IMPACT OF FIRE SEVERITY ON PRESENCE OF AN ENDEMIC VOLE

By

MICHAEL JOSEPH GILBOY

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Approved by:

Dr. John Koprowski
School of Natural Resources and the Environment

ABSTRACT

Wildfires are increasing in severity in the Madrean sky island complex and are impacting small mammal communities. Knowing exactly how fire is changing vegetation and affecting habitat can inform management decisions. Few studies have studied how wildfire is impacting small mammals on these sky islands and none have researched directly the Mt. Graham white-bellied vole (*Microtus longicaudus leucophaeus*). During the fall of 2018, I captured small mammals at 8 sites to contrast vole presence among herbaceous cover, standing woody cover, coarse woody debris cover, and fire severity on Mount Graham, Arizona, USA. I had a total of 206 captures with 18 of those being voles distributed across 4 different sites. A higher presence was recorded at trap locations with a lower fire severity and a higher amount of herbaceous cover. Standing woody cover and coarse woody debris cover did not impact the likelihood of a vole being present at a trapping location. Preserving meadows and other areas of high herbaceous cover while also using fire management techniques to reduce fire severity could improve the habitat used by the Mt. Graham white-bellied vole.

Impact of fire severity on presence of an endemic vole

Mikey Gilboy[1]

[1] *Conservation Research Laboratory, School of Natural Resources and the Environment, University of Arizona, Tucson, AZ 85719, USA.*

RH: Gilboy · Fire impacts on voles

ABSTRACT

Wildfires are increasing in severity in the Madrean sky island complex and are impacting small mammal communities. Knowing exactly how fire is changing vegetation and affecting habitat can inform management decisions. Few studies have studied how wildfire is impacting small mammals on these sky islands and none have researched directly the Mt. Graham white-bellied vole (*Microtus longicaudus leucophaeus*). During the fall of 2018, I captured small mammals at 8 sites to contrast vole presence among herbaceous cover, standing woody cover, coarse woody debris cover, and fire severity on Mount Graham, Arizona, USA. I had a total of 206 captures with 18 of those being voles distributed across 4 different sites. A higher presence was recorded at trap locations with a lower fire severity and a higher amount of herbaceous cover. Standing woody cover and coarse woody debris cover did not impact the likelihood of a vole being present at a trapping location. Preserving meadows and other areas of high herbaceous cover while also using fire management techniques to reduce fire severity could improve the habitat used by the Mt. Graham white-bellied vole.

KEY WORDS habitat, *Microtus longicaudus leucophaeus*, Mount Graham, small mammal trapping, vegetation cover, wildfire.

INTRODUCTION

The Madrean sky island complex is a grouping of mountains in southern Arizona, USA and northern Sonora, Mexico that have different floral and faunal communities due to an elevational gradient (Pelletier et al. 2013). These communities have coevolved in isolation due to the Sonoran Desert being a barrier to dispersal for many species (McLaughlin 1994, McCormack et al. 2009, Atwood et al. 2011, Pelletier et al. 2013). While some animals can move across the desert to disperse or avoid harsh conditions, such as black bears (*Ursus americanus*) throughout the Madrean sky islands (Atwood et al. 2011), smaller, less mobile, species may not be able to make such a journey (McCormack et al. 2009).

Communities on these sky islands have coevolved due to this isolation (McLaughlin 1994) and in the presence of the historic fire interval found on these mountain ranges (Allen et al. 2002). Analysis of tree ring data and quaking aspen (*Populus tremuloides*) age structure indicates many of the historic fires in the mountainous areas of the sky islands were high frequency, low severity fires with very few high severity fires appearing in the record before 1950 (Allen et al. 2002). Stand-replacing fires with high severity patches have occurred more frequently throughout the Madrean sky islands in the last 70 years, contributed to changes in forest management and higher temperatures (Margolis et al. 2011).

Increasingly severe fires have negative impacts on local faunal species that are unable to leave the sky islands, with an example being the endangered Mount Graham red squirrel (*Tamiasciurus hudsonicus grahamensis*) (Koprowski et al. 2006). Negative impacts from fire are not typically direct mortality but indirect mortality from the reduction of resources (Koprowski et al. 2006). While these types of impacts have been studied in-depth for the endangered Mount

Graham red squirrel (Koprowski et al. 2006), other small mammal species found on the sky islands that have not been evaluated nearly as thoroughly.

The Mt. Graham white-bellied vole (*Microtus longicaudus leucophaeus*) is a semi-fossorial subspecies of the long-tailed vole that is endemic to Mount Graham, Arizona, which is the southernmost extent of the long-tailed voles range (Hoffmeister 1986), just like the Mount Graham red squirrel, however it is not listed as a threatened or endangered species and is not afforded the same protections as the Mount Graham red squirrel (U.S. Fish and Wildlife Service 1994).Not much is known about the ecology of this vole, with an Arizona Game and Fish Department report (Spicer 1985) being most of the published research on it. Similar subspecies have been considered by the U.S Fish and Wildlife Service (1994) to be listed and the Mt. Graham white-bellied vole has been captured rarely (Spicer 1985, Posthumus 2015) during surveys, which indicates that it is a subspecies that should be investigated in case a possible future listing is warranted.

This lack of available information coupled with increasingly severe fires (Margolis et al. 2011) and the isolation of the voles (McCormack et al. 2009) led me to evaluate the impact that fire disturbances have on where voles are found on Mount Graham. Specifically, my objective was to describe the vegetation covariates that influence where voles would be trapped and how fire severity changed those characteristics. I predicted that sites with the highest total cover (herbaceous, woody, and coarse woody debris) would capture the most voles and areas with the lowest fire severity would have the highest likelihood of having a vole present.

STUDY AREA

I conducted my study in 2018 on Mt. Graham, the highest peak in the Pinaleño mountain range in southern Arizona. Elevations at trapping sites ranged from 2,840 m to 2,930 m and the mean annual precipitation is >63 cm (Sellers and Hill 1974). Nearly half of the rainfall comes during the monsoon season in late summer, although there is typically snowfall accumulation during the winter months. The vegetation communities at the trapping sites consisted of mixed-conifer forests with some high mountain meadows and Ponderosa pine forests (Anderson 2008).

All the trap sites were located within the perimeter of the 2017 Frye Fire (Figure 1) that burned 19,604 ha (U.S. Forest Service 2017). Half of the trap sites were located along streams that had vegetation consisting of tall graminoids, conifer trees, and some wildflowers and other angiosperms. The half of the trap sites that were not located along streams but instead in flatter areas of forest that would lead into meadows typically had low herbaceous cover and were dominated by conifer trees.

METHODS

I sampled small mammals, vegetation, and fire severity at streams and coniferous forest areas on Mt. Graham from September to November 2018. I used a geographic information system (GIS; ArcGIS 9.1, ESRI, Berkeley, CA, USA) to determine which areas on the mountain to survey based on recorded fire severity, previous trapping locations, and proximity to streams. I chose four different locations where Mt. Graham white-bellied vole had been previously caught (Vole Trapping Site 2, Vole Trapping Site 4, Trapping Site 2, and Trapping Site 3) (Spicer 1985, Posthumus 2015) and then chose four locations within 250 m of each of those locations (Vole Trapping Site 1, Vole Trapping Site 3, Vole Trapping Site 5, and Vole Trapping Site 6). These new locations were chosen based on similar vegetation and proximity to streams as the original location with a different fire severity (U.S. Forest Service 2017).

Trapping was conducted during four different trips with two sites being trapped on each trip. I placed 40 Sherman traps at each site. The traps were set in pairs along a transect with 5 m in-between the two traps at each location and 10 m between each pair, creating a transect that was 190 m long. The transects were perpendicular to the road, unless there was a stream present. In that case, I set the transect along the stream and placed the paired traps on either side (Figure 2). I baited traps using a mixture of oats and peanut butter. A cotton ball was put into the traps to provide insulation.

I opened the traps for 2 consecutive nights at each site. I checked them twice each morning, once near sunrise and again in the mid-morning. I left them closed all day and reopened and rebaited them each night. I identified each animal to species and marked them using a permanent marker for recapture rate. I handled animals under the guidelines of the American Society of Mammalogists (Sikes et al. 2011) and with approval of the University of Arizona Institutional Animal Care and Use Committee.

Vegetation was surveyed by estimating herbaceous, woody, and coarse woody debris (CWD) using 2 x 2-m quadrats (n = 10 quadrats/site). The survey consisted of separating the quadrats into 9 separate squares (66 x 66-cm). I estimated the cover percentage of each of the cover classes (herbaceous, woody, and CWD) in each square, then combined those to get the cover percentage for the entire quadrat (Daubenmire 1959). I used this to estimate the average vegetation cover for each site as well as compare the amount of cover at different trapping locations.

I collected fire severity data using the presence of burn scars on nearby trees as an indicator of fire severity at all 20 trapping locations along each transect. Using the techniques described in Malmström (2010), the 10 nearest trees to the trapping location were observed and recorded as burned or unburned. Trapping locations with fewer than 3 of the trees burned were designated as low fire severity, between 3 and 7 trees were designated as moderate fire severity, and greater than 7 trees burned was designated as high fire severity.

Statistical Analysis

I used paired t-tests (alpha = 0.05) in Microsoft Excel to compare the difference in means between the trap locations where captures occurred, and all the trap locations used (Liebhold and Gurevitch 2002, Fortin and Dale 2005). This was done for herbaceous cover, standing woody cover, coarse woody debris, and fire severity (Table 1). Means that were different indicate a preference to the mean at which voles were captured compared to the mean of all other possible trapping locations.

To analyze the differences in sites to compare fire severities I used an ANOVA test in Microsoft Excel to determine the variance between the mean fire severity at each site (Liebhold and Gurevitch 2002). I then completed multiple paired t-tests to compare each site's mean fire severity to every other site, using a Bonferroni correction (Holm 1979) on an original 95% confidence level to account for the potential of false positives (alpha = 0.0018). Sites where voles were present were compared with other sites with voles present as well as sites where presence was not recorded to identify the trend between mean fire severity and presence of voles.

I compared the variation of fire severity at each site using multiple paired F-tests to compare the variation at each site to every other site (Liebhold and Gurevitch 2002), again using a Bonferroni correction to account for false positives (alpha = 0.0033). Two sites (Vole Trapping Site 1 and Vole Trapping Site 3) were omitted from this analysis because their fire severities were completely homogenous, meaning F-tests would not provide a precise analysis of differences in variation (Liebhold and Gurevitch 2002). Like the analysis done on mean fire severity, sites with recorded presence as well as sites without recorded presence were compared to determine the impact that the fire severity mosaic has on vole presence.

RESULTS

During 640 trap nights, I captured 206 rodents representing 4 species. The most abundant was the deer mouse (*Peromyscus maniculatus*) with 170 captures. The next most abundant was the Mt. Graham white-bellied vole, which is the focal species of this study, with 18 captures, followed by white-throated woodrats (*Neotoma albigula*) and cliff chipmunks (*Tamias dorsalis*) with 10 and 8 captures, respectively. The vole captures were distributed among four of the study sites (Figure 3). Vole Trapping Site 4 was the only historic trapping location that didn't record a vole capture and Vole Trapping Site 6 was the only new location that recorded a vole capture.

Mean fire severity, herbaceous, standing woody, and coarse woody debris percent cover varied among the 8 different sites (Table 2). Only two sites (Vole Trapping Site 1 and Vole Trapping Site 3) were completely unburned whereas only two plots (Vole Trapping Site 2 and Vole Trapping Site 5) had sections with high fire severity. Of the four sites that had vole captures, Vole Trapping Site 2 had the highest fire severity and highest mean coarse woody debris percent cover, Vole Trapping Site 6 had the highest standing woody cover percent and Trapping Site 2 had the highest mean herbaceous percent cover.

When comparing the four covariates (fire severity, herbaceous cover, standing woody cover, and coarse woody debris cover) at each of the vole trapping locations compared to all the trapping locations, fire severity and herbaceous cover where the only two covariates that were different. The mean fire severity at the locations where voles were captured was 30.5% less than the mean fire severity ($t = 4.957$, $df = 45$, $P < 0.0001$) at all the trapping locations and the mean herbaceous cover at the vole trapping locations was 50.51% greater (t = -5.487, df = 31, $P < 0.0001$) than at all the trapping locations.

When comparing the mean and variance of fire severity at each site, there was no clear trend for either between sites where voles were caught and sites where they weren't. Some sites with captures (Vole Trapping Site 6 and Trapping Site 3) were statistically the same (t = 0.541, df = 40, $P > 0.05$) for both mean and variance of fire severity while other sites with captures (Vole Trapping Site 2 compared to Vole Trapping Site 6) were statistically different (t = 8.447, df = 38, $P < 0.05$) for both mean and variance of fire severity. When comparing sites where captures occurred and where they didn't, this was again true with some (Vole Trapping Site 1 and Trapping Site 2) being statistically the same and others (Vole Trapping Site 1 and Trapping Site 3) being statistically different for both mean and variance of fire severity.

DISCUSSION

Consistent with previous studies that captured the Mt. Graham white-bellied vole (Spicer 1985, Posthumus 2015), the number of vole captures was very low, especially compared to deer mice which had over 9 times more captures. Based on the results of comparing fire severity, herbaceous cover, standing woody cover, and coarse woody debris cover at the individual trapping locations compared to all the trapping locations, fire severity and herbaceous cover were the two factors that appear to influence the recorded presence of voles. Individual trap sites that had a lower fire severity and a larger amount of herbaceous cover were more likely to record a vole presence at that site.

The herbaceous cover being a primary factor influencing presence is consistent with where voles were previously recorded and how their presence has been described (Spicer 1985, Hoffmeister 1986). Fire severity having an inverse relationship with recording presence is not consistent with previous studies that state small mammals avoid fire by hiding in "refugia" (Yarnell et al. 2007, Horncastle et al. 2019), but it could be due less to actual mortality from fire but instead a slower rate of vegetation regeneration cover than assumed during other studies (Cheeseman and Delaney 1979, Yarnell et al. 2007).

Standing woody cover did not have an impact on vole presence, which could be because the "refugia" created by herbaceous cover is such a dominant factor in presence of small mammals (Yarnell et al. 2007) that the cover created by trees does not impact it. The amount of coarse woody debris also didn't have an impact on vole presence, which could be due to both the positive and negative impacts on small mammals (Harmon et al. 1986, Barro and Conard 1991). Coarse woody debris has been used by small mammals as cover from predators (Harmon et al. 1986), but the fact that coarse woody debris is present means that there is a high chance that there was a large amount of debris flow to that area, which has been a possible cause of mortality of small mammals (Barro and Conard 1991).

The analysis of those covariates explains how different vegetation cover classes and fire severity impact vole presence on the individual trap scale, but when looking at fire on the trap site scale the same trend doesn't hold true. This could be because each of our sites is larger than the home range of the voles. While the home range size of the Mt. Graham white-bellied vole has not been recorded, home range sizes of other *Microtus* species have been recorded to range from 80 m^2 to 400 m^2 (Habvey and Barbour 1965, Gaulin and FitzGerald 1988). Using that as a baseline, the trapping sites that were delineated can contain at least 2 complete home ranges and up to 10 or more. This leaves room within sites where voles were not present, but factors were being recorded, even for sites that had a capture. Since the factors directly within home ranges have the largest impact on presence (Leblond et al. 2011) and covariate measurements were recorded outside of home ranges on sites with captures, the same trend of fire severity impacting presence was not seen on the trap site scale versus the individual trap location scale.

This study could have been improved by increasing the number of trapping days at each site and increasing the number of sites used. While the total number of captures for 8 days of trapping was large (n = 206), there were few trap sites used (n = 8) meaning that there was high uncertainty in the analysis related to sites. Increasing the number of trap days would have allowed me to have a higher likelihood of capturing voles at sites where they were present but not recorded.

Additional research that could have be done to better understand the factors that influence the presence of the Mt. Graham white-bellied vole and how that presence is impacted by fire is including a distance from water covariate. The Mt. Graham white-bellied vole has been described as typically being found close to streams in meadows (Hoffmeister 1986), but just how close they need to be to have a higher recorded presence has not been researched.

MANAGEMENT IMPLICATIONS

My results indicated that areas with low fire severity and high amounts of herbaceous cover are important for use by the Mt. Graham white-bellied vole, meaning that areas with high herbaceous cover on Mount Graham should be protected from degradation and have assisted rehabilitation after fire. I recommend the use of fire management techniques such as thinning and prescribed burns since they promote less severe fires and a higher growth in herbaceous plants (Gorte and Gorte 1979).

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LITERATURE CITED

Allen, C. D., M. Savage, D. A. Falk, K. F. Suckling, T. W. Swetnam, T. Schulke, P. B. Stacey, P. Morgan, M. Hoffman, and J. T. Klingel. 2002. Ecological restoration of southwestern ponderosa pine ecosystems: a broad perspective. Ecological Applications 12:1418-1433.

Anderson, R. A. 2008. Vegetation changes within the subalpine and mixed-conifer forest on Mt. Graham, Arizona. Dissertation, Northern Arizona University, Flagstaff, USA.

Atwood, T. C., J. K. Young, J. P. Beckman, S. W. Breck, J. Fike, O. E. Rhodes Jr., K. D. Bristow. 2011. Modeling connectivity of black bears in a desert sky island archipelago. Biological Conservation 144:2851-2862.

Barro, S. C., and S. G. Conard. 1991. Fire effects on California chaparral systems: an overview. Environment International 17:135-149.

Brown, D. E., editor. 1994. Biotic communities Southwestern United States and Northwestern Mexico. University of Utah Press, Salt Lake City, USA.

Cheeseman, C. L., and M. J. Delany. 1979. The population dynamics of small rodents in a tropical African grassland. Journal of Zoology 188:451-475.

Daubenmire, R. F. 1959. A canopy-cover method of vegetational analysis. Northwest Science 33:43-46.

Fortin, M. J., and M. R. T. Dale. 2005. Spatial analysis: a guide for ecologists. Cambridge University Press, Cambridge, United Kingdom.

Gaulin, S. J. C., and R. W. FitzGerald. 1988. Home-range size as a predictor of mating systems in *Microtus*. Journal of Mammalogy 69:311-319.

Gorte, J. K., and R. W. Gorte. 1979. Application of economic techniques to fire management – a status review and evaluation. USDA Forest Service General Technical Report INT-53, Fort Collins, USA.

Habvey, M. J., and R. W. Barbour. 1965. Home range of *Microtus ochrogaster* as determined by a modified minimum area method. Journal of Mammalogy 46:398-402.

Harmon, M. E., J. F. Franklin, F. J. Swanson, P. Sollins, S. V. Gregory, J. D. Lattin, N. H. Anderson, S. P. Cline, N. G. Aumen, J. R. Sedell, G. W. Lienkaemper, K. Cromack Jr., and K. W. Cummins. 1986. Ecology of coarse woody debris in temperate ecosystems. Advances in Ecological Research 15:133-302.

Hoffmeister, D. F. 1986. Mammals of Arizona. University of Arizona Press, Tucson, USA.

Holm, S. 1979. A simple sequentially rejective multiple test procedure. Scandinavian Journal of Statistics 6:65-70.

Horncastle, V. J., C. L. Chambers, and B. G. Dickson. 2019. Grazing and wildfire effects on small mammals inhabiting montane meadows. Journal of Wildlife Management 83:534-543.

Koprowski, J. L., K. M. Leonard, C. A. Zugmeyer, J. L. Jolley. 2006. Direct effects of fire on endangered Mount Graham red squirrels. The Southwestern Naturalist 51:59-63.

Leblond, M., J. Frair, D. Fortin, C. Dussault, J. P. Oullet, and R. Courtois. 2011. Assessing the influence of covariates at multiple spatial scales: an application to forest-dwelling caribou faced with intensive human activity. Landscape Ecology 26:1433-1446.

Liebhold, A. M., and J. Gurevitch. 2002. Integrating the statistical analysis of spatial data in ecology. Ecography 25:553-557.

Malmström, A. 2010. The importance of measuring fire severity – evidence from microarthropod studies. Forest Ecology and Management 260:62-70.

Margolis, E. Q., T. W. Swetnam, and C. D. Allen. 2011. Historical stand-replacing fire in upper montane forests of the Madrean sky islands and Mogollon plateau, southwestern USA. Fire Ecology 7:88-107.

McCormack, J. E., Huang, H., and Knowles, L. L. 2009. Sky islands. In R. Gillespie and D. Clague, editors. Encyclopedia of Islands. University of California Press, Berkeley, USA.

McLaughlin, S. P. 1994. An overview of the flora of the sky islands, southeastern Arizona: diversity, affinities, and insularity. USDA Forest Service General Technical Report RM-GTR-264, Tucson, USA.

Pelletier, J. D., G. A. Barron-Gafford, D. D. Breshears, P. D. Brooks, J. Chorover, M. Durcik, C. J. Harman, T. E. Huxman, K. A. Lohse, R. Lybrand, T. Meixner, J. C. McIntosh, S. A. Papuga, C. Ramussen, M. Schaap, T. L. Swetnam, and P. A. Troch. 2013. Coevolution of nonlinear trends in vegetation, soils, and topography with elevation and slope aspect: a case study in the sky islands of southern Arizona. Journal of Geophysical Research: Earth Surface 118:741-758.

Posthumus, E. E. 2015. Red squirrel middens influence abundance but not diversity of other vertebrates. PLoS ONE 10:e0123633.

Sellers, W. P., and R. H. Hill, editors. 1974. Arizona climate. University of Arizona Press, Tucson, USA.

Sikes, R. S., W. L. Gannon, and the Animal Care and Use Committee of the American Society of Mammalogists. 2011. Guidelines of the American Society of Mammalogists for the use of wild mammals in research. Journal of Mammalogy 92:235-253.

Spicer, R. B. 1985. Status of the white-bellied vole, *Microtus longicaudus leucophaeus* (Allen) of southeastern Arizona. Arizona Game and Fish Department Report, Phoenix, USA.

U.S. Fish and Wildlife Service. 1994. Species profile for Graham Mountains long-tailed vole. https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=A09T. Accessed 23 March 2019.

U.S. Forest Service. 2017. Remote sensing and fire data for Frye Fire, 2017. https://www.fs.fed.us/eng/rsac/baer/barc.html. Accessed 10 October 2018.

Yarnell, R. W., D. M. Scott, C. T. Chimimba, and D. J. Metcalfe. 2007. Untangling the roles of fire, grazing and rainfall on small mammal communities in grassland ecosystems. Oecologia 154:387-402.

APPENDIX

Figures

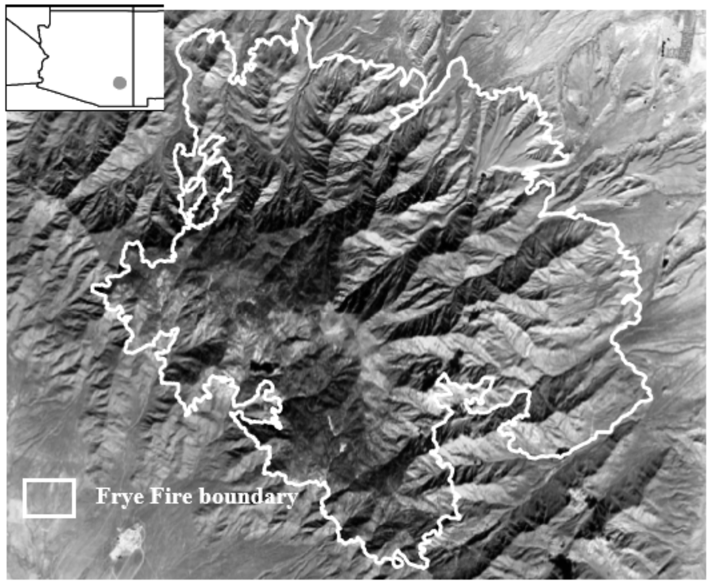

Figure 1: Outline of Frye Fire on Mount Graham, Arizona, USA, summer of 2017 (U.S. Forest Service 2017). Inset depicts location of Mount Graham relative to the rest of the state.

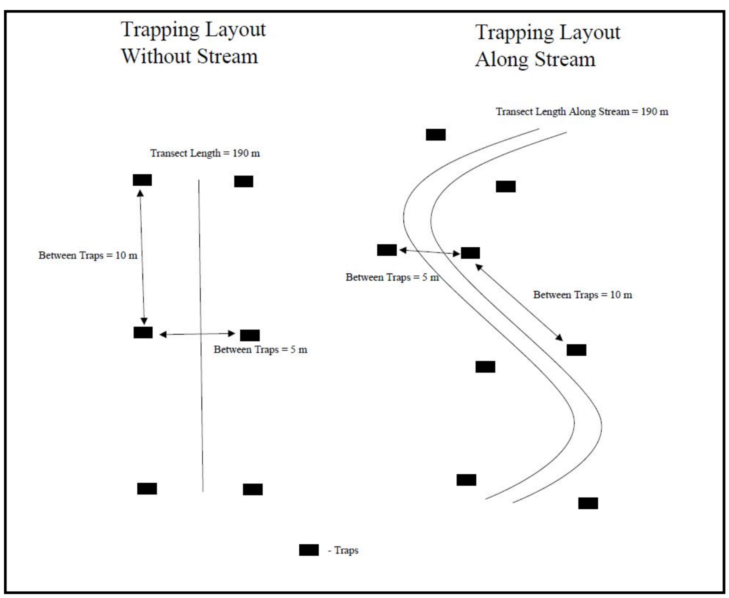

Figure 2: Trap layout for both trap setups. *Left*: Trap layout when not trapping along stream with traps on a straight 190 m transect with paired traps 5 m apart and trapping pairs 10 m apart. *Right*: Trap layout when traps were placed along stream with paired traps being placed 5 m apart along opposite sides of the stream and trapping pairs 10 m apart along the stream.

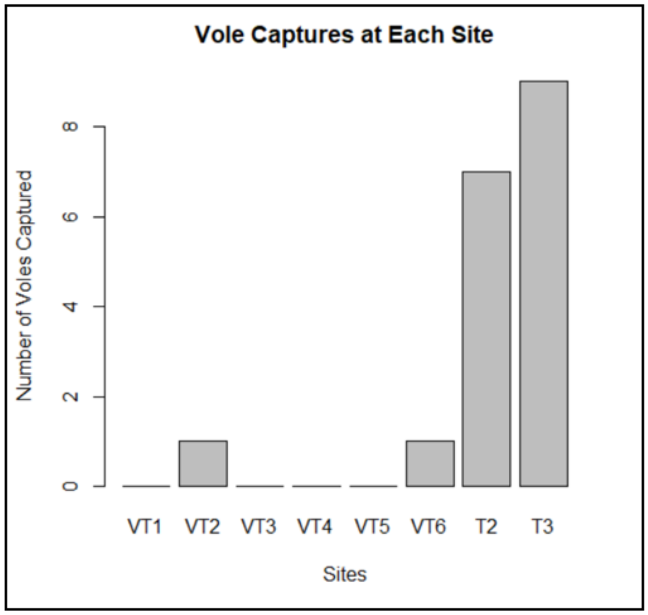

Figure 3: Distribution of captures based on the characteristics listed for each site (Table 2) of Mt. Graham white-bellied voles during the fall of 2018 on Mount Graham, Arizona, USA.

Tables

Table 1: Description of covariates used in the analysis of Mt. Graham white-bellied vole presence during the fall of 2018 on Mount Graham, Arizona, USA.

Variable	Variable Description
Herbaceous (% cover)	Average percent cover of herbaceous plants at each trapping location
Standing Woody (% cover)	Average percent cover of standing woody plants at each trapping location
Coarse Woody Debris (% cover)	Average percent cover of coarse woody debris at each trapping location
Fire	Indicates whether the trap was in an unburned/low, moderate, or high fire severity area 1 = unburned/low severity, 2 = moderate severity, 3 = high severity

Table 2: Fire and cover characteristics of the eight different sites surveyed during the fall of 2018 on Mount Graham, Arizona, USA.

Site	Mean Fire Severity (SE)	Mean Herbaceous Percent Cover (SE)	Mean Standing Woody Percent Cover (SE)	Mean Coarse Woody Debris Percent Cover (SE)
VT 1	1 (0)	0.525% (0.11)	0.095% (0.06)	0.19% (0.1)
VT 2	2.7 (0.11)	0.392% (0.1)	0.255% (0.1)	0.26% (0.08)
VT 3	1 (0)	0.365% (0.13)	0.66% (0.13)	0.16% (0.04)
VT 4	1.65 (0.17)	0.4% (0.08)	0.38% (0.12)	0.155% (0.05)
VT 5	2.5 (0.18)	0.285% (0.08)	0.225% (0.09)	0.22% (0.06)
VT 6	1.4 (0.11)	0.542% (0.09)	0.36% (0.12)	0.197% (0.05)
T 2	1.25 (0.1)	0.852% (0.06)	0.045% (0.02)	0.063% (0.03)
T 3	1.32 (0.1)	0.83% (0.05)	0.285% (0.12)	0.1% (0.03)