The Effects of Fire Disturbance on Mammals in The Lake States Region

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Background

- A fire regime is the frequency and severity of fires in an ecosystem. These regimes are responsible for the rate that a forest regenerates. Forest regeneration is vital to ensure plant and animal diversity.
- Fire destroys vegetative cover and food sources important to many species living in the habitat.
- Most species prefer a certain stage of succession in a habitat. As a forest moves through successional stages, populations of both plant and animal species fluctuate.
- A habitat without fire for a long period of time is often less diverse.
- The overall effects on large and small mammals after a fire disturbance has not been extensively studied in the Lake States Region.

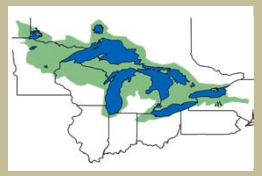


Figure 1: Lake States Region

Objectives

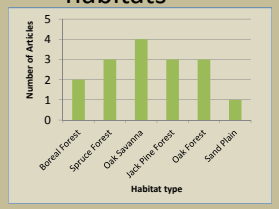
- **Investigate the effects of fire (wild and prescribed) disturbance on mammals in the Lake State Region**
- **Contribute to the on-going gap analysis by the Lake States Fire Science Consortium**
- **Determine whether fire has a positive or negative effect on overall mammal species, deer mouse populations, and red-backed vole populations**
- **Determine whether the change in population following fire was greater for deer mice or red-backed voles.**

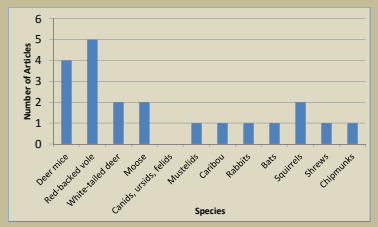
Methods

- A comprehensive literature search was performed to identify all publications relating to the effect wildfire and prescribed fire have on mammals in the Lake States Region.
- We used chi-squared analysis on the categories of population shifts to determine if there was a statistically significant distinction in whether fire has positive or negative effect on mammals.
- We considered a positive response to fire as a population increase observed in a species after the disturbance had taken place. We considered a negative response to fire as a population decrease observed in a species after the disturbance had taken place. Observations of no change were ignored.
- A t-test was conducted to determine whether the mean percent change in population of deer mice was statistically different from that of red-backed voles.

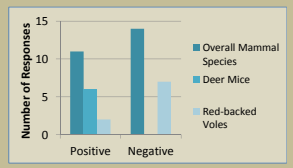
Results

- 7 articles were found
  - Included 25 mammalian responses in 5 habitats





- Fire disturbance had no effect on the mammal population as a whole ($X^2_{calc} = 0.36 < X^2_{crit} = 3.84$)
- Fire disturbance had a positive effect on deer mouse populations ($X^2_{calc} = 6.00 > X^2_{crit} = 3.84$)



- According to the t-test, deer mouse populations were affected more by fire than red-backed vole populations ($t_{calc} = 2.79 > t_{crit} = 2.23$)

Results Continued

Source	Information	Location	Habitat type	Species	Type of fire	What was measured
Fisher and Wilkinson (2005)	Covers multiple different species and their response to the burned environment during different time periods of forest recovery. Recommendations to preserve biological diversity.	Northern United State and Southern Canada	Boreal Forest	deer mice, red-backed voles, moose, mustelids, caribou, rabbits, bats, shrews, arboreal sciurids, canids, ursids, felids	Doesn't specify (post fire)	Population change
Martell (1984)	Focuses on a couple of small mammal species in the boreal forests of Ontario, Canada. Discusses the effects fire was on each species. Collection was one year post fire. Mean number caught/100 trap nights	Ontario, Canada	Spruce Forest	deer mice, red-backed voles	Wildfire	Population
Tester (1965)	Researchers bait and tag mammals in a specific site. Do a controlled burn and look for the animal response to the burn.	Anoka Co., Minnesota	Tall grass prairie with scattered oaks	deer mice, red-backed vole, ground squirrel, chipmunk	Presribed fire	Population before and 35 days after a fire
Krefting (1974)	Following wild fire in northeasternMinnesota small mammals were snap-trapped on two burned and one unburned area for three nights each fall from 1955 to 1967.	Lake Co., Minnesota	Jack pine forest	deer mice, red-backed voles	Wildfire	Population
Beck and Vogl (1972)	Red-backed voles were collected in six study areas 3 were burned (2, 4, 11 times) and three had not been burned for 35 years	Burnett Co., Wisconsin	Brush prairie savanna	red-backed vole	Prescribed fire	Population
Vogl and Beck (1970)	Measures the effect wildfire has a white tailed deer population after a wildfire in Wisconsin	Burnett Co., Wisconsin	Sand plain	white-tailed deer	Wildfire	Amount of deer tracks
Irwin (1975)	Measures white-tailed deer and Moose population in burn and close to burn area for three year period	Northeastern Minnesota	Hardwood and boreal conifer forests	white-tailed deer, moose	Wildfire	Population

Species Observed

Deer mouse (*Peromyscus maniculatus)* –
- Brown fur with white feet
- 5-8 inches long
- Habitat - protected area on the ground surface

- Red-backed vole (*Clethrionoiuys gapperi*) –
- Brown fur
- 5 inches long
- Habitat – dense ground cover

- White-tailed deer (*Odocoileus virginianus*) –
- 50-100 cm shoulder height, 100-150 lbs
- Habitat – moderate to high vegetative cover

Discussion

- Large mammals, especially carnivores, were grossly underrepresented in the studies.
- Forest habitats were well-represented but grasslands were under-represented.
- As a whole, the mammal population was not affected by fire. Positive responses of some animals were cancelled out by negative responses from others.
- Fire improved habitat for deer mice by decreasing predators, providing protective ground cover and increasing food supply on the ground surface.
- Results suffered from the lack of research but they will serve as a guide for future research in the Lake States Region.
- Land managers and researchers need this information to make responsible decisions when trying to protect the diversity of animal species in an ecosystem.

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Acknowledgements

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