

# Status of threatened arvicoline rodents in Northeast Iowa: Correlations between habitat quality and availability

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## Abstract

Arvicoline rodents play a key role in vegetation regulation in Iowa's wooded grasslands and prairies. Three of these rodents with remaining potential habitats in Iowa are the meadow vole (*Microtus pennsylvanicus*), prairie vole (*Microtus ochrogaster*), and southern bog lemming (*Synaptomys cooperi*). As a result of increased habitat fragmentation across the state, suitable arvicoline habitat has diminished, and in response, the abundance and diversity of arvicolines has decreased. This study combines trapping data from nine sites in Northeast Iowa to present a current picture of arvicoline rodent distribution. Data suggests that meadow voles now occupy areas once inhabited by southern bog lemmings and prairie voles, while the two displaced species appear to be absent from the area. There is a need for green-space corridors between habitat patches, or expansion of existing fragments, in order to construct habitats that are conducive to larger and more diverse arvicoline populations.

## Introduction

Arvicoline rodents are characterized by periodic, density dependent fluctuations in population levels (Allaby, 1998). Arvicoline rodents aid in nutrient cycling in ecosystems, are a source of prey for larger predators, and likewise prey on and regulate the growth of tree saplings and other vegetation (Franklin, 1979). As a result, they are vital components of Midwest ecological systems. Due to the key role arvicoline rodents play in ecosystems, Ostfeld and Canham (1993) suggest that cyclic fluctuations of their populations be classified as a keystone process.

Iowa's rodent habitat has become increasingly fragmented, which is a cause for concern regarding population viability. Once more common in Northeast Iowa (Bowles, 1981, 1975), the prairie vole and the southern bog lemming seem to be diminishing in numbers, and are believed to be supplanted by meadow voles (Bowles, 1981). This study presents information regarding the present state of arvicoline rodents in Northeast Iowa, relative to predicted distributions and historic records. Data was combined from multiple studies which surveyed natural areas in Northeast Iowa (Bremer and surrounding counties) with differing patterns of vegetation, fragmentation, rodent presence, and histories of land-use, for the presence of arvicoline rodents. Geographic Information System (GIS) software (ArcGIS version 9) was used to compare layers of data, and to visualize any patterns in arvicoline presence in comparison to historic records and predicted ranges. Based on studies by Lin and Batzli (2001, 2004) and Brady and Slade (2004), it was hypothesized that meadow voles would be found most frequently, prairie voles secondly, and southern bog lemmings the least of the three species.

## Materials and Methods

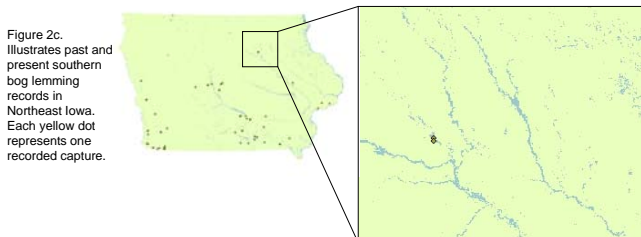
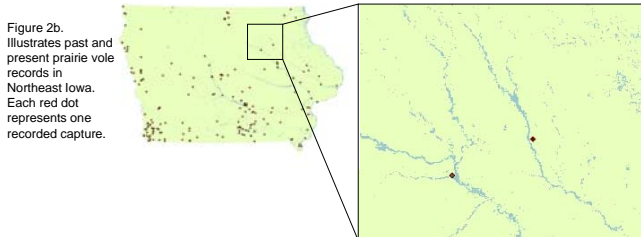
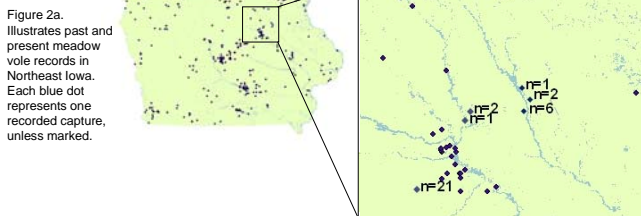
The three rodents studied have preferred habitat ranges that include the entire state of Iowa (Franklin, 1979; Polder, 1953). This study focused on Bremer and surrounding counties of Black Hawk, Butler, Chickasaw, Floyd, and Grundy in order to determine rodent presence for a specific section of Northeast Iowa. Local County Conservation Boards, Iowa Department of Natural Resources, and Iowa college/university collections were searched for records of arvicoline presence. Sites with records indicating previous presence of prairie voles or southern bog lemmings were targeted for inclusion in this study; meadow vole presence was also considered.

Sherman live traps (H.B. Sherman Traps, Tallahassee, FL) were used to trap the animals. Traps were baited with rolled oats, and all captures recorded. Permanent marker was used to identify any potential recaptures. Information on the recent presence of arvicoline organisms for this study relies on trapping done specifically for this study, as well as data collected by McCullough (2002, 2004, 2005, 2006) and Andreesen and Harken (2006). The number of organisms trapped for each site is expressed as a fraction of total trap nights. One night of trapping with 40 Sherman live traps represents 40 trap nights; for comparison purposes, one drift fence is also considered equal to 40 trap nights.

Traps were set and assessed in accordance with the procedure followed by McCullough (2003). Appropriate placement of Sherman live traps was determined by a walking survey of the locale. Traps were baited, set in the late afternoon, and checked the following morning. For each of the trapping sessions, traps were left out for two consecutive nights, unless weather or other circumstances necessitated their removal. Cotton balls were placed in traps to provide insulation, and thus reduce mortality, when nighttime temperatures were predicted to drop below 45° F. For statistical analysis, the number of organisms trapped at each site was compared to the respective patch sizes and relative habitat quality values assigned to each site. These values were analyzed using a forward stepwise linear regression statistics test.

ArcMap GIS software was used to analyze past and current incidences of the arvicolines under study, particularly known prairie vole and southern bog lemming locales. Background layers were imported from Iowa State University's Iowa GAP analysis program (<http://cairo.gis.iastate.edu>), as well as from county conservation board resources. Using information from current and historical records, as well as layers illustrating the relative position and size of available patches, a visual representation of correlations between rodent location and habitat characteristics was created.

Figures utilize GIS layered data.



Survey Site	Total trap nights	Organisms
New Hampton	1320	65 meadow voles
Hay-Buhr	1320	2 meadow voles, 1 prairie vole
Mink Creek	1200	17 meadow voles
Dike	1080	21 meadow voles
Boevers	1200	6 meadow voles
Falls Access	240	0 arvicolines
Babcock Prairie	940	1 meadow vole
Wartburg Prairie	480	2 meadow voles
Sweets Marsh	40	1 meadow vole
<b>Total</b>	<b>7820</b>	<b>115 meadow voles, 1 prairie vole</b>

Table 1. Summary of trapping results for all nine survey sites, relative to total trap nights. Total values were also tabulated.

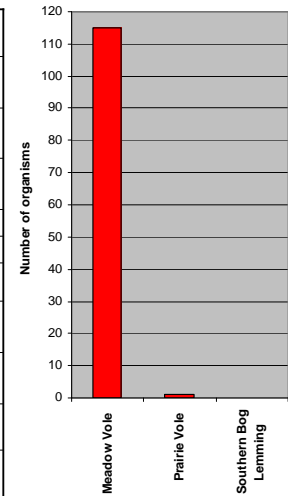
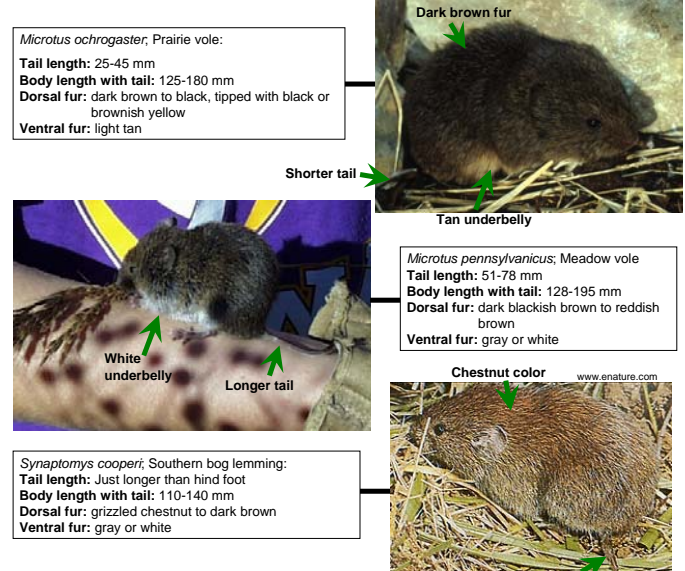


Figure 1. Total arvicolines trapped in study.



## Results

Two studies examining rodents in Bremer and surrounding counties (Sloan, 1964; Bowles, 1975) found meadow voles commonly present. Southern bog lemming and prairie vole records with specific location information were not as abundant. With the information available, nine sites were selected for inclusion in this study's analysis. These sites were New Hampton, Hay-Buhr, Mink Creek, Dike, Boevers, Falls Access, Babcock Prairie, Wartburg Prairie, and Sweets Marsh natural areas in Bremer, Butler, Black Hawk, Chickasaw, and Floyd counties.

Across all trapping sites, a total of 116 arvicoline rodents were trapped (7820 total trap nights). Split up by species, results were 115 meadow vole captures, one prairie vole capture, and zero southern bog lemming captures (Table 1, Figure 1). The ratio of meadow voles to prairie voles to southern bog lemmings therefore becomes 115:1:0. Stepwise linear regression eliminated both variables as indicators of organisms present for this study.

Figure 2a illustrates meadow vole occurrence in relation to habitat availability and quality, Figure 2b presents the same for prairie voles, and Figure 2c shows the same information for southern bog lemmings. As a result of this study, one prairie vole capture was added to the previous data through a point on the map, but due to multiple captures meadow voles were referenced by site and not individual organism.

## Conclusions

- Data indicates there is decreased presence of arvicoline rodents in available habitat in Northeast Iowa, and meadow voles appear to dominate the existing environment. This study suggests that the prairie vole and southern bog lemming are rarely found in, or absent from, the Northeast Iowa area.
- Wapsipicon River Greenbelt (Sweets Marsh, Hay-Buhr, and Boevers) offers the best option for merging and expanding habitat that will support increased growth and diversity of prairie voles.
- If future land-use practices follow current habits, arvicoline rodent survival will be at increased risk. This problem may be remedied by increasing the area of land set aside as viable habitat and connecting existing islands via corridors.
- In order to make better informed management decisions, more information needs to be collected on the change to ecology and behavior of southern bog lemmings, prairie voles, and meadow voles.

## Acknowledgments

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