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The Porcupine in Oregon

Its Life History and Control

By Edward F. Hooven

November 1971
Research Paper 10



Forest Research Laboratory
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OREGON STATE UNIVERSITY
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PREFACE

This note was prepared to answer the questions most often asked by foresters concerned about the porcupine and its control. The literature was reviewed for information on the animal's life history and the extent of damage in other areas. Direct field work reported was done primarily near Medford, Oregon, in mixed species. Because of the increased amounts of damage occurring west of the Cascade Mountains, however, some observations were made in stands that were almost all Douglas-fir.

It should be understood that control measures are undertaken only after the porcupine has become a pest animal and is causing damage to future crop trees. Porcupine populations occurring in noncommercial timber-producing areas are considered as desirable components of the wilderness wildlife.

THE PORCUPINE IN OREGON: ITS LIFE HISTORY AND CONTROL

Edward F. Hooven

INTRODUCTION

The yellow-haired porcupine (see checklist of plants and animals for generic names) occurs throughout all of the forest types of the West. Its range covers the entire state of Oregon, chiefly in areas occupied by ponderosa pine. The porcupine, until recently, was rarely observed in the humid coast region north of the Umpqua River or west of the Cascade Range. This condition of scarcity has changed to one of increasing prevalence in western Oregon. The animal is now abundant in many areas west of the Cascade Summit and increasingly active in many areas of principally Douglas-fir.

LIFE HISTORY

The porcupine is a stocky, heavy-bodied rodent, which weighs more than 35 pounds when fully mature (10). Its body is covered dorsally with spines distributed among the hairs. The spines, reaching their greatest development on the rump and tail, are sharp with back-slanting barbs and are loosely attached. The spines form the principal defense against the porcupine's enemies. The eyes are small and black and are reported to give no reflection from light at night (19). The ears are small and barely visible in the fur. The legs are short.

The porcupine walks upon the entire sole of the foot like bears and man. It is an expert climber and spends considerable time in trees, especially during daylight hours. It does not hibernate and is active all year. Life expectancy is unknown. One raised from infancy, however, succumbed to pneumonia after 6 years of captivity (personal communication with Alice Clark, Corvallis, Oregon). Because of its small lung capacity, it is susceptible to pneumonia, especially under damp conditions.

Feeding Habits

The porcupine, a vegetarian, feeds upon a broad variety of plants. Consequently, its diet varies according to the available food supply. Its feeding habits may differ widely within a given area, depending upon the types of vegetation present. It has definite seasonal food preferences, especially in the ponderosa pine region, where it feeds upon the ground vegetation such as grasses, forbs, and herbs during the spring and early summer (4). During the late summer when the ground vegetation dries and loses its succulence, the food selection becomes more dominantly twigs and bark of shrubs and trees. In the fall and winter, it turns increasingly to the inner bark and foliage of ponderosa pine, the pine mistletoe, and available herbaceous vegetation. The porcupine eats the inner bark of ponderosa pine throughout the year, but it consumes considerably more during the late winter season (21). It rejects the outer rough material of the bark, eating only the exposed inner bark and cambium. Although the porcupine decidedly prefers ponderosa pine, it likes lodgepole pine and white fir; white pine and sugar pine are seldom selected as food.

The food habits of the porcupine west of the Cascade summit are unknown. Here, the ground vegetation remains green and succulent late into the fall, which affords the animal a greater choice of foods throughout the year. Because of the great availability of food, the damage to conifers is presently not extensive and generally remains unnoticed. Douglas-fir of sapling or smaller size, however, is sometimes seriously damaged.

Type of Damage

The porcupine chews or strips the bark from trees, especially ponderosa pine (Figure 1). This debarking deforms the structure of the stem because of prolific sprouting and limb formation near the girdled zone. The most common deformation is a spike-top above the girdled area. Breakage, which often occurs at this point, reduces the quality of the timber, because the merchantable height of the tree is reduced, and the exposure of the tree to infection by insects or disease is increased.

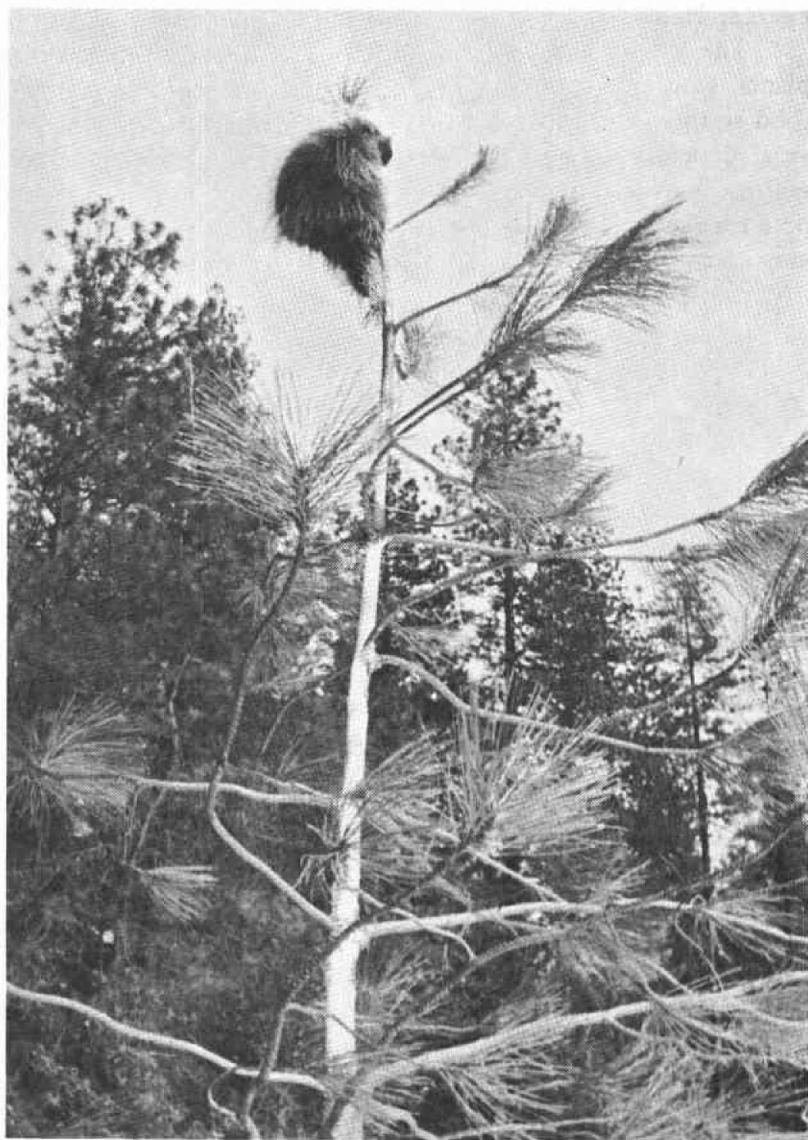


Figure 1. A porcupine in the top of a ponderosa pine sapling from which it has stripped the bark. (Photo courtesy of Jack Thomson and William A. Neitro, Bureau of Land Management, Medford, Ore.)

Foresters in other areas found that the most frequently attacked pines are the dominants and codominants. Ten percent of the trees observed were attacked and 7 percent (75 percent of the injured trees) were permanently damaged in the Black Hills of South Dakota (22). They found in central Idaho that the porcupine preferred ponderosa pine in the pole class with diameters from 8 to 10 inches (5). The annual loss was estimated at 1.2 percent of the annual growth in northern Minnesota (12).

The amount lost to, and the seriousness of, porcupine damage is difficult to estimate with reasonable accuracy. Ponderosa pine, once established and during its development from a seedling to a large tree, is exposed to long-term potential attack by the porcupine. Estimations are that an individual animal in its lifetime can do as much as \$6,000 damage to timber stands (13). Often, many young small trees are damaged, especially in plantations, on large burned or cut-over areas. The porcupine feeds upon the cambium of the lateral branches and the main stem of the seedlings (Figure 2), and few of the attacked trees survive. The planting success is severely reduced; girdling the young trees also increases the danger of infection by heart or butt rot.

Besides trees, the porcupine frequently damages unoccupied cabins and camps, plywood signboards, construction materials, wooden-handled tools, and rubber or plastic fittings on automotive (20) and logging equipment. Inquisitive dogs, livestock, and game animals are often seriously injured or unable to feed after an encounter with a porcupine.

Reproduction

The porcupine presumably has one of the lowest reproductive potentials among the North American mammals. The female is not sexually mature until the second fall (21), when she may weigh 8 or more pounds. Toward the end of summer the normally solitary animal searches for a mate. The estrous cycle is repeated every 25-30 days and occurs from September through December. The gestation period requires 7 months after fertilization, and parturition occurs from April through June (7, 9). The female bears one young a year and no



Figure 2. A ponderosa pine seedling girdled by a porcupine. Seventy percent of the trees in a 100-acre plantation were destroyed by the third year after planting.

authentic record of twins exists. The young is born where some protection is offered, such as brush piles, thickets, windfalls, or rock dens. The low reproductive rate is compensated for by an advanced stage of development of some of the sense organs. At

birth, the eyes are open and the incisor teeth are well developed. The quills dry and become functional as a protective cover in less than an hour. The young quickly begins to progress more or less on its own, and feeds on green vegetation shortly after birth. Postnatal care is of short duration and weaning begins early, but nursing may continue for as long as 3.5 months (3).

The porcupine's sense of sight is poorly developed. Hearing, though somewhat better advanced, is still rather dull. Smell is apparently the most important sense and is widely used in helping the animal find acceptable food.

Movements and Density

Although the porcupine may be active any time during the day or night, it is mainly nocturnal. Movement begins at dusk when the animal leaves the protective cover where it spent the day and begins to feed on the available low shrubs and herbaceous vegetation. Foraging continues throughout the night, with the porcupine returning to the protection of tree, brush, or rock den at daybreak. On cut or burned-over tracts, it takes advantage of down logs and scattered slash for shelter.

During the winter in eastern and southern Oregon, the porcupine has a tendency to gather at denning sites such as talus slopes or broken rimrock. The tendency to congregate during the winter may be related, in part, to the breeding season.

During late spring, the porcupine moves from these protected areas to forests and meadows for the fresh vegetation (8). The local movements occur as a slow and deliberate progress along more or less definite travelways, with the animal becoming widely scattered over the flatter country. During its travels it often utilizes special "rest-trees" which provide maximum protection in the dense and bushy crowns.

In western Oregon, north of the Coquille River, the porcupine does not appear to migrate. It is more sedentary, taking refuge in slashings and cull logs on ridges and shallow draws that have a southerly exposure.

The territorial demands of the porcupine are not well known. Its daily movements may have the appearance of

aimless wandering, but there is some indication of a territorial preference, with the animal confining itself to a limited area. Studies in the northeastern United States (12) found that 54 percent of the porcupines moved about 0.4 mile, 23 percent moved from 1 to 1.3 miles, but that the average distance moved was only about 0.5 mile in a 2-year period. The maximum distance moved was 1.3 miles in 14 months. Of interest in relation to the territorial requirements and movements was the minimum recapture time of 8 days and only 330 feet (5 chains) from the place where first caught, and the maximum recapture time of 2 years, also only 330 feet from the original place of capture.

In the dry, pine-growing areas of Oregon, the porcupine has a tendency to limit its activities in the spring to natural meadows and water courses where the forbs and grasses are succulent. As the season advances and the vegetation becomes drier, the tendency for more frequent and farther movements increases.

In western Oregon, because of the prevalence of green food, the tendency for movement is not strong and the animal confines its movements to about 5 acres.

Because the porcupine is basically nocturnal and solitary in habits, the population density is difficult to determine. From 3 to 15 animals per square mile have been reported for areas in the southwest (21). In the Lake States region, one porcupine per 3 acres or about 210 per square mile was found during short periods of time (12). Such high figures possibly resulted from the congregation of animals near denning sites.

CONTROL

Predators of Porcupines

The porcupine is completely covered on the upper body surface and tail by stout, thick-set spines or quills that are easily detached from the skin. The quills give excellent protection against many enemies. The porcupine, however, is hunted by a considerable number of predators. The success of artificial

control would be enhanced if it were possible to support the increase of these natural enemies.

The fisher is the animal most noted for its ability to prey upon the porcupine (2). The fisher also preys upon squirrels, mountain beaver, mice, voles, marmots, and grouse. The fisher is rare in Oregon, but 24 were imported and released in 1961 as part of a porcupine control program.

The wolverine, a large member of the weasel family, also preys upon the porcupine in addition to squirrels, marmots, and other small animals. It, also, is rare in Oregon.

The cougar, although its diet is reported to be about 50 percent deer, is also an effective predator upon the porcupine and other small mammals. The cougar is not numerous and is principally limited to remote and inaccessible mountainous areas.

The bobcat preys upon hares, brush rabbits, pocket gophers, woodrats, squirrels, vole, and deermice. Porcupine remnants have been found among the stomach contents of the bobcat, and porcupine is an important food item for it in the Northeast (16, 23). The bobcat is found in practically every habitat and life zone of Oregon.

The coyote, which preys chiefly upon mice, hares, rabbits, and squirrels, will also prey upon the porcupine to some extent (17, 11).

Trapping

Trapping is a nonspecific and difficult method of control because the porcupine appears to have no definite daily movement pattern. No effective design is known that will attract the porcupine to a trap site, although many are caught by trappers that concentrate on predatory animal control. The fetid scents used to attract the larger predators such as coyotes may be of some attraction to the porcupine. Porcupine can often be trapped at winter denning sites. Number 1½ or 2 steel traps, placed inside the den entrance and firmly secured to prevent loss, are usually effective. Any general hardware store can usually supply the traps.

Hunting

Hunting, although sometimes effective, is nonsystematic and more a source of recreation than porcupine control. A bounty payment can be added as an inducement to hunt. Bounties on pest animals, however, often are expensive and have few benefits.

Hunting is generally done with small-caliber rifles or handguns. The .22 caliber longrifle bullet with a hollow point is a favorite combination. The best time to hunt is at dawn or dusk when the animal is still visible and actively moving about the ground surface. Hunting by car headlights can be done during darkness, but is difficult and not as productive because of poor visibility. During spring and summer months, the animal can often be found in forest meadows, cut-over areas, brushfields, and other open areas that contain an extensive variety of fresh forbs and herbaceous vegetation. Spotlights can be used advantageously at this time. As the summer progresses the animals tend to become more dispersed, although they may still be found along water courses and the fringes of most open areas.

Poisoning

Poisoning has long been a primary method for porcupine control. It can be used to take advantage of the porcupine's preference for talus boulders, rocky outcrops, and denning sites. The method can be especially successful when used with bait stations.

Strychnine, both powdered alkaloid and sulfate, is an effective poison that has been used in rodent baits for many years (18). It has been the principal poison for the control of porcupines. Strychnine is odorless, does not deteriorate, and is economical in relation to other toxic agents. It is fast acting because it is absorbed rapidly from the stomach and intestines of most mammals. The initial physiological action is cramping of the muscles, and a lethal dose will result in convulsions in a few minutes. Symptoms are increased respiration, convulsions, and paralysis of the medulla center of the brain. Death results from asphyxia.

The lethal dose of strychnine for the porcupine is from 6 to 8 mg per kg of body weight and for the laboratory rat is from 10 to 15 mg per kg. The lethal dose for cats and dogs is from 75 to 300 mg per kg, and for horses is from 100 to 150 mg per kg. Cattle, deer, and other ruminants are somewhat resistant to poison because of the long time it remains in the stomach, but from 200 to 300 mg per kg can be lethal. The lethal dose is much less for animals if the stomach is empty. Poor physiological condition of the animal also increases its susceptibility to the poison.

Secondary poisoning is considered slight, but has resulted when scavengers fed upon the stomach and intestines of strychnine-killed animals.

The general antidote for strychnine-affected mammals is tannic acid.

Sodium arsenite, a general herbicide used in past years, was reported as giving good results when used to kill porcupines (6). The powdered form is inexpensive and readily accepted by the porcupine. The LD50 (dose that would be lethal to half the population) for porcupines (6.5 mg per kg) is low in contrast to that for other small rodents and game animals (10-15 mg per kg). From 75 to 300 milligrams of sodium arsenite (technical) is placed in holes punched into apples. The apples should be placed far back into rock crevices out of the reach of livestock and large game animals. The potential hazard of such apple baits is short lived, as the fruit breaks down and decomposes rapidly. Sodium arsenite should be used with extreme care because of its exceedingly potent toxicity. Acute arsenical poisoning is characterized mainly by gastro-enteritis (intestinal inflammation) and diarrhea. Kidney injury and degeneration appear in both acute and chronic poisoning. Skin disorders also may appear (18).

Sodium arsenite is considered extremely hazardous to domestic stock, wildlife, and birds. Game animals have died where it was used for locust control and birds have been killed by eating insects that were poisoned by sodium arsenite. Sodium arsenite is also extremely toxic to plants when in direct contact with them.

The Oregon State Department of Agriculture regulates use of both strychnine and sodium arsenite. Strychnine alkaloid at concentrations of 1.1 percent and above and sodium arsenite above 2 percent concentration are restricted to commercial use and cannot be packaged for use around homes and gardens.

Bait Blocks. Experience has shown that best control of porcupines is through the use of bait blocks. The bait blocks generally contain a formulation of strychnine and are highly satisfactory because of the ease of distribution or removal. They give best results when used at denning sites, rest trees, or ground stations.

The bait blocks are prepared with a mixture of 1 ounce of powdered alkaloid strychnine added to 12 to 16 ounces of common salt. The salt and strychnine compound is mixed with a caking agent such as magnesium carbonate or vegetable shortening. The bait mixture is placed in a hollowed-out block of wood, preferably ponderosa pine (Figure 3).

Ready-made blocks, with 1 ounce of strychnine to 16 ounces of salt, are prepared by the U.S. Fish & Wildlife Service, Pocatello, Idaho. However, the purchaser must be supplied through the Division of Wildlife Service, Bureau of Sports Fisheries and Wildlife, Portland, Oregon. The block is roughly 2 by 2 by 5 inches.

Dens. Effective control operations can be enhanced by proper baiting of active porcupine dens. All possible dens should be located by determining travel routes as indicated by damaged trees. The blocks containing the salt-strychnine mixture should be firmly attached to poles or heavy branches and placed well back into the den.

Rest Trees. Rest, or roost, trees are trees in the travelways that are constantly revisited by the porcupines during the course of their migrations. The rest trees will have a carpet of fecal pellets around them from the continuing use of the animals. The bait block should be wired or nailed to the bole of the tree well above the reach of livestock or big-game animals. The block should be placed sufficiently above a large branch to allow the porcupine room to stand while feeding. Exposed blocks should be used only in areas of light rainfall, and then

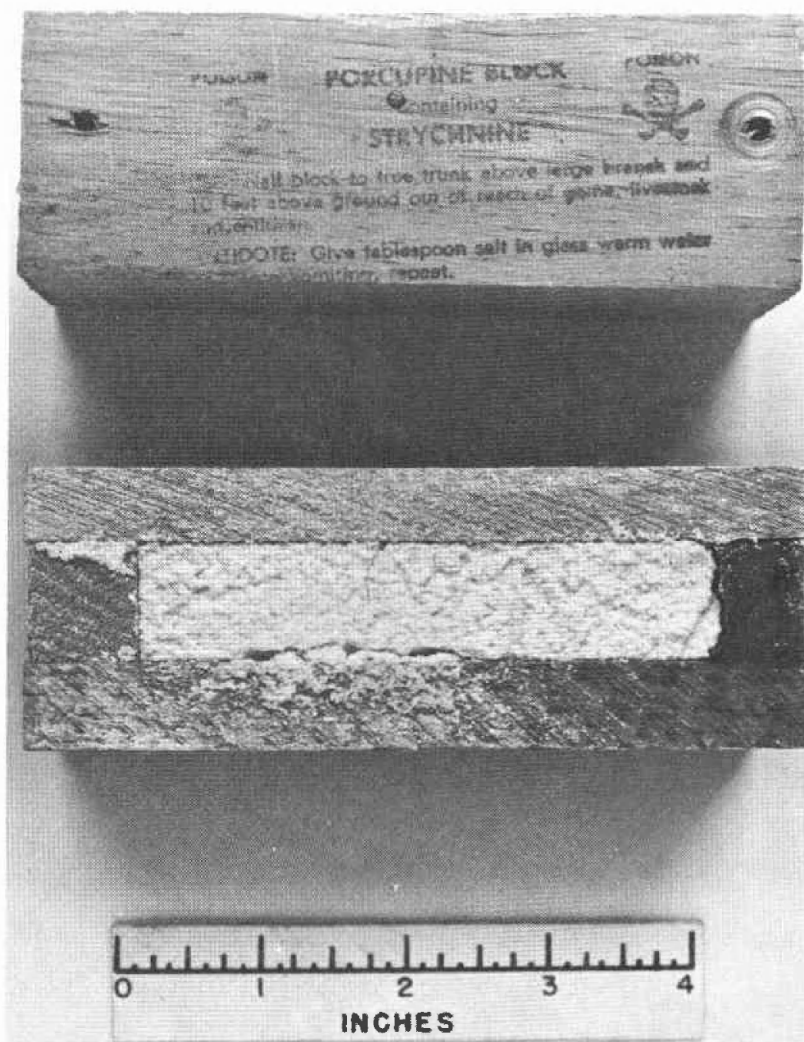


Figure 3. Bait blocks constructed of ponderosa pine wood to hold salt-strychnine mixture. Blocks should be placed in the shelter, salt side up, because the caking agent has a tendency to evaporate.

the salt block should have a protective cover to prevent leaching of the salt.

Ground Stations. The ground station is advantageous because it can be placed wherever it is judged most necessary, such as near routes of travel, along ridges, or in draws where damaged trees indicate that the porcupine is active. Because of possible attraction and subsequent danger to livestock and big-game animals, the salt-strychnine blocks must be secured in a shelter.

The shelters can be constructed of pressed board, half-round sections of culvert pipe, exterior-grade plywood, or some other safe and convenient means of protecting the blocks. Two bait-blocks, fastened one to a side, should be used for each shelter. Whatever material is used for construction, the shelter should offer complete cover to the porcupine without crowding. The completed shelter should then be secured to prevent tipping, which denies large animals, such as cows, horses, or big-game animals, access to the salt-strychnine.

A hardboard shelter (Figure 4) is light and easy to transport, has components that can be stowed compactly for field distribution, and is economical. The hardboard shelter consists of 2 pieces of hardboard, $\frac{1}{4}$ by 18 by 36 inches, to form the A-frame; 3 wooden cleats, 1 by 2 by 36 inches, to support the A-frame; and 2 wooden cleats, 1 by 2 by 16 inches,



Figure 4. A hardboard bait station after 6 months' exposure in the field. The shelter is losing its form and prevents ready access to the salt block. It is also improperly secured to prevent tipping by browsing animals or horses.

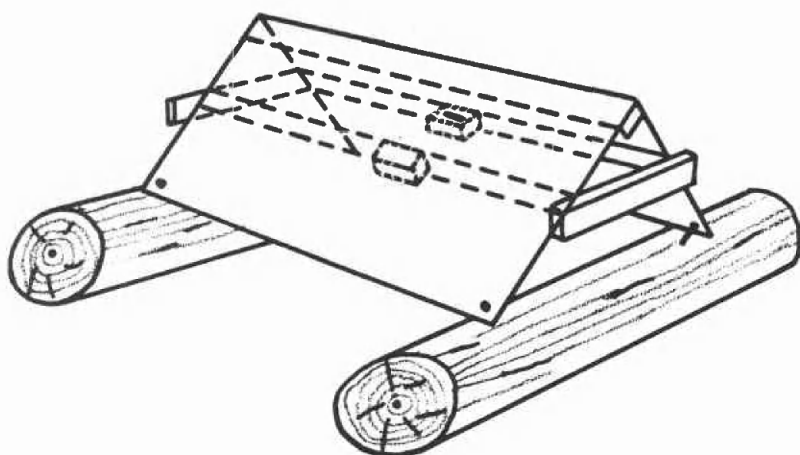


Figure 5. A diagram of a hardboard shelter.

to hold the A-frames apart and give rigidity to the structure (Figure 5). A salt block is nailed to each side of the shelter. The shelter should be clearly marked as dangerous and nailed firmly to the supporting logs. It does not weather satisfactorily, however, as it has a tendency to sag and become flattened by rain or snow. Also, it is easily crushed by the larger grazing animals. Once misshapen, difficulty is encountered in renewing the bait blocks and its usefulness is short lived.

A shelter also can be constructed of exterior-grade plywood (Figure 6). The plywood shelter consists of 2 sheets, 5/8 by 24 by 36 inches, of exterior-grade plywood to form the A-frame; 1 wooden cleat, 1 by 2 by 36 inches, to give support to the peak of the joined sides; 2 triangular fenders, 10 inches to the side, to give added rigidity; and 4 cleats, 1 by 2 by 6 inches, to support the fenders (Figure 7). The fenders, cleats, and sides should be constructed with waterproof glue in addition to the nails. A salt block is nailed to each side of the shelter. The shelter should be clearly marked as dangerous.

Plywood is less durable than metal, but long outlasts hardboard. Plywood, unlike metal or hardboard, appears to attract porcupines. Properly secured plywood shelters are not easily overturned and are easily serviced. But they are costly, heavy, and bulky.



Figure 6. A bait shelter constructed of exterior-grade plywood and securely fastened to reject incense cedar cants. The addition of steel posts and wire decreases the danger of large animals gaining access to the bait.

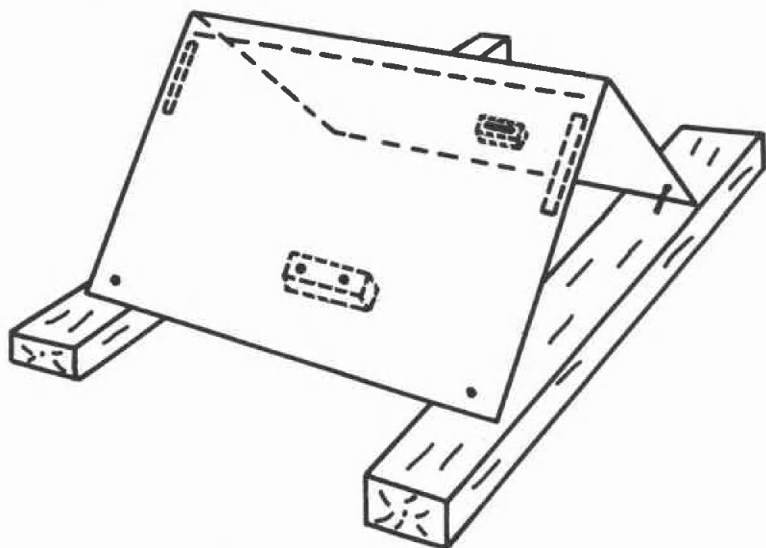


Figure 7. A diagram of a plywood shelter.



Figure 8. An aluminum bait station secured by the addition of metal fence posts. The station is durable and only a periodic check of the condition of the salt blocks is required.

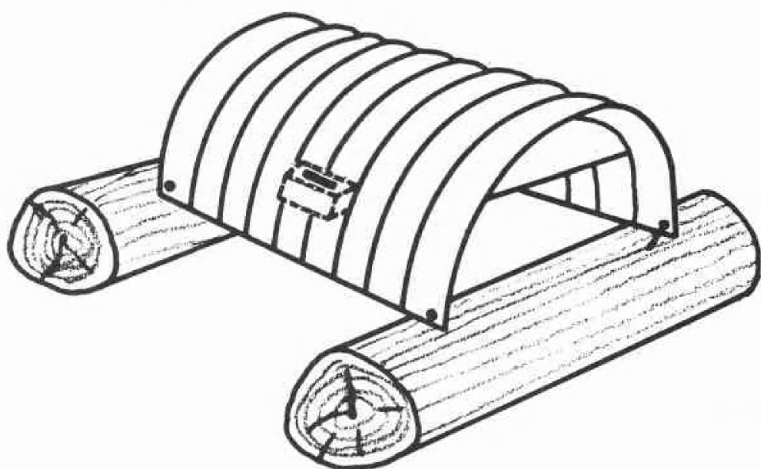


Figure 9. A diagram of bait station made from a metal culvert.

A metal shelter (Figure 8) is durable, weatherproof, and will not sag or flatten (14, 15). Its rigidity makes it resistant to damage by the large grazing animals, easy to handle, and economical because of its long usefulness.

The metal shelter can be constructed from half-round culvert, preferably aluminum 18-24 inches in diameter and 24-36 inches long (Figure 9). A fender is secured at each end to increase rigidity and prevent access into the shelter by large animals. Two holes must be predrilled on each side to hold the bait blocks, and a hole at each corner for fastening the shelter to poles. A salt block is fastened to each side. Aluminum nails or screws should be used when the shelter is of aluminum. The shelter should be clearly marked and fastened securely to the supporting logs.

Fences of 2-inch mesh from 1 to 2 feet high can be extended from the shelter to increase the success of the station. These "leads" or "drift" fences, extended from two sides of the shelter for as much as 150 feet, aid in directing the animal to the station.

Salt is generally the basic attractant for the porcupine at its bait station, but some porcupines seem completely unaware of its presence. Fetid scent smeared around or on the station may serve as an added attractant. Scents can be obtained from trappers engaged in predatory animal control or made by placing decaying meat beneath the shelter. Canned cat or dog food can be partially opened and fastened to one of the anchor posts. The putrifying material apparently has some attraction for porcupines. The carcass of a dead animal, especially a dead porcupine, at or near the station also appears to attract or lure other porcupines to the site.

Sodium hydroxide (NaOH) or soda ash (Na_2CO_3) are components of exterior plywood glue that also appear to have an attraction for porcupines. Either chemical, painted around and on the salt block, increases the rate of acceptance.

Programming

A formal control program should be prepared when porcupine damage occurs sufficiently to warrant baiting. The

concentration of control efforts should vary in relation to the intensity of damage. Areas of damaged trees should be recorded on a map. Stations should be numbered, and number, location, servicing record, and effectiveness should be recorded. If a station is ineffective, it should be moved. A map showing kills can be used to indicate movement patterns and the stations can be shifted accordingly.

DISCUSSION

The porcupine is one of several animals that are serious pests to forestry. Because its natural enemies have been severely reduced by human activities, the porcupine must be controlled by man. Because of its slow annual increase and desire for salt, the animal can be kept at a density compatible with the growing of trees.

Although other methods are helpful, the simplest and most effective method of porcupine control is by the use of poison-bait stations. The pesticides used are toxic materials capable of killing the target animal, and if improperly used are also capable of harming other forms of mammalian life. Bait stations should be a mile or more from any habitation to protect domestic animals such as cats or dogs from the possibility of secondary poisoning. Shelters should be examined and serviced periodically, because the binder evaporates from the salt. Servicing should be done in the spring and fall before any seasonal movements.

All pesticides should be viewed as hazardous, and those used for porcupine control are not excepted. Pesticides should always be used with discretion as the hazard is a direct function of the toxicity and availability of the material to wildlife. Careless, indiscriminate, or unnecessary use cannot be tolerated. The 6 percent strychnine, as issued by the Pocatello Depot of the Bureau of Sports Fisheries and Wildlife, exceeds the restriction by the Oregon Department of Agriculture (as of August 1970) of 1.1 percent strychnine alkaloid for home or garden use. Therefore, the poison-bait stations should be established and serviced by responsible and capable personnel.

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CHECKLIST OF PLANTS AND ANIMALS

Common Name	Scientific Name
Plants	
Douglas-fir	<i>Pseudotsuga menziesii</i> (Mirb.) Franco
Fir, white	<i>Abies concolor</i> , Lindl. & Gord.
Pine, lodgepole	<i>Pinus contorta</i> Loud.
ponderosa	<i>Pinus ponderosa</i> Dougl.
sugar	<i>Pinus lambertiana</i> Dougl.
white	<i>Pinus monticola</i> Dougl. ex D. Don
Mammals¹	
Beaver, mountain	See Mountain beaver
Bobcat	<i>Lynx rufus</i> (Schreber)
Cougar	<i>Felis concolor</i> Linnaeus
Coyote	<i>Canis latrans</i> Say
Deer	<i>Odocoileus</i> sp.
Deermouse	<i>Peromyscus maniculatus</i> (Wagner)
Fisher	<i>Martes pennanti</i> (Erxleben)
Gopher, pocket	<i>Thomomys</i> sp.
Hare	<i>Lepus americanus</i> Erxleben
Marmot	<i>Marmota</i> sp.
Mountain beaver	<i>Apodonta rufa</i> (Rafinesque)
Mouse	<i>Peromyscus</i> sp.
Porcupine, yellowhaired	<i>Erethizon dorsatum</i> (Linnaeus)
Rabbit, brush	<i>Sylvilagus bachmani</i> (Waterhouse)
Squirrel	<i>Tamiasciurus hudsonicus</i> (Erxleben)
	<i>Tamiasciurus douglasii</i> (Bachman)
Vole	<i>Microtus</i> sp.
Wolverine	<i>Gulo luscus</i> (Linnaeus)
Woodrat	<i>Neotoma</i> sp.
Birds	
Grouse	<i>Bonasa umbellus</i>
	<i>Canachites canadensis</i>

¹From Ingles, Lloyd G. *Mammals of the Pacific States*. Stanford University Press, Stanford, Calif. 1965.