, which can be made cheaply by any tin smith. make a cylinder of stove-pipe-shutiron, about 4 inches in diameter and a foot long with tight fitting lids at each end. Have a small tin tube an inch in diameter soldered in each lid. The tubes should be one, a foot long and the other about 2 feet. Procure a small hand bellows and have its nozzle fit snug into the shorter tube. Also get several feet of garden hose and strip one end of it over the end of the longer tube, and your machine is complete.

To use the machine. place the lid with the long tube on the cylinder and fill the cylinder with some small pieces of charcoal, putting in a handful of sulphur. Then put in some live coals or a few shavings, put on the lid with the hand-bellows attached, and it is ready for use. Now find a Gophers' burrow insert the hose several feet, pack the earth about the hose and force the sulphur fumes into the burrow by means of the bellows.

If there is no outlet to the burrow and the soil hard and clayey it will not work with good result as the air soon becomes compressed in the burrow and the fumes will not pass along. However if there is an outlet at the

other end of the burrow the Gopher will either succumb to the Sulphur deadly fumes or he will come out and can be captured.

In sandy soil this method will not work as the soil is too loose and pervious and will take up the fumes so they will not go to any distance and the Gopher remains unharmed.

6th Method Carbon disulphide.

Carbon disulphide has the chemical composition of CS_2 . It is a highly volatile liquid and its fumes are death to living organisms. Its specific gravity is heavier than that of air. It being 1.292 and in using it you must either make the application on a level with the Gopher or above him. So if using it on uneven ground or on hill sides, it must always be introduced at the highest point. To use it open the burrow, take awad of cotton the size of a walnut, saturate it with the liquid and throw it into the burrow. It will at once evaporate and the fumes, following along the burrows overtake the Gopher and cause his death by suffocation. It is best to cover up the hole so as to prevent the escape of the Gopher.

In the use of this liquid care must be exercised as it is highly inflammable and should never be brought near a fire nor be used while smoking.

This, like fumigation does not give satisfactory

results in sandy or loose soils. nor does it work good on hill sides even in clay or loamy soils unless you are sure the application is made quite near the animal and to definitely locate him is impossible

7th Method Trapping

Trapping the last method herein described is the surest and safest of all methods. It is slower than numbers 1. 2. 4 and 6 above described; but it makes sure of the Gopher, because when you have him in the trap you have him, and a bird in the hand is worth two in the bush.

There are various forms of Gopher traps on the market but none of them are better and easier to manipulate than the common steel trap. For trapping Gophers use the number eight steel rat trap with the paw above the spring. This size I have used for some years with good success.

There are several ways of setting the traps which must be learned through experience and observations by the trapper.

One way, and the best one is to find the main channel by digging a small hole down to it, a drain spade is the best instrument for this kind of work as you are able, with it, to make a small deep hole. After finding the channel, remove all loose dirt and cut a small notch in one side for the spring of the trap to project into. the trap must be set flush with the bottom of the channel. This is one of the most important

points about setting traps for if the trap is either higher or lower than the Gopher's runway he will easily detect the trap and cover it over with dirt. Neither should the hole be larger than is really necessary for the working of the trap, so that everything about the runway, will remain, as much as possible, just as the Gopher left it, so as to avoid his suspicion of the trap. If you wish to bait the trap, stick a small piece of apple or carrot on a stick, some 3 inches long, and stick it in the side of the hole you dug, placing it some 4 or 6 inches up the side. Having set the trap cover over the hole, by placing several shingles over it and shore several shorefulls of dirt upon them so as to exclude the light, for if the least bit of light enters the hole, the Gopher will become aware that something is wrong, and he will cover up the trap with dirt and plug up the burrow solid and tight, and your work has come to nothing.

However if all has been properly done as above stated you will seldom miss catching the Gopher.

Another good place to set the trap, is in an auxiliary or side channel, especially where the Gopher is at work throwing out dirt late in the evening. If he be disturbed at this time of the day, he will seldom shut up the hole, but will leave it till later on in the night when he generally returns to complete his work, and if a trap be there the Gopher will seldom miss being

caught.

In setting a trap in such a place take a garden trowel and enlarge the hole some 6 or 8 inches back so the trap will have ample room to work in. Here also the trap must be set flush with the bottom of the channel.

If traps are set late in the evening, they need not necessarily be covered over, as stated in first method of trapping. However it is best to cover them over as it ensures better success. If, however, the traps are set during the day they must always be covered over, as above stated, in order to be successful. It is not necessary that the traps should be baited if they are properly set according to the above directions. I very seldom baited my traps and can say that I have had good success in catching the gophers.

It is often very difficult to find the gopher's channel without much digging, and to avoid this, I took an end-gate rod of a wagon and prodded the ground with it, about where I thought the burrow ought to be and in this manner the burrow can easily be found, after a little practice. When the rod strikes the burrow it gives a slight plunge downward, with but little pressure of the hand, and as it strikes the lower side of the hole it makes a sudden stop and the burrow is located.

Poisoning and trapping, I deem the most practical, as well as economical and successful

methods of ridding fields from the Gopher. Trapping, however, I would recommend as the best of all methods as a child could do the work required in setting and looking after the traps. moreover no serious results could follow.

The two methods, just mentioned, can be used in all kinds of soils and in all kinds of fields and crops with but a very slight disturbance to the growing crops.

In conclusion I can conscientiously say that the Gopher problem is one to which every tiller of the soil should give his attention, and try to rid the infected fields before the Gopher has taken control of them, for, if they are not exterminated they will, sooner or later, overrun the state to such an extent that their extermination will take much time and will cost thousands of dollars.