

SMALL MAMMALS IN ASPEN CLEARCUTS

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Small mammals are an important part of the trembling aspen *Populus tremuloides* forest ecosystem. An understanding of the reaction of these animals to alteration of their habitat through clearcut logging is valuable knowledge that can be added to the growing amount of information about the effect of logging on wildlife species.

Approximately 1,400 ha (3,500 acres) of mature aspen forest in the Pasquia-Porcupine region of Saskatchewan (Fig. 1) are clearcut annually for the production of waferboard. Research into the effect of this clearcutting on wildlife population has been ongoing for the past several years but most of the effort has been directed toward the resident big game species. This preliminary study of small mammal populations on the clearcuts and in the adjacent mature forests was conducted in an effort to obtain a more complete knowledge of the ecological effects of forest cutovers.

Study Area

Small mammal trapping was carried out in three locations in the Piwei cutting block in the Porcupine Provincial Forest about 55 km southwest of Hudson Bay, Saskatchewan (Fig. 1). The Piwei cutting block is a series of recent clearcuts (< 10 years old) in the mature aspen stands characterizing this area. Some mixedwood stands (aspen - white spruce *Picea glauca*) and pure softwood stands are also found in this locale.

TRAP AREA A

This trap area consisted of a 3-year-old cutover and adjacent mature aspen forest. In the three years since logging, aspen suckering had resulted in a dense stand of aspen approximately 2 m high overtopping a shrub layer of beaked hazelnut *Corylus cornuta* and a modest herb stratum. Tops of numerous felled trees had been left in the cutover as slash.

The adjacent mature stand had an aspen - balsam poplar *Populus balsamifera* overstory about 20 m high with a canopy density of 80-100 percent. The shrub stratum under this canopy consisted of moderate amounts of high-bush cranberry *Viburnum trilobum*, beaked hazelnut and speckled alder *Alnus rugosa*; the ground cover was primarily leaf litter.

TRAP AREA B

This trap area consisted of a 1-year-old cutover and the adjacent mature forest. The cutover was characterized by aspen sprouts about 0.5 m high and a limited herb stratum; total ground cover was approximately 50 percent. Tops of the aspens removed during logging dotted the cutover.

The mature stand, situated at the top of the Piwei River valley, was on terrain with a slope of about 20°. Over-story was 20 m high aspen and the moderately dense shrub under-story was composed primarily of beaked hazelnut. Ground cover was mostly leaf litter and bunchberry *Cornus canadensis*.

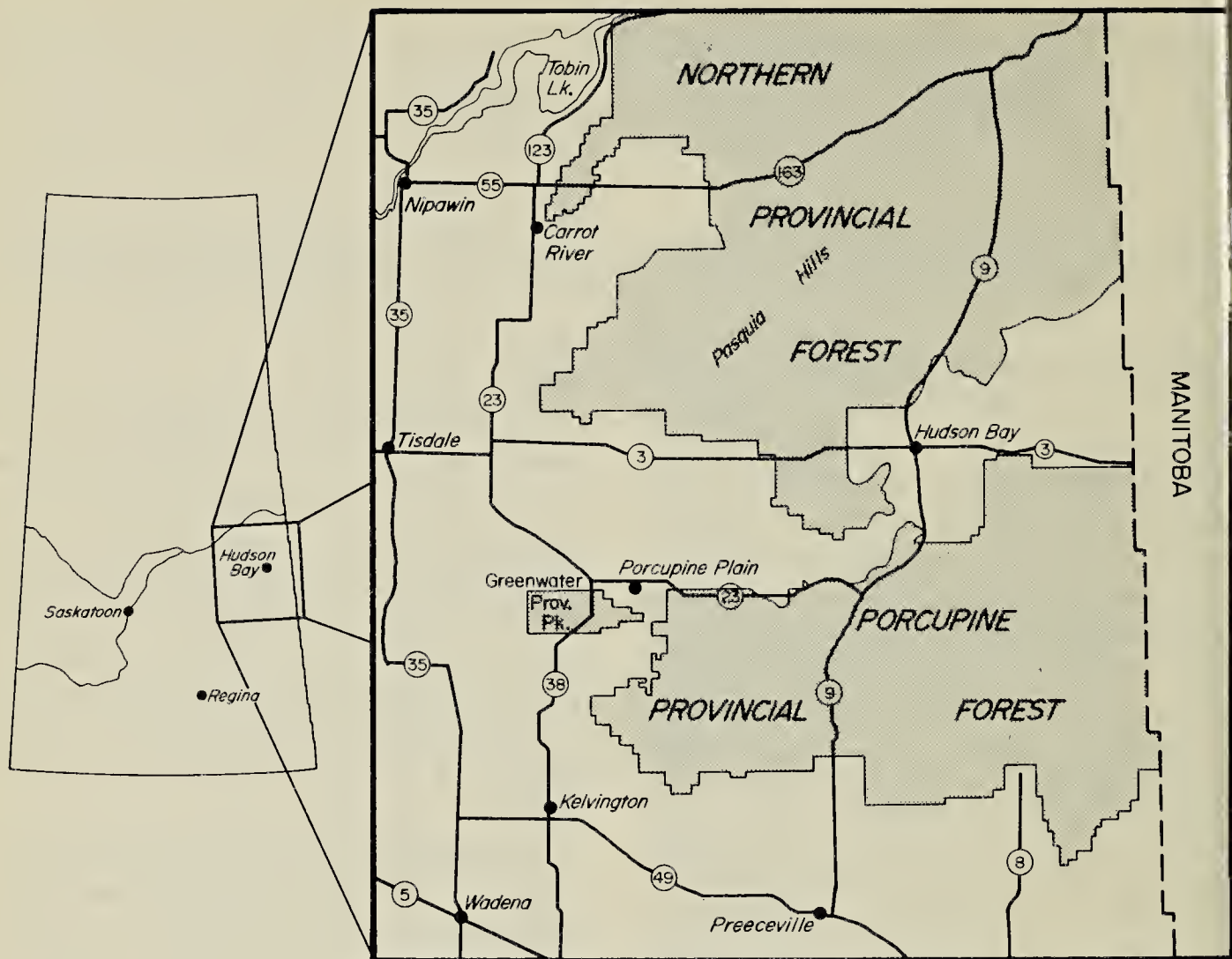


Figure 1. The Pasquia - Porcupine region of Saskatchewan.

TRAP AREA C

This trap area consisted of a 3-year-old cutover and adjacent uncut forest. Before logging, the portion of the cutover in which the trapping took place had a white spruce component overtopped by the aspen canopy. This spruce stratum was left when the aspen was removed and some of the trees had subsequently blown down. The cutover was a tangle of fallen spruce, aspen tops and limited amounts of sprouting aspen. Ground vegetation varied from moderate amounts of forbs and grasses under the sprouting aspen to dense stands of grasses and sedges *Carex* spp. in the spruce-dominated parts of the trap area.

The uncut stand adjacent to the cutover was a mixed aspen — white

spruce stand with the aspen overtopping the spruce. The shrub stratum was sparse and principal ground cover was leaf litter, particularly in those portions where spruce predominated.

Methods

On each of the three trap areas, two lines of 30 snap-traps each were employed; one line was located on the cutover and one line in the adjacent mature forest. Three traps were set at each station with about 10 m between stations resulting in a 10-station trap line about 100 m in length. Trapping on each area took place on two consecutive nights yielding a total of 60 trap-nights per line and 120 trap-nights per area. Traps were baited with peanut butter and checked every 24 hours.

TABLE 1. Small Mammals Captured (Number per 100 trap-nights) on the three trap areas.

Species	TRAP AREA A		TRAP AREA B		TRAP AREA C	
	Mature Forest (60 TN)*	Cutover (60 TN)	Mature Forest (60 TN)	Cutover (60 TN)	Mature Forest (60 TN)	Cutover (60 TN)
<i>Clethrionomys gapperi</i>	13.3	31.7	15.0	26.7	8.3	36.7
<i>Peromyscus maniculatus</i>	1.7	8.3	8.3	5.0	1.7	3.3
<i>Microtus pennsylvanicus</i>	—	—	1.7	1.7	—	5.0
<i>Sorex cinereus</i>	3.3	1.7	—	—	—	—
<i>Blarina brevicauda</i>	—	1.7	—	—	—	—
Total	18.3	43.4	25.0	33.4	10.0	45.0

Number of trap-nights (TN) in each area.

Trap area A was trapped 1 and 2 September, 1977; trap area B was trapped 12 and 13 September, 1977 and trap area C was trapped 13 and 14 September, 1977.

Results

Small mammal numbers for the three trap areas expressed as the number of individuals captured per 100 trap-nights are presented in Table 1. Red-backed voles *Clethrionomys gapperi* were the most frequently trapped animals (79 individuals in 360 total trap-nights) and deer mice *Peromyscus maniculatus* were the second most frequent (17 individuals). Meadow voles *Microtus pennsylvanicus*, masked shrews *Sorex cinereus* and short-tailed shrews *Blarina brevicauda* were captured infrequently with trap totals of 5, 3 and 1, respectively. Small mammal nomenclature follows Banfield.²

The possibility of differential trap success accounting for some of the differences in trap area capture totals (catch/effort, Table 1) was

examined using Nelson and Clark's¹⁰ equation for determining the influence of sprung traps on catch/effort (CE) calculations (Table 2). Apparently, little bias due to sprung traps occurred as the corrected CE values (Table 2) were in approximately the same relative proportions as the capture totals (Table 1).

In each trap area, small mammal capture totals and CE were greater in the cutovers than in the mature or uncut stands. The total number of small mammals captured and CE on the cutover portions of the three trap areas were least in the youngest cutover (trap area B, one year old) whereas the trap totals and CE in the older cutovers (three years old) were larger and similar in both. Small mammal capture totals and CE in the uncut portions of the trap areas were highest in trap area B, lowest in trap area C and intermediate in trap area A.

Capture totals and CE for red-backed voles in the uncut areas were similar in trap areas A and B but only

TABLE 2. Catch/Effort with Correction for Sprung Traps.

Species	CE (%) TRAP AREA A		CE (%) TRAP AREA B		CE (%) TRAP AREA C	
	Mature Forest	Cutover	Mature Forest	Cutover	Mature Forest	Cutover
<i>Clethrionomys gapperi</i>	18.4	48.1	18.8	33.0	9.4	51.0
<i>Peromyscus maniculatus</i>	2.3	12.7	10.4	6.2	1.9	4.0
<i>Microtus pennsylvanicus</i>	—	—	2.1	2.1	—	7.0
<i>Sorex cinereus</i>	4.6	2.5	—	—	—	—
<i>Blarina brevicauda</i>	—	2.5	—	—	—	—
All Species	25.3	65.8	31.3	41.3	11.3	63.0

about half those levels in trap area C. Deer mouse captures and CE in the uncut areas were similar in trap areas A and C but much higher in trap area B. The only masked shrews trapped in the uncut portions were caught in trap area A.

In the cutover portions of the trap areas, red-backed voles were trapped most frequently in trap areas A and C and least frequently in trap area B. Trapping frequency of deer mice was highest in trap area A and lowest in trap area C. The largest capture of meadow voles occurred in the cutover portion of trap area C. The only masked shrew and short-tailed shrew captured in a cutover were trapped in area A.

Discussion

Higher capture totals and CE for small mammals on the cutovers as compared to the adjacent uncut stands indicates clearcut logging improved the habitat of aspen-dominated areas for small mammals. Increases in small mammal populations after logging have been documented in studies of Douglas-fir *Pseudotsuga menziesii* forests in

California and Oregon^{13 3} and hardwood and boreal coniferous forest in West Virginia,⁶ where population densities have remained more or less constant after logging upland black spruce *Picea mariana* stands in Ontario⁹ and hardwood forests in New York.⁸

A simplified explanation of improved habitat after logging would be greater availability of food and cover. The cutover portions of the three trap areas had a ground cover of herbs, low shrubs and logging slash that was generally superior as a small mammal habitat, even in the 1 year-old cutover, to that of the uncut portions. Several authors^{13 1 3 7} have described the food of deer mice as consisting primarily of seeds and insects and the food of red-backed voles as mostly succulent plant parts and some seeds. The rapid recovery and proliferation of the vegetation in the aspen clearcuts of the three trap areas presumably resulted in increased food supplies, particularly for red-backed voles, and better cover conditions than were available in the uncut stands. Lower trap total and CE for the cutover portion of tra

area B than for the other two cutover trap areas were probably because the short interval since logging (one year) limited vegetative recovery in the cutover resulting in habitat conditions inferior to those in the 3-year-old cutovers. However, habitat conditions in the 1-year-old cutover were still superior to those of the uncut stands.

Capture totals and CE for the uncut portions of the three trap areas indicated the mixedwood stand (trap area C) had the lowest small mammal population, presumably because the sparse ground cover under this stand provided poor food and cover conditions. The uncut portion of trap area B may have been better small mammal habitat than the uncut portion of trap area A because of denser shrub and herb layers.

The most noticeable change in the small mammal population following clearcutting was in the density rather than composition. Apparently, both uncut and clearcut habitats were best for red-backed voles as they made up the major proportion of the small mammal populations in each habitat. Deer mice, trapped in low proportions in both the clearcuts and uncut areas, must have been limited in the hardwood-dominated areas. The lack of change in population composition after logging is contrary to the findings of studies of small mammals after logging Douglas-fir forests,¹³ black spruce forests,⁹ black pine *Pinus banksiana* forests in Manitoba¹² and mixed conifer-hardwood forests in Minnesota.⁷ These studies reported a decrease in red-backed voles and an increase in deer mice after clearcutting, likely as a result of a lack of cover making the clearcuts unsuitable for red-backed voles. The rapid vegetative recovery of the aspen cutovers in this study probably meant the period when a lack of cover was limiting red-backed



Deer mouse

Wayne Lynch

voles had already passed by the end of the first complete growing season after clearcutting. Because the vegetative composition of recent aspen clearcuts closely resembles that of mature aspen stands,⁵ major changes in the small mammal population composition would not be expected.

Meadow vole capture totals were highest in the cutover portion of trap area C characterized by extensive grass and sedge cover. Martell and Radvanyi⁹ felt meadow vole microdistribution and density were correlated to the amount of moist, graminoid cover present. Banfield² describes the typical habitat of masked and short-tailed shrews as moist forests; the few individuals of these species captured during the study were trapped on trap area A, the moistest of the three trap areas.

Numerous studies have demonstrated the role of small seed-eating mammals in hindering regeneration of coniferous trees of commercial importance (see Pank¹¹). In particular, mice have been found to be partly responsible for natural seeding failure after logging or fires and they often make artificial

seeding difficult or impossible. Because aspen regenerates after logging or fires primarily by suckering from the existing root system, seed-eating small mammals are probably of little importance in affecting revegetation of aspen cuts or burns. However, small mammals could conceivably affect regeneration of white spruce after logging mixedwood stands like that characterizing trap area C.

Although small mammals in an aspen-dominated forest habitat do not appear to be of direct economic importance to man, they are an integral part of the food chains or webs that characterize all biotic communities. In simplified terms, producers (plants) in the aspen community are eaten by primary consumers (herbivores such as red-backed voles and deer mice) which are in turn eaten by the secondary consumers (carnivores) such as red-tailed hawks, broad-winged hawks, short-tailed weasels and coyotes. Through these interrelationships of the food web in the aspen forest, small mammals can directly and indirectly influence the floral and faunal characteristics of the community to a significant degree.

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¹AHLGREN, C. E. 1966. Small mammals and reforestation following

prescribed burning. *J. Forestry* 64(4):614-618.

²BANFIELD, A. W. F. 1974. The mammals of Canada. Univ. of Toronto Press, Toronto. 438 pp.

³GASHWILER, J. A. 1959. Small mammal study in southwest Oregon. *J. Mammal.* 40(1):128-139.

⁴GASHWILER, J. A. 1970. Plant and mammal changes on a clearcut in west-central Oregon. *Ecology* 51(6):1018-1026.

⁵HUNT, H. M. 1977. Browse succession in an aspen forest. Sask. D.T.R.R. Wildlife Technical Report series 77-39. 86 pp.

⁶KIRKLAND, G. L. Jr. 1977. Responses of small mammals to the clearcutting of northern Appalachian forests. *J. Mammal.* 58(4):600-609.

⁷KREFTING, L. W. and C. E. AHLGREN. 1974. Small mammals and vegetation changes after fire in a mixed conifer-hardwood forest. *Ecology* 55(6):1391-1398.

⁸KRULL, J. N. 1970. Small mammal populations in cut and uncut northern forests. *New York Fish and Game Journal.* 17(2): 128-130.

⁹MARTELL, A. M. and A. RADVANYI. 1977. Changes in small mammal populations after clearcutting of northern Ontario black spruce forest. *Can. Field-Natur.* 91:41-46.

¹⁰NELSON, L. Jr. and F. W. CLARK. 1973. Correction for sprung traps in catch/effort calculations of trapping results. *J. Mammal.* 54(1):295-298.

¹¹PANK, L. F. 1974. A bibliography on seed-eating mammals and birds that affect forest regeneration. U.S.D.I. Fish and Wildlife Service, Spec. Sci. Rep., Wildl. No. 174. 28 pp.

¹²SIMS, H. P. and C. H. BUCKNER. 1973. The effect of clearcutting and burning of *Pinus banksiana* forests on the populations of small mammals in southeastern Manitoba. *Am. Midl. Nat.* 90(1):228-231.

¹³TEVIS, L., JR. 1956. Responses of small mammal populations to logging of Douglas-fir. *J. Mammal.* 37(2):189-196