A Test of the Relative Abundance, Diversity and Distribution of Ants at the Wild Basin/Vireo Preserve in Relation to Habitat Manipulation for the Black-capped Vireo (*Vireo atricapilla*)

Faculty supervisor: Kendra K Abbott
Student Researchers: Stephen Robinson, James LaManna
December 13, 2013

Purpose

To Identify if there are changes in diversity (species and abundance) of ants species . One concern of manipulating the habitat for the Black-capped Vireo is how this will influence the associated arthropod community that is used as a food source.

Introduction

Biodiversity is a measure of the integrity of life within a particular ecosystem. The interconnectedness of biodiversity is what maintains a healthy ecosystem (Ehrlich and Wilson 1991). The health of the ecosystem is not only important as a moral obligation to protect life and the numerous benefits that humans receive but that same biodiversity maintains a homeostasis of ecological services on our planet (Ehrlich and Wilson 1991). Invertebrates make up an overwhelming majority of biodiversity in any ecosystem and therefore should be included in any monitoring program (Wilson 1988,Taylor & Doran 2011). As a result, a measure of biodiversity is particularly useful in determining the effectiveness of conservation practices and the changes that they have on the ecosystem.

Arthropods are commonly being used in rapid biodiversity surveys for conservation purposes (Romero and Jaffe 1989, King and Porter 2005, Groc et al. 2007). Among the arthropods ants have commonly served as the focal group for structured inventories of arthropod diversity and abundance for a number of reasons. Ants are good bio-indicators as they are diverse, abundant and colonies are generally in a fixed position. Further ants are thought to be a keystone taxon in the functioning of terrestrial ecosystems due to their impact on soil ventilation, plant-arthropod interactions, seed dispersal, and predation (King and Porter 2005). And finally a number of studies have tested protocols and sampling methods for ants and have identified efficient practices and methodologies for strict inventory or community characterization (Romero and Jaffe 1989, King and Porter 2005, Groc et al. 2007).

The Black Capped Vireo is an endangered, neo-tropical species that breeds in parts of Mexico, Oklahoma, and Texas (BCP 2007a). In 1996, the Balcones Canyonlands Preserves in western Travis County were established to mitigate the losses of vireo habitat due to urban expansion that resulted in habitat destruction. The Black Capped Vireo has historically had a healthy population at the Black-capped Vireo Research Area, but the populations have steadily decreased since 1987 (BCP 2007a). The ideal habitat for the Black-capped Vireo consists of greater density of deciduous vegetation from 0-2 meters, deciduous cover from 30-45%, total woody cover including Ashe juniper covering from 35-55%, heterogeneity of vegetation structure

allowing light penetration, and openness not exceeding 65% (BCP 2007b). The City of Austin has maintained a section of the Black-capped Vireo Research Area to reproduce the habitat of Black-capped Vireo. In this experiment, we examine the differences of biodiversity between the maintained plot and the unmaintained plot.

To most easily determine the biodiversity of an ecosystem, we will use terrestrial invertebrates due to their vast population sizes compared to vertebrates, diversity, and the ease of which they can be collected (Anderson 2004). Ants also serve as a good bio-indicator due to their sensitivity to environmental changes within an ecosystem, allowing conservation practices and their results to better understood (Groc et al. 2010). We propose to test the biodiversity of two managed areas of the BCP, the Black-caped vireo preserve and the juniper/oak woodland.

Materials and methods

Study sites

Ant sampling took place during May 2013 at the Black Capped Vireo Research Area, a segment of the Balcones Canyonland Preserve consisting of 214 acres, is a dedicated macro site residing in the western hills of Austin, Texas. The Black Capped Vireo Research Area was established to maintain and preserve future sites of habitation for the endangered Black Capped Vireo (BCV).

Treatments

At the Black-capped Vireo Research Area, we looked at two specific plots of land: maintained and unmaintained. The maintained plot of land was hand cleared in 2010/2011. Trees that were less than 15 feet tall or less than 8 in diameter at breast hight (dbh) were removed if they fell under the list of target species. The list of target species included but was not limited to sumacs, silk tassel, yaupon holly, mountain laurel, live oaks, ashe juniper, and persimmon. If there was a slope of greater than 15% than trees were hand cleared and less than 15% they were mechanically cleared. Mechanical and hand removal of was done to remove woody vegetation that covered over 55% of the area (BCP Land Management Plan 2007). All slash was mulched and then removed by placing in mulch socks or removed from the preserve. The unmaintained plot is a juniper-oak woodland/grassland dominated by *J. ashii*, and *Q. buckleyi*. The tree canopy is closed containing dense understory of a variety of tree seedlings. There are a few open grasslands that become more abundant on slopes.

Sampling methods

To compare the two sites, we chose to use pitfall traps to perform a taxonomic evaluation of ant biodiversity between two sites. Evaluation of present ant species, particularly fire ant species, genus *Solenopsis*, found present within the Black Capped Vireo Research Area are of particular interest. Red imported fire ants (*Solenopsis invictus)*, classified as an invasive species, are known to disturb the diversity of an ecosystem. The pitfall traps consisted of 50 ml test tubes placed within plastic pipes that have been dug into the ground; the traps were then

filled ⅔ of the way with a diluted solution of non-toxic antifreeze. Pitfall traps were then set up in a four by five grid, set apart by a distance of ten meters. Each trap consists of a short (7cm) length of PCV pipe that contains an 80cc centrifuge tube with the top portion (grooved section) removed so as to fit in the PVC pipe (Fig. 1).



Figure 1: Pitfall Trap number 5 showing PVC insert in soil, cut centrifuge tube with cap, metal tag with blue stake wisker.

When not in use the cut tube is switched out with a tube containing a screw cap so that the trap is closed (Fig. 2). Holes for the PVC pipe were created by hammering a 1 inch by 7 inch conduit nipple into the ground and then removed with soil inside (Fig. 3).



Figure 2: Pitfall trap showing centrifuge tube with cap;trap closed. Also shown is nail holding numbered metal tag and stake wisker to the left of the capped-tube.



Figure 3: Conduit nipple used to create hole for PVC pipe.

Each trap received a numbered metal tag, attached to a 15.24 cm nail (driven into the ground) by 24 gauge steel galvanized wire. Attached upright to each nail was a “blue stake whisker” to facilitate relocating of the trap. Each trap had a GPS location recorded (Appendix A). Traps will normally be run for a period of 7 days and will be non-baited, but will contain nontoxic propylene glycol. When not in use empty traps will be closed so as not to capture any organisms. Samples will be collected in Whirl-Pak sample bags and frozen until processed. When processed ants and any other arthropods will sorted, counted and sorted to morphospecies. Representative morphospecies will be pinned and identified to species. This research will document changes in the ant fauna in the treated compared to untreated area and how this may impact the terrestrial community in the treated areas.

Preliminary Results/Discussion

All ants were curated and identified to species level and housed at Wild Basin Creative Research Center. Number of species were counted and were also

*Analyse*s

Pitfall traps yielded 20 species of ants at the vireo preserve totaling 958 ants. A majority (655 individuals) of the individuals collected were *Pheidole dentata* and *Forelius privinosis*. We are continuing to analyze and organize the data so we can identify diversity differences between the two-treatment areas.

Table 1: Different species observed at both managed and unmanaged areas of the vireo preserve.

Pheidole dentata	514
Pheidole metallescens	60
Pheidole tetra	10
Pheidole hyatti	10
Solenopsis xyloni	65
Solenopsis invictus	54
Solenopsis aurea	6
Forelius privinosis	141
Forelius Sp B	12
Crematogaster punctulata	8
Crematogaster laeviscula	15
Solenopsis xyloni	4
Campanotus festinatus	5
Trachymyrmex turrifex	8
Labidus coecus	4
Aphaenogaster Sp A	5
Myrmecina americana	1
Cyphomyrmex rimosus	4
Paratrechina longicornis	2
Monomorium minimum	30

To determine the diversity indices between the two plots of land at the Black-capped Vireo Research Area, a diversity index of the present ant species was established. The Simpson index will be used as the diversity indice since it is the least biased of the diversity indices when you have a small sample size as well as when you have a small number of species (Mouillot and Lepretre 1999). The combined diversity index was 0.7131. Simpson diversity index ranges from 0-1. Zero being no diversity and 1 being the most diverse. Most diverse is defined by Simpson diversity index as have the same number of individuals in each species. This diversity index reflects the unevenness of the number of individuals in each species. It will be interesting to see how the different sites indices compare.

Citations

Anderson, A.N., A. Fisher, B.D. Hoffmann, J. Read and R.Richards. 2004. Use of terrestrial invertebrates fro biodiversity monitoring in Australian rangelands, with particular reference to ants. Austral Ecology. 29:87-92.

Balcones Canyonlands Preserve. 2007a. Tier III Balcones Canyonlands Preserve Land Management Plan:City of Austin Black-capped Vireo research area, West Austin Macrosite. City of Austin.

Balcones Canyonlands Preserve. 2007b. Tier IIA Balcones Canyonlands Preserve Land Management Plan: Black-capped Vireo management. City of Austin

Ehrlich, P.R. and E.O. Wilson. 1991. Biodiversity Studeis: Science and Policy. Science. 253(5021):758-752.

Greensdale, P.J.M. 1973. Sampling ants with pitfall traps: digging-in effects. Insectses sociaux. 20(4): 343-353.

Groc, S., J.H.C. Delabie, R. Cereghino, J. ORivel, F. Jaladeau, J. Grangier, C. S.F. Mariano, A. Dejean. 2007. Ant species diversity in the 'Grands Causses' (Aveyron, France):In search of Sampling methods adapted to temperate climates. Ecology. 330:913-922.

King, J.R. and S.D. Porter. 2005. Evaluations of Sampling Methods and Species Richness Estimators for Ants in Upland Ecosystems in Florida. Environmental Entomology. 34(6):1566-1578.

Mouillot, D. and A. Lepretre. 1999. A comparison of species diversity estimators. Population Ecology. 41:203-205.

Romero, H. and K. Jaffe. 1989. A comparison of Methods for sampling ants (Hymenoptera, Formididae) in Savannas. Biotropica. 21(4):348-352.

Taylor, R.J. and N. Doran. 2001. Use of terrestrial invertebrates as indicators of the ecological sustainability of forest management under the Montreal Process. Journal of Insect Conservation. 5:221-231.

Wilson, E.O. 1988. Biodiversity. National Academy Press, Washington DC.

Appendix A: Map of pitfall trap arrays in the two different treatment areas. Plot 1A has 20 pitfalls in the vireo managed area and Plot 1B has 20 pitfalls in the unmanaged area.

