Late-winter Habitat Use by the Fisher, *Pekania pennanti* (Erxleben, 1777), in the Boreal Plains Ecozone of Northwestern Saskatchewan, Canada

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Late-winter habitat use by the Fisher, *Pekania pennanti* (Erxleben, 1777) in northwestern Saskatchewan was assessed in February 2009, 2011, and 2012. A total of 78 Fisher tracks were recorded over 60 300 m of snowshoe surveys. Fisher tracks were significantly less frequent than expected in Tamarack (*Larix laricina* [Du Roi] K. Koch) stands with > 40% crown closure and mainly 0–10 m trees ($P < 0.05$) and in open areas. Fishers used other habitat types equal to availability, including muskeg and coniferous, mixed, and deciduous forest stands. Maintaining mosaics of forest stands of different seral stages interspersed with muskeg would meet the late-winter habitat needs of Fishers in the Boreal Plains Ecozone of northwestern Saskatchewan.

Key Words: Fisher; *Martes pennanti*; *Pekania pennanti*; muskeg; Saskatchewan; winter habitat; Boreal Plains

Introduction

In western Canada, Fisher (*Pekania pennanti* [Erxleben, 1777]; formerly *Martes pennanti*, Sato *et al.* 2012) habitat studies have been conducted in coniferous, mixed, and deciduous forests (Badry *et al.* 1997; Weir and Harestad 1997; Proulx 2006). However, none has been carried out in the Boreal Plains Ecozone of northern Saskatchewan, where treed fens and bogs (referred to as muskeg) are abundant and the Fisher is a species of economic importance because of its value as a furbearer and its role in supporting the subsistence of Aboriginal groups (Koback 2014*). The purpose of this study was to assess late-winter habitat use by the Fisher in northwestern Saskatchewan.

The study was conducted in Mistik's Forest Management Agreement (FMA) area, north of Meadow Lake (54°07'N, 108°25'W), adjacent to the Alberta border. The area encompasses approximately 1.8 million ha of forest, water, and non-forested land. It is a mosaic of upland deciduous and coniferous boreal forest, muskeg, and water (McLaughlan *et al.* 2010) resulting from frequent fires of various sizes and intensities (Parisien *et al.* 2004). The area lies within the Boreal Plains Ecozone where White Spruce (*Picea glauca* [Moench] Voss), Black Spruce (*Picea mariana* [Miller] Britton, Sterns & Poggenburgh), Jack Pine (*Pinus banksiana* Lambert), and Tamarack (*Larix laricina* [Du Roi] K. Koch) are the dominant conifers (Environment Canada 2008). Deciduous stands of Trembling Aspen (*Populus tremuloides* Michaux), Balsam Poplar (*Populus balsamifera* Linnaeus), and Paper Birch (*Betula papyrifera* Marshall) occur throughout the study area (Rowe 1972).

Field inventories were carried out in February 2009, 2011, and 2012. The range of temperatures was similar among years (0 to −30°C), but, based on monthly average temperatures for the region, the 2012 winter (−10.8°C) was slightly warmer than 2009 (−16.3°C) and 2011 (−16.5°C) (Munroe 2012*; Government of Canada 2014*). During inventories, snow depths ranged from 30 to 65 cm in 2009 and 2011, and 30 to 45 cm in 2012. The survey method followed Proulx (2006, 2011). A random-stratified approach (Krebs 1978) was used to locate linear transects averaging ≥ 1 km long and ≥ 1 km apart that crossed all habitat types. Different transects were surveyed from year to year. Transects were plotted on 1:15 000 scale maps, and starting points were located using compass bearings and distance to distinct photographic features. Transects were followed on snowshoes, using a compass and a hip chain (a device used to record linear distances). Transect lengths varied according to accessibility, safety, and environmental conditions (e.g., open water, unexpected snowstorm, etc.). I recorded only well-defined tracks: those not melted or deformed, not filled with crusty snow, and judged to be less than 48 h old (a subjective assessment based on my experience). Because Fisher and American Marten (*Martes americana* [Turton, 1806]) footprints are similar (Halfpenny *et al.* 1995), when mustelid tracks were encountered, I investigated both sides of transects and within forest stands to find the best tracks available. The combination of footprint (size, presence/absence of toe prints) and trail (gait, distance between jumps, and dragging of the feet) characteristics were used to identify all tracks (Murie 1975; Rezendes 1992; Halfpenny *et al.* 1995). I recorded the location of tracks as both linear distance along the transect and universal transverse mercator.

Autocorrelation is often present in ecological data and cannot be completely avoided (Proulx and O'Doherty 2006). It may occur during analyses of track survey data because of uncertainty whether one or more animals has made the tracks being counted. It is difficult to confirm that a series of tracks along a transect belongs to a single animal (de Vos 1951) as home ranges overlap (Badry *et al.* 1997; Weir 2003), and winter dispersal movements are known to occur (Arthur *et al.* 1993). Because of rugged environmental conditions, I did not follow tracks that crossed close together to learn whether the same animal made them. On the basis of track characteristics, Proulx (2006, 2011) deduced that two different animals could be as close as 100 m along the same transect. To minimize spatial autocorrelation, a minimum spacing of tracks and a minimum spacing of transects were used (Proulx and O'Doherty 2006). Only tracks ≥ 100 m apart within the same forest stand were recorded as two independent tracks. Tracks < 100 m apart but in two different stand types were also recorded as two independent tracks (Bowman and Robitaille 1997; Proulx 2006).

The Silvacom Group (Edmonton, Alberta) produced 1:15 000 scale vector maps for data analyses, using Saskatchewan Forest Inventory Vegetation datasets (Saskatchewan Environment 2004*). Nearly half the total length of transects surveyed in 2009, 2011, and 2012 was in treed bogs and fens. Independent of their age, these habitats varied considerably in structure according to many factors, such as landscape position, origin, slope gradient, water table location, drainage, etc. (Smith *et al.* 2007). Habitat classes were, therefore, based on the vegetation composition (≥ 60% Black Spruce stands, ≥ 60% Tamarack stands, pure and mixed Jack Pine stands with less than 60% Black Spruce or Tamarack, and deciduous or mixed-coniferous-deciduous stands); crown closure (percentage of ground area covered by the vertical projection of the crown to the ground, 0–20%, 21–40%, or > 40%); and tree height (0–10 m, 11–20 m, or > 20 m) in the forest stands (Saskatchewan Environment 2014*). Crown closure values for deciduous stands refers to summer datasets; I considered crown closure to be 0% in winter. Crown closure values for coniferous stands were representative of stand conditions throughout the year. Winter crown closure data for mixed wood stands was corrected according to the proportion of deciduous species.

The proportion of habitat types traversed by survey transects were used to determine the expected frequency of tracks per habitat type if tracks were distributed randomly with respect to habitat types (Proulx and O'Doherty 2006; Proulx 2011). Habitat use (i.e., observed versus expected frequency of track intercepts) was tested using χ^2 statistics with Yates correction (Siegel 1956; Zar 1999). When χ^2 analyses suggested an overall significant difference between observed and expected frequencies, further comparisons were conducted for each habitat class using the *G* test for correlated proportions (Sokal and Rohlf 1981). Probability values ≤ 0.05 were considered statistically significant.

Transects crossed major habitat types: Black Spruce-dominated stands, 23.2%; Tamarack-dominated stands, 22.6%; other coniferous stands, 6.6%; deciduous stands, 18.4%; mixed wood stands, 22.9%; and open areas, 6.1%. A total of 78 Fisher tracks were recorded over 60 300 m of transects. There was a significant difference between observed and expected frequencies of tracks per habitat class ($\chi^2 = 18.7$, df 9, $P < 0.05$) (Figure 1). No Fisher tracks were encountered in open areas, i.e., cut blocks, burns, roads, and pipelines. Tracks were significantly less frequent than expected in Tamarack stands with > 40% crown closure ($G = 3.9$, $P < 0.05$), which consisted mainly of 0–10 m tall trees. Fishers used other muskeg and coniferous, mixed wood and deciduous forest stands as available.

Fishers avoided open areas and Tamarack stands with > 40% crown cover and small trees because these stands do not have a well-developed understory (McLaughlan *et al.* 2010; G.P., unpublished). They offer relatively little ground structural complexity for prey and provide Fishers with little protection against weather and predators (G. P., unpublished). This finding is in agreement with previous studies in various ecozones (Proulx 2006; Lancaster *et al.* 2008; Weir and Corbould 2010).

In the Boreal Plains Ecozone, late-winter Fisher habitat may correspond to any forested area that provides suitable prey, as suggested for other ecozones by Strickland *et al.* (1982) and Arthur *et al.* (1989). In Mistik's FMA area, large forested areas dominated by Trembling Aspen were being used by Fishers, as was

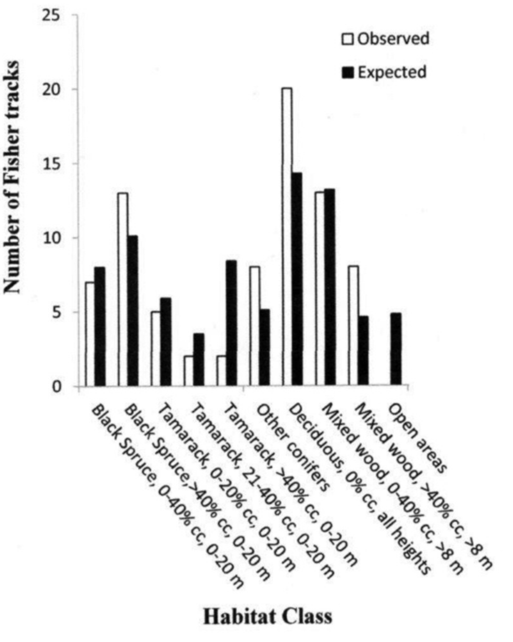

Figure 1. Observed and expected distribution of Fisher tracks ($n = 78$) by habitat class (including percentage crown closure [cc] and range of tree heights) in late-winter 2009, 2011, and 2012, Mistik's Forest Management Agreement area, Saskatchewan.

found in the Prairie Ecozone (Badry *et al.* 1997). In these ecozones, the presence of dense coniferous cover during winter may not be necessary when there is a well-developed understory. Fishers were found in deciduous stands and in muskeg where a lack of crown cover was compensated for by well-developed undergrowth (McLaughlan *et al.* 2010; G.P., unpublished), which may provide Fishers with homoeothermic advantages (Buskirk *et al.* 1989; Badry *et al.* 1997) and access to prey (Powell and Zielinski 1994). In treed bogs, Fishers investigated shrub thickets and the bases of trees, and their tracks were often associated with Snowshoe Hare (*Lepus americanus* Erxleben, 1777) trails (G.P., unpublished). Thus, this study suggests that conserving mosaics of muskeg interspersed with forest stands of diverse composition and structure would meet the late-winter habitat needs of Fishers.

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