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Woodland voles captured among sparse shrubs in native tallgrass prairie on Konza Prairie Biological Station, Kansas

Donald W. Kaufman and Glennis A. Kaufman

Division of Biology, Ackert Hall, Kansas State University, Manhattan, KS 66506-4901
Corresponding author dwkaufma@k-state.edu

From autumn 1981 through spring 2009, woodland voles (*Microtus pinetorum*) were captured rarely and only in woodland habitats (four in ca. 15,000 trap nights) and never in grassland habitats (ca. 300,000 trap nights) on the Konza Prairie Biological Station, Kansas. Konza Prairie is located in the Flint Hills region of eastern Kansas in Geary and Riley counties (see Knapp and Seastedt 1998 or http://keep.konza.ksu.edu/visit/map.htm for maps and location). We summarized characteristics of these voles (all four voles captured in moist gallery forest; Kaufman and Kaufman 2009) as well as their locations and habitat features because small mammals only were to be sampled in grassland sites away from gallery forest habitats as we completed our long-term studies of small mammals during autumn 2009 through spring 2013 (nearly 30,000 more trap nights during this time period). Unexpectedly, two woodland voles were captured in a prairie site during March 2013, which was the last sampling period of our 32 year study. Herein, we describe the characteristics of the two voles captured along a prairie trapline plus features of the habitat surrounding capture locations.

Both woodland voles were captured in experimental treatment 004B along a single sampling transect (20 stations in length; two live traps per station; 15 m between stations; SE ¼, Sec. 24, R7E T11S, Riley Co., Kansas; identified as small mammal trapline 004BW in Konza Prairie Long-Term Ecological Research records and publications). This experimental treatment was a native tallgrass prairie site that was not burned since spring 2009 and not grazed for over 30 years. As a result of infrequent fires (planned 4-year cycle of spring fires since 1979), 004B is being invaded by native shrubs; much of this increase in shrubs occurs first along upper reaches of draws and along slopes around limestone outcrops (Freeman 1998). Our trapline started in upland (stations 1-3), crossed a slope (stations 4-8), and continued into lowland (stations 9-20), where it crossed a small shallow grassy draw <1.5 m in depth (stations 13-14, which was included in lowland).

On 16 March 2013, the first woodland vole recorded was a large reproductive female (49 g), which had conspicuous mammae but was not pregnant. She was captured in lowland native prairie with sparsely interspersed shrubs (station 16; 004BW-16) and was recaptured once at the same station on the following day. The second vole was a smaller individual but still a large female (42 g; not pregnant and with inconspicuous mammae) that was captured on 18 March 2013. This individual was trapped 45 m from the first female along the edge of the grassy draw (004BW-13); it was recaptured in the same location on 19 March. In addition to the two woodland voles, we also captured a small male prairie vole (*M. ochrogaster*; 33 g) in the second trap at 004BW-16 on 17 March.

It is interesting to note that the two woodland voles were associated both in space and time with the prairie vole. This association has been observed in the southern portion of the distributional range of the woodland vole (Smolen 1981). Woodland voles also associate with another grassland microtine, the meadow vole (*M. pennsylvanicus*), where the woodland vole either increases when the meadow vole population crashes or populations of both species crash simultaneously (Smolen 1981).

Therefore, the relationship between woodland and prairie voles needs further investigation to understand the extent of their interactions, although it has been suggested that these species can use a common runway (Bee et al. 1981).

In spring 2013, the general habitat features in lowland prairie of the 004B treatment included standing dead herbaceous vegetation that exceeded 25 cm in height and a dense mulch layer that was 10-15 cm deep or deeper. These conditions are associated commonly with both prairie voles and southern bog lemmings (*Synaptomys cooperi*) on Konza Prairie and elsewhere (Bee et al. 1981; Finck at al. 1986; Clark and Kaufman 1991). Likely important for woodland voles, this infrequently burned research site was in the initial stages of invasion by native rough-leaved dogwood (*Cornus drummondi*) and to a lesser extent by smooth sumac (*Rhus glabra*), aromatic sumac (*R. aromatic*) and American plum (*Prunus americana*). Consistent with these features, dogwood (1-2 m in height) was growing up through this herbaceous layer in much of the lowland within 200 m of the trap station; however, stems were sparsely interspersed such that the composition and structure of the prairie vegetation was little altered. Because of the low density of dogwood stems, herbaceous vegetation immediately surrounding station 004BW-16 and elsewhere in lowland areas of treatment 004B were still quite typical of unburned and ungrazed lowland prairie and as such resembled the herbaceous vegetation in nearby 004B sites that completely lacked woody vegetation.

As with 004BW-16, prairie conditions surrounding 004BW-13 included deep mulch with standing dead grasses. More specifically, the capture site at station 13 was along a shallow grassy draw in a moist soil site that lacked shrubs. However, a dense shrub patch was present along and in the draw within 15 m of the capture location, while other sparse but developing dogwood patches were present within 50 m.

Across its distributional range, the woodland vole can occur in a wide variety of habitats from mature climax forests with closed canopies to grassy fields that have associated shrubs or brambles (Smolen 1981). Common features of its microhabitat are thick ground cover of plant litter or leaves and well-drained soil. Occurrence of woodland voles along the 004BW transect undoubtedly was related to the lowland topographic position, deep mulch due to absence of fire since 2009 and infringing shrub patches associated with infrequent prairie fires. In contrast to the well-drained soil cited in other studies (Smolen 1981), station 13, where one woodland vole was captured, often is inundated with water during periods of high precipitation. Therefore, moist grassy areas also might be suitable for these voles. At a larger scale, both capture stations were within 200 m of a shallow broad stream reach that drained the 004B treatment. This stream and associated lowland undoubtedly provided suitable habitat for woodland voles, as it was bounded by moist grassland and had an incomplete distribution of trees and shrubs along >400 m of its length and likely provided a source habitat for woodland voles caught along our trapline.

Based on this and our earlier work (Kaufman and Kaufman 2009), woodland voles are rare on Konza Prairie and likely so in this general region of the Flint Hills. The presence of woodland voles in unburned prairie with sparse shrubs and a continued expansion of shrubs into infrequently burned lowland suggest that these voles might become more common in general as shrubs invade infrequently burned and ungrazed prairie lowland areas. However, these recent captures do not change our concern that the woodland vole should be viewed as a species in need of conservation in at least the western portion of its range in Kansas.

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