A FIELD GUIDE TO ANIMAL DAMAGE OF ALBERTA'S NATIVE TREES

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A FIELD GUIDE TO ANIMAL DAMAGE OF ALBERTA'S NATIVE TREES

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INTRODUCTION

Animal damage by wildlife and domestic livestock in Alberta forests can pose a serious threat to the regeneration, survival, and growth of deciduous and coniferous seedlings and trees. Damage can occur at all stages of seedling and stand development. Some wildlife species consume seed in a mature forest that is needed to regenerate the forest naturally or supply the seed needed for growing seedlings in nurseries. Germinants and planted seedlings are most susceptible to browsing, clipping, cutting, and bark damage that can either cause seedling mortality, slow the growth of the tree, or cause a permanent deformation of the stem. For example, successive apical browsing of a seedling will cause it to have a shrubby appearance with multiple apical stems. As seedlings grow into saplings, poles, and mature timber, damage is more often limited to bark damage and cutting.

Although many injuries are minor and have an insignificant effect at the time of harvest, mortality of seedlings from animal damage can contribute to reforestation failure or lead to understocked stands. Repeated browsing and stem injuries can reduce the rate of growth, thereby lengthening stand rotation age. Furthermore, any cut surface or wound increases a plant's susceptibility to fungal, insect, and disease infestation.

The development and implementation of an effective integrated pest management program is needed to limit animal damage in forests to ensure a sustainable supply of wood and fibre for the future, and to protect the often substantial investment of resources in site preparation, planting

of seedlings, and tending of juvenile stands. An important first step in developing such a program is to accurately identify the species responsible for the damage. The objective of this manual is to provide a field guide for identifying the species of animal responsible for specific types of damage.

Identification of the species of animal causing damage can be confirmed by using a combination of diagnostic characteristics of injuries, tracks, scat, timing of damage, grazing history, geographical distribution, and other distinctive field signs of animals. Information on each of these attributes may be required to discriminate between certain species. For example, injury features may be all the information needed to discriminate browsing by horses from other domestic livestock and cervids (eg. deer, elk, moose), because horses have upper and lower incisors (front teeth) that create a clean, flat break unlike the torn, jagged one caused by cattle and cervids. However, when key characteristics are identical for more than one species such as deer and cattle that lack upper incisors, other information such as the timing of damage is required. In general the diet of cervids shift from forbs, grasses and leaves of woody plants during summer to twigs and bark of woody plants during winter. Since cattle are generally grazed in forested areas only during the summer, fresh browsing of seedlings recorded in early spring is attributable to cervids and fresh browsing recorded in early fall is attributable to cattle. Field sign such as tracks and scat would then be used to differentiate deer from moose or elk damage.

KEY TO ANIMAL INJURIES TO TREES

USE OF KEY

Animals causing damage to trees and seedlings may be systematically identified using the **Key to Animal Injuries to Trees** and the **Animal Identification** section of this booklet. To use the key, select the most appropriate damage category (bark damage, stem, root and branch damage, or cone, bud and seed damage). Then select the best fit of two mutually exclusive statements and proceed to the corresponding key number and subsequently the next pair of statements. Continue in this manner until a species or group of species is identified.

The species or group of species selected from the key should then be verified using the **Animal Identification** section of the field guide. Other injury characteristics, tracks, scat, timing of damage, grazing history, habitat, and geographical distribution should correspond with the selected species or ultimately identify the species if more than one was listed in the key. If the species description fails to match the key selection an error was likely made during the keying process and the procedure must be repeated.

BARK DAMAGE KEY

- removal of bark from the root, stem or branches of woody vegetation
- numerous tooth marks on and around the perimeter of the injury if gnawed
- tooth marks only on one side of the injury if stripped or scraped
- tooth marks absent if damage inflicted by claws, antlers, rubbing, or woodpecker activity
- width, depth, and orientation of tooth, claw, and antler marks and injury shape are characteristic

Figure 1 Bark damage on tree stem (gnawed).

1	bark damage on mature trees or larger saplings	2
1'	bark damage on seedlings and smaller saplings	12
2	basal injuries	3
2'	crown injuries	9
3	no distinct marks on wood or bark; bark pale and smooth around injury up to 1.3 m high; abrasion from rubbing	DOMESTIC LIVESTOCK (P. 25)
3'	distinct or indistinct marks on wood or bark; bark normal around injury	4
4	evenly spaced rows of small (0.5 cm) circular injuries	WOODPECKER (P. 52)
4'	irregular shaped injuries	5
5	hole excavated in wood; wood chips at base of tree	WOODPECKER (P. 52)
5'	bark removed with little or no damage to wood	6

6	vertical claw and tooth marks; large bark strips hanging from coniferous trees and on the ground; exposed sapwood consumed	BEAR (P. 10)
6'	claw marks absent	7
7	bark not gnawed, but scraped or stripped; vertical, shallow, close-spaced tooth marks (4 - 9 mm wide) on coniferous or deciduous trees	CERVID (P. 18)
7'	bark gnawed	8
8	distinct horizontal or diagonal tooth marks (4.5 mm wide) on coniferous or deciduous trees	PORCUPINE (P. 42)
8'	indistinct, fine tooth marks (1.6 - 2.5 mm wide); 1 cm wide bark strips peeled vertically or horizontally; discarded bark around base of coniferous trees	RED SQUIRREL (P. 44)
9	evenly spaced rows of small (0.5 cm) circular injuries; or rounded cavity entrances	WOODPECKER (P. 52)
9'	irregular shaped injuries	10
10	sapwood with numerous tooth marks	11
10'	sapwood with few tooth marks (1 mm wide); bark removed in patches; little bark at base of tree	BUSHY-TAILED WOODRAT (P. 16)
11	horizontal or diagonal tooth marks (4.5 mm wide); wound adjacent to a limb large enough to support an animal	PORCUPINE (P. 42)
11'	narrow tooth marks (1.6 - 2.5 mm wide); 1 cm wide bark strips peeled vertically or horizontally on conifers; discarded bark around base of tree	RED SQUIRREL (P. 44)
12	tooth marks absent	13
12'	tooth marks present	14
13	antler marks; coniferous or deciduous bark abraded or stripped and hanging from top and bottom of wound; broken branches; injuries at 0.4 - 2 m above ground	CERVID (P. 18)
13'	antler or horn marks and shredded and/or abraded bark absent; nicks and scrapes on lower stem and branches	CERVID AND DOMESTIC LIVESTOCK (P. 18 AND 25)

- 14 *indistinct tooth marks 0.1 - 1 mm wide; tooth marks not uniform and occur at all angles; damage up to 30 cm high on coniferous and deciduous stems; hit and miss pattern; discarded bark and peeled twigs in vicinity* **MOUSE** (p. 33)
- 14' *distinct tooth marks >1 mm wide* 15
- 15 *tooth marks (1.6 mm wide); coniferous and deciduous stems gnawed $\leq$ 2.5 cm in diameter; seedlings tilted at angle, pull easily from ground, or turned brown; exposed roots* **POCKET GOPHER** (p. 39)
- 15' *tooth marks (1.6 - 3.2 mm wide) horizontal and diagonal; coniferous and deciduous trees usually $\leq$ 6 cm in diameter* **SNOWSHOE HARE** (p. 49)

snowshoe hare

STEM, ROOT, AND BRANCH DAMAGE KEY

Browsing

- feeding on small diameter woody vegetation by cervids and domestic livestock that leaves either a rough, jagged or a smooth perpendicular break with no tooth marks
- typical of species lacking upper front teeth and of horses

Figure 2 Seedling browsed by a cervid.

Clipping

- feeding on small diameter woody vegetation by rodents and hares that creates a smooth, angled, knifelike break with tooth marks
- head is tilted to one side to enable clipping
- diameter, angle, and sharpness of the cut stem are characteristic
- root clipping is typical of pocket gophers

Figure 3 Seedling clipped by a snowshoe hare.

Cutting

- feeding by rodents that results in large tree branches and trunks being completely severed with multiple bites

Figure 4 Tree and branch cut by a beaver.

1	cutting of mature deciduous and coniferous trees; trunk deeply notched leaving an hourglass cut or cone-shaped stump	BEAVER (P. 13)
1'	cutting, browsing, or clipping of coniferous or deciduous seedlings, saplings and mature tree branches	2
2	clean break	3
2'	rough, jagged break; tooth marks absent	9
3	root clipping	POCKET GOPHER (P. 39)
3'	stem or branch damage	4
4	perpendicular break; no tooth marks	DOMESTIC LIVESTOCK (P. 25)
4'	angled break; diagonal or horizontal tooth marks	5
5	distinct tooth marks	6
5'	indistinct tooth marks	8
6	tooth marks 1.6 - 3 mm wide; coniferous and deciduous seedlings and branches $\leq$ 6 mm in diameter	SNOWSHOE HARE (P. 49)
6'	tooth marks >3 mm wide	7
7	tooth marks (4 - 6 mm wide); deciduous and coniferous seedlings, saplings, and branches >6 mm in diameter; peeled stems; conical stumps	BEAVER (P. 13)
7'	tooth marks (4.5 mm wide); coniferous and deciduous branches $\leq$ 2.5 cm in diameter show parallel rows of tooth marks; smaller twigs cleanly clipped	PORCUPINE (P. 42)
8	tooth marks (1.6 - 2.5 mm wide); cut edge of conifer branch rasped not gouged by teeth; green conifer branchlets lying on ground with cones and buds removed	RED SQUIRREL (P. 44)
8'	tooth marks (0.1 - 1 mm wide); cut edge is rasped with multiple cut bites; shoots $\leq$ 6.2 mm in diameter	MOUSE (P. 33)
9	fresh browsing of coniferous and deciduous trees incurred from late fall through the following spring	CERVID (P. 18)
9'	fresh browsing of coniferous and deciduous trees incurred during summer	DOMESTIC LIVESTOCK (P. 25)

CONE, BUD, AND SEED DAMAGE KEY

- removal of cones from the tree crown to be eaten or cached and consumption of buds and dormant or germinating conifer seeds

Figure 5 Bud damage caused by a grouse.

Figure 6 Seed damage caused by a mouse.

1	removal of buds from coniferous or deciduous stem	2
1'	damage to cones and conifer seeds	3
2	tip of stem often damaged; most conifer needles cut bluntly around bud	CERVID AND DOMESTIC LIVESTOCK (P. 18 AND 25)
2'	bud cleanly extracted; individual conifer needles sometimes removed or clipped	GROUSE (P. 31)
3	seeds extracted from cones cut from conifers with or without branchlets attached; accumulation of cone scales on the ground	RED SQUIRREL (P. 44)
3'	seeds extracted from uncut cones on the ground	4
4	one-quarter of seed coat removed at one end or along one edge; endosperm and embryo removed; scalloped appearance of cut edges; rejected seeds sport puncture holes	MOUSE (P. 33)
4'	more than one-half of seed coat removed or split off	5
5	one-half of seed coat removed from one flat side; endosperm and embryo removed; fine serrations along cut edges	GROUND DWELLING SQUIRREL (P. 28)
5'	seed coat split almost in half; cut edges shattered and irregular	SHREW (P. 47)

ANIMAL IDENTIFICATION

Figure 7 Black bear.

Bear

BLACK BEAR

(*Ursus americanus*)

GRIZZLY BEAR

(*Ursus arctos*)

DAMAGE CHARACTERISTICS

Bark Damage

- occurs primarily to large pine, trembling aspen and balsam poplar trees
- trees 15-38 cm in diameter often girdled
- bark stripped on the lower trunk of mature and pole-sized trees
- large strips of bark may litter the ground or be left hanging from the tree
- scraped area may be as large as 90 cm long by 30 cm wide
- exposed sapwood eaten leaving vertical incisor and canine tooth grooves, often as high as the bear can reach standing on its hind legs
- claw marks (usually diagonal but occasionally vertical or horizontal) on the sapwood may arise during feeding or during marking of a territory
- hair may be clinging to the tree
- typical in May, June, and July

Figure 8 Bear damage to a mature tree.

FIELD SIGNS

Tracks

Figure 9 The toes of the front foot of the black bear form an arc over the intermediate pad. Claw marks, when showing, will have a length about equal to or less than the length of the toe pads. Scale is 5 cm.

Figure 10 The hind foot. Scale is 5 cm.

Figure 11 The toes of the front foot of the grizzly bear are crowded together and form a straight line across the intermediate pad. Claw marks about twice the length of the toe pads usually show. Scale is 10 cm.

Figure 12 Bear walking gait.

Scat

Figure 13 Scat are large and cylindrical with blunt ends. Segments are 5-7.6 cm long and 3-5 cm in diameter. Color may vary with food material ingested. A berry rich diet produces a blue semi-liquid scat with fruit seed; a grass, forb, and animal protein rich diet produces black scat with animal hair; a mast rich diet produces brown scat. Insect parts may also be observed in the droppings.

Other

- logs or stumps torn apart for insects
- excavated rodent burrows or anthills
- stripped berry patches

Figure 14 Rotted log torn apart by bear in search of insects.

DISTRIBUTION

*Fig. 15
Black bear.*

*Fig. 16
Grizzly bear.*

Figure 17 Beaver.

BEAVER

(*Castor canadensis*)

DAMAGE CHARACTERISTICS

Cutting

- trembling aspen, balsam poplar, birch, and willow preferred
- pine, spruce, and fir rarely felled
- trees up to 84 cm in diameter felled, though 10-15 cm in diameter preferred
- cone-shaped stumps 30-60 cm high
- partially cut trees with an hourglass shape
- broad chisel-like tooth marks 4 - 6 mm wide
- close inspection reveals the fine space between the front two incisor teeth
- gnawing at an angle to the stem, whereas porcupine cutting may be parallel
- wood chips at the base of large trees
- incidence of damage increases from spring through fall

Figure 18 Beaver cutting branches from a tree.

FIELD SIGNS

Tracks

Figure 19 The hind foot shows webbing between the toes. The fifth toe may be visible on a clear front print. Claw marks are rarely present on the second inside toe of the hind foot. Scale is 5 cm.

Figure 20 The front feet toe-in and may be hidden by the hind feet. Sometimes the tail may obliterate both prints. Scale is 15 cm.

Scat

Figure 21 Oval pellets, 2.5-3.2 cm long and 1.9 cm in diameter are composed of coarse sawdust-like material. Scat are rarely detected as they are deposited in water.

Other

- scattered stems with the bark removed in the cutting areas and adjacent waterways
- peeled stems < 3 mm in diameter may not bear tooth marks
- flooded areas, ponds, beaver lodges or dams
- trails connecting waterways to the area of damage

Figure 22 Beaver pond showing structure of a dam and lodge.

DISTRIBUTION

- distributed throughout Alberta
- in association with standing or running water

Figure 23 Beaver.

BUSHY-TAILED WOODRAT

(*Neotoma cinerea*)

Figure 24 Bushy-tailed woodrat.

DAMAGE CHARACTERISTICS

Bark Damage

- short strips of bark removed in patches from the upper bole of conifer saplings and mature trees
- girdling at the crown may occur
- sapwood generally untouched, leaving a smooth surface with considerably fewer horizontal or diagonal tooth marks than the heavy gnawing of a porcupine or fine gnawing of a red squirrel
- tooth marks about 1 mm wide
- strips used for nest material; thus, less litter on the ground than from a red squirrel
- usually occurs in late winter and early spring

FIELD SIGNS

Tracks

Figure 25 Footprints are roundish with extended heels. The four toes of the front feet and the five toes of the hind feet are bulbous. Scale is 2.5 cm.

Figure 26 Diagonal bounding gait.

Scat

Figure 27 Pellets are 9-15 mm long and 3-4 mm in diameter. Accumulation of fecal pellets, tar-like deposits of older scat, or white urine residues in the vicinity of the nest site.

Other

- small branches clipped for food or nest material
- stick houses up to 0.5 m high by 1 m wide containing miscellaneous debris concealed in buildings, crevices, rock outcroppings, hollow logs or beneath stumps
- distinctive odour of scat and urine arises from the den area

DISTRIBUTION

Figure 28 Bushy-tailed woodrat.

Figure 29 Moose.

Cervid WHITE-TAILED DEER

(*Odocoileus virginianus*)

MULE DEER

(*Odocoileus hemionus*)

ELK (WAPITI)

(*Cervus elaphus*)

MOOSE

(*Alces alces*)

DAMAGE CHARACTERISTICS

Bark Damage

Antler Rubbing

- occurs to coniferous and deciduous trees
- bark is abraded or stripped from the upper bole and branches of trees
- no tooth marks
- shredded bark hanging from the top and bottom of the bark wound
- smaller branches and saplings may be broken off
- traces of velvet may remain on the tree
- rubs occur 0.04 - 2 m above ground
- each tree used only once and there may be several rubs in one area
- height of damage may eliminate other mammals as the perpetrator
- rarely culminates in girdling
- occurs in late summer to late fall

Figure 30 Antler rubbing damage to coniferous sapling.

Deer

- prefer trees with smooth aromatic bark such as: pine, trembling aspen, balsam poplar, alder, and willow
- prefer saplings 1.6-2.5 cm diameter and 180 cm tall
- 5-year-old trees preferred, though occurs to trees < 15 years old
- length of the injured area averages 25 cm
- usually confined to 0.04-1.0 m above the ground
- finely shredded bark remains hanging on the tree

Elk and Moose

- prefer saplings ≥ 7.5 cm in diameter
- usually exceeds 1.0 m above ground
- abrade the tree trunk bare with little frayed bark remaining
- trees have more blunt and sporadic antler scores than those injured by deer
- may leave coarse, broken branches dangling

Feeding

- occurs to mature deciduous trees
- elk and moose commonly bark aspen
- bark is scraped or stripped, rather than gnawed, from upper bole using vertical upward sweeps of the lower front teeth
- bottom of the bark wound is sharply cut and the top is jagged because cervids lack upper teeth to nip the bark off
- stripped bark usually tapers to a narrow point where it breaks
- fresh bark may be stripped far above the point where cervids grasp the bark with front teeth

Figure 31 Antler rubbing damage to deciduous saplings.

Figure 32 Cervid feeding on bark of deciduous tree.

- new bark may be stripped immediately below the break on terminal and lateral stems during browsing in early to mid-spring
- shallow, close-spaced tooth marks remain in sapwood:
 - deer - 4 mm wide
 - elk - 6 mm wide
 - moose - 6-9 mm wide
- elk and moose have rounder tooth marks with greater indentation than deer
- usually occurs from fall through spring

Trampling

- nicks and scrapes on tree stem or branches near base
- wounds usually smaller than those caused by cattle
- differentiate cervid from domestic livestock damage by other distinctive field signs in the vicinity and grazing history

Browsing

- occurs to pine, spruce, trembling aspen, balsam poplar, and paper birch
- moose prefer shrubs in plantations like willow, red-osier dogwood, and cranberry
- cut edges rough and jagged
- newly planted seedlings may be pulled from the ground during browsing
- in early spring, fresh browse points documented before the release of livestock will be winter damage resulting from cervids
- in summer, fresh browse points likely caused by livestock
- in fall, until the end of October when domestic stock is removed from a plantation, fresh browse points can either be caused by cervids or domestic livestock

Bud Damage

- buds nipped with a small part of the twig also removed
- broken ends of the stems, damage ≥ 40 cm from ground level, and the blunt-ended cropping of long needles surrounding the bud will differentiate cervid from grouse damage

FIELD SIGNS

Tracks

Figure 33 The outline of the print is heart-shaped. Dew claws are rarely visible except in a soft substrate. Scale is 5 cm.

Figure 34 The print is broader and rounder than that of deer. Dew claws may be visible. Scale is 10 cm.

Figure 35 The print is large and pointed with length far exceeding width. Dew claws are often visible. Scale is 10 cm.

Figure 36 Cervid walking gait.

Scat

Winter

Deer

Figure 37 Pellets of adult deer are 10-22 mm long and 5-10 mm in diameter. One end is blunt and the other is more pointed. All cervids deposit scats in clumps of 20-30 pellets and pellet shape varies with diet.

Elk

Figure 38 Pellets of adult elk are 18-25 mm long and 8-15 mm in diameter. One end has a dimple and the other has a nipple.

Moose

Figure 39 Pellets of adult moose are 20-30 mm long and 11-23 mm in diameter and round at both ends. Pellets have a very coarse texture.

Summer

Deer

Figure 40 Individual, soft pellets clumped together. Clumps are 2.8-4.0 cm long and 2.3-3.5 cm in diameter. All cervids may produce more than one individual clump.

Elk

Figure 41 Individual, soft pellets clumped together. Clumps are 11.5-12 cm long and 4.6-9.8 cm in diameter.

Moose

Figure 42 Pellets amalgamated in a soft mass. This clump is 6 cm long and 5 cm in diameter, but represents only a small portion of the total sample.

DISTRIBUTION

Deer

Figure 43 White-tailed deer.

Figure 44 Mule deer.

Elk

Figure 45 Elk.

Moose

Figure 46 Moose.

Domestic Livestock

CATTLE

(*Bos taurus*)

GOAT

(*Capra hircus*)

HORSE

(*Equus caballus*)

SHEEP

(*Ovis aries*)

Figure 47 Cattle.

DAMAGE CHARACTERISTICS

Bark Damage

Feeding

- bark damage using front teeth occurs infrequently except when overgrazed
- bark may be scraped or stripped, similar to cervid (see P. 18)

Trampling

- nicks and scrapes are on the tree stem or branches near the base
- wounds usually larger than those caused by cervids
- presence of nearby tracks and scat will differentiate domestic livestock and cervid damage

Rubbing

- bark rubbed from base of large trees
- prefer coniferous trees but also rub deciduous trees
- rub trees at edge or in center of forest openings
- hair left on bark

Browsing

- cut edges jagged and torn as all bovids (cattle, sheep, and goats), like cervids, lack upper front teeth
- horses have upper front teeth that may create a cleanly nipped square break
- damage difficult to differentiate from cervids; thus, the presence of tracks and scat, grazing history of a particular area, and season are important
- fresh browsing in summer indicates domestic livestock whereas fresh browsing in late fall, winter and early spring during the absence of domestic livestock indicates cervids

FIELD SIGNS

Tracks

Cattle

Figure 48 Adult tracks are 15-17 cm long with a round outline that is more pronounced if hooves are untrimmed. Between hoof halves the print outline is concave.

Goat

Figure 49 Adult prints are blocky and are 6.5-7.5 cm long. Tracks may be confused with sheep and deer; thus, habitat type and historical range use provide discriminating features.

Horse

Figure 50 Adult prints form a single semi-circle (15-17 cm long) with a triangular indentation in the back. Shod horse prints will show a distinct mark from the horseshoe.

Sheep

Figure 51 Adult prints are wedge-shaped and are 7.5-9 cm long. Tracks may be confused with deer, bighorn sheep, and goats. Deer have a longer step length and are solitary or in small groups. Native sheep and goats are usually well scattered or in small groups. Habitat type and historical range use provide the best indicators of sheep presence.

Scat

Cattle

Figure 52 Scat may be brown, semi-soft patties, up to 30 cm in diameter, or firm layered chips, up to 15.5 cm long.

Goat

Figure 53 Scat resemble those of mountain goats, deer, and sheep; but, pellets tend to be smaller and more layered. Pellets are 0.8-1.8 cm long and 0.5-1.3 cm in diameter and may be amalgamated in summer. Similar to sheep, historical range use provides a clue to species identification.

Horse

Figure 54 Scat are light to dark brown and contain coarse undigested fibres. Pellets are rounded, 4-6 cm in diameter, and may be amalgamated in summer.

Sheep

Figure 55 Scat resemble those of mountain sheep and goats. Dry pellets are spherical or elongated with either two rounded ends or one rounded and one pointed end. Moist pellets may be concave on one side. Individual pellets are 0.8-1.8 cm long and 0.5-1.3 cm in diameter and may be amalgamated in summer.

Figure 56 Ground squirrel.

Ground Dwelling Squirrel CHIPMUNK

(*Tamias* spp.)

GROUND SQUIRREL

(*Spermophilus* spp.)

DAMAGE CHARACTERISTICS

Seed Damage

- newly germinated coniferous seedlings clipped
- endosperm and embryo removed from tree seeds and eaten or cached
- accumulation of open seed hulls
- unlike mice, *Tamias* spp., remove about half of a seed coat from one flat side of the seed
- cut edges have fine serrations with no wide indentations as observed with mice

Figure 57 Seed damage caused by a chipmunk.

FIELD SIGNS

Tracks

Figure 58 The gait of ground-dwelling squirrels shows a diagonal front feet pattern (note diagonal line drawn through front feet tracks) with four toes on the front feet and five toes on the hind feet. Ground squirrels have front feet 1.6 cm and hind feet 2.5 cm long. Chipmunks have front feet 1 cm and hind feet 1.6 cm long.

Scat

Figure 59 Chipmunk scat are rarely found above ground and usually deposited at random. Pellets may be found infrequently on logs or stumps where they perch. Scats are only slighter larger than that of voles and mice with a length of 5-13 mm and a diameter of 2-3 mm.

Figure 60 Ground squirrel scat, 9-16 mm long and 4-5.5 mm in diameter, are generally connected by tails. Pellets may be found outside the burrow entrance or in the tunnel system.

Other

- terminal buds removed
- burrow systems for ground squirrels

Figure 61 Ground squirrel burrow.

DISTRIBUTION

- 3 species of chipmunk are distributed throughout Alberta
- 5 species of ground squirrel are distributed throughout central and southern Alberta
- for species distribution maps see Pattie and Hoffman 1992

Figure 62 Ruffed grouse.

Grouse

BLUE GROUSE

(*Dendragapus obscurus*)

RUFFED GROUSE

(*Bonasa umbellus*)

SHARP-TAILED GROUSE

(*Tympanuchus phasianellus*)

SPRUCE GROUSE

(*Dendragapus canadensis*)

DAMAGE CHARACTERISTICS

Bud Damage

- ruffed and sharp-tailed grouse prefer trembling aspen, balsam poplar, and willow buds
- spruce and blue grouse prefer spruce and pine needles
- trees often show selective feeding of buds only
- bud is cleanly removed with little breakage
- occasionally twigs may be broken during bud removal leaving bark fibres hanging
- individual conifer needles, not twigs, are nipped
- grouse usually stand on the ground or on another limb while feeding and generally do not jump from the ground for buds just out of reach
- buds consumed on branches beyond the reach of grouse, that are not stout enough for the bird to stand on, may be due to cervids or domestic livestock
- occurs in winter

Figure 63 Bud damage caused by grouse; needles removed.

FIELD SIGNS

Tracks

Figure 64 Prints have three long toes with one short toe pointing the opposite direction. Track length is 5-6.4 cm.

Scat

Figure 65 Pellets are firm, curved cylinders (2.5-3.5 cm long), though they may be soft in summer. Scats are deposited in clusters, often times on logs or rocks.

DISTRIBUTION

- grouse are distributed throughout Alberta
- blue grouse are associated with higher elevation montane and foothills regions
- ruffed and spruce grouse are distributed throughout all forested regions of Alberta
- sharp-tailed grouse are distributed throughout Alberta except at high elevations
- for more detailed distribution maps consult Johnsgard 1973

Figure 66 Vole.

Mouse

DEER MOUSE

(*Peromyscus maniculatus*)

MEADOW VOLE

(*Microtus pennsylvanicus*)

RED-BACKED VOLE

(*Clethrionomys gapperi*)

DAMAGE CHARACTERISTICS

Bark Damage

- occurs to coniferous and deciduous trees
- tree diameters 0.1-19 cm preferred
- incidence of damage increases with decreasing height
- injuries occur to trees ≤ 16 m high
- bark is gnawed on roots and low branches at the root collar or the snow surface
- barking may extend up the bole to over 120 cm, because of snow cover, though it is typically ≤ 30 cm
- discarded bark and small piles of peeled twigs 7.5-10.2 cm long may lie near the injured tree
- succulent inner bark or phloem is consumed
- selection of stems and branches displays a hit-or-miss pattern
- tree roots may be exposed and peeled

- girdling may occur
- tooth marks not prominent and give the gnawed surface a fuzzy, roughened appearance
- close inspection may reveal tooth marks 0.1-1 mm wide, 0.1-1.6+ mm deep, and 0.1-9.5 mm long in irregular patches
- tooth marks at all angles and not uniform
- trees infected with rusts (*Cronartium* spp.) may be more susceptible to damage
- typically occurs in winter under snow cover and occasionally in summer under dense, matted vegetation

Figure 67 Bark damage caused by voles.

Clipping

- occurs to coniferous and deciduous seedlings
- occurs to seedlings and shoots ≤ 6.2 mm diameter
- cut rougher than other larger rodents as many bites are needed to sever the stem
- tiny stumps similar to beaver cutting may remain

Seed Damage

- germinating coniferous seedlings dug up and the cotyledon clipped
- seeds opened at the micropyle end
- about one-quarter of the seed coat eaten either at one end or along one edge of the seed
- chewed edges have a scalloped appearance
- endosperm and embryo removed
- empty seeds that are rejected may have a puncture hole
- seed hulls lying on the ground
- no distinct tooth marks
- occurs primarily in summer

Figure 68 Seed damage caused by deer mouse.

FIELD SIGNS

Tracks

Figure 69 The front foot and the hind foot of the deer mouse have four and five toes, respectively. Scale is 19 mm.

Figure 70 The front foot of a vole has four toes and the hind foot has five toes. A print outline may not be present if only pads register. Scale is 12 mm.

Figure 71 Deer mice when hopping may leave a tail drag (left) or may hold their tails vertically, leaving none. Scale is 15 cm.

Figure 72 Walking gait of voles where the hind foot oversteps the front foot (right) and diagonal hop where a tail drag rarely shows.

Figure 73 Scats are cylindrical with rounded ends (3-5 mm long). Deer mouse scat cannot be distinguished from vole scat, except by the location in runways and tunnels. In contrast to deer mice, vole scat may also form a clump due to urine deposition and are found outside of the nests. Droppings may be mixed with fruit or seed.

Other

Deer Mouse

- most common nocturnal mammalian seed eater
- bark damage and clipping extremely rare
- clusters of fruit (eg. rose) clipped and individual fruit opened at the top with the seeds removed
- no surface runways in ground vegetation
- small burrow holes in the ground are more common than above ground nests
- nests above ground (15 cm in diameter) are usually under a root or log

Figure 74 Rose hip opened at the top with seeds removed.

Vole

- well-traveled runways and abandoned winter nests (15-20 cm in diameter) constructed in tufts of grass
- surface runways, 2.5-5 cm wide, contain clipped stems and leaves of vegetation cut from the sides and bottom of the tunnel
- runways contain scat, particularly at intersections
- tunnel openings (3.8 cm in diameter) leading to underground summer nests may be detected by probing for holes

Figure 75 Vole runways in dense grass vegetation.

DISTRIBUTION

Figure 76 Deer mouse.

Figure 77 Meadow vole.

Figure 78 Red-backed vole.

POCKET GOPHER

(*Thomomys talpoides*)

Figure 79 Pocket gopher.

DAMAGE CHARACTERISTICS

Bark Damage

- occurs to small and large coniferous and deciduous trees, commonly lodgepole pine and trembling aspen
- stem barking and girdling below and near ground level
- injuries may extend upwards to 2 m with deep snow cover
- tooth marks about 1.6 mm wide
- occurs primarily in winter under snow cover

Clipping

- occurs to coniferous and deciduous seedlings
- root pruning
- stems ≤ 2.5 cm at the base are gnawed into two or more sections at or near ground level
- trees may tilt at an angle, be easily pulled from ground, or turn brown in the summer due to cut stems or roots
- plugged holes may remain if entire seedling is removed
- roots may be exposed by burrowing
- occurs year-round but more common in winter

Figure 80 Root clipping.

FIELD SIGNS

Tracks

Figure 81 Both front and hind feet have claw marks extending beyond the five toes. Prints are rarely observed in the freshly moved soil of mounds, but may be seen in snow as a waddling gait with a drag imprint of a thick tail. Scale is 2.5 cm.

Scat

- defecation occurs within the underground tunnel system
- rarely found

Other

- flat, fan-shaped mounds of soil
- dispersed underground burrow systems
- underground tunnels 5 cm in diameter

Figure 82 Fan-shaped mounds.

- earthen winter casts lying on snow in the early spring as a result of winter burrowing in snow
- roots exposed by burrowing
- small seedlings buried in mounds or winter casts

Figure 83 Winter casts.

DISTRIBUTION

Figure 84 Pocket gopher.

Figure 85 Porcupine.

PORCUPINE

(*Erethizon dorsatum*)

DAMAGE CHARACTERISTICS

Bark Damage

- trembling aspen, balsam poplar, paper birch, willow, and lodgepole pine preferred
- stem girdling on seedlings and pole-sized trees
- basal, bole, and upper branch gnawing
- distinct broad horizontal or diagonal front tooth marks (4.5 mm wide) in exposed sapwood
- injuries common to areas of the tree accessible from a limb on which the animal can sit
- animals often return to the same injured tree year after year where the callus tissue is also consumed
- occurs in fall and winter

Figure 86 Bark damage.

Clipping / Cutting

- trembling aspen, balsam poplar, paper birch, willow, and lodgepole pine preferred
- fine twigs are clipped cleanly, at an oblique angle
- larger branches ≤ 2.5 cm have a slanted cut with a number of parallel rows of tooth marks

FIELD SIGNS

Tracks

Figure 87 The trail shows a short, waddling gait with pigeon-toed prints. The front foot has four toes and is 6.4 cm long, including claw marks; the hind foot has five toes and is over 7.6 cm long, usually printing ahead of the front foot. Clear prints will show the rough texture of the sole of the foot and drag imprints from the hair on the lower legs. A drag mark from the tail is common and even the body in deep snow. Lines drawn through the long axis of each print form an arrow indicating the direction of travel.

Scat

Figure 88 In winter, conifer-containing pellets are elongated (25 mm long), often curved and yellow or red. Quills may be found among the scat.

Figure 89 In summer, scat containing grasses, herbs, and shrubs are black and individual segments may be joined together by thin strands.

DISTRIBUTION

- porcupine are distributed throughout Alberta

Figure 90 Red squirrel.

RED SQUIRREL (*Tamiasciurus hudsonicus*)

DAMAGE CHARACTERISTICS

Bark Damage

- mature conifers > 6 cm diameter preferred
- 1 cm wide bark strips removed vertically or diagonally from upper bole or branches in either irregular or circular patches that leave ragged edges
- girdling may occur 1.8 - 4.6 m from the crown
- prominent tooth marks lacking as squirrels commonly lick exposed sapwood
- fine gnawing may be visible on the sapwood with marks 1.6 - 2.5 mm wide
- discarded outer bark (2.5 x 7.5 cm) found on the ground beneath injured trees will differentiate this barking damage from that of porcupine
- bark may be left hanging from tree, but phloem and cambium underneath are consumed
- damage usually occurs in late spring and early summer with rare occurrences in late summer

Figure 91 Bark damage from red squirrel.

Clipping / Cutting

- slanted cutting of terminal and lateral conifer twigs and branches
- cutting creates a rough edge with tooth marks that rasp rather than gouge like other rodents or hares
- cuts may appear smooth and square-like due to exuded resin
- green branchlets lying on the ground, often with cones or buds removed

Figure 92 Branchlets clipped with cones removed.

Cone Damage

- green, unopened conifer cones or small twigs litter the ground
- oblique cuts on branchlet ends with a rough edge
- cone cutting occurs in late summer with ripening of cones

Figure 93 Cones and twigs on the ground.

FIELD SIGNS

Tracks

Figure 94 Pads may show without the outline of the foot. The hind foot has five toes and the front foot has four toes. Tracks may end at the base of a tree. Scale is 5 cm.

Figure 95 The gait of tree dwelling squirrels shows paired front feet hopping perpendicular to the line of travel.

Scat

Figure 96 Individual scats are often irregular and may range from spherical to ellipsoid (8 mm long). Scat are found on logs, stumps, middens, and in squirrel nests. When the diet is moist, pellets will form small clumps.

Other

- middens (accumulations of cone scales and stalks indicative of feeding stations)

Figure 97 Squirrel midden

DISTRIBUTION

Figure 98 Red squirrel.

Figure 99 Shrew.

SHREW

(*Sorex* spp.)

DAMAGE CHARACTERISTICS

Seed Losses

- seeds are split almost in half, as opposed to mice and chipmunk damage
- seeds shattered with very irregular edges rather than gnawing at seed edges only as in mice or removal of one-half of the flat seed surface as in chipmunks

Figure 100 Seed damage by a shrew.

FIELD SIGNS

Tracks

Figure 101 Five toes are present on both feet. Often only the pads will show in a track; in a clear print, however, the overall outline may register. Scale is 2.5 cm.

Figure 102 The hopping gait is very mouse-like, but the intergroup distance is very short. Three hops, rather than one for a mouse, fit into a 15 cm distance.

Scat

Figure 103 Scats are cylindrical and 0.64 cm long. They can only be distinguished from mice or vole droppings by the presence of other sign.

Other

- burrow openings ≤ 2.5 cm in diameter, which are smaller than those of voles or mice
- nest 15-20 cm in diameter along a tunnel
- droppings located outside the nest, as opposed to mice

DISTRIBUTION

- 7 shrew species are distributed throughout Alberta
- for detailed species maps see Pattie and Hoffman 1992

Figure 104 Snowshoe hare.

SNOWSHOE HARE

(*Lepus americanus*)

DAMAGE CHARACTERISTICS

Bark Damage

- pine preferred over spruce and trembling aspen and willow are preferred over balsam poplar, alder, and buffaloberry
- barked stems usually ≤ 6 cm diameter
- bark removed from base of coniferous and deciduous trees up to 2 m high (varies with snow depth)
- gnawing in patches typical, but patches may be joined into long strips or to girdle the stem
- sapwood appears ragged with 2 mm wide horizontal or diagonal tooth marks
- individual tooth marks not always distinct
- occurs from fall through spring

Clipping

- clip branches, stems, and buds of coniferous and deciduous trees at a 45° angle
- stems ≤ 6 mm in diameter preferred
- height of damage above ground varies with snowdepth
- can reach up to 0.5 m above snow
- occurs from fall through spring

Figure 105 Bark damage caused by snowshoe hare.

Figure 106 Seedlings clipped by snowshoe hare.

FIELD SIGNS

Tracks

Figure 107 Tracks as the gait changes from a hop to a walk. Heelprints are not apparent when the hare walks on its toes. Five toes are present on the front foot and four on the hind foot. The fifth digit and other toes may not register due to hair on the feet. Scale is 5 cm.

Figure 108 The diagonal hop of the snowshoe hare. The hind feet are exceptionally wide. Scale is 5 cm.

Scat

Figure 109 Scats are slightly flattened and circular (1.3 cm in diameter). Scat is brown in winter and more greenish in summer. When the pellets are broken open the woody content is observed and they may have a sweet smell. Scats may be deposited singly or in small piles.

Other

Figure 110 Trails occur in tall grass and underbrush where a tunnel may form through overarching grass blades and twigs, respectively. Well-traveled trails, 10-15 cm wide, may contain scat.

DISTRIBUTION

Figure 111 Snowshoe hare.

Woodpecker PILEATED WOODPECKER

(Dryocopus pileatus)

YELLOW-BELLIED SAPSUCKER

(Sphyrapicus varius)

Figure 112 Pileated woodpecker.

DAMAGE CHARACTERISTICS

Bark Damage

Pileated Woodpecker

- occurs on large mature coniferous trees
- damage at base of tree close to ground
- large wood chips at base of tree
- irregular shaped excavated hole
- may be seeking insects

Yellow-bellied Sapsucker

- birch, aspen, and pine preferred
- damage to saplings and mature trees
- damage on bole at all heights but crown preferred
- series of round (0.5 cm) holes in regular spaced rows
- feed on sap and insects attracted to sap

Woodpecker cavities

- mature deciduous trees and partly alive trees preferred
- round or oval shaped entrance leads to expanded cavity
- cavities may be occupied by other cavity nesting birds or mammals

FIELD SIGNS

Other

- large excavated cavities (3-5 cm entrance) on neighboring well rotted snags
- large wood chips at base of snags

DISTRIBUTION

- woodpeckers are distributed throughout the forested areas of Alberta

Figure 113 Pileated woodpecker and yellow-bellied sapsucker.

Figure 114 Yellow-bellied sapsucker.

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