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Biodiversity using Ants as a Surrogate Group

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ABSTRACT

Biodiversity is the measure of taxonomic diversity and disparity within an area. Biodiversity is important for conservation evaluation as well as ecological assessments. Several groups of organisms have been used to assess biodiversity, such as plants, mammals, birds, butterflies, beetles, etc. Ants represent another potential surrogate taxon for biodiversity. They occur in many types of habitats, fulfill a variety of ecological roles, can be diverse and numerous, and there are several very good references for identification. Over 9,000 species are known worldwide, and ants are among the most numerous individuals in many habitats. For this study, ants were collected from leaf litter, pan traps, and Lindgren funnels in an ecotone as well as from leaf litter in the woods near Eagle Lake. The ecotone represents the disturbed transition area between woods and a field; the woods represent a less-disturbed area of continuous habitat. Specimens were labeled, organized, and identified in order to analyze the diversity of ants between these two habitat types. Some species of ants were more numerous in the ecotone, but a greater diversity of ants occurred in the woods.

INTRODUCTION

Biodiversity is surveying the taxonomic diversity of a particular ecosystem. It can be very telling of the overall ecological health of the area. Mammals, birds, lizards, butterflies, and plants have often been used to measure the biodiversity of an area. Ants, which are ubiquitous and numerous may also be used to assess biodiversity of an area.

Ants appear to be an ideal candidate for use as an indicator taxon because they are diverse, found abundantly in almost every terrestrial habitat in the world, and easily collected (Agosti et al. 2000). Ant species typically have a stationary nest, with restricted foraging areas. This makes them a better indicator taxon than other insects which move frequently between ecosystems in search of food, mates, or nesting sites. Thus, making ants a more constant presence across a whole ecosystem. This allows them to be sampled reliably. Ants are important ecologically because they function at many levels in an ecosystem; as predators and prey, as detrivores (organisms that feed on decaying matter), mutualist, and herbivores.

An efficient method of surveying the biodiversity of the Eagle Lake area is to focus on a single diverse taxonomic group, referred to as an indicator taxon. In this particular study we collected samples of ants from two different areas around Eagle Lake; woods (Figure 1) and ecotone (Figure 2). An ecotone is the transition between two habitat types. The goal of this study was to identify ants to genus from these two areas and record the number of individuals of each species. These data were analyzed to find any correlations between a genus' abundance and the location in which it was collected.

Figure 1 Woods Habitat

Figure 2 Ecotone

MATERIALS and METHODS

There are multiple methods for collecting ants. These include sifting through leaf litter, pan traps, Lindgren funnel traps, pitfall traps, and hand-picking, which consists of collecting ants from under stones and bark, within rotting wood, from trails or vegetation, and locating nests. For this study, we employed Lindgren funnel traps, yellow pan traps, and sifting of leaf litter.

Lindgren funnel traps are made of locking stacks of black plastic funnels (Figure 3). Three of these were hung on shepherd's hooks along the ecotone and three were hung within the nearby woods near Eagle Lake. Ants travelling above the trap that fall in are kept due to the smooth sides of the funnels. The ants are dropped into a collection jar and collected later.

Pan traps (Figures 4) are nothing more than a 9x12 baking pan painted yellow placed on the ground and filled with a mixture of dish soap and salt water. The purpose of the soap is to break the surface tension of the water and allow for any insects that find their way in to rapidly sink rather than stand on the surface of the water. The salt simply keeps the water from evaporating as quickly, allowing for the trap to be left in the field longer. Three pan traps were deployed along the ecotone and three were placed within the nearby woods.

For sifting leaf litter (Figure 5), leaf litter was collected from the forest floor, with preference given to areas with fungal growth. This included areas near fallen logs and visible fungi. This material was sifted through a special tool comprised of a screen affixed to a wire loupe with a handle. A collection bag was attached to the bottom of the apparatus. As material was loaded into the sifter, large objects such as twigs and leaves and rocks were separated from the finer soil and insects.

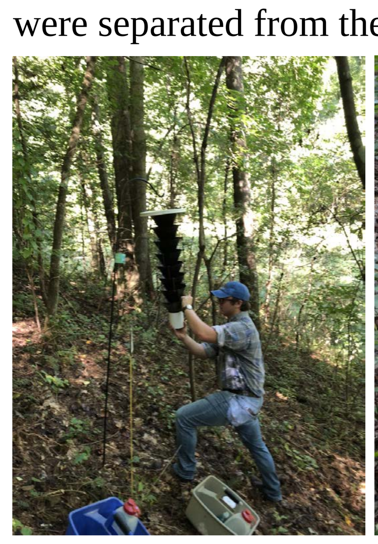

Figure 3 Lindgren Funnel

Figure 4 Yellow Pan Trap

Figure 5 Sifting Leaf Litter.

Berlese funnels (Figures 6 and 7) were used to separate out organisms from the leaf litter collection method. The sifted material is placed on a screen covered in cheese cloth which lies in the funnel. A light bulb is held above the litter to encourage insects to move down through the litter and eventually into the funnel. Due to the smooth sides of the funnel all insects are dropped into a collection container full of alcohol. Insects are then pulled and sorted.

Figure 6 Setup of Burlese Funnel

Figure 7 Burlese Funnel

After samples were pulled and separated from the Berlese funnels, they were put on points (Figure 8), or small triangular pieces of paper, using clear nail polish as an adhesive. These were then pinned and sorted. This makes labelling and identifying easier.

Labelling (Figure 9) is done to record the date of collection, location, and collection method for each specimen.

Figure 8 Pointing a specimen.

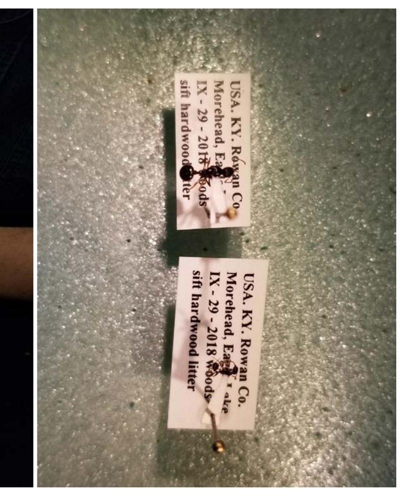

Figure 9 Labeled specimens

Identifying the genera of ants was the next step after the samples were properly pointed and labeled. We utilized two identification guides of common ant genera, Bolton (1994) and Vinson et al. (2003) that gave us step-by-step instructions on distinguishing individual genera by comparing varying characteristics of the specimens' morphology.

RESULTS

Table 1. Number of ants of each genus collected from leaf litter from ecotone and woods

Species	Ecotone	Woods	Total	Habititat Preference
Hypoponera	0	27	27	Woods
Paratrechina	4	30	34	Woods/Field
Brachymyrmex	0	24	24	Woods
Camponotus	0	1	1	Woods
Aphaenogaster	22	37	59	Woods/Field
Strumigenys Sp1	6	12	18	Woods
Strumigenys Sp2	0	2	2	Woods
Myrmecina	10	11	21	Woods
Solenopsis	2	0	2	Field
Amblyopone	0	1	1	Woods
Dorymyrmex	1	0	1	Field
Totals	45	145	190	

Figure 10

Figure 11

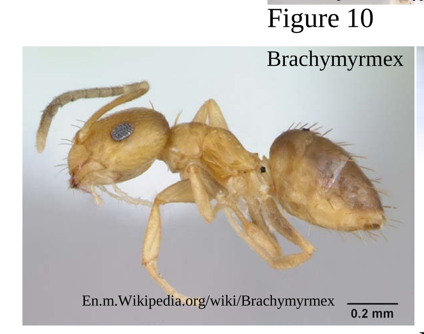

Figure 12

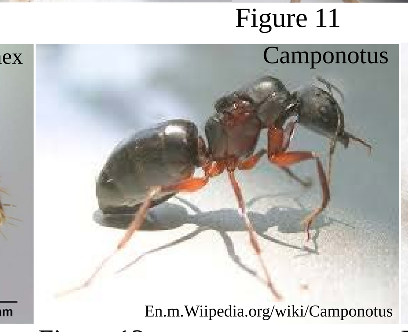

Figure 13

Figure 14

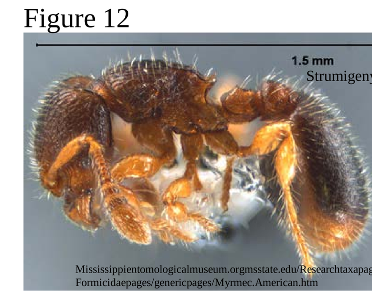

Figure 15

Figure 16

Figure 17

Figure 18

Figure 19

Figures 10 – 19. Pictures of ant genera collected in our study.

In this study, we collected ten different genera of ants. A total of 190 individuals were prepared (Table 1). We found a total of 45 individuals in the ecotone and 145 in the woods. Some genera were found nearly or entirely in one habitat or the other. The genera *Hypoponera* (Figure 10), *Paratrechina* (Figure 11), *Brachymyrmex* (Figure 12), and *Camponotus* (Figure 13) were found exclusively in the woods. Some genera showed to be divided amongst both ecotone and woods. These genera were *Aphaenogaster* (Figure 14), *Strumigenys* Sp1 (Figure 15), and *Myrmecina* (Figure 16). No genera were found to be found in the ecotone only with exception to those with very few individuals.

DISCUSSION

Ants are usually found in clumped distributions; therefore, one can reasonably expect to find very large or small numbers of individuals in any given sample. This justifies our recorded data for the genera *Solenopsis* (Figure 17), *Amblyopone* (Figure 18), *Dorymyrmex* (Figure 19), *Camponotus*, and *Strumigenys* sp2. On the other hand, the genera *Hypoponera*, *Paratrechina*, and *Brachymyrmex* showed a distinct clumped distribution, each having 30-100 individuals that were not prepared. The ants collected within the sampling range showed a high level of diversity in genera, location, and numbers. These data are useful when looking for a measure of general biodiversity in the area. It was not surprising to find any of these genera where we did due to the ecotone sharing features of both woods and fields.

Some genera were represented by a few individuals. These were *Camponotus*, *Solenopsis*, *Strumigenys* sp2, *Amblyopone*, and, *Dorymyrmex*. Due to so few specimens collected it was difficult to determine if the location that they were collected was reasonable. These low quantities could be the result of collecting individuals that have strayed from the colony in search of food, or by collecting an ant from a very small colony.

All of the ants collected were collected via leaf litter sifting. This allowed for a better comparison during the analysis of data. We attempted to collect ants using Lindgren funnel traps; but no specimens were collected. This was anticipated. We also tried collecting ants with yellow pan traps. This, unlike the Lindgren funnels, did give us samples. They were, however, all *Camponotus*. This showed us that it was not worth setting these traps in order to collect ants.

ACKNOWLEDGEMENTS

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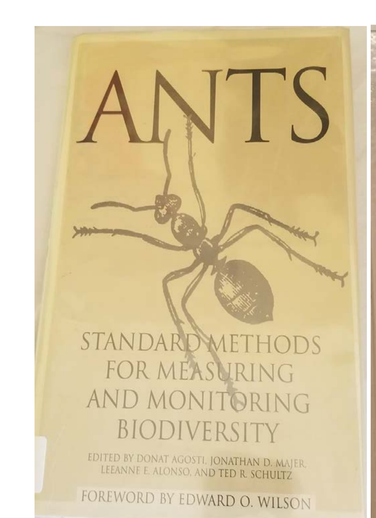

Figure 20

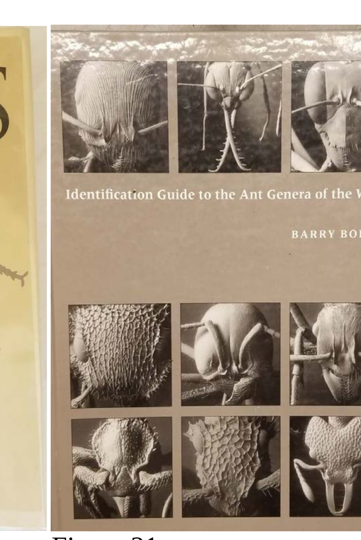

Figure 21

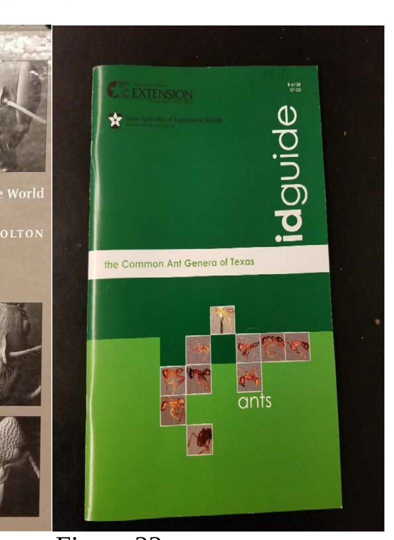

Figure 22

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