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Differential responses of prairie rodents to edge effects from recreational trails

Cameron M. Shorb[1], Laur A. Freymiller[1], Daniel L. Hernández[1]

[1] *Carleton College Biology Department, 1 North College St., Northfield, MN 55057, USA*

Corresponding author: Daniel L. Hernández (hernandez@carleton.edu)

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Abstract

Edge effects are a common phenomenon in which an ecological variable changes with respect to distance from a habitat edge. Recreational trails may constitute a habitat edge for prairie rodents because of high human presence, high predator presence, or limited shelter compared to the prairie core. Despite the prevalence of trails in conservation parcels, their effect on wildlife distribution remains largely unstudied. We examined the impacts of recreational trails on small mammal activity in the restored prairies of the Cowling Arboretum at Carleton College. The prairies were restored from 1995 to 2008 and now comprise a contiguous prairie block of approximately 155 ha. Over 2 consecutive summers, we used infrared motion-sensing cameras to record the relative amount of time rodents spend at baited stations placed at different distances from the trail. The results varied between taxa: voles (*Microtus* spp.) avoided trail edges whereas mouse (Cricetidae and Dipodidae) and thirteen-lined ground squirrel (*Ictidomys tridecemlineatus*) activity was unaffected by trail proximity. Trails may therefore have species-specific effects on small mammals, with potential consequences for the connectivity and distribution of populations.

Keywords

camera, edge effects, thirteen-lined ground squirrels, mice, recreational trails, small mammals, voles

Introduction

Habitat fragmentation leads to edge effects (Laurance and Yensen 1991, Flaspohler et al. 2001, Fahrig 1997, Haddad et al. 2015), which can affect species differently (Donovan et al. 1997, Debinski and Holt 2000, Miller and Hobbs 2000, Ries et al. 2004, Bock et al. 2002). Edge effects occur when ecological processes differ with respect to distance from a habitat edge (Donovan et al. 1997). Whereas some mobile organisms are attracted to edges, others avoid edges because of unfavorable interspecific interactions or resource availability (Ries et al. 2004). Such edge-aversion can change the functional area of a habitat patch from the perspective of that species (Laurance and Yensen 1991).

Recreational trails in natural areas are a nearly linear land use, creating long edges and potentially fragmenting habitat despite occupying minimal area. In addition to facilitating human activity (Reilly et al. 2017), trails may alter the abiotic environment by affecting light availability, soil temperature, soil moisture, erosion, litter depth, or other factors (Ballantyne and Pickering 2015). Insofar as trails induce edge avoidance, they may partially fragment otherwise contiguous patches. Thus, trails may decrease connectivity and core habitat area disproportionately to their footprint (McDonald and St. Clair 2004).

Responses to trail edges can vary widely among species (Benítez-López et al. 2010, Debinski and Holt 2000, Miller and Hobbs 2000, Reilly et al. 2017) due to differences in foraging behavior (Kerth and Melber 2009), vulnerability to predators (Flaspohler et al. 2001, Pardini 2004), or responses to human activity (George and Crooks 2006). A study of large mammal activity in an urban park found that bobcats (*Lynx rufus*), coyotes (*Canis latrans*), and mule deer (*Odocoileus hemionus*) were all less likely to cross trails during the day in places where there was high human activity (George and Crooks 2006), but the degree of responsiveness to human activity was species-specific. Deer were the most tolerant, while bobcats demonstrated a stronger aversion to areas of high human activity (George and Crooks 2006). In contrast, Reilly et al. (2017) found no correlation between wildlife occurrence and human activity for populations of 10 medium- to large-sized mammal species, including bobcats, coyotes, and mule deer. However, in areas of high recreational activity, coyotes were less active during the day and striped skunks (*Mephitis mephitis*) were more active in the late morning, perhaps to avoid coyotes (Reilly et al. 2017).

Smaller animals may also show species-specific responses to trail edges. The reduced cover and greater light on and near trails may put small mammalian prey at greater risk of predation (Kotler et al. 1991, Orrock and Danielson 2009), discouraging activity near trails. Cricetid species have been found to differ in their ability to cross highways and wooded medians; translocated deer mice (*Peromyscus maniculatus*) successfully crossed these boundaries and returned to their home ranges more often than meadow voles (*Microtus pennsylvanicus*) or red-backed voles (*Myodes californicus*) (McDonald and St. Clair 2004). Edge-aversion may also be a response to resource scarcity near edges. For example, both red-backed voles and their primary food source, truffles, decrease in abundance with increasing proximity to the clearcut edge of forest patches

(Mills 1995). When new edges were mowed in existing habitat, meadow voles showed no edge effect (Harper et al. 1993) or a slight preference for the edge (Nams 2012).

Whereas some studies have documented bird and large mammal responses to human trails, and others have observed species-specific responses of small mammals to other edges, the impact of recreational trails on small mammals is unknown. In this study, we examined the edge effects of trails on small mammals (< 0.5 kg) in a restored tallgrass prairie managed for conservation and recreation. Small mammals may be especially responsive to edge effects from trails because of their small size and vulnerability to terrestrial and aerial predators. Small mammals may avoid trails if they perceive them as barriers or unfavorable habitats, and these responses may vary with species.

We hypothesized that (1) small mammal activity would vary with respect to distance from recreational trails, (2) the presence or strength of this effect would vary among species, and (3) diurnal species would show the strongest edge avoidance.

Methods

Study site description

The Carleton College Cowling Arboretum (Northfield, MN, U.S.A., 44°28'N, 93°09'W) contained 155 ha of contiguous tallgrass prairie planted following conversion from agriculture between 1995 and 2008. The prairie was bordered by deciduous forest to the west and north, an agricultural field to the east (corn and soybean planted in annual rotation), and a state highway to the south (one lane in each direction, speed limit 45 mph). Over 100 plant species occur in the prairie, of which about 35 have >1% cover (Hernández et al. 2013). Previous studies at this site have examined the impacts of forest edge on white-tailed deer browsing (Nisi et al. 2015) and grassland bird distributions (Beck et al. 2016), but ours was the first study to examine the edge effects of recreational trails on animal movement. The relatively large size of this restoration and prevalence of recreational trails made this an ideal location to examine the impacts of trails on grassland small mammal activity.

The mammalian herbivore assemblage was a mix of prairie specialists (e.g., thirteen-lined ground squirrels [*Ictidomys tridecemlineatus*], plains pocket gophers [*Geomys bursarius*], and prairie voles [*Microtus ochrogaster*]) and generalists (*e.g.*, meadow voles, prairie deer mice [*Peromyscus maniculatus bairdii*], white-tailed deer [*Odocoileus virginianus*] and Eastern cottontail rabbits [*Sylvilagus floridanus*]) (Nisi et al. 2015). Predators of small mammals were common, and included red-tailed hawks (*Buteo jamaicensis*), great-horned owls (*Bubo virginianus*), barred owls (*Strix varia*), long-tailed weasels (*Mustela frenata*), short-tailed weasels (*Mustela ermine*), red foxes (*Vulpes vulpes*), coyotes, and feral house cats. Estimated home ranges for the focal species exhibit broad variation even within taxa, but movement of individuals is commonly greater than 20 m for *M. pennsylvanicus*, greater than 60 m for *P. maniculatus*, and greater than 100 m for *I. tridecemlineatus* (Getz 1961, Wood et al. 2010, Rongstad 1965).

Figure 1. A recreational trail through restored tallgrass prairie in the Cowling Arboretum at Carleton College, Northfield, Minnesota, USA.

The Arboretum contained a network of trails that were open to the public, most commonly used for walking and running. The trails consisted of dirt or gravel vehicle tracks in grass mowed to a width of 3–5 m (Fig. 1). Off-leash dogs, biking, and unofficial vehicles were not allowed, though the land managers drove on the trails with a pick-up truck and a small all-terrain utility vehicle several times per week.

Experimental design and methods

We measured animal activity using motion-sensing digital infrared cameras. We used cameras instead of live traps because we were primarily interested in whether activity, rather than presence or absence, was affected by the proximity of recreational trails. Camera stations were located along transects perpendicular to the trails, with stations at 0, 2, 4, 8, 16, and 64 m from the trail. Data was not collected from all distances for all transects due to occasional camera failures. To minimize the possibility of edge effects from habitat features other than trails, we placed transects in a core area of the prairie, beyond 100 m of forested areas, agricultural fields, roads, or other trails (Fig. 2). We set 12 unique transects in 2014 and re-sampled from 5 of those in 2015. Cameras were deployed along one transect at a time for approximately 48 h at each transect. Thus, each transect location represents an independent observation occurring at a unique time.

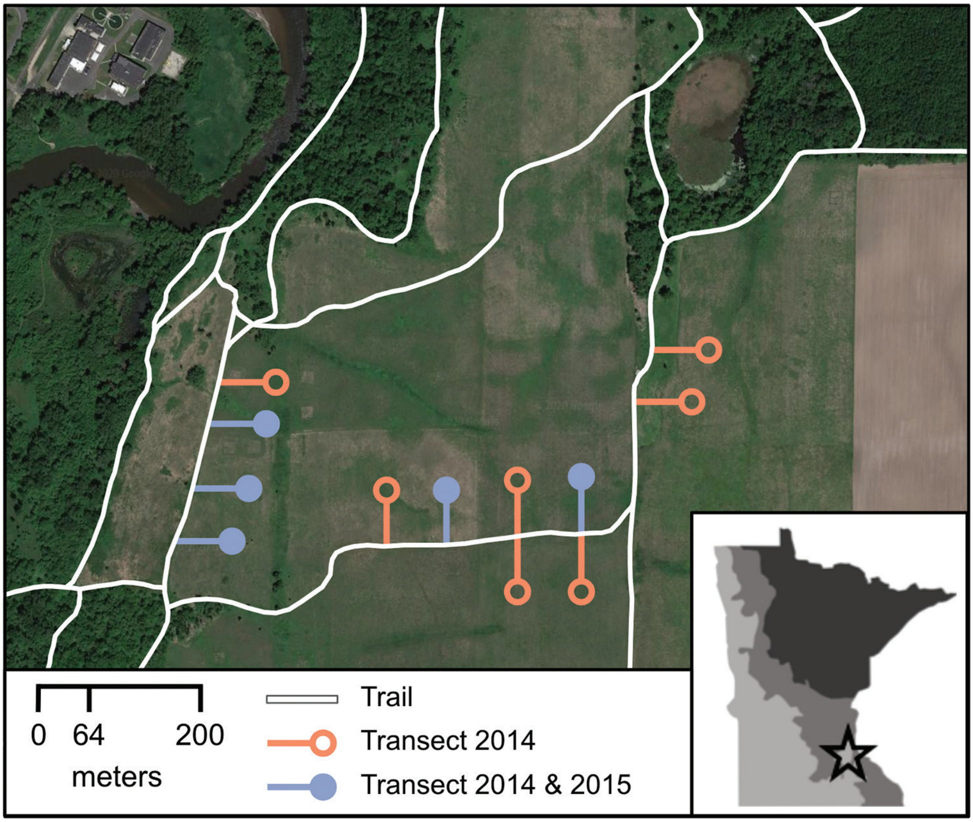

Figure 2. Approximate location of camera station transects (colored lines capped with circles) in relation to recreational trails (white lines) in the Cowling Arboretum at Carleton College, Northfield, Minnesota, USA, 2014-2015. Transect symbols have been elongated for visibility and are not to scale. The farthest camera station on each transect was always at least 64 m from any other trail or transect. Cameras and bait were only stationed along one transect at a time. Inset map shows the location of the Arboretum (star) in relation to Minnesota's major vegetative zones: conifer-hardwood zone (dark gray), deciduous forest-woodland zone (medium gray), and prairie zone (light gray).

At each station, we cleared a patch of vegetation about 50 × 80 cm with electric clippers or hand shears in order to ensure clear images of the animals (Fig. 3). At the edge of the clearing, we drove 2 rebar stakes into the ground, to which we attached a digital infrared camera (RECONYX RapidFire RM45, Holmen, WI, USA with SanDisk CF memory card, Milpitas, CA, USA) such that the lens was ~25 cm off the ground and its field of view was angled ~30° below horizontal (Fig. 3). Cameras were set at their default settings, programmed to take one black-and-white picture per second for 3 consecutive seconds following a motion trigger. Continued movement triggered further pictures with no lag time. Cameras operated continuously for the approximately 48-h sampling period at each transect.

We baited the stations with seeds of native prairie species common to the Arboretum: *Silphium laciniatum* (Asteraceae), *Desmodium canadense*, and *Dalea purpurea*

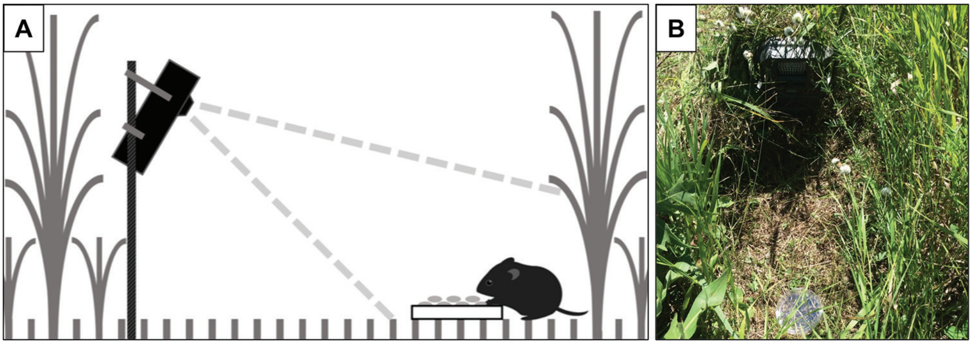

Figure 3. A Schematic of camera station seen from the side, depicting patch of cleared vegetation; digital infrared camera, zip-tied to rebar stakes, with its field of view angled approximately 30 degrees below horizontal (dashed lines represent approximate field of view); and petri dish of native prairie seeds for bait. Schematic not to scale **B** photo of camera station seen from above. Stations were deployed 2014–2015 in Northfield, Minnesota, USA, 2014–2015.

Vent. (Fabaceae)] (seeds were purchased from Prairie Moon Nursery, Winona, MN, USA). We autoclaved the seeds to prevent germination of non-local strains in the prairie planting. We mixed the seeds in roughly equal proportions, put them in petri dishes (roughly enough seeds to cover the bottom of the dish), and set one dish 50 cm in front of each camera. We did not collect data during periods of rain (4 d in July 2015, 6 d in August 2014, 6 d in August 2015) because in trial studies we observed that it influenced the effectiveness of the bait by washing it out of the petri dish.

We measured animal activity by counting all visits of each species to each camera at each transect, where a “visit” is defined as a set of 3 photos following a motion trigger, in which an animal appeared in at least one. Therefore, an animal feeding at the bait dish and triggering the camera multiple times counted for more “visits” than one that quickly passed in front of the camera. Thus, visit count is an approximate measure of the time members of each species spent at the bait station, rather than the number of unique occurrences. When a camera captured 2 animals simultaneously, we counted that photo set as 2 visits. Otherwise, we made no effort to distinguish between individuals. In our analyses, we controlled for differences in camera deployment times by calculating activity as the number of sightings per 24 h ([number of visits over deployment period]/[(hours the camera was deployed)/24]).

It is possible activity levels at the camera stations were different than those at undisturbed points in the prairie. Animals may have been attracted by the bait or repelled by the cut vegetation, the smell of humans, or the cameras and petri dishes. However, our study examined the relative activity levels at different distances, not the absolute activity level, and the degree of disturbance caused by the camera stations did not differ with respect to distance from trail.

The photos allowed for clear distinction among thirteen-lined ground squirrels, voles, and mice, but did not always allow for identification of species within the latter two taxa because of body orientation (e.g., tail not visible) or blurriness of the photo.

Based on previous live-trapping in the Arboretum prairie, voles are predominantly meadow voles, though prairie voles have occasionally been found in live traps (D. L. Hernández, personal observation). The local mouse species are prairie deer mouse, western harvest mouse (*Reithrodontomys megalotis*), meadow jumping mouse (*Zapus hudsonius*), and white-footed mouse (*Peromyscus leucopus*) (Angell and Braker 2010, Angell and Braker 2012). When we could not positively identify the animal in the photo, we excluded the visit from our analyses (< 1% of all visits).

Data analysis

For each taxon, we conducted a Kruskal-Wallis test for differences in activity with respect to distance from trail (m). We could not use an ANOVA because the data were not normally distributed. To avoid any potential issues with double counting, we aggregated data for points along transects that were used in both years (average weighted by the length of camera deployment in each year). We did not use a repeated measures approach because only 5 of the 12 transects were repeated in both years. When a Kruskal-Wallis test yielded a significant result ($P < 0.05$), we conducted a Dunn's test to identify which distances had significantly different activity while accounting for multiple comparisons. All statistics were done in R (R Version 3.3.2 with STATS package, www.r-project.org, accessed 30 Jun 2018).

Results

Trail edge effects on prairie rodent activity were apparent but varied among the species observed. Over 2 study seasons, our camera stations (n = 57 in 2014, n = 26 in 2015) captured 4358 visits by the focal taxa: 557 by mice (9.0 sightings station^{-1} in 2014; 1.7 sightings station^{-1} in 2015), 2494 by thirteen-lined ground squirrels (27; 36), and 1307 by voles (14; 20) (Fig. 3; Appendix 1: Table A1. In addition to the focal taxa, cameras occasionally captured pictures of Eastern cottontail rabbits, shrews (Soricidae), weasels, sparrows (Emberizidae), striped skunks, raccoons (*Procyon lotor*), an Eastern chipmunk (*Tamias striatus*), a Virginia opossum, and a domestic dog. Collectively, these non-focal taxa made up approximately 6% of the total visits (Appendix 1: Table A2). The sample size was too low to draw any meaningful conclusions about the distribution of these taxa. The influence of distance from the trail was not significant for either mouse activity ($\chi_5^2 = 1.03$, $P = 0.960$) or ground squirrel activity ($\chi_5^2 = 0.860$, $P = 0.973$). In contrast, vole activity was affected by distance from the trail ($\chi_5^2 = 16.0$, $P = 0.007$).

Over the 2-year study, we recorded only 13 visits by voles at 0 m (Fig. 4, Appendix 1: Table A1, available online in Supporting Information). All of the other distances had more than 130 recorded vole visits over the study period, with greater than 200 visits at 16 m and 64 m (Appendix 1: Table A1, Fig. 4). Vole activity at 0 m (average 0.474 visits day^{-1}) was less than at 16 m (20.7 visits day^{-1}, $P = 0.003$) and marginally significantly

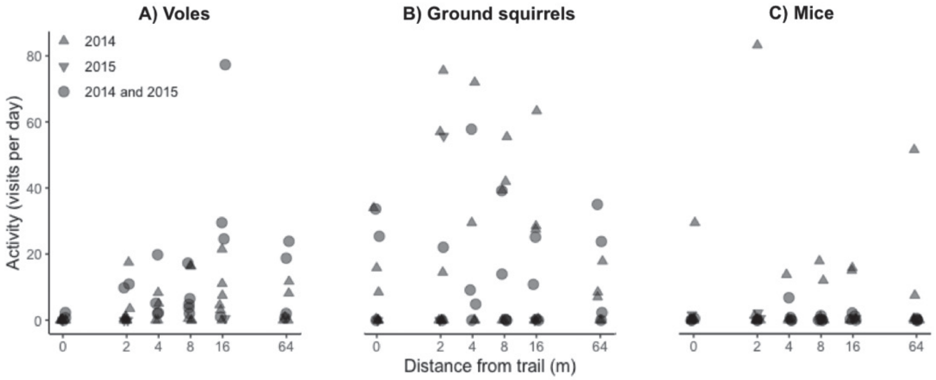

Figure 4. Small mammal activity at camera stations (visits day^{-1}) by distance (m) from recreational trails in Northfield, Minnesota, USA, 2014-2015. Panels show activity levels of **A** voles (*Microtus* spp.) **B** thirteen-lined ground squirrels (*Ictidomys tridecemlineatus*), and **C** mice (Cricetidae and Dipodidae). A "visit" is defined as a motion-triggered set of 3 photos in which an animal appeared in at least one photo. Observations were made at 57 camera stations over 12 transects in 2014 and 26 camera stations over 5 transects in 2015. Each data point represents the average activity at a camera station across the total observation period (approximately 48 hours when observed in one year and approximately 96 hours when observed in both years).

less than at 4 m (5.94 visits day^{-1}, $P = 0.078$), 8 m (6.74 visits day^{-1}, $P = 0.062$), and 64 m (8.49 visits day^{-1}, $P = 0.060$). These relationships were the same whether or not we combined data from the five transects that were repeated in both years. In 2014 alone (n = 12 transects), vole activity at 0 m was less than at all other distances except 2 m (0 – 4 m: $P = 0.041$; 0 – 8 m: $P = 0.020$; 0 – 16 m: $P = 0.005$; 0 – 64 m: $P = 0.046$). In 2015 alone (n=5 transects), vole activity did not differ with respect to distance from trail ($\chi_5^2 = 1.18$, $P = 0.946$).

Discussion

The edge effect of recreational trails was species-specific, affecting voles but not mice or ground squirrels. For voles, the effect was small in spatial extent but strong: camera stations immediately adjacent to trails never recorded more than 1 vole sighting per monitoring period (approximately 48 h). Our findings support our hypothesis that edge effects differ among species (Benítez-López et al. 2010, Debinski and Holt 2000, Miller and Hobbs 2000, Flaspohler et al. 2001, Pardini 2004, Reilly et al. 2017). Edge tolerance in white-footed mice has been found with road edges (Bissonette and Rosa 2009), but it is unknown whether all mouse species respond similarly to edges. Because photos were not high-enough resolution to differentiate among mouse species, it is possible there were additional species-specific differences in edge responses among mice that we did not detect.

We rejected our hypothesis that diurnal species would be more edge-averse than nocturnal species. Thirteen-lined ground squirrels showed no edge aversion despite being exclusively photographed during the day, when humans and dogs are most active on the trails. Voles were primarily nocturnal, largely eliminating the chance of direct disturbance by humans, yet strongly avoided the trail edge. Similarly, McGregor et al. (2008) found that white-footed mice and Eastern chipmunks avoided crossing roads but did not cross any more often in areas with low traffic, suggesting their behavior was not a direct response to human activity. Voles might be avoiding the scent of humans or domestic dogs, exposure to nocturnal mammalian predators using trails (Frey and Conover 2006, Harmsen et al. 2010, Reilly et al. 2017, Orrock and Danielson 2009), or exposure to owls (Kotler et al. 1991, Orrock and Danielson 2009).

Voles' edge aversion contradicts previous evidence that meadow voles may be edge-tolerant (Harper et al. 1993) or even edge-loving (Nams 2012). This may be due to the different nature of the edges in question: whereas these previous studies created new edges by mowing portions of the study area, our study focused on the impacts of trails that had been maintained for at least 9 years and consistently used by humans, vehicles, dogs, and possibly wild predators. This suggests the use of the trail may be more important than its physical structure.

Many studies of edge effects on small mammals have been conducted at much courser scales (e.g., Adams and Geiss 1983, Bock et al. 2002). By increasing our sampling intensity closer to the edge (including camera stations at 0 m, 2 m, and 4 m from the trail), we were able to detect an edge effect of <4 m – an effect size the studies above could not have detected. Even small edge effects could limit activity and thus species interactions near the edge, and we stress the importance of designing studies that can detect these fine-scale phenomena.

Although the majority of camera studies in recent years have focused on carnivores and ungulates (Burton et al. 2015, Reilly et al. 2017), cameras can be a powerful tool for studying small mammals, and have been used as such since the early days of animal-triggered remote photography (Kucera and Barrett 2011; see Gregory 1927, Gysel and Davis 1956, Pearson 1959, Osterberg 1962). While cameras cannot be used when marking individuals or the collection of tissue samples is required, camera traps can be left out in the field for longer than live traps, yielding more data per deployment. The disadvantages of cameras include the price, the possibility of malfunction, and the inability to distinguish very similar-looking species. Yet recent years have seen camera quality climb and price drop (O'Connell et al. 2011). In addition to technical advantages, camera traps offer a more humane alternative to live traps, which can stress, injure, or kill study subjects (Slade et al. 1993, Anthony et al. 2005). We hope to see their expanded use to conduct humane and detailed research on small animals in the field.

If small mammals avoid trail edges, trails could disproportionately reduce the size of their functional habitat, in turn affecting the connectivity and distribution of their populations. This would put recreation at odds with conservation in lands managed for both purposes. Fortunately, we found little to no evidence of conservation threats posed by trails in the study site. Edge effects were small in scale (<4m) and limited to meadow voles, a species of least concern (Cassola 2017). However, because similarly small and species-specific effects could exist elsewhere, small mammal conservation efforts should be supported by fine-scale and species-specific research into potential trail edge effects. Managers should also consider that reducing foot or vehicle traffic may not be sufficient to limit the effect of trails (or roads; see McGregor et al. 2008), given that the voles in our study were primarily nocturnal and therefore not responding directly to humans.

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Appendix 1

Table A1. Average mammal activity level [visits/(d of observation)] at baited camera stations at varying distances from recreational trails (m) in Minnesota, USA, in 2014 and 2015. Where points in the same location were used in two years, activity is listed as the average activity of the two years, weighted by the observation period in each year. See Table A2for disaggregated observations listed independently in each year. A "visit" is defined as a motion-triggered set of 3 photos in which an animal appeared in at least one photo. The first four digits of transect codes refer to the restoration year of the prairie in that location, not the year in which data were collected.

Year	Transect	Observation period (d)	Distance (m)	Taxon	Activity (visits/day)
2014	1999.1	1.87	0	Chipmunk	0.00
2014	2003.1	2.00	0	Chipmunk	0.00
2014	2004.1	1.96	0	Chipmunk	0.00
2014	2004.2	2.00	0	Chipmunk	0.00
2014	2005.1	2.00	0	Chipmunk	0.00
2014	2008.1	1.96	0	Chipmunk	0.00
2014	2008.2	1.96	0	Chipmunk	0.00
2014 and 2015	1999.2	3.89	0	Chipmunk	0.00
2014 and 2015	2003.2	3.93	0	Chipmunk	0.00
2014 and 2015	2005.2	3.98	0	Chipmunk	0.00
2015	1998.1	1.83	0	Chipmunk	0.00
2014	1998.2	2.17	2	Chipmunk	0.00
2014	1999.2	2.04	2	Chipmunk	0.00
2014	2003.1	2.00	2	Chipmunk	0.00
2014	2004.1	1.96	2	Chipmunk	0.00
2014	2004.2	2.00	2	Chipmunk	0.00
2014	2005.1	2.00	2	Chipmunk	0.00
2014	2008.1	1.96	2	Chipmunk	0.00
2014	2008.2	1.96	2	Chipmunk	0.00
2015	2003.2	1.97	2	Chipmunk	0.00
2014 and 2015	1998.1	3.83	2	Chipmunk	0.00
2014 and 2015	2005.2	3.98	2	Chipmunk	0.00
2015	1999.1	1.82	2	Chipmunk	0.00
2014	1999.2	2.04	4	Chipmunk	0.00
2014	2003.1	2.00	4	Chipmunk	0.00
2014	2004.1	1.96	4	Chipmunk	0.00
2014	2008.1	1.96	4	Chipmunk	0.00
2014 and 2015	1998.1	3.83	4	Chipmunk	0.26
2014 and 2015	1999.1	3.69	4	Chipmunk	0.00
2014 and 2015	2003.2	3.93	4	Chipmunk	0.00
2014 and 2015	2005.2	3.98	4	Chipmunk	0.00

Year	Transect	Observation period (d)	Distance (m)	Taxon	Activity (visits/day)
2014	2003.1	2.00	8	Chipmunk	0.00
2014	2004.1	1.96	8	Chipmunk	0.00
2014	2004.2	2.00	8	Chipmunk	0.00
2014	2005.1	2.00	8	Chipmunk	0.00
2014	2008.1	1.96	8	Chipmunk	0.00
2014 and 2015	1998.1	3.83	8	Chipmunk	0.00
2014 and 2015	1999.2	3.89	8	Chipmunk	0.00
2014 and 2015	1999.1	3.69	8	Chipmunk	0.00
2014 and 2015	2003.2	3.93	8	Chipmunk	0.00
2014 and 2015	2005.2	3.98	8	Chipmunk	0.00
2014	1998.2	2.17	16	Chipmunk	0.00
2014	2003.1	2.00	16	Chipmunk	0.00
2014	2004.1	1.96	16	Chipmunk	0.00
2014	2004.2	2.00	16	Chipmunk	0.00
2014	2005.1	2.00	16	Chipmunk	0.00
2014	2008.1	1.96	16	Chipmunk	0.00
2014 and 2015	1999.2	3.89	16	Chipmunk	0.00
2014 and 2015	1999.1	3.69	16	Chipmunk	0.00
2014 and 2015	2003.2	3.93	16	Chipmunk	0.00
2014 and 2015	2005.2	3.98	16	Chipmunk	0.00
2015	1998.1	1.83	16	Chipmunk	0.00
2014	2003.1	2.00	64	Chipmunk	0.00
2014	2004.1	1.96	64	Chipmunk	0.00
2014	2004.2	2.00	64	Chipmunk	0.00
2014	2005.1	2.00	64	Chipmunk	0.00
2014	2008.1	1.96	64	Chipmunk	0.00
2014 and 2015	1998.1	3.83	64	Chipmunk	0.00
2014 and 2015	1999.2	3.89	64	Chipmunk	0.00
2014 and 2015	2003.2	3.93	64	Chipmunk	0.00
2014 and 2015	2005.2	3.98	64	Chipmunk	0.00
2014	1999.1	1.87	0	Dog	0.00
2014	2003.1	2.00	0	Dog	0.00
2014	2004.1	1.96	0	Dog	0.00
2014	2004.2	2.00	0	Dog	0.00
2014	2005.1	2.00	0	Dog	0.00
2014	2008.1	1.96	0	Dog	0.00
2014	2008.2	1.96	0	Dog	0.00
2014 and 2015	1999.2	3.89	0	Dog	0.00
2014 and 2015	2003.2	3.93	0	Dog	0.25
2014 and 2015	2005.2	3.98	0	Dog	0.00
2015	1998.1	1.83	0	Dog	0.00
2014	1998.2	2.17	2	Dog	0.00
2014	1999.2	2.04	2	Dog	0.00
2014	2003.1	2.00	2	Dog	0.00
2014	2004.1	1.96	2	Dog	0.00
2014	2004.2	2.00	2	Dog	0.00
2014	2005.1	2.00	2	Dog	0.00
2014	2008.1	1.96	2	Dog	0.00
2014	2008.2	1.96	2	Dog	0.00
2015	2003.2	1.97	2	Dog	0.00
2014 and 2015	1998.1	3.83	2	Dog	0.00
2014 and 2015	2005.2	3.98	2	Dog	0.00
2015	1999.1	1.82	2	Dog	0.00

Year	Transect	Observation period (d)	Distance (m)	Taxon	Activity (visits/day)
2014	1999.2	2.04	4	Dog	0.00
2014	2003.1	2.00	4	Dog	0.00
2014	2004.1	1.96	4	Dog	0.00
2014	2008.1	1.96	4	Dog	0.00
2014 and 2015	1998.1	3.83	4	Dog	0.00
2014 and 2015	1999.1	3.69	4	Dog	0.00
2014 and 2015	2003.2	3.93	4	Dog	0.00
2014 and 2015	2005.2	3.98	4	Dog	0.00
2014	2003.1	2.00	8	Dog	0.00
2014	2004.1	1.96	8	Dog	0.00
2014	2004.2	2.00	8	Dog	0.00
2014	2005.1	2.00	8	Dog	0.00
2014	2008.1	1.96	8	Dog	0.00
2014 and 2015	1998.1	3.83	8	Dog	0.00
2014 and 2015	1999.2	3.89	8	Dog	0.00
2014 and 2015	1999.1	3.69	8	Dog	0.00
2014 and 2015	2003.2	3.93	8	Dog	0.00
2014 and 2015	2005.2	3.98	8	Dog	0.00
2014	1998.2	2.17	16	Dog	0.00
2014	2003.1	2.00	16	Dog	0.00
2014	2004.1	1.96	16	Dog	0.00
2014	2004.2	2.00	16	Dog	0.00
2014	2005.1	2.00	16	Dog	0.00
2014	2008.1	1.96	16	Dog	0.00
2014 and 2015	1999.2	3.89	16	Dog	0.00
2014 and 2015	1999.1	3.69	16	Dog	0.00
2014 and 2015	2003.2	3.93	16	Dog	0.00
2014 and 2015	2005.2	3.98	16	Dog	0.00
2015	1998.1	1.83	16	Dog	0.00
2014	2003.1	2.00	64	Dog	0.00
2014	2004.1	1.96	64	Dog	0.00
2014	2004.2	2.00	64	Dog	0.00
2014	2005.1	2.00	64	Dog	0.00
2014	2008.1	1.96	64	Dog	0.00
2014 and 2015	1998.1	3.83	64	Dog	0.00
2014 and 2015	1999.2	3.89	64	Dog	0.00
2014 and 2015	2003.2	3.93	64	Dog	0.00
2014 and 2015	2005.2	3.98	64	Dog	0.00
2014	1999.1	1.87	0	Ground squirrel	0.00
2014	2003.1	2.00	0	Ground squirrel	8.50
2014	2004.1	1.96	0	Ground squirrel	15.83
2014	2004.2	2.00	0	Ground squirrel	34.00
2014	2005.1	2.00	0	Ground squirrel	0.50
2014	2008.1	1.96	0	Ground squirrel	0.00
2014	2008.2	1.96	0	Ground squirrel	0.00
2014 and 2015	1999.2	3.89	0	Ground squirrel	0.00
2014 and 2015	2003.2	3.93	0	Ground squirrel	25.40
2014 and 2015	2005.2	3.98	0	Ground squirrel	33.67
2015	1998.1	1.83	0	Ground squirrel	0.00
2014	1998.2	2.17	2	Ground squirrel	0.00
2014	1999.2	2.04	2	Ground squirrel	0.00
2014	2003.1	2.00	2	Ground squirrel	57.00
2014	2004.1	1.96	2	Ground squirrel	75.57

Year	Transect	Observation period (d)	Distance (m)	Taxon	Activity (visits/day)
2014	2004.2	2.00	2	Ground squirrel	14.50
2014	2005.1	2.00	2	Ground squirrel	0.00
2014	2008.1	1.96	2	Ground squirrel	0.00
2014	2008.2	1.96	2	Ground squirrel	0.00
2015	2003.2	1.97	2	Ground squirrel	55.73
2014 and 2015	1998.1	3.83	2	Ground squirrel	0.00
2014 and 2015	2005.2	3.98	2	Ground squirrel	22.08
2015	1999.1	1.82	2	Ground squirrel	0.00
2014	1999.2	2.04	4	Ground squirrel	0.00
2014	2003.1	2.00	4	Ground squirrel	29.50
2014	2004.1	1.96	4	Ground squirrel	72.00
2014	2008.1	1.96	4	Ground squirrel	0.00
2014 and 2015	1998.1	3.83	4	Ground squirrel	0.00
2014 and 2015	1999.1	3.69	4	Ground squirrel	4.88
2014 and 2015	2003.2	3.93	4	Ground squirrel	9.14
2014 and 2015	2005.2	3.98	4	Ground squirrel	57.82
2014	2003.1	2.00	8	Ground squirrel	42.00
2014	2004.1	1.96	8	Ground squirrel	39.32
2014	2004.2	2.00	8	Ground squirrel	55.50
2014	2005.1	2.00	8	Ground squirrel	0.00
2014	2008.1	1.96	8	Ground squirrel	0.00
2014 and 2015	1998.1	3.83	8	Ground squirrel	0.00
2014 and 2015	1999.2	3.89	8	Ground squirrel	0.00
2014 and 2015	1999.1	3.69	8	Ground squirrel	0.27
2014 and 2015	2003.2	3.93	8	Ground squirrel	13.97
2014 and 2015	2005.2	3.98	8	Ground squirrel	39.20
2014	1998.2	2.17	16	Ground squirrel	0.00
2014	2003.1	2.00	16	Ground squirrel	28.50
2014	2004.1	1.96	16	Ground squirrel	63.32
2014	2004.2	2.00	16	Ground squirrel	27.50
2014	2005.1	2.00	16	Ground squirrel	0.50
2014	2008.1	1.96	16	Ground squirrel	0.00
2014 and 2015	1999.2	3.89	16	Ground squirrel	0.26
2014 and 2015	1999.1	3.69	16	Ground squirrel	10.85
2014 and 2015	2003.2	3.93	16	Ground squirrel	0.00
2014 and 2015	2005.2	3.98	16	Ground squirrel	25.15
2015	1998.1	1.83	16	Ground squirrel	0.00
2014	2003.1	2.00	64	Ground squirrel	8.50
2014	2004.1	1.96	64	Ground squirrel	17.87
2014	2004.2	2.00	64	Ground squirrel	7.00
2014	2005.1	2.00	64	Ground squirrel	0.00
2014	2008.1	1.96	64	Ground squirrel	0.00
2014 and 2015	1998.1	3.83	64	Ground squirrel	0.00
2014 and 2015	1999.2	3.89	64	Ground squirrel	2.31
2014 and 2015	2003.2	3.93	64	Ground squirrel	35.05
2014 and 2015	2005.2	3.98	64	Ground squirrel	23.82
2014	1999.1	1.87	0	Mouse	0.00
2014	2003.1	2.00	0	Mouse	0.00
2014	2004.1	1.96	0	Mouse	0.00
2014	2004.2	2.00	0	Mouse	29.50
2014	2005.1	2.00	0	Mouse	0.50
2014	2008.1	1.96	0	Mouse	0.00
2014	2008.2	1.96	0	Mouse	0.51

Year	Transect	Observation period (d)	Distance (m)	Taxon	Activity (visits/day)
2014 and 2015	1999.2	3.89	0	Mouse	0.51
2014 and 2015	2003.2	3.93	0	Mouse	0.00
2014 and 2015	2005.2	3.98	0	Mouse	0.00
2015	1998.1	1.83	0	Mouse	1.64
2014	1998.2	2.17	2	Mouse	1.38
2014	1999.2	2.04	2	Mouse	0.00
2014	2003.1	2.00	2	Mouse	0.00
2014	2004.1	1.96	2	Mouse	83.23
2014	2004.2	2.00	2	Mouse	0.50
2014	2005.1	2.00	2	Mouse	0.00
2014	2008.1	1.96	2	Mouse	0.00
2014	2008.2	1.96	2	Mouse	0.00
2015	2003.2	1.97	2	Mouse	0.51
2014 and 2015	1998.1	3.83	2	Mouse	0.00
2014 and 2015	2005.2	3.98	2	Mouse	0.00
2015	1999.1	1.82	2	Mouse	2.20
2014	1999.2	2.04	4	Mouse	0.00
2014	2003.1	2.00	4	Mouse	0.00
2014	2004.1	1.96	4	Mouse	13.79
2014	2008.1	1.96	4	Mouse	0.51
2014 and 2015	1998.1	3.83	4	Mouse	0.78
2014 and 2015	1999.1	3.69	4	Mouse	6.78
2014 and 2015	2003.2	3.93	4	Mouse	0.00
2014 and 2015	2005.2	3.98	4	Mouse	0.00
2014	2003.1	2.00	8	Mouse	0.00
2014	2004.1	1.96	8	Mouse	17.87
2014	2004.2	2.00	8	Mouse	12.00
2014	2005.1	2.00	8	Mouse	0.00
2014	2008.1	1.96	8	Mouse	1.02
2014 and 2015	1998.1	3.83	8	Mouse	0.00
2014 and 2015	1999.2	3.89	8	Mouse	0.00
2014 and 2015	1999.1	3.69	8	Mouse	1.35
2014 and 2015	2003.2	3.93	8	Mouse	0.00
2014 and 2015	2005.2	3.98	8	Mouse	0.25
2014	1998.2	2.17	16	Mouse	0.00
2014	2003.1	2.00	16	Mouse	0.00
2014	2004.1	1.96	16	Mouse	15.83
2014	2004.2	2.00	16	Mouse	15.00
2014	2005.1	2.00	16	Mouse	0.50
2014	2008.1	1.96	16	Mouse	0.00
2014 and 2015	1999.2	3.89	16	Mouse	0.00
2014 and 2015	1999.1	3.69	16	Mouse	2.16
2014 and 2015	2003.2	3.93	16	Mouse	0.25
2014 and 2015	2005.2	3.98	16	Mouse	1.26
2015	1998.1	1.83	16	Mouse	0.55
2014	2003.1	2.00	64	Mouse	0.00
2014	2004.1	1.96	64	Mouse	51.57
2014	2004.2	2.00	64	Mouse	7.50
2014	2005.1	2.00	64	Mouse	0.00
2014	2008.1	1.96	64	Mouse	0.51
2014 and 2015	1998.1	3.83	64	Mouse	0.00
2014 and 2015	1999.2	3.89	64	Mouse	0.51
2014 and 2015	2003.2	3.93	64	Mouse	0.00

Year	Transect	Observation period (d)	Distance (m)	Taxon	Activity (visits/day)
2014 and 2015	2005.2	3.98	64	Mouse	0.00
2014	1999.1	1.87	0	Opossum	0.00
2014	2003.1	2.00	0	Opossum	0.00
2014	2004.1	1.96	0	Opossum	0.00
2014	2004.2	2.00	0	Opossum	0.00
2014	2005.1	2.00	0	Opossum	0.00
2014	2008.1	1.96	0	Opossum	0.00
2014	2008.2	1.96	0	Opossum	0.00
2014 and 2015	1999.2	3.89	0	Opossum	0.00
2014 and 2015	2003.2	3.93	0	Opossum	0.00
2014 and 2015	2005.2	3.98	0	Opossum	0.00
2015	1998.1	1.83	0	Opossum	3.82
2014	1998.2	2.17	2	Opossum	0.00
2014	1999.2	2.04	2	Opossum	0.00
2014	2003.1	2.00	2	Opossum	0.00
2014	2004.1	1.96	2	Opossum	0.00
2014	2004.2	2.00	2	Opossum	0.00
2014	2005.1	2.00	2	Opossum	0.00
2014	2008.1	1.96	2	Opossum	0.00
2014	2008.2	1.96	2	Opossum	0.00
2015	2003.2	1.97	2	Opossum	0.00
2014 and 2015	1998.1	3.83	2	Opossum	0.00
2014 and 2015	2005.2	3.98	2	Opossum	0.00
2015	1999.1	1.82	2	Opossum	0.00
2014	1999.2	2.04	4	Opossum	0.00
2014	2003.1	2.00	4	Opossum	0.00
2014	2004.1	1.96	4	Opossum	0.00
2014	2008.1	1.96	4	Opossum	0.00
2014 and 2015	1998.1	3.83	4	Opossum	0.00
2014 and 2015	1999.1	3.69	4	Opossum	0.00
2014 and 2015	2003.2	3.93	4	Opossum	0.00
2014 and 2015	2005.2	3.98	4	Opossum	0.00
2014	2003.1	2.00	8	Opossum	0.00
2014	2004.1	1.96	8	Opossum	0.00
2014	2004.2	2.00	8	Opossum	0.00
2014	2005.1	2.00	8	Opossum	0.00
2014	2008.1	1.96	8	Opossum	0.00
2014 and 2015	1998.1	3.83	8	Opossum	0.00
2014 and 2015	1999.2	3.89	8	Opossum	0.00
2014 and 2015	1999.1	3.69	8	Opossum	0.00
2014 and 2015	2003.2	3.93	8	Opossum	0.00
2014 and 2015	2005.2	3.98	8	Opossum	0.00
2014	1998.2	2.17	16	Opossum	0.00
2014	2003.1	2.00	16	Opossum	0.00
2014	2004.1	1.96	16	Opossum	0.00
2014	2004.2	2.00	16	Opossum	0.00
2014	2005.1	2.00	16	Opossum	0.00
2014	2008.1	1.96	16	Opossum	0.00
2014 and 2015	1999.2	3.89	16	Opossum	0.00
2014 and 2015	1999.1	3.69	16	Opossum	0.00
2014 and 2015	2003.2	3.93	16	Opossum	0.00
2014 and 2015	2005.2	3.98	16	Opossum	0.00
2015	1998.1	1.83	16	Opossum	0.00

Year	Transect	Observation period (d)	Distance (m)	Taxon	Activity (visits/day)
2014	2003.1	2.00	64	Opossum	0.00
2014	2004.1	1.96	64	Opossum	0.00
2014	2004.2	2.00	64	Opossum	0.00
2014	2005.1	2.00	64	Opossum	0.00
2014	2008.1	1.96	64	Opossum	0.00
2014 and 2015	1998.1	3.83	64	Opossum	0.00
2014 and 2015	1999.2	3.89	64	Opossum	0.00
2014 and 2015	2003.2	3.93	64	Opossum	0.00
2014 and 2015	2005.2	3.98	64	Opossum	0.00
2014	1999.1	1.87	0	Rabbit	0.00
2014	2003.1	2.00	0	Rabbit	0.00
2014	2004.1	1.96	0	Rabbit	0.00
2014	2004.2	2.00	0	Rabbit	2.50
2014	2005.1	2.00	0	Rabbit	0.00
2014	2008.1	1.96	0	Rabbit	0.00
2014	2008.2	1.96	0	Rabbit	0.00
2014 and 2015	1999.2	3.89	0	Rabbit	0.00
2014 and 2015	2003.2	3.93	0	Rabbit	1.52
2014 and 2015	2005.2	3.98	0	Rabbit	0.00
2015	1998.1	1.83	0	Rabbit	0.00
2014	1998.2	2.17	2	Rabbit	0.00
2014	1999.2	2.04	2	Rabbit	0.00
2014	2003.1	2.00	2	Rabbit	0.00
2014	2004.1	1.96	2	Rabbit	4.60
2014	2004.2	2.00	2	Rabbit	0.00
2014	2005.1	2.00	2	Rabbit	0.00
2014	2008.1	1.96	2	Rabbit	0.00
2014	2008.2	1.96	2	Rabbit	0.00
2015	2003.2	1.97	2	Rabbit	0.00
2014 and 2015	1998.1	3.83	2	Rabbit	0.00
2014 and 2015	2005.2	3.98	2	Rabbit	0.00
2015	1999.1	1.82	2	Rabbit	0.00
2014	1999.2	2.04	4	Rabbit	0.00
2014	2003.1	2.00	4	Rabbit	0.00
2014	2004.1	1.96	4	Rabbit	0.00
2014	2008.1	1.96	4	Rabbit	0.00
2014 and 2015	1998.1	3.83	4	Rabbit	0.00
2014 and 2015	1999.1	3.69	4	Rabbit	0.00
2014 and 2015	2003.2	3.93	4	Rabbit	0.00
2014 and 2015	2005.2	3.98	4	Rabbit	0.00
2014	2003.1	2.00	8	Rabbit	0.00
2014	2004.1	1.96	8	Rabbit	0.51
2014	2004.2	2.00	8	Rabbit	0.00
2014	2005.1	2.00	8	Rabbit	0.00
2014	2008.1	1.96	8	Rabbit	0.00
2014 and 2015	1998.1	3.83	8	Rabbit	0.00
2014 and 2015	1999.2	3.89	8	Rabbit	0.00
2014 and 2015	1999.1	3.69	8	Rabbit	0.00
2014 and 2015	2003.2	3.93	8	Rabbit	0.00
2014 and 2015	2005.2	3.98	8	Rabbit	0.00
2014	1998.2	2.17	16	Rabbit	0.00
2014	2003.1	2.00	16	Rabbit	0.00
2014	2004.1	1.96	16	Rabbit	19.40

Year	Transect	Observation period (d)	Distance (m)	Taxon	Activity (visits/day)
2014	2004.2	2.00	16	Rabbit	0.00
2014	2005.1	2.00	16	Rabbit	0.00
2014	2008.1	1.96	16	Rabbit	0.00
2014 and 2015	1999.2	3.89	16	Rabbit	0.00
2014 and 2015	1999.1	3.69	16	Rabbit	0.00
2014 and 2015	2003.2	3.93	16	Rabbit	6.35
2014 and 2015	2005.2	3.98	16	Rabbit	0.00
2015	1998.1	1.83	16	Rabbit	0.00
2014	2003.1	2.00	64	Rabbit	0.00
2014	2004.1	1.96	64	Rabbit	0.00
2014	2004.2	2.00	64	Rabbit	0.00
2014	2005.1	2.00	64	Rabbit	0.00
2014	2008.1	1.96	64	Rabbit	0.00
2014 and 2015	1998.1	3.83	64	Rabbit	0.00
2014 and 2015	1999.2	3.89	64	Rabbit	0.00
2014 and 2015	2003.2	3.93	64	Rabbit	1.52
2014 and 2015	2005.2	3.98	64	Rabbit	0.00
2014	1999.1	1.87	0	Shrew	0.00
2014	2003.1	2.00	0	Shrew	0.00
2014	2004.1	1.96	0	Shrew	0.00
2014	2004.2	2.00	0	Shrew	0.00
2014	2005.1	2.00	0	Shrew	0.00
2014	2008.1	1.96	0	Shrew	0.00
2014	2008.2	1.96	0	Shrew	0.00
2014 and 2015	1999.2	3.89	0	Shrew	0.00
2014 and 2015	2003.2	3.93	0	Shrew	0.00
2014 and 2015	2005.2	3.98	0	Shrew	0.00
2015	1998.1	1.83	0	Shrew	0.00
2014	1998.2	2.17	2	Shrew	0.00
2014	1999.2	2.04	2	Shrew	0.00
2014	2003.1	2.00	2	Shrew	0.00
2014	2004.1	1.96	2	Shrew	0.00
2014	2004.2	2.00	2	Shrew	0.00
2014	2005.1	2.00	2	Shrew	0.00
2014	2008.1	1.96	2	Shrew	0.00
2014	2008.2	1.96	2	Shrew	0.00
2015	2003.2	1.97	2	Shrew	0.00
2014 and 2015	1998.1	3.83	2	Shrew	0.00
2014 and 2015	2005.2	3.98	2	Shrew	0.00
2015	1999.1	1.82	2	Shrew	0.00
2014	1999.2	2.04	4	Shrew	0.00
2014	2003.1	2.00	4	Shrew	0.00
2014	2004.1	1.96	4	Shrew	0.00
2014	2008.1	1.96	4	Shrew	0.00
2014 and 2015	1998.1	3.83	4	Shrew	1.30
2014 and 2015	1999.1	3.69	4	Shrew	0.00
2014 and 2015	2003.2	3.93	4	Shrew	0.00
2014 and 2015	2005.2	3.98	4	Shrew	0.00
2014	2003.1	2.00	8	Shrew	0.00
2014	2004.1	1.96	8	Shrew	0.00
2014	2004.2	2.00	8	Shrew	0.00
2014	2005.1	2.00	8	Shrew	0.00
2014	2008.1	1.96	8	Shrew	0.00

Year	Transect	Observation period (d)	Distance (m)	Taxon	Activity (visits/day)
2014 and 2015	1998.1	3.83	8	Shrew	0.00
2014 and 2015	1999.2	3.89	8	Shrew	0.26
2014 and 2015	1999.1	3.69	8	Shrew	0.27
2014 and 2015	2003.2	3.93	8	Shrew	0.25
2014 and 2015	2005.2	3.98	8	Shrew	0.00
2014	1998.2	2.17	16	Shrew	0.00
2014	2003.1	2.00	16	Shrew	0.00
2014	2004.1	1.96	16	Shrew	0.00
2014	2004.2	2.00	16	Shrew	0.00
2014	2005.1	2.00	16	Shrew	0.00
2014	2008.1	1.96	16	Shrew	0.00
2014 and 2015	1999.2	3.89	16	Shrew	0.00
2014 and 2015	1999.1	3.69	16	Shrew	0.00
2014 and 2015	2003.2	3.93	16	Shrew	0.00
2014 and 2015	2005.2	3.98	16	Shrew	0.00
2015	1998.1	1.83	16	Shrew	4.37
2014	2003.1	2.00	64	Shrew	0.00
2014	2004.1	1.96	64	Shrew	0.00
2014	2004.2	2.00	64	Shrew	0.00
2014	2005.1	2.00	64	Shrew	0.00
2014	2008.1	1.96	64	Shrew	0.00
2014 and 2015	1998.1	3.83	64	Shrew	0.00
2014 and 2015	1999.2	3.89	64	Shrew	0.26
2014 and 2015	2003.2	3.93	64	Shrew	0.00
2014 and 2015	2005.2	3.98	64	Shrew	0.00
2014	1999.1	1.87	0	Total Carnivora	0.00
2014	2003.1	2.00	0	Total Carnivora	0.00
2014	2004.1	1.96	0	Total Carnivora	0.00
2014	2004.2	2.00	0	Total Carnivora	0.00
2014	2005.1	2.00	0	Total Carnivora	0.00
2014	2008.1	1.96	0	Total Carnivora	0.00
2014	2008.2	1.96	0	Total Carnivora	0.00
2014 and 2015	1999.2	3.89	0	Total Carnivora	0.00
2014 and 2015	2003.2	3.93	0	Total Carnivora	0.25
2014 and 2015	2005.2	3.98	0	Total Carnivora	0.00
2015	1998.1	1.83	0	Total Carnivora	3.82
2014	1998.2	2.17	2	Total Carnivora	0.00
2014	1999.2	2.04	2	Total Carnivora	0.00
2014	2003.1	2.00	2	Total Carnivora	0.00
2014	2004.1	1.96	2	Total Carnivora	0.00
2014	2004.2	2.00	2	Total Carnivora	0.50
2014	2005.1	2.00	2	Total Carnivora	2.50
2014	2008.1	1.96	2	Total Carnivora	0.00
2014	2008.2	1.96	2	Total Carnivora	0.00
2015	2003.2	1.97	2	Total Carnivora	0.00
2014 and 2015	1998.1	3.83	2	Total Carnivora	0.00
2014 and 2015	2005.2	3.98	2	Total Carnivora	1.01
2015	1999.1	1.82	2	Total Carnivora	0.00
2014	1999.2	2.04	4	Total Carnivora	0.00
2014	2003.1	2.00	4	Total Carnivora	0.00
2014	2004.1	1.96	4	Total Carnivora	0.00
2014	2008.1	1.96	4	Total Carnivora	0.00
2014 and 2015	1998.1	3.83	4	Total Carnivora	0.00

Year	Transect	Observation period (d)	Distance (m)	Taxon	Activity (visits/day)
2014 and 2015	1999.1	3.69	4	Total Carnivora	0.00
2014 and 2015	2003.2	3.93	4	Total Carnivora	0.00
2014 and 2015	2005.2	3.98	4	Total Carnivora	0.00
2014	2003.1	2.00	8	Total Carnivora	0.00
2014	2004.1	1.96	8	Total Carnivora	0.00
2014	2004.2	2.00	8	Total Carnivora	0.00
2014	2005.1	2.00	8	Total Carnivora	2.00
2014	2008.1	1.96	8	Total Carnivora	0.00
2014 and 2015	1998.1	3.83	8	Total Carnivora	0.00
2014 and 2015	1999.2	3.89	8	Total Carnivora	0.00
2014 and 2015	1999.1	3.69	8	Total Carnivora	0.00
2014 and 2015	2003.2	3.93	8	Total Carnivora	0.00
2014 and 2015	2005.2	3.98	8	Total Carnivora	0.75
2014	1998.2	2.17	16	Total Carnivora	0.00
2014	2003.1	2.00	16	Total Carnivora	0.00
2014	2004.1	1.96	16	Total Carnivora	4.09
2014	2004.2	2.00	16	Total Carnivora	0.00
2014	2005.1	2.00	16	Total Carnivora	0.00
2014	2008.1	1.96	16	Total Carnivora	0.00
2014 and 2015	1999.2	3.89	16	Total Carnivora	0.00
2014 and 2015	1999.1	3.69	16	Total Carnivora	0.00
2014 and 2015	2003.2	3.93	16	Total Carnivora	0.00
2014 and 2015	2005.2	3.98	16	Total Carnivora	0.50
2015	1998.1	1.83	16	Total Carnivora	0.00
2014	2003.1	2.00	64	Total Carnivora	0.00
2014	2004.1	1.96	64	Total Carnivora	6.13
2014	2004.2	2.00	64	Total Carnivora	0.00
2014	2005.1	2.00	64	Total Carnivora	0.00
2014	2008.1	1.96	64	Total Carnivora	0.00
2014 and 2015	1998.1	3.83	64	Total Carnivora	0.00
2014 and 2015	1999.2	3.89	64	Total Carnivora	0.00
2014 and 2015	2003.2	3.93	64	Total Carnivora	0.25
2014 and 2015	2005.2	3.98	64	Total Carnivora	0.00
2014	1999.1	1.87	0	Vole	0.00
2014	2003.1	2.00	0	Vole	0.00
2014	2004.1	1.96	0	Vole	0.00
2014	2004.2	2.00	0	Vole	0.00
2014	2005.1	2.00	0	Vole	0.50
2014	2008.1	1.96	0	Vole	0.00
2014	2008.2	1.96	0	Vole	0.00
2014 and 2015	1999.2	3.89	0	Vole	2.31
2014 and 2015	2003.2	3.93	0	Vole	0.76
2014 and 2015	2005.2	3.98	0	Vole	0.00
2015	1998.1	1.83	0	Vole	0.00
2014	1998.2	2.17	2	Vole	17.54
2014	1999.2	2.04	2	Vole	0.00
2014	2003.1	2.00	2	Vole	0.00
2014	2004.1	1.96	2	Vole	1.02
2014	2004.2	2.00	2	Vole	3.50
2014	2005.1	2.00	2	Vole	1.00
2014	2008.1	1.96	2	Vole	0.51
2014	2008.2	1.96	2	Vole	0.00
2015	2003.2	1.97	2	Vole	0.00

Year	Transect	Observation period (d)	Distance (m)	Taxon	Activity (visits/day)
2014 and 2015	1998.1	3.83	2	Vole	10.95
2014 and 2015	2005.2	3.98	2	Vole	9.82
2015	1999.1	1.82	2	Vole	0.00
2014	1999.2	2.04	4	Vole	8.33
2014	2003.1	2.00	4	Vole	0.00
2014	2004.1	1.96	4	Vole	0.00
2014	2008.1	1.96	4	Vole	5.11
2014 and 2015	1998.1	3.83	4	Vole	19.83
2014 and 2015	1999.1	3.69	4	Vole	5.14
2014 and 2015	2003.2	3.93	4	Vole	2.29
2014 and 2015	2005.2	3.98	4	Vole	2.01
2014	2003.1	2.00	8	Vole	0.00
2014	2004.1	1.96	8	Vole	0.00
2014	2004.2	2.00	8	Vole	0.50
2014	2005.1	2.00	8	Vole	16.50
2014	2008.1	1.96	8	Vole	16.34
2014 and 2015	1998.1	3.83	8	Vole	6.52
2014 and 2015	1999.2	3.89	8	Vole	2.06
2014 and 2015	1999.1	3.69	8	Vole	17.31
2014 and 2015	2003.2	3.93	8	Vole	4.84
2014 and 2015	2005.2	3.98	8	Vole	3.78
2014	1998.2	2.17	16	Vole	11.08
2014	2003.1	2.00	16	Vole	21.50
2014	2004.1	1.96	16	Vole	4.60
2014	2004.2	2.00	16	Vole	0.00
2014	2005.1	2.00	16	Vole	7.50
2014	2008.1	1.96	16	Vole	3.06
2014 and 2015	1999.2	3.89	16	Vole	77.34
2014 and 2015	1999.1	3.69	16	Vole	24.61
2014 and 2015	2003.2	3.93	16	Vole	29.54
2014 and 2015	2005.2	3.98	16	Vole	1.01
2015	1998.1	1.83	16	Vole	0.55
2014	2003.1	2.00	64	Vole	1.00
2014	2004.1	1.96	64	Vole	11.74
2014	2004.2	2.00	64	Vole	0.00
2014	2005.1	2.00	64	Vole	0.00
2014	2008.1	1.96	64	Vole	8.17
2014 and 2015	1998.1	3.83	64	Vole	18.78
2014 and 2015	1999.2	3.89	64	Vole	23.89
2014 and 2015	2003.2	3.93	64	Vole	2.04
2014 and 2015	2005.2	3.98	64	Vole	0.75
2014	1999.1	1.87	0	Weasel	0.00
2014	2003.1	2.00	0	Weasel	0.00
2014	2004.1	1.96	0	Weasel	0.00
2014	2004.2	2.00	0	Weasel	0.00
2014	2005.1	2.00	0	Weasel	0.00
2014	2008.1	1.96	0	Weasel	0.00
2014	2008.2	1.96	0	Weasel	0.00
2014 and 2015	1999.2	3.89	0	Weasel	0.00
2014 and 2015	2003.2	3.93	0	Weasel	0.00
2014 and 2015	2005.2	3.98	0	Weasel	0.00
2015	1998.1	1.83	0	Weasel	0.00
2014	1998.2	2.17	2	Weasel	0.00

Year	Transect	Observation period (d)	Distance (m)	Taxon	Activity (visits/day)
2014	1999.2	2.04	2	Weasel	0.00
2014	2003.1	2.00	2	Weasel	0.00
2014	2004.1	1.96	2	Weasel	0.00
2014	2004.2	2.00	2	Weasel	na
2014	2005.1	2.00	2	Weasel	na
2014	2008.1	1.96	2	Weasel	0.00
2014	2008.2	1.96	2	Weasel	0.00
2015	2003.2	1.97	2	Weasel	0.00
2014 and 2015	1998.1	3.83	2	Weasel	0.00
2014 and 2015	2005.2	3.98	2	Weasel	na
2015	1999.1	1.82	2	Weasel	0.00
2014	1999.2	2.04	4	Weasel	0.00
2014	2003.1	2.00	4	Weasel	0.00
2014	2004.1	1.96	4	Weasel	0.00
2014	2008.1	1.96	4	Weasel	0.00
2014 and 2015	1998.1	3.83	4	Weasel	0.00
2014 and 2015	1999.1	3.69	4	Weasel	0.00
2014 and 2015	2003.2	3.93	4	Weasel	0.00
2014 and 2015	2005.2	3.98	4	Weasel	0.00
2014	2003.1	2.00	8	Weasel	0.00
2014	2004.1	1.96	8	Weasel	0.00
2014	2004.2	2.00	8	Weasel	0.00
2014	2005.1	2.00	8	Weasel	na
2014	2008.1	1.96	8	Weasel	0.00
2014 and 2015	1998.1	3.83	8	Weasel	0.00
2014 and 2015	1999.2	3.89	8	Weasel	0.00
2014 and 2015	1999.1	3.69	8	Weasel	0.00
2014 and 2015	2003.2	3.93	8	Weasel	0.00
2014 and 2015	2005.2	3.98	8	Weasel	na
2014	1998.2	2.17	16	Weasel	0.00
2014	2003.1	2.00	16	Weasel	0.00
2014	2004.1	1.96	16	Weasel	na
2014	2004.2	2.00	16	Weasel	0.00
2014	2005.1	2.00	16	Weasel	0.00
2014	2008.1	1.96	16	Weasel	0.00
2014 and 2015	1999.2	3.89	16	Weasel	0.00
2014 and 2015	1999.1	3.69	16	Weasel	0.00
2014 and 2015	2003.2	3.93	16	Weasel	0.00
2014 and 2015	2005.2	3.98	16	Weasel	na
2015	1998.1	1.83	16	Weasel	0.00
2014	2003.1	2.00	64	Weasel	0.00
2014	2004.1	1.96	64	Weasel	na
2014	2004.2	2.00	64	Weasel	0.00
2014	2005.1	2.00	64	Weasel	0.00
2014	2008.1	1.96	64	Weasel	0.00
2014 and 2015	1998.1	3.83	64	Weasel	0.00
2014 and 2015	1999.2	3.89	64	Weasel	0.00
2014 and 2015	2003.2	3.93	64	Weasel	0.25
2014 and 2015	2005.2	3.98	64	Weasel	0.00

Table A2. Disaggregated mammal activity [visits/(d of observation)] at baited camera stations at varying distances from recreational trails (m) in Minnesota, USA, in 2014 and 2015. Each observation is listed independently in its respective year; see Table A1 for observations aggregated across repeated transects. A "visit" is defined as a motion-triggered set of 3 photos in which an animal appeared in at least one photo. The first four digits of transect codes refer to the restoration year of the prairie in that location, not the year in which data were collected. In 2014, the observation period was not recorded when no animal activity was observed, but in every case the observation period was about two days.

Year	Transect	Observation period (d)	Distance (m)	Ground squirrel	Vole	Mouse	Rabbit	Shrew	Opossum	Chipmunk	Weasel	Dog	Total Carnivora
2014	1998.1	2.00	2	0.00	0.50	0.00	0.00	na	na	na	na	na	0.00
2014	1998.1	2.00	4	0.00	7.50	0.50	0.00	na	na	na	na	na	0.00
2014	1998.1	2.00	8	0.00	4.00	0.00	0.00	na	na	na	na	na	0.00
2014	1998.1	2.00	64	0.00	4.50	0.00	0.00	na	na	na	na	na	0.00
2014	1998.2	2.17	2	0.00	17.54	1.38	0.00	na	na	na	na	na	0.00
2014	1998.2	2.17	16	0.00	11.08	0.00	0.00	na	na	na	na	na	0.00
2014	1999.1	unknown	0	0.00	0.00	0.00	0.00	na	na	na	na	na	0.00
2014	1999.1	1.87	4	0.00	9.07	0.00	0.00	na	na	na	na	na	0.00
2014	1999.1	1.88	8	0.00	28.27	1.60	0.00	na	na	na	na	na	0.00
2014	1999.1	1.87	16	2.13	38.93	4.27	0.00	na	na	na	na	na	0.00
2014	1999.2	2.04	0	0.00	0.49	0.00	0.00	na	na	na	na	na	0.00
2014	1999.2	unknown	2	0.00	0.00	0.00	0.00	na	na	na	na	na	0.00
2014	1999.2	2.04	4	0.00	8.33	0.00	0.00	na	na	na	na	na	0.00
2014	1999.2	2.04	8	0.00	3.92	0.00	0.00	na	na	na	na	na	0.00
2014	1999.2	2.04	16	0.49	2.45	0.00	0.00	na	na	na	na	na	0.00
2014	1999.2	2.04	64	4.41	45.55	0.98	0.00	na	na	na	na	na	0.00
2014	2003.1	2.00	0	8.50	0.00	0.00	0.00	na	na	na	na	na	0.00
2014	2003.1	2.00	2	57.00	0.00	0.00	0.00	na	na	na	na	na	0.00
2014	2003.1	2.00	4	29.50	0.00	0.00	0.00	na	na	na	na	na	0.00
2014	2003.1	2.00	8	42.00	0.00	0.00	0.00	na	na	na	na	na	0.00
2014	2003.1	2.00	16	28.50	21.50	0.00	0.00	na	na	na	na	na	0.00
2014	2003.1	2.00	64	8.50	1.00	0.00	0.00	na	na	na	na	na	0.00
2014	2003.2	1.96	0	0.00	0.51	0.00	0.00	na	na	na	na	na	0.00
2014	2003.2	1.96	4	0.00	4.60	0.00	0.00	na	na	na	na	na	0.00
2014	2003.2	1.96	8	0.00	9.70	0.00	0.00	na	na	na	na	na	0.00
2014	2003.2	1.96	16	0.00	59.23	0.51	0.00	na	na	na	na	na	0.00

Year	Transect	Observation period (d)	Distance (m)	Ground squirrel	Vole	Mouse	Rabbit	Shrew	Opossum	Chipmunk	Weasel	Dog	Total Carnivora
2014	2003.2	1.96	64	0.00	4.09	0.00	0.00	na	na	na	na	na	0.00
2014	2004.1	1.96	0	15.83	0.00	0.00	0.00	na	na	na	na	na	0.00
2014	2004.1	1.96	2	75.57	1.02	83.23	4.60	na	na	na	na	na	0.00
2014	2004.1	1.96	4	72.00	0.00	13.79	0.00	na	na	na	na	na	0.00
2014	2004.1	1.96	8	39.32	0.00	17.87	0.51	na	na	na	na	na	0.00
2014	2004.1	1.96	16	63.32	4.60	15.83	19.40	na	na	na	na	na	4.09
2014	2004.1	1.96	64	17.87	11.74	51.57	0.00	na	na	na	na	na	6.13
2014	2004.2	2.00	0	34.00	0.00	29.50	2.50	na	na	na	na	na	0.00
2014	2004.2	2.00	2	14.50	3.50	0.50	0.00	na	na	na	na	na	0.50
2014	2004.2	2.00	8	55.50	0.50	12.00	0.00	na	na	na	na	na	0.00
2014	2004.2	2.00	16	27.50	0.00	15.00	0.00	na	na	na	na	na	0.00
2014	2004.2	2.00	64	7.00	0.00	7.50	0.00	na	na	na	na	na	0.00
2014	2005.1	2.00	0	0.50	0.50	0.50	0.00	na	na	na	na	na	0.00
2014	2005.1	2.00	2	0.00	1.00	0.00	0.00	na	na	na	na	na	2.50
2014	2005.1	2.00	8	0.00	16.50	0.00	0.00	na	na	na	na	na	2.00
2014	2005.1	2.00	16	0.50	7.50	0.50	0.00	na	na	na	na	na	0.00
2014	2005.1	2.00	64	0.00	0.00	0.00	0.00	na	na	na	na	na	0.00
2014	2005.2	2.13	0	30.12	0.00	0.00	0.00	na	na	na	na	na	0.00
2014	2005.2	2.13	2	8.00	18.35	0.00	0.00	na	na	na	na	na	1.88
2014	2005.2	2.13	4	64.47	3.76	0.00	0.00	na	na	na	na	na	0.00
2014	2005.2	2.13	8	37.65	7.06	0.47	0.00	na	na	na	na	na	1.41
2014	2005.2	2.12	16	32.00	1.88	0.94	0.00	na	na	na	na	na	0.94
2014	2005.2	2.13	64	0.00	1.41	0.00	0.00	na	na	na	na	na	0.00
2014	2008.1	unknown	0	0.00	0.00	0.00	0.00	na	na	na	na	na	0.00
2014	2008.1	1.96	2	0.00	0.51	0.00	0.00	na	na	na	na	na	0.00
2014	2008.1	1.96	4	0.00	5.11	0.51	0.00	na	na	na	na	na	0.00
2014	2008.1	1.96	8	0.00	16.34	1.02	0.00	na	na	na	na	na	0.00
2014	2008.1	1.96	16	0.00	3.06	0.00	0.00	na	na	na	na	na	0.00
2014	2008.1	1.96	64	0.00	8.17	0.51	0.00	na	na	na	na	na	0.00
2014	2008.2	1.96	0	0.00	0.00	0.51	0.00	na	na	na	na	na	0.00
2014	2008.2	unknown	2	0.00	0.00	0.00	0.00	na	na	na	na	na	0.00
2015	2003.2	1.97	2	55.73	0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	1998	1.83	0	0.00	0.00	1.64	0.00	0.00	3.82	0.00	0.00	0.00	3.82

Year	Transect	Observation period (d)	Distance (m)	Ground squirrel	Vole	Mouse	Rabbit	Shrew	Opossum	Chipmunk	Weasel	Dog	Total Carnivora
2015	1998	1.83	2	0.00	22.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	1998	1.83	4	0.00	33.30	1.09	0.00	2.73	0.00	0.55	0.00	0.00	0.00
2015	1998	1.83	8	0.00	9.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	1998	1.83	16	0.00	0.55	0.55	0.00	4.37	0.00	0.00	0.00	0.00	0.00
2015	1998	1.83	64	0.00	34.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	2005.2	1.85	0	37.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	2005.2	1.85	2	38.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	2005.2	1.85	4	50.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	2005.2	1.85	8	40.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	2005.2	1.85	16	17.26	0.00	1.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	2005.2	1.85	64	51.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	1999.1	1.82	2	0.00	0.00	2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	1999.1	1.82	4	9.90	1.10	13.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	1999.1	1.82	8	0.55	6.05	1.10	0.00	0.55	0.00	0.00	0.00	0.00	0.00
2015	1999.1	1.82	16	19.81	9.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	1999.2	1.85	0	0.00	4.32	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	1999.2	1.85	8	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00	0.00
2015	1999.2	1.85	16	0.00	159.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	1999.2	1.85	64	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00	0.00
2015	2003.2	1.97	0	50.66	1.01	0.00	3.04	0.00	0.00	0.00	0.00	0.51	0.51
2015	2003.2	1.97	4	18.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015	2003.2	1.97	8	27.87	0.00	0.00	0.00	0.51	0.00	0.00	0.00	0.00	0.00
2015	2003.2	1.97	16	0.00	0.00	0.00	12.67	0.00	0.00	0.00	0.00	0.00	0.00
2015	2003.2	1.97	64	69.92	0.00	0.00	3.04	0.00	0.00	0.00	0.51	0.00	0.51

Supplementary material 1

Tables S1, S2

Authors: Cameron M. Shorb, Laura A. Freymiller, Daniel L. Hernández

Data type: occurences

Explanation note: **Table S1.** Average mammal activity level [visits/(d of observation)] at baited camera traps at varying distances from recreational trails (m) in Minnesota, USA, in 2014 and 2015. Where points in the same location were used in two years, activity is listed as the average activity of the two years, weighted by the observation period in each year. See Table S2 for disaggregated observations listed independently in each year. A "visit" is defined as a motion-triggered set of 3 photos in which an animal appeared in at least one photo. The first four digits of transect codes refer to the restoration year of the prairie in that location, not the year in which data were collected. **Table S2.** Disaggregated mammal activity [visits/(d of observation)] at baited camera traps at varying distances from recreational trails (m) in Minnesota, USA, in 2014 and 2015. Each observation is listed independently in its respective year; see Table S1 for observations aggregated across repeated transects. A "visit" is defined as a motion-triggered set of 3 photos in which an animal appeared in at least one photo. The first four digits of transect codes refer to the restoration year of the prairie in that location, not the year in which data were collected. In 2014, the observation period was not recorded when no animal activity was observed, but in every case the observation period was about two days.

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