

# SURVIVAL OF SMALL MAMMALS IN A CONIFEROUS FOREST BURN

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*Abstract:* Six species of small mammals survived a forest fire in the forest-tundra transition of northern Manitoba by occupying a refugium of zonal pond vegetation. Critical factors in the continued survival of the two insectivores (Masked Shrew and Water Shrew), two granivores (Red Squirrel and Meadow Jumping Mouse), and two herbivores (Gapper Red backed Vole and Meadow Vole) appeared to be utilization of separate microhabitats (pond, marsh, shrubs and trees) and exploitation of different, though overlapping, sets of food resources.

During August, 1974, biological studies were conducted by a museum team at Southern Indian Lake in northern Manitoba. The south half of the 144-kilometer (89-mile) lake lies within the boreal coniferous forest biome while the north half is forest-tundra transition. The region has been subjected to repeated forest fires and the resulting mosaic of post-burn communities offers excellent opportunities to study recolonization and succession of taiga plants and animals. This report deals with a population of small mammals which apparently found refuge from a forest fire by retreating to a narrow band of wet vegetation lining a small pond near the northern end of the lake (57° 29'N, 98° 34'W).

The elongated pond of about 0.8 hectares (2 acres) in size lay in a steep-sided valley in the Kame Hills, completely surrounded by a 35-meter-high (115-foot) sand esker and adjacent sandhills of glacio-fluvial origin (Fig. 1). The pre-existing forest consisted of Jack Pine (*Pinus banksiana*) on the hilltops, Black Spruce (*Picea mariana*) and Paper Birch (*Betula papyrifera*) on

the slopes and valleys; a shrub layer of Mountain Alder (*Alnus crispa*) and Labrador Tea (*Ledum groenlandicum*) and a ground cover of mosses, lichens and herbs (Fig. 2). The pond supported a marsh of predominantly sedge (*Carex aquatilis*), Wild Calla Lily (*Calla palustris*), Marsh Five-finger (*Potentilla palustris*), and Water Parsnip (*Sium suave*); thickets of willow (*Salix* spp.) and alder; and Tamarac (*Larix laricina*) and Black Spruce encroaching onto the sedge mat.

The fire occurred about 1964 and burned inland for several kilometers leaving a layer of ash and a tangle of charred, standing and fallen trees on the sandhills. The only vegetation to survive in the vicinity of the pond was a sedge marsh, a willow-alder thicket and about 30 spruce trees growing along the margin of the pond. Due to the very steep sides of the esker and hills, this peripheral green zone was only 2 to 8 meters (7 to 26 feet) wide. The nearest unburned sites were other inland ponds (1.6 km (1 mile) distant) and an alder-willow thicket growing on the edge of Southern Indian Lake (0.3 km (0.3 mile) distant) with numerous sandhills in between.

By 1974, underground stems of alder, willows, paper birch, and Labrador tea that survived the fire

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Fig. 1. Pond lying along the northern base of a sand esker. The narrow zone of marsh, shrubs, and a few black spruce survived a forest fire which swept through the region 10 years ago.

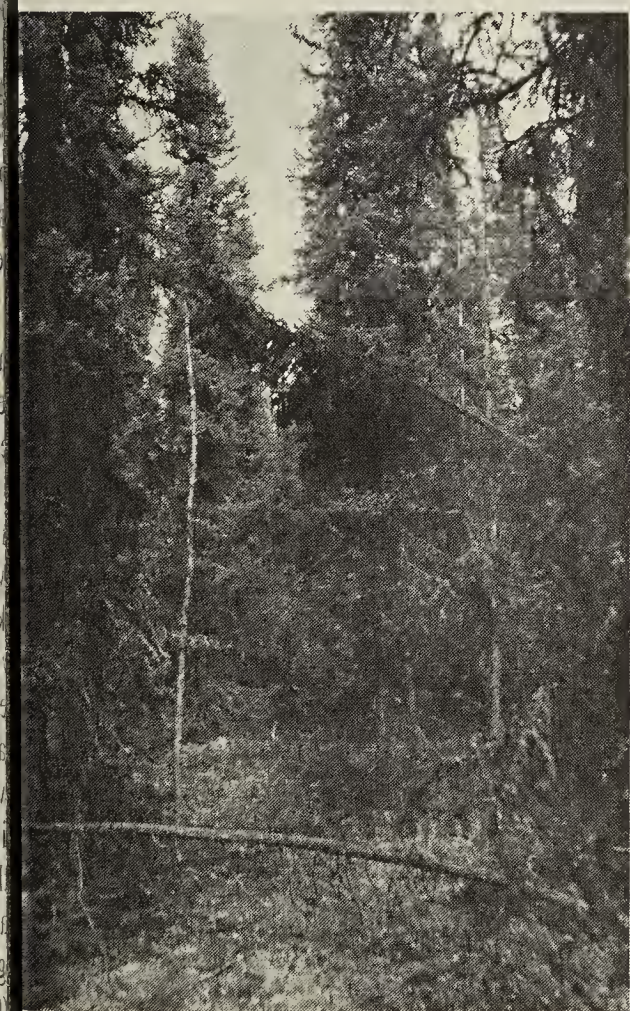


Fig. 2. A mature Black Spruce forest (minimum age of 150 years) in the same vicinity as the 10-year-old burn. Judging by the size and spacing of the trees, this forest was similar to the original forest surrounding the pond.

sprouted shoots 0.5 to 1.5 meters (1.6 to 4.9 feet) high, and Jack Pine seedlings had reached a height of 1 meter. Numerous early successional plant species had invaded the hillsides but 50 to 75 percent of the ground was still bare sand, ash and charcoal.

In order to determine the kinds of mammals inhabiting the pond margin, 260 museum special traps were set for 3 nights in the marsh, shrub and tree communities. The following were collected: 6 Masked Shrews (*Sorex cinereus*), 5 Water Shrews (*Sorex palustris*), 1 Gapper Red-backed Vole (*Clethrionomys gapperi*), 11 Meadow Voles (*Microtus pennsylvanicus*), and 15 Meadow Jumping Mice (*Zapus hudsonius*). Six Red Squirrels (*Tamiasciurus hudsonicus*) were observed for a total of 44 small mammals. Chewed birch stumps and an abandoned beaver lodge overgrown with sedge revealed that a Beaver (*Castor canadensis*) had either succumbed to the fire or departed with the resulting destruction of its food supply.

Considering the great distances to



the nearest unburned regions, the rugged terrain, and the sparseness of the vegetation recolonizing this secondary bare area, it is probable that the species of small mammals found at the pond did not arrive after the burn, but survived the fire by retreating to the narrow band of wet vegetation. The period of intense heat and suffocating smoke must have been avoided by shrew, mouse, and tree squirrel alike through the use of cool burrows. It is surprising, firstly, that these mammals survived within a few meters of the fire and, secondly, that they were able to persist in such small numbers for many generations in a narrow zone at the edge of the pond. Of critical importance must have been the fact that each species used a different, though overlapping, set of food resources and occupied a separate microhabitat from the others. All available environments were exploited — pond, marsh, shrubs and trees.

The six species of mammals consisted of two insectivores, two granivores and two herbivores. The Masked Shrew and Water Shrew, though both insectivorous, select many different insect and other invertebrate prey not only as a result of the dissimilar size of the two shrews, but also because of habitat preference. The Masked Shrew is found throughout all terrestrial communities present (most commonly in the sedge mat), while the Water Shrew seldom strays far from water and all five specimens were collected in the marsh and hydric shrub thickets. In addition, the Water Shrew enters the aquatic environment, at least when the pond is not frozen to the bottom, to feed on pond life not utilized by the other mammals.

The Red Squirrel and Meadow Jumping Mouse feed on a variety of seeds, berries, fungi and animal material as these resources become available throughout the year. However, partial segregation of diets would result from

their body-size differential, plus the fact that the squirrel's basic food item of Black Spruce seed is largely unavailable to the mice, the cone remaining out of reach on the tree until all the seeds have been scattered by the wind. The jumping mouse avoids competition for food and denning site during the critical winter months by hibernating deep in the sandy hillside for about 7 months of the year at this latitude.

The two voles devour green plant material, roots, and bark, but they are usually well segregated by habitat preference. As expected, the 1 Meadow Voles were captured in the sedge marsh, the single red-back in the shrub thicket.

Devastating and widespread forest fires are of common occurrence in the transitional zone between the boreal coniferous forest and the tundra. The ability of the six most-abundant species of small mammals to retreat to and then persist together in a small green oasis, surrounded by a charred sandy "desert", reveals the crucial role that niche segregation plays in the survival of mammal populations in the face of reoccurring, major habitat destruction. It also demonstrates the adaptability of each species to survive within a small refugium (at precariously low numbers) until the appropriate stage of plant succession once more permits dispersal over former range.

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