



Squirrels eat a variety of fresh greens as well as seeds and dried nuts. In spring, ground squirrels prefer greens over seeds and nuts. Once the natural grasses begin to dry, squirrels will actively forage for seeds.



As foragers, squirrels are well-adapted to find sparsely dispersed food, one seed at a time. Once squirrels have had their fill, they will collect food in their cheek pouches and take it back to the nest to cache. Squirrels tend to forage close to their burrow, although they will travel for desirable foods.

## Biology and Control

Prefer to forage in the early morning or late afternoon/early evening to avoid the day's heat. Squirrels may prefer crops over bait. If the squirrels won't eat the bait, alternative control approaches may be necessary (trapping or fumigation). Feeding preferences are influenced food is availability. In rangelands the vegetation may be dry in early summer and squirrels actively foraging for seeds. If irrigated crops are available the squirrels will select for crops.



Squirrel burrows have an average opening of 4 inches in diameter



Interconnected through underground tunnel systems with multiple entrance and exit holes. Burrows are usually less than three feet deep. Their burrows will often be on sloped ground where flooding is less likely and visibility is good.





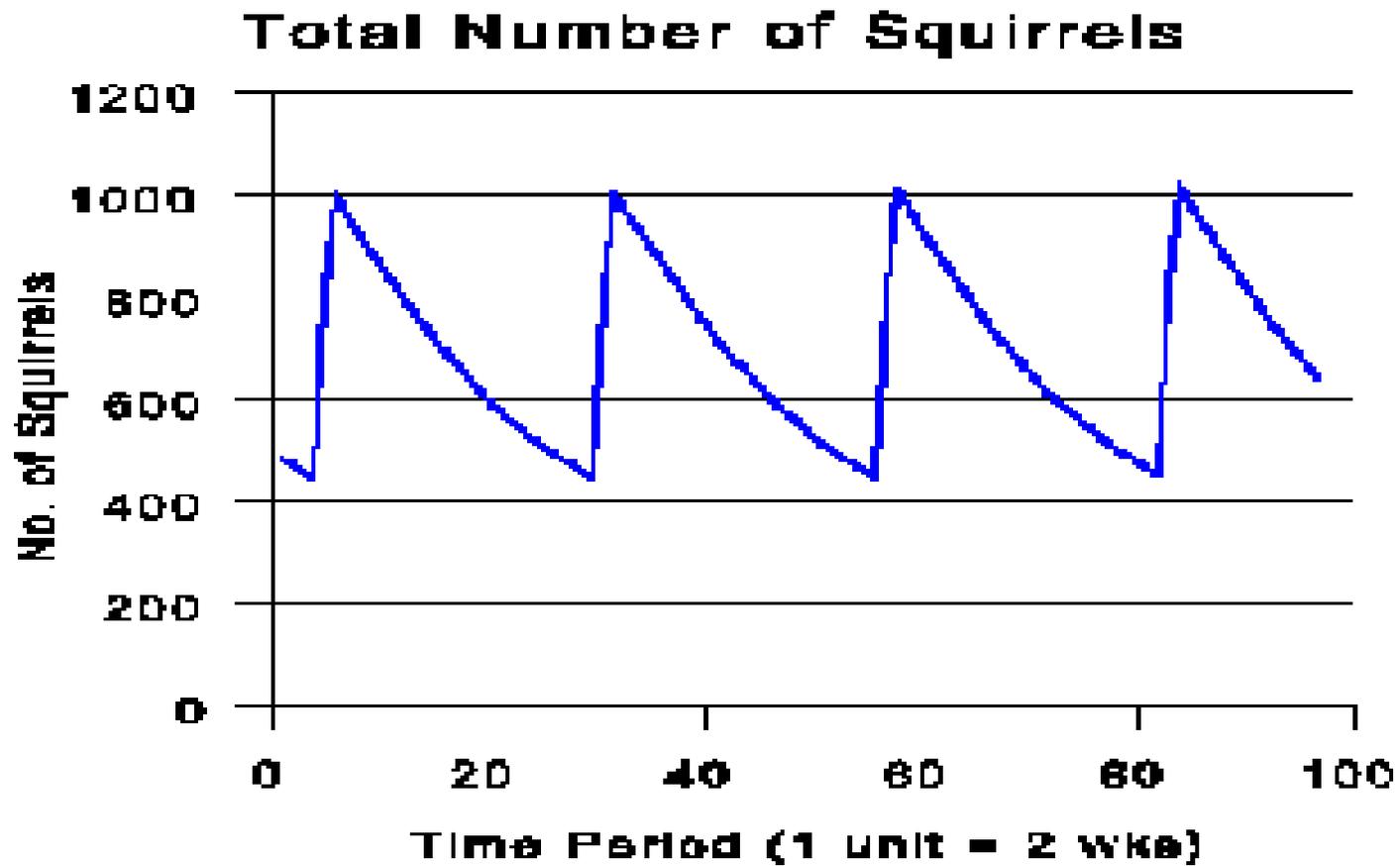
**Signs of an active burrow:**

- food debris and litter (shells, greens clippings, seeds, etc.)
- tracks
- fresh deposits of soil from burrow



**Signs of an inactive burrow:**

- spider webs
- leaves and debris in entrance



Population left untreated.

Total population of ground squirrels for years 1-3. These years illustrate the stability of the population.

## Breeding facts:



- Townsend ground squirrels reproduce once a year
- 
- Average litters are 7 or 8 young with a range of 1 to 15. Five to six are most likely to survive.
  
- Breeding season ranges from February-March – Weather dependent



Males emerge earlier than females after hibernation. At peak breeding season, the ratio of males to females aboveground equalize. Squirrel gestation is 25 to 30 days.

Young are nursed below ground for about 6 weeks before they emerge and begin foraging above ground.



Young squirrel numbers are greatest from late April until June, when they may disperse to new territory or move to old, unoccupied burrows.

## How breeding relates to control:



Optimal time for control is during the breeding season when both males and females have emerged from hibernation for peak breeding season. At this time, a majority of the squirrels are aboveground foraging for food and breeding.

The young have not yet been born and, because of over-winter mortality, the squirrel numbers are usually at their lowest point.

Fumigation is probably the best control method during this season as these squirrels are foraging for greens and are not often interested in the seed-based bait.



## Factors That Influence Squirrel Activity



morning and early evening

midday

Spring and Fall

Winter and Summer

mild sun

hot, cold, windy or rainy weather

# DETECTION, MONITORING AND PERSONAL RECORD-KEEPING



## WHAT TO DO: BEFORE

Determine how severe the potential or actual problem is.

Treatment method will vary if you see 10 or 50 squirrels.

Technique: Pick a few areas where you see ground squirrels and count them. Then write it down. The important thing about this process is just to be sure that you use the same area and the same method every time. Counting squirrels in this way before you begin any control method will also help to determine a baseline with which to compare effectiveness of control.

A good way to count is to scan an area from one end to another, counting squirrels along the way. You may not see the entire squirrel, but count it anyway. As long as you do not overlap your scan area, you don't have to worry about double counting squirrels. Remember, time of day, season, and weather conditions will influence activity.

## **Some ways to monitor squirrel numbers:**

Ex. 1 - Every time you drive up to the old barn, you count all the squirrels you see in the area.



## **Counting squirrels while slowly driving through their habitat.**

Ex. 2 - You drive slowly out to the south pasture and count the squirrels along the road.



## **Monitoring numbers from truck.**

Ex. 3 - If you want to be more accurate... sit in one place with a pair of binoculars. Slowly scan along the ground over a preset area. Counting squirrels for several days will give you a good indication of the squirrel activity level before you being control.

## **MONITORING (During Control Program)**

Monitoring ground squirrel activity during control programs will aid in long-term ground squirrel control.

It can tell you how effective your control was.

It can tell you how much you may have to control in the future.

It can help you decide when to implement your next control.

Try to count squirrels as described in **Detection (Before)** at least once a month throughout the year.

Key detection periods are early spring, late spring, and fall.

# PERSONAL RECORD KEEPING (After)



## Record-keeping.

- For pesticides that are restricted use materials , certified pesticide applicators must retain legal records of rodenticides used.
- Even if records are not mandatory, you should keep written records of all control efforts, including the amount and type of pesticide used.
- Record the active ingredient and concentration as these vary among rodenticides and are important when reviewing past control efforts.

Again, this information will be extremely helpful in determining how effective control was and for making plans for future control

Sample records sheet				
Date	Time	Location	Weather	Number of squirrels*
4/15/03	08:00	South Pasture	Warm, clear skies	38, 42, 42
4/16/03	08:10	South Pasture	Overcast, cool	15, 12, 16
4/17/03	08:05	South Pasture	Warm, partially cloudy	40, 35, 37



- The best time to count is in the morning on a nice day because that is when the squirrels will be most active. Ground squirrels hibernate in winter and may estivate during the hottest part of the summer

# POISON BAIT



Poison bait is a common method of large-scale ground squirrel control because it requires relatively little labor when compared to other methods and achieves high efficacy

It involves distributing bait, usually grain based, which is put in bait stations (anticoagulants only), or broadcast mechanically or by hand .

<i>Rodenticide Material</i>	<u>Chlo. 0.005%</u>	<u>Chlo. 0.01%</u>	<u>Diph. 0.005%</u>	<u>Diph. 0.01%</u>	<u>ZnP 2.0%</u>
<u>Mechanical Broadcast Baiting*</u>		✓		✓	✓
<u>Spot Baiting</u>		✓		✓	✓
<u>Bait Stations</u>	✓		✓		



UC Statistics 101, Fall 2011  
© 2011 Professor University of California



PROS		CONS
<ul style="list-style-type: none"> <li>●can be used to control more than once in a year</li> <li>●can be used in <u>bait stations</u></li> <li>●less toxic to environment</li> </ul>		<ul style="list-style-type: none"> <li>●requires multiple applications</li> <li>●higher material costs</li> </ul>
<ul style="list-style-type: none"> <li>●good for quick population knockdown</li> <li>●only requires one application</li> <li>●low material costs</li> </ul>		<ul style="list-style-type: none"> <li>●can only be used once per year, usually once every few years</li> </ul>

<i>Rodenticide Material</i>	<u>Chlo.</u> <u>0.005%</u>	<u>Chlo.</u> <u>0.01%</u>	<u>Diph.</u> <u>0.005%</u>	<u>Diph.</u> <u>0.01%</u>	<u>ZnP 2.0%</u>
Gloves	✓	✓	✓	✓	✓
Long sleeves, pants, and shoes	✓	✓	✓	✓	✓
Eyewear		✓		✓	✓
Respirator		✓		✓	✓

# FUMIGATION



## Gas cartridge

Fumigants are toxic gases or vapors that are introduced into the squirrel [burrow](#) system. This is a good method of control because it provides quick results and it introduces relatively low levels of toxicity into the environment.

- Fumigate in the spring when soil moisture is high or at other times when irrigation provides soil moisture. This prevents fumes from escaping through dry cracks in the soil.
- Do not fumigate when squirrels are hibernating or estivating because they plug their nesting chamber and fumes will not reach them.
- For most effective control, fumigate 3 weeks after first squirrels emerge from hibernation .
- Re-treat any burrow that has been re-opened after 2 days.

### **Reduce Materials:**

- Squirrel burrows often have several entrances. If the number is high, you can reduce your fumigation effort by dragging the fields or shoveling in the burrow openings to determine which burrows are active. The squirrels will easily dig out, but not from some of the interconnected burrows. Treat only those that are re-opened.
- Use only amount specified on label. Applying more fumigant than recommended to each burrow does not increase efficacy.

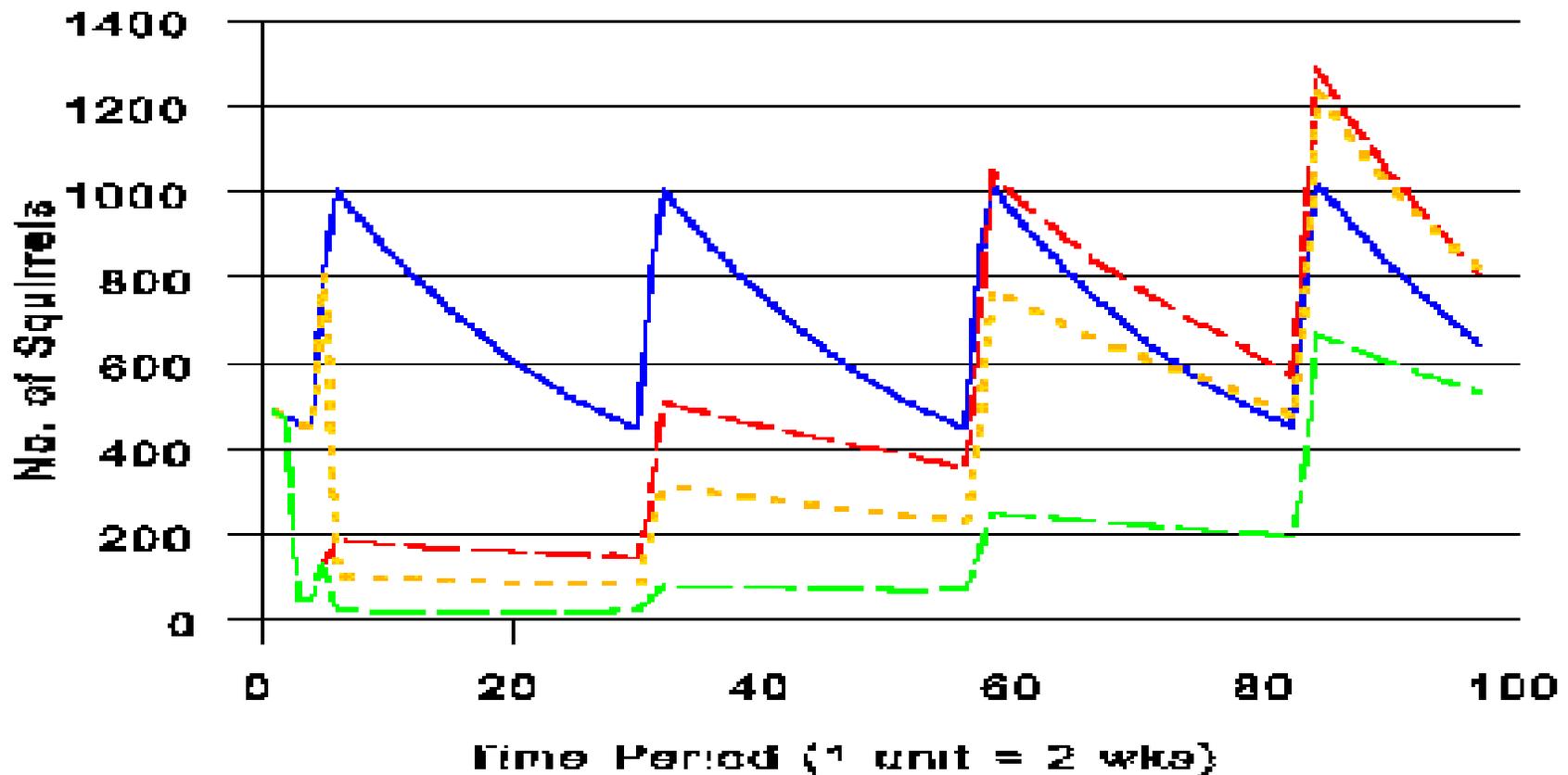
**Do not use fumigants near dry grass or other flammable materials.**

**•Do not treat burrows that are in or near buildings. Check label for specific restrictions.**



<b>Pros</b>		<b>Cons</b>
•no restricted use permit required	Gas Cartridges	•more expensive than other fumigants
•less expensive than other fumigants	Aluminum Phosphide	•requires <u>restricted use permit</u>

## Total Number of Squirrels



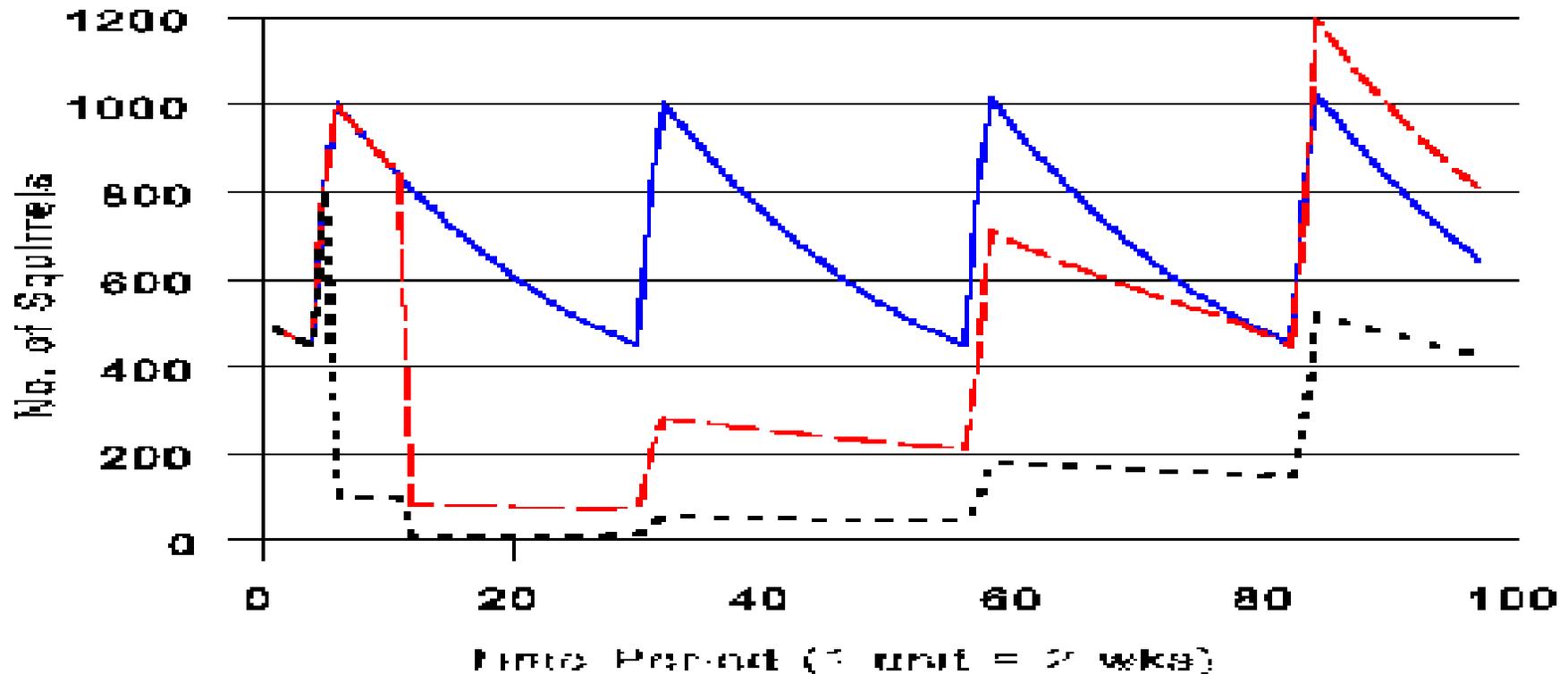
The solid line (-----) represents an uncontrolled, stable population.

The dashed red line ( - - - - ) represents a population exposed fumigation in the spring in May.

The orange dots (.....) represent a population treated with anticoagulants in July.

The dashed green line ( - - - - ) represents a population treated with fumigation in the spring followed by anticoagulants in the summer.

## Total Number of Squirrels



Anticoagulant treated population graph.

The solid blue line (-----) represents an uncontrolled, stable population.

The dashed red line ( - - - - ) represents a population treated with anticoagulants in the fall.

The dark dots (.....) represent a population treated in the summer and the fall with anticoagulants.

# BURROW DESTRUCTION



Burrow destruction is generally used after another control method (such as [poison baiting](#) ) has been used.

It helps to prevent the reinfestation of ground squirrels.

In the long run, this may be one of the most cost efficient control methods you can practice



## HOW IT WORKS:



Ground squirrels work hard on their burrows and do not readily give them up. They continue to improve their burrows through multiple years and generations, creating complex systems that can be anywhere from 3 to 30 feet long and 2 to 4 feet deep.

- When burrows are abandoned, new squirrels will reinfest the area and occupy the old burrows. By destroying the burrows, you will slow or prevent the reinfestation of ground squirrels.
- Ripping the burrows to a depth of 18 inches can reduce reinvasion into old burrows.



Trapping is not the most effective method of control, mainly because of the high labor required to achieve good results.

Trapping is an art, not a science.

## BEST MANAGEMENT PRACTICES FOR TRAPPING

### Time of Year:

Anytime squirrels are present



- Most traps require the use of bait, which may limit the effectiveness during certain times of the year.

- Bait must be at least as appetizing as what they are currently feeding on.

- Best overall results come from trapping squirrels just before they have their young, although trapping anytime squirrels are active can be effective.

Prebait the traps.

Rolled oats are a good trap bait because they are inexpensive and readily accepted by squirrels.

PROS		CONS
<ul style="list-style-type: none"> <li>•Non-target species can be released</li> <li>•Safer than other traps to non-target animals and children</li> </ul>		<ul style="list-style-type: none"> <li>•Requires baiting to be effective</li> <li>•Squirrels caught must be <u> euthanized </u></li> <li>•Squirrels caught cannot be released in another area without a permit</li> </ul>
<ul style="list-style-type: none"> <li>•Does not require baiting, so may have longer period of efficacy</li> </ul>		<ul style="list-style-type: none"> <li>•These are usually placed in burrows, so can be hazardous to other animals that inhabit burrows.</li> </ul>
<ul style="list-style-type: none"> <li>•Usually the least expensive and requires relatively little labor</li> </ul>		<ul style="list-style-type: none"> <li>•Usually requires baiting to be effective</li> </ul>

## HABITAT MODIFICATION-BIOLOGICAL CONTROL

Habitat modification generally means physically removing or adding things that change the habitat for ground squirrels. There are 4 basic methods of altering a squirrel's habitat; their effect on control appears limited. Another more efficient method of habitat modification is [burrow destruction](#).

### Eliminating piles



### Squirrel haven

- Burn brush piles and eliminate trash piles immediately. Squirrels will often use these for cover if they are available. However, removing these piles is no guarantee that you will have any affect on the population. Squirrels infest areas with no cover without a problem.

## \*Flood Irrigation



- Flood irrigation, as opposed to sprinkler or drip irrigation, may discourage some squirrels from burrowing in the flooded area. It will not eliminate them.

## •Cultivation

- Land under frequent tillage, such as for crops, may deter ground squirrels. However, that will not keep them from inhabiting the area immediately surrounding the land. And it will not keep the squirrels from foraging in that area for food.

**Biological control**, or predation, is also considered a method of habitat modification. Many predators eat ground squirrels, including hawks, eagles, rattlesnakes, and coyotes. However, in most cases they are not effective in keeping ground squirrels populations at acceptable levels, and introducing these animals may have other repercussions.



Dogs may keep squirrels out of small areas, but are not effective in controlling large squirrel populations.



Shooting, like trapping, tends to require a lot of effort. It is most helpful as a follow up method to another type of control to get the few remaining squirrels.

## **HOW IT WORKS:**

Shooting controls squirrels in small numbers. The biggest problem with shooting is that the squirrels will often come to recognize it and become gun shy. They may learn to retreat to their burrows any time a vehicle drives into the area or they hear a gunshot. This is also a time intensive method.

## **HOW TO USE IT:**



### **Shooting as a control method.**

Shoot the squirrels from as far a distance as you can. To increase the effectiveness, it may be wise to settle into a location and wait a while before you begin shooting so that squirrels become acclimated to your presence.

CONTROL METHOD	TIME OF YEAR	EFFICACY	COST OF MATERIALS	LABOR	RESTRICTIONS
Poison Bait					
Fumigants					
Trapping					
Shooting					
Burrow destruction					
Repellents					
Relocation					
Habitat modification					
Burrow exploder					