Ecological studies by undergraduate students at Brackenridge Field Laboratory, University of Texas at Austin.

RM Plowes, LE Gilbert
Published online 31 March, 2021

This document contains summaries and abstracts from student independent studies conducted at BFL. The full reports and the analyses by the students have not been independently verified or reviewed.

The data underlying the reports can be provided at the discretion of the Director. However, the reports were developed by students and are not generally available for sharing.

The majority of these studies were conducted in BIO373L Field Ecology. This course is instructed by Dr L. E. Gilbert and assisted by TA’s: R. Plowes, C. Estrada, R. Bocsa, H. Gillespie, K. Pierce, E. Resetarits, K. Jiang, L. Dugan, R. Deans, L. Trotter, C. Rakowski, C. Petersen

Acknowledgements: H. Januska, J. Lawson, A. Miller for compiling the data.
Abstracts from Previous BIO373L Student’s Independent Projects

1999

Gall Distribution on the Leaves of Vitis cadicans

Amanda Rives – S99

Galls are commonly found on various parts of many types of plants. Questions concerning the impact of abiotic factors and the presence of other gall forming organisms are commonly posed in ecological studies of gall distribution. Considering theories of niche partitioning and competition, one would conclude that organisms would utilize different parts of the plant or would not oviposit on leaves that already had signs of a different organism. One would also assume that abiotic factors such as leaf location in the plant would play a role in the distribution as well. Additionally, it is possible that as leaf size increases, so should the number of galls. These ideas were tested using two different types of galls found on Vitis cadicans. Leaf width and height were measured, and the number of galls was counted at two different heights within three sites. These three sites were located at Brackenridge Field Lab in Austin, Texas and were at varying distances from the Colorado River. The obtained data were analyzed using a chi-square test. These tests indicated that height and distance from the river influence gall distribution. There was also a small correlation between increasing leaf size and more galls per leaf. It was also evident that the different types of galls that were studied were less commonly found together than on separate leaves.

The Last Stand of Solenopsis geminata in Fire Fly Meadow

Julie Warr – S99

About fifty years ago the fire ant Solenopsis invicta began its colonization of the south-eastern United States beginning near Mobile, Alabama (Porter 1990). S. invicta has managed to competitively exclude the native fire ant, S. geminata, from its habitat (Porter et al. 1988). All of Brackenridge Field Lab has been invaded by S. invicta except for Fire Fly Meadow. This study attempts to determine why this meadow has escaped the wrath of S. invicta while the remainder of the property is overrun with the exotic fire ants.
Intraspecific Competition and Self-Thinning in Radishes
Sherry Jacobsen – S99

Self-thinning as a result of intraspecific competition occurs in many plant species. When average biomass is plotted against final density, a slope of -1.5 is often found. This result is so common, it is referred to as the -3/2 power law. We examined radishes to determine if intraspecific competition and resulting self-thinning occurred in the species. Though correlations were found, they were not as strong as the -3/2 power law, indicating that, though intraspecific competition and self-thinning are probably present, most radish mortality resulted by other means.

A comparison of bird species diversity and foliage height diversity during spring migration
Samuel Hanes – S99

Previous studies have shown that bird and foliage diversities are positively correlated for breeding birds. I wanted to see if this was true during spring migration along the Colorado River. I investigated whether or not migratory birds had the same general distribution, relative to vegetation diversity, as do breeding birds, or if they were more evenly distributed. Unfortunately, few migratory birds were spotted during the duration of this study so comparisons between species richness vs. time and the species diversity for all birds vs. foliage height diversity were made. Three sites in five different areas were chosen for study at Brackenridge Field Laboratory. At each plot, the foliage height diversity was measured by dividing the foliage into three layers (ground level-2m, 2m-10m, and 10m+). Then each site was sampled for birds from April 9th to May 3rd beginning around 8:00 am. Overall there did seem to be a positive correlation between bird species diversity and foliage height diversity. While the diversity of breeding birds is probably more closely tied to vegetation structure than migrant diversity, migrants also need structurally diverse vegetation.

Organization of Soil Invertebrate Fauna as Determined by Forest Cover
Bryan Wofford – S99

Soil arthropods are key components in the recycling of nutrients. In wooded areas, arthropods are more abundant as there is more leaf litter to break down while in open areas, arthropods are less abundant as there is less organic matter to break down. In this study, I attempt
to determine if soil invertebrate abundance and diversity is determined by climactic factors (temperature, moisture) or biological factors (nutrients from fauna) at Brackenridge Field Laboratory. Ten soil samples in total were taken from both open and wooded areas. The insects from each sample were then sorted and identified. Based on the results, species richness was higher in the covered areas rather than the open areas. Abundance was also reduced at the open sites when compared with the wooded areas. Overall, the factors affecting soil composition seem to be site specific and act in conjunction with one another rather than an either/or scenario.

Pollinators of Lupinus texensis
Gillian Saenz and Andrea Nunn – S99

The mutualism that occurs between plants and pollinators is crucial to ecosystems. In this study I aim to identify the major pollinators of the Texas Bluebonnet (*Lupinus texensis*) at Brackenridge Field Laboratory. Observations of bluebonnet patches began in mid-March and continued weekly for approximately four weeks. Any insects found visiting the flowers were captured and kept for identification. I also dissected a bluebonnet to collect any internal insects. A total of ten species were found on the flowers. Overwhelmingly, however, *Apis mellifera* was the most common insect found throughout the patches and was thus deemed the major pollinator of the bluebonnet.

Interactions Between Different Ant Species Living in Close Proximity
Jennifer Washburn – S99

In this study, I examined three situations of various ant species with nests in close proximity to one another. The nests were observed over the span of five weeks at Brackenridge Field Laboratory in Austin, Texas. Three ant species of the genus *Pogonomyrmex* (*barbatus*), *Forelius*, and *Solenopsis* (*invicta*) were the species being monitored living in close quarters to one another. Dominance between ant species was measured by setting out two ten minute and one hour bait traps with different baits at each site and seeing which species was predominantly found on the baits. I predicted that certain ant species would prefer different food baits which would allow them to live in such close proximity to one another. Overall, I found that *Pogonomyrmex* and *Forelius* ants were able to live in close quarters without much conflict due to different foraging preferences. In the presences of the *Solenopsis* fire ants, both the
*Pogonomyrmex* and *Forelius* ants were out-competed, however, this may just be due to *S. invicta*’s raised aggression levels towards other species.

**The distribution of different ant species at BFL in bait traps and pitfall traps**

*Michael Sorial – S99*

Since the invasion of the important fire ant, *Solenopsis invicta*, native ant species have decreased in diversity and abundance at Brackenridge Field Laboratory. In this study, I aim to complete a survey of the relative abundance of ant species at BFL using baited and pitfall traps placed along the pre-existing transects at the field lab. When looking at all of the collected specimens from the traps, it is clear that *S. invicta* is the dominant species of ant present. *S. invicta* was also found in much higher numbers in the bait traps rather than the pitfall traps.

**A field study of two types of insect-induced galls and their distribution on Mustang Grape (Vitis mustangensis) at Brackenridge Field Laboratory, Austin Texas**

*Jason Moss – S99*

Galls form as a result from an attack from a parasite (bacterium, fungus, or insect) on a plant. Galls often provide food and protection to parasitic larvae living within its tissues. In this study, I collected samples of Mustang Grape (*Vitis mustangensis*) from three different sites at Brackenridge Field Laboratory and compared them for the presence of insect induced galls. I hoped to find a difference between the sample sites with regards to gall distribution and oviposition preference of the gall inducing insects. A higher number of galls were found on the Mustang Grape collected from the river area, suggesting that the insects prefer a moister environment. Because the gall insect has not been identified, this is merely a prediction and more data is needed to make conclusive statements.

**Red Imported Fire Ant Impacts on the Herpetological Community at BFL**

*Paco Cardenas – S99*

The invasion of the imported fire ant, *Solenopsis invicta*, has caused shifts in species diversity and abundance throughout trophic levels. Their high levels of aggression and their ability to live in a number of habitats has let them outcompete many native species. In this study, I conducted a survey of the reptiles and amphibians present at Brackenridge Field Laboratory to
see how their numbers and territories have changed since the invasion of *S. invicta* at BFL. I caught, heard, or saw a total of 22 species: six amphibians and sixteen reptiles. Two species, the Mediterranean gecko and the eastern hognose snake, were found that had not been reported seen at BFL previously. The species richness has also decreased from 39 to 22 as 19 species on the current checklist were not observed at all. This could have just been due not enough sampling, however. Based on the collected data, it is difficult to determine what impact *S. invicta* has had on the herpetological community at BFL, and more intense sampling is needed.

**A Comparison of the Water Quality of Two Freshwater Habitats at BFL**

**Corinna Keenmon – S99**

Benthic macroinvertebrates can be used as ecological indicators of water systems as they respond readily to change. Therefore, conducting macroinvertebrate surveys over time and show changes in their compositions which could then be linked to potential changes in the water quality. In this study, I collected macroinvertebrate samples from Town Lake and a manmade pond, Pond F, at Brackenridge Field Laboratory to determine which site had a higher quality of water. Out of the collected specimens, taxa richness, the modified family biotic index, the percent contribution of the dominant family, the EPT index, and the Jaccard Coefficient was used to determine water quality. Families Pelycypoda, Pyralidae, and Psephenidae were found only at Town Lake while the family Libellulidae was found at Pond F only. Overall, Pond F and Town Lake seem to have similar water quality levels. Pond F may have slightly lower water quality because it is man-made and could be used in experiments, however.

**Insect Invasion on Texas Prickly Pear Cactus: A Case from the Brackenridge Field Laboratory**

**Andy Chen – S99**

Two, unidentified Hemipteran species were observed in several patches of the Texas prickly pear cactus, *Opuntia lindheimeri*, at Brackenridge Field Laboratory. After further research, I identified the two previously unidentified insects as *C. vittiger* and *C. tabulata*. I wanted to fully understand the insect communities found on the cacti, so I conducted a survey of the insect infestations found on Opuntia and also tested whether or not the number of spines on a cactus influence the degree of infestation. A total of 12 Opuntia patches were measured for size,
degree of spines, insect infestation, and surface damage. As my sample size was small, it was difficult to establish any correlation between spines and insect presence. However, I did observe that certain insects were more likely to be found on cacti with no spines.

**Bird Feeding**

*Rich Redding – S99*

The majority of bird species at Brackenridge Field Laboratory are caching passerines, meaning they store seeds as a means of exploiting a food surplus. Based on this, I would predict that bird feeding stations that are more visible to be visited more frequently than feeding stations located in heavy cover. Conversely, you would expect to see more birds nesting near the covered feeders as this would be where they would set up their nests and territories. I expect that there will be more feeding at the covered sites because the most abundant birds, the cardinals, are trying to mate this time of year. At each feeder, I placed a pre-weighed amount of sunflower seeds and then weighed them again two days later. Seeds were placed at five covered, five semi-covered, and five open sites. One open site had to be excluded due to ant interference. Overall, it was difficult to see any foraging pattern. The first group of sites, 1-3, showed very little foraging, however this could be due to the fact that the sites were located close to the street.

**The Effect of Bird Type on Seed Choice and Patch Dynamics**

*Sharon Williams – S99*

Food selection and feeding strategies of birds is dependent on their body size and morphological characteristics as well as inter and intraspecific competition. In this experiment, I looked at seed size preferences and competitive interactions of local avifauna at Brackenridge Field Laboratory in Austin, Texas. Four different seed choices were placed at two different sites at BFL, however, only one site produced viable results. At the other site, the bird species, its size (small, medium, large), seed size preference, feeding location, and the competitive gradient were all recorded. In general, I found that larger birds were able to make better use of their resources than smaller birds. Larger birds also tended to be more dominant and therefore more competitive. Overall, the factors I analyzed did seem to have some kind of importance to birds and where and how they forage.
Habitat Partitioning by Fish
Darin Rokyta – S99

The goal of the project described herein was to gain some understanding of habitat partitioning of a shallow creek fish community. The assumption being followed is that one source of species richness and diversity is a wide selection of available habitat types. Thus, different types of habitats were examined, and correlations sought between different habitat variables and species richness and diversity. These habitats can be differentially utilized by species of the community with enough niche separation to allow co-existence. The study was necessarily short-term, and some comparison with data collected last summer will be made. At each site, two seine hauls were performed over an approximately eight-to-ten-meter distance. The catch from both hauls were combined and identified. In the previous summer, 14 species of fish were caught while only eight species were caught this spring. Continued monitoring and more data collection would be needed to identify the factors that caused the decrease in observed species; however, it could just be due to winter mortality or emigration.

Effects of Parasitoid Phorid Fly on Brooding Behavior of Fire Ant Host
Alfredo Ghezzi – S99

Invasive species are often so successful in new environments as they have no natural predators in the area. This is one reason why the imported fire ant, Solenopsis invicta, has been able to outcompete native ant species. In S. invicta’s native habitat in Brazil, there are parasitoid phorid flies that are specialized specifically to S. invicta, so it’s thought that the introduction of these flies into the United States could be a sort of biological control of fire ant populations. In this experiment, I examined the behavioral effects that the phorid fly, Pseudacteon tricuspis, has on the brooding activity of S. invicta. I measured the effects of attacking females on the total number of ants, a fraction of the brooding ants, and on individual ant’s speed at Brackenridge Field Laboratory in Austin, Texas. The results showed that movement of fire ants was effectively reduced after a phorid fly attack and individual, non-brooding ants seemed to care more for self-protection than brood-protection. However, these results do not show if the phorid flies can reduce fire ant populations. A more intense study which observes the long-term effects phorid flies have on the invasive fire ants would need to be conducted to determine if the flies are a viable biological control option.
Investigating the Japanese privet, *Ligustrum japonicum*, at Brackenridge Field Laboratory

Laurie Sewell – S99

Japanese privet, *Ligustrum japonicum*, has been invading and expanding its reach at Brackenridge Field Laboratory since its introduction as an ornamental plant before the lab was founded. In this study, I aim to find out what habitat characteristics the privet prefers as well as if past human land use in the area correlates with the current distribution of privet. I walked each of the ten pre-existing transects at BFL and searched for *L. japonicum* plants. I discovered that the privet was often found in soil with few rocks and loose topsoil and in flat areas of land. I did not find any correlation between past land use with privet dispersion, which may be due to the fact that the plant produces a black berry which birds then disperse. Actions have been and continue to be taken in efforts to remove *L. japonicum* from BFL altogether, although this has proven to be a difficult task.

How Arthropod Diversity Relates to the “Edge Effect” and to Habitat Transitions

Julie Marquis – S99

Habitat fragmentation is becoming more and more common as urbanization continues to spread. There is evidence, however, that some arthropods thrive on these edge habitats. This goal of this study was to examine arthropod diversity along a gradient away from an edge habitat at Brackenridge Field Laboratory. Diversity was considered across transitions from grassland to forest and riparian forest to interior forest. I did not find any convincing evidence that arthropod diversity changes according to distance from an edge, however, sun exposure and vegetation seemed to have the strongest correlation to arthropod diversity.

The role of spines on *Opuntia lindheimeri*

Jonathan Rossing – S99

After preliminary observations that Opuntia cacti can have varying degrees of the number of spines present, I designed this study to determine whether or not the number of spines a cactus has correlates to the level of insect infestation. Opuntia cacti were sampled at Brackenridge Field Laboratory in Austin, Texas. Each patch was measured in size and spines and then observed for insect infestation. From observations along, I saw that more insects were present on spineless cacti. Our data also showed a correlation between spinelessness and insect infestation levels.
Further research is needed to fully understand why this is as spineless cacti would offer no protection from predators to the insects infesting the plant.

**Deer Foraging Effects on Local Plant Vegetation**  
**Darren Boyer – S99**

In this study, the focus was to observe the effect of deer foraging using an exclosure within acreage that is overpopulated with white-tailed deer. By examining differences in diversity, abundance, and species richness we intend to show that deer have an ecological impact on the vegetation population and are selective for certain species when a variety of plants are available. In early March 1999, several plots were marked out within certain meadows regions of Brackenridge Field Laboratory. Eight sites were affixed within 2 meters of a 4 ft high fenced exclosure that would eliminate deer foraging within that area. Another eight sites were established adjacent to the exclosed sites but located on the outside of the exclosure opposite the fence where deer could forage.

**Foraging Habits of the Armadillo**  
**Kevin Delaney – S99**

Armadillos are not typically spotted, but their presence can be readily observed in the form of their foraging burrows (called dugs). This study takes place at Brackenridge Field Laboratory aims to address how armadillos know where to forage and what they eat. The number of armadillo dugs was counted in an area to estimate the number of armadillos present. The area was then categorized by ground cover type, soil hardness, and soil moisture levels. A large shovel full of soil was then sifted through using a wire mesh to see the contents of the foraging sites.

**The Amphibians and Reptiles of Brackenridge Field Laboratory, Austin, Texas**  
**Thomas Devitt – S99**

A survey of the herpetofauna of Brackenridge Field Laboratory, an urban field station located near downtown Austin, Texas, revealed 22 species of amphibians and reptiles. Funnel traps, pitfall traps and time-constrained searches were used to inventory species. Food
competition between *Thamnophis cyrtopsis* and *Thamnophis proximus* was investigated using the work of Fouquette (1954) and will be the subject of future research.

**Ramifications of Exotic Plants on Native Texas Tree Species Diversity**  
**Abigail Jacobs – S99**

Brackenridge Field Laboratories (BFL) is a research facility for the University of Texas at Austin. Many plants have been introduced there, some of them for ornamental purposes when the land was at one time part of a neighborhood. Some of these plants, despite conscious removal efforts, have maintained their presence on the research facility. The effect of these exotic, or introduced plants is known to decrease the native Texas tree diversity. Although, individual species of exotic plants may show an increase in native tree diversity, the entire trend across BFL is a decrease in native tree diversity with respect to increasing exotic plant abundance. There is also evidence to support that the greatest native tree diversity occurs in the interior portions of the lab as opposed to the exterior perimeter, which is bordered by a river, a road and housing developments.

**Intraspecific Competition in the common radish, *Raphanus sativus***  
**Jack Guinn – F99**

This experiment tests for the presence of intraspecific competition through the presence or absence of self-thinning in plots of the common radish, *Raphanus sativus*. Intraspecific competition is competition for resources between individuals of the same species. Resources are seen as a limiting factor of growth and reproductive success for any individual. Any interaction that reduces the ability of one organism to obtain resources is competition (Ricklefs et al. 1999). Radishes with differing numbers of seeds per plot were planted and allowed to grow. After several weeks, the radishes were dug up, dried, and weighed to determine the biomass of each plot. Results showed that survivorship decreases with an increasing seed density as expected.

**The behavior of the imported fire ant, *Solenopsis invicta*, atmiddens**  
**John Dunn – F99**

The insect world is a pheromonal landscape of chemical signals. Known only to the ants and chemically savvy entomologists, the unseen hands that may move mounds in an instant leave
few visibly marked clues. The deposition of litter piles (middens) may be one of the few signaling tools in the ant’s inventory that is large enough for humans to behold. This study investigated the conspicuous behavior of litter consolidation and determined that there is some role beyond housekeeping that midden piling serves. Comparisons of worker ant behavior on and around middens were observed to differ according to the origins of the refuse. Foreign middens, both intraspecific and interspecific with respect to the colony of *Solenopsis invicta* elicited altered levels of activity on the introduced middens, increasing and decreasing respectively.

**Aquatic Insect Density in Various Sections of a Stream**

**Summer Messer – F99**

Aquatic insects are found in several different freshwater habitats such as lakes, ponds, rivers, and streams. This experiment studies whether the density and diversity of aquatic insects varies between three close, but different, sections of a stream. The stream in question is Barton Creek, and the areas are lower, middle, and upper. Chemical tests were performed on the three sections and aquatic insects, plus additional organisms, were counted. The oxygen, CO$_2$, alkalinity, chloride, nitrite, ammonia, and pH were roughly the same for lower, middle, and upper Barton Creek. The insect density did not vary a great deal between the three locations, however, diversity did. The most aquatic insect diversity was found in the upper area of Barton Creek. Rate of flow of water, creek bed make-up, and food availability are the greatest factors affecting aquatic insect distribution.

**Self-thinning in the domesticated radish, Raphanus sativus**

**Ashley Crumpton – F99**

Plants of the same species in abundance experience intraspecific competition for resources. Studies have shown that the domesticated radish (*Raphanus sativus*) will begin to self-thin and loose biomass in response to intraspecific competition. This study examines this phenomenon by planting six different density plots of radishes at Brackenridge Field Laboratory and measuring the average dry mass of each plot. I predict that there will be a negative relationship between increasing radish density and the average dry mass per plant. Results showed a biomass decrease with increasing radish density as well as a decrease in survivorship as density increased which suggests intraspecific competition is at play.
Competition in the field – is it fact or fiction?
Kara Bednarowicz – S00

If two or more organisms use the same resources, which are insufficient to supply their combined demands, the individuals are competitors. Intraspecific competition, which is competition among individuals of the same species, may reduce growth and reproductive rates for some individuals. Interspecific competition, which is competition between different species, also reduces growth rate and is characterized by a negative effect on both species. The null hypothesis for this experiment is that competition has no effect on plant growth; while the alternative hypothesis states that competition negatively influences plant growth. The null hypothesis will be rejected, and the alternative hypothesis supported if there is evidence that treatments with high densities show less growth (biomass) than treatments of lower densities. The results showed no clear evidence to refute the null hypothesis or to support its alternative. There does appear to be differences in the average values of the measurements taken, but this is due to the simplification of the averaging process itself. If the standard deviations for these average values are considered, there is no significant difference between the measurements.

Competition in the field – is it fact or fiction?
Kara Bednarowicz – S00

This study examines the effects of competition on two genera of plants. Many interactions between organisms within communities center on the division of resources among consumers. If two or more organisms use the same resource, which are insufficient to supply their combined demands, the individuals are competitors (Purves et al. 1998). Intraspecific competition, which is competition between different species, may reduce growth and reproductive rates for some individuals while interspecific competition, which is competition between different species, also reduces growth rate and is characterized by a negative effect on both species (Pontin 1982). The null hypothesis for this experiment is that competition has no effect on plant growth, while the alternative hypothesis states that competition negatively influences plant growth. Two genera of flowering plants, *Celosia* and *Salvia*, at Brackenridge Field Laboratory were used to conduct this study. Subplots with different combinations of plants
were created to simulate intra- and interspecific competition. Results showed no clear evidence to refute the null hypothesis, however, there does appear to be differences in the average values of the measurements taken. Though this could be due the simplification of the averaging process itself. A longer study period time in which the subplots had more time to grow may provide more distinguished results.

**A Simple Food Chain: Studying interactions between producers, consumers, and predators**

Jon Vu – S00

Food chains include intricate relationships between producers, consumers, and predators. If the number of producers increases, it can be expected that the number of consumers would also increase. If the number of predators increases, however, it can be expected that the number of consumers would decrease which would relieve the stress of herbivory on producers and their numbers would increase. In this study, I examine how supplementing nutrients to producers would impact the food chain. I predict that this would increase both producer and consumer numbers and that introducing predators would reduce consumer numbers and increase producer numbers. Mason jars with two different control set-ups and two different experimental set-ups were constructed. The bottom-up control jars had algae with no nutrients, consumers or predators while the top-down control had algae and consumers but no nutrients or predators. The experimental bottom-up jar had algae and nutrients with no consumers or predators and the top-down experimental jar had algae, consumers, and predators with no nutrients added. Based on the results, my hypothesis was not supported. This was unexpected but is thought to have been caused by random environmental variations that greatly impacted the results.

**Foraging Behavior of the Armadillo (Dasypus novemcinctus)**

Alison Burke – F00

Armadillo dens have been hypothesized to be found in areas with high prey availability. This study examines this theory by comparing areas with evidence of armadillo foraging and areas without armadillo foraging to determine if there is a difference in prey availability. Eight sites that had signs of foraging and eight sites that had no signs of foraging were chosen at Brackenridge Field Laboratory (BFL) for prey content. A dirt sample was taken at each site and the number of earthworms and grubworms were counted in each. Overall, there was no
significant difference found in the amount of prey found at foraged sites and non-foraged sites. This may imply that there are other factors at play that affect where armadillos forage. Future studies that investigate potential factors such as soil moisture may provide more insight.

**Vertical Foraging Rate vs. Horizontal Foraging Rates in *Solenopsis invicta***

*Vincent Jackson – F00*

Imported Fire Ants (*Solenopsis invicta*) have spread throughout the southeastern United States at a constant rate, since being introduced to the US from South America over 7 decades ago (Gilbert 2000). The spread of *Solenopsis invicta* has become an epidemic to some harvesting communities as foraging rates and colony growth become uncontrollable. If it is known that Imported Fire Ants dominate areas horizontally, tests can be done to see if they dominate areas vertically as well. By using foraging rates, a test can be designed to test the differences between the two. I predict that the vertical foraging rate will be lower than the horizontal foraging rate in *Solenopsis invicta*.

**Riverbank vegetation survey of a segment of the Colorado River***

*Benjamin Walther – F00*

Brackenridge Field Laboratory (BFL) in Austin, Texas lies at the confluence of several bedrock formations, soil types, and vegetation types. This survey was undertaken to obtain a detailed description of the species composition of the woody riverbank vegetation along the BFL and the opposite sides of the river. The survey found that the opposite side is more diverse in its species composition and more even in the relative abundances of its species. Topographic and geologic factors may be controlling these different species compositions, but more surveys need to be made before the underlying forces can truly be understood.

**Impact of Oak Wilt on Live Oak Distribution at BFL***

*Debra Rankin – F00*

Oak wilt has posed a serious threat to oak populations throughout Central Texas. At Brackenridge Field Laboratory in Austin, Texas, the facility has been battling the fungus since the 1960s. In this study, I aim to assess the spread of oak wilt and what effect it has on the size class distribution of live oak trees at BFL and whether it is possible or not for live oaks to re-
establish in areas where live oaks have previously been killed by oak wilt. Through my data collection and research, I found that larger oak trees were the most likely to be affected by oak wilt, but that re-establishment may be possible as smaller oaks were found in the vicinity of the larger, dead oaks. As treatment for oak wilt is expensive and not plausible in a large area such as BFL, it is important that continuous monitoring of live oak populations be done in order to track the spread of oak wilt.

2001

Leaf Caching of *Atta texana* at BFL
Tanya Vo – S01

The foraging behavior of *Atta texana* at Brackenridge Field Laboratory was examined in the field to determine whether foragers retrieve more leaves from larger caches than from smaller caches. The formation of caches may increase the likelihood of leaf retrieval; therefore, I suggest that foragers retrieve more leaves from larger caches than from smaller caches assuming the larger the cache, the more likely foragers are to notice the cache and retrieve the leaves.

An Island Biogeography Study on Macroscopic Animals which Dwell Under Rocks, and the effects of *Solenopsis invicta*
Roselynn White – S01

Based on the Theory of Island Biogeography, which states that larger islands will have more species and smaller islands will have fewer species, I predict that rocks will also follow this pattern. Large and small rocks in both sunny and shady habitats were chosen for sampling at Brackenridge Field Laboratory. Each rock was flipped over, and the number of species was counted. Anything that I could not identify was collected in a vial. Hot dog baits were also placed at each rock and any insects found foraging on them were collected and identified. Overall, there appeared to be a correlation between rock diameter and species diversity, however, it was weak. More data points would be necessary to provide significant results. I also found that the presence of invasive fire ants had an effect on the correlation between species diversity and rock diameter, however, more data points are needed here too.
Land Snails
Shannon Hancher – S01

It was thought that the Rabdotus snails at Brackenridge Field Laboratory had been wiped out by invasive fire ants. In order to test this, I compared current snail densities to snail densities from the late 1960s when invasive fire ants were not yet present. Snails were sampled along a wooded area and grassy area in the lowest terrace at BFL. Overall, 363 specimens were captured in the wooded area and 50 in the grassy area. Rabdotus specimens were caught only in the wooded area, however, only four out of the total 363 were, in fact, Rabdotus snails. I also found no difference in snail sizes between the wooded and grassy areas. I originally thought there would be a difference as snails seal their shells when temperatures are too warm and when there is little moisture which would inhibit their ability to feed, resulting in smaller sizes. Future snail studies could be conducted at night to see if snail activity is greater as temperatures would be cooler.

The Native vs. Non-Native Plant Preference of the Atta texana at Brackenridge Field Laboratory
Michelle Griego – S01

Leaf cutter ants do not actually eat plants but use them to cultivate a highly specialized fungus which they then eat. Previous studies have shown that the ants’ foraging selection is influenced by factors such as chemical repellents in the plants, physical characteristics of the leaves, proximity, and plant defense systems. In this study, I examined the plant preferences of Atta texana and whether or not there was bias for native or non-native plants at Brackenridge Field Laboratory in Austin, Texas. I predicted that native plants would be preferred by the ants. Four native () and four non-native plants () were chosen for this study. I used a hole puncher to create tiny disks of each of the eight plant’s leaves and placed them along an Atta foraging trail. Each day I checked the disks and counted which were missing. The results surprisingly showed that the ants did not discriminate between native and non-native plants. This may have been due to the design of the experiment: the leaf disks were left out exposed and other animals could have influenced results. If this experiment was repeated, a barrier should be placed around the leaf disks to try and eliminate outside disturbances.
Comparing the Floral Community, Surface Temperature, and Substrate pH of Four Atta texana Colonies: Do These Factors Influence Colony Location?
Sean Watson – S01

In this study I examined four different Atta texana colonies at Brackenridge Field Laboratory and at Barton Creek Wilderness Park to determine if the surrounding vegetative communities, surface temperatures, and substrate pHs were similar. At each colony, I determined the dominant woody species present within a 25-meter radius. I then used a HOBO data logger to measure the surface temperatures and a soil analyzing kit to measure the soil pH. Overall, I found that the woody species and surface temperatures between the BFL and Barton Creek colonies were significantly different, however, the soil pH were similar.

Friends of Foes? A look at the Hackberry Psyllid and the Hackberry Butterfly
Karelys Diaz – S01

Many organisms call the sugar hackberry (Celtis laevigata) their home, including gall making insects. Galls are abnormal growths of plant tissue caused by a wound, infection by a microorganism, or the feeding and laying of certain insects and mites. This experiment takes a closer look at petiole galls of the hackberry trees to answer the following questions: 1) Exactly which insect is responsible for all of the hackberry petiole galls that covered the trees earlier in the spring? 2) What other insects might be competing for the habitat? 3) What kind of relationship do they have? I collected 1,000 petiole galls from Brackenridge Field Laboratory over the course of five days.

Deer Population Estimate Techniques
Ferguson – F01

Large populations of any organism can have adverse effects on the organism’s environment, the population itself, as well as other organisms or populations. When a population begins to reach its habitat’s carrying capacity, changes in the population occur as a direct result. Currently, the population of Whitetail deer (Odocoileus virginianus) at Brackenridge Field Laboratory (BFL) is approaching the carry-capacity of the field laboratory. The purpose of this study is to assess the relative accuracy, efficiency and expense of three methods of conducting population estimates: the drive census, automatic cameras, and video and visual surveillance of
the deer. The drive census data yielded an estimate of 68 deer: 26 males with antlers, 30 does, and 8 fawns. Four deer that had died were also added to the count, 1 male with antlers, one fawn with buttons (budding antlers), and 2 does. The dead antler- male was added to the male count to equal 27 males with antlers. Fifty-four photos of bucks, from 10 rolls of film, were analyzed and separated into 22 different individuals. Five more individuals could be accounted for by sightings and antler sketches. The photos and sketches could account for exactly 27 antlered bucks, which accounts for the 27 counted during the drive census. From the video and visual surveillance, roughly 19 individuals were accounted for total, however, if treated as a visual mark-release-recapture, the population is estimated to be 30 individual bucks, ~11% over the population counted. The camera, visual and surveillance methods of counting deer seem to be very nearly as accurate as those for the drive census. However, a good method would ideally yield estimates above the drive census estimates, because as a result of deer that may have snuck past or hid; the census count is a minimum population estimate.

A study of the distribution and microhabitat of the Texas Spiny Lizard (Sceloporus olivaceus) at Brackenridge Field Laboratory, University of Texas, Austin and an evaluation of capture techniques
Scott Henry – F01

This study was based, in part, on research conducted by Blair from 1951 to 1956 in a 10-acre tract near Austin. During that 5-year period he and his team of graduate students collected and marked over 3000 individuals. The current study was designed to use the capture techniques outlined in his study and apply them to Brackenridge Field Laboratory grounds. In this study I will examine the following questions: 1) Does the Texas spiny lizard occur on BFL grounds? 2) If it does, where is it located on BFL grounds, what is the preferred habitat? 3) What is the most efficient capture method to use for these lizards? The original intent of this study, conducting an MRR population study, proved to be not viable and was discontinued. The focus of this new study, an evaluation of capture methods and a description of the microhabitat in which there is the greatest probability of capturing a specimen, will provide important background data enhancing the effectiveness of any future MRR studies. No captures were recorded in any of the trapping methods examined, however, twelve individuals were observed during the visual survey. The types of microhabitats where these lizards were observed varied slightly with regard
to the tree species occurring in them, but for the most part all were very similar. The main characteristic was the presence of a slightly elevated open area, usually on the edge of a wooded area, which received direct sunlight.

**A Comparison of the Percent Mycorrhizal Infection Between a Native Grass, Little Bluestem (*Schizachyrium scoparium*) and an Exotic Grass, King Ranch Bluestem (*Bothriochloa ischaemum*)**

Caimee Schoenbaechler – F01

Mycorrhizae has been shown to greatly enhance the ability of plants to uptake nutrients that are relatively immobile and present in low concentrations in the soil solution. They have been found to protect plants from excessive uptake of salts and toxic metals in saline, acidic, or contaminated soils. In return for these services, the fungi obtain sugars directly from the plant root cells. The exotic species King Ranch Bluestem has received much attention resulting from its apparent superiority to American forms with respect to quality, production, and persistence under grazing. The purpose of this study is to determine if there exists a difference in the mycorrhizal infection between the native grass, Little Bluestem, and the exotic grass, King Ranch Bluestem, and if this result can provide insight to the success of these particular species. Ten clumps of each grass were carefully dug up to keep the roots intact. The roots were stained and observed under a microscope to observe if any roots were infected with mycorrhizae. The Mann-Whitney U Test showed that there is no significant difference in the percent infection of mycorrhizae between these two grasses at BFL (p = 0.115). Ninety-two percent of the observed roots of Little Bluestem were infected with mycorrhizae, while 84% of the observed roots of King Ranch were infected. These results indicate that the exotic King Ranch Bluestem has more success for reasons other than mycorrhizae help.

**Effect of Deer Grazing on Plant Biomass, Soil Density, and Soil Water Content at the Brackenridge Field Laboratory**

Michelle Tran – F01

The overpopulation of a species can be detrimental to its community. Once an organism has reached the carrying capacity, the ultimate result is in the downfall of its own population. The recent white-tailed deer population at Brackenridge Field Laboratory of Austin, Texas has
had a considerable effect on the flora due to the increase in deer browsing. Prior studies have shown that plant biomass has a correlated effect on soil and its contents. This study was done to observe the effect deer has on plant biomass, soil density and soil water content at Brackenridge. Based on results, I found no correlation between the effects of deer herbivory on soil density and water content. That is not to say that there is no effect at all, however. The study sites for this experiment are not well representative of BFL as a whole which may have made data insignificant.

**Red Admirals and Parietaria**

*Sarah Alkhalifa – F01*

A noticeable increase of Red Admiral butterflies has been observed in recent years at Brackenridge Field Laboratory. A possible cause for this rise could be due to a recent increase in the growth of Parietaria which is a host plant for the butterflies. This study aims to uncover any patterns of the Red Admiral caterpillar distribution on Parietaria at BFL. Specifically, I aim to determine if the butterflies prefer to deposit their eggs in areas with higher Parietaria density and ground coverage and if yes, does the proximity of Parietaria to the butterfly fruit feeders influence the amount of caterpillar activity found in areas near the feeders. A total of 40 random samples from areas near the butterfly fruit feeders and away from the feeders were taken for study. Parietaria coverage and caterpillar activity were recorded for each sample. Overall, the data collection was not sufficient to make conclusive statements about egg depositing and caterpillar activity patterns, however, there does seem to be a direct relationship between evidence of caterpillar activity and the amount of Parietaria ground coverage.

**Analyzing patterns of distribution between Solenopsis invicta and Solenopsis geminata**

*Benjamin Labay – F01*

The fire ant *Solenopsis invicta* Buren invaded southeastern United States from South America more than half a century ago. Agricultural and ecological consequences of the invasion are well documented; however, the mechanisms behind the colonization in perspective of competitors is poorly understood. In this addition to the understanding of equilibrium community stability, distinct distribution patterns were observed between the imported fire ant *Solenopsis invicta* and its native congener *Solenopsis geminata*. A large population of the native fire ant, *S.
*geminata* was observed in an old neighborhood, surrounded by heavily infested *S. invicta* areas. Information provided by this study is important in characterizing the effects of habitat on the distribution of the imported polygyne fire ant.

**Does Cactus Patch Size and Degree of Isolation Influence Quantity and Diversity of its Resident Insectan Predators?**

**Marigny Manson – F01**

The Island Biogeography Theory predicts dispersal patterns from the mainland to islands of various sizes and distances away. This same theory can also be used to predict dispersal patterns from large vegetative patches to other vegetative patches of the same species at some distance away. In this study, I treated the cactus *Opuntia lindhermeri* as a series of islands and observed how a cactus’ volume impacted the abundance and diversity of Hemipterans, Diptera, and Coleoptera found with reference to the distance to and volume of its nearest neighbors. I predict that the largest number of insects would be found on large cacti closely bounded by other large cacti. 20 groups of cactus pads, each isolated by at least 2 meters, were chosen for this study. For each group, its volume, distance from its edge to the edge of all other cacti within 8 meters, volume of all nearest cacti, type and the approximate number of insects found on it were all recorded. There was no significant correlation found between any of the tested variables. However, the strongest correlation was between plant volume and the number of individuals. It may be beneficial to conduct more studies and include other plants nearby that may also be attracting insects.

**Hacking Down the Hackberries: A study on tree ring width of Hackberry (*Celtis laevigata*) and sun light availability**

**Andrea Bowling – F01**

Plants are dependent on many resources to help them grow and be healthy. In this study 5 we looked at light as a resource and asked if hackberry trees (*Celtis laevigata*) grow more (indicated by ring width) in more sunlight as opposed to under the canopy of live oak (*Quercus virginiana*). We also looked at hackberry trees that had once grown under the canopies of oaks, and when the oak died of oak wilt, the hackberries started receiving more light. To do this we cut down fifteen hackberry trees from three different environments, open, shaded, and shade
released and compared the ring width of all the trees. We found that trees grown in the open generally have a higher mean ring width than trees grown in the shade, and shade released trees correspond well to those patterns of shade and then open light availability.

The use of biomass to calculate carrying capacity of white-tailed deer (Odocoileus virginianus) at Brackenridge Field Laboratory in Austin, TX

Jayson Matos – F01

Biomass can be used to calculate the annual primary productivity which can then be used to make predictions about a species, population, or community. In this study, I attempted to calculate the primary productivity to determine the carrying capacity of the white-tailed deer population at Brackenridge Field Laboratory. I sampled the biomass of 14 previously established enclosures as well as at a location adjacent to each enclosure. At each location, a circular plate was randomly placed and the plants within the area covered by the plate were collected and dried. Overall, the average biomass inside the enclosures was 5.4 grams while the average outside the enclosures was 2.97 grams. Based on this data, I then estimated that the primary production available at BFL was 2.61E7 gC/yr and the deer population was harvesting about 45% of the primary productivity. I then found that the estimated carrying capacity of deer to be 88 deer. The deer population is already at 70 deer and the browsing line is quite noticeable, indicating that the deer population is close to carrying capacity.

The Northern Cardinal (Cardinalis cardinalis) at Brackenridge Field Lab

Kaci Richardson – F01

In this study I aim to create a baseline of information on the Northern Cardinal (Cardinalis cardinalis) population at Brackenridge Field Laboratory. More specifically, I wanted to determine if the cardinals had call preferences. Ten data sessions in the morning (6am-8am) and ten data sessions in the evening (6pm-8pm) were conducted at randomly selected regions at BFL. The vegetation they were found in, height from the ground, and whether morning or evening calls were preferred were also recorded. Overall, I found no significant preference for morning or evening calls. I did find that vines were the dominant type of vegetation the cardinals were found and that the birds preferred heights less than 15 feet. Future studies should collect
morning vs. evening call data at a different time of year as territories and mates were already established when I conducted this study.

**Pollinator Distribution Between Three Species of Compositaceae**

**Alegra Bartzat – F01**

While most flowers have evolved to be generalist pollinators, some have evolved to be specialists only pollinated by one insect. In this study, I examined the pollinator distribution of three different species in the family Compositae: *Verbisina enciloides*, *Verbisina virginiana*, and *Eupatorium spp.*. I predict that *V. virginiana* will attract a greater diversity of pollinators and more generalists than either *V. enciloides* or Eupatorium sp. Because the microhabitat *V. virginiana* tends to grow in is available to pollinators that search in both open, sunny areas and shaded areas. Insects were collected using a butterfly net and observed for pollen on their bodies to confirm that they were in fact pollinating the plants. Results showed that *V. enciloides* actually had the highest species richness and *V. virginiana* had the lowest. However, after searching for pollen grains on the collected insects, *V. virginiana* had the highest species richness of insects with pollen. More accurate sampling must be done to make any decisive claims, however, as pollen grains could have easily fallen on the collected insects.

**2002**

**Examination of the Effects of Interspecific Competition and Herbivory on Grassland Forbs and Grasses Found at Brackenridge Field Laboratory**

**Alonna Beatty – S02**

Herbivory and interspecific competition are each distinct processes with varying effects that can act dependently or independently of one another. We ran this experiment using several plots in a grassland area at Brackenridge Field Laboratory, Austin, Texas. Each plot is affected by two separate treatments to help us examine the effects of both competition and herbivory separately and in conjunction with one another. Due to deer preference of forbs, I hypothesized that forb density and biomass would be greater in deer exclosures. Due to the fact that there are so many variables to account for, the most effective method of examining the effects of herbivory by deer and interspecific competition may be to gauge the individual response of each species in the various treatments of the plots. Three pairs of adjacent circular plots were set up in
a grassland area and divided into three sections. Each of the three sections were treated by removing all grass, removing all forbs, or leaving all grass and forbs (control). For each pair, one plot was enclosed in a wire cage to prevent herbivory from deer.

*only intro and methods*

**Intelligent Quadrant, Random Quadrant, and Linear Transect Methods: A Comparison of Sampling Efficacy for Total Plant Surveys**

Sam Collier – S02

This study compared the efficiency and accuracy of modified versions of the quadrant and transect sampling methods and provides a complete dicot species count for Brackenridge Field Laboratory. Six subdivisions with differing dominant species in the upper meadow were chosen for the quadrant sampling method. Six fifty-meter transects were then created across the upper meadow to provide sampling of both ends of the meadow. Six random coordinate quadrants were also chosen for sampling. Dicots collected from each method were pressed and tallied. Known specimens that were missed were then collected on a walkthrough of the area. Because there was no total species count completed in each quadrant/transect, the discussion is limited to species accumulation. After completing and compiling results from each survey, it demonstrated a lack of sampling intensity. After six samples of each method, the total specimens collected was nowhere close to the overall total number of species actually present. For future studies, a more detailed preliminary assessment of the study site should be implored to guard against being deceived by vegetative patterns that are really very similar.

**Subterranean Fauna as an Indicator and Potential Driver of “Ecological Integrity” at Brackenridge Field Laboratory**

James Justus – S02

The term ‘ecological integrity’ has been coined to capture the general concept of the health of an ecosystem. This experiment tests whether subterranean earthworm, arthropod, and insect diversity and abundance are an adequate ecological integrity indicator for two areas of Brackenridge Field Laboratory. Soil samples were randomly collected from two areas within BFL that contain relatively dry soil. The first area is a Chinese privet (*Ligustrum sinense*) monoculture in the north east region of BFL (B, Picture 1). The second area is a healthy, high
biodiversity, high ecological integrity area approximately 150 meters north- northwest from the first (A, picture 2). The soil samples were sifted, and abundances of the subterranean fauna was recorded. A significant difference between the point diversity, soil moisture, subterranean diversity and abundance was demonstrated in an area of high ecological integrity and an area of low ecological integrity dominated by an exotic species (*Ligustrum sinense*). This supports the idea that subterranean abundance and diversity is an ecological indicator. However, little can be said explaining the differences between the two areas due to a number of factors that were not accounted for.

**The Impact of Competition and Herbivory on Plant Productivity**

**Alexa Lim – S02**

Interspecific competition and herbivory have both been identified as impacting plant productivity. Plants all compete with each other for resources needed for growth, however, different plant species have different levels of herbivory. In this study, I wanted to determine if there would be a difference between enclosed and open biomass production due to browsing pressure from deer at Brackenridge Field Laboratory. I expect for the enclosed biomass to be higher than exposed plots. I also looked at if certain species would have higher productivity and what effect species would have on each other in control plots. A total of twelve plots were chosen within a grassland area at BFL. Each plot with divided into three sections – one control, one with all grasses removed, and one with all forbs removed. Six of the twelve plots were surrounded by a wire cage to prevent deer herbivory. The plots were left to grow and were collected in late April 2002. Species were collected from each plot and weighed.

A significant difference between enclosed and open biomass, for both total biomass and on a plot-by-plot basis, was not detected. The forbs data analysis considered five species, and also showed no difference between the treatments and controls. However, there was a significant difference in the count and biomass for the individuals of the three grass species in both the enclosed and open plots. *Panicum fasciculatum* (Browntop Panic Grass) – a poor competitor – was not present in either the enclosed or the open treatments but was found in the controls. There was no significant difference in the interactions between grazing and competition, but it has been found that decreased grazing increases competition. The data is inconsistent with previous studies and expected outcomes. Much of the competition in plant communities occurs in the
early stages of growth. The plants in this study were pre-existing and not observed from seedlings. Therefore, the early, definitive competition may have been missed.

Misunderstood Moss: Does ball moss, *Tillandsia recurvata* (Bromeliaceae), provide a transient niche for insects in the Brackenridge woodlands?

Schonna Manning – S02

At Brackenridge Field Laboratory, *Tillandsia* tends to be predominant on live oak and juniper. A great deal is documented regarding the structure and function of bromeliads in tropical systems, although, the role of *Tillandsia* in the woodland ecosystem is still for the most part unspecified. This study reviews the insect communities at Brackenridge Field Laboratory associated with *T. recurvata* found growing on living substrate, the ground, and on manmade structures. A total of ten *Tillandsia* specimens were collected from each substrate throughout BFL. Each ball was teased apart and any insects found inside were preserved and identified. Results showed there was no significant difference found between the insect communities found in the *Tillandsia* for the three substrates. This pattern suggests that insect utilization is fairly common on the ball moss, even when located on inorganic substrate where foraging insects would not normally be found.

Effects of Herbivory on Resource Allocation in the Annual Wildflower *Coreopsis spp.*

Walt Meitzen – S02

Herbivory has caused many plants to evolve unique defense mechanisms. These mechanisms, however, require energy and resources which the plant then has to decide when to allocate resources to growth or to defense. White-tail deer at Brackenridge Field Laboratory like to browse on young *Coreopsis* plants. I hypothesize that the herbivory damage results in a decreased ability for vegetation and reproductive allocation, and the young plants enter into senescence prematurely. *Coreopsis* plant samples were taken from an area protected from herbivory and from an area with no protection. Plant size, number of inflorescences, stage of inflorescence maturity, and the number of mature seeds in capsules was recorded for each sample. The plants free from browsing pressure were significantly larger, had higher inflorescence numbers, had more seed per capsule production, and were more mature than plants subjected to herbivory. A future study of planting seeds from each group in a protected
environment would yield results that show these differences are due to environmental differences and not genetic differences.

The Deer Dilemma
Diane Mollaghan – S02

Demographic projections and predictions provide powerful tools for ecologists, enabling one to make more educated decisions about land management and conservation. The subject of this study is an enclosed population of Whitetail deer at Brackenridge Field Laboratory. The problem of estimating the Whitetail deer population growth trajectory at BFL is confounded by human intervention that took place in the spring of 2002, when 38 deer were removed from the population. We are therefore facing three intertwined problems, the first is to estimate the population trajectory prior to intervention, the second is to project how the present population will recover and finally how will the influence of the variability and fluctuations of productivity allow us to estimate a carrying capacity. Census data that had been collected over the years, skulls, molars, and antlers were all used to estimate the size and ages of the deer population. The data shows the population is in decline, likely due to having reached its carrying capacity. The most current estimate for the habitat’s carrying capacity is 37.42 deer, but multiple factors influencing the carrying capacity for this habitat requires further attention.

Do Butterfly Show Preference for Flowers
Ha Pham – S02

In this study, I observed different species of butterfly and their interactions with different flower species at Brackenridge Field Laboratory in Austin, TX. I wanted to determine if butterflies nectar on different flower species equally, whether butterflies had a preference for red, yellow, or blue flowers, and if certain butterfly species are generalists or specialists. Butterflies were caught and recorded by what flower they were by and were also observed on different days. Data was compiled to determine if there was a trend in nectaring patterns. The most prominent butterflies observed were the Dainty Sulphur, Orange Sulphur, Buckeye, Variegated Fritillary, and Swallowtail. The majority of the species of butterfly observed showed preference for one or two flowers (specialists) whereas the Variegated Fritillary overall did not show preference for
any particular species of flower. Replicating this study with observation data collected all on the same day may give more accurate results.

**Effects of *Solenopsis* Fire Ants on *Plethodon* Salamanders at Brackenridge Field Laboratory**
*Cameron Siler – S02*

The invasion of the imported fire ant, *Solenopsis invicta*, has impacted many native organisms. Among the many species of organisms affected by the ant is the Western Slimy Salamander, *Plethodon albagula*. This study was performed to investigate if there was any relationship between *S. invicta* and the *Plethodon* salamanders at Brackenridge Field Laboratory, focusing specifically on whether the ants pose a threat to the salamanders’ populations as well as limiting their distribution. An intense survey to locate the salamanders was performed. Once salamander locations were found, ant and soil samples were taken. For further data on the proximity of the fire ants to salamander locations, baits were set out at the salamander locations and the time it took for ants to begin foraging was recorded. The average times of bait discovery at salamander shelters was found to be significantly higher than the average times of bait discovery for the different habitats. This could show that the ants do have a negative effect on the salamanders and in response; the salamanders located themselves in environment that is harder for the ants to forage in. Distances between salamander locations and the nearest ant mound, however, suggested that the salamanders were not as distant as possible, which could lead to the interpretation that *S. invicta* have no effect on the *Plethodon* salamanders. The results do not conclusively support the *Solenopsis* sp. ants having a negative effect on the *Plethodon albagula* salamanders, nor do the results fully show this interaction to not occur. Whatever the reason may be for the restricted locations of *P. albagula* individuals at Brackenridge, further studies should be performed to investigate whether the species is threatened within the preserve.

**Red Admiral Butterfly *Vanessa Atalanta* interactors with its parasitoids and host plant *Parietaria***
*Tasmin Smith – S02*

This observational experiment attempts to better interpret the interaction between Red Admiral larvae with its parasitoids and its host plant *Parietaria* within Brackenridge Field
Laboratory by examining two main null hypotheses: there is no difference between habitats and there is no difference between transects. The parasitoid interaction with habitats was found to be driving the results and more parasitoids were found in the woody habitat than in the old pasture than in the upper terrace. There were significantly more parasitized larvae found than live larvae in three of the four habitats with *Parietaria*, and this was not explained by total *Parietaria* distribution. There is also an inverse relationship between larval evidence and larval and parasitoid populations. In Spring of 2002, the parasitoid populations are in a dramatic increase while minimizing the Red Admiral butterfly populations.

**The Effects of Parasitoid Phorid Flies on Fire Ant Behavior**

Elizabeth Alegria – F02

Since its introduction, *Solenopsis invicta* has spread all over the southeastern United States as a direct of its foreign origins. Since there are no natural enemies in its introduced area, the population sizes of the *Solenopsis invicta* have increased dramatically and they are continuing to increase faster than their native counterparts, *S.geminata* and *S.xyloni*. A popular population control method is the tiny parasitoid flies from the family Phoridae. These “ant-decapitating” flies specialize on ants, thereby helping reduce the ant population levels. In this experiment, the effects of attacking female phorid flies *P. tricuspis* on the foraging activity of *S. invicta* were measured with respect to natural food items (dead crickets) and a substitute (piece of hotdog). Temperature and humidity were also recorded at each of these sites by using HOBOs. We also observed the host specificity of *P. tricuspis* in an area containing both native and imported fire ants. Results showed that the phorid fly’s parasitism had profound effects on the fire ants and is a viable method for population control of *S. invicta*. A notable observation, however, was that the flies did not discriminate between *S. invicta* and native fire ants which could be problematic.

**The Protection Effect by Wild Onion, *Allium spp.*, on Grasses and Forbs from Herbivory by the White-tailed Deer**

Amber Andel – F02

Producers, on an ecological scale, compete among one another from a trophic level perspective, fighting for resources and space. Many observations, however, have been made in
which one plant finds refuge from herbivory by living amongst another plant that possesses characteristics to reduce primary consumption, whether by its general phenetics (i.e., spines and thorns) or toxicity. The wild onion contains a toxin, N-propyl disulfide, used as a secondary compound adapted for defense against herbivory. Deer tend to steer clear of eating the wild onion due to the toxin, which in turn protects other plants growing near the onion from herbivory. I analyzed before and after measurements of individuals plants, both with and without wild onion growing in close proximity, to study the effects of herbivory by the white-tailed deer. Clumps of wild onion were planted in five exclosure sites. The height of ten plants was taken initially and again after 4-6 days to measure any herbivory. Control plts showed a significant decrease in plant height due to their exposure to herbivory. Two of the five experimental plots, however, also exhibited losses in plant height. The experiment may have been too short to fully observe any protection the wild onions could have offered to the other plants. Perhaps a longer study where the onions are able to integrate themselves fully may provide better insight.

Comparing photosynthetic characteristics of invasive and native plants in Central Texas

David Bethel – F02

Invasive species can have a substantial negative impact on an ecosystem as they compete with native species, often displacing or driving the native species to extinction. In either sun or shade, a plant may be more successful than competitors by having higher photosynthetic rates for a given light level, or in other words, higher photosynthetic efficiency. Photosynthetic efficiency can be measured by the slope of the light response curve below the saturation point. In this experiment, I generated light response curves for two native (Ilex vomitoria and Berberis trifoliata) and two invasive species (Ligustrum sinense and Nandina domestica) of plants in Central Texas. I sampled each species in both sunny and shaded habitats, and then compared photosynthetic characteristics between invasive and native plants in each light environment. I specifically considered three hypotheses: 1) That invasive species in sunny habitats have higher photosynthetic rates at saturation, enabling them to be good colonizers. 2) That invasive species have lower compensation points, allowing them to outlast native competitors in low-light scenarios. 3) That invasive species have higher efficiency in both light environments, making them better competitors. Results showed both invasive species had higher rates at saturation than either native plant which indicates that the invasive species can adapt to thrive in high levels of
sunlight. Both native species, however, had lower compensation points than either invasive plant which contradicts my hypothesis and suggests that the invasive species may not do as well in low-light areas. Both invasive species had higher photosynthetic efficiencies in the sun, however, *L. sinense* had lower efficiency than one of the native species (agarita). The trends seen in this report support the idea that invasive species have photosynthetic traits similar to other sun-tolerant colonizing species.

**Factors determining diversity and abundance of mosquito larvae (Order Diptera: Family Culicidae)**

**Susan Cameron – F02**

Mosquitoes are particular about their breeding places as some species prefer tree holes, some prefer salty water, and some prefer open containers. In this study, I analyzed factors affecting mosquito breeding site choice and its effect on diversity and abundance of mosquito larvae. I hypothesized that the amount of sunlight a site received would affect the abundance and diversity of mosquito larvae and that the amount of light a container received (whether it was open or closed) would affect the abundance and diversity of mosquito larvae. Glass bottles filled with water were set up with one of following treatments: sun and foil, sun and no foil, shade and foil, shade and no foil. Contents from the bottles were preserved in ethanol so any larvae present could be identified. Analyses showed that the amount of sunlight was a significant factor in determining the presence and abundance of mosquito larvae. The shade/foil treated bottle had the highest abundance of larvae while the sun/no foil had the lowest. A repeat of this study in the spring or summer may provide more details on mosquito larvae abundance and breeding ground choices.

**Analysis of Habitat Factors of Hair Cap Mosses (genus Polytrichum) on Brackenridge Field Laboratory**

**Greg Evans – F02**

This experiment attempts to test whether *Polytrichum* has a preferred habitat at Brackenridge Field Laboratory and to determine if temperature, humidity, and average light levels influence habitat choice. I hypothesized that experimental sites will have higher temperatures due to the metabolism and photosynthetic activities of mosses. I also expected to
find higher humidity levels on experimental sites due the extremely large boundary layer created
the mosses and for there to be lower light concentrations on the experimental sites, due to
desiccation issues. Temperature appeared to be the most important environmental factor tested in
this experiment. Surprisingly, experimental sites had a lower average temperature in most cases.
It was expected that experimental sites would have higher average temperatures, however, the
statistical analysis showed this trend to be significant (p = 0.0411). Humidity and the average
light levels had no significant difference between control and experimental sites. However, this
test may need to be repeated at different times of the year due to possible changes in the canopy
which could let more or less light in.

Initial investigation of nine-banded armadillo (Dasypus novemcinctus) populations at
Brackenridge Field Laboratory
Kathryn Goodyear – F02

Despite the ecological significance of the nine-banded armadillo as an indicator of
change and as one of the key mammal species at Brackenridge Field Laboratory, very little is
known about the population. In an attempt to answer one of the more fundamental questions
about armadillo activity – the correlation between their foraging sites and their burrowing sites –
I examined previous experiments on armadillo foraging behaviors done at BFL. In May 1999
and December 2000, attempts were made to relate either soil quality or worm activity to
armadillo burrow distribution patterns. Neither experiment resulted in any positive correlation.
Dismissing prey availability as the criterion of burrow location, armadillo activity was assessed
in an attempt to aid future studies of armadillo burrow site choice. The GPS coordinates of 10
prominent armadillo burrows were taken and cameras were set up. Den breadth and height were
measured for each burrow and string was placed in front of each to determine if they were
“active” burrows or not. Photographical evidence suggested that these were no longer armadillo
dens as raccoons were observed frequently at them. Armadillos are known to disperse over time,
and their abandoned burrows are often subsequently inhabited. Future studies done with
armadillos that have radio collars could provide more accurate information about burrowing
behaviors such as how long they stay at one burrow.
Food Selection of the Red Imported Fire Ant (*Solenopsis invicta* Buren)

Clark Jones – F02

As the range of fire ants increases, they become a greater threat to the health of many individuals. Understanding the foraging tendencies of the fire ant, *Solenopsis invicta* Buren, is a key element if we are to attempt to control and/or predict the behavior of these ants. This experiment was conducted to determine and illustrate the feeding preferences of the red fire ant *Solenopsis invicta* Buren. Tests were conducted using three separate colonies of ants. Each colony was presented with four separate categories of food types which included lipid, starch, sugar, and protein. An additional presentation of a combination of all four types was also provided at the same time. Two colonies (referred to as Piggy and Kase) used in the experiment produced results that yielded no information about feeding trends. A third colony (Ska) exhibited preference for the lipid, but this preference was not statistically significant. The behavioral, but statistically insignificant trend of the fire ant preferentially feeding for the lipid indicates that fire ants presented with a choice of foods equidistant from the colony will consume foods of this preferred form.

Population Structure and Peak Reproductive Age of the White-Tailed Deer (*Odocoileus virginianus*) at the Brackenridge Field Laboratories

Cody McLarty – F02

The study of population structures is an important aspect of habitat management and population health. A population that grows out of control will eventually alter the habitat it thrives in, causing detrimental effects to the habitat and very possibly to that population of organisms. A good example of this is the population structure of the white-tailed deer (*Odocoileus virginianus*) population and its ability to grow and surpass the carrying capacity of its habitat. This study was done on the white-tailed deer population at the Brackenridge Field Laboratories (BFL) in the fall of 2002. A deer census was conducted for the past four years, showing that the deer population has been growing exponentially. Static life tables were constructed in order to study the population structure and the peak reproductive age of the white-tailed deer at the BFL. I hypothesized that the deer at BFL have a Type I survivorship curve, that the population has surpassed its carrying capacity and has begun to decline, and that does are most reproductive in mid-life around 7.5-8 years of age. Data showed the deer have a decrease in
mortality with an increase in age which suggests the BFL population has a Type I survivorship curve. The carrying capacity was estimated to be 37 while the capacity from 2001 was 68. This suggests the deer have, in fact, already reached their carrying capacity and their population in declining. Reproductive performance was also found to increase at around 7.5-8 years of age. Continuing to study population dynamics is of utmost importance so as to ensure browsing pressure does not become too high and begin to threaten certain plant species.

Observations of Insects Visiting *Colubrina texensis*

Rachel Racicot – F02

Insects and plants rely on each other for nutritional resources and propagation. In early March and through April, the bush, *Colubrina texensis*, flowers at Brackenridge Field Laboratory in Austin, Texas, offering nectar to a variety of insect species. With this information, I wanted to observe insect diversity, preference, cues for emergence, and whether they had a generalist or specialist relationship with the bush. Insects were collected from C. texensis bushes at Brackenridge Field Laboratory in Austin, TX. The collected specimens were then identified, and a species accumulation curve was made to project total diversity. A total of 71 different species were collected with 69 of them being collected directly from C. texensis bushes. The species accumulation curve showed a linear relationship between sample and accumulation of species. This indicates further sampling is needed, including accounting for number of individuals of each species, to find the total species diversity on *Colubrina texensis*.

Successional patterns of invasive *Ligustrum sinense* based on available sunlight in the sloping forest habitat of Brackenridge Field Laboratory

Cheryl Rosel – F02

Monitoring invasive species is important as they can have devastating impacts on local ecosystems because they have no natural predators. Many invasive plant species are introduced to an area for ornamental purposes and can quickly spread if left unchecked. One such species is *Ligustrum sinense* which is found in abundance at Brackenridge Field Laboratory. Removal of this invasive plant has been unsuccessful, however, there appears to be differences in the level of success when comparing removal between habitat types. I predicted that *L. sinense* would prefer the partially shaded areas of the sloping forest habitat at BFL rather than fully shaded areas. I
walked throughout the sloped forest area and took GPS coordinates of adult Ligustrum plants, then used a fisheye camera and Light Gap analyzing software to determine the percent canopy openness. Based on the collected data and results, I found that light did seem to be a limiting factor in the success of young *L. sinense* plants on sloping land. I believe water and nutrient runoff leaves fewer resources available for the plants to use, making the sloping forest an unideal habitat for Ligustrum.

**Overview of Spiders at BFL**

**Reister R – F02**

In this paper, I aimed to compile a set of baseline information of the wolf spider population at Brackenridge Field Laboratory. To obtain samples and habitat preferences, I used three different collection techniques. I first walked throughout BFL and collected and recorded spiders in a number of habitats. I then used a sweep net and collected any spiders I caught into vials. The final collection method I used was pitfall traps in differing habitat types. Initial collection results showed that the wolf spiders were overwhelmingly the most abundant. I then caught and marked 20 wolf spiders and released them and allowed them to disperse for four days. I then caught 20 more wolf spiders, five of which were marked. I used a slight variation of the Mark Release Recapture method and estimated the overall wolf spider population of the area to be about 80 spiders. This study may serve as a baseline for more complex spider studies done at BFL in the future.

**Demography of Deer**

**Mollaghan D – F02**

Demographic projections and predictions provide powerful tools for ecologists, enabling one to make more educated decisions about land management and conservation. The subject of this study is an enclosed population of Whitetail deer at Brackenridge Field Laboratory. The problem of estimating the Whitetail deer population growth trajectory at BFL is confounded by human intervention that took place in the spring of 2002, when 38 deer were removed from the population. We are therefore facing three intertwined problems, the first is to estimate the population trajectory prior to intervention, the second is to project how the present population will recover and finally how will the influence of the variability and fluctuations of productivity
allow us to estimate a carrying capacity. Census data that had been collected over the years, skulls, molars, and antlers were all used to estimate the size and ages of the deer population. The data shows the population is in decline, likely due to having reached its carrying capacity. The most current estimate for the habitat’s carrying capacity is 37.42 deer, but multiple factors influencing the carrying capacity for this habitat requires further attention.

2003

The differential distribution of *Anaea andria* (Nymphalidae) larvae on its host plant, *Croton fruticosus*, in Central Texas

Laura George – S03

Utilization of a specific host plant is a common occurrence in phytophagous insects, such as butterfly larvae. *Anaea andria* (Nymphalidae) uses *Croton fruticosus* (Euphorbiaceae) as its host plant and location of oviposition in Central Texas at Brackenridge Field Laboratory. This study aims to determine if a differential distribution of larvae exists on the *Croton fruticosus* population based upon location in either light or shade and either along open trails or in more densely wooded locations in one area of BFL that could be related to a preference in oviposition. It also examines the pattern of distribution of *Croton* plants in the area to determine if it is different from random. The number of larvae or evidence of previous existence of larvae on the plant was recorded as well as the light and wooded conditions of the location for an area with an abundance of *Croton* plants. Although statistical analysis of the data did not yield significant results, there remains a very obvious pattern in the distribution of larvae on individual *Croton* plants in different habitat types. This clumped distribution of *Croton* individuals along the roadside and in light gaps in the woods could have arisen for a number of reasons. Frequency data also showed a strong pattern favoring the presence of larvae on plants located in either light or in edge habitats or both. Plants in both shade and woods were much more likely to have no larvae on them at all. Plants in the shade and/or woods that were used as host plants were also much less likely to have multiple larvae on them.
A population Study of *Euptychia cymela*

Mike Marshall – S03

The presence of *Euptychia cymela* at Brackenridge Field Laboratory is recent, and thus I decided to conduct an initial population study. To perform a thorough population study, I posed the following questions: 1. What is the estimate of the total population size at BFL? 2. What type of habitat are they utilizing? 3. What is their habitat range at BFL? 4. Are there any factors that appear to be limiting their range? 5. What is their host plant and food source? To determine population size, the Schnabel technique of mark and release was utilized. GPS coordinators were taken of the captures to determine habitat and range. Hotdog baits were placed near the host plant to determine if *Solenopsis invicta* played any role in limiting *E. cymela* range as they lay their eggs on the ground. I consulted literature on *E. cymela* and looked for *E. cymela* herbivory damage in the field. I estimated the population to be approximately 262 individuals. I determined that they reside in the old quarry and lower terrace habitats at BFL and that the butterflies are most abundant in Juniper woodland areas and edges. A chi-square test showed that *S. invicta* may be limiting the distribution of the butterflies. Based on literature, it was determined that the host plant was *Dichanthelium dichotomum*. Heavy larval damage was found on many *Dichanthelium* plants which supports this claim. In conclusion, I believe this sudden appearance of *E. cymela* at BFL is due to a founding event in the immigration of a small population from a larger metapopulation.

Diversity and Roles of Insects on *Colubrina texensis* at BFL

Olya Shuhatovich – S03

The goal of this study was to look at the species diversity on *Colubrina texensis* using a species accumulation curve and to find out what the role of animals on this plant is – whether they serve as pollinators, thieves of pollen, flying or watching predators or simply as nectar collectors. Specimens were collected from the plants at ten different trials and identified. A total of 116 specimens were collected with 44 different species. The relative abundance curve shows a great diversity of species that were present on *C. texensis*. According to the data, the most popular species present during the sampling period are from Family Pentatodame, Coccinellidae, Lygaeidae, Lordellide, Myridae, Sarcophagide, *Apis mellifera*, and different species of
Trichopoda. This suggests that those species largely rely on *Colubrina texensis* as a source of nectar and habitat for mating and are perhaps pollinators of the plant.

**Dung Beetle Abundance and Behavior Compared with Deer Dung Densities across BFL**

Alison Benbow – F03

Dung beetles play a remarkably important role in their environment as they improve nutrient cycling, soil structure, and forage growth. The tunneling behavior of some dung beetles also increase the soil’s capacity to absorb and hold water. This study observes dung beetle abundance and behavior across Brackenridge Field Laboratory. I predicted that dung beetles would be found more frequently in areas of high dung density, that deer dung is concentrated in different densities across BFL and has a very high density overall, and that recruitment to both high density and low density areas is possible, even though the beetles are more frequently found in high dung areas. Seven transects were walked to locate areas with deer dung. Ten areas where deer dung density was high and ten where it was low were chosen to observe dung beetle activity. Fresh dung was then placed at undisturbed sites to test whether dung beetles would be found there the following day. An overall density calculation established that there is a very high overall abundance of deer dung at BFL and that areas with high and low densities do exist. Data also showed that dung beetle frequency is correlated with dung density; high dung density correlated with high dung beetle presence and vice versa. The last test showed that recruitment of dung beetles is also possible. Five of the seven spots where fresh dung was placed showed beetle recruitment within 24 hours.

**Differences in the Litter-Level Arthropod Community: *Juniperus ashei* vs. Mixed-Deciduous**

C. R. Britt – F03

The litter layer found on the forest floor plays a significant role within forest ecosystems. Most litter flows into the detrital pathway. Decomposition of litter is facilitated by the activities of the basal consumer trophic level of detrital food webs as well as macroarthropods. Groups of the basal consumer trophic level are an important food source for the aboveground pathway. This has an effect on the arthropods present in the litter level. The litter cover also produces a microclimate for flora and fauna. Forest succession has been observed across Central Texas.
With succession there is a change in litter properties. This is expected to have an effect on the arthropods present in the litter. In order to sample the arthropod community, 25 pitfall traps were placed in areas with a majority of *Juniperus ashei* litter and 25 pitfall traps were placed in areas with a majority of deciduous litter. It was found that there was a separation in the arthropods between the two litter types. There was also a difference in moisture content between the 2 litter types. As succession continues, there may be a shift in the arthropods present within the forest community at Brackenridge Field Laboratory.

**The Ashe Juniper and its Dispersion Patterns at BFL**

*Michael Garcia – F03*

The goal of this study is to find the dispersion patterns of the Ashe Juniper at Brackenridge Field Laboratory and the causes of these patterns, be it light intensity, soil type, water availability, etc. Also, I want to prove that the population of Ashe juniper rises as you move north across BFL. Four transects were walked moving north across BFL, and the following data was collected: canopy coverage, number of juniper trees present, any dead junipers, sizes of present junipers, and any signs of herbivory. Data showed that as one walked north the number of juniper trees grow exponentially. Results showed this increase could be due to the canopy coverage and soil type with closed canopies and rocky soil preferences.

**Nursing Effects on Succession**

*Bonnie Helms – F03*

The prickly pear cactus’ spiny leaves not only act as a defense mechanism for the plant itself, but can also act as a safe haven for other plants to grow in. The cacti act as nurse plants and reduce solar radiation, moderate temperature extremes in the air and soil, protect from herbivory damage, and much more. I hypothesized that the relative abundance of tree species would change from outside to inside the prickly pear patches and that the density of different tree species would not change from outside to inside the patches. Nine prickly pear patches were chosen and the number of tree seedlings inside and outside of the patch was recorded. The density of tree seedlings was determined by dividing the area by the number of seedlings present. There was determined to be a significant difference between the type of species inside and outside the patches. The abundance of cedar elm decreased from outside to inside while the
abundance of gum elastic increased from inside compared to outside. No significant difference was found in the density of seedlings from inside to outside the patches. This could indicate that the prickly pear patches are aiding in the process of succession by allowing the tree seedling to have a safe place to grow. To fully understand the effects of prickly pear as a nurse plant aiding in succession, a more long-term experiment should be conducted with a larger sample size.

Reproductive Strategies and Seed Predation in Malvaceae
Meredith McClure – F03

Reproduction is expensive in terms of resource allocation and involves tradeoffs between survival and fecundity to achieve maximum fitness. In plants, resource allocation is most often measured in terms of biomass; reproductive effort may be quantified by the ratio of biomass allocated to reproductive organs to vegetative biomass. Seed predation can often exert a strong influence on plant fitness, and plants have evolved a variety of strategies for coping with this negative interaction. This study will compare reproductive effort of three Malvaceae species found at Brackenridge Field Laboratory and the intensity of predation experienced by each. These comparisons will test the null hypotheses that predation levels do not differ among species (H1), biomass allocation to reproduction does not differ among species (H2), biomass allocation to seeds does not differ among species (H3), and number of seeds per plant does not differ among species (H4). For each Wissadula seed head collected, number of locules, evidence of predation in the form of exterior holes, and number of locules predated were observed. For each Turk’s Cap fruit collected, number of locules, fruit predation in the form of exterior holes, and seed predation in the form of pierced locules were observed. Evidence of predation and number of seeds was more difficult to determine in Rose Mallow; most seeds had already been dispersed at the time of observation, leaving only sepals. Holes in remaining sepals were judged as indications of predation. Absolute biomass allocation to reproduction and seed production were measured rather than the ratios of these values to vegetative biomass. Turk’s Cap avoids seed predation by producing fruits to satiate predators, and Wissadula produces large numbers of seeds, ensuring that a relatively large proportion avoids predation. The reproductive strategy of Rose Mallow may have evolved in response to different pressures; this species does not appear to be adapted to cope with seed predation in any aspect measured here. More detailed studies are necessary to discover the adaptive value of its method of putting forth seeds.
Myrmeleon sp. (Neuroptera: Myrmeleontidae): Spatial Distribution, Mass, and Pit Size
Corrine Polvado – F03

Two subpopulations of Myrmeleon larvae reside over two distinct habitats at Brackenridge Field Laboratory (BFL). In this paper, the two habitats are utilized to investigate spatial distribution in relation to habitat and size structure. The paper also investigates the correlation between pit size and ant lion mass. I tested whether there was a uniform ant lion density across the habitats, whether densities were uniform between pit size classes, and if pit size correlated with the mass of an individual. To measure pit density, spatial distribution, and habitat preference, sample points were randomly generated over the two habitat sites. Pit presence was equated with ant lion presence. Distance was measured in centimeters by a ruler (cm). The Point-Quarter Technique was used to collect data. Ant lion density was not found to be uniform between Site A’s sandy habitat and Site B’s gravel and sand habitat. Site A’s sandy habitat had an increased density per meter than Site B. Increased density in Site A suggests the sandy habitat is a favorable larval habitat compared to the gravel-sand substrate of Site B. Densities of small and large pits were found to be uniformly distributed over the gravel habitat, however densities of small and large pits were found not to be evenly distributed over the sandy habitat. Pit diameter was found to be correlated with individual’s mass. A significant difference in weight was found in comparing small pit individuals against medium and large pit individuals. A significant difference was not found in comparing medium pit individual’s weight to large pit individuals; however, this could be due to errors in data collection.

The Short-Term Effect of Diversity on Productivity in the Semi-Arid Climate of Central Texas
Jon Sarno – F03

Levels of productivity in a landscape are dependent upon several ecosystem and community processes, one of which is the level of diversity present in a community. Understanding the roles different components play in contributing to primary productivity will afford us the means by which to predict future patterns in landscape ecology. This study evaluated the short-term response of productivity to diversity in an effort to understand the initial dominant trends. The patterns were observed using three different seed types, a mixture of these,
and plots with no seeds over a nine-week time span. The trends were not expected to be static, and short-term findings are only indicative of initial patterns of dominance, but this does lead to a better understanding of the mechanisms at work in the ecosystem. The results of this short-term experiment lead us to conclude that levels of productivity are most likely a function of certain individual species ability to be more productive than others. The mixed samples observed may have only done so well due to their oat seed content. The oats may out-compete the legumes in such proximal plots and give the entire sample site the characteristics of a monoculture oat plot. The ability of the oats to do so well in a short period of time may be balanced if a longer survey was performed.

Demographic Analysis of the Population Dynamics of the White-Tailed Deer at Brackenridge Field Laboratory

Adam Witt – F03

Population ecology is primarily based on two attributes of living organisms: birth and survival. Demographic analyses of the relationships between these two factors allow ecologists to make projections that are important for wildlife conservation and management. The purpose of this study is to provide insights into the population dynamics of the white-tailed deer at Brackenridge Field Laboratory as these insights may help guide future management decisions regarding the white-tailed deer population. The deer census in the fall of 2003 shows a deer population of 39 individuals consisting of 22 does, 12 bucks, and five fawns. The low ratio of young deer (fawns and yearlings) to adult deer suggests that the deer population has possibly exceeded the carrying capacity of the BFL system and that natality and fawn survival has been reduced due to lack of sufficient food resources. Our value of $\lambda=1.23$ shows a population growth of 23% per year. This suggests that by the fall of 2004 the deer population may grow to 48 individuals without further management. Thus, it appears management needs to further decrease the size of the deer population.

Beno’re Experimental Meadow

Laura Young – F03

The Beno’re Experimental Meadow at Brackenridge Field Lab (BFL) provides an excellent opportunity to study grassland community dynamics. In addition to establishing a new
baseline of plant species composition and spatial distribution in the meadow, this study reviews the models of community development proposed in a previous study, and assesses community development in terms of 1) trends in grass species richness and composition, and 2) invasion of species from the surrounding woodland into the meadow, and from the meadow into the woodland. The first, and most significant finding is the failure of woody plants to invade the meadow. No juniper seedlings were found, despite the ubiquitous presence of mature juniper in the surrounding woodlands. *Schizachyrium scoparium* (little bluestem) has also spread to the meadow which may become an important indicator of community development. Long term and careful study of the key features of community dynamics, particularly soil development and species composition, will be important in the upkeep of the meadow. However, if the goal is also to understand what factors contribute to the establishment and maintenance of the historic habitat of the region – wooded savanna – more should be done than to simply monitor the status of various features within the meadow.

**A Snapshot of Succession: Three Phases of Vegetation in a Central Texas Woodland**

**Shria Hafner – F03**

Vegetative succession must be observed over a long period of time in order to get an accurate look at how the community is changing. This is due to the fact that many large, woody species have long lifetimes and take years to establish and integrate into a community. In this study, I analyzed areas at Brackenridge Field Laboratory that were once grasslands with large mesquite trees that are now currently dense, wooded areas. I used historic, aerial photographs that were once open grasslands to find my areas of study. These areas were then explored for evidence of mesquite trees. Any dead and live mesquite trees were marked on a map with GPS coordinates. The dominant canopy species were also recorded to see what species took over what used to be grassland. Results showed that the areas that used to be open grasslands had high densities of dead mesquite trees and hackberry trees now dominated these areas. This study shows three successional phases: the dead, standing mesquites, trees that have shaded them out, and the seedlings that represent a future stage. Woody encroachment in grasslands threatens many vegetative species, with this study exploring how it impacts the mesquite population in such an area.
Measurements, Analysis, and Predictions of the Plant (Eysenhardtia texana) and the Butterfly (Colias cesonia) at BFL
Zeina Bsaibes – S04

This study examines the relationship between the dogface butterfly (Colias cesonia) and its host tree, Texas kidneywood (Eysenhardtia texana). The dogface butterflies lay their eggs on the leaves which the larvae then eat, however, parasitic wasps prey on the larvae. The larvae that survive also pupate on the kidneywood trees. Males tend to emerge first and will wait and periodically check up on the females that have yet to emerge from the chrysalis. Based on this information, I hypothesized that there would be a significant distribution difference in parasitic wasp pupae on large trees versus small and that dogface larvae would then be mainly found on small trees. I also hypothesized that male butterflies would visit the females more frequently as temperature increases, but visitation frequency would not change with time (days). Kidneywood trees were categorized into small (<0.5m), medium (0.5m<x<1m), or large (>1m) and the presence of both butterfly larvae and wasp pupae was recorded. Male butterflies were observed for four days and the number of visits they made was recorded. Wasp presence was seen on almost every tree that had or showed butterfly larvae presence, however, there was no way to determine if the wasps were already there or if they were attracted specifically to the larvae. No difference in larvae counts between large and small trees was observed. Higher temperatures were also seen in conjunction with more male visits which supports my hypothesis. Contrary to my last hypothesis, over the course of the four day observation period, male visitation also increased which could be due to the fact that the females were getting closer to emerging.

Pattern of Regeneration in Juniperus ashei
Kevin Daude – S04

Although it seems as if adult Juniperus ashei produce a zone of inhibition below the canopy, the replacement dynamics are not well understood. This study attempts to understand the regeneration process of J. ashei present at Brackenridge Field Laboratory. Initial data collection included cutting down, measuring, and counting rings on a sample of four trees. Then, five transects were walked and the number of saplings along each was counted. From the cut tree rings, the junipers seem to show an exponential growth where the early life exhibits a faster
growth rate than latter years. Deciduous shade was also found to be significantly preferred by the junipers. These results may give insight to predict future locations at which juniper saplings may develop.

The Impacts of Deer Grazing on Plant Species Diversity
Jessica Douglas – S04

Many studies have investigated the relationship between the presence of white-tailed deer (Odocoileus virginianus) and plant species diversity, however, it is still uncertain whether their presence is a benefit or detriment. To further study the impacts of deer on plant diversity, deer exclosures were studied at Brackenridge Field Laboratory. The number of species and each species type was recorded for inside and outside of five exclosures. It was found that monocot species almost always dominated outside of exclosures and dicots dominated inside. This is consistent with previous findings that deer herbivory tends to shift the dominant species from dicots to monocots. No evidence was found suggesting that deer limit species diversity in the area. Species numbers were consistent across all categories studied. This data suggests that herbivory could be used as a tool for the restoration of destroyed grassland areas.

An Investigation of the Japanese Privet Population at BFL
Jacob Friesenhahn – S04

Exotic and invasive species are of particular interest to ecologists as they often outcompete native species due to a lack of predation. The Japanese privet (Ligustrum japonicum) is one such invasive shrub that is now found throughout Texas. I conducted a follow up survey of the Japanese privet population at Brackenridge Field Laboratory to determine distribution, size structure, and if any canopy associations were present. A total of 176 sites were surveyed along established transects at BFL. The main tree species of the canopy, canopy type (evergreen or deciduous), and canopy coverage (0-3) was recorded for each site. The nearest privet in each quadrant was then found and its size class noted. The privets were found to have a significant association with moderate canopy cover, juniper trees, and evergreen canopies. Based on this data, I predict that privets will continue to spread to areas of BFL where junipers and other evergreen trees are found. Continuous studies on privet spread should be conducted for management purposes.
Seed Size Selection and Habitat Preference Among Dove Species at BFL

Steven Gibson – S04

Brackenridge Field Lab is home to four species of dove, all in the family Columbidae. Mourning dove, rock dove, inca dove, and white-winged dove are all present at BFL year-round at rather conspicuous levels. All four species feed almost exclusively on seeds. The purpose of this study is to determine how this seed supply is divided between the doves of BFL. I hypothesized that the single resource of seeds is allocated amongst different dove species based upon seed size. I also hypothesized that the different habitats at BFL are preferred by different species, creating even more available niches to sustain the four species of dove. Mixed bird seed was separated into three class sizes: millet (small), milo (medium), corn (large) and sunflower seeds which were removed. Each kind of seed was placed at three feeding sites and the feeding behaviors were observed for 30 minutes. The results greatly supported my hypothesis that seed size selection was dependent upon species. It was found that inca and rock dove have different diet preferences from that of both mourning and white-winged. Additionally, there was a trend suggesting that inca and mourning dove are more likely to subsist on smaller seeds alone. The more generalist strategies adopted by the white-wings and rock dove may be better suited to urban environments giving them a slight advantage at BFL Strong trends also showed that seed resources are also divided amongst dove species by location and habitat. Feeder 1 has a disproportionately large abundance of white-winged dove (78%), feeder 2 seems to be a preferred site for mourning dove with 77%, rock dove comprised 39% of dove species at the lab site, and Inca dove represent 9% of the dove species feeding at the lab site. These trends suggest that white-winged dove prefer the thicker habitat, followed closely by mourning dove. Rock dove and Inca dove show the strongest affiliation for the lab site and this may be due to a preference for an urban style habitat.

Breeding Birds Survey of BFL

Steven Gibson – S04

In this study I aimed to complete a list of bird species that were currently breeding within Brackenridge Field Laboratory. I also included a list of which bird species were present and absent out of a compiled list of all species seen at BFL. The last survey was conducted in 1983
and since then, the structure of BFL has greatly changed. Vegetative growth has become thicker, so I predict bird species that prefer more dense vegetation will be more abundant while species that prefer open habitats will have decreased in abundance. I walked each of the pre-existing transects at BFL three times and stopped at 40-meter intervals to look and listen for avian territorial activity. The presence/absence survey was conducted simultaneously where I marked down whether a species was spotted or not. I observed a total of 47 bird species, four of which were late migrant species. Five species (Red-bellied woodpeckers, Yellow Billed Cuckoos, Titmice, Blue-Gray Gnatcatchers, and Wood Ducks) had increasing populations likely due to the increase of wooded areas. Differences between the previous 1983 study and this study could be due to human error as I may have simply missed some species.

A survey of an ant community: judging various hypotheses concerning increased ant diversity
Ahmar Hashmi – S04

Ant diversity and abundance are used as ecological indicators to assess the health and biodiversity of an ecosystem. An ant survey done earlier in the semester showed that the old quarry habitat at Brackenridge Field Laboratory had the greatest level of ant diversity. This study looks into what could have caused that. I hypothesized that the quarry habitat is actually a conglomeration of several sub-habitats. This habitat heterogeneity thus provides a large number of exploitable niches for a larger community of organisms. Different habitats were determined by dominant and subdominant trees. Ant baits were set out at each habitat and rockiness, tree types, canopy deciduousness, and the amount of leaf litter present were recorded. The three dominant environmental factors in this area are the presence of juniper, the presence of cedar elm and the amount of light that penetrates the canopy. The live oak and sugar hackberry do not affect the trends seen in this study. Rockiness and the amount of leaf litter found at particular bait sites do not affect the trends observed either. The conclusions that can be drawn from the data are that the ants are oftentimes relegated to certain areas of the quarry, given the type of habitat present in the different areas. Although the particulars of this distribution are not completely answered in this study, we can conclude that the general hypothesis (the notion of an increased number of habitats) is at work in the quarry. Perhaps extensive separation of habitats (namely, separations
of juniper and cedar elm dominated areas) over the length of the quarry will lend enough heterogeneity in the habitat to support the “refuge” hypothesis.

A Further Look at the Population of *Euptuchia cymela* at Brackenridge Field Laboratory

Michelle Keirstead – S04

*incomplete paper*

Observations of a population over time can show changes in its size and structure. In the spring of 2003, a population study was done on the butterfly species *Euptuchia cymela*. In this study, I also aim to complete a population study on the species and compare data with the data collected from the previous year. The population was estimated using the mark-release-recapture technique. A map of *E. cymela*’s predicted host plant, *Dichanthelium dichotomum*, was also made to observe butterfly activity around them.

The patterns of abundance and mortality in *Anaea andria* (Nymphalidae) larval instars within different habitats and host-plant distributions

Lisa Latson – S04

Host plant specialization among phytophagous insect species is important when attempting to determine the particular ecological needs and habitat requirements of the species in question. During the spring months of 2004, at Brackenridge Field Laboratories in Austin, TX, an unusually great number of *Anaea andria* larvae were observed on the species’ host plant, *Croton fruticulosus*. In this study I investigated the dynamics involved in *Anaea andria* female oviposition choices upon plants of the *Croton fruticulosus* as it relates to spatial structure of habitats and larval density upon infected plants. I also examined the mortality rate among *A. andria* during a short time span to gain some insight into particular stages of vulnerability throughout varying habitats and speculate upon possible sources of larval mortality. A total of 60 *C. fruticulosus* plants with larval presence were observed. The location and habitat features of the plants were also recorded. High densities of larvae were found in areas where light was most available, which was within the edge habitat. When the number of larvae in the wooded habitat was high, the number of larvae in the corresponding instar stage was low within the edge habitat. This supports the claim that *A. andria* tend to avoid laying eggs on plants that already have larvae. No observed difference in larval mortality rates was observed between the wooded and
edge habitat larvae populations. Overall, this study’s findings remain consistent with previous findings and further adds to the knowledge base on A. andria.

Measuring of Canopy and Vegetation Structure in Brackenridge Field Laboratory from Deer’s Perspective
Sheng Ma – S04

In natural conditions, a population is limited by the carrying capacity of its environment. The carrying capacity is determined by the amount of available resources; when individuals in the same population begin competing with each other for resources, this is a sign the population is past its carrying capacity. This study observes the available resources to deer at Brackenridge Field Laboratory in the winter. Resources were measured and estimated by canopy structure, ground cover, and presence of leaves at reachable height to deer. At high canopy levels, it was found that there was much less shrub and ground cover. This may suggest that deer may find more available resources in less dense canopy areas.

The impact of Mustang vine in a mixed bottomland forest community: successional facilitator or a component of a dynamic steady state community
T. G. Moldenhauer – S04

This study focuses on the competitive interaction between mustang vine (Vitis mustangensis) and the trees of a mid-successional bottomland community at Brackenridge Field Laboratory. I predict that mustang vine has a role in the removal of trees from the canopy and edge and that hackberry trees would be most successful filling the gaps this creates. Analysis of this should show the community is in a dynamic steady state of vine and tree interaction that would leave the community composition relatively unchanged over time. A portion of the lower terrace habitat was sampled to obtain information on vine abundance, growth densities, and tree composition. Vine and tree species associations were recorded. A positive correlation was found between hackberry trees and mustang vine. As mustang vine climbs hackberry trees, the excess weight along with the lack of a taproot makes them more susceptible to falling over. The newly formed gaps are then quickly colonized by more hackberry as they are shade tolerant. This competitive interaction is likely to continue well into the future, keeping species composition relatively stable in the absence of other disturbances.
The relationship between altering the fire regime and ant species diversity
Christina Ramsey – S04

The invasion of the red imported fire ant (IFA), *Solenopsis invicta*, has led to an overwhelming decrease of native ant species as they are outcompeted. Many land management techniques have been researched to try and curb the spread of the IFA and to help restore ant diversity. This paper investigates what effect prescribed fires have on increasing the ant species diversity on the community level at the Ladybird Johnson Wildflower Center. I estimated the current ant abundance and diversity in three treatment types: burn summer, burn winter, and control. Six baits (three in open canopy, three in closed canopy) were placed in each of the three treatment types and collected after 30 minutes. *S. invicta* dominated more than 90% of the control and winter burn sites and approximately 65% of the summer burn sites with the other 35% comprised of *F. pruinosus* and *F. mccooki*. This suggests that the more abundant *S. invicta* is, the less abundant other ant species are. The results show that the IFA appear unaffected by fire burn regimes and thus continue to reduce biodiversity by outcompeting other ant species.

Quantifying Deer Rub Effects and Preference at Brackenridge Field Laboratory
John Russell – S04

When white-tailed deer (*Odocoileus virginianus*) are present in large numbers, high browsing levels can begin to pressure plant communities and alter the area as a whole. Antler rubbings also damage woody vegetation and can even lead to the death of the tree. This study aims to find if deer prefer to rub certain tree species at Brackenridge Field Laboratory and to determine the relative survivorship of trees with antler rubbings. Transect at BFL were walked to determine where antler rubbings were located. The species, whether the tree was dead or alive, tree size, diameter, rub length and width, percent removal from the surface area caused by the rub, and if there was an obstruction blocking the tree were recorded for each found rubbing. A preference for deer rubbing their antlers on Laurel Cherry trees was observed over any other species. Laurel Cherry showed no change in mortality rates, however, many exhibited dead or dying branches with signs of discoloration due to rubbings. Although this preference has no detrimental effect on Laurel Cherry mortality currently, overuse and over-rubbing may lead to a decline in their populations thus decreasing tree diversity at BFL.
Opuntia lindheimeri: Texas Prickly Pear Cactus at BFL
Cayce Zahn – S04

The Texas prickly pear cactus (Opuntia lindheimeri) is an abundant evergreen found in the drier areas of South Texas and Northeast Mexico. The cactus typically prefers full sun exposure and is tolerant of very high temperatures. This study aims to determine if there is a correlation between vegetation cover (canopy and shrub) and the presence of Texas prickly pear cactus (adults and seedlings). I also wanted to determine whether seedlings were found near adult plants (or clumps) or were isolated. Two areas at Brackenridge Field Laboratory (old pasture and near ponds 3 and 4) were surveyed for presence of the cactus. GPS coordinates were taken of located prickly pears as well as canopy and shrub cover levels and plant size. A total of 32 O. lindheimeri plants were counted. Adult clumps were present in most canopy and shrub cover levels, however, were most prevalent in areas with little canopy cover and intermediate shrub cover. The majority of seedlings counted (8/9) were within 10m of an adult clump which suggests that seedlings do disperse near adult plants. This survey provides useful information about O. lindheimeri locations for future studies as well as information regarding management.

Odonata Community Patterns at Brackenridge Field Laboratory
Amory Nguyen – S04

In this study, I aim to identify the dragonfly and damselfly species that are found at Brackenridge Field Laboratory in Austin, Texas. I sampled three areas centered around a pair of man-made ponds: The pasture, the upper river terrace, and the lower river terrace. Specimens were collected using an aerial net, preserved and pinned, then identified. From my collected data, I found that the pasture and lower river terrace had the most species in common, which was interesting as these two areas were the farthest away from each other. I found a total of seven different species in total with Libellula lydia, the common whitetail, being found in all locations. Constant monitoring of the Odonate populations at BFL are important and should be done as these insects are good ecological indicators.
Exploring the colonization of *Nandina domestica*

Ollie Wolters – S04

Invasive species such as heavenly bamboo (*Nandina domestica*) have continuously displaced native vegetation at Brackenridge Field Laboratory in Austin, Texas. I aimed to assess the current density and dispersal patterns of the bamboo in an enclosure at BFL. All *N. domestica* plants present were mapped and the height, any signs of herbivory, and crown coverage were recorded for each plant. Once mapped, three deer proof enclosures were placed over non-flowering adult bamboo individuals so their growth free from browsing pressure could be observed in the following year. From the sampled acre, I found that *N. domestica* had colonized much of the area. Browsing from deer has kept the bamboo mostly at bay, so a follow-up study on the covered plants will provide insight to how the plant will spread in their absence.

Spatial Distribution of *S. coccinea* as a Function of Seed Number

Yuh-Huan Chen – F04

Predicting the spatial distribution of a population of plants is difficult, as life-history strategies of the plant must be taken into consideration. It may be possible, however, to estimate the abundance of a plant based on differential seed production in various habitat types. Tropical sage (*Salvia coccinea*) has been observed at Brackenridge Field Laboratory in mostly open areas rather than wooded areas. This difference may be due to a difference in seed production between the two habitat types, differential habitat diversity, pollination systems and pollinator availability, and flower number. Random patches of *S. coccinea* were sampled in both open and wooded areas and the number of seeds, flowers, height, and habitat type was recorded. Overall, the data showed that seed number was much higher in open areas than in wooded areas. Plants in open areas had access to more sunlight than those in shaded areas which could have contributed to seed number differences.

Community Variables Affecting Live Oak Recruitment

Amanda Hill – F04

Oak wilt has been devastating the population of live oak trees at Brackenridge Field Laboratory and the population relies on the recruitment of new trees to remain stable. The purpose of this study is to see what kinds of conditions are favorable for recruitment of new oak
seedlings. I examined the relationship between different age classes of oak trees and the relationship between oak trees and juniper trees. I tested the following four hypotheses: 1.) Oak seedlings would be more likely to be found near large adult oak trees, 2.) Seedlings are just as likely to be found around dead oak trees, 3.) High densities of oak seedlings are associated with low densities of juniper seedlings, and 4.) Adult juniper trees have an effect on oak seedlings. I used the point-quarter method to record the distribution of three size classes of oak and juniper trees along three transects at BFL. A chi-square test showed that there was no significant relationship between oak seedling distribution and adult tree distribution and seedling distribution and dead tree distribution. The data also did not support my third hypothesis and it is most likely to be that there is little or no competition between oak and juniper trees. Data also showed that adult juniper trees had no adverse effect on oak recruitment.

**Size Distribution of Actively Foraging *Bulimus dealbatus* in Woody and Sunny Habitats**

Janian Kiger – F04

A local land snail, *Bulimus dealbatus*, was observed at Brackenridge Field Laboratory to determine its relative distribution with respect to size in sunny vs. woody transects. By showing correlation between density and certain sizes, we can show size distributions in its population structure. I predict that there is a correlation between active snails and their shell length with that of the actual shell length of the sampled dead community and that there is a correlation between active snail density and length in sunny transect versus the active snail density and length in woody transects. The first data collection took place when snails were foraging after a heavy rain in warm temperatures. Measurements were taken from both shaded and sunny areas in the river terrace habitat. The second data collection period took place when it was cooler, which had made the snails sessile and were therefore not foraging. The statistical tests showed no difference in length between any of the snail populations, therefore, it can be concluded that there are no differences between the lengths of snails in woody or sunny transects. Data also supported that there was no difference between snail shell lengths in the dead sampled shell population and the live, active snail shell length.
Deer Browsing on *Nandina domestica* and its Effects on Biomass Production

Vanessa Loya – F04

Deer have typically only shown interest in browsing *Nandina domestica* (Heavenly bamboo) when they are starving or to add variety to their diet. In this study, I observed whether the deer at Brackenridge Field Laboratory were eating any of the bamboo and if any browsing of the plant had any effect on biomass production. I predicted that, across BFL, there would be no difference in deer browsing levels and that there would be no effect on *N. domestica* leaflet production due to deer browsing. I conducted point-quarter samples of two points in the quarry habitat; one scarce of bamboo and one plentiful of bamboo. Any evidence of deer browsing was recorded. With the use of a contingency table, I was able to determine that there was, in fact, a significant difference in browsing levels between the two areas I sampled. I also found evidence to support my prediction that the deer are browsing *N. domestica* enough to decrease its biomass.

Temperature effects of the *S. invicta*’s foraging ability and ability to compete with other native ant species

Janie Munoz – F04

The red imported fire ant, *Solenopsis invicta*, has managed to invade much of the United States and outcompete native ant populations. While the invasive *S. invicta* are more aggressive and have no natural predators, native ants have adapted to their native environment. In this study, I wanted to determine what effects rising temperatures have on the foraging activity of *S. invicta* and at what temperature do they cease foraging all together. I predict that the foraging activity of *S. invicta* would steadily decrease at about 43°C. Hot dog baits were set up and a crop light was used to steadily increase the temperature of the baited area to simulate an increased temperature. When temperatures reached the early 40’s and mid-40’s there was a distinguishable drop of foraging ants. Foraging at the shaded control bait actually increased when the experimental bait reached these hot temperatures which may indicate that the ants actively choose not to forage in the heat.
Lichen Introduction for the Quarry Habitat at the Brackenridge Field Laboratory in Austin, Texas
Sarah Simmonds – F04

Lichens have recently been listed as indicators of the health of a forest ecosystem. A close relationship exists between lichen communities and air pollution as they are sensitive to SO2 concentrations due to their reliance on atmospheric nutritional sources. I conducted a survey of lichens present at Brackenridge Field Laboratory to determine the number of species present and any variations across a habitat. Lichens were collected from eight sites within the quarry habitat at BFL and the richness was analyzed as a means for assessing their value for the ecosystem. Results showed little variance throughout the quarry with few exceptions to some rare or less tolerant species. Nevertheless, this small, initial sampling of lichens lays the foundation for further work in forest management and ecology at BFL.

Deer Rubs and Their Effects on Sapling Growth and Diversity
Adam Tate – F04

Whitetail deer (*Odocoileus virginianus*) continue to have a dramatic impact on the overall diversity of flora within Brackenridge Field Laboratory (BFL). Aside from the obvious effects of foraging, deer activity such as antler rubbing also plays a critical role in altering woody vegetation densities. This study attempts to isolate the effect of increased deer density on the overall succession of the forest canopy. By measuring the overall density of saplings within an area and comparing this to the number of saplings damaged or killed by this rubbing activity, we will attempt to illustrate the selective pressures for, and against, certain species throughout BFL. The point-quarter technique was used to determine which sapling species were present in two areas. Then, a complete scoring of the two areas for antler rubs was conducted. In the first area, Juniper saplings dominated the area, but had also suffered the most from rubs. In the second area, Cedar Elms were found to dominate the area, however, Cedar Elms and Junipers suffered equal amounts from rubs. This finding established that sapling density was not the determining factor in rub selection and thus, this selective pressure may affect the overall structure of the canopy over time. A chi-square analysis showed that Juniper trees were being selectively rubbed in both areas. This preference could alter the woody plant community as Juniper trees face the additional threat of deer rubs.
A Comparison of the Lichen Communities on Mesquite (*P. glandulosa*) and Cedar Elm (*U. crassifolia*) at Brackenridge Field Laboratory (BFL)

Elizabeth Washbourne – F04

Lichens are integral components of ecosystems in terms of net primary productivity, biomass, and nutrient cycling. They perform gaseous exchanges with the environment over their entire surface area, have specialized mechanisms for the collection of air particles, are nitrogen fixers and may accumulate aerosols at a faster rate than vascular plants. All of these make lichens good indicators for the health of an ecosystem. I conducted a survey of lichens on mesquite and cedar elm trees at Brackenridge Field Laboratory as comparisons between these two communities will provide the foundation for the diversity and abundance of lichens at BFL. Five random branch samples were taken from five mesquite and cedar elm trees and were examined to identify any lichen species present. A total of 22 lichen species were identified. Jaccard’s Index of Similarity had a value of 0.91 which implies the lichen communities of mesquite and cedar elm are only slightly different. Further studies on the lichen communities should be conducted to determine any microclimatic and edge effects present.

2005

Ant Distribution and Edge Effect in Open and Closed Habitats at the Ladybird Johnson Wildflower Center

Charly Fritz – S05

Fires can significantly alter an ecosystems diversity and the species that return often depend on the intensity and frequency of fires. A previous study has shown that the greatest similarity in species was between burned plots and the lowest similarity (greatest diversity) was between the unburned plots. The Ladybird Johnson Wildflower Center experiments with prescribed fires, so I wanted to observe how *S. invicta* and other ant species were affected. I predicted the number of bait sites under *S. invicta* control will be greater in open areas than in closed areas. I will test the null hypothesis, H0, that there is no difference between the presence of *S. invicta* in the two areas. Due to edge effect reducing the number of species, I also predict that closed, woody areas over 20 meters in diameter will have a greater diversity of species than smaller areas. Baits were placed in control sites (no-burn) and sites that had undergone a prescribed fire. The chi square value rejected the null hypothesis, H0, that there was no
difference between the presence of S. invicta at open and closed sites ($0.005 < x < 0.001$). The Fisher test also rejected H0 ($p=0.007$) and Shannon’s index showed that the closed sites had no diversity ($p=0$) and the open sites were more diverse ($p=1.074$). More surveys including one with a much larger sample sizes and methods needs to be conducted to better estimate the diversity of ants in the area.

**Lichens**

**Grace Kelleher – S05**

Lichens exhibit characteristic distributions and are restricted to particular ecological niches. An inventory of lichen in an area can be crucial in making ecological assessments and establishing a baseline for monitoring atmospheric and terrestrial quality, biodiversity, and forest health. Research on the lichen diversity at Brackenridge Field Laboratory has not been explored very much. Therefore, I have conducted a survey of the lichen communities present in the quarry and river habitats and compared my findings to see if there are any differences observed in the morphology of lichens. Ten random sites in both the quarry and river habitats were chosen to sample lichen species present. The Jaccard index value of similarity was 1.666 which implies that the quarry and river habitats have more lichen species in common than different. More lichen of the crustose morphology was observed in the river area while foliose morphology was more abundant in the quarry area. A t-test concluded, however, that there was no difference in the species of both habitats.

**Correlations Between Soil Arthropod Species Composition and Foraging of Dasypus novemcinctus**

**Kendra Kocab – S05**

One cause of ecological changes in an area is disturbance caused by one animal on another animals’ habitat. When studying areas that have been disturbed, it is important to determine what the disturbances are and how they affect an area. Using this as a guideline, an ecological question was applied to the correlation between armadillo diggings and soil arthropod species composition: Are there differences in the species diversity of arthropods inhabiting the soil where armadillos forage as opposed to soils where armadillos do not forage? This question was tested using the null hypothesis, $H_0$, that there is no difference between the arthropod
species composition of areas where armadillos dig and that of where they do not dig. This experiment was conducted at Brackenridge Field Laboratory (BFL) in Austin, TX. The armadillo species that inhabits this area is the Nine-Banded Armadillo, *Dasypus novemcinctus*. Evidence of armadillo foraging can be found over many parts of BFL where the soil is soft enough for optimal digging. Soil samples were taken from five freshly dug armadillo foraging sites and five undisturbed sites. And species present in the samples were sorted and identified. Results showed that there is a difference in soil fauna species composition which supports the notion that sites where armadillos forage are different than sites they do not forage in.

**An aphid-ant relationship: effect on herbivory by dogwood sawfly larvae (*Macremphytus tarsatus*)**

Lisa Lau – S05

Some studies have shown that aphid populations increase when attended by ants. Upon further investigation, however, the relationship between ants and aphids can vary from mutualistic attending to exploitative predation by ants on the aphids. This paper explores the association between a honeydew producing aphid and its tending *Crematogaster* ant. The focus is on the ant-aphid mutualism and its indirect relationship to the larval stage of the saw fly *Macremphytus tarsatus*. Using leaf damage as an indicator for the intensity of herbivory by *M. tarsatus*, we test for a relationship between the number of aphid colonies (we assume there is a positive correlation between the number of aphid colonies and the number of tending ants) and the presence of *M. tarsatus*. (H1) A greater number of aphid colonies on a tree will mean decreased herbivory of the canopy tree and understory sapling. A smaller number of aphid colonies on a tree will mean increased herbivory of the canopy tree and understory sapling. We then test the question: are the aphids attracting the ants? We hypothesize (H2) that the time to the bait on an infected tree will be less than the time to the bait on uninfected trees. There will exist a positive correlation between a greater number of aphid colonies present on a tree and a faster time to the bait. The results presented here indicate that the presence of *Crematogaster* ants indirectly protects the dogwood trees from herbivory by *M. tarsatus* caterpillar and that the aphids are the ones that attract the ants to the plant in the first place.
A survey of the ant community at Brackenridge Field Laboratory

Phillip Schulz – S05

The introduction of exotic species due to human traffic poses a worldwide threat to the diversity of natural biological communities. Some species are so successful outside their native range that they can disturb entire ecosystems. The red imported fire ant, *Solenopsis invicta*, is one such invasive species and has been very successful in outcompeting native ant species. In this study, I replicated pitfall surveys that had been conducted at Brackenridge Field Laboratory previously to determine the statue of the ant community 25 years after the introduction of *S. invicta*. Pitfall traps were placed at ten sites across BFL. A total of 15 ant species were collected, but surprisingly *S. invicta* was not the most abundant. *Forelius mcooki* was over three times as abundant as the imported fire ant. Overall, native ant abundance, species richness and ant community diversity all declined, but remained higher than 1987 infested levels. Actual abundances, species richness, and diversity may be higher than calculated due to decreased ant activity during the 2005 survey period.

Characterization of the Spider Community on *Juniperus ashei* in the Old Quarry

Ruth Starwalt – S05

A total of nine sites within the Old Quarry habitat at Brackenridge Field Laboratory were randomly selected and sampled using the point-quarter technique. Canopy cover, shrub cover, and ground cover were all recorded on a scale of 0-3 for each site. In each quadrant, the nearest *Juniperus ashei* was censused for the number of web spiders, their respective families, and their locations. The distance, diameter, and number of trunk branching of the trees were also recorded to get microhabitat descriptions. Although it is clear that web-spider families are supported by the structural environment of *Juniperus ashei*, tree size and number of trunk branching do not seem to be good indices for abundance and diversity. We would expect that adult trees have greater diversity and abundance than saplings, having a greater amount of real estate for spiders, but Shannon’s Index and the rank abundance curves indicate that if this expectation is true, the effect is very minimal. The same is true for trunk divisions.

*no introduction*
Impacts of *Solenopsis invicta* (Hymenoptera: Formicidae) on the Arthropod Community at BFL 23 Years After the Invasion

C.A. Tucker-Britt – S05

Ant communities are an important ecological component, and their species richness and composition have been shown to reflect key ecosystem processes. Introduction of an invasive ant species can wreak havoc on these communities and potentially affect other arthropod communities. One such invasive ant is the imported red fire ant, *Solenopsis invicta*. *S. invicta* invaded Brackenridge Field Laboratory in the 80s and a previous study reported that ant species richness and abundance had significantly decreased since the invasion. The goal of this study was to determine if diversity, richness, or abundance of ants and non-ant arthropods had significantly changed since the previous study. Eight pitfall traps each were placed at ten sites across BFL. Any ants collected were identified to species and any non-ant arthropods collected were identified to order. Although there were no significant differences between the sample dates for species diversity, species richness, native ant abundances, or total ant abundances there was some interesting trends. The Shannon Index was lower for both infested and uninfested sites than in 1999, but it is interesting to note that the diversity was greater in the infested sites. It is not surprising that there was not a significant difference in order diversity between infested and uninfested areas since *S. invicta* has been fully established throughout BFL for several years. It was also not surprising that there was a significant difference between transects because it is expected that certain areas of BFL will support a higher diversity of arthropods than other areas. However, it was interesting to observe that transect C located in the infested areas and had one of the lowest arthropod diversity values, but the highest ant diversity value in 2004. Overall, the abundance of *S. invicta* was much less than seen in 1987 and 1999, and it appears that native ants and other arthropods have stabilized since the initial invasion.

Vegetation Patch Heterogeneity and Host Plant Recognition

Jody Van Reet – S05

There is a multitude of evidence that suggests that vegetation heterogeneity affects the ability of insects to identify their specific host plants. Theory holds that insects use chemical signals to determine when to land, visual signals to determine where to land, and tactile or taste signals from a plants surface to tell them whether to stay or leave. Given this theory, I observed
Red Admiral butterflies at Brackenridge Field Laboratory and their behaviors with their host plant, *Parietaria pennsylvanica*. I predicted that areas that are closer to 100% *Parietaria* would exhibit more larval damage than more heterogeneous environments. I also predicted that proximity to the edge of the woods would not affect degree of larval damage, and similarly, canopy cover would also not affect the degree of larval damage. When *Parietaria* was observed, canopy cover, the location relative to the edge of the woodlands, clump size, and any evidence of larval damage was recorded. Statistical analyses strongly indicated that the more homogenous a patch of *Parietaria* was in its natural habitat, the more likely it is to be affected by Red Admiral larvae. Canopy cover nor proximity to edge seemed to have any impact on larval damage. Since canopy cover and proximity to edge were eliminated as potential causes, it seems safe to say that Red Admirals are better able to recognize their host plants when the surroundings are not confounded by other species.

**Insect Community on Colubrina texensis**

Nicole Cooper – S05

Keeping tabs on insect populations and communities is vital as the health of their populations are usually indicative of the health of the entire ecosystem. This study looks at the insect populations found on *Colubrina texensis* (Hog Plum) shrubs found at Brackenridge Field Laboratory (BFL), in Austin, Texas. Insects were collected throughout April and May. The number of visits of each species along with the time of day and temperature were all recorded. Overall, 32 different species were identified on the shrubs. Insect activity was found to be greatest during warmer days and less during wet, cloudy days. Further investigation into how so many species are able to share the shrub’s resources would provide information on trophic interactions.

**Intraspecific competition and the effects of overcrowding on the size and spatial distribution of pits in the antlion larvae, Myrmeleon crudelis**

Stephen Benigno – F05

Intraspecific competition occurs between individuals of the same species. When too many individuals are competing for the same finite resource it can lead to a population crash. Antlions (*Myrmeleon crudelis*) exhibit a behavioral response known as shadow competition,
where sessile foragers closer to a mobile food source reduce the foraging success of individuals farther away from the food source. This experiment observes the effects overcrowding has on the pit size and spacing of an antlion population at Brackenridge Field Laboratory. I hypothesized that the spatial distribution of antlions will change with the addition of more individuals, that larger pits and larger antlions would be found closer towards edges of habitats, and that the occurrence of large and small pits would differ significantly between experimental and control plots. Two plots were constructed within an antlion population located in a shed. The experimental plot had a total of 35 antlions added to the population. A photographic journal was kept to record movement, placement, and size of pits over the course of two weeks. The increase in number of pits in control and experimental plots showed a similar growth pattern despite the addition of extra individuals. Distribution and pit size changed to accommodate the increase of individuals in the experimental plot. Overall, interactions gradually changed in distribution from clumped to uniform throughout the experiment. Intraspecific competition showed that larger antlions were able to outcompete smaller individuals and build more strategically placed pits closer to the edge of the plots.

Assessment of Ant Lion Habitat Based on Age and Movement

Adam Bray – F05

The ant lion (myrmeleon sp.) inhabits specific niches within a habitat requiring distinct environmental factors. Observing ant lion populations can provide valuable information about habitat quality. Past studies have laid the groundwork for determining ant lion habitat quality, but several hypotheses still need testing. This study tests whether ant lion weight correlates with pit size and age and if the presence/absence of large and small pits in a habitat and their frequency of movement represent the overall quality of a habitat. Three sites with different cover levels at Brackenridge Field Laboratory were chosen for ant lion collection. The specimens were collected using a soil sieve and ten from each site were weighed. Pit depth, diameter, and movement were all recorded as well. A direct correlation was found between the weight/size of the larvae and pit size. Based on this correlation, an assessment of habitat quality can be made. Stable age distribution was found throughout BFL which indicates a healthy habitat as large and small individuals were observed. It was also observed that unfed ant lions had a lot of movement which may suggest communities that exhibit high levels of movement may face a food shortage.
Foraging Patterns of a Litter Ant Community
Cole Garrett – F05

Foraging, retrieval, and resource defense are all important elements of ant communities and define how they interact with other environmental elements. I overserved habitat type, climatic conditions, and temporal variance and how each impacted the foraging pattern of litter ants at Brackenridge Field Laboratory. Baits were placed throughout the old quarry habitat and collected ants were identified. Each bait site was also characterized by the density of leaf litter present (0-3) and the time and various climatic conditions were recorded. Foraging behavior in litter ants was found to be stable and predictable for at least a short amount of time. Leaf litter type and density as well as temperature were all found to be correlated with foraging patterns. A wider range of factors need to be investigated to make definitive statements about foraging patterns.

Determining preference of female *Eurema lisa* egg laying on host plant, *Cassia lindheimeri Senna*, based on larval presence, egg presence, Coreid bug presence, and herbivory
Amanda Kearney – F05

Fire Fly Meadow at Brackenridge Field Laboratory was examined to determine if the female *Eurema lisa* butterfly have a preference for laying eggs on a host plant (*Cassia lindheimeri*) with certain physical features. I predicted that the butterflies would prefer plants with less herbivory, no larvae presence, no previously laid eggs, no larvae or eggs, and no presence of ant mimicking coreid bugs. The population of *E. lisa* was estimated to be 28 using the Lincoln-Petersen technique. *C. lindheimeri* plants were then located and marked and signs of herbivory, egg and larvae presence, and coreid presence was recorded for each plant. The butterflies were then watched, and the number of plants visited before laying eggs was counted. Through statistical analyses, it was found that *Euremas* do show a preference for which plant they lay eggs on. A clear trend appears between increased herbivory and decreased egg laying per plant, and also the absence of larva and eggs on the plants with low herbivory for a higher frequency of preference by the females. Another trend arises with low numbers of larva, females lay eggs at a higher rate than when larva is present A final trend observed in female preference was when an ant mimicking coreid bug was present of Cassia plants; no females laid eggs on that plant. Plants containing eggs had no observational difference in choice of the *Eurema*. Overall,
these preferences suggest that the butterflies have the ability to discern between which environment would be most suitable to lay eggs at.

**Quantifying *Melia azedarach* Seeding Distribution, Abundance, and Age Glass for Adult Trees Occurring Singly and in Clusters**

**Zach Lanfear – F05**

The invasive Chinaberry tree (*Melia azedarach*) has proved to be quite successful at moving into disturbed areas as well as undisturbed. The Janzen-Connell seed ring hypothesis predicts that seedlings closer to a parent tree with suffer higher mortality rates than seedlings farther away. I predicted that Chinaberry does not follow this hypothesis due to a lack of seed predation and disease from being an invasive species. I also predicted that several adult trees clumped together offer an advantage to saplings compared to isolated trees. Chinaberry trees were sampled at Blunn Creek Nature Preserve and the Austin greenbelt. The number of seeds, saplings, and adult Chinaberry were recorded and relative abundances of each were compared. The Chinaberry was found to follow some predictions of the Janzen-Connell seed ring hypothesis. Data showed a decrease of abundance of seeds with distance and an increase of relative abundance of saplings compared to seed abundance. There is not, however, a low probability of survival of saplings near adult trees. Chinaberry growing in clumps is thought to offer an advantage to saplings due to their toxicity to other organisms thus providing space for only tolerant species (more Chinaberry) to grow.

**Pogonomyrmex barbatus nests and the surrounding ant community**

**Sarah McBiles – F05**

Since the invasion of the red imported fire ant, *Solenopsis invicta*, native ant numbers at Brackenridge Field Laboratory have been declining. *Pogonomyrmex barbatus* colony numbers have dwindled to only three remaining nests and one right outside the fence line. This study looks at how *P. barbatus* attempts to coexist with *S. invicta* as both species share habitat preferences. The four active *P. barbatus* mounds and one inactive mound were sampled with baits for what species were present. Analyses showed a significant difference in the sampled communities which suggests that *P. barbatus* nests must be on the edge of the fire ant’s habitat.
This could be due to effective defending of nests, the fire ants not preferring their habitat, or that the fire ants have not spread to those areas yet.

**Disturbance effects on the arthropod community at BFL**

*Marie Medina – F05*

Disturbances may create openings in a habitat that allow new species to colonize thus increasing species diversity. They can also do the opposite and decrease diversity if a disturbance is too extreme. In this study, I examined how historical disturbances and deer grazing have impacted the arthropod community at Brackenridge Field Laboratory. Specifically, are differences or similarities due to equal historical disturbances regardless of deer presence or are they different or similar as a result of equal deer pressure. Vegetation sweeps were conducted throughout BFL in areas with high deer browsing and areas where deer have been excluded from. The vegetation in each habitat was found to have been shaped much more by past historical disturbances rather than browsing pressure from deer. Thus, the impact deer have on the arthropod community is less than the impact habitat has. A higher diversity of arthropods was found in mixed vegetation, however, which deer herbivory decreases. Overall, high browsing from deer has indirect effects on arthropod communities through altering a habitat’s plant composition.

**Distribution of Invasive *Capsicum* species**

*Jessica Meinhardt – F05*

Invasive species can have devastating effects on native communities due to a lack of natural predators. This study aims to generate baseline knowledge of the invasive pepper plant, *Capsicum annum*, at Brackenridge Field Laboratory. This survey will assess habitat preference, bird versus local dispersal, and evidence of herbivory of the plant. I predicted that the majority of *Capsicum* patches would be associated with deciduous trees due to the partial shade growing requirements. The plant was surveyed by walking preexisting transects. When a plant was located, GPS coordinates were taken along with the habitat, patch size, distance to next larger patch, direct canopy density, canopy composition, ground cover, herbivory, and presence of fruit. *Capsicum* was found more at deciduous trees such as Cedar Elm and Hackberry when compared to the evergreen Ashe Juniper. This preference may be due to the light levels deciduous and
evergreen trees each provide. Low ground cover levels were also observed to be preferred in patches. The success of *Capsicum* could largely be due to an absence of herbivory which gives the plant the ability to focus resources on growth rather than defense. This survey along with the early detection of the invasive plant would allow swift removal should the plant begin to detrimentally effect native species.

**Effects of herbivory on the density of forbs at Brackenridge Field Laboratory**

**Tonya Simons – F05**

White-tailed deer (*Odocoileus virginianus*) have adapted well to developed areas. These common herbivores to central Texas have had exceedingly high population sizes in areas such as Brackenridge Field Laboratory. The number of foraging herbivores in a given ecosystem greatly affects the spatial arrangement, density, and species composition of forbs. In contrast, barriers to deer whether they are natural such as fallen trees or thorny cacti or artificial (man-made) can have dramatic effects on species richness and relative abundance of forbs. Comparisons between natural and artificial barriers revealed that species compositions and relative abundance were similar, but that there is a higher degree of similarity between natural barriers to herbivory. Comparisons between enclosed and open areas showed little similarity, only four of fifteen species found were common between the different areas. Diversity comparisons between natural barriers, artificial barriers, and open areas showed that indeed there are significant differences between all three, expect for in the analysis between fallen tree natural barriers to man-made barriers. These comparisons demonstrate that herbivory can impact forb density, diversity, and spatial arrangements within a given ecosystem by restricting some species to areas where they cannot be foraged and at the same time allowing other species to flourish in areas that they might not have under different conditions. Thus, analysis to determine differences between artificial enclosures to natural barriers in addition to comparisons with easily accessible areas will provide key insights into the effect of herbivory on ecosystem dynamics at Brackenridge Field Laboratory.
Red Admiral Butterfly *Vanessa Atalana* interactions with its parasitoids and host plant *Parietaria*

Tasmin Smith – F05

This experiment explores the relationship between the Red Admiral butterfly and its parasitoids and host plant *Parietaria* at Brackenridge Field Laboratory by testing two main null hypotheses: there is no difference between habitats (A) and that there is no difference between transects, indicating there is no edge effect in relation to population numbers of Red Admiral larvae or its parasitoids (B). *Parietaria* patches were located and then examined for Red Admiral larvae, presence of parasitoids, and evidence of past larval presence. There was no difference between collected *Parietaria*, indicating edge effect had no impact. Parasitoids exist in distinct population levels in three different habitats. The woody habitat has the highest parasitoid population, the old pasture has an intermediate-sized population, and the upper terrace has the lowest population. The quarry, however, overlaps the woody and old pasture habitat in population and was not distinct in its counts. The data further identified the interaction between parasitoids and habitats to be driving all the other results found. Live larvae, however, did not show population differences between habitats. There is a relationship between parasitoids and habitat. Overall, this shows the parasitoid populations are expanding at a faster rate than their host and are dramatically limiting the numbers of larvae allowed to mature.

The Distance of Dispersal by the Red Scale (*Dactylopius coccus*) as seen on the Texas Prickly Pear (*Opuntia lindheimeri*)

Tyler Smith – F05

The red scale (*Dactylopius coccus*) is an insect that has made the Texas prickly pear cactus (*Opuntia lindheimeri*) its host plant. The primary method of dispersal for red scales has not been documented well. Short range dispersal has been noted to be wind based while long range dispersal happens through passive transport of infested plant material. This study observes the patterns of dispersal of female red scale colonies at Brackenridge Field Laboratory. Cacti were located and marked by following transect lines already in place. The cacti were examined for any presence of infestation and whether the nearest cacti clump had any signs of infestation. Analyses showed that cacti near an infected clump were statistically more likely to also be infested. Future studies that examine the actual methods of red scale dispersal are needed.
Indirect effects of white-tailed deer grazing on invertebrate communities at Brackenridge Field Laboratory

Phebe van der Meer – F05

Through foraging selectivity, deer directly affect the growth and survival of many herbs, shrubs, and tree species and modify patterns of relative abundance and vegetation dynamics. This indirectly effects other species such as insects, birds, and other mammals. This study compares the plant and arthropod communities inside (high deer density) and outside (low deer density) of Brackenridge Field Laboratory to see how high browsing pressure from deer has impacted the field lab. I predicted that the high browsing inside BFL has negatively impacted the invertebrate predator community. Pitfall traps were placed along the river terrace on the east and west side of BFL to compare the abundance of spiders and carabid beetles on both sides of the fence. A greater diversity of shrubs was found on the west end of BFL (outside) in comparison to the east end (inside). There was no significant difference found for presence or absence of carabid beetles, but there was a significant difference in spider abundance. Overall, a clear impact in shrub density was seen between areas where deer had access to and where they were excluded from.

Dactylopius coccus, a Measure of Success; Effect of pad height and condition on frequency of infection, colony size, and predation

Lauren Colangelo – F05

Dactylopius coccus (Homoptera; Dactylophiidae), often called the Cochineal bug, is a common scale parasite of most cactus (specifically Opuntia). The insect has been overserved on Opuntia cacti at Brackenridge Field Laboratory in Austin, Texas. The Cochineal insect can be seen as both a pest and a product to humans as it produces a valuable red dye while controlling Opuntia where it is a weed or ruining aesthetic value of ornamental cacti (Morgan). This study addresses how height and condition of a pad affects the likelihood of infestation, size of colony and frequency of predation. 274 data points were collected using over 50 Opuntia patches throughout BFL. Increased height of pad was found to be associated with decreased frequency of predation within a colony and increased colony size. Increased scarring of the pad (lower pad condition) was associated with a decrease in frequency of colonization and colony size. Height but not pad condition affected frequency of predation.
Distribution and Recruitment of Phorid Flies to Disturbed Mounds versus Baits
Melanie Bailey – S06

Without the presence of natural enemies, invasive species tend to flourish when they
invade new places as their populations are not controlled by predation. This is the case of
*Solenopsis invicta*, or the red imported fire ant. One such way to try to control the populations of
*S. invicta* is to introduce parasitoid phorid flies that parasitize *S. invicta* specifically. In this
study, I assessed differences in phorid fly activity at disturbed *S. invicta* mounds and at baits at
Brackenridge Field Laboratory. I also studied fly activity across different habitats. I predicted
that disturbed mounds would attract more flies than baits would, and that there would be more
phorid fly activity in the river terrace area than at other habitats. A total of 32 ant mounds were
found across four open habitats (upper pasture, experimental gardens, old pasture, and river
terrace) and hotdog baits with fly paper were placed 5-10 meters away while trays with fly paper
were placed near the mounds. The baits were collected after five hours and a hand lens was used
to identify if any phorid flies were present. The data supported my hypothesis that phorid fly
activity was higher at disturbed mounds than at baits. However, phorid fly activity was not found
to be significantly different between habitat types.

Soil Variability and the Ecological Implications Across Brackenridge Field Laboratory,
Austin, Texas
Alena Chiang – S06

The capacity of the soil to function affects ecological processes, including the capture,
storage, and redistribution of water; the growth of plants; and the cycling of plant nutrients. I
tested the following hypotheses at Brackenridge Field Laboratory: greater canopy cover would
lead to more acidic soil pH, a higher soil pH would have greater nutrient contents, increased pH
would decrease arthropod diversity, the greater diversity of arthropods would lead to a higher
nutrient content of soil, darker soil color would have a higher nutrient content, greater canopy
cover would lead to higher soil nutrient content, and the higher the pH of soil, the darker in color
the soil would be. Soil samples were taken from 23 sites and tested for pH and phosphorous
content. Canopy cover was also observed using an objective scale of 0-3. Next, 12 sites of the 23
were chosen for further nutrient testing. Arthropod samples were collected using Broglie’s
Berlese Apparatuses and were categorized. Our data collection showed that certain sites had similar arthropod populations, however, further analysis revealed no answers as the cause of such similarities. Further research could be done to determine exactly what factors play a part in dictating arthropod diversity. Aspects such as humidity or temperature could be explored in an effort to explain population patterns.

**Cost and Benefit of Foraging for Bird Species at Brackenridge Field Laboratory**

**Thomas Le – S06**

Despite the popularity of feeding birds, few studies have been conducted on the foraging behavior of birds. In this study, I observed the foraging behaviors of the White-Winged Dove (*Zenaida asiatica*), Mourning Dove (*Zenaida macroura*), Inca Dove (*Columbina inca*), Chipping Sparrow (*Spizella passerina*), and Northern Cardinal (*Cardinalis cardinalis*) at Brackenridge Field Laboratory. I wanted to determine if the bird species at BFL preferred food sites closest to the nearest forest cover or not, and how they determine what may be “worth” going out into an open area. The “worth” provided was a large amount of bird seeds. My null hypothesis states the distance away from forest cover would have a significant relationship with the foraging behavior of different bird species while my alternate hypothesis states that the bird species at BFL would have no relationship to the forest covers for foraging. Three trials were conducted with four seed sites each at varying distances from the forest cover. The third trial, however, had a larger amount of seeds present at the seed sites furthest away from the forest cover. No birds were recorded eating the seeds present at the farthest seed sites. This data supports my null hypothesis that there is a significant relationship between bird foraging and the distance away from forest cover. The bird species at BFL use the forest cover for protection from predators and the “worth” was not great enough to take a risk.

**Soil Variability and the Ecological Implications Across Brackenridge Field Laboratory, Austin, Texas**

**Katherine McCrea – S06**

Soil properties such as color, acidity, and nutrient levels can serve as indicators for soil quality, which in turn can indicate general ecosystem health. Ecological assessments of soil characteristics help link soil properties to other ecological factors such as species diversity. The
University of Texas Brackenridge Field Laboratory is a biological reserve, which lies on the north shore of the Colorado River and possesses various habitat and soil types. A study was performed at BFL assessing the soil characteristics of its southern end. Twenty-three soil samples were taken and tested, focusing on points along a transect line which spans perpendicular to the river and crosses a gradation of soil type, habitat type, and elevation. Samples were classified by color using the Munsell Soil Color Charts and nutrient levels were tested with a focus on phosphorus levels using the LaMotte soil test kit. In addition, macroarthropod populations were analyzed at twelve of the twenty-three different sites. Data was then analyzed and comparisons of different aspects of the soils were made. Some of the stranger relationships found from data comparisons are listed as follows: 1) Phosphorus levels are linked with pH levels a) more neutral pH levels lead to a decrease in nutrient levels. 2) Different pH and nutrient levels correspond with different canopy levels a) the most basic and nutrient rich found in medium canopy coverage b) the most acidic and nutrient poor found in highest canopy coverage. 3) Soil acidity correlated with color and species abundance a) the more basic the soil the lighter the color b) the more basic the soil the less species richness. Several other relationships between soil properties were also found. The linkage of these properties with other ecological aspect shows the importance and need for more research on soils and their effect on the environment. More ecological soil assessment within BFL is also recommended for further analysis.

**The pollination strategy of Texas Bull Nettle (Cnidoscolus texanus)**

**Mary Owens – S06**

The characteristics of the Texas bull nettle put the plant in the moth pollination syndrome, however, the flowers remain open for 2 to 3 days before falling off. This gives a number of potential pollinators the chance to visit at night or during the day. Therefore, I hypothesized that Texas bull nettle would have nectar available during the night and day as a strategy to ensure pollination, but more nectar would be produced at night relative to daytime. Nocturnal flower visitors are predicted to be moths while diurnal visitors would be generalist pollinators. A total of 15 plants were classified as either female with or without fruit, male with or without fruit, or both sexes with or without fruit. Flowers were collected at different times of the day to perform nectar collection and determine the sucrose content. The plants were watched
to determine what pollinators were visiting. The null hypothesis of bull nettle plants not specializing in a pollination strategy is rejected. *Cnidoscolus texanus* does fall in the moth pollination syndrome. Having flowers available to both sets of pollinators seems to be a reproductive strategy that allows bull nettle to thrive in harsh conditions.

**Analyzing the trade-off between Three Ant Communities at Brackenridge Field Laboratory**

*Thy Phan – S06*

In three ant communities at Brackenridge Field Laboratory, the distribution, ecology, and behavior of ants is profoundly influenced by environmental stress, competition, and the presence or absence of phorid flies. Theory predicts a tradeoff between resource discovery versus resource domination, stress tolerance and competitive dominance, and presence vs. absence of phorid flies in reference to *Solenopsis invicta*. In this particular experiment, ant communities of *Solenopsis invicta*, *Monomorium*, and *Forelius mccooki* were tested to determine if they showed a significant difference in the trade-off variables discussed previously. Because it reduces the amount of tandem errors, a large sample is more advantageous to use to yield more accurate results. I determined that ant communities in my experiment had statistically significant preference for certain trade-off variables.

**A Survey of Grass-inhabiting Spiders and the Effects of Herbivory on Spider Diversity and Abundance at Brackenridge Field Laboratory**

*Rebecca Schwendiman – S06*

We decided to examine the relationship between deer herbivory, plant community structure, and spider abundance and diversity at the Brackenridge Field Laboratory (BFL) in Austin, Texas. Previous works (unpublished) have shown that White-tailed deer (*Odocoileus virginianus*) consume a significant portion of the primary productivity of the grasses and herbaceous plants at BFL. A portion of BFL, however, the Experimental Gardens, has been surrounded by a dear proof fence for an extended period time such that there has been ample time for the communities inside and outside of the experimental gardens to diverge, as a direct or indirect result of deer grazing. There is reason to believe there may be a significant difference between these communities as previous studies have shown herbivory by deer, sheep, cows, and
even geese, to effect spider community diversity and abundance. Specifically, we will test the hypotheses that: 1) There is a significant difference between the spider communities inside the experimental gardens and outside the experimental gardens, when similar vegetation types are sampled in both settings. 2) There is a significant difference between the spider communities of different vegetation habitats (with respect to structure) regardless of whether inside or outside the experimental gardens. A total of 12 sites (6 inside and 6 outside of the experimental gardens) were chosen and samples were collected using a sweep net. The species were sorted and identified using Jackman’s *Field Guide to Spiders & Scorpions of Texas*. As predicted, the species diversity was highest in the high grass samples, although not significantly higher than the low grass samples. Also, as predicted, vegetation type of the sampled area was a better predictor of the spider community than was the presence of herbivory (as seen by the low similarity between communities of different vegetative structure).

**Role of Moss as a Substrate for Seed Germination and Growth**

Lauren Clark – F06

While mosses can provide a water retaining substrate in which other plants can grow in at least for a short time, they also compete with the seedlings for moisture so that a seedling may be outcompeted before it can establish stable roots under the rival nonvascular plant where thin soils often develop. I predict that mosses inhibit the growth of seedlings even though they initially provide a moist area for germination. Three moss samples (A-C) and a curious species (D) were collected along a stream at Brackenridge Field Laboratory. Cucumber seeds were placed in the moss in plots to observe how they would germinate. Counter to my initial hypothesis, all moss species tested facilitated seedling growth, and all were more absorptive than the controls. After a week and a half, the cucumber seedlings were able to grow more vigorously and abundantly on a living moss substrate than on the absorbent non-living substrate. Further study is needed to conclude whether long term survival is likely on moss substrates.
Mechanism of Dispersal of *Heteropogon sontortus* (Tanglehead) versus *Bothriochloa ischaemum* (KR Bluestem)

Chris Della Sala – F06

While many invasive species flourish due to having unchecked populations, native species (plant in particular) have the advantage of having adaptations to their native environment. One possible example of this is seed dispersal mechanisms of Tanglehead (a native grass) and KR Bluestem (an invasive grass). Deer fur is known to pick up seeds and could therefore act as a dispersal mechanism. Deer fur was run along Tanglehead and KR Bluestem to determine whether or not the fur could be a mechanism or not. Results showed that deer fur was able to pick up and carry Tanglehead seeds 7 out of 10 times while the fur was unable to pick up any KR Bluestem seeds. This proves that deer fur is a possible mechanism of seed dispersal for Tanglehead and not KR Bluestem seeds. A chi-square analysis showed that there was no difference in species arrangements along the wall and fence, therefore giving no evidence supporting that deer fur is an actual mechanism of Tanglehead seed dispersal.

Evaluation of a biological control program in a greenhouse at the Brackenridge Field Laboratory

Lenny Foster – F06

Red spider mites and greenhouse thrips are a significant problem in a greenhouse at the BFL. These pests cause cosmetic damage to some of the plant species present in this greenhouse. Biological control agents have been released into the greenhouse in the past few months to control these pests (Estrada and Gilbert 2006). However, the effect that these agents are having on the pest populations is not clear, as the control agents were released more or less haphazardly without monitoring their effect on the pest populations (Estrada and Gilbert 2006). A predatory mite species, *Neoseiulus californicus*, and juvenile bold jumping spiders were evaluated for their effect on spider mites and thrips, respectively. The predatory mite species was found to kill mites at rates comparable to that vendors advertise for this agent, 1 adult mite per day (Buglogical); mean numbers of mites killed ranged from 0.87 to 1.27 mites per day (Figure 2). Though significantly more thrips died in experimental runs where spiders were present with the thrips, the silk lines of the spiders trapped thrips, confounding the results. *N. californicus* is an effective
Odonata Density Diversity Comparison in Relation to Differing Aquatic Vegetation at Brackenridge Field Laboratory
Paul Hitchings – F06

The design of this project was to observe and correlate qualitative and quantitative evidence that different habitats support different Odonate species and larval densities based on varying vegetative features. Two artificial ponds (F and B) at Brackenridge Field Laboratory that hosted different vegetative growth were sampled. A technique similar to the Hess Sampling Technique was used to collect Odonate larvae. While only 5 out of 49 identified species of Odonates at BFL were captured, a large amount of variation existed between the two ponds. The majority of the captured individuals of Pond F were blue dashers, but the most common species captured at Pond B was the common green darner. A chi-square test also showed that there was a significant difference in the number of larvae in each pond. The vegetative differences could have accounted for such differences. Pond F contained no cattail reeds while Pond B contained a high density of cattail reeds which could have had an effect on the diversity.

Effects of Aboveground Biotic Homogenization on Arbuscular Mycorrhizal Colonization in Texas Grassland
Stephanie Kivlin – F06

Exotic species invasions due to anthropogenic factors are increasing as global travel and industry become more prominent. Effects of exotic species are seen in biotic homogenization of many differing communities leading to decreased beta diversity across ecosystems. Although aboveground homogenization has been examined independently, profound insight on ecosystem processes that can be crucial in the face of global climate change can be gained from determining the role that aboveground system diversity has on belowground communities. This study examined the role of aboveground homogenization of grassland on the belowground arbuscular mycorrhizal fungi community and saprophytic fungi community colonizing plant roots. Results indicated that mean percent root length colonized by saprophytes was significantly different between species, sites and communities (monocultures and mixed grass plots) examined.
Significant differences in mean percentage of root length colonized by the AM fungal community were not shown. In addition, the effect of enemy release from saprophytes was exhibited by the exotic species *B. ischaemum*. This finding could provide a potential mechanism to explain the relative success of this species in its naturalized environment. As fungal colonization is expected to be affected by elevated CO2 due to global climate change, AM fungal and saprophytic communities are essential to determine future carbon and nitrogen cycling patterns. Shifts in these communities due to exotic species invasion could have impacts on both the aboveground community and ecosystem level processes.

**Spatial distribution and individual variation (size and shell color polymorphisms) of the land snail *Helicina orbiculate* (*Helcinidae*) at BFL**

**Amanda Lea – F06**

Various land snail species, most within the family *Helicidae*, have been subject of population genetic studies due to shell polymorphisms such as size, shape, coiling, and pigmentation. The purpose of this study is to examine spatial patterns of shell polymorphisms, size and color, of *Helicina orbiculata* (*Helcinidae*) across BFL in the context of habitat fragmentation and dispersal-limited isolation. The first phase will test dispersal rates and patterns of *H. orbiculata*, as well as population density with respect to microclimate variables. The second phase will be an extensive survey of BFL and an analysis of population morph frequencies with respect to habitat, distance from one another, and distance from dispersal barriers. No conclusion could be drawn about population density due to an inappropriate modeling technique. Dispersal rates are thought to be higher when rain is abundant, but overall, a lack of movement was observed. A number of different morphs were observed. Brown morphs were observed in woody litter which may be the result of camouflage while the number of gray/banded morphs increased with distance from the river.

**Environmental factors affecting the distribution of a population of nine-banded armadillos (*Dasypus novemcinctus*) at Brackenridge Field Laboratory, Austin, Texas**

**Spencer Lockwood – F06**

The distribution of *Dasypus novemcinctus* (the nine-banded armadillo) is based largely on habitat and little on territoriality, which allows for clumping of armadillos in more suitable
habitats. This study investigates the distribution of a *D. novemcinctus* population in a section of the Brackenridge Field Laboratory in Austin, Texas and the environmental factors that may impact that distribution. Burrow holes were located in an area of the field lab and the shrub density was reported on a scale of 0-3 for each hole. The burrowing habits were determined to be distinctive in nature and distribution around BFL. The armadillos burrow in areas with dense shrubs and they seem to prefer burrowing under or between a hard barrier such as a tree, sticks, or rocks.

*Harmonia axyridis* Metamorphosis Size Class Comparison in Two Habitats  
Erika Machuca – F06

*Harmonia axyridis* (Coleoptera: Coccinellidae), commonly known as the Multicolored lady beetle, exhibits a high level of phenotypic plasticity for several life-history traits so behavior or morphology varies with changing environmental conditions. Depending on the environmental conditions of the site, the species might opt to change its life history stage that could be more favorable hence, the length of the life stage period might be shortened or lengthened. The purpose of this study is to find if there are metamorphosis size class differences that might be influenced by behavioral plasticity by the different environments of two habitats. Distribution of metamorphosis size class based on environment was examined on the Cowpen daisy at two different sites at Brackenridge Field Laboratory as all life stages can be found on the plant. Relative abundance of *H. axyridis* larva and pupa are higher in Site 1 possibly because it is more favorable to remain in earlier life cycle stages (Chart 1). After the onset of adult characteristics, adults disperse more in Site 1 than in Site 2, which may be because there are no adults in Site 1. The relative abundance of size classes is more evenly distributed (Chart 2) indicating that this patch of Cowpen daisy is more suitable for the different size classes. The t-test result showed that there was a significant difference between having some adults (Site 2) versus no adults (Site 1).
Analysis of patterns of diversity and abundance in leaf-litter invertebrates at Brackenridge Field Laboratory
Laura Prakash – F06

The interactions within the community of soil and leaf-litter organisms help maintain soil fertility and structure and may therefore serve as sensitive indicators of habitat quality and biodiversity. The objective of this study is to provide baseline information on diversity and abundance of macro invertebrates present in the leaf-litter across Brackenridge Field Laboratory. The null hypothesis is that species diversity and abundance of leaf-litter organisms is independent of the site it is collected from while the alternate hypothesis is that differences in populations between sites will be observed. Five samples were collected from each of the three habitats at BFL and canopy cover, ground cover and soil properties were measured to understand any differences present at each site. Arthropod specimens were collected from the samples and identified into broad taxa. The number and species of macro invertebrates extracted from the leaf-litter by the Berlese apparatus were much lower than expected and probably do not accurately represent the population present in the leaf litter at BFL. Thus, no statistically significant inferences can be made about the differences in the leaf litter populations related to their sites based on this data.

2007
Finder Keeps it All? Food Preference, Scavenger and Defendant Qualities in an Ant Population
Heather Aguirre – S07

The establishment of an ant hierarchy with respect to food gathering is dependent upon various factors. Some of these are linked to the species’ ability to find vs. ability to dominate as well as food size and food preference. This particular experiment is designed to take into account three factors and see how these affect the hierarchy. This experiment is not concerned with the effects of food size and only partially with food preference. Based on previous research, we suggest that food preference may have a small effect on hierarchy establishment. However, what seems to be the major factor is the species ability to find and maintain dominance over the found bait. Those species that are able to find food resources are not usually the defenders and dominant group once discovered by other species. An additional factor that could have a
potential effect in our study is the presence of foreign invasive species such as Solenopsis invicta or foreign fire ant. In past years, the foreign fire ant has been a major threat to native species. However, recently the *S. invicta* population has decreased drastically thus allowing native populations to recuperate and have a fair opportunity to establish itself at the top of the hierarchy.

**Comparing Activity of Two Species from Two Different Habitats Held in the Same Environment**  
**Ruvani Chandrasekera – S07**

This study aimed to identify any differences in the morning and evening activity of two butterfly species belonging to the same subfamily, Heliconiidae (*H. ismenius* and *H. charitonia*). *H. ismenius*, originated from a forest in Mexico while *H. charitonia* comes from open grasslands or edges of forests, but both are observed at Brackenridge Field Laboratory where this study takes place. Based on the habitat preferences, I hypothesized *H. ismenius* would be active earlier in the day and go to roost sooner than *H. charitonia* since they may be more sensitive to the amount of light present. I also aimed to identify any behavioral activities specific to a certain species or sex of a species in the morning or evening. Light, temperature, and humidity were recorded and roosting, perching, sunning, flying, and feeding behaviors of the butterflies were recorded once in the morning and once in the evening for three days. Based on recorded observations, we see that *H. ismenius* is, active earlier and goes to roost later than *H. charitonia*. This supports only half of the posed hypothesis; however, a very small population sample was used which could have affected results.

**Phorid Flies Distribution at Brackenridge Field Laboratory**  
**Rafael De La Paz – S07**

The introduction of fire ants, *Solenopsis invicta*, into the United States has caused a huge problem for native ant species and the biodiversity of ecosystems because they have no natural predators. One way to alleviate the pressure caused from the fire ants was to introduce phorid flies that parasitize *S. invicta* specifically. This study aims to identify the distribution of the phorid fly *Pseudacteon curvatus* at Brackenridge Field Laboratory among different habitats and attractiveness of disturbed versus baited traps. I hypothesized that the flies would be more
abundant at the river terrace habitat and that disturbed and baited traps would attract an even amount of phorid flies each. Ant colonies were located in the three habitats at BFL (quarry, river terrace, and pasture). Each habitat contained six phorid fly traps with three baited and three disturbed. The data showed that *P. curvatus* were more attracted to a disturbed fire ant mound than a foraging trail, and there was no preferable habitat at BFL. These results could be due to the fly’s attraction to the alarm pheromones released by the ants at disturbed mounds and gives insight to how the flies could be an effective limiter to fire ant populations.

**Insect Community Patterns at Brackenridge Field Laboratory on *Colubrina texensis***

Keely Hall – S07

This test was run at Brackenridge Field Laboratory (BFL) to find out information about the insect community throughout the 82 acres of BFL, specifically on *Colubrina texensis* (Snakebush). With this experiment I found that I did not collect enough insects to find the full species diversity of insects on Snakebush. This can be seen in Species Cumulative Curve because I did not even reach a plateau on this curve like you would expect when you are coming to reach carrying capacity of the insects that nectar on this plant. Even though I did not reach a plateau we can see that there is a great diversity of insects found on this plant and means that there is an extreme number of insects that help nectar this plant. With the number of insects that nectar on this plant you would expect to see this plant throughout BFL and it is seen quite a bit but not as much as I would expect with the amount of nectar that has to be leaving this plant.

**Timing of Leaf Emergence in *Carya illinoinensis***

Craig Handley – S07

The pecan tree, *Carya illinoinensis*, is ubiquitous in Texas and also much of the southern United States and Northern Mexico. During expansion, new leaves are particularly vulnerable to damage from biotic and abiotic factors. It has been proposed that the differences in leaf phenology particularly the timing of leaf emergence may be an evolutionary mechanism that would allow a population to become more fit based on its ability to respond to stressors in local environments. Using age and time of leaf emergence as measures, this investigation considers the possibility of convergence of leaf phenologies in populations of pecan trees across Central and East Texas. While no conclusive results were obtained, there were a number of observations
made that will increase the abilities of future studies to understand differential leaf emergence in pecan trees.


Kimberley Lawhon – S07

Invasive species can lead to biodiversity loss as they overtake native land and resources due to there being no limiting factor on their populations. *Solenopsis invicta*, an invasive fire ant species, has taken over much of Brackenridge Field Laboratory. As a control, *Pseudacteon* (phorid flies) have been introduced as they parasitize *S. invicta* specifically and could therefore act as a population control. In this study, I identified if there was a difference in the distribution of phorid flies between habitats at BFL and whether the flies had a preference for disturbed mounds or foraging trails. I predicted that there would be a difference in distribution across habitats and that the flies would prefer disturbed mounds. Six sites in each of the three habitats at BFL had disturbed mound and foraging traps placed at them. Based on results, the phorid flies did prefer the disturbed mounds over the foraging trails, however, there was no significant difference in phorid fly numbers between the different habitats.

**Morphometrics and scaling allometry of the Western Slimy Salamander (*Plethodon albagula*) at Brackenridge Field Laboratory***

Misha Ludwig – S07

The *Plethodon albagula* salamander population at Brackenridge Field Lab (BFL) was most recently documented in a study of the effects that the Imported Red Fire Ant, *Solenopsis invicta*, was having on its density, and/or distribution, in May of 2002 (Siler, 2002). *P. albagula* is the only recorded Plethodon species to inhabit the central Texas area, and by studying the population morphometrics at BFL, an effective evaluation of how well the population is responding to the ever-changing landscape, habitat and environmental conditions of the area could be established. The current study aims at locating and recording the SVL, and head width/head length of the species at BFL, as well as assessing whether there is a correlation in head morphology versus snout-vent length (SVL) in individual size determination. The morphometrics of the current population were then compared to the study conducted in 2002 to
help evaluate the ongoing dynamics of the population. Strong correlations were seen in SVL in relation to both aspects of head size in the current population. There was also an increase in mean SVL in the population from 2002 to 2007 that should be investigated further to determine whether there is a causational effect due to local weather patterns.

Investigation into the Structure, Orientation, and Vegetation Location of Spider Webs at BFL

Xilu Ma – S07

Brackenridge Field Laboratory has three different habitats each with unique vegetation variation. In this study, I examined spider webs across BFL and studied how vegetation impacted spider webs. I hypothesized that location, vegetation, and region were all correlated to how a spider’s web was structured. Transects in each of BFL’s regions were chosen and walked to look for spider webs and the type of web found was recorded along with the location. Based on results, I concluded that there is significant support for a correlation between region, vegetation, and orientation and a web’s structure.

Population and Recapture Observations of Male vs. Female Zerene cesonia Butterflies

Demitris Norwood – S07

Female Zerene cesonia butterflies are avidly searching for host plants during the April months. The Kidneywood, Eysenhartia texana, found at Brackenridge Field Laboratory and throughout the Texas region is one such host plant. Unfortunately, deer prefer Kidneywood along with other plants while foraging, so Kidneywood is scarce main areas of BFL, but abundant in the Experimental Gardens, unscathed by deer populations. This experiment attempts to discover if female Dogface Sulfur butterflies travel greater distances than males in search of viable host plants to lay eggs. Since butterflies have to pick specifically the Kidneywood plant to lay eggs so that larvae are successful after hatching, and since the Kidneywood is not abundant at BFL (deer prefer to forage and the overpopulation of deer at BFL), the butterflies are limited to the Experimental Gardens to lay eggs on viable host plants. Alternatively, male Z. cesonia butterflies are in search of receptive females to mate with. While male butterflies can travel up to 2 km in response to pheromones a female has emitted, males are capable of distance traveling as well. An alternate hypothesis to females searching for host plants is that males, in search of
females, will travel greater distances to find females to mate with. Data was inconclusive in showing that female butterflies disperse farther out than male butterflies, however, results did suggest that the number of males visiting the Experimental Gardens was significantly higher than females who visited the patch.

**Effects of Allelopathy on Soil Fertility**

*Rachel Watkins – S07*

Allelopathy is defined as the suppression of growth of a plant by a toxin released from a nearby plant of the same or another species. The toxins in the plant are called allelochemicals, which are released either by living plant tissues such as roots, or by the decomposition of plant materials, such as leaves. This ensures the allelopathic plant has a “ring” or resources available for use by only itself. In this experiment, the level of allelopathy among different trees was tested. Soil samples were taken from under four different tree species (Tree-of-Heaven (*Ailanthus altissima*), Ashe Juniper (*Juniperus ashei*), Pecan trees (*Carya illinoinensis*), and Cottonwood trees (*Populus fremontii*) that are thought to have allelopathic characteristics at Brackenridge Field Laboratory. Soil samples from grass in a field was also taken as a control. A cucumber seed was placed in each sample and allowed to germinate for 20 days, after which growth of the seeds was observed. Overall, Ashe Juniper and Pecan had the highest levels of allelopathic characteristics followed by Cottonwood and then Tree-of-Heaven. This study should be replicated with soil samples taken from areas with similar densities as trees in lower density areas tend to show higher levels of allelopathy.

**Aphid Survivorship in the Presence of Ants at Brackenridge Field Laboratory**

*Tim Whitney – S07*

The aphid is a Hemiptera found predominately at Brackenridge Field Laboratory during the springtime. After noticing that ants could be found cohabitating on the Frostweed plant (*Verbesina virginica*) I wanted to find out if there was a relationship that existed between the two. Previous studies into the mutualistic relationship between the two species piqued my interest. I hypothesized that presence of ants on a Frostweed would increase the survivorship of aphids. After collecting initial and final aphid number counts on 10 duplicates of a control and treatment plant I performed statistical analyses. The analysis of the data concluded that there was
no significant difference in proportion survivorship between control (without ants) and treatment (with ants) plants. An acceptance of the null hypothesis proved that my hypothesis was wrong. In the end my hypothesis was too broad, and I could have benefited from examining a particular species of ant. All ants do not all tend aphids and for this reason my hypothesis could have been more specific.

**Early larval mortality in *Vanessa atalanta* may facilitate *Parietaria pensylvanica* abundance, parasitoid community**

**Thomas Huff – S07**

In this study, I examined the relationship between the Red Admiral butterfly (*Vanessa atalanta*), its host plant (*Parietaria pensylvanica*) and parasitoids of the butterfly. Because the adult butterfly population is low, I believe that opportunistic parasitoids are attacking early larval stages, which would in turn result in higher numbers of healthy adult host plants. I visually inspected *P. pensylvanica* plants throughout Brackenridge Field Laboratory and collected any larvae or parasitoid cocoon evidence that I found. The collected specimens were then reared in captivity and were noted as either parasitized by wasp, fly, or if the larvae died with no evidence of parasitism. Overall, 43 out of the 80 collected specimens had parasitoid wasp cocoons emerge while the fly cocoon emerged three times. These results indirectly support my prediction that *P. pensylvanica* would be more abundant as the parasitoids reduced the butterfly numbers by over half which reduces herbivory.

**Effects of native versus non-native invasive and non-invasive grass species**

**Rachel Brooks – F07**

Invasive species have been shown to potentially alter habitat properties such as geomorphology, hydrology, biogeochemistry and disturbance; these alterations increase the competitive ability of the invasive species and subsequent exclusion of native species increases rate of alteration. Invasive species do not necessarily have to be non-indigenous; many native species can act aggressively and invasively in their natural range due to disturbance or alterations in interspecies competition. This study observes two native grass species, little bluestem (*Schizachyrium scoparium*) and invasive tanglehead (*Heteropogon contortus*), and one non-native invasive species, King Ranch bluestem (*Bothriochloa ischaemum*) to determine the effect of both native and non-native grasses on species diversity and richness at Brackenridge Field
Laboratory. I predicted that KR bluestem dominated areas would have the least diversity and richness, Tanglehead areas would have comparable reductions in diversity and richness, and the little bluestem dominated areas would have the highest diversity and richness. Data was collected from three KR bluestem dominated patches, four Tanglehead dominated patches, and four little bluestem dominated patches. For each site, all non-dominant plant species were collected, weighed, and separated by species. Unexpectedly, non-indigenous invasive KR bluestem areas were found to have the highest species diversity and richness across all tested sites. Little bluestem areas were most similar to the KR bluestem areas and Tanglehead areas had the lowest species diversity and richness. This could be due to Tanglehead requiring more nutrients from the soil which prevents other plants from growing. Future studies that compare soil samples from each dominated area would provide more insightful data.

**Effects of Native and Invasive Grasses on Arthropod Diversity and Community Similarity at Brackenridge Field Laboratory, Austin, Texas**

Cristina Castillo – F07

Little bluestem (*Schizachyrium scoparium*) and Tanglehead (*Heteropogon contortus*) are both native Texan grasses, while K.R. bluestem (*Bothriochloa ischaemum*) is native to Asia and Central Europe and was introduced to Texas as a range grass. Non-native invasive species in general are known to damage native populations. I hypothesized (H1) that the invasive K.R. bluestem will show differences in arthropod species richness and (H2) species diversity, when compared to native grasses, Little bluestem and Tanglehead. I also hypothesized that the two native grasses would have a more similar community of arthropods when compared to the invasive K.R. bluestem. Mono-dominant patches of each of the grass species were located at Brackenridge Field Laboratory and arthropod pitfall traps were set up. The arthropod surveys showed that all three grasses had similar species richness values, however, the K.R. bluestem patches did have the lowest richness of the three. A difference in species diversity was also observed most apparently between the native Little bluestem and the invasive K.R. bluestem. Contrary to my hypothesis, the diversity indices were most similar between K.R. bluestem and Tanglehead. This could be due to the aggressive spread of Tanglehead, making it out as an invasive native plant.
Availability of protein or carbohydrate rich food and subsequent changes in food preference in *S. invicta*

Jessica Diller – F07

Complementary foods are those that provide different essential nutrients for a particular organism. Many animals have been shown to exhibit food preference for food types that are less abundant in their habitat as acquiring these foods would increase the variability of their diet, thus improving their nutrition. In this experiment, I investigated the effect of artificially creating an environment abundant in a particular nutrient on food preference in the red imported fire ant, *Solenopsis invicta*. Experimental food sources were rich in either protein or carbohydrate nutrients, both of which are known to differentially attract foraging ants. I used simultaneous feeding during preference tests to observe which food type the ants would choose to collect and predicted that *S. invicta* would favor the food source that was not abundantly provided 24 hours prior to preference tests. A preference for carbohydrates over protein was found regardless of previous food availability but was only significant in areas where protein had been supplemented prior to preference tests (p = 0.024452). However, when the number of workers on the same types of baits between areas of different supplemental treatment were compared, there was a significant difference between the preferences for carbohydrate (p=0.043336) and a considerable difference between the preferences for protein (p=0.077034). In both cases, a greater preference was exhibited for each food in the area that had received the alternate food in supplemental feeding. These results could have been due to a preexisting preference for carbohydrates and could be explored further in a study that provides ant with carbohydrate food for a longer period of time and monitor if food preference has changed.

**Land Snails of BFL**

Sumana Islam – F07

Actual predation events are rarely observed; therefore, studies of predation can be done using artificial models. This study determined snail diversity at the river terrace habitat at Brackenridge Field Laboratory, then carried out a predation experiment with artificial, clay snails to observe how camouflage effects the susceptibility of snails to their predators. To determine diversity, a point quarter survey was used to count each type of snail (on trees) at five different points. Clay snails were then made and place on either dark wood, light wood with a rough
surface, or light wood with a smooth surface. The color contrast between the clay snail and the
wood was then analyzed. Three types of snails were found; one was big and brown/tan/gray
colored, another was medium, cone shaped, and white to light brown colored, and the last one
was small, circular, and white with different shades of color. The most abundant snail found was
the small, circular snail. Results from the predation experiment showed no significant difference
in predation rates in the three tested wood types. While this experiment does offer insight to the
susceptibility of organisms to predators, it does not take into account prey defense mechanisms.
A longer observation period should also be taken in order to get more accurate results.

Distribution and Abundance of *Mestra amymone* at BFL

Katelyn Littelfield – F07

Estimating the population of a species provides valuable information about how
population size varies with changing weather, resources and competition. This study uses a
rough point quarter method to estimate the population size and distribution of *Mestra amymone* at
Brackenridge Field Laboratory in Austin, TX. Known transects were walked and the number of
*M. amymone* were counted at points every 20 meters walked. The total butterfly population was
then estimated by multiplying the total area of BFL by the average number of butterflies counted
divided by the area of the circle at each point. The ground and canopy covers were also scored
(0-3) for each point that was surveyed in order to determine if there was a habitat preference.
Strong correlations were found between the number of butterflies present and low canopy cover
and high ground cover. The total abundance of *M. amymone* was estimated to be close to 17,000
this year. This estimate is not accurate, however, as I estimated the population for the entirety of
BFL. *M. amymone* prefer open areas so future studies should include only the open area habitats
at BFL.

Scorpion abundance and under-rock community composition at Brackenridge Field
Laboratory, Austin, Texas

Mike Marischen – F07

Community compositions and comparisons between populations in a given habitat are the
focus of many ecological studies. This is because no single population in an ecosystem is
isolated. Whether directly or indirectly each population affects, and is affected by, all the others
in a given ecosystem. In most terrestrial habitats, collections of arthropods and small vertebrate populations comprise unique communities, which exist underneath rocks. Such is the case with Brackenridge Field Laboratory (BFL), in Austin Texas, where rocks are abundant and the small animals that live underneath them are diverse and plentiful. In November of 2007, a research project was done at BFL in which under-rock communities in two adjacent areas were examined, quantified and compared. Also, because the abundance of scorpions was initially assumed to differ greatly between the two areas, the project initially focused on a possible correlation between scorpion abundance under rocks and the abundance of scorpion prey species under rocks. A prediction was made (H1) that a lower abundance of scorpions under rocks in a given area would correlate with a lower abundance of scorpion prey species under rocks in that same area. After extensive data was collected from the two areas (area W and area E) however, it was found that no significant difference in scorpion abundance existed between the two areas as initially assumed, and the hypothesis was rendered untestable. Nonetheless, the under-rock communities of both areas were characterized, and important baseline data was gathered and new questions concerning the under-rock community at BFL were raised.

**Measuring Net Primary Productivity across different pond habitats: using both terrestrial and aquatic techniques**

**Kate Quigley – F07**

Net Primary Production (NPP) is the amount of or rate of carbon deposition within plant tissue. This is an important tool as it allows ecologists to make predictions on the floral and faunal species richness and abundance. This study aims to estimate the NPP for habitats dominated by *Typha latifolia* (common cattail) using both terrestrial and aquatic techniques at Brackenridge Field Laboratory. A comparison of two aquatic habitats (one dominated by *T. latifolia*, one devoid of *T. latifolia*) was undertaken to determine the vegetative difference. Vegetative samples were taken from the two ponds and dried, weighed and then used to calculate the total instantaneous NPP (terrestrial technique). NPP was also measured through oxygen measurements in a Light and Dark Bottle experiment that mimicked photosynthetic and respiration environments (aquatic technique). The use of terrestrial and aquatic methods in order to estimate Net Primary Productivity across one aquatic vegetation type does not seem to yield an accurate result in comparison to each other. The largest difference occurred in Pond 1- where
A comparison of arthropod diversity between a King Ranch bluestem, *Bothriochloa ischaemum*, dominated patch and a native grass patch
Cassandra Rediske – F07

Invasive species have been known to change community composition, competitive interactions, community diversity, and disturbance regimes. Specifically, exotic grass invasions simplify the ecosystem plant communities which can form cascading effects by further simplifying invertebrate and vertebrate communities as well. The invasive grass King Ranch bluestem, *Bothriochloa ischaemum*, (native to Europe and Asia) is considered a problem in Central Texas and has been linked to lower species richness in areas it dominates. This study examines the arthropod diversity in *B. ischaemum* patches compared to native grass patches. I hypothesized that native grass patches would have higher diversity than *B. ischaemum* patches. Arthropods were collected using pitfall traps and a sweep net in *B. ischaemum* and native grass patches at Bee Caves Ecolab. No difference in species richness of orders was found between *B. ischaemum* habitat patch and the native grass patches. Taking into account the very few samples collected and small overall geographic area, this conclusion may or may not be correct. Also, conclusions, if any, are limited to this small geographic unit. Further sampling would need to be done in order to repudiate the statistical result.

Ligustrum: Factors Influencing Growth and Its Effect on Plant Diversity
Trevor Rubenstahl – F07

Ligustrum is the genus of two invasive plant species present at Brackenridge Field Laboratory: Japanese privet (*L. ovalifolium*) and Chinese privet (*L. lucidum*). This study aims to determine where Ligustrum grows and if canopy trees affect its growth. I hypothesize that the presence of Ligustrum would decrease plant diversity. 70 known transects at BFL were walked and the presence or absence of Ligustrum was recorded along with canopy, understory, and
ground cover and canopy tree and other present plant species at each point. Ligustrum was found to be concentrated in the old quarry habitat and the most common canopy tree associated with Ligustrum was cedar elm. The most common canopy tree that lacked Ligustrum was hackberry, with statistically significant results \( p = 0.00099 \). A slight trend was also observed between the increase of Ligustrum and decrease of species diversity. Future studies should include more data points as well as exclude areas that are regularly maintained to eliminate human disturbance.

**The role of Texas Prickly Pear, *Opuntia lindheimeri*, as a nurse plant**

Katherine Saunders – F07

The nurse plant syndrome is a positive relationship in which two species of plants are associated with each other spatially. Usually, an adult species provides some sort of shelter for a seedling species, or it provides changes to the environment that make it more beneficial for the seedling to survive. This study examines how the Texas Prickly Pear (\textit{Opuntia lindheimeri}) acts as a nurse plant towards plant species that white-tailed deer (\textit{Odocoileus virginianus}) like to graze on at Brackenridge Field Laboratory. Five patches of \textit{O. lindheimeri} were located for this study. At the first patch, plants growing within the cactus patch and plants growing outside the patch were collected and identified. Poison ivy (\textit{Taxicodendron radicans}) and dog-toothed spurge (\textit{Poinsettia dentata}) were chosen as the plants of focus for this study due to deer preference for them. At the next four sites, \textit{T. radicans} and \textit{P. dentata} presence was recorded along with whether they were inside or outside of the cactus patches. A significant difference was found between the inside and outside of the patches in the presence of poison ivy and dog-toothed spurge. This gives evidence to support that \textit{O. lindheimeri} is an effective nurse plant, and provides shelter from deer herbivory.

**Tree Fall Distribution Across BFL**

Abey Thomas – F07

Understanding canopy gaps is important as they promote and facilitate understory growth and succession. However, the study of tree falls has not been thoroughly studied as it is difficult to determine what caused the fall. This study aims to explore the tree fall distribution at Brackenridge Field Laboratory as well as discern any patterns between tree species and habitat. I predicted that there will be a pattern of tree fall found and that it will vary across the habitats.
with certain types of tree falls dominating certain habitats. 24 points split between the pasture river terrace, and old quarry habitats were chosen to survey using the point-quarter technique. Tree falls were categorized as wind fall (visible break in trunk), soil (uprooted), vine (covered in vines), or unknown (difficult to determine the cause of fall). When looking at the relationship between tree species and tree fall types, there was statistical significance with Ash Juniper tree falls due to wind damage and Cedar Elm with soil damage. Hackberry fallings were caused predominantly by both vine and soil type falls, showing there was no one clear type of fall associated with Hackberry. When looking at the relationship between habitats and tree fall types, the soil type fall was varied across most habitats (no significance), while the vine damage and wind damage were significantly dominant in the river terrace and quarry respectively.

Nest Site Distribution Patterns of Mud Daubers at BFL *Trypoxylon politum* and *Sceliphron caementarium*

Manuela Windham – F07

Brackenridge Field Laboratory’s most common Sphecidae species include the Organ-Pipe Mud Daubers (*Trypoxylon politum*) and the thread-waisted Black and Yellow Mud Dauber (*Sceliphron caementarium*). Both species are solitary wasps, which means that the female builds a mud structure, hunts, and fills each cell with provisions for her offspring. This study aims to survey nest site distributions for each species and to determine if the wasps had preferred soil types for nest building. Soil samples and wasp nests were collected throughout BFL and tested for pH level. No correlation was found between soil pH and nest mud pH, indicating the wasps do not have a preference for soil type. Most *T. politum* nests were typically found in locations with high ground clearance and deep recesses while *S. caementarium* had a more random distribution in regard to ground clearance and alcove-like indentations. Expanded parameters such as nitrogen and phosphorus contents along with other habitat types such as Stengl and Chaparral that focus on regional soil type could provide more conclusive results.
The Effects of Microhabitat, Soil Disturbance and Olfactory Cues on Freshwater Turtle Nest Predation along the Colorado River at Brackenridge Field Laboratory

Sophie Guilfoyle – S08

Freshwater turtle populations are declining worldwide. The most vulnerable life stages of most turtle species is while they are eggs in the nest, and just after they emerge during the hatchling stage. Predation rates are as high as 50% among freshwater turtle nest eggs, and myriad of microhabitat factors resulting from female nest site selection such as soil composition and temperature, the presence of vegetation, proximity to the water, nest density and the distance from the nest to the water. In order to determine which factors of microhabitat lead to higher rates of predation, 20 constructed nest sites were randomly placed at Brackenridge Field Lab within 64 meters of the Colorado River. Each site was subject to two experimental variables – high or low soil disturbance and the presence or absence of olfactory cues – and sites were monitored over the course of a week to determine whether predation had taken place.

Environmental factors such as soil temperature, canopy and ground cover, and distance from the nest to the nearest tree, neighboring nest, and the Colorado River were recorded to determine whether there was a relationship between each factor and constructed nest predation rates. Results showed that there was no significant difference between predation rates in high or low soil-disturbed sites, or in the presence or absence of olfactory cutes. There was a trend for higher predation rates where there was more ground or canopy cover. No significant trend emerged relating predation rates to distance to the nearest nest, tree, or proximity to the water, with $R^2$ values all less than 0.5.

Habitat Preference of Land Snails Across Two Transects at Brackenridge Field Laboratory

Victoria Banks – S08

The land snail population at Brackenridge Field Laboratory (BFL) in Austin, Texas has not been well documented. This study aims to determine if the three species of land snails present at BFL (Mesodon roemeri, Rabdotus dealbatus, and Helicina orbiculate) prefer the three habitat types (old quarry, old pasture, river terrace) at BFL equally. Two of the southernmost transects that span all three habitats were chosen for data collection. A total of 26 two-by-two-
meter plots were sampled from. At each plot, all the snail shells present were collected and identified to species. Ground cover (dense or sparse), habitat type (river, quarry, or pasture), canopy (open or closed), vegetation, and sun exposure (sun or shade) were recorded for each plot. Results showed that the pasture is dominated almost equally by *Helicina orbiculate* and *Rabdutos dealbatus*, the quarry was dominated by Helicina orbiculate, and the river terrace was dominated by *Helicina orbiculate* and *Mesodon roemeri*. Overall, I found that *R. dealbatus* prefers sunn, grassy areas, *H. orbiculate* prefers to hide beneath leaf litter, and *M. roemeri* prefers decaying logs in the river area.

**Comparison of Quadrat, Line Intercept and Point-Quarter Sampling Techniques in Determining the Density of Juniper Trees in the Old Quarry Area of Brackenridge Field Lab**

Divya Balakrishnan – S08

Sampling the trees present in an area gives insight to successional trends and what species the current conditions favor. However, it can be difficult to choose which sampling method to use. This study examines which method – the Quadrat Method, Line Intercept Analysis, or the Point-Quarter Method – provides the most accurate estimates of juniper tree density at Brackenridge Field Laboratory (BFL) in the quarry habitat. I predict that the Quadrat Method will work the best as it assumes that there are no large variations in tree densities in the area. Five 200m² sites were chosen for sampling in the quarry habitat and each method was performed with randomly chosen points as well as systemic intervals. Results showed that the Point-Quarter Method provided the best results. Out of the three methods, it had the largest p-value which means it was the most likely to have been affected only by chance. Increasing the total number of data points may yield different results, however.

**Ant Preference for Protein and Carbohydrate Rich Food Sources at Brackenridge Field Laboratory**

Mia Gonzales – S08

Abundance and scarcity of a food resource are related to the degree of preference an organism has for that particular food source. When a resource is in abundance, preference for it decreases while a scare resource will have high preference. This study was to see if ants at
Brackenridge Field Laboratory (BFL) exhibit preference between a protein rich food, tuna, or a carbohydrate rich food, strawberry jelly. Both baits were left at two sites at BFL for 30 minutes each. The number of ants on each bait were counted, and samples of ants were taken for identification. Ants identified on the baits included *Crematogaster punctulate*, *Monomorium minimum*, *Pheidole sp.*, and *Solenopsis invicta*. For all species, there was a significant preference for the protein rich food bait. This knowledge of ant food preference can be used in management of invasive species (such as *S. invicta*). Pesticides can be geared towards the preferences to ensure a higher chance of it being eaten.

**A Comparison of Pollinating Insects found on Colubrina texensis vs. Ptelia trifoliata**

*Topping – S08*

While pollination is beneficial to both pollinators and plants, both sides try to maximize their benefit while keeping energy expenditure to a minimum. Thus, pollinators must be able to recognize patches with high density of flowers as this would mean high density of nectar. This study examines this relationship by comparing the number of pollinators present of two generalist flowering plants, *Colubrina texensis* and *Ptelia trifoliata*. Because *P. trifoliata* is larger and has more flowers, I believe more pollinators will be present there than on *C. texensis*. Pollinators visiting each plant were identified and recorded over the course of two-weeks at different times of the day. Results showed that the Ptelia plants had more insects present than Colubrina as expected however, in order to make conclusive statements a larger sample size is needed.

**Infestation of the Cochineal Bug, Dactylopius coccus, on the Prickly Pear Cactus (Opuntia sp.) at Brackenridge Field Laboratory**

*Sarah Dowdy – S08*

In many places, the prickly pear cactus (*Opuntia sp.*) is farmed to harvest Cochineal insects for their red pigment. However, infestation of these bugs left unchecked can wreak havoc on cactus populations. I conducted a study at Brackenridge Field Laboratory in Austin, Texas to determine the level of infestation of Cochineal insects on the prickly pear cactus populations in the quarry and pasture habitats. I hypothesized that infestation of patches would be localized as distribution of the insects is wind based, that cacti in dense canopy coverage would have higher
levels of infestation, and that cacti with new growth would have higher infestation levels. A total of 30 cactus patches were studied and rated on a scale of 1-4 for infestation levels. The degree of canopy openness and the presence of other parasites were also recorded for each cactus patch. I found that Cochineal infestation was present on approximately 30% of Opuntia patches. I also found that patches in open habitats with high amounts of sunlight were more likely to be infected than patches in closed canopy habitats, which was contrary to what I hypothesized. New growth was also found to have higher levels of infestation, supporting my last hypothesis. When comparing my results to the infestation results from three years prior, I found that infestation levels have decreased which could be due to recent rainfall. I believe continuous monitoring of infestation levels will provide us with conditions that affect infestation levels.

The Shoal Creek Population of *Tetramesa romana* and its Effect on *Arundo donax*

**J. Falk – S08**

Invasive species often times out-compete native species as they have no natural predators. One such example is the giant reed (*Arundo donax*). These reeds can grow up to 30 feet high and end up shading out many native species. This, in turn, reduces insect diversity as the vegetative diversity has decreased. A small wasp, *Tetramesa romana*, has recently been seen laying eggs in the giant reeds which may prove to be an effective biocontrol of the reeds. In this study, I attempted to locate the epicenter of the wasp population along Shoal Creek in Austin, Texas. In areas with high wasp density, I also noted the clump size of the giant reeds and how many flowers per area of the plant. Overall, I found a significant relationship between the average density of wasps per meter cane and the distance from the point with the highest wasp clump density. Future studies can use this as a baseline observation to see how the wasp population eventually colonizes the entire length of Shoal Creek.

A Continued Study of the Little Wood Satyr Butterfly at Brackenridge Field Laboratory

**A. Grant – S08**

In 2003, the little woody satyr butterfly (*Megisto cymela*) was introduced to Brackenridge Field Laboratory in Austin, Texas to determine its range, population size and dynamics and its host plant. I aim to determine the butterfly’s current population size and to see if the grass *Dichanthelium dichotomum* is actually its host plant or not. I used the Mark-Release-Recapture
method to determine a population estimate and visual surveys were conducted to see if *D. dichotomum* was the host plant. I found a population estimate of 237 for the entirety of BFL which was consistent with the previous population estimates. From the visual surveys done at night, I found no *M. cynela* activity on the grass thought to be its host plant. The surveys done during the day showed that a sedge plant followed by an unknown grass and lastly by *D. dichotomum* had the most butterfly activity. Future studies should be conducted, and samples of the sedge plant should be taken for identification.

**An assessment of the population of *Scincella lateralis* at Brackenridge Field Laboratory**

C. Poorte – S08

The ground skink (*Scincella lateralis*) is one of the most common lizard species in Texas. In this study, I aim to try and determine the distribution of the ground skink at Brackenridge Field Laboratory in Austin, Texas. The ten premade transects were used as they cover the three habitat types (quarry, pasture, river terrace) equally. When a skink was spotted, the GPS coordinates were recorded as well as the ground cover, canopy cover and leaf litter type. Overall, 50 skinks were spotted with the majority of the sightings on the southwestern side near the Colorado river. Ground cover did not appear to have a prominent pattern for skink sightings while most skinks were seen in areas with canopy cover levels of 1 or 2. A soil comparison between areas with skinks and areas without skinks was also done and showed that the skinks may have a preference for more clay-like soils. I estimate that the *S. lateralis* population is quite dense at BFL, however, continued monitoring of the population should be done to ensure fire ant populations do not move into skink habitats and disturb their populations.

**Characterization of the Habitat of *Carex planostachys***

Andrew Bennett – F08

Natural grasslands and savannas have suffered as woody plants have begun to encroach into them and shade out native plants. The native grassland plants are unable to thrive under the dense canopies of the invading woody plants which decreases the ground cover vegetation. *Carex planostachys* (cedar sedge) is a small, perennial sedge that is able to grow under dense juniper canopies. This paper outlines a groundwork study on the habitat of cedar sedge on which future studies may build in elucidating its ecological role. Six points were randomly selected in
the quarry habitat at Brackenridge Field Laboratory to survey cedar sedge. Canopy trees were identified, the relative abundance of juniper trees was calculated, and the amount of sedge clumps present were counted for each site. Soil measurements such as pH and nitrogen content, leaf litter depth, and percent canopy openness were also taken at each site. Although no habitat parameter was found in this study to vary to a statistically significant degree with the presence of *Carex planostachys* or with Juniper relative abundance, enough of a relationship was observed to suggest that one is present. Juniper trees and cedar sedge were found to be associated with shallower leaf litter. Further testing is needed with a greater number of samples to more clearly represent actual conditions. If further studies are to be carried out, perhaps conducting them in areas where Juniper trees and cedar sedge populations have been long established would yield more definitive results.

**Study of the impacts of Prosopsis glandulosa on soil nitrogen and conditions favoring its growth**

*Uma Bhat – F08*

Nitrogen fixation is essential in maintaining a balance of nitrogen in the ecosystem. *Prosopsis glandulosa* belongs to the Leguminosae family, which consists of many important nitrogen-fixing plants. This study looks at *P. glandulosa* at Brackenridge Field Laboratory and whether or not nitrogen fixation was taking place under their roots. The following hypothesis were tested: 1) nitrogen fixation is present under mesquites in Central Texas 2) There is a difference in the proportion of canopies, saplings and dead mesquites at BFL 3) There is a difference in the abundance of mesquites in the river, quarry, and pasture habitats and 4) There is a difference in the proportion of mesquites in different subjective ground cover categories and 5) There is a difference in the proportion of mesquites in different ground cover categories. A general survey of *P. glandulosa* was executed by walking marked transects at BFL. Soil samples were taken from the four largest canopy trees and tested for pH and nitrogen concentration then compared to soil samples taken from an area with no *P. glandulosa* present. We found a significant difference in the proportion of mesquite canopies and saplings at BFL (p=2.38E-8), a significant difference in the proportion of mesquites in the river terrace, and pasture habitats (p<.001), a significant difference in the proportion of mesquites in varying ground and canopy cover levels (p=.000269, p=.00025), and a significant difference in the amount of nitrogen
accumulated underneath mesquite canopies at BFL (p= .017467). Reasons for these differences could be attributed to drought, interspecific competition, and differences in soil nutrients amongst different habitats. However, we did not find a significant difference in the pH levels of mesquite and non-mesquite areas (p = .07638). Overall, we confirmed earlier studies suggesting conditions favoring the growth of mesquite include dry habitats with limited nutrients, low canopy cover and higher ground cover.

Armadillo Characteristics at Brackenridge Field Lab
Donna Casterline – F08

Prior studies done on the armadillo population at Brackenridge Field Laboratory have concluded that armadillos first prefer the pasture enclosures for burrow sites, then the river terrace habitat, and prefer the rocky quarry habitat the least. However, a comprehensive comparison between burrows in the three habitats has not yet been done. The goal of this study aims to identify if the armadillos choose burrow sites with similar characteristics in each of the three habitats. Burrows were located and assessed with string coverings and cameras to determine if they were active or not. Burrow measurements, the amount of sand in the soil, evidence of foraging, proximity to water, and canopy, shrub, and vine cover were recorded in order to compare similarities and differences between burrows in the different habitats. Results showed the soil in the pasture was the hardest while the soil at the river terrace burrows was the softest. This suggests that armadillos do tend to choose burrow sites with similar characteristics in the three habitats.

A comparative analysis between Opuntia (Cactaceae) populations at Brackenridge Field Laboratory and Stengl “Lost Pines” Biological Field Station and an examination of associated differences in soil chemistry
Alyson Center – F08

Plant growth and development often differ between habitats due to the physical environment as well as the physiological and competitive constraints of a plant species. Opuntia, a group in the Cactaceae family, is known to have a wide range of morphologies and is sensitive to soil moisture, temperature, and light. The objective of this study was to examine if there were any differences between Opuntia populations at Brackenridge Field Laboratory (BFL) and Stengl
“Lost Pines” Biological Station (SLP). Opuntia surveys were conducted at both sites along with soil samples that looked at pH, nitrogen, phosphorous and potassium levels, infiltration rate, and depth of the top three soil horizons to determine any soil composition differences. The dominant species at BFL was \textit{O. engelmannii} while the dominant species at SLP was \textit{O. macrohiza}. Soil tests showed significant differences between the pH, infiltration rates, and depths which could have affected the differing dominant species. Common garden experiments should be conducted as a follow up test to determine whether or not the species differences were due to differing habitat preferences among \textit{Opuntia}.

\textbf{Ant Foraging Intensity at the Brackenridge Field Laboratory}

\textbf{Mark Hall – F08}

The health of ant communities has been linked to the health of their ecosystem as ants are sensitive to slight changes in the environment. Invasive ant species such as \textit{Solenopsis invicta}, however, impact native ant abundances, diversity, and foraging behaviors as they have no natural predators and are very aggressive. This study compares how ant foraging intensity has changed since 1987 in areas that were infested with \textit{S. invicta} and areas that were not infested. Infested and uninfested sites from a previous study were chosen to sample foraging ant species at. Hotdog baits were placed on the ground, on tree trunks, and on tree branches to test foraging at each area. Many of the results of this study showed that substantial differences have occurred in the ant community in the 18 years since Porter and Savignano’s (1990) paper was published. They observed strong species presence dichotomies in 1987 between the infested and uninfested sites. They observed 13 species of ants in the uninfested sites but only \textit{S. invicta} at the baits in the infested sites. Almost equal numbers of species were observed in both types of sites this year, and \textit{S. invicta} was only observed at 4 of the 38 baits. Ants of the genus \textit{Pheidole} appear to be the most dominant currently, with \textit{Pheidole} observed at 11 of the 38 baits and responsible for every recruitment observed. Drought, parasitoid flies, and the natural cycle of invasion have all decreased \textit{S. invicta} presence and led to a more balanced ant community at BFL.
Foraging Tendencies of *Atta texana*

Daniel High – F08

Leafcutter ants (*Atta texana*) “farm” their own food by inoculating foraged leaves with a special, coevolved fungus. The fungus garden is tended by the ants through the addition of more chewed plant material and is the only known food for leafcutter ants. Lead preference and rejection is observed when the ants are foraging, but it is not completely understood how ants choose leaves for collection. Cuttings of different plant material along with orange peel, sorghum seed, and white presso millet were left along leafcutter ant trails at Brackenridge Field Laboratory in Austin, TX. The types of plant material tested included *Ligustrum sinensis, Ulmus crassifolia, Ampelopsis arborea, Diospyros texana, Smilax Bona-nox, Quercus fusiformis, Juniperus ashei, Celtis laevigata,* and *Berberis trifoliolata.* The sorghum seed was the most readily taken bait while *U. Crassifolia, A. arborea, S. Bona-nox, Q. fusiformis, C. laevigata, B. trifoliata,* and millet were all foraged in moderate amounts. *D. texana, J. ashei,* and orange peel were not foraged at all unless they were left out for long periods of time. The untouched baits all contained high levels of citrus phenols which the leafcutter fungus cannot grow in. This suggests the ants forage leaves that will specifically benefit the growth of the fungus and can sense certain chemicals that will lead to rejection of a bait type.

A Survey of Raccoon, *Procyon lotor,* Population and its Nocturnal Activity at Brackenridge Field Laboratory, Austin, TX

Stephanie Kanuch – F08

Determining the population size of the common raccoon (*Procyon lotor*), which is a nocturnal animal, is no easy feat. Such data is beneficial as it provides a better understanding to how disease spreads from a reservoir population to human and domestic animal populations. Brackenridge Field Laboratory is one of the only wooded areas in the Austin, TX area and thus houses a large concentration of raccoons, making it a prime site to conduct a population survey of raccoons. Remote cameras were set up to “mark” individuals which were identified through tail coloration, size, and markings. Each individual was given a number to track them in future photos. The max number of raccoons per frame for each fifteen-minute interval was counted in order to establish activity periods. From the data, two minimum population sizes were established: 13 raccoons from the time interval data and 63 raccoons from the identification data.
The estimated maximum population was 83 raccoons. Raccoon activity was highest during the hours including and immediately following dusk. Urban environments have a tendency to have higher raccoon densities, so the raccoon population estimate for BFL is unsurprising.

The effect of the presence of deer on the distribution and abundance of vines at Brackenridge Field Laboratory

Angela Kirchner – F08

During times of drought, deer have been observed to eat plants not normally in their diet. This study’s goal is to determine if the presence of deer have an impact on vine distribution and abundance at Brackenridge Field Laboratory during a drought period. I predict that there will be a significant difference in vine abundance in areas with deer versus areas without deer. Vine and host tree measurements and species were taken at three transects within the fence at BFL (deer presence) and at three transects outside of the fence (deer absent). Statistical tests showed significant differences between vine abundance, density, diameter, and height in the presence of deer and in the absence of deer. The results imply that deer herbivory could be the reason for these differences, however, it cannot be concluded. Differences in moisture and nutrient levels in the soil could also explain the differences.

Survey of the Chinese Tallow (Sapium sebiferum) at the Brackenridge Field Laboratory

Maria Mancha – F08

The success of invasive plant species is largely due to a lack of predation. The lack of herbivory allows invasive species to allot more of their energy to growth and dispersion. One such plant is the Chinese Tallow (Sapium sebiferum), which is present at Brackenridge Field Laboratory in Austin, TX. The study examines the density and distribution of the Chinese Tallow at BFL as well as if there are any possible light or soil moisture requirements for growth. Marked transects were walked throughout BFL and the GPS coordinates of any Chinese Tallow plants found were recorded. Soil samples and the canopy openness measure were also taken to determine preferred habitats. A total of 172 individuals were counted with the majority located in the old quarry and central pasture habitats. A significant difference was found between soil moisture from sites where Chinese Tallow was present and sites where they were absent. This finding does not necessarily indicate that a higher soil moisture level is required for success, but
rather that the plant is more likely to be found in areas with higher soil moisture. There was no significant relationship found between canopy openness and the presence of Chinese Tallow. The surveying of invasive species gives valuable information regarding management of populations and should be conducted frequently.

**Herbivory of *Juniperus ashei* by *Sciurus niger***

*Jeff Streett – F08*

*Juniperus ashei* is a dioecious species, where the females produce small, blueish-purple cones and the males produce yellow pollen. *Sciurus niger* (fox squirrels) like to eat the cones from the female trees. At Brackenridge Field Laboratory, male juniper trees had a lot of growth near the ground and bushy shapes while female trees had straighter branches, were not as bushy, and typically did not have branches until five or more feet from the ground. The goal of this study was to determine whether the sexual dimorphism of the junipers was the result of herbivory by *S. niger*. Cones were collected from juniper trees throughout the quarry and then mixed together to get a random distribution of cones for sampling. Fifteen cones were placed under a cage to prevent disturbance and fifteen were placed in the open at three test sites in the quarry habitat. Results showed that the cone piles were disturbed, as if they were scavenged through, but only one cone was found to be missing. This could be due to the squirrel’s preference for fresh cones, or fully ripened cones which many of the collected cones were not. This suggests that *S. niger* is likely not the cause of the dimorphism observed in the *J. ashei* trees. Another study done with cameras to capture activity under live, female trees along with activity under compiled cones would provide more accurate and detailed information on the possible causes for the differences seen between the male and female junipers.

**Susceptibility of Different Ant Species to Antlion Traps and Ant Avoidance of Antlion Zones***

*Colin Strickland – F08*

Antlion larvae (*Mymeleon spp.*) create pit traps that catch ants and other arthropods which they then feed on. Ants are their primary prey and I wanted to determine if there was a difference between ant species and their ability to escape the antlion traps. I also observed ant presence in heavily populated antlion zones to determine whether or not ants would forage in a
dangerous area. Five ant species (Pheidole dentata, Atta texana, Solenopsis invicta, Monomorium minimum, and Forelius mccooki) were collected using baits, then placed into enclosed areas with antlion traps. I recorded whether or not an ant was able to escape or not in the presence of an attacking antlion. Baits were also placed in close proximity to antlion hotspots to see if they would forage there or not. Based on results, some ant species were found to be better at escaping antlion traps than others. A. texana had the highest rate of escape (66.70%) while the other four species had rates of 30% or less. Ants were also observed to avoid the highly populated antlion areas as none were seen at the baits placed nearby. Previous studies have shown that the ants avoid the antlions and not the antlion habitats, so a follow up study on how ants know to avoid those areas would yield interesting results.

**Impacts on Nandina domestica from deer across Brackenridge Field Laboratory**

*Carmen Ulrich – F08*

Plant communities have been observed to become less heterogenous in the presence of deer herbivory. In periods of abundance, deer will consume high levels of preferred plants and reduce their numbers. In periods of drought, however, the available plant material is decreased, and deer will begin to graze on less desirable plants, such as Nandina domestica (heavenly bamboo). *N. domestica* and deer are both present at Brackenridge Field Laboratory in Austin, TX, and signs of deer herbivory have been observed on the bamboo likely due to drought. This study aims to determine *N. domestica* distribution throughout BFL and to look at the amount of grazing in the different habitats. I hypothesized that shorter *N. domestica* plants would exhibit more signs of herbivory since these plants may be younger and have more tender leaves. Bamboo in less dense areas as well as those located on a lower incline are hypothesized to show more signs of herbivory as well. The height of *N. domestica* plants and the level of herbivory observed (0-4) was obtained from 19 transect points throughout BFL. At ten of these sites, the density and the slope of the ground was also recorded. Overall, grazing levels on *N. domestica* were high at each surveyed site. There was no relationship found between density, height, or the slope of the ground and browsing rates. It is clear that the drought has led the deer to feed on normally undesirable plants. A follow up study on *N. domestica* grazing levels during a non-drought time would provide complimentary results showing lower levels of grazing.
The Pteridophyte Community along the Stream Bed at Brackenridge Field Laboratory
Susana Wadgymar – F08

Population surveys are essential when looking at how different species are interacting and responding to environmental factors. The fern community at Brackenridge Field Laboratory in Austin, TX had never been studied or surveyed, which is what this paper aims to do. Fern distributions were recorded along the stream bed and recorded as clumps of individual species or combination clumps with multiple species present. Diversity seemed to increase as one traveled down the stream bed. The fern population at BFL has suffered from recent drought conditions and have dried up. A follow up study done at a different time of the year or under different weather conditions would yield more information on the fern dynamics at BFL.

2009
Effects of Grasshopper (Orthoptera) on grasslands of the Brackenridge Field Laboratory
Victor Bui – S09

In excess, increases in insects can degrade terrestrial habitats which, in turn, harms other organisms. In the Spring of 2009, a significant population of grasshoppers were found in the grasslands at Brackenridge Field Lab. Four grassland areas were surveyed to study the population effects that the increase of grasshoppers could cause on plant growth. In this study, I determined the population density of Orthoptera within BFL and what variation is present between regions at BFL, what species are found at BFL, and what the grasshoppers eat and how this effects plant population dynamics. Overall, I found a total estimated population of 1,032 within the four areas I surveyed. Six grasshopper species were found in total, and include: Chortophaga viridifasciata, Eritettix simplex, Arphia conspersa, Paradolophora haldemani, Trimerotropis pallidipennis, and Malanoplus confuses. The dietary results showed that grasshoppers do not tend to prefer one food type over the other, but are, instead, specialist eaters and forage at random.
Abundance and distribution of the white-eyed vireo \((Vireo griseus)\) at Brackenridge Field Laboratory

Gabriela Casares – S09

The white-eyed vireo \((Vireo griseus)\) is a Neotropical migrant found throughout the eastern United States and commonly found in central Texas. There has been a lack of studies done on the avian species at Brackenridge Field Lab, which has prompted me to investigate the territories and preferences of \(V. griseus\) and whether there is a correlation between canopy coverage and abundance of the bird. A modified point-count, presence-absence technique was used to determine territory locations. A total of 17 \(V. griseus\) territories were found at BFL during Spring 2009. Territories were established without habitat preference, however, canopy coverage seemed to be important to \(V. griseus\) with less coverage correlating with more territories. Continued monitoring could indicate whether this is a growing or declining population.

The Distribution of the foraging population of Subterranean termites \((Reticulitermis spp. & Coptotermes spp.)\) across the Brackenridge Field Laboratory

Nehemiah Cox – S09

I investigated the transects at Brackenridge Field laboratory for signs of termite and ant infestation. 103 Transect points were selected and the 10 m radius around each point was examined for logs in order to determine the presence of termites and ants. The presence of termites was influenced and limited by the Decay Class of investigated logs and the tree species of the logs. Furthermore, the ant community present negatively affected the chances of observing termite infested logs. The soil composition, humidity, and soil temperature also influenced the subterranean termite population and limited the available habitats to them. These multitudes of factors influenced the termite population and forced it toward the fences enclosing the Brackenridge Field Laboratory.

Effect of Deer Herbivory on Arthropod Abundance and Species Richness

Robert ElDabaje – S09

The effects of large mammal herbivory on vegetation levels and plant species diversity is well documented as are the variable feeding patterns of white-tailed deer based on plant species available. Furthermore, increases in plant diversity have been suggested to lead to higher levels
of arthropod diversity. The aim of this study is to observe the direct effects of deer herbivory on arthropod abundance and diversity by analyzing the arthropod communities of a number of ecological communities, both inside and outside of well-established enclosure that completely prevent deer browsing in areas inside each enclosure. Arthropods were collected using pitfall traps set up both inside and outside of four different enclosures, each with a different plant composition and vegetation level. Areas with vegetation preferred by white-tailed deer for consumption observed the largest and most significant differences in biomass levels between enclosure interior and exterior, with higher arthropod abundance and species richness levels being found inside the enclosures as expected. With regards to enclosures that did not have high levels of vegetation preferred by deer, differences between internal and external arthropod communities were much less remarkable. Totals across all four sites showed more significant differences between internal and external arthropod abundance and diversity, suggesting that higher sample size could lead to more significant results and conclusions.

Inter-specific interactions of deer and arthropods through the monopolization of autotrophic resources at BFL
Ian Etheredge – S09

Deer herbivory can show an array of effects on an environment when at elevated levels. At BFL, which is home to an inordinately high number of deer, the effect of herbivory has been seen on various levels. The flora, especially at deer browsing levels, has shown a dramatic decrease in biodiversity and overall availability of primary production due to its monopolization by deer. In this study we show how deer herbivory goes beyond simply its effects on forb, grass and browse level species but also on the species which depend on these primary producers as well. We have seen a significant shift in the taxonomic composition of areas with heavy deer browsing, a positive indication of indirect inter-specific interaction.

Prevalence of Solenopsis invicta in recently disturbed areas in Tarrytown
Kristina Kinsel – S09

Disturbances allow for an invasion of the invasive species, Solenopsis invicta, where native ants previously occurred in abundance. This study serves to assess the possibility of the invasion of S. invicta in Tarrytown, an area that harbored a population of Solenopsis geminata
prior to the experiment. Areas disturbed by construction projects and large landscaping endeavors were sampled for potential invasion. The ants present at each disturbed site were sampled through the placement of a bait at the site for a forty-minute period. The bait and any ants on it were then collected after that time period, and the results were analyzed to discern any possible trends. It was discovered that *S. invicta* occurred more often than *S. geminata*, and that *S. invicta* appeared to prefer an open canopy layer and a sparse ground cover level. Results were not, however, statistically significant, as the sample size was very low. Further studies should be conducted with paired baits, as well as a larger sample size.

**The Effects of Nutrient Levels on Recruitment of *Solenopsis invicta***

Meagan Murdock – S09

Worker polymorphism enables *Solenopsis invicta* to access and transport different food sources. Through a competitive view, *S. invicta* was tested at Brackenridge Field Laboratory for differential size ratio recruitment to different qualities of food. Quality of food was based on the function of protein. Four baits were used with different protein level where higher levels of protein in bait were considered to be a higher quality of food. Of the samples collected no statistical significance was found, but trends in abundance at baits were seen between meat and egg baits.

**Interactions between large-mammal herbivores and invertebrate communities: How deer populations affect invertebrate species diversity and abundance at BFL***

Blake Sissel – S09

Impacts of large-mammal herbivory on invertebrate community and structure is a fairly well studied system. However, this system and the corresponding interactions are different depending on the specific ecosystem in question. We analyzed the effects of deer populations on 1) invertebrate diversity in terms of species richness, and 2) invertebrate abundance in terms of both individual numbers and total biomass. I found no significant evidence that deer herbivory affects either of these community dynamics, but we found methodological problems that could have interfered.
Herbivory Effects on Soil Nutrient Concentrations

Jerrad Stoddard – S09

Herbivores have profound impacts on plant communities, both direct and indirect. This study provides insight into the effects of deer consumption on nutrient concentrations of soils at Brackenridge Field Laboratory in Austin, Texas. Soil samples were taken inside and outside a well-established exclosure, and soil tests were conducted to determine phosphorous concentration and pH for each sample. It was determined that there was a significant difference in soil phosphorous concentration but not pH. However, further investigation is needed before conclusions are drawn.

Comparison of Odanata Sex Different Between Open Field and Pond Habitats

Nunu Taupradist – S09

An analysis of Odonata population counts at Brackenridge Field Laboratory revealed that there is a higher frequency of male dragonfly and damselfly species compared to females at pond habitats. This could be attributed to the territorial nature of male species, however, females were shown to not be significantly more abundant than males in open field habitats –a result inconsistent with expectations that females favor to remain away from pond habitats when not mating. A species composition comparison shows little similarities between species seen at open fields and ponds.

Effect of Presence of Typha latifolia on Diversity of Aquatic Plants

Jameson Wall – S09

Invasive species can be detrimental to native species as they have no natural predators present to keep populations in check. Cattails are one such invasive species that can quickly take over ponds. To study their effect on how they impact plant diversity, I chose eight enclosure ponds at Brackenridge Field Laboratory to observe. Plant samples were taken from each pond and identified. Based on results, it was determined that the diversity of plant life is negatively affected by the presence of cattails as determined by finding the Jaccard Index of Similarity. Future studies could be performed to determine if the cattails lower diversity by shading out other plants or whether they use up a disproportionate amount of nutrients in the soil.
**Status of *Quercus Virginiana* (Live Oak) at Brackenridge Field Laboratory**

Matt Westbrook – S09

The purpose of this study is to access the status of *Quercus Virginiana* (Live Oak) at the University of Texas at Austin’s Brackenridge Field Laboratory. The spread of the fungus *Ceratocytis fagacearum* (oak wilt) is the most serious threat to the species statewide. Two methods were used: a follow up on previously healthy trees near an infected site documented roughly ten years ago, and a nearest neighbor analysis of dispersal and density of adults and juveniles. Forty seven percent of the previously healthy trees were found to either be dead or dying of oak wilt. The nearest neighbor method estimated a density of 9 individuals per hectare for adult trees and 5 individuals per hectare for juveniles, indicating a low recruitment level. The R-values attained were 0.40 for adult to adult (p-value 0.13, df=37) and 0.54 for juvenile to juvenile (p-value 0.19, df=37). The clumped dispersion pattern indicated facilitates the spread of oak wilt through the communal roots of oaks within the clumps. Alternately, the clumped dispersion of juveniles could allow them to flourish if they are able to remain unharmed, especially if immunity is being selected for in the long term.

**Exclusion of Odocoileus virginianus and Resulting Community Shifts**

Almaguer, R – S09

Deer exclosures placed in varying conditions throughout the Brackenridge Field Laboratory are examined for potential shifts in community structure after protection from browsing pressure. Plant species density, height, and richness, insect presence, and non grass species are examined in two 4x4 meter large exclosures found in distinct BFL regions, the pasture and river terrace. Plant height coincides with dry weight samples, and the exclosures produce much more than the controls which are accessible to deer. Density was not impacted by the erection of the exclosures in the pasture area, but a slight difference was noted in the river terrace region. Insect presence and non grass plant species were found in greater abundance in the river terrace area, and varied less across control and exclosure then by habitat. The exclosures have not been in place long enough to determine a clear shift from shrub to grassland dominated terrain.
Differences in Vegetation Growth, Abundance, and Cover in the Soil beneath Live Oak Trees (*Quercus fusiformis*) at Brackenridge Field Laboratory, Austin, Texas

Misha Bilzard – F09

Populations of live oak trees (*Q. fusiformis*) in the United States have been killed from a fungus called oak wilt (*Ceratocystis fagacearum*). Though the understory vegetation growing beneath *Q. fusiformis* has been studied, it is not known what effects the fungus may indirectly cause to the vegetation beneath *Q. fusiformis* that have been infected and then died. Since the spread of *C. fagacearum* is difficult to prevent and protecting *Q. fusiformis* with fungicides or more drastic measures, such as digging trenches around trees, any differences in vegetation could be widespread. To test this hypothesis, *Q. fusiformis* that had died from oak wilt, *Q. fusiformis* that had died from being girdled, and living *Q. fusiformis* were analyzed. Vegetation cover and diversity were directly measured, and vegetation growth rate and biomass were indirectly determined using cucumbers seeds grown in soil collected from the trees. Though there were no statistical differences among all three of the sites, further tests or data analyses should be used before any conclusions can be drawn from the data. Importantly, longer experiments for the cucumbers are needed to determine if trends of slower growth and lesser biomass (when compared to the controls) were random or might lead to statistical differences.

Habitat and Herbivorous Insect variation associated with two species of *Celtis*

Melanie Laughlin – F09

Two species of *Celtis* are found at Brackenridge Field Laboratory (BFL) in Austin, TX. The two species of focus in this study are *Celtis laevigata* (Sugar hackberry) and *Celtis reticulata* (Netleaf hackberry). Both species are native to central Texas and are known to occupy contrasting habitats. *C. laevigata* is known to occupy bottomland areas with deep soil, while *C. reticulata* is known to inhabit rocky, xeric areas. Psyllids are small herbivorous insects which form galls on *Celtis* species. These are known to invade *C. laeviaga and reticulata: Pachyphylla celtidismamma* (Nipple) *Pachyphylla celtidisvesicula* (Blister), *Pachyphylla celtidisgemma* (Bud). Samples of *Celtis* branches were collected using the Point-quarter method, and then classified by different morphological traits; this process was repeated for different habitats at BFL. By comparing traits of different samples, we determined which habitat each species prefers at BFL. The different galls were compared on each specimen to determine if each one was host
specific. Traits were graphed according to number of sites in each type of habitat. From this data we noticed the Quarry contained no bud galls and was the most scabrous. The Pasture appeared to have sites with intermediate traits, such as average leaf width. The River was the only habitat with bud galls and berries; this could be due to higher levels of nutrients in the soil. This study showed each habitat contains samples of *Celtis* which vary in morphological traits. The bud gall appears to only be found in the River habitat suggesting it may host specific. The only area of uncertainty is the Pasture habitat, which appears to have an intermediate variation of morphological traits. This experiment shows the flaws of only relying on the Morphological hypothesis of defining a species. If genetic testing was integrated into this experiment it would be more accurate identifying each species of *Celtis*.

**Gregarious roosting in *Heliconius erato*; roost size and roost fidelity**

Angie Martinez – F09

Most species in the genus *Heliconius* have been observed to display gregarious roosting behavior, including *Heliconius erato*. It has been observed in the field that *H. erato* return to the same roosting site every night. Research on this behavior has not determined if roost size is correlated to roost fidelity. This study on the relationship between roost size and roost fidelity in *H. erato* was conducted in a 462 square meter greenhouse at the Brackenridge Field Laboratory in Austin, TX. The null hypothesis for this study is that roost size is not correlated to roost fidelity, and the alternative hypothesis is that roost size does correlate to roost fidelity. Eight distinct roosts were observed over 6 consecutive nights and the numbered individuals roosting at each site were recorded. The results of this study show that there is no correlation between roost size and roost fidelity in *H. erato*. These results may have been affected by the size of the study area and the handling effects on roost fidelity. Future studies on this topic may provide information on how habitat size affects roost size and thus roost fidelity if roost size and roost fidelity are correlated.

**Effects of the 2008-2009 Drought Upon Tree Species at Brackenridge Field Laboratory**

Kenda Mitchusson – F09

During 2008-2009, the central Texas region experienced a severe drought. During that time, several trees died due to the stress caused by the drought. It was observed that some species
seemed to be more affected by the drought than others. Based on this observation, data was collected to determine which trees suffered the most losses from the drought at Brackenridge Field Laboratory. The circumference of the trees was measured to determine if the drought had more of an effect upon size as opposed to species, and the GPS location of the dead trees was recorded as well. Based on results, we discovered that Cedar Elms and Hackberry trees made up the majority of dead trees at BFL. This data is not conclusive, however, as these trees could have died due to reasons other than the drought. There was not sufficient data on tree circumference to determine whether age was a factor in tree death. Based on out GPS points, we found most dead trees in the quarry area. This could be due to the fact that the quarry is farther away from water sources than other areas, which could have exacerbated the effects from the drought.

Foraging Preference of Ants for Carbohydrates, Lipids, or Protein

Jan Nguyen – F09

The role of worker ants in an ant colony is to forage for food, defend the colony, and help build/repair the colony. Primarily, the worker ants forage for food to bring back to the queen so that she is able to obtain energy and reproduce. When it comes to foraging, how do the worker ants know what to forage for? What kind of food do they prefer? Of the main food groups of carbohydrates, lipids, and protein, do they have a preference? Why would they have a preference? The hypothesis is that ants do have a foraging preference; the null hypothesis is that ants do not have a foraging preference. 60 baits for 15 sites of honey, tuna, and peanut butter served as baits of carbohydrate (C), protein (P), and lipid (L). 59 ants total were collected from 3 trials. A chi-squared test determined that there was a significant correlation between ants and foraging preference ($p$-value = 0.02). Overall, the ants preferred the lipid food source, which could be attributed to the type of ant species studied as they are known to prefer lipids.

Comparing tadpole densities at Brackenridge Field Laboratory

Kathrine Ross – F09

Brackenridge Field Laboratory, located in Austin, Texas, is a center for biological research, education, and data collection. Over time, several man-made ponds have been created inside this tract of land for research experiments. Four small ponds located in the southern corner of the property have been studied to research tadpole density within each. Even though these four
small ponds are located relatively close to each other, there are significant differences in the sizes of tadpoles found within each. A two-week study on the ponds including water temperature fluctuations, sediment and water depth, canopy coverage and other biological observations were evaluated. Observations regarding habitat usage by other aquatic and non-aquatic organisms were also recorded to better understand different biological factors affecting tadpole growth and development.

**Parasitoid Phorid Flies and Characteristics that aid in IFA control at BFL**

Rob Salinas – F09

Phorid flies naturally inhibit native ant populations they are chemically attracted to through parasitism. They lay their eggs in the ants which becomes fatal as the flies mature. *Solenopsis invicta* (the Imported Fire Ant, or IFA), however, are not parasitized because the native flies are not chemically attracted to them. Phorid flies that do naturally attack the IFA were brought from South America to Brackenridge Field Lab to try and control the population. I looked at IFA mound locations across BFL to determine if location was a factor that determined whether or not a phorid fly would attack. Ant mounds were marked with a GPS unit and fly traps were placed at the mounds to catch and identify if phorid flies were present. Results showed that there is a significant difference in location that the phorids prefer. Sixteen individuals were found in an open microhabitat while only six were found in a closed habitat. A small sample size could have produced inaccurate results; thus, the experiment should be replicated on a larger scale.

**The distribution and foraging interactions of Solenopsis invicta and native ants around the Brackenridge Field Laboratory firefly meadow**

Tam Tran – F09

The progression lines of *Solenopsis invicta*, the red imported fire ant are redrawn every year. *Solenopsis invicta* have been slowly advancing each year throughout the state of Texas. I used baiting techniques along several transects around the firefly meadow and the surrounding woodland to map the extent of the border in which *S. invicta* and other ant species are found at. I also observed the foraging interactions between fire ants and other ant species when the fire ants begin to move into a new zone. I found that apart from dominating open, sunny habitats around the meadow, the red imported fire ants are only found foraging 5 meters inside woodland.
habitats with dense canopies. However, when baits containing *S. invicta* workers are moved five meters further into wooded areas, those bait sites are still maintained and foraging activities by imported fire ants continue. Other species of ants such as *Pheidole dentata* are exclusively found in closed canopy habitats and can be seen as being excluded from foraging in sunnier environments by *invicta* species.

2010

**Abundance and distribution of vining plants in three habitats at Brackenridge Field Laboratory**

Daniel Krenzelok – S10

The vining plant community at Brackenridge Field Laboratory in Austin, Texas was sampled in three habitats: along the fence, edge, and forest interior. It was thought that some differentiation might be seen in the vine species which occupied each habitat. While a few species were only found in one or two habitats, BFL was not sampled extensively enough to draw and definitive conclusions. It was found that more individual plants were found on fences than edges, and more individuals on edges than in forests; this is presumed due to the presence of more sunlight or external support; separating the effects of these two variables proved difficult in this study. With more careful and extensive studies preferences of specific vine species may be found.

**Effects of ashe juniper (*Juniperus ashei*) and cedar elm (*Ulmus crassifolia*) on seedling germination, seedling growth, and plant community composition**

Gina Calabrese – S10

Ashe juniper is an evergreen angiosperm native to the southwestern U.S. that has been increasing in density and invading more rare ecosystems. While fire suppression has contributed to this invasion, allelopathic compounds have been isolated in ashe juniper and there is evidence that ashe juniper reduces groundcover density and diversity. In order to determine the impact of ashe juniper on community composition in a central Texas woodland, a vegetation survey of the species beneath ashe juniper was conducted at Brackenridge Field Laboratory and compared to a survey of the species beneath cedar elm, the most common tree at BFL and a species not known to be allelopathic. Trees of each species were spatially paired and measured for light flux, shrub,
vine, and groundcover level, and proportion dicots, and a species list generated for each tree. Data were analyzed in paired t-tests and Jaccard indices of similarity between pairs were averaged and relative abundances of species associated with ashe juniper and cedar elm were compared. To isolate the effects of allelopathy from other factors, grass and cucumber seedlings were grown in soil from underneath ashe juniper and cedar elm trees, and mean seedling height and proportion of seeds germinated were measured and analyzed using anovas and t-tests. Few differences were found in mean seedling height and proportion of seeds germinated, but there was some evidence of a negative effect of ashe juniper on grass seedlings grown in soils from the quarry. Jaccard's similarity of vegetation communities associated with ashe juniper and cedar elm was higher than expected, and there were few differences in relative abundances of associated species, but ashe juniper was associated with higher levels of groundcover, vines, and shrubs.

Some characteristics of the sundew species *Drosera brevifolia* and plant color variation between canopy levels at Stengl “Lost Pines” Biological Research Station, Smithville, Texas

Heather Oslund – S10

Carnivorous plants pique our curiosity with the subversion of the generally accepted place of plants in the traditional food chain. Their use of animals as a nutrient source allows for a great deal of research on how they are able to do this and where these plants are found as they could be an indicator of environmental conditions. This study utilized the carnivorous plant *Drosera brevifolia* which has an adhesive trap of sticky mucilage secreted from trichomes on leaf surfaces on the ground. Plants were analyzed from 3 separate sites around the Stengl “Lost Pines” Biological Research Station in Bastrop County, Texas for plant diameter, bud number, number of plants, dominant plant color and canopy openness. Results showed that the majority of green plants were found in areas with more canopy cover while the majority of red plants were found at areas with much less canopy cover. This difference may be due to sun stress as seen in a passionflower plant, but this and other options need to be studied further. As well as further studying this color difference, this paper also discusses the need for future study of this plant from basic morphology and demography to animal interactions and bioindicator possibilities.
Effects of Ground Cover Vegetation Height on *Solenopsis invicta* bait dominance

John Paszalek – S10

A study of the effects of ground cover height on the competitive outcome of bait foraging was conducted at Brackenridge Field Laboratory (BFL). We attempted to manipulate the ability of *Solenopsis invicta* to dominate baits by changing the height of ground cover. We predicted that reduced ground cover height would increase the competitive advantage of *S. invicta*. Although no direct effects of ground cover height were detected, the reduction of vegetation has strong effects on the presence of ants through temperature changes.

Differences in Ant Abundance and Foraging Activity between Exclosures and Surrounding Areas

Garrett Durland – F10

Ants and white-tailed deer (*Odocoileus virginianus* Zimm.) are both dominant components of the ecosystem at Brackenridge Field Laboratory in Austin, TX. Ants and white-tailed deer interact directly and indirectly on a number of levels, but few studies have been conducted to determine the result of these interactions. In this study, paired baits were used to determine ant abundance inside and outside exclosures. The nature of the data prompted a T-test, Sign test, and a Wilcoxon-Mann-Whitney test all of which failed to reject the null with p-values greater than 0.20 (alpha = 0.05). Whether the failure to reject the null was due to inadequate experimental design, insufficient number of samples, or interactions with contrasting effects is difficult to ascertain. Problems with the study are addressed and recommendations for future studies are given, including measuring ant mound location instead of using baits and decreasing the distance between points in a pair.

Spatial Distribution and Burrow Habitat of the Nine-Banded Armadillo, *Dasypus novemcinctus*, and Brackenridge Field Laboratory

Tabatha Jurak – F10

The nine-banded armadillo, *Dasypus novemcinctus*, relies on its ability to burrow for protection from predators and weather, as well as raising young. The placement of these burrows appears to depend on soil type (must be easy to dig in) and amount of vegetation surrounding the entrance. A previous study done at this same location showed a preference for many shrubs and
enclosed areas. Data for this study was collected from the center portion of Brackenridge Field Laboratory in Austin, Texas. Burrows were marked with a GPS system and the density of canopy, shrub, and ground coverage was recorded. The spatial distribution was analyzing using the Poisson distribution. The densities of burrows were used to compare enclosures to non-enclosures as well as the three habitat types: quarry, pasture, and river. The results show a spatial distribution that is random but has a slight tendency towards being clumped. This reveals that armadillos probably do not mind being near one another and that sometimes the location of resources could cause a slight clumping. The results of habitat characteristics show a preference for dense canopy coverage and very little shrub and ground coverage, contrary to the results of the previous study. Enclosures have a higher density of burrows than non-enclosures, possibly due to its protection. Finally, the pasture and river have a higher density than the quarry, due to availability of water and good soil for digging.

Discovery-Dominance Trade-Off in Ants at Brackenridge Field Laboratory

Suzanne Li – F10

The discovery-dominance trade-off is a theory in which species that are better at discovering food resources tend to fare worse at dominating the resource, and vice versa. This theory is important in explaining animal community dynamics, especially at a small scale. To model this theory, I set hot dog baits around Firefly Meadow at Brackenridge Field Laboratory (BFL) and documented the first species of ants to arrive at the baits, and the species of ant that dominates the bait after one hour of discovery. Chi square analysis and relative abundance of discovery and dominant ant species is used to analyze the data, and it is found that S. invicta, imported red fire ant, was the most abundant ant at the trials. However, the discovery-dominance trade-off is still exemplified by the ants in the BFL community. These data further support current theories regarding the trade-off and should be taken into consideration when implementing pest control for any one species of ant.
Methods of Earthworm collection and relative moisture content at Brackenridge Field Laboratory
Michael Marek – F10

Earthworms are important to the world’s ecosystem as they provide healthy soil to the earth's surface for growth of vegetation and other microorganisms. Collecting earthworms can be a challenge in dry conditions since the terrestrial worms prefer moist conditions. Earthworms are collected in dry conditions by inducing water to a small area over several days before collecting. This brings the worms to the top where they are collected in a 1 ft³ sample of soil that is sifted through a series of mesh wire for easy visibility. Collected samples were taken to determine the percent H₂O in each site. There were 25 sites randomly selected in four different areas at Brackenridge Field Laboratory. These sites and areas were compared in ground coverage, shrub coverage, canopy coverage, pH, moisture, and the number of earthworms collected. Results show that there was no significant evidence that there was a difference in opened and closed areas that had earthworms present. The pH and moisture conditions were in favor of the earthworms. The moisture percent of the soil ranged from 5-16% H₂O. Increasing the sample sites would provide more information to better determine if there is a difference in the preference of earthworms and the vegetation coverage around them.

Impacts of Deer Herbivory on Vegetation at Brackenridge Field Lab
Liz McConnell – F10

The white-tailed deer (Odocoileus virginianus) population at Brackenridge Field Lab (BFL) has had significant impacts on local vegetation since their introduction. Four high fenced deer exclosures were erected in 2008 to help understand the changes that deer herbivory has on plant community dynamics. Post oak and Spanish oak recruitment has been greatly diminished due to deer herbivory. Deer have also had a negative impact on the survival of chinaberry and hackberry saplings. Deer at BFL have impacted many species of forbs. Morphology of shrubs also appears to change greatly in response to deer herbivory. These direct impacts on primary production have far reaching impacts on the rest of the ecosystem.
Influence of Earthworm Abundance and Variation on the Biodiversity of Subterranean Communities at Brackenridge Field Laboratory

Jeanne Mescher – F10

Organisms that modify their environments greatly influence the structure of surrounding plant and animal communities. Earthworms, which mix the organic material in soil, play a large role in facilitating vegetative growth and may be a factor in plant biodiversity. Earthworms may also be a factor in the diversity of the invertebrate, soil dwelling communities at Brackenridge Field Laboratory. By sampling earthworm and other invertebrate populations of this area and evaluating the taxonomic richness, and evenness, I found that the subterranean communities at Brackenridge Field Laboratory have relatively high biodiversity, correlating with high earthworm abundance.

Sediment and Vegetation Survey of Flood Deposits at the Brackenridge Field Laboratory

Jillian Rowley – F10

Riparian plant communities and soil profiles reflect the flooding history of an area, such as the floodplain of the Colorado River at the Brackenridge Field Laboratory. The ecological impact of a flooding event is significant and often scours much of the soil and vegetation away; however, some species can survive these events as well as some of the older sediments. The purpose of this experiment was to survey the vegetation and sediment of the flood deposited terrace both at the surface and along an intermittent stream that discharges to the Colorado River to interpret the effects of frequent flooding along this floodplain. Several questions to be answered include whether the alluvium deposited from flooding events decreases in thickness laterally away from the river, reflecting the magnitude of the events, and whether the sandy silt loam was deposited in one event from the major flooding event of 1900 when the McDonald Dam broke. Point quarter methods were used to quantify vegetation at the surface of the flood deposit as well as along the streambed and on the slopes of the terrace. Soil samples were analyzed for composition, grain size, texture, sorting, roundness, and color. The deposits closer to the Colorado River were more homogeneous and reflect mostly a history of flooding events on the terrace while the deposits on the North side of the bridge reflect a much more complex history. Layers of clay, silt and sand are embedded within the lower sections being oxidized. The interpretations drawn from the results of this survey conclude that the majority of the sandy silt
loam deposit is the result of the 1900 flood. This does not account for all of the alluvial deposits considering the differences in sediment along the surface gradients.

**Comparative analysis of Coyote (*Canis latrans*) diet at Brackenridge Field Laboratory in Austin, TX**

**Conrad Williams – F10**

Fecal analysis was used to determine the fall diet of urban coyotes (*Canis latrans*) at Brackenridge Field Laboratory in Austin, TX. Additionally, comparisons were made to the diet of coyotes in more naturally and ecologically distinct areas of south Texas. While the most common mammalian food items for Coyotes in south Texas were rodents and lagomorphs, the most common mammalian remains found in scat at BFL were those of domestic cats (*Felis catus*). Both populations consume deer, particularly fawns. Finally, potential impacts of the recent Coyote establishment at BFL on deer and feral cat populations are discussed.

**2011**

**Comparison of Vegetation in a Ten-Year Old Oldfield With Restored Blackland Prairie in Mueller, Texas**

**Ashley Asmus – S11**

Conservation efforts must take into account that small fragments of land, especially oldfields or brownfields, will become increasingly important with the speed of urban and agricultural development. Recovery of these oldfields to maximum functional diversity is the primary objective. One question in oldfield restoration is what steps must be taken actively to restore these sites, and what can be allowed to happen over time? This study asks that question of an oldfield in the Mueller Development on the northwest side of Austin, Texas, USA. There, a former airport tarmac area undisturbed and un-mowed for ten years sit side-by-side with an actively restored piece of blackland prairie. Three fifty-meter transects were used to establish a total of 15 0.5x05meter quadrats in each area. Our study found that although the two sites had many species in common, fundamental differences in biomass accumulation and biomass-species richness relationships exist.
The Impact of White-Tailed Deer (Odocoileus virginianus) on Forest Dynamics
Kathleen Burns – S11

Deer can affect forest dynamics by altering the species composition of plant communities through high browsing pressure. These shifts can impact a forest’s successional trend and thus its overall structure and function. In 1990, white-tailed deer colonized the urban research field station Brackenridge Field Laboratory (BFL). The aim of this study was to examine the effects of the white-tailed deer on the forest dynamics in BFL. To assess the impact of herbivory, I paired sampling sites in the southern river terrace habitat of BFL with nearby sites outside BFL that experienced little browsing pressure. I collected data on the relative frequency of ground cover species, and the relative abundance of trees and shrubs both inside and outside of BFL using nested quadrats. Tree density and tree species richness were lower in sites within BFL. Ground cover and shrub species richness was comparable for both site locations. Jaccard’s index of similarity of 0.94 for the two locations suggests a divergence in species composition. This divergence may be attributable to deer selectivity, which can often stifle tree regeneration directly through browsing and indirectly through the increase of grass density. In addition, chi-square tests found a significant difference in the proportion of canopy and sapling trees both inside and outside BFL. While sites outside BFL appear to become more intensely wooded over time, the southern river terrace habitat of BFL appears to become an increasing grassland due to herbivory.

Open Pollination Communities at Colubrina texensis and Opuntia lindheimeri
Kevin Farge – S11

Habitat fragmentation has been shown to reduce the diversity of species present in calcareous grasslands. A diversity of pollinating species, however, is important to the propagation of certain plants. To look at the diversity of species currently visiting open pollination events in Central Texas, faunal communities at the plants Colubrina texensis and Opuntia lindheimeri were studied at the Brackenridge Field Laboratory in Austin, Texas, and specimens were taken for later identification. Observations were also made of community level interactions at the plants, and the surrounding area was surveyed and studied. These two plant species each attracted unique combinations of pollinators and pollinator-predators into their pollination communities, and a diversity of insect families were collected during the course of
the study. Both systems had their main predators in the family Reduviidae, and also class
Arachnida. Similar trophic level structure was observed in both communities, but with varying
amounts of diversity between the two, likely due to differences in the number of flowers
presented and the way in which visitors partitioned the resource. The diversity and richness of
species at such events could be used as a measure of ecosystem health, and of habitat
connectivity in the fragmented landscape. Comparisons can also be made over time, and more
research could be done to shed light on the role played by insects in the propagation of plants and
of their use of grasslands as part of the landscape mosaic.

Survey of Aquatic Macroinvertebrate Communities within Four Ponds at Brackenridge
Field Laboratory
Charlotte Heron – S11

Aquatic macroinvertebrates are useful tools for studying several aspects of an ecosystem,
from dispersal and the effect of predators to water quality and ecosystem health. This study uses
a survey of macroinvertebrates from four ponds of different relative distances with an aspect of
within pond heterogeneity caused by the presence/absence of Typha latifolia (Common Cat-
Tail). Ponds without T. latifolia were expected to look more similar to each other than when
compared to a pond with T. latifolia, and adjacent ponds were expected to have a high degree of
similarity, especially when considering invertebrates with a winged stage. The results were
examined with rank abundance curves, a Shannon diversity index and a Jaccard’s index of
similarity to determine the variation between communities.

Density of Dead Trees and Woodpeckers at Stegle Research Center Smithville, TX
Keith Kaden – S11

Dead trees are a crucial part of forest ecosystem as they provide light to saplings and the
understory and release nutrients through decomposition. Too many dead trees though, can cause
a forest to collapse or could be the result of a serious problem occurring such as disease. Dead
trees at Stengl Research Center in Smithville, Texas, provide important resources to local fauna
such as woodpeckers. Due to increased drought in recent years, it is hypothesized that there are
now more dead trees than there were twenty years ago. This study looks to provide baseline data
do dead tree density at Stengl as well as woodpecker’s occupancy between two habitats. This
study compares trees within a 20-meter radius of a woodpecker siting, and a non-occupied random sampling point. A Chi-squared test concluded a p-value of 1.42E-191 between the two habitats. The average dead tree density of woodpecker sites was 64.06 trees per hectare and 31.17 trees per hectare for random non-occupied sites. More sample points would be needed to be statistically significant to compare densities of trees with different species of woodpeckers; (Downy Woodpecker (Picoides pubescens), Red-bellied Woodpecker (Melanerpes carolinus), and Pileated Woodpecker (Dryocopus pileatus).

{Brackets around Brackenridge}

A Visible Fungus Survey During a Dry Year
Ashley Latimer – S11

Bracket fungi, polypores, are common at Brackenridge Field Lab on dead trees and rotting logs, and one simply has to look for them to find them. This study attempts to be a starting place for future studies of these fungi at Brackenridge by recognizing morphospecies, providing locations of sites for future study, and identifying questions to be answered in the future. Trails and transects were surveyed for the presence of brackets, and they were described, mapped, and photographed. Five morphospecies were assigned to bracket fungi observed on dead junipers, oaks, sugar hackberry, mulberry, and mesquite across a wide variety of habitats, and are not entirely precluded from growth on oaks effected by oak wilt, while many photographed dead brackets were not assigned a morphospecies because of incomplete information due to decomposition.

Do ants locate food items more efficiently as their distance to a drop off increases?
Nathan Le – S11

Ants are becoming an excellent source of information in understanding the way our soils and ecosystems as a whole work. For this reason, ant behavior has been a large component of ecological studies in recent times. In this study, I attempt to bring to light the relationship between ant food discovery efficiency and the distance of that food from a steep drop off or precipice. Contrary to my hypothesis, however, no convincing evidence was elucidated by this study to definitively say that food discovery efficiency is correlated with the distance from a drop-off.
Canopy Cover and its Effects on the Discovery-Dominance Trade-Off in the Ant Communities of Brackenridge Field Laboratory

Jennifer Moon – S11

The trade-off between resource discovery and dominance is known to be an important consequence of competition among ant communities. This paper tested the idea that the ant communities of Brackenridge Field Laboratory (BFL) will differ in their discovering and dominating ant species, depending on whether they are found in open or closed canopy coverage areas. In order to carry out this experiment, hot dog baits were set up in both open and closed canopy coverage areas in BFL. The ant species that first arrived at the baits within a period of five to ten minutes and the ant species that dominated the baits after one hour were documented. An overwhelming number of *Solenopsis invicta* ants both discovered and dominated the hot dog baits in both the open and closed canopy coverage area; other ant species were only found in either open or closed, but not both, canopy coverage areas. Chi-square goodness of fit tests proved that there are significant differences in the number of ants that discovered and dominated the hot dog baits in open vs. closed canopy coverage areas for all three ant species analyzed in this experiment. The behaviors of ants seen in this experiment correspond to the classification of ants by Wilson (1971), and the dominance of *Solenopsis invicta* can be attributed to the lack of phorid flies.

Are cactus patches a type of nurse plant?

Amanda Preuss – S11

Deer herbivory is a natural part of the environment, but over-browsing by deer can devastate the ecosystem. As cactus patches have a natural, built-in defense mechanism – their prickly needles – they have the ability to act as nurse plants and protect tree saplings and other small plants from deer herbivory. 15 total cactus patches were marked and the number and type of saplings growing within the patches were counted and observed for browsing activity. Results showed a high statistical significance meaning there is a difference in the herbivory between plants found in cactus patches and plants found in open areas. I also concluded that the farther a plant is in the cactus patch, the less herbivory damage it will receive. Overall, data from this experiment supports my prediction that cactus are nursery plants.
A Survey of *Parietaria pensylvanica* at Brackenridge Field Laboratory

Magdaline Salinas – S11

It is important for ecologists to study the effects of droughts, particularly in light of recent global climate change. In 2011, Brackenridge Field Laboratory experienced less rainfall than it did in 2002. This experiment looks at how the change in precipitation has caused the population of *Parietaria pensylvanica* to change as well. A survey was conducted by walking through 10 transect lines at Brackenridge Field Laboratory. Data about patch size and evidence of damage from *Vanessa atalanta* caterpillars was noted. The population of *P. pensylvanica* was found to be dramatically lower now than in 2002. The majority of the patches of *P. pensylvanica* found exhibited larval damage. Droughts not only affect many plant species, but also the organisms that depend on these plants. How much each topographic level is affected by a drought would be an interesting further study.

Population Size of the Hackberry Butterfly at BFL

Emily Wieweck – S11

Brackenridge Field Laboratory (BFL) is home to many species of butterfly. The most abundant of these is the hackberry butterfly, which encompasses more than one species under the same genus of *Asterocampa*. By setting up traps in a concentrated area of BFL, we begin to get an idea of what the population size of this butterfly might look like in the area. We estimated that the population size could be evaluated using the mark release recapture method. After marking over three hundred butterflies and finding minimal numbers of recaptures the population size was concluded to be much larger than expected. This population study was complimented by information on the type of habitat that the hackberry butterfly most frequents and the ratio of males to females that are seen from the population study.
Butterfly Community Survey and Dispersal of *Colias eurytheme* at Brackenridge Field Laboratory
Brady Atkins – S12

The role of dispersal in ecological communities is a major factor in colonization, pollination, and gene flow across habitats. Disruption of this dispersal, for example by building a large building in an area of butterfly activity, can severely alter the biological composition of an entire ecosystem resulting in detrimental long-term effects. My study sought to one: survey the butterfly community at Brackenridge Field Laboratory (BFL) and two: test the effects of differing distances on dispersal between habitats. My results supported that as distance between habitats increased, there was no difference in dispersal. This may have been due to location of host plants that did not necessitate migration.

Foraging trends under variable patch shading in *Sciurus niger* at the Brackenridge Field Laboratory
Parke Benjamin – S12

Throughout ecological analyses of foraging species, numerous qualitative predictions have been made as to how the physical composition of feeding patches relates' to predation risk and the subsequent effect this has on the presence or absence of foraging. Resultantly, recent studies of squirrel populations have postulated that viable food sources are often ignored when positioned in 'risky' microhabitats (lightly shaded or unshaded), versus 'safer' ones. In order to test the effects varying levels of shade had on foraging behavior, we studied the feeding habits of the Brackenridge Field Laboratory's native population of fox squirrels (*Sciurus niger*) on sample baits near pre-existent deer feeders. In addition to using shaded and unshaded baits as analogues for safe and risky microhabitats, we performed a series of measurements with augmented food (from the feeder itself) to observe whether the proportion of foraging in certain areas was dependent on the marginal value of food available. We found feeding levels to be significantly higher in shaded, rather than sunny habitats, and concluded that augmentation had a minimal effect on foraging trends as a whole.
The effects of drought on multiple tree species at Brackenridge Field Laboratory

Korey Conley – S12

Global climate change has been shown to cause a decrease in the amount of rain that central Texas and the surrounding areas receive. Conditions from La Nina have caused drought conditions that have been exacerbated by human use and evaporation. Brackenridge Field Laboratory (BFL) is located next to a lake whose level does not change but the region still suffers from worsened precipitation conditions from the lowering levels of the nearby Lake Travis. These drought conditions have caused a large amount of mortality in multiple species found within BFL. In this study, I wanted to determine the percent mortality of the individuals depending on a) habitat location in terms of elevation, b) the species and their location or c) the species. I found no significance in the points of interest; however, I did observe a large amount of death in the smaller Juniperus spp. Individuals rather than the larger individuals and a high death rate of Carya illinoinensis. Although the results did not yield significant results, if the drought continues as predicted, we will continue to see patterns emerge with greater distinction.

Role of Flowering Plant Community Composition in Butterfly Community Determination

Brittany Murrie – S12

Interactions between butterfly communities and plants communities are complex in nature. The butterfly and plant communities involved in this study were located at Brackenridge Field Laboratory in Austin, TX and included twelve butterfly species and four flowering plant species. A better understanding of the complex interactions between and interdependence of the two communities could lead to more effective methods of butterfly conservation. A survey of each community was completed, and the data was used in a community ecology analysis to determine if the flowering plant community was the determining factor of the butterfly community composition. Through RDA analysis using community matrices, several interesting relationships were revealed but we were unable to reject the null hypothesis as a whole.

A Population Study of the Rusty Lizard, Sceloporus olivaceous, at Brackenridge Field Lab

Laura Sherwin – S12

This paper seeks to characterize the distribution of the lizard Sceloporus olivaceous within Brackenridge Field Lab, as well as its preference for habitat and substrate type.
*Sceloporus olivaceus*, commonly known as the rusty lizard, is common in its range from northern Mexico to central Oklahoma continuous through Texas east to west. One extensive population study has been done in the past on this species, conducted by W. Frank Blair and published in 1960; it extensively covers the biology and population dynamics of the species. This study found that distribution of *S. olivaceus* at BFL is relatively uniform, and that they have no preference for substrate type but do avoid juniper trees. Also, they are more commonly found in areas within two meters of a road. The information provided in this study will be useful to anyone interested in studying the *S. olivaceus* population of BFL in the future.

**An Observational Study of the Rusty Lizard *Sceloporus olivaceus* at Brackenridge Field Laboratory**

*Curris Williams – S12*

The rusty lizard, *Sceloporus olivaceus*, is one of a few lizard species that inhabit the University of Texas at Austin's Brackenridge Field Laboratory (BFL). Though they are a common sight on the property, few studies have been conducted to investigate their behavior, preferred habitat, or population distribution there; this study was conducted to gain insight on those matters. The undoubted literary authority on *S. olivaceus* population ecology is the 1951-1957 study, *The Rusty Lizard*, by W. Frank Blair; this book was relied upon heavily for background information on the species, as well as tips on techniques for fieldwork. This study found evidence suggesting that the *S. olivaceus* population at BFL seems to prefer the Old Quarry habitat zone of the property, as well as Cedar Elm trees. Differences in preferred habitat with respect to sex were examined, but no evidence supports a significant disparity.

**Earthworm Casts, Canopy Cover, and Leaf Litter Abundance**

*Jennifer Loeffler – S12*

Soil fauna such as earthworms provide the ecosystem with newly recycled nutrients and soil structure. Because these organisms provide necessary ecosystem functions, there has been much research on how human disturbances impact their productivity. This study’s aim was to identify earthworm patterns at Brackenridge Field Laboratory (BFL) and if canopy cover and leaf litter were influential factors in earthworm densities. Earthworm cast surveys were conducted in all three habitats at BFL (quarry, river terrace, and pasture) in both open and closed
canopies as well as in abundant leaf litter and absence of leaf litter areas. Results showed that the presence of earthworm casts was directly related to high levels of canopy cover and leaf litter abundance. Continued surveying of earthworm casts at BFL would provide more information on the quality and nutrient dynamics of the soil across the three habitat types.

**Ant Bait Preference at Brackenridge Field Laboratory**

**Kambiz Jahanian – S12**

Ants have intricate lives with very complex societal roles which involve workers scavenging for food for the whole colony. The preferential selection of a bait depends on the nutritional requirements for an entire colony which are very complicated and may differ between species or shift during different seasons. To understand the differences in preference for ants, carbohydrate and protein baits were placed next to each other to determine whether the ants are more likely to pick one over the other. Baits were set out at eleven in the morning each sampling day and were allowed to sit for about 60 minutes before collecting, counting, and identifying the ant species. Chi-squared tests showed that canopy cover and ground cover do not cause a significant difference in bait preference, but the sample sizes may have been too small. Using the statistical software R, paired t-tests showed that there seemed to be no significant differences in preference for the species observed. Despite the small sample size, I believe the data still shows the trend that fire ants do seem to prefer protein baits over sugar baits during the spring. The Shannon diversity index calculated showed more diversity at sugar baits, therefore it would be beneficial to investigate the preferences of the other species at BFL more thoroughly with a larger sample size. To see if preferences do change depending on the season it would be valuable to replicate this study in the fall.

**Brackenridge Field Laboratories’ Butterfly Population Survey: Quantifying the Effects of Parasitoids on the Red Admiral Butterfly**

**Jimmy Lawson – S12**

The braconid wasp is an important parasitoid in the insect community, preying upon some of the most diverse insect orders, Coleoptera, Diptera, and Lepidoptera. Braconid wasp larvae eat their victims, typically other insect larvae. This relationship affects many insects’ reproductive strategies, depending on the rate of the parasitism observed. The more larvae that
are parasitized, the more likely an insect is to lay more eggs, ensuring at least some make it to adulthood. Red Admiral Butterflies lay their eggs in their larval hostplant. These larvae then eat and live within the plant until they eventually pupate and emerge as an adult. The braconid wasp takes advantage of these helpless larvae, injecting their own eggs which proceed to feed upon the Red Admiral larvae. I looked at the frequency of braconid wasp parasitoids in the Red Admiral Butterfly population at Brackenridge Field Laboratories, in addition to the relative abundance of the Red Admiral Butterfly in hopes to quantify the effects of the wasp, examine the differences in parasitism rates in varying habitats, and look for a link between relative abundance and parasitism rates. Sampling four major habitats in Brackenridge Field Laboratories and taking over 80 larvae samples and seven relative abundance samples, no correlation was found between relative abundance and parasitism rate. In addition, the parasitism rate seemed to be rather uniform throughout Brackenridge Field Laboratories, with none of the habitats differing significantly from each other.

**Habitat Preference Exhibited by Woodpeckers (Family Picidae) and increased tree mortality due to extended drought conditions at Stengl “Lost Pines” Biological Station**

Clark – S12

Woodpeckers are an instrumental component to many ecosystems and are used as indicator species of avian diversity and forest health. They provide key ecological roles like construction of cavity nests for various species and their foraging habitats increase feeding efficiency for other birds. This study was conducted at Stengl “Lost Pines” Biological Station to determine whether woodpeckers prefer areas where there is more dead-to-living trees, and to see if extreme drought conditions have increased tree mortality on the property. The result indicated that there was insufficient evidence to comment on woodpecker habitat preference. This was most likely due to the fact that there has been an increase in tree mortality as well as an increase in woodpecker density on the property due to displacement from adjacent areas that have recently undergone succession due to forest fires.
Using Behavioral Bioassays to Predict Social Form of S. invicta in Isolated Areas
Sam Smith – S12

Most Solenopsis invicta colonies are monogyne, meaning they only have one queen. In Texas, however, most colonies are polygyne, meaning they have multiple queens. This makes it difficult to control populations as you would have to remove all queens to remove the colony. In this study, I wanted to see which form – monogyne or polygyne – existed in isolation more frequently at Brackenridge Field Laboratory. A behavior assay was used to determine which form a colony was. Polygyne colonies were less aggressive towards each other while monogyne colonies were universally more aggressive. Out of the sampled areas with fire ants, all were found to be from monogyne colonies which suggests that polygyne colonies were not likely to be found in isolated areas.

Exploring Pine Sapling Density in Varied Microhabitats
Lane Davis – F12

Changing regional environmental factors can have a profound effect on the organisms in a community. At the Stengle Biological Research Station in Bastrop, Texas, many of these disturbances have threatened the Loblolly Pine. I investigated the establishment and presence of the pine’s sapling population in disturbed areas. I chose plots with varied disturbance levels (0-3; with 0-2 being tree fall/mostly cleared and with 3 as the result of a cleared area due to fire) and used the point-quarter technique to find the nearest distance to pine saplings. I also noted pine needle coverage, shrub coverage, and canopy cover to look at other possible relationships between sapling abundance. I hypothesized that pine saplings would establish easier in areas with more acidic soil, and that sapling density would increase when the disturbance in an area is greater.

Note: paper is only intro and methods

Diversity of Arthropod Communities in Grasslands at Brackenridge Field Lab
Nicholas Kuzola – F12

The complex interactions of species within a habitat provides insight about ecosystem services and biodiversity. This study focuses on the differences in grassland habitats at Brackenridge Field Lab (BFL) in Austin, Texas. I used arthropods as an indicator of habitat
diversity and structure. Sweep net sampling was performed along ten meter transects six times and eight sampling sites across BFL. The classification of each site was determined to compare specific variables: proximity to water, height of dominant grass, and historic land use/land cover. Diversity indices including Jaccard’s index of similarity and Shannon’s diversity index were calculated to compare biodiversity between habitat types. Chi-squared calculations were performed to test whether there was a significant difference in species abundance between water sites and inland sites, as well as to test whether there was a significant difference in species abundance depending on the height of grass. I found no significant difference in species abundance between sites, which shows that BFL has a high degree of biodiversity across study sites. Jaccard’s index remained relatively constant (between 1.83 and 2.00) when comparing sites, and Shannon’s index also only varied slightly (between 2.01 and 2.21).

Quantitative Assessment of Passerine Risk-Reward Threshold through Foraging Distance from Refuge

Katie Luethcke – F12

The spatial preferences of seed-eating birds between their refuge and foraging sites are of great conservational interest, as they affect the optimal rate at which the birds can forage while still escaping predation. We studied the optimal risk-reward threshold, or distance traveled from a refuge site to retrieve seed, for shrubland/woodland birds foraging for seed in an open grassland area. We surveyed two areas of Brackenridge Field Laboratory and recorded the distance at which 4 species of passerines and 1 species of non-passerine would leave their shrub refuge to forage for seed in an open area. Among the passerines, Northern Cardinals (Cardinalis cardinalis) possessed a larger risk-reward threshold than Bewick’s Wrens (Thryomanes bewickii). This indicates that the most suitable habitat for Northern Cardinals may include more open areas, while Bewick’s Wrens (Thryomanes bewickii) would benefit most from a closer spatial relationship between its food supplies and refuge sites. Additional studies that include more non-passerine species may also be able to detect a difference between non-passerine and passerine risk-reward thresholds. We can use these unique habitat spatial preferences among species, along with other important elements like habitat contrast and soil complexity, to build optimal backyard habitats for passerines and non-passerines alike.
A Survey of Commensal and Parasitic Organisms in Flowering Plant Species
Michael Martinez – F12

Studying commensal and parasitic organisms of flowers at the Brackenridge Field Laboratory gives new understanding to the organisms and how they interact with the plant resources and each other. Identifying and finding the abundance of these species lays the groundwork for future studies in population dynamics and ecological interactions. Samples of Cedar Sage (Salvia roemeriana), Turk’s Cap (Malvaviscus arboreus), Frostweed (Verbesina virginica), and Lantana (Lantana spp.) were collected and the diversity of invertebrate species found in each plant species flower can be an assessment of their resource (nectar/pollen) interactions. Several species forage for the nectar and pollen while other species eat these species. Others simply parasitize the ovaries or soft tissue of the plant itself. We found that there were only four parasitic species: thrips spp., moth spp., aphid spp., and caterpillar spp. However, only the Cedar sage and Turk’s cap species were found to be parasitized by thrips, all others only contained members within the flower. Commensal Organisms include: Crab spider, mites spp., Green lacewing larva, Monomorium minimum, Monomorium pharoanis, Solenopsis invicta, Forelius mccooki, Nylanderia terricola, Brachymymrex patagonicus, and Brachymymrex depilis.

Optimal Foraging in Continuous Size Class Ant Solenopsis invicta
Shannon McLellan – F12

The optimal foraging theory allows researchers to predict how an animal is likely to forage for food. The central-place theory is a variant of the optimal foraging theory specifically applied to animals that forage by leaving from and returning to a single point. The central-place theory was used to predict the foraging behaviors of Solenopsis invicta, a continuous worker size fire ant. In eusocial animals such as S. invicta with a sterile worker class, the entire colony is considered a single functional unit instead of an individual. This is because individual workers are sterile and therefore can only increase their fecundity by increasing the fecundity of the entire colony. Under the assumption that larger workers are more energetically costly produce and maintain than smaller workers, I hypothesized that larger workers would be sent preferentially to forge food sources of higher nutritional value while smaller workers would be sent to food sources of lower nutritional value. I did not find any significant correlation between worker size and nutritional value. We found evidence to support that workers forage in a gradient such that
larger workers mined higher nutritional value sources while smaller workers mined less valuable sources however we did not find that this preference changed significantly over time.

Assessing protein quality and quantity preferences in recruitment of *Solenopsis invicta*
Monica Ramirez – F12

*Solenopsis invicta*, or the Invasive Fire Ant (IFA), is an invasive species that has dominated ant communities upon its arrival in the 1980s and has displaced native arthropod populations across 13 US states. The IFA has had a mixture of impacts in some communities depending on its predation and out-competition of pests or loved species. I was interested to see if IFA had a protein content and size preference in foraging and recruitment of food. I used peanut butter and frozen grasshoppers as protein resources. Three experiments were carried out: one with varying protein content in the peanut butter, one varying portion size in grasshoppers, and one varying portion size in peanut butter. Ten exit holes were found along cracks in the road running along the old quarry at Brackenridge Field Lab and sampled repeatedly. Two levels were made within each experiment and offered to the exit holes. There was no significant difference detected for different levels of protein content or protein portion in peanut butter samples. There was a significant different in the portion sizes of crickets, however. There also appeared to be a trend in the presence of major workers with more ants that were sent to retrieve the food.

Differences in Diet and Distribution of *Filistatidae* Spiders Living in Artificial Versus Natural Environments at Brackenridge Field Laboratory
Bobbie Renfro – F12

*Filistatidae* (Crevice Weavers) spiders are common in warm climates and readily found living both in natural and artificial environments. In comparing two such environments at Brackenridge Field Laboratory (BFL) in Austin, Texas, I am looking to determine possible differences in spatial distribution and prey selectivity between the natural and artificial habitat populations. My results showed that the spatial distribution of filistatids does differ between the natural and artificial environment. Spatial distribution, based on my data, is not consistently one arrangement in the natural habitat. In the artificial habitat, I had hypothesized that spatial distribution would be aggregated based on the condensed and limited food and crevice resources. Unexpectedly, all artificial site produced a Poisson or random distribution. Thus, there is an
equally likely chance of a spider building a web at any given point on the ceiling of the BFL breezeway (my artificial environment). Regarding prey selectivity, my results suggested effects on prey availability by the artificial environment. The presence of the lights attracted a greater variety of prey near the filistatids. However, it was not conclusive on whether or not Crevice Weavers selectivity of prey is altered, as the natural and artificial populations both preyed upon a high relative abundance of Daddy Longlegs and other spiders.

**Effect of Tanglehead Grass (*Heteropogon contortus*) on Local Flora Diversity at Brackenridge Field Laboratory**

*Sloan Richey – F12*

Tanglehead grass, *Heteropogon contortus*, historical range is south and west Texas. It has since moved north and has appeared at Brackenridge Field Lab in Austin, Texas recently. Trails at the field lab have started to become dominated by the grass. In order to find the extent of the Tanglehead colonization at BFL, I identified where it was located by taking GPS coordinates. I also examined different diversity indexes to see what effect, if any, Tanglehead had on local flora diversity. I found that Tanglehead had no statistical impact of species richness (pvalue = 0.21), but that there was a statistical impact on evenness (pvalue < 0.001) and plant density (pvalue = 0.036).

**Post-Wildfire Ant Communities in Spicewood, Texas**

*Key Slocum – F12*

In September of 2011, a wildfire burned through Spicewood, TX leaving a spatial mosaic of burned and unburned habitats. The vegetation and wildlife of the area was severely compromised, decreasing the overall diversity and abundances of species throughout the region. Cypress Valley Canopy Tours provides an excellent display of both burned and unburned habitats, allowing us to compare the ant communities of the burned areas after 15 months of succession with the already present ant communities found in the unburned areas. We found that the diversity in each habitat was extremely low, each only containing two species and being dominated by the imported fire ant *Solenopsis invicta*. However, our survey led us to find that the average population size of colonies in the burned habitat is significantly larger than the populations in the unburned habitat, nearly doubling them.
Ant Diversity Under Rocks in Open Canopy Areas at Brackenridge Field Laboratory
Adrian Tan – F12

Few studies have been made on the invertebrate diversity under the rocks at Brackenridge Field Laboratory, which has left many questions unanswered. In this experiment, I looked under rocks of various sizes specifically to survey the ant species present at BFL and to determine whether or not rock size affects the number of species that are accommodated by a given rock. This would help survey the any population in areas with hidden colonies. I found that, in open canopy areas, there is a slight positive correlation with the size of the rock and the number of species present. Solenopsis invicta was also documented as the most frequent species found under rocks.

Effects of sunlight, decay level, and habitat type on arthropod diversity in dead wood communities
Pongwarin Thanapat – F12

Deadwood is an important part of maintaining ecosystems, specifically in forest systems. This study was performed on the deadwood communities (specifically saproxylic arthropods) at Brackenridge Field Laboratory, which were produced by extended droughts. The effects of light, level of decay of the deadwood, and habitat type on the species diversity were studied. Due to the nutrients that deadwood holds these decomposer and detritivore species are an important part of the ecosystem. We aimed to see how light, decay level of the deadwood, and habitat type affects the diversity of the communities. The Jaccard Index of Similarity showed us that the species of younger deadwood communities was more different than that of middle/older deadwood communities. The multiple regression analysis resulted in the significance of light, decay level and one type of habitat on the variation in diversity of the communities. Overall, we found that the variations in species diversity at deadwood sites are affected by these three variables 27% of the time.
Comparative Analysis on the Distribution and Ecological Impact of Three Exotic Shrubs at BFL: *Ligustrum sp.*, *Nandina Domestica*, and *Solanum capsicastrum*

Cody Colleps – S13

The study of invasive species is becoming increasingly important as these species continue to pose a threat to a community’s biodiversity, can degrade native landscapes, and can cause significant economic damage. Geographic Information Systems (GIS) can be a useful tool to better understand these species. I used GIS to compare the distribution and ecological impacts of three exotic shrub species within the understory at Brackenridge Field Laboratory (BFL); *Ligustrum sp.*, *Nandina domestica*, and *Solanum capsicastrum*. I found that Ligustrum posed the greatest threat to both herbaceous ground cover and plant species diversity. While I found Nandina to pose an ecological threat, it was not as significant as that of Ligustrum. No relationship was found between *S. capsicastrum* and ground cover or species diversity. With no relationship found, I suggest that this may be because of its relatively young invasion. Results of this study may be useful in the future management of these species within BFL.

Arthropod Community of *Mahonia trifoliata* at Brackenridge Field Laboratory

Omar Garza – S13

This study investigates the arthropod community present on the shrub *Mahonia trifoliata*. I used Jaccard’s index of similarity to measure the diversity of the arthropod specimens I collected solely from this one plant species. I also investigated the habitat preferences of spiders, the likely occupants of the highest trophic level in this community’s food web. My analysis revealed that species composition is not very homogenous within any of the three clump-size classes. My analysis also revealed that spiders have two apparent habitat preferences. There are two potential candidates that may share a host specific relationship with Agarita. Regardless, some of the members of this community influence Agarita’s morphology due to their presence and activity. Improved sampling techniques and a fine-tuned observation collection process may better measure diversity and could complete the food web of this community.
Snail Community Diversity at the BFL, Past and Present
Rebecca Glenn – S13

Land snails are sensitive to the environment surrounding them and for this reason are good indicators of the severity of climate change. At Brackenridge Field Lab in Austin, Texas, a survey was done of the land snail community in 1967 and the community diversity was estimated using the Shannon diversity index. In this study we surveyed the same location that was historically surveyed to estimate present-day snail community diversity and compare it to the past estimations. A 20-plot survey was carried out and observations were made about each plots canopy coverage. It was found that the snail community surveyed, in the same location as 1967, was less diverse than in the past. Diversity was found to be higher in closed canopy areas in comparison to open canopy areas. Some potential reasons for the decline in diversity we suggest are climate change, the drought in central Texas in 2011, and the invasion of the invasive fire ant Solenopsis invicta. Further experimental studies should be carried out to examine the impact of S. invicta on various species of land snails.

The Effect of White-Tailed Deer on the Vegetation at Brackenridge Field Laboratory
Bridget Haby – S13

Brackenridge Field Laboratory in Austin, TX has hosted a White-tailed deer population since 1990. The high deer density at this research facility has created problems such as the overgrazing of certain forbs. In this study, three different deer enclosures were surveyed to compare the abundance of certain forbs inside and outside of the enclosures. Use of a 0-3 coverage scale was used to estimate to density of 6 different forbs within a total of eighteen 1x1 meter plots. A difference in abundance of species was observed, however further studies should be done to determine the specific preferred diet of the White-tailed deer at BFL.

Movement of individuals between aggregations of Leiobunum sp. within the Brackenridge Field Laboratory, and some dietary preferences
Amy Hamilton – S13

Aggregations of Leiobunum sp. are seen throughout the Brackenridge Field Laboratory. In the tropics, it is seen that similar species have scent-specific populations that aggregate on individual plants regularly. We questioned if this scent-specificity is seen in the populations at
BFL. If the aggregations at BFL are separate, it assumes that the scent specificity is highly
developed in these *Leiobunum*. A mark-release recapture study was done to determine the
amount of transfer between aggregations. Population estimates were also conducted. Tests were
conducted to determine if *Leiobunum* eat the butterfly eggs from the greenhouses. It was
determined that the aggregations at BFL are integrated into a single population. Population size
estimates were not accurate due to sampling method. The *Leiobunum* present in the greenhouses
do not eat the butterfly eggs.

*S. Invicta* and the Arthropod Community: A Study of Abundance and Diversity
Michael Harvey – S13

*S. invicta* has been an economic and ecologic scourge in the south eastern United States
for several decades. Given what is known about the negative impacts *S. invicta* has on native
Hymenoptera species, it is likely that there are negative impacts on the arthropod community as a
whole. I studied the arthropod community abundance and diversity of two areas of contrasting *S.
invicta* presence. Pitfall traps were used to collect quantitative samples of the active arthropods
within the two areas. Results show the two areas are only about 50% similar in species richness
with a slight advantage of species richness in the *S. invicta* present area. The relative abundance
and diversity of arthropods are shown to be lower in *S. invicta* infected areas. Ultimately this
study shows that even with decades of exposure to *S. invicta*, the native arthropod community is
still impacted by the invasive ants’ presence.

The ecological role of cyanide in the fruits and seeds in an avian dispersed evergreen Rosid:
*Prunus caroliniana*
Jacob Heiling – S13

Here I provide preliminary observations on seed dispersal ecology of *Prunus caroliniana*,
an evergreen rosid native to the southern United States and California. *P. caroliniana* produces
large crops of avian dispersed drupes that persist in a sub-ripe state on the parent trees for 12-14
months from the time of pollination. My findings are consistent with and expand on the existing
knowledge of dispersal ecology and phenology of the species. *P. caroliniana* pericarps are
cyanogenic from the green stage and maintain cyanogenicity in fruit that appear visually ripe.
Pericarp cyanogenicity is ultimately lost in the final stages of ripening coincident with arrival of
overwintering avian frugivores. In my study, as in S.T. Skeate’s study of Florida frugivore communities, two species of North American passerine birds clearly emerged as the primary and secondarily most important frugivores for *P. caroliniana* in terms of proportion of total fruit removal— the American robin (*Turdus migratorius*) and cedar waxwing (*Bombycilla cedrorum*) respectively. Both bird species are at peak abundance throughout *P. caroliniana*’s range in the months surrounding the final ripening and loss of cyanogenicity of *P. caroliniana*’s fruit. Seed cyanogenicity is undetectable (given my assay technique) in the developing seeds, but reaches the highest levels of all tissues that I tested in the seeds of ripe fruit and those processed by birds.

**Ant Species Composition at Different Times of the Day**

*Tiffany Hoang – S13*

Ants, just like animals, maintain their discrete seasonal and daily activity patterns to optimally exploit food resources, reduce conflict with competitors, and avoid predators. In this study, I compared native ant species composition throughout different times of a day and examined whether temperature played a role in altering composition. I did so by collecting ants with hotdog baits and bringing them back to the lab to count and sort by species type. Ants were collected briefly after sunrise, two times during the middle of the day, and briefly before sunset around sampling sites that remained constant throughout the day. Additionally, I recorded temperature around the sampling sites. With this data, I calculated species relative abundances, Jaccard’s coefficients, and created relative-abundance curves and linear regressions. I found that relative abundance and dominance did not differ significantly between the four times of day. *Pheidole dentata* workers dominated and exhibited high relative abundances throughout.

However, I found that species richness and evenness differed significantly as the day continued. *Crematogaster laviuscula* and *Pheidole floridana* became more abundant during the middle of the day but were absent around sunset when *Pheidole hyatti* and *Monomorium minimum* became more abundant. Overall, temperature did not play a significant role in altering ant species composition.
Saproxylic Arthropod Communities: How Do They Compare?
Nathan Hoppe – S13

Saproxylic arthropod communities are an important part of the ecosystem as some of the species directly contribute to nutrient cycling. There has been evidence of successional trends of arthropod communities as the tree advances in its decomposition process as well as evidence that show that habitat differences can affect the biodiversity of these species. This paper hypothesized that there will be more species present in trees that are in the latest stage of decay as well as in riparian habitats. It is also hypothesized that riparian and rangeland habitats would be most similar in terms of species composition along with trees that are in the middle to latter stages of succession. The results supported the hypothesis for species presence in riparian habitats and similarity in decay; however, it was shown that more species are present in a decay state of two as well as there are greater similarities in species that are found in riparian habitats and in habitats of dense woody vegetation structure. More studies are needed to study the biodiversity of these habitats and stages of decay in further detail beyond this initial survey.

Drought stress on the habitat preference of *Solenopsis invicta* (Hymenoptera: Formicidae) and ant species richness at Stengl “Lost Pines” Biological Station, Smithville, Texas
Taylor Jones – S13

Droughts are thought to be one of the worst natural disturbances that effect forested areas due to the high rates of tree mortalities they cause. As climates continue to change and water levels continue to drop, it is important for us to be able to understand and predict the impact of droughts on habitat compositions for conservational and manageable practices. I specifically wanted to look at the impact of differing drought stress levels had on habitat preference in *Solenopsis invicta* and the overall ant species richness at each level. I conducted my experiment at Stengl “Lost Pines” Biological Station, a unique ecosystem of hard and pine wood forests uncharacteristic of Central Texas. I used hotdog baits to attract ants to 100 different sample sites that were rated based on signs of drought stress (0-3, 0 being least amount to 3 being the highest). I identified the *S. invicta* present in all of my samples and sorted all of the collected ant species. I used a chi-square goodness-of-fit test to determine if *S. invicta* showed more of a preference for highly impacted sites, as I hypothesized due to their preference for open canopy and found that my data was non-significant ($X^2=1.66$, df=1, p-value=0.20),
suggesting that *S. invicta* may not have a preference for areas with or without signs of drought stress. I then analyzed the similarity between the different levels of drought stress using the Jaccard’s index of similarity to determine if my hypothesis that higher drought levels would result in decreased ant species richness was true. Based on the Jaccard’s index, I found that sites with the lowest and highest levels of drought stress shared the most similar ($J=1.33$) composition of ant species present, while the median drought levels had the most diverse species richness ($J=0.5$) when compared. As a result, from this study, I concluded that drought did not play a significant role in habitat preference for *S. invicta*; however, the different levels of stress did seem to affect overall ant species diversity possibly due to different stages of disturbance and ant opportunists briefly colonizing the area. These findings are important when trying to understand drought effects and may help play a key role in understand drought impacts on entire forest ecosystems.

**Mark-Release-Recapture Study at the Brackenridge Field Laboratory**

**William Jorn – S13**

Dung beetle community structure has always been an important issue in ecological studies due to its strong ecosystem effects. A modified mark-release capture experiment was designed on the Brackenridge Field Laboratory (BFL) property to study dung beetle walking/flying speeds. Individually marked beetles were released with bait traps to try to record the walking/flying recruitment speeds of dung beetles. Unfortunately, the resulting data had no recruitment of marked beetles. However, evidence of the dung beetles' preference was found towards clumped dung piles. Evidence also demonstrated that a unique arthropod community lives within the deeper dung at BFL.

**Texas Trees Respond to Drought: How Species Type and Distance from Water Table Affects Tree Mortality in Times of Drought**

**Sean McElaney – S13**

Drought is a common occurrence in Texas and because of this many tree species have adapted to be able to survive in this sometimes-harsh environment. Since central Texas is currently in a severe drought, this fact should show through. I looked at whether or not tree species type had an effect on the mortality during a drought. I also looked at whether distance
from a water source had an effect on mortality. I used the tree tag and transect systems in place at Brackenridge Field Laboratory to determine where tree death has been occurring and measuring distance from water. Using the distance and species data I ran a multiple regression to see if they had a confounding impact on the tree mortality. I ran a sister study at Stengl Research Center in Bastrop to see if similar effects were occurring there. For both studies I had inconclusive results, this was most likely due to a flaw in the design of the study not the actual lack of correlation.

Environmental Factors Affecting Nine-Banded Armadillo Burrowing, Brackenridge Field Lab - Austin, TX
Molly Rupp – S13

The nine-banded armadillo invaded the United States in the mid 1800’s and since then has had great success in expanding its range. The armadillo burrows for shelter and food which has contributed to its expansion into all types of habitats that provide the necessary soil and biological composition for its survival. I performed a study at Brackenridge Field Laboratory that observed the burrowing habits and habitat preferences of the nine-banded armadillo. I walked transects along BFL and counted burrows present along with canopy cover, shrub cover, and ground cover to determine habitat preferences. Based on results, I concluded that shrub cover was the only environmental factor (that I used) that influences armadillo burrow locations.

Investigating the Distribution of Dreys and Squirrel Nesting Preference at Brackenridge Field Laboratories.
Helena Wayt – S13

Studies have shown Fox squirrels to be highly adaptive animals with a variety of factors influencing their distribution and abundance. This study investigates the distribution of dreys and nesting preferences of Fox squirrels in Brackenridge field laboratory. I located the dreys in BFL by walking the trails, roads, transects and off trail areas. Once a drey was located, I recorded the UTM coordinates, nest height, and species of tree in which the drey was found. I found a total of sixty-one dreys. Dreys were overwhelmingly found in Junipers, were no lower than 2.47 meters off the ground, and had a clumped distribution. Further investigation should be performed to determine the driving factor behind juniper nesting preference and distribution across BFL.
Pollinator Community Patterns: Pollinators of Lantana, Cowpen daisy, and Frostweed Shrubs
Cosette Bonilla – F13

My project is a community-based study that focuses on the diversity of pollinator species in which different flowering shrubs attract. This project centered on capturing butterflies and bees as the pollinators. The flowering shrub sites were comprised of Lantana, Cowpen daisy, Lantana and Cowpen daisy, or Frostweed. All shrub sites attracted a variety of pollinators; however, it was the Lantana and Cowpen daisy shrubs with the most pollinator activity. I hypothesized that a combination of these flowering shrubs would attract a more diverse pollinator community. Using four different methods, the results from the analysis did not support my hypothesis that a combination of Lantana and Cowpen daisy shrubs attract a diversity of pollinator species. The analysis results supported that the Lantana shrub attracted a more diverse pollinator community.

Mapping the Spread of Invasive Triadiea sebifera into BFL
Thomas Borowiec – F13

Introduced to North America in the late 1700s, Chinese Tallow (Triadica sebifera) is an exotic invasive, native to China and Japan. It has spread south from the Carolinas, hugging the Gulf coast and has been reported to reach as far as northern California. The species represents an ecological threat to American ecosystems by way of its high fecundity, resistance to local parasites and unpalatable leaves. Its waxy seed coat has allowed it to disperse via the coastal and inland waterways, and the high fat content of these seeds leads to its ingestion and subsequent spread by wintering bird species. It commonly invades an area and forms monoculture stands, slowly choking out native species with its tolerance to shade and rapid growth, reaching sexual maturity in just three years. This study seeks to understand the preferred habitat types of the species at Brackenridge Field Lab (BFL) and to explore possible methods of control.
(Note: This paper is only an abstract and introduction)
Foraging Behavior of Red Imported Fire Ants (*Solenopsis invicta*) by Temperature

Jeong-Min Chu – F13

In this study, I observed the foraging behavior of red imported fire ants, *Solenopsis invicta*, according to the different temperature of the ground. The purpose of this study was to test whether or not temperature differences could cause changes in the foraging behavior of *S. invicta*. Baits were placed in random spots across Acre 15 in Brackenridge Field Lab to examine the foraging behavior of the ants. The temperature of the ground was taken and the number of ants going towards the bait was counted. I used R studio to conduct an ANOVA test, using temperature as a predictor variable and number of ants entering the bait as a response variable. As a result, I got a p-value of 0.9864 and R² value of 0.001015 and thus failed to reject the null hypothesis. More data sampling is needed and data recording at higher and lower maximum and minimum temperature could attribute in getting more exact data for the purpose of the study.

The Farm: A Preliminary Analysis

Chase Cobb – F13

In this study, I performed a large-scale investigation into many key climatic, geologic, biologic, and historical factors of the southeast central Texas region and Lavaca County. In gathering this data, I was able to apply it to my family’s farm in the area to better understand the environmental and ecological processes occurring. I examined the history of the land as well as the climate, geology, soil composition, biome, disturbances, and the flora and fauna present. This data could serve as a guide for other farm areas in what ecological conditions are favored.

The effect of dense grasses on plant life

Ashley Corley – F13

Many invasive grasses and some native grasses have a tendency to grow very densely which makes it hard for other species to grow in the same habitat as them. Most of these grasses are hard to compete with so they begin to become the dominant plant in the habitat which can cause many ecological problems. Brackenridge Field Lab has invasive and native grass species that present this behavior, but it is shown throughout the 82 acres of land that the invasive grasses have more control of what plant species grow at BFL because they are becoming more abundant than the native grasses. The data showed that the invasive grasses tended to have a
lower number of plant species that grow in the same habitat as them as compared to the native grasses. Therefore, our null hypothesis that there was no difference in the average number of plant species that grow in the habitat of the 6 different grasses was rejected.

The effects of invasive grasses *Sorghum halepense* and *Bothriochloa ischaemum* versus native grasses *Setaria scheelei, Chloris texensis, Heteropogon contortus*, and *Bothriochloa laguriodes* on biodiversity at Brackenridge Field Laboratory

Lollie Duncan – F13

Early ranching in Texas involved the implementation of invasive grasses for cattle to feed on. These invasive grasses have since spread well beyond the boundaries of ranches and are consistently spreading their boundaries further. Invasive grasses such as *Sorghum halepense* (Johnsongrass) and *Bothriochloa ischaemum* (King Ranch Bluestem) have the ability to outcompete native plants for space, sun and water. The ability to out compete natives has had a negative impact on the biodiversity of infected areas. We studied the relationship of invasive grass density and the biodiversity under and around the grass. We hypothesized that as density of invasive grass increases, biodiversity will decline and that the invasive grasses would be more prevalent than the native grasses across BFL. The correlation between density and biodiversity resulted in insignificant results (p-value 0.13), however, the proportions of grass species were significant (p-value = 2.91x 10⁻⁶).

Estimating the size and habitat preference of the Mestra butterfly population at Brackenridge Field Lab

Kirsten Lara – F13

Estimating population size and habitat preference can provide information about a species of interest as well as its environment. In this study, I used the Mark Release Recapture method to estimate the size of the Mestra butterfly population at BFL. Butterflies were caught and marked on BFL grounds. The GPS location, sex, and habitat type at each capture site was recorded. This data was then used to calculate the approximate size of the Mestra population. Data was also separated and analyzed based on sex to estimate population size and the sex ratio. Habitat preference of males and females was analyzed by examining their relative abundance in each habitat: prairie, quarry, and river terrace. I used a chi-squared test for independence to see if
the proportion of males and females differed significantly in these habitats. I estimated the Mestra population at BFL to be roughly 1200 individuals (between 1178 and 1359). There were significantly more males in our sample, and males seemed to be more abundant in the prairie and quarry. There was not a significant difference in the proportion of males and females within each habitat, although the whole sample did prefer the prairie. In order to preserve biodiversity and better understand how a species interacts with its environment, we must continue to study and assess the size and distribution of populations.

**Flower Preference and Constancy in *Bombus Pennsylvanicus* at Brackenridge Field Laboratory**

**Alan Ritchie – F13**

The decline in wild bee populations world-wide is thought to be a product of decreases in available habitat and resources, mainly in undisturbed regions with high floral density. Climatic stress and urbanization are two of the direct causes of floral diversity and bee habitat loss. Bumblebees, genus *Bombus*, are one of the most widely distributed native bee genera in North America, and important pollinators of both wild angiosperms and commercial crops. Several species of bumblebee have experienced dramatic population declines across their historic range and have become the focus of conservation efforts due to their economic significance. Bumblebees will often exhibit flower constancy, a tendency to visit a particular type of flower despite the abundance of other resources within their foraging range. If bees do not adjust their foraging patterns in response to environmental stress and low floral resource availability, constancy could be a contributing factor to population decline. In this study, corbicular loads of *Bombus fraterinus* occupying the Brackenridge Field Laboratory were collected and analyzed to assess foraging habits during a period of prolonged drought. The vast majority of the pollen loads revealed that the majority of bees were collecting pollen from *Solanum elaeagnifolium*, a relatively scarce plant within the sampling area, indicating similar foraging patterns and a preference for *Solanum* as a source of pollen. These results show that flower constancy is maintained in spite of adverse conditions, and that the floral resources being utilized by the bees should be considered to refine how constancy is defined. Additionally, Other factors, such as floral rewards, colony-level feedback, flower morphology or individual level resource
assessment might play important roles in the foraging preferences of wild bees and should be studied further for conservation efforts.

Smut Fungus on Three Species of Grass at BFL
Lindsey Roche – F13
In this experiment, I looked at the fungal infection of three grasses, silver bluestem (Bothriochola saccharoides), King Ranch bluestem or KR bluestem (Bothriochola ischaemum), and marsh bluestem (Andropogon glomeratus). I used the point quarter technique to collect data on the smut fungus on these three grasses. I collected data in three different habitat areas at BFL, in Susie’s meadow, near the southern pastures, and along the roads and ponds by the central pastures. At each of these points I recorded the habitat type, GPS coordinates, to the plant of silver bluestem, KR bluestem, and marsh bluestem, the number of fungus infected heads and the total number of heads (later became proportion of infection), other surrounding grass species, and the presence of Mestra amynome. I used a chi-squared test of homogeneity to compare the level of fungal infection between the three species, silver bluestem, KR bluestem, and marsh bluestem. I also used a Mann-Whitney u-test to compare the proportion of infected heads between the two groups. In one group, silver bluestem was alone, and the other silver bluestem was with another species susceptible to infection. I found there to be significant difference in both tests and that the percent of fungal infection on the grass heads are different between the three grass species and it seems like KR bluestem plants had a higher percent fungal infection than most of the silver bluestem and marsh bluestem plants. The fungal infection rates tend to be higher in one of group than the other and I saw a trend that there were higher fungal infection rates in the group with silver bluestem, marsh bluestem and/or KR bluestem than in the groups with silver bluestem alone. I graphed the data I collected at each point showing the portion of fungal infection for the grasses present at each collection point.

The Difference in Infection Rate of Isolated Individual Clumps Versus Grouped Clumps of Bothriochloa saccharoides
Robert Slatton – F13
Bothriochloa saccharoides, silver bluestem, is a native grass that can be seen around the upper, rocky soil areas of Brackenridge Field Laboratory. This grass prefers the thin, loamy soil
with limestone underneath that is characteristic of the upper habitats at Brackenridge Field Laboratory. Walking around with fellow classmates, I noticed an unknown fungal infection in the flowering heads of this grass. To test whether or not there is a significant difference between the infection rate of flowering heads between isolated individual clumps of silver bluestem and grouped clumps of silver bluestem, I counted the proportion of flowering heads that were infected for individual and grouped clumps. The results yielded that there was a significant difference in infection rate between isolated individual clumps and grouped clumps with grouped clumps having a higher proportion of infected flowering heads.

**Analysis of dispersal in Mestra amynone butterflies within grass mixtures of Bothriochloa ischaemum and Bothriochloa saccharoides**

*Soraya Toghani – F13*

Understanding evolutionary and ecological interactions of an animal population can help in protecting and sustaining a certain species’ population, along with the habitat that it lives in. Being knowledgeable of a species’ population size can also provide certain clues about the abundance and distribution of this species. Recently at the Brackenridge Field Laboratory (BFL) a butterfly, *Mestra amynone*, has appeared abruptly and has been seen in very high abundance. In order to analyze this butterfly that has not been seen for several years, the population size was estimated to be about 1178 using mark release recapture. In addition, a correlation and regression analysis were run in order to test the significance between King Ranch Bluestem and Silver Bluestem grass abundance and the number of butterflies present in a certain area. The correlation analysis did confirm that the mixture of grasses is actually correlated to the *Mestra* present in an area. Also, the regression analysis proved that higher abundance of grass in an area was a good indicator that many *Mestra* butterflies would be present.

**Nandina domestica: A case study at the Brackenridge Field Laboratory**

*Clara Whiting – F13*

Invasive plants are one of the main challenges to land management. This paper examines an invasive present at the Brackenridge Field Laboratory, *Nandina domestica*, and attempts to elucidate factors affecting its range and its effects on other plants and root structure. All 10 transects were walked and the number of individuals was recorded as well as several other
variables: canopy/ground cover, size class and the presence of other invasive species. Two samples of soil, one from under a *Nandina* patch and one from an area free of *Nandina*, were taken from two habitats: juniper/oak woodland and meadow habitat. Cucumber seeds were planted in trays containing the samples in order to determine possible allelopathic affects from *Nandina* on germination. In one site, the roots of eleven *Nandina* plants were dug up in order to determine if the plants were spreading by seed or by rhizome. Unpaired t-tests were used to determine significance between the number of *Nandina* present at different parts of the BFL, as well as to determine if competitive exclusion is occurring between Chinese privet and *Nandina*. Chi-squared analysis was used to determine a preference for a particular ground/canopy cover, as well as whether or not *Nandina* has an effect on cucumber germination. The results show that *Nandina* has a preference for higher canopy covers, which help conserve moisture, and lower ground cover, less competition. This does lead to a significant decrease in abundance of *Nandina* as you run north to south across the BFL. There is competitive exclusion occurring between *Nandina* and Chinese privet, with substantially less *Nandina* occurring, despite proper habitat, where Chinese privet is growing. *Nandina* seems to have no effect on the germination of cucumber seeds, though the long-term effects on growth rate remain unknown. Finally, excavation of *Nandina* root structures indicates that the plants are primarily reproducing by seed and not rhizome. Therefore, in order to best manage the spread of *Nandina* at the BFL, it would be the most beneficially to try and limit the number of seeds entering the seed bank primarily along the southern riparian edge, which is the correct habitat but had not yet experienced the same levels of invasion.

**Effects of *Opuntia lindheimeri* Spinescence Compared to the Exclusionary Effect of Brush Piles at Deterring Herbivory.**

Casey Young – F13

Much is known about the effect that some plants have as a nurse plant to other species. This is especially true in areas with extreme climates or with heavy herbivore activity. The Brackenridge Field Laboratory in Austin, Texas represents both. It is here that I seek to examine the effect Prickly Pear (*Opuntia lindheimeri*) has as a nurse plant, as compared to brush piles, which may have a “nurse effect” by virtue of excluding herbivores, in an attempt to quantify the effect that the prickly pear’s spines have on herbivore deterrence over the simple exclusion of the
brush piles. Here I choose 4 sets of paired data (paired by *O. lindheimeri* /brush pile), and sample 4 plants that occur in each area, within each patch/pile, and record the abundance and length of each (plants are Greenbrier (*Smilax bona-nox*), Texas Lantana (*Lantana urticoides*), tropical Sage (*Salvia coccinea*) and Turk’s Cap (*Malvaviscus arboreus*)). While the mean size and abundance of each plant was greater in the *O. lindheimeri* patches (Turks cap was the only plant sampled to occur in a higher abundance in the brush piles, and the only plant whose mean length was greater in the brush piles than in the *O. lindheimeri* patches), t-testing yields, in all cases, p-values insufficient to reject the null hypothesis that *Opuntia lindheimeri* patches do not contain a greater abundance, or larger specimens of the sampled plant species.

**Distribution and Habitat Preference of Black Crazy Ant**

**Kelvey Merrill – F13**

The black crazy ant (*Paratrechina longicornis*) is a tramp ant with one of the largest distributions of any ant in the world. *P. longicornis* is a pest in almost all of the areas that it invades. The ability of *P. longicornis* to thrive indoors is not only a nuisance but also means that it can live virtually anywhere in the world. At BFL *P. longicornis* has been present for many years. In the last few years there has been a spike in the density of ant. The increase in its presence has begun to present problems in BFL. This experiment aims to more fully understand the distribution of the ant and recognize habitat selections that might be present in the ant populations within BFL.

**Flora and Lepidoptera Interactions at the BFL**

**Richard Gillett – F13**

Pollination is an indispensable service to both pollinators and pollination and is currently threatened – especially in urban areas where pollinators do not always have access to pollen. In order to get a sense of pollinator health at Brackenridge Field Laboratory (located in the urban sprawl of Austin, Texas), we sampled butterfly and flowering plant species and assessed their diversity as well as other trends that became apparent as sampling continued. In particular, I tested similarities between flowering fields of mostly Cowpen daisy (*Verbesina encelioides*), Texas lantana (*Lantana horrida*), or white thoroughwort (*Ageratina altissima, Eupatorium rugosum*), assessing if their butterfly counterparts allocate themselves depending on flower
species composition, or if they are generalists and are equally likely to be found in all flower fields. Four flowers fields were chosen to compare, with the first three being composed of varying amounts of Cowpen daisy or Texas lantana and the last being Eupatorium species. Rank abundance curves were used with Jaccard’s Index of Similarity, as well as Shannon’s Index of Diversity and equitability to assess differences in the flowering and butterfly communities. Differences found in butterfly species were not significant for the first three sites, suggesting that butterflies found there are generalists between Cowpen daisy and Texas lantana (p = 0.34, 0.48, 0.08). Site 4, characterized by Eupatorium and an abundance of Libytheana bachmanii (snout-nosed butterfly), was highly distinct in its comparisons to the other sites (p<<0.001). The reason for why is unclear, but a wide variety of butterflies and other pollinators were found, suggesting a healthy community at BFL.

The population of Mestra amymone at Brackenridge Field Laboratory in Fall of 2013
Stacey Yen Loi – F13
Mestra dorcas amymone is the only subspecies of Mestra dorcas native to the South America as well as the southern United States. Little is known about the species; they possess a small oval bubble along the costa margin of their forewing and lay their eggs on Catnip Noseburn, Tragia nepetifolia. The adult butterflies have been observed feeding not only on plants, like Texas lantana (Lantana urticoides), but also on the seedhead of Silver Bluestem grass, Bothriochloa laguroides. In November of 2013, Brackenridge Field Laboratory (BFL), experienced a large influx of the small white butterfly. The large population at BFL was an uncommon event making the butterflies a desirable population to study. In this study, I estimated the population size to be between 1500 and 2700 using the Lincoln Peterson method and by finding the relationship between recapture rate and cumulative number of butterflies marked. I examined the sex ratio and how recaptured butterflies migrated within the BFL habitat.

The Impact of Fish Predation on the Benthic Macroinvertebrate Community Structure in Ponds
Yujin Kim – F13
The Impact of fish predation on benthic macroinvertebrate community structure in ponds was studied. Two ponds without fish and two ponds with fish at Brackenridge Field Laboratory
(Austin, Texas) were sampled using a dip net. The macroinvertebrate samples were identified to family. Results showed that the ponds without fish had a higher diversity of benthic macroinvertebrates compared to the ponds with fish. However, there are many other factors that could be the source of the reduction in diversity and therefore the results are inconclusive.

2014

Defoliation Events of Hackberry Trees at BFL (The additive effects of herbivorous caterpillars on leaf defoliation)

Lesli Copp – S14

Ecological assessments of tree canopy coverage and defoliation of its leaves can be an important tool in evaluating the overall health of trees in a particular habitat. Brackenridge Field Lab has a wide diversity of tree species including the Sugar Hackberry, Celtis laevigata, which was the tree I focused on for this report. In order to understand the relationship between herbivorous species on their host plant species they need to be studied within their natural environment. I wanted to assess the impact of caterpillars on canopy coverage to determine if there were any other factors leading to these prominent canopy defoliation outbreaks. I was able to determine the presence of caterpillars by the defoliation patterns on the trees leaves. I ran several statistical analyses to determine if there were any other factors that were key components to these defoliation outbreaks. I did not find any statistical significance with any of my tests. However, I did find a trend in my data that alludes to a possible plant feedback mechanism that could quite possibly keep these caterpillars from full tree defoliation.

HOW PLANT TYPE, LEAF LITTER COMPOSITION, AND EDGE HABITATS EFFECT GROUND DWELLING ARTHROPOD DIVERSITY AT BRACKENRIDGE FIELD LABORATORY

Jonathan Dickey – S14

Ground dwelling arthropod richness within Brackenridge Field Laboratory (BFL) has been affected over time by various factors including the invasion of exotic plants and arthropods. Based on initial observations of BFL and the frequency at which particular species of arthropods have been found, arthropod richness varies based on the given microhabitat. Pitfall traps were placed in the Old Quarry habitat at BFL and in an edge habitat with the Old Pasture site. Trap
sites were chosen based on whether native or invasive plants were dominant and leaf litter density was recorded. Based on the data collected, there was no difference in levels of arthropod diversity between a continuous habitat and an edge habitat. Leaf litter depth was, however, found to have significantly affected the richness and abundance of arthropods within the sites that were sampled at BFL. Leaf litter depth and the type of plant (native/invasive) had no strong correlation, however.

The Effects of Decomposing Logs on Nutrient Composition in Brackenridge Field Laboratory

Wyatt Eason – S14

Nutrient composition is a critical aspect to understanding how an ecosystem functions and maintains itself. Logs that lie on the forest floor undergo decomposition and thus return these valuable nutrients back to the soil. Using soil test kits, the objective of this experiment was to determine if soil under decomposing logs varies in nutrient content, when compared to soil not under logs. Statistical analysis of the data showed no significant results with regard to pH, nitrogen and phosphorous levels. From these results, we can infer that the nutrient distribution in BFL is relatively homogenous, and that nutrients from decomposing logs don’t necessarily affect plant growth and distribution directly.

Differences in mistletoe (Phoradendron tomentosum) host species across Texas habitats

Kelly Garner – S14

Mistletoes are known to preferentially parasitize one species in a given area. The mistletoe species used in this study was Phoradendron tomentosum and can be found across Texas. In northern and southern Texas P. tomentosum is found on honey mesquites, but in central Texas, P. tomentosum parasitizes hackberry, cedar elm, and rarely mesquite trees. The goal of this study was to determine why P. tomentosum only used mesquite as a host species even when other potential host species were present. I hypothesized that the most abundant host species within a habitat will have the highest number of individuals infested, that mistletoe will grow above the deer browse line, and that mistletoe will only grow on mature trees. Data was collected from two different areas: Garner Ranch in north Texas, and Brackenridge Field Laboratory (BFL) in central Texas. Based on my data, mistletoe was found to only grow above
the browse-line, and trees infested with mistletoe had a significantly larger DBH, which supported my third hypothesis. Although it seems *P. tomentosum*’s preferred host is mesquite, because it is not as abundant in central Texas, this mistletoe species may have adapted to germinate on other, more abundant species.

**Effects of deer browsing on the structural diversity of woody vegetation at Brackenridge Field Laboratory**

**Heidi Harper – S14**

This study aimed to determine how deer browsing affected the structural diversity of woody vegetation by comparing basal diameter measurements in a browsing (B) and non-browsing (NB) plot at Brackenridge Field Laboratory. It was found that the NB plot was more structurally diverse and even than the B plot. A large number of 1-5 cm basal diameter saplings were missing from the B plot suggesting that deer browse mainly on vegetation in that size range. A normal distribution on vegetation sizes was seen in the NB plot whereas the distribution was skewed right in the B plot. Future work should look across the seasons to see how deer browsing changes throughout the year.

**The Effects of Grass Species Diversity on Productivity in Three Areas at Brackenridge Field Lab**

**Alexandra Murillo – S14**

Many studies have shown that species diversity and productivity of grassland systems are positively correlated; however, some studies have shown otherwise. I hypothesized that species diversity is a significant predictor of variance in biomass. To support this, 21 above-ground grass samples were taken from three different sites at Brackenridge Field Lab. The resultant data was statistically analyzed in order to examine the effects that species diversity has on productivity. The results from the main research question and several additional questions suggest that higher biodiversity is strongly correlated with higher productivity.
A comparison of spider diversity and composition between forest strata levels at Brackenridge Field Laboratory
Christian Ninal – S14

I characterized the spider population at Brackenridge Field Laboratory by comparing species composition and diversity between communities defined by forest vertical stratification. Using the tree-beating method and sweep-netting method, I collected samples of spiders from three different layers and was able to assess species richness, diversity, and habitat preference. I predicted that there would be a difference in composition between the forest layers and that the diversity would follow a gradient – with the canopy being the least diverse due to presumably harsh environmental conditions (drier, windier) and higher predation pressure. My results suggested that various factors caused by the gradient has caused the two communities to be different. However, our results regarding diversity could be considered contradictory to prior ecological knowledge.

Rock-sheltering arthropod species richness: Multivariate analysis
Patrick O’Connor – S14

Arthropoda, a phylum characterized by tremendous diversity, are integral to the maintenance of the environment and are commonly analyzed by ecologists whom aim to quantify the effects of disturbance on an ecosystem among other endeavors. In an effort to better understand rock-sheltering arthropod diversity at BFL, I recorded eight measures of variation across roughly two dozen sites. A multivariate regression was performed with SPSS and backwards elimination resulted in the equation: y(number of species under rock)=0.002x(rock area in cm²). A significant relationship was found between independent variable, rock area, and dependent variable, arthropod species richness, in some ways drawing parallels to the theory of island biogeography.

Predicting habitat utilization by female red admiral butterflies, Vanessa atalanta, in a high-quality habitat in Brackenridge Field Laboratory
Tressa Olsen – S14

There are numerous biotic and abiotic variables associated with edge effects that influence butterfly habitat utilization such as ovideposition, thermoregulation, and protection
from predation. I investigated habitat utilization by the migratory red admiral butterfly, *Vanessa atalanta*, in a host plant-rich clearing in Brackenridge Field Laboratory in Austin, Texas. I recorded variables of each sublet including ground cover, presence or absence of fire ants and host plant density. I used a multiple regression statistical analysis to find the predictive strength of each variable on the egg-laying behavior of V. atalanta by quantifying and comparing the number of juvenile butterflies in small plots based on distance from woodland edge. I found that many variables, including canopy cover, ground cover, distance from edge and density of host plant were all strongly correlated with each other, but only host plant density and presence or absence of red imported fire ant, Solenopsis invicta had the strongest predictive effect of number of juvenile butterflies.

**Trichogramma Wasp Parasitism on Heliconius charithonia Eggs and Pseudomyrmex Impact on Heliconius charithonia Population**

Nichole Vojnovich – S14

In order to understand the relationship between *Heliconius charithonia*, passion vines, various ants, and Trichogramma wasps, this experiment manipulated predator and parasitoid visitation. I expected that the EFN ability to recruit ants will yield significant results and that they are necessary to protect the host plant. I also expected that the eggs placed closest to the fan will have a higher rate of parasitism due to the egg scent dispersing over a larger area in the greenhouse. To determine if scent was a factor in parasitoid behavior, Heliconius eggs were placed at varying distances from a fan. Extra floral nectarines (EFNs) were also cordoned off from ants as a second test method to see how well the host plant survives. I found that egg scent dispersal had no significance effect on egg parasitism, and that there were significant differences in parasitism between *sprucei* and *non-sprucei* plants.

**Investigating the Pollinator Communities of Five Different Plant Species with Small White Flowers**

Amanda Wallace – S14

I investigated whether different species of plants that utilize small white flowers in the springtime as a means of reproduction have similar pollinator communities. This was done first by selecting the five plant species I wanted to study: *Ilex vomitoria* (yaupon), *Cornus*...
drummondii (roughleaf dogwood), Achillea millefolium (yarrow), Torilis arvensis (hedge parsley), and Ptelea trifoliata (wafer ash). I visited several different plants of these species with an aspirator and collected samples of visitors (excluding bees and other large visitors such as moths and butterflies). The insects collected where then very roughly sorted into one of nine categories based on my limited experience with insect identification. I ran a Shannon diversity index and a Jaccard pairwise analysis. I found that the overall evenness was 0.75012 and the overall diversity was 3.332753. The most diverse community is the yarrow community, with an H value of 3.157363. Yaupon sites had the highest evenness calculation, with an E value of 0.882843. Hedge parsley and wafer ash have the most pollinators in common, with a Jaccard’s index value of 0.222222.

Distance between monogyne and polygyne fire ant mounts: The battle for land at Brackenridge Field Laboratory.

Chelsea Casper – F14

This study compared the differences in mean distances between colonies (mound locations) between two different red imported fire ant genotypes, monogyne and polygyne. Mound distances between colonies of the two genotypes were compared against each other and within their respective genotypes. We found greater distances between monogyne colonies and shorter distances between polygyne colonies. There was a statistically significant difference in mean distances between polygyne and monogyne colonies as well as polygyne to neighboring polygyne colonies. We failed to reject the null hypothesis that there was a statistically significant difference in mean distances between monogyne to other monogyne colonies, and polygyne to polygyne colonies. However, there was a statistically significant mean distance between polygyne to monogyne colonies. As natural enemy densities decrease, resource competition lessens and polygyne establishment rates will continue to increase, along with the economic issues associated with them.
Herbivory Damage in Native and Invasive Species of the Oleaceae and Verbenaceae Family at BFL
Raissa Delacrua – F14

In this study, I compared native and invasive species of plants from the Oleaceae and Verbenaceae families for herbivory damage. I chose three main paths within BFL to obtain leaves and judge the overall plant damage for two kinds of lantana (Texas and creeping lantana as native and invasive species, respectively), elbowbush, and Chinese ligustrum. Twenty-four leaves were measured for percent damage and all four species were compared to determine any trends. Additionally, I tested for significant differences in the pattern of population distributions between these three areas of interest. My findings were consistent with my predictions that both species of native plants would exhibit more damage per individual leaf than the invasive plants.

Assessment of canopy gaps within Stengl “Lost Pines”: effects of gap size and percent canopy openness on plant species richness within gaps
Susan Eshelman – F14

Disturbances in the form of canopy gap formation can greatly affect the biodiversity of a habitat. Gap size and disturbance intensity can influence the level to which biodiversity is maintained. This study aims to assess the relationship between within-gap plant species richness and gap size and percent canopy openness within Stengl “Lost Pines” Biological Station (SLP). Data was collected for thirty gaps of varying size and in a variety of habitats within SLP. Results indicated no correlation between within-gap plant species richness and gap size or percent canopy openness. Weak correlations were found between the percent of monocot and dicot species found within gaps and the percent of canopy openness as well as percent novel sapling species within the gap and gap size. Additionally, the results of the Spearman’s rank-order correlations indicated no correlations between percent of novel species within the gaps and gap size or percent canopy openness.
**Disholcaspis cinerosa** (Hymenoptera: Cynipidae) Asexual Gall Distribution Within Clusters of Quercus fusiformis

Meg Hardick – F14

*Disholcaspis cinerosa* is a gall-forming insect of the family Cynipidae which is specialized to the Central Texas native Live Oak (*Quercus fusiformis*). It is part of a potentially vulnerable microcommunity involving parasitoid wasps and ants. This study aimed to examine the spread of the gall based on tree density, age, and the presence of other gall-forming species, as well as determine if the presence of *D. cinerosa* has an effect on the reproductive capabilities of Live Oaks. The study determined that there was not a clear relationship between proximity and gall infection, and that the presence of the gall did not entirely eliminate other gall-forming species. It also showed that there is little evidence that the presence of *D. cinerosa* galls has a negative effect on tree health as determined by counting acorns.

**Habitat Preference of White-tailed Deer Within Brackenridge Field Laboratory**

Bradley Hart – F14

There has been a White-tailed Deer population within Brackenridge Field Laboratory for over two decades now, and they have had a significant impact on the vegetation within the field lab. Deer can greatly inhibit natural successional stages by their intense browsing damage, as well as vegetative damage by creating trails and antler rubs. Based on previous research done at BFL, I hypothesized that White-tailed Deer will prefer edge habitats as opposed to completely open areas such as grasslands, or thickly forested areas. In this study, I determined that the deer do significantly prefer edge habitats more than open or closed habitats. This may lead to an expansion in edge habitat within BFL or at least maintenance of the edge habitat and a limit in successional changes due to high mortality and limited growth of sapling trees.

**Presence and Density of Tillandsia recurvata in the Brackenridge Field Lab Depends on Habitat, Host Species and Host Size**

Erissa Hinshaw – F14

*Tillandsia recurvata* is an epiphyte that grows on larger host plants. There is evidence that *T. recurvata* can cause either beneficial or detrimental effects on its host and environment. This study aims to determine what conditions are most beneficial to *T. recurvata* by examining
density and location in coordination with habitat, host species, host survivorship, host size, and light exposure in the Brackenridge Field Laboratory. Habitat and host species were found to be significant for presence of *T. recurvata*, while host size was found to be significant for *T. recurvata* density. Host survivorship and light exposure were not significant for density. The abundance of *T. recurvata* in certain habitats may be due to its preference for certain host species present in that habitat or due the habitats’ proximity to an urban environment. Insight into the habitat and host preferences of *T. recurvata* is important for the prediction of its future territorial expansions across Texas.

**Possible impacts of fungus on the health of the invasive giant reed (*Arundo donax*)**

**Marissa Lamb – F14**

Giant Reed (*Arundo donax*) is an invasive plant that has caused an array of problems within the Central Texas area. Fungus is commonly found within the patches of these reeds, and often contains fungus of the genus *Arthrinium*, including *Arthrinium arundinis*. This fungus is utilized by the leaf miner (*Lasioptera donacis*), a biocontrol agent of the giant reed currently being studied. While this fungus is difficult to identify in the field, overall fungal presence can be generalized to determine the impacts fungal species may have on stands of the giant reed. In this study, fungal presence is compared to abiotic factors between the sites and health of stands is compared between three different sites. Results showed that a possible correlation may exist between high fungal presence and poor health of stands. These effects may be more observable then those of *Tetramesa romana*, another identified candidate for biocontrol that was present within all three sites.

**Determining the Distribution of *Solanum pseudocapsicum*, an Exotic and Invasive Species at Brackenridge Field Laboratory**

**Anna Perkins – F14**

Winter cherry, *Solanum pseudocapsicum*, is in invasive species at Brackenridge Field Laboratory (BFL) and in other parts of the southern United States. While the presence of *S. pseudocapsicum* has not been shown to be particularly detrimental to any specific species, invasive species in general tend to reduce biodiversity and outcompete native plants. A survey of *S. pseudocapsicum* was performed at BFL to determine factors effecting the distribution of the
species. Chi-squared tests were used to show that the abundance of *S. pseudocapsicum* varies significantly among different canopy cover levels, shrub cover levels, and canopy tree species. This suggests that the distribution of *S. pseudocapsicum* can be regulated by space (presence of other shrubs), light, and methods of distribution.

2015

**Ant competition and environmental factors throughout the BFL**

Matthew Bui – S15

A modified ant bait study was done at select acres showing ant species diversity to determine the range of *S. invicta* dominance and any contributing environmental factors such as canopy coverage levels and terrain levels. With 26 baits exhibiting ant dominance from five different ant species, *S. invicta* did not show statistical dominance over the other species, only dominating 14 of the 26 baits. When analyzing for canopy coverage, a moderate correlation was shown between higher canopy coverage and abundance of ant species, although *S. invicta* showed the inverse of this, dominating a high number of sites in open areas. The quarry did have the most abundant number of ant species present, although this value was deemed to not be significant. Overall, the most restricting variable for interpreting results was probably sample size and any future considerations should escalate the scale and scope of the project.

**Ecological Factors Affecting BFL Snail Species: Mesodon roemeri, Rabdotus dealbatus, Helicina orbiculata**

Francesca Filipetto – S15

Calcifying organisms, such as land snails, require adequate amounts of carbonate, calcium, and alkaline pHs in order to form calcium carbonate. In the decades before BFL was established as a field laboratory its lands were used to mine limestone, which is made of calcium carbonate. Using pH as an indicator of calcium carbonate, I hypothesize that snails will be present in areas of high soil pH. Thirteen sites were sampled for snail presence or absence, soil pH, habitat type, canopy cover, ground cover, and shell length according to species type if snails were present. There was a significant difference in soil pH according to the presence and absence of snails at the site. There were also significant differences between snail species with habitat type, canopy cover and ground cover. The distribution of the snail community at BFL was
associated with the soil pH, and the abundances of the three snail species within the community depended upon habitat type, canopy cover, and ground cover.

A survey of the effects of the removal of *Nandina domestica*, an invasive shrub at BFL.

**Jake Greenfield – S15**

In a survey of ten sites along the northwestern creek, it was found that an attempt to remove *Nandina domestica* by the cut and paint method has failed. By counting the numbers and types of each species of seedling that were found at both recently and formerly disturbed sites we were able to discern whether *N. domestica* was effectively removed. While the diversity among the sites differed greatly, with different species present at most sites, the diversity at each site was low at around 7 per site, and all the sites except 1 included *N. domestica*. This was a clear indication that the attempt to remove *N. domestica* was not completely successful, although further study is needed in order to discern whether certain sites were being repopulated by seed already present in the soil's seed pool or whether the seedlings were arising from a dispersal event. Ultimately, this survey was a useful pilot study to set up future research into invasive plant removal at BFL.

Distribution and Effects of Puccinales Fungi on Grass Species at Brackenridge Field Laboratory

**Amber Hiers – S15**

Rust fungi is a fungal pathogen that causes a decrease in photosynthesis, inhibits growth, and increases susceptibility to other pathogens and pests. Various wild grasses and cereal crops can be negatively impacted by rust fungi, so it is important to understand fungi distribution and its effects. Three habitats were looked at: old pasture, lower river terrace, and an old quarry. In each habitat type, 20 measurements were taken. These measurements included recording ground cover, canopy cover, and shrub cover along with infection status and those grass species infected with rust. Five areas with rust present and five areas without rust were measured over two weeks for growth rate. Infection status was dependent on habitat type where the lower river terrace was found to have many more infected sites than the other two habitats. Ground cover was significant with many more infections at sites with higher ground cover. Median growth of sites without rust was higher than sites with rust.
Rock colonization in Ant species at BFL
TJ Keel – S15

By sampling the various ant species under differing rock sizes at Brackenridge Field Laboratory I was able to establish a correlation between rock sizes and the relative ant species abundance underneath these rocks. The invasive ant *Solenopsis invicta* is the most common ant at BFL by a large margin. However, this was not the case underneath rocks; suggesting conscious colony location selection by the ants. Furthermore, when comparing the relative abundance of ants under rocks to past open field relative abundances we see a disproportionate number of large ants. Further testing needs to be done to prove large ant preference towards establishing colonies under rocks.

Foraging Sites of *Dasypus novemcinctus* at Brackenridge Field Laboratory
Toni Red – S15

In order to determine whether or not the foraging behavior of the nine-banded armadillo is a problem, a preliminary investigation on the foraging sites the armadillo was done. To determine where armadillos like to dig, evidence of digging along each transect at Brackenridge Field Laboratory was recorded along with the amount of leaf litter and ground cover of the sites. Chi-squared tests show that armadillos have no preferences of the 3 BFL habitat types (Quarry, Pasture, and River), or the amount of leaf litter and ground cover. In a few cases, there were patches of ground that had multiple digging sites. I compared the soil macro fauna of those sites to patches of ground without armadillo diggings. Patches of ground with armadillo diggings versus patches of ground without armadillo diggings are similar in insect composition with a Jaccard’s index of similarity of 1.2.

Vegetation and water clarity greatly impact the habitat quality of aquatic macroinvertebrates at Brackenridge Field Laboratory
Maria Rodriguez – S15

Macroinvertebrates are important indicators of water quality and their biodiversity can give us clues about the state of an aquatic ecosystem. It is important to understand what factors most influence macroinvertebrate biodiversity in order to predict how aquatic ecosystems will respond to disturbance such as fertilizer runoff, erosion, and drought. In the experiment, I
sampled 25 ponds at Brackenridge Field Laboratory for macroinvertebrate density and biodiversity. The ponds varied in size, fish density, density of aquatic vegetation, and water clarity. I found macroinvertebrate biodiversity and density were positively correlated with abundance of vegetation and water clarity. In addition, macroinvertebrate species richness was positively correlated with macroinvertebrate density in the ponds. This indicates that there was little inter-species competition occurring in the ponds. The data also indicates that most macroinvertebrates found in the ponds in late April depend heavily on aquatic vegetation, and that they are either highly dependent on sight or very sensitive to substances that made the water cloudy.

**Prickly Pear Cactus in the Old Quarry of BFL**

**Erica Sorensen – S15**

Prickly Pear cactus at BFL are commonly found in large patches in large clear open areas, but recently they have begun to spring up in the forested area of the Old Quarry of Brackenridge Field Laboratory. This project gives insight into some of the factors that may be causing this. Data was collected along the transect of the north and south Quarry and included patch size, a subjective analysis of shrub and ground level, the cacti’s health status, the distance to the closest canopy tree, as well as the presence of dead or fallen trees. A fisheye lens was also used to measure canopy cover, by using the Gap Light Analyzer program that calculated the canopy % openness. By performing a linear regression on canopy % openness and patch size, a correlation was found between the two variables and the more open the canopy, the larger the patch size was. Shrub cover and ground cover levels were also compared to data from the previous lab, Heterogeneity of Vegetation. Areas with more patches appeared to be in habitats that had much more variation in shrub level, and also along the edges of dense shrubs. The correlation between shrub/ground levels and health were analyzed and were found to be statistically insignificant. This was most likely due to the small sample size because observationally there was a decrease in the cacti’s health when high-density shrub was present. The results of this lab help support the idea that steps should be made to remove the cacti from the old quarry before it grows to a large scale and has detrimental effects to the flora and fauna diversity.
Frog and Tadpole Diversity in Brackenridge Field Laboratory
Madelyn DeYoung – F15

This report expands on previous studies done on the frog and tadpole populations at Brackenridge Field Laboratory. We focused on areas where tadpole density was recorded to be the highest to determine why this was. Upon exploring various ponds throughout the BFL, the following predictions were made for this experiment: 1. Tadpoles will congregate in areas of ponds with more vegetation cover in order to avoid predators. 2. Tadpoles will congregate in areas closer to the perimeters based on observations. 3. Species richness of frogs will be higher in enclosures with more drainage holes than enclosures with fewer due to easier access. 4. Species richness will be greater at unenclosed ponds than enclosed ponds also due to more area for travel and access of resources. Six ponds were used for data collection. We walked through the ponds and counted and took photos of frogs and tadpoles present. The species was identified through the photos, although many turned out blurry and were therefore unidentifiable. A greater diversity of frogs was found in ponds 1 and 2 (p=0.015), which were unenclosed. Results also showed a significant difference between tadpole density near the banks versus areas in the middle (p=0.0004). A follow up study should be conducted in the spring, as that is when most amphibians breed.

A Survey of Eastern Fox Squirrel (Sciurus niger) Nests at Brackenridge Field Laboratory
Audrey Dupuis – F15

The main goal of this project is to survey the squirrel nests at Brackenridge Field Laboratory and look for trends in their characteristics. Specifically, where squirrels build their nests and what the surrounding microhabitat looks like were analyzed. Squirrel nests were searched for along transects and paved roads at BFL. The GPS coordinates, height from the ground, tree species and width, whether the nesting tree was connected to another tree, canopy/shrub/ground cover levels (0-3), and proximity to a live oak, pecan, or juniper tree were recorded for each nest found. A total of 71 nests were located. They were most often found in juniper trees, but one cannot conclude that this is due to some sort of preference. It could just be that juniper is such a common tree species at BFL that squirrels are more likely to nest in juniper. A significant correlation was found between nest location and proximity to certain food-bearing
trees. Future studies could implement cameras to monitor nests to observe time spent away from nests and if there would be any correlation with that and nest locations.

**Dynamics of *Lantana montevidensis* dispersal in the Old Quarry habitat at Brackenridge Field Laboratory**  
David Comer – F15

*Lantana montevidensis* is an invasive species of lantana that occurs in dense patches throughout the Old Quarry habitat at BFL. Lantana, which has high light requirements, was hypothesized to disperse along roadways and take advantage of tree gaps to penetrate deeper into wooded areas. This study sampled along transects in the Old Quarry and determined that there was no association between tree gaps and lantana presence. Lantana was found to be most abundant about 10 meters from the road and frequency of occurrence began to drop dramatically about 30 meters from the road. These results suggest that distance to an edge has an impact on lantana dispersal, but further investigation is needed to determine the circumstances under which lantana is able to colonize in the Old Quarry.

**A Survey of Eastern Fox Squirrel (*Sciurus niger*) Nests at Brackenridge Field Laboratory**  
Marlena Fay – F15

A general survey of eastern fox squirrels (*Sciurus niger*) nesting behaviors would be beneficial as it would provide an understanding to how the species acclimates to specific habitats and environments. This study looks at what the most common tree species the squirrels’ nest in and if there are any trends that can be seen at Brackenridge Field Laboratory. The transects at BFL were walked and observed for squirrel nests. For each nest found, nesting tree species, width, GPS coordinates, nest height, and proximity to the nearest fruit-bearing tree was recorded. It was discovered that Juniper was the most common nesting tree species as well as the most common nearest fruit-bearing tree, so there is a trend seen for these species. That being said, BFL is representative of a juniper-oak woodland savanna, so it cannot be ruled out that it might just be coincidental that these species were chosen due to the type and availability for each tree species. A follow up study should include information on which habitat type (quarry, river terrace, pasture) nests were found in to determine if the squirrels have a habitat preference.
The autumnal macrofungal community of BFL
Kyle Gervers – F15

Over a two-three-week period with relatively heavy rains, macro fungi sporocarps were sampled along three transects of urban juniper and hardwood woodland habitat at Brackenridge Field Lab. The densities of canopy and ground cover were assessed wherever sporocarps were present. The species of tree most proximal to the fruiting body occurrence was also recorded. Specimens were collected and distinct species were identified. 26 species of macro fungi were observed across all transect sites. Diversity comparisons were made between sites with different levels of plant cover and dominant tree type using rank abundance curves, Jaccard indices of similarity, Shannon diversity indices. Across all sites, species evenness was found to be somewhat low, though sites with dense canopy cover and dominated by cedar elm demonstrated pronounced unevenness. Comparisons of species composition demonstrated little similarity between each site type, though comparisons between sites with dense or open canopies (J = 0.46) and cedar elm and hackberry-dominated sites (J = 0.42) displayed greatest dissimilarity. Shannon diversity indices were lowest among dense canopy sites (H’ = 1.90) and cedar elm-dominated sites (H’ = 1.92)—lower than the index for all sites (H’ = 2.63). Cumulative species curves developed for each site type indicated that sampling effort should be increased in order to better represent richness. Nevertheless, these analyses may demonstrate specifically how simple habitat factors can affect the macrofungal community of BFL.

An Ecological Assessment of Habitat Preference for Juniper, Mesquite, and Chinaberry Seedlings/Saplings of Brackenridge Field Laboratory
Ryan Gonzales – F15

Mosaic habitats due to differing biotic and abiotic factors is a major reason for the diverse species composition seen at Brackenridge Field Laboratory. The Juniper (Juniperus spp.), Chinaberry (Melia azedarach), and Honey Mesquite (Prosopis glandulosa) are three common species seen at the lab and are the focus of this study. I wanted to determine the specific habitats in which seedlings and saplings of these species best thrive in. I predict that Juniper trees will be primarily found in the shade to prevent water loss, that Chinaberry will be found in both open and closed habitats, and that Mesquite will be found primarily in open habitats due to their preference of sunlight. Open and closed sites were located throughout BFL. At each site, three
random points were chosen for survey using the point-quarter technique. The distance of any seedling or sapling present within a 10-meter radius was recorded and the species were identified. The relative abundance chart shows a clear representation that Juniper prefers closed canopies while Mesquite prefers an open habitat. On the other hand, Chinaberry seems to have more of a closed canopy preference; however, it still shows that they can be found in both open and closed habitats, just as I predicted. Other factors such as soil structure, drought impact, deer population, and human disturbances should be looked at to make conclusive statements about the habitat preferences of the species looked at here.

Ant communities’ discovery-dominance tradeoff in Brackenridge Field Laboratory?
Skylar Kwan – F15

In order to check the model of discovery-dominance tradeoff, I conducted a series of trials that tested the discovery rates of eight ant species (including both native and invasive) and their dominance patterns. To compare the discovery times of each species, 4 primary baits were set up 3 feet apart from each other at each site and each site was revisited every 20 minutes. If the baits were discovered, ant samples were collected, and time was recorded. If any same-arena domination events occurred before the baits were removed, the new species and time were also collected and recorded. The species curve predicted the presence of 11 species, however, only 8 were found in this study. The invasive fire ant, *Solenopsis invicta*, also made up more than half of the total data. Overall, the results were unable to show a significant deviation from this relationship.

Effects of *Vitis mustangensis* on its Supporting Trees’ Structure
Leticia Lee – F15

Woody vines have been known to alter the composition of trees in a forest by physically weighing down trees as well as shading them out and other understory vegetation. The Mustang Grapevine (*Vitis mustangensis*) is one such woody vine that can be found at Brackenridge Field Laboratory. The grapevines can grow so thickly that they are able to kill elm and hackberry trees thus changing the surrounding plant community. This study investigated how the presence and abundance of *V. mustangensis* affects the surrounding trees, which can provide greater understanding into the succession of the plant and faunal communities present at BFL.
hypothesized that there would be more trees in a mustang grapevine patch, that older trees with larger diameters would have a larger area of vines with bigger average diameters, and that the presence of other vines would decrease the diameter of mustang grapevine. \textit{V. mustangensis} patches were located along the transects or within 20 meters of the transects. GPS location, tree damage, average vine diameter, tree diameter, the number of trees, and the presence of other vines was recorded for each patch. As predicted, a strong, positive correlation between the area of a vine patch and the number of trees was found. Although it was thought that trees with a larger DBH would have a larger area of vines with bigger average diameters, the graphs showed that there was a slight negative correlation between the area of a vine patch to the average DBH of the trees Average Vine Diameter (cm). The presence of other vines also had no significant relationship with \textit{V. mustangensis} vine diameter. Although most of the results found in this study agreed with past research on woody vines and \textit{V. mustangensis}, most of the results were not as conclusive as one would hope. Future studies using more specific characteristics such as how the vine is growing and how vine growth affects trees would be interesting to note.

\textbf{Arthropod Diversity at the BFL in the Absence of Termites}

\textbf{Conor McMahon – F15}

It is reasonably common knowledge that poor ecologic relations have existed between termites and ants for millions of years – many species of ants predate termites, and termites have evolved a number of defenses against ant attack, while various ants have continued to evolve offensive strategies to use in raids against termites. In particular, the red imported fire ant \textit{Solenopsis invicta} is a known predator of subterranean termites. For this independent project, I chose to focus on attempting to sample termites and ants from across Brackenridge Field Laboratory and look for negative associations between their presences in various sites. I hypothesized that termites would be less frequent in areas with large populations of carnivorous ants, especially the \textit{S. invicta}. Ants were collected using pitfall and baited traps. Very few termites were able to be collected due to the cold weather, so the project focus was shifted to an analysis of differential arthropod diversity. No significant difference was found between the two habitats there were sampled, however, a significant difference was found in terms of the average number of species produced via the pitfall versus the baiting trap. The pitfall traps produced on average 3.97 species, with $\sigma = 2.386$, while the corresponding bait trap data points were only $\mu =$
2.07 and \( \sigma = 1.016 \). While no significant data was able to be collected this semester regarding termites, the remaining terrestrial arthropod data, originally intended as an additional parameter to weigh termite presence against, was able to be focused on instead to provide information regarding the arthropod community of the BFL.

Survey of Anuran Community Composition in Artificial BFL Ponds

Zoe Trautz – F15

The purpose of this study was to identify trends in habitat preferences of both adult frogs and tadpoles between and within select artificial ponds at Brackenridge Field Laboratory, and more generally to better characterize the Anuran communities present at BFL. I hypothesized that tadpoles would occur at a greater density in areas of ponds with greater vegetation cover and at areas closer to shore. I also predicted that species richness of adult frogs would be higher in pond exclosures with more gaps in their walls and in unenclosed ponds. Tadpole density for each of the six ponds sampled was based on a scale of 0-3 (0=0 tadpoles, 1=1-10 tadpoles, 2=11-20, 3=21+) and counts were made of adult frogs. Vegetation cover was also assessed visually for each pond and vegetation maps were created based on these. Contrary to my prediction, no correlation was found between tadpole density and vegetation cover. It was found, however, that tadpoles do tend to congregate near the banks of ponds. Frog species richness did not appear to relate to the number of enclosure openings, but it was found to be higher around the rims of the unenclosed ponds. This may have been due to greater accessibility between these ponds. Sample sizes were relatively small, which could have influence results. A replicated study with a larger sample size as well as better species identification could yield more decisive results.

Foraging behavior of native BFL birds in the presence of a predator’s call

Becca VanHouten – F15

Metabolic costs while foraging near forest cover is much less than doing so out in the open and one theory states that birds do not venture further out because this cost is not worth the risk for some species. A study done in 2006 by a Bio 373L student named Thomas Le sought to determine if the native bird species at Brackenridge Field Laboratory also displayed these same foraging behaviors. Focusing on three species, the Whit-winged Dove, Inca Dove and Mourning Dove, Le concluded that the native birds of BFL do indeed rely on forest cover for protection. I
wanted to take this study further and add another element. What would happen to the known foraging behavior if the call of a predator was added? Would the birds stay even closer to the forest cover, would they diminish in number, or would there not actually be a change in behavior? In order to do this, I performed a control study that was then compared to trial runs and hypothesized that the average number of birds at each feeding site would change in the presence of a predator call. There was not enough significant data to show a difference in the average number of birds at each feeding site in the presence of a predator call. Although not enough evidence was given by the data, it did seem that the birds stayed closer to the forest cover in two out of the four trials.

2016

Caterpillar Community Patterns at Brackenridge Field Laboratory

Alex Aguirre – S16

In this study, I aim to assess the community patterns of the larval stage of a butterfly (Libytheana carineta) and moth (Isogona tenuis) who both lay their eggs on Hackberry trees. L. carineta is typically found in woodlands and forests, so I hypothesize that its presence will correlate with increased canopy cover. I. tenuis, however, have been found to prefer riparian trees, therefore I believe that there will be more moth larvae in the River Terrace habitat than in others. A sweep net was used to catch caterpillars within Hackberry trees in the Old Quarry and River Terrace habitats at Brackenridge Field Laboratory over the course of three weeks. Canopy cover, shrub cover, habitat, and the presence of Crematogaster laeviuscula were all recorded. The presence of C. laeviuscula was linked to a significant decrease in caterpillar presence. Contrary to their typical habitat and what was found in the literature, canopy cover did not correlate with caterpillar community structure. However, I. tenuis was found to prefer the River Terrace over the Old Quarry which falls in line with their observed habitat preference.

Lantana, biological controls, and clump size

Amy Wrobleski – S16

Texas Lantana, Lantana urticoides, and invasive Lantana camara are two closely related Lantana species. However, L. urticoides is native to Southern Texas and Northern Mexico, while L. camara is invasive and considered a weed in many areas around the world. Both plants grow
in scattered clumps and grow to be one to two-meter-high shrubs. Patch size has been found to affect the visitation rate of pollinators, which therefore impacts the diversity of patches. I hypothesize that as patch size increases, the diversity of species visiting the patch will also increase. GPS coordinates were taken of *Lantana* present at Brackenridge Field Laboratory. The plants were classified as either native or invasive, clump size was measured, canopy cover was scaled, and each plant was observed for five minutes and pollinator visitors were tallied and categorized. The number of arthropods and similar species of arthropods were found to be the same on both the native and invasive species of *Lantana*. There was, however, a positive relationship between clump size and the number of morpho species. Larger clump patches attracted a more diverse range of pollinators. A replicate of this study with more sample sites as well as identifying exact species present would provide more insightful data.

**Effects of *Nandina domestica* on plant diversity at Brackenridge Field Laboratory**

Kheuankeo Williams – S16

Invasive plant species are a major threat to the conservation of plant biodiversity as they have no natural predators and can therefore take over an area quickly. The effects of *Nandina domestica* on terrestrial ecosystems has been written to have caused reductions in species richness and diversity. In this study, I evaluated plant biodiversity in the presence of *N. domestica*. I hypothesized that in control sites where *N. domestica* is dominant there would be significant reduction of species richness compared to sites where *N. domestica* had been removed. I also predicted that sites with less *N. domestica* coverage would show the most plant species richness. The plant communities of four sites were sampled using four-meter quadrants. Data revealed that control sites had 18 plant species compared to T2 which had 24 plant species. This further helped support my hypothesis that a community that is dominated by *N. domestica* would have less diversity and would have less plant species. As for T0 having an index of 18 and T1 having an index of 17, I suspect that it takes time for native plant species to grow to compete with the invasive plants.
Spiders as Indicators of Habitat Health at Brackenridge Field Laboratory
Cooper Wyatt – S16

Spider growth and reproductive rates have been linked to the amount of prey they ingest and habitat quality which makes them good ecological indicator organisms. There are several possible applications for using spiders as ecological indicators, including assessing whether conservation efforts are needed somewhere and how well conservation practices might be working. In this study, it was predicted that spider diversity can be used to predict insect diversity and, beyond that, ecosystem health in different habitats. Pit traps were placed in three habitats (a forested quarry area, an open meadow, and an often-disturbed experimental garden) at Brackenridge Field Laboratory. Canopy cover, ground cover, moisture, and GPS coordinates were taken for each trap location. The Shannon Indices calculated by habitat produced a p-value of 0.733 which is not significant. However, the Shannon Indices calculated by site included many more data points, making it easier to analyze statistically. The p-value produced by regression analysis was 0.000597, which is much lower than the alpha value of 0.05, suggesting that the correlation is significant. This suggests that spider diversity can reliably predict insect diversity, supporting the study’s hypothesis.

Assessing herbivory rates on Texas Ash (Fraxinus texensis) saplings at Brackenridge Field Laboratory
Heather Yang – S16

Herbivory results in adaptations of both the herbivore and the plant. The resource availability hypothesizes that the patterns of plants defenses are inherently due to the accessibility of resources. Plants in nutrient rich environments tend to grow faster and are more susceptible to herbivory while plants in nutrient poor environments grow slower and are less susceptible to herbivory due to their resources being allocated to defense. This study assessed if any environmental factors (e.g., canopy coverage, disturbance level, and presence of aphids, sapling densities) and any quantitative traits (e.g., height and diameter) affected herbivory rates on Texas ash saplings at Brackenridge Field Laboratory. In addition, the correlation between sapling height and diameter was evaluated. Populations of Texas ash saplings were surveyed in the Old Quarry habitat. Levels of herbivory were measured by taking leaves from each tree and the proportion of total leaf area removed was estimated. Results showed there was no significant
A correlation between the herbivory rates of Texas ash saplings and canopy coverage, disturbances, aphid visitations, or sapling density. There was, however, a positive correlation between sapling heights and their diameters which was expected because both quantitative traits are indicative to tree size. A follow up study on the effects of tree species diversity (richness and evenness) on herbivory rates may provide more telling information.

An assessment of above ground arthropod diversity in *Nandina domestica* removed plots at Brackenridge Field Laboratory

Jessica Lee – S16

Non-native species that are introduced into a habitat have the ability to become naturalized and eventually become invasive to the region, displacing native species and causing enormous ecological and economic loss. This is true for both plant and animal species. *Nandina domestica* (heavenly bamboo) is one species of invasive shrub that has been purposefully introduced to the United States as an ornamental plant. This project aims to assess differences in arthropod diversity in plots dominated by *Nandina*, and plots that were once dominated by *Nandina*, but have since had a removal treatment. I sampled vegetation dwelling (above ground) arthropods to determine if there was a difference in diversity between the sample sites. Assuming native vegetation will support a more diverse arthropod community, I hypothesized that total arthropod community diversity will be different between each of our selected sites. More specifically, I expected the plots where *Nandina* had been removed to be more diverse than plots dominated by *Nandina*. Although the data collected supports the proposed hypothesis, it also strongly suggests that more replications would be required to obtain a representative sample of specimens to assess species diversity in the selected sites. This is shown via the species cumulative curves as well as the rank abundance curves. Increasing sampling intensity would likely increase our power to make inferences about the health of each different vegetative community.
Evaluating aquatic arthropod communities at Brackenridge Field Laboratory: Mosquito composition and diversity between two sizes of cow tanks

Katie Litchen – S16

Aquatic environments play a substantial role in energy flows and nutrient transfers between terrestrial and aquatic habitats. In relatively isolated aquatic environments, such as ponds, community composition is variable depending on the rate and nature of colonization. Such processes therefore have the potential to generate reaching ecological effects at local levels as well as at broader scales. This study attempts to evaluate the local ecology of the aquatic arthropod community within cow tanks at the Brackenridge Field Laboratory (BFL), focusing specifically on how the size of the tank might influence the composition of predators, abundance of mosquito larvae, and overall diversity. In this study, the aquatic arthropod community within two different sizes of tanks will be sampled, and data on which taxa are present, their abundance, and whether they are predatory to aquatic life-stages of mosquitoes will be recorded. Based on the idea that the increased surface area of the larger tanks would present a greater target for colonization, I predict that the larger tanks will have a greater overall richness of taxa. I also predict that larger tanks and increased predator abundance will be associated with lower abundances of mosquito larvae, as increased diversity and density of predators will result in greater predation pressures. Results showed the abundance of mosquitoes partially supported the hypotheses outlined at the beginning of the study. Mosquito larvae and pupae were more abundant both relatively and overall in the smaller tanks. The results of the test on the influence of predator presence, however, was insignificant. A weak positive correlation between predator and mosquito densities was revealed, contrary to initial predictions, but it too was revealed insignificant. When evaluating diversity between the tanks in terms of taxa richness alone, the data collected in the samples originally estimates the richness for both sizes of tanks to be identical. Both overall richness and average richness per sample were the same in small and large tanks.

Colonization of concrete substrates by adjacent native and exotic communities

Lauren Trotter – S16

In urban and suburban areas, fractured roadways and sidewalks act as a rocky substrate available to plants for colonization. Evidence suggests that the ecological context of the concrete
surface determines what factors most greatly affect colonization. In urban areas without directly adjacent natural environments, the community of plants that inhabit walkways, referred to as concrete communities in the context of this study, has been found to be comprised of species that would naturally inhabit rocky soils and bare rock. The roadways at the Brackenridge Field Laboratory provide an opportunity to determine what factors drive the colonization paved roads in a semi-natural setting and measure the presence of exotic plants in these concrete communities. I hypothesize that, because the roads on the property are fairly intact, the concrete communities at this stage of colonization will be determined more by properties of the substrate rather than the composition of the neighboring natural community. I also hypothesize that concrete communities will contain a higher percentage of exotic plants than the adjacent natural communities. Based on the evidence provided by chi-squared statistical analysis and the trends shown by the relative abundance graphs, it can be concluded that at BFL, the communities growing in concrete roads and the adjacent natural substrates are different, and that these differences are related characteristics of the substrate itself. Further evidence supporting this hypothesis was provided by the chi-squared analysis that demonstrated a similarity between the concrete communities across both habitats, despite differences found in the natural communities of these habitats.

“Testing for canopy cover preference in Lantana and lantana pollinators”
Mercedes Munselle – S16

Since sunlight is the primary energy source of a plant, this study aims to shed light on whether there is a correlation between canopy openness above a flowering plant, *Lantana urticoides* and *Lantana camara*, and pollinator visitations. I hypothesize that there will be a positive correlation between pollinator visits and canopy openness. Since the two species of Lantana are similar in all but flower color and origin (*L. camara* is invasive), canopy cover preference will also be tested between these species. Since their morphology is so similar (including the sunlight catching leaves), I hypothesis that there will be no significant difference in canopy openness between the species. Lantana plants were sampled at Brackenridge Field Laboratory and any pollinators that visited were recorded. Canopy cover was also recorded on a scale of 0-3. When regression tests were performed on every observed pollinator separately, the only two that had a significant positive correlation were the butterflies and the bees. Perhaps the
other, more obscurely observed, pollinators were simply witnessed by chance. There was also no significant difference found in canopy openness above the two Lantana species.

**Investigating a Relationship between the Density of Leaf Galls in Texas Persimmon (Diospyros texana) and the Presence of Surrounding Trees**

_Nikki Butler – S16_

In this study, the main interest revolved around the development of Texas persimmon leaf galls. The conditions under which these galls form was the goal for analysis. Whether leaf gall density is affected by the density of surrounding trees, canopy cover, or the distance to the nearest neighbor was observed. Since persimmon trees are able to thrive in sun and shade environments as well as clumped or open environments, the main reason for a difference in leaf gall density would be a result from the preference by the mite. I predicted that there would be a higher leaf gall density when the Texas persimmon tree is in an area with a higher tree density and has close neighboring trees because the mites would likely have more habitats when more trees are available. I also predicted that open canopies would result in higher leaf gall densities because mites tend to prefer warm and dry conditions and would look for these conditions to lay their eggs in. Texas persimmon trees were observed at Brackenridge Field Laboratory and data on the gall density, tree density, canopy cover, and the average distance to the nearest neighbor was recorded for each tree. Analyses showed that there was no relationship between leaf galls and tree density, canopy cover, or the average distance to the nearest neighbor tree. This may suggest that the mites do not discriminate between individual Texas persimmon hosts. Since these mites specialize to Texas persimmon which are able to grow in a variety of environments, the mites may have co-evolved with Texas persimmon to be generalists for the environment they lay their eggs in as long as it is on the leaves of Texas persimmon. Another explanation for the insignificance may be that there are different species of mites using Texas persimmons within BFL as hosts. More studies concerning the species of mites on these specific persimmon trees can be done to better understand this relationship.
Spring 2016 Ecological Survey and Habitat Preference of *Tillandsia recurvata*

Roya Azodi – S16

*Tillandsia recurvata* is a greyish rounded plant that commonly grows upon the bark or branches of trees and other plants. Through it goes by the common name “ball moss”, *T. recurvata* is part of the Bromeliaceae family, therefore not a true moss, and is an epiphyte. It would initially seem then that there would not be a preference regarding host if habitat is suitable; however, such is not the case. Instead there seems to be some degree of host preference based on preliminary observations of where the ball moss is and is not seen growing within the Brackenridge Field Laboratory. Specifics for its preferred habitat conditions will be noted by recording observational data throughout the study site. On what trees is it that ball moss is present, is the tree a sapling or a canopy, to what degree does the plant have access to light, and what level of drought surrounds the host tree are all questions to which measurements were needed. Transects at BFL were walked and whenever *T. recurvata* was spotted, the location, the habitat type, the species of host tree, whether it was a sapling or canopy host, light exposure, percentage of tree that was dead, and if drought damage was present were all recorded. In terms of relative abundance, Juniper was the most common host for *T. recurvata* overall, with Cedar Elm and Live Oak next as equally common, and least common of host trees species were *Celtis spp.* (Hackberry), American Elm, *Prosopis spp.* (Mesquite), and Pecan and a single *Ilex vomitoria* (Yaupon) shrub. A significant difference in habitat preference for both light exposure and drought levels was observed. More *T. recurvata* was observed in high light exposure conditions than expected and more *T. recurvata* were also observed to prefer low drought levels. A possible correlation factor for the distribution of ball moss could be due to elevation change, which was not a factor considered in this study.

The effect of *Bothriochloa ischaemum* on the biodiversity of a Stengl Biological Station grassland

Sahonara Gonzalez – S16

In many areas of North America, it has been estimated that less than 1% of original grasslands remain. Loss of this ecosystem continues as grasslands are further pressured by disturbances such as overgrazing, fragmentation, land use changes, climate change, and introduction of non-native invasive species. One such invasive plant is *Bothriochloa ischaemum*
King Ranch Bluestem, which was introduced in the early 1900s. This study looks at the effects Bothriochloa ischaemum has on the biodiversity of plots in which the species is present at the Stengl Biological Station. For this study, I expected percent Bothriochloa ischaemum cover and the three diversity parameters species richness, Simpson’s, and Shannon’s diversity index to have a significant relationship. I also hypothesized that there will be a significant difference between the diversity parameters when plots are divided into lower vs. higher KR coverage. I established four transects starting from the edge of the road and going towards the meadow and randomly chose five sample points to survey. As expected, KR percent cover negatively affected the biodiversity of the invaded plots sampled in the Stengl Biological Station meadow. Analyses showed that species richness, Simpson’s, and Shannon’s diversity index all had a negative relationship with the percent of KR coverage in the quadrants. Future research on the effect KR litter has on vegetation would provide more insight to how this invasive plant affects native plant diversity.

Survey of ant species found on trees at Brackenridge Field Lab
Sarah Perrilloux – S16

Central Texas has a diverse community of ants that are an important part of its ecosystem and biodiversity. Even after the invasion of the non-native fire ant species Solenopsis invicta, there are still many species of ants that thrive and compete in all of the habitats occurring in the area. Earlier in the semester, we surveyed the ant species at Brackenridge Field Laboratory by placing baits on the ground. This paper builds off of that study and aims to survey the ant species that occur in trees with the same method. I wanted to determine the relative abundance of ant species that forage in trees, as well as determine any sort of tree preference of these ants. In the previous ant study, Crematogaster laeviuscula were much more common than other ant species that can be found in trees. Therefore, I hypothesized that there will be mostly Crematogaster spp. found on the baits, or that they will have the highest relative abundance. I also predicted that the ants will have a preference for trees with a larger diameter, due to more available space for foraging activities. This study shows a clear difference between the ant makeup in the trees of BFL and the terrestrial ant survey that was conducted earlier in the semester. My original hypothesis that Crematogaster spp. would be the most abundant species is supported by this data, although P. dentata ended up being more abundant than C. lineolata. Contrary to my initial
hypothesis, tree diameter had no statistically significant effect on the presence of ants. The t-test for this and percent canopy openness showed no evidence for any sort of habitat or tree preference in this regard. However, the mean diameter for sites with ants was a larger number than that of trees without ants. Although ant populations in BFL and most of Central Texas has been invaded and severely altered by the presence of *S. invicta*, this survey showed that there are non-invasive species that still occur in abundance on trees. Only two sites had fire ants, with only one of those being the non-native species *S. invicta*.

**The Impact of Invasive Nandina on Ground Dwelling Arthropod Biodiversity**

_Victoria Brister – S16_

When a new, nonnative species is introduced into an environment, whether by anthropogenic or natural occurrences, it has the potential to reproduce and expand its population, and in that expansion alter the biotic composition of an ecosystem. This study explores how the invasive Nandina plant or *Nandina domestica* has impacted the arthropod diversity of Brackenridge Field Laboratory. I utilized pitfall traps and multiple species diversity tests to examine whether or not there is a correlation between _Nandina_ presence and arthropod diversity. The overall species richness at each site found the site with the least variety of species to be the control plot. This supports my hypothesis that the invasive Nandina is correlated with a decrease in ground dwelling arthropod diversity. Based on the cumulative species curve, however, additional research and sampling is required for a more complete understanding of the relationship between _Nandina_ and ground dwelling arthropod diversity.

**The Effect Different Habitats have on the Growth Rate of Different Tree Species in BFL**

_Candice Asare – F16_

The environment or habitat a plant is located in impacts all phases of growth and development. Different habitats can have different factors that can be beneficial or unfavorable to a plant’s growth. Three habitats at Brackenridge Field Lab (old quarry, old pasture, and oak savanna) were chosen to study how different habitats affected the growth rate of different tree species. _Celtis occidentalis_ (hackberry) and _Ulmus crassifolia_ (cedar elm) trees were chosen for this study as they are found in all three habitats. Circumference growth rate and the rate a tree grew over the nail/wire used to attach a tree tag was recorded. Comparisons on the rate the tree
Response of Central Texas understory at Brackenridge Field Laboratory one year after the removal of the invasive shrub *Ligustrum*

Kathryn Bell – F16

Invasive plants often displace native plants that fill similar niches because they are not checked by herbivores or pathogens and can easily outcompete natives due to the lack of external population control. Chinese Privet, *Ligustrum sinense*, is an especially aggressive invasive plant that has impacted the Southeastern United States. Ligustrum made its way to Brackenridge Field Lab in the mid 1900s and has taken over much of the understory at the field lab. In an attempt to combat this aggressive invasive species, several sites at BFL that had become pure stands of mature privet were cleared using hand felling techniques in the late fall of 2015. In this study, I compared two of these cleared sites to adjacent mature privet stands. Based on findings in previous studies, I hypothesized that there will be a significant difference in species diversity between the cleared and adjacent untreated sites. I also hypothesized finding higher densities of herbaceous plants in the sites that have been cleared of privet. Each of the four sites underwent a general survey in which the total number of understory species was found using a hand counter and the plants were photographed and identified. The results of the Shannon diversity index suggest that there is a difference between the diversity at the cleared sites and the stand sites. The results of the Jaccard’s index calculations also show signs of the difference in size between the two comparison plots. Overall, the results found in this study suggest that there are significant differences between sites that were cleared of privet about one year ago and the adjacent
untreated areas. The results also suggest that there are factors other than privet removal affecting the succession of these two sites because of differences found between them.

An Analysis for Ant Community Structure Over Time
Luis Medina – F16

Habitat structure can influence ant community structure at multiple levels. For example, structurally complex habitats with different food resources may lessen foraging competition between coexisting ants, while habitats with reduced complexity may increase predation. Thus, determinants of ant community assemblages include competition, predation, parasitism, physiological tolerances and anthropogenic disturbances. At Brackenridge Field Laboratory, studies focused on invasive red fire ant, *S. invicta*, suggest that coexisting ant species interact through trophic and spatial relationships mediated by habitat structure. In this study, I focused on the effects of environmental factors that influence habitat structure on ant community assemblages. Data obtained from student-led ant surveys was compiled accordingly by location and year, and then tested for changes in ant communities in relation to temperature and precipitation. Although, the results for this study were not significant, it illustrates major changes in ant communities over the span of almost 13 years for 5 different acre areas of the Brackenridge Field Laboratory (BFL).

A study of the status of oak wilt in Quercus virginiana to determine projected trends in disease transmission at Brackenridge Field Laboratory
Janna Newman – F16

The spread of the fungal disease, *Ceratocystis fagacearum*, within the past century has had a devastating impact on oak communities across the United States. The population of *Quercus virginiana* within Central Texas has experienced noticeably dramatic increases in their mortality rates since the epidemic first began gaining attention in the 1930s. This rapid proliferation of the disease has been attributed to a variety of anthropogenic causal factors including management practices, alteration of oak forest composition, and further pathogen dispersal through means of various biotic vectors – including humans. Due to the potential for oak wilt to spread even further into the southwest via these methods, it is critical to analyze the extent of its existing range today to determine projections of the rate of expansion and direction...
of its spread. The live oak community at Brackenridge Field Lab was surveyed using point-quarter methods along transects to determine the current status of oak wilt on the property. Comparative, quantitative analyses were used in conjunction with information gathered from the most recent analysis of this community (Rankin 2000) to make projections about the present and potential future transmission of oak wilt.

The Recovery of Select Plants After the Elimination of White-tailed Deer at Brackenridge Field Laboratory

Trey Russell – F16

When white tailed deer are present in a community at a reasonable level, as in at a level where the ecosystem can handle the effects of browsing, the deer can be good for the ecosystem. However, high browsing pressure can have devastating effects on plant communities. In this study, I examined the recovery of several plants at Brackenridge Field Lab now that the deer have not been present for almost a year. I selected four o’clock (Mirabilis jalapa), ragweed (Ambrosia artemisiifolia), bird pepper (Capsicum annuum), passionflower (Passiflora lutea), laurel cherry (Prunus caroliniana), and poison ivy (Toxicodendron radicans) – all plants that suffered from over browsing – to observe their recovery. For poison ivy and laurel cherry, I planned to measure how much they have recovered by looking at the number of each plants in a quadrat and comparing an inside the fence quadrat to an outside the fence quadrat. For ragweed, bird pepper, passionflower, and four o’clock plants, a survey will be done marking the presence of each of them with a GPS unit throughout the southern one-third of Brackenridge field lab by navigating the transects and roads. Due to laurel cherry’s slow growth rate, I predict that each of the plants other than laurel cherry will have recovered equally since the deer have left. The paired two-tailed t-test performed on the poison ivy plants inside and outside of the fence was insignificant, which indicates that the poison ivy plants are recovering well. Based on a comparative analysis done with a previous student’s report, the presence of laurel cherry trees inside the fence increased from 0 to 0.24. This shows an increase in their population as well. Looking at past acre reports and comparing them to my survey results, it is clear that each plant (bird pepper, passionflower, common four o’clock, and ragweed) population is also coming back quickly now that the deer have been eliminated.
Mapping the Distribution and an Attempt to Assess Effects on Invertebrate Community by Longhorn Crazy Ant (*Paratrechina longicornis*) at BFL

Alejandro Santillana – F16

In the last year, researchers and students have noticed a significant increase in *P. longicornis* presence at Brackenridge Field Laboratory (BFL). The aim of this study is to discover the extent of *P. longicornis* intrusions into the forest surrounding the buildings at BFL, and to evaluate their impact on the local invertebrate community. I predict that *P. longicornis* distribution at BFL is confined to the immediate surroundings of buildings. I also predict that within its range at BFL, *P. longicornis* has a detrimental effect on invertebrate species richness. Sausage baits were placed and collected after 45 minutes to determine the distribution of *P. longicornis*. To investigate the effect on invertebrate species richness, pitfall traps were placed along the *P. longicornis* distribution border. The traps were then collected; however, the yield was low due to heavy rain that flooded the traps. With the low number of paired pitfall trap sampling success, a comparison was not possible. The data pool was much too small to perform a Shannon index, much less statistical significance. With sufficient data, a Student’s t-Test would be carried out to investigate a difference between the average richness within and outside *P. longicornis* range.

The butterflies of Stengl: a species comparison of two meadow habitats

Bianca Sicish – F16

A diverse community of butterflies is an indicator for high biodiversity of plants, which in turn indicates higher genetic diversity and greater overall health of an ecosystem. In 2016, Stengl “Lost Pines” Biological Station more than doubled in size due to an endowment of land. The new acreage had not yet been studied for species richness, evenness, and diversity of butterfly communities. In this study, I surveyed two meadows within the new acreage using the checklist searching or timed survey method. I conducted several tests for species richness, evenness, diversity, and general comparisons between the two sites. I hypothesized that the site with higher disturbance (site 1) will have less species richness, evenness, and diversity compared to the lower disturbance site (site 2). I also hypothesized that there would be a significant difference in the community structure of the two sites when accounting for the most abundant species. Overall, a slight trend emerged between the two sites. It appeared that the site of high...
disturbance (Site 1) had lower species evenness and species diversity, while the opposite was true of Site 2. This is an interesting find for the preliminary stages of a study, but more sampling effort is needed. The chi-squared analysis showed that there could be a significant difference between the community structures of the two sites, but the p-value also indicates that this assumption could be further proven or disproven by more data collection.

**Ball Moss (Tillandsia recurvata) and Lichens at Brackenridge Field Laboratory – Host and Light Preference**

**August Svendsen – F16**

Epiphytes are plants that grow on other plants instead of in the soil, as is the common way for most plants. The ball moss (*Tillandsia recurvata*), which can be found in many areas of Brackenridge Field Laboratory, falls into this category. Another epiphytic organism is the lichen, which is the result of symbiotic relationships between fungi (the “host” mycobiont) and algae and/or cyanobacteria (the photobiont). Since ball moss and lichens are both epiphytic and photosynthesizing organisms with wind dispersal, it would be interesting to see whether they are found on the same hosts or not. A survey was done in each of the three habitat types at BFL; old quarry, old pasture and river terrace, with 10 trees from each habitat type being surveyed. If a tree had either of the epiphytes, the tree species, canopy cover level ranging from 0-3 (0 as no canopy and 3 as dense canopy), and whether the tree had lichens, ball moss or both was noted. We hypothesized that the ball moss and the lichens would prefer the same hosts because of their preference for rough bark and that the tree species with rough bark would be well represented. These hypotheses were supported by the low number of different species as only four different species were sampled. The three most abundant were Cedar elm and Juniper that have rough bark, and Hackberry, which can also have rough bark as it gets bigger. Our third hypothesis was that the different habitat types would differ when it came to the presence of ball moss and lichens due to different species composition, but this was not supported by our \( \chi^2 \)-test. Our fourth hypothesis, which predicted a difference between canopy cover levels as a result in a preference for more light by both the ball moss and the lichens, was also not supported.
One Too Many Guests: *Neospinharus furcatus* (Araneae: Theridiidae) and Emesinae (Hemiptera: Reduviidae) in the webs of *Tidarren sisyphoides* (Araneae: Theridiidae)

Jennifer Thompson – F16

Members of the spider subfamily Argyrodinae are well known for invading the webs of host spiders and using them as their own. The interactions of the invading species and their hosts can be complex, with invaders varying in foraging techniques across and within species. Throughout November of 2016, data was collected on groups of *N. furcatus* in host webs of *Tidarren sisyphoides* (family Theridiidae) at Brackenridge Field Lab in Austin, Texas. Another prominent member of these communities was the insect subfamily Emesinae (family Reduviidae). In this study, I wanted to determine whether host web surface area correlates with *N. furcatus* colony size, whether *N. furcatus* colonies were associated more often with live hosts or dead/absent hosts, if the presence or absence of *T. sisyphoides* in a host web related to the size of the invading colony, and whether *N. furcatus* colony size or web area related to the presence of Emesinae insects. While numbers of *N. furcatus* in colonies increased in general as web surface area increased, small to medium sized webs showed considerable variability in the number of individuals they contained. Overall, it may be concluded that a larger web area provides greater resources that support larger colonies. The number of sites colonized by *N. furcatus* did not relate to the presence of a host. This is consistent with findings from a controlled experiment where released *N. trigonum* showed they invaded uninvaded webs regardless of the presence of a host. As only 9 *T. sisyphoides* were found in host webs and all but 2 had either egg sacs or spiderlings, further data would need to be collected before and after the species’ breeding season to test this hypothesis. The presence of Emesinae in host webs did relate to *N. furcatus* colony size or the host web surface area. Other topics to be studied include the gender and age structure of *N. furcatus* and whether it is a predator of *T. sisyphoides* or simply causes this host to relocate.


Anneleen Verhoeven – F16

Measuring population size is important for understanding trends and dynamics of populations. Population studies of animals, such as butterflies, are difficult because of their
mobility, therefore special methods are used to create an estimate of the population size. As many butterfly species disperse, it is particularly interesting to observe changes in population size of the same geographic area at different points in time. The Common Mestra (*Mestra amymone*) has been seen in the Austin area in unusually large numbers in the fall of 2016, so I wanted to perform a study to estimate the population size. I estimated the population size of the common Mestra using two methods – MRR and a transect method. The MRR method proved ineffective, so the transect method was primarily used instead. From this data, the population densities were found, and the total population estimate was calculated. It was expected that there would be a significant difference between the count of butterflies in different habitat types because the butterflies have a preference for open and disturbed areas. The statistical tests used to assess if there was difference in butterfly counts between habitats concluded that the difference was indeed significant. Higher counts of butterflies were found in grassland and disturbed areas as expected. We found that the population size estimate was high, but based on observations and the MRR study, could’ve been higher.

**Population Size and Density of the Common Mestra at Brackenridge Field Laboratory**

**Maria Villapando – F16**

Since butterflies are incredibly mobile species, it can be challenging trying to quantify the size of their populations for insight on their ecology and behavior. Various methods to quickly survey butterfly population densities have been generated to monitor endangered species or use these estimates as indicators of ecosystem health and habitat biodiversity. In this paper we compared two survey methods to estimate the population size and density of the common Mestra, *Mestra amymone*, at Brackenridge Field Laboratory (BFL) in Austin, Texas. The goal of this study is to estimate and record the population size and density of the common Mestra at BFL today by using and comparing two different sampling methods, Mark Release Recapture (MMR) and Line Transect Sampling, taking into account the vegetation mosaic at BFL. We hypothesize that *M. amymone*’s population size at BFL will be large and that there will be significantly more Mestras found in open canopy areas than forest canopy areas per hectare. Our results agree with a previous student’s results, finding a strong correlation between open canopy habitats and Mestra presence in 2007, since our chi-squared test showed a significant difference between the density of Mestras per hectare on open versus closed canopy habitats. Future studies could focus
on testing habitat preference in this species since stratified random sampling might be occurring during surveys, with open areas getting sampled the most.

**Comparison of meadow plant communities at Stengl Lost Pines’ recently purchased land**

**Kathryn Elston – F16**

In 2016, 368 acres were donated to the already 208-acre field lab, Stengl “Lost Pines” Biological Station. The new land has a variety of different historical uses, which has created unique vegetative compositions throughout. This study examines three mechanically cleared meadows in the newly acquired land. I expect that the relative abundance of species will differ between the three sites and that the frequencies of each species will be significantly different. 10x10 meter quadrants were used to randomly sample each of the three sites and the species found in each were identified. Results showed that the meadow communities were different with Site 1 being the most diverse and Site 3 being the least diverse. A small sample size may have produced inaccurate results, therefore future comparisons should incorporate a larger sample size.

**2017**

**Analyzing the Effects of Disturbance Type on Light Gap Colonization by Privet and Native Plants**

**Chris Bourbois – S17**

The death of canopy trees is a common way for resources to be freed up. These deaths, as well as the resources they provide, are referred to as light gaps. Light gaps, by providing a sudden influx of resources, can be an effective system in which to study the tradeoff between longevity and rapidity as light capture strategies. Some species, however, seem almost immune to these factors. Chinese privet (*Ligustrum sinense*) has been shown to germinate and grow well under low light conditions, and to rapidly grow to colonize light gaps. This project aims to quantify the observation of privet growth at Brackenridge Field Lab through the use of point quarter surveys and Gap Light Analyzer software. I aim to determine whether privet appears at different abundances or densities at standing light gaps or fallen light gaps than in standard canopy areas, whether native plants are suppressed by privet at light gaps, and if light plays a significant role in privet density. I hypothesized that privet would be more prevalent at standing
light gaps than canopy areas and less prevalent at fallen tree gaps than typical canopy areas, that native plants will be less abundant at standing light gaps than typical canopy areas, due to competition from privet, and that light would be correlated with privet density. Based purely on the results of the statistical analyses presented here, the hypothesis regarding privet density and canopy openness would be found incorrect, while hypotheses regarding increased prevalence of privet at standing gaps and decreased prevalence of natives at standing gaps would be the inverse of what was observed.

**Changes in woody vegetation communities in Ghanzi, Botswana after clearing**

Elizabeth Conlon – S17

Bush encroachment from overgrazing is a major problem faced by farmers in Southern African tree savannas. Six plots at Thakadu Bush Camp in Ghanzi, Botswana, were cleared of all woody vegetation to investigate if removal is a viable option to reduce shrub encroachment. This experiment followed changes in plant communities two years after the removal of woody vegetation. A paired t-test showed that species abundance across all the plots did not change significantly one year ($t = 0.146, df = 23, p = 0.885$) or two years ($t = -9.106e-17, df = 23, p = 1$) after clearing. Simpson’s diversity index, Simpson’s evenness index, and the Shannon index increased across all the plots over two years. Jaccard’s index of similarity decreased, suggesting the vegetation community two years after clearing was less similar to the original community. Rank abundance curves to assess changes in evenness showed ambiguous trends from the evenness and richness of the original community to the post-clearing communities. Continued monitoring of the vegetation communities at Thakadu is necessary to provide a long-term picture of how woody vegetation diversity and abundance changes after clearing and whether manual removal is an option for bush management.

**Diversity of plant-species interaction: Torilis arvensis**

Clara Dawson – S17

Invasive plants can disrupt interactions of native plants and their ecosystem by affecting the behavior of native insects and through competition. At Brackenridge Field Lab (BFL), an introduced plant native to Canada and Europe, *Torilis arvensis*, is found throughout the three habitats (old pasture, quarry, and river terrace) and is visited by many species. In this study, I
wanted to look at the diversity of plant-species interactions of *T. arvensis* throughout BFL as well as compare the diversity of plant-species interactions between *T. arvensis* and *Achillea millefolium*. I hypothesized higher species similarity between the river terrace and old pasture habitats because of the prevalence of sun and a high species diversity between shade and no shade sites. Due to the different species attraction of *T. arvensis* and *A. millefolium*, I hypothesized that the plant-species interactions similarity between *T. arvensis* and *A. millefolium* would be low. Based on ant preference of open areas, I also hypothesized a higher presence of ants in shade vs. no shade sites. Species that interacted with *T. arvensis* at the three habitat sites were collected and identified. To compare *T. arvensis* and *A. millefolium*, I collected data from eight plants of *A. millefolium* and eight plants of *T. arvensis* in close proximity to each other, and again recorded all species that interacted with the plants. Based on my results, the river terrace and quarry had the highest species similarity, contradictory to my hypothesis that stated that the river terrace and pasture would have the most similar species composition due to prevalence of light. The pasture and quarry and pasture and river terrace had comparable Jaccard’s index of similarities at around (0.86). Although I hypothesized that due to *T. arvensis* preference for full sun, shade vs. no shade sites would have high species diversity and therefore a low Jaccard’s index, my results showed an index of (1.411) which shows a high similarity of species. Identification of the species that interacted with both plants could have been implemented to gain further understanding of the possible impact of introduced plants on the community.

**Mosquito Presence and Habitat Preference at BFL**

**Megan Fitch – S17**

Throughout the Brackenridge Field Lab in Austin, Texas, over 60 mosquito baits were hung around 3 different habitat types. The baits consisted of a glass jar full of nutrient-rich water with a wire loop for hanging around tree branches. Half of the baits were covered in aluminum foil to imitate a dark environment while the other half were exposed. After several days, the baits were collected and any organisms inside were recorded. It was found that there was no significant difference in mosquito presence between the habitats. There was also no relationship between the types of baits and the presence of larvae. The pH was measured to determine if it was a confounding variable, which it was not. Future projects and research can be conducted based on these findings.
Locating *Pheidole tetra* at BFL
Jazzmyne Herrington – S17

Officially established in 1967, the Brackenridge Field Laboratory (BFL) is an 82-acre biological research site that contains many different habitat types with diverse vegetation and ecological relationships. Throughout the lab, 12 different *Pheidole* ants have been reportedly found. This includes *Pheidole bicarinata*, *Pheidole dentata*, *Pheidole floridana*, *Pheidole metallescens*, *Pheidole lamia*, *Pheidole pelor*, *Pheidole hyatti*, and *Pheidole tetra*. Their location, habitat preference, and ecological interactions seem to be understudied at BFL. In my individual project, I have set out to map the distribution of *P. tetra* specifically, a subspecies of *Pheidole crassicornis*, at BFL and observe its respective habitat type preference. Because *Pheidole* ants colonize in the soil and under rocks, locating them will be difficult. This allows me to hypothesize that *P. tetra*’s colony’s will be found in areas of sparse ground cover and in quarry or pasture habitats. Hot dog baits were placed at different habitats and collected after 40 minutes. Any present *Pheidole* species were collected to be identified. Ground cover and canopy cover was also recorded (0-3) at each bait site. Only 10 of the baits lured *P. tetra*, and only three colonies were located when looking under rocks. This gave me a sample size of 13, which in itself provides to be fairly insignificant for tests. Although my data showed no significance, it did form a pattern regarding habitat preference type. When graphing the relative abundance of ground cover, sparse cover (0-1) dominated almost over 80% of the data. As this study was based off of *P. tetra* locations from 2015, colonies could have relocated which would have skewed this data.

Poison Ivy Community Dynamics at Brackenridge Field Lab
Andrew Kirsop – S17

The range of *Toxicodendron radicans* (Poison Ivy) in North America is extensive, stretching from Texas to the East Coast. Many are familiar with its rash, caused by urushiol in an on the plant. Brackenridge Field Laboratory (BFL) is an ideal study location for poison ivy given its conditions. BFL has been released of the pressures of deer grazing for about 2 years and the effects are easily observed. Poison Ivy is a favorite food of deer, and without them it seems the population at BFL has grown significantly. I hypothesize is that there will be more poison ivy in areas that were never under deer grazing, but that the poison ivy in BFL will still be measurable.
To examine the poison ivy community at BFL, quadrats were set at 28 locations along the southwest fence line. 14 points were inside the fence, on BFL property where the deer had access, and 14 more points were set outside the fence, where the riparian community had been relatively undisturbed. Plant count, leaf shininess, gall presence, root maturity and plant height for one sample, canopy cover, and whether any eaves had been eaten was recorded. Paired t-tests were performed to analyze the abundance and height data. Based on results, it is clear that there are differences in the groups of poison ivy exposed and unexposed to deer grazing at BFL. While the recovery may be rapid at deer browsing height inside, I would not say that poison ivy has yet fully recovered.

**Host plant preference dynamics in Anaea andria**

Jessika McFarland – S17

All herbivorous insects show some degree of host selectivity, and the dominant strategy among herbivorous insects tends to involve specialization on sets of closely related host plants. The mysteries of host plant selection in butterflies led me to conduct an experiment at Brackenridge Field Lab observing the relationship between *Anaea andria* (Nymphalidae) and its host plant, *Croton fruticulosus* (Euphorbiaceae). I hypothesize that *A. andria* chooses its host plant due to greater sunlight availability and that they prefer smaller host plants for oviposition. A total of 32 host plants were randomly chosen and labeled. Each plant was classified categorically for height (0-3), direct sunlight at midday (0-3), evidence of *A. andria* activity through consumption and colonization (0-3). When analyzing for statistical relationships between measures of *C. fruticulosus* environmental conditions and *A. andria*’s evidence of host plant usage, my chi-square test indicated there was a relationship between leaf consumption and sunlight availability ($p = 0.04$). This result meant I could reject my first null hypothesis, which stated *A. andria* does not choose its host plant based on sunlight availability. However, the test between sunlight availability and colonization was insignificant, which gave me less power to fully support this rejection ($P = 0.53$). All my tests involving plant size as a variable were insignificant, and I thus failed to reject my secondary null hypothesis that *A. andria* did not chose *C. fruticulosus* as a host plant based on size.
Locating the Newly Discovered Parasitic Queen: Recording Ant Colony Locations at BFL
William Mudge – S17

Records of ant colonies and their location must be established, along with the conditions present in order to better understand the newly discovered parasitic ant and its behavior. The parasitic queen ant was found attached to the queen of a *Pheidole tetra* at Brackenridge Field Laboratory (BFL) in Austin, Texas. This parasitism involves the impregnation of the host queen by the parasitic queen, followed by the host colony raising the parasite’s offspring. This newly discovered ant’s behavior has only been seen in other ants twice before: once in Florida and once in Ecuador. This study locates, identifies, and describes the different colonies under rocks in the suspected area in order to establish records and potentially identify a trend that can help us to locate and better understand the parasitic queen. *P. tetra* colonies were looked for under rocks, and a variety of habit details were recorded. The ant log only has 43 colonies recorded after looking under 360 rocks. Each with their specific number and the conditions that were present, followed by the species type. Of the species found, 11 of them were believed to be from the genus *Pheidole*; and of that only 5 were *tetra*’s. By the numbers, the record doesn’t carry much significance, nor does it have any scientifically proven trends as of now. However, with more sampling, the record will grow to be more scientifically accurate in depicting the ant colonies under rocks at BFL and trends will become more evident. Once enough data has been gathered, statistical tests can be run to see what factors are significant in whatever ant species is the focus of the study at hand.

The absence of deer affecting the growth of poison ivy.
Lisa Rivera – S17

Poison ivy is a known food source of deer. When deer were present at Brackenridge Field Lab up until 2015, the poison ivy within the BFL were almost non-existent. In 2016, however, the deer population at the field lab was removed. Since the herbivory of the deer nearly drove the poison ivy to extinction, I wanted to see if there was any significant recovery of the plant within BFL since 2016. I hypothesize that within the two years of the absence of deer, poison ivy has flourished within BFL and the growth is equal to the amount of that in the outside of the fence of BFL that has been unaffected by deer herbivory. I also hypothesize that because this growth will be newer, the BFL poison ivy would have more shiny leaves and less galls than plants outside
the fence at BFL. 14 points inside BFL and 14 points outside the fence at BFL were observed. The number of plants, height, canopy cover, and the leaf’s texture to see if it was mostly shiny or dull was recorded at each point. For the canopy cover, which is a subjective estimate, we categorized 0 as being open and 3 as closed. Based on the paired t-test I performed, I had to reject the null and conclude that there is a difference in growth between inside and outside of the fence. Furthermore, we also recorded extra details to study the growth of poison ivy within the BFL by measuring height, leaf condition and presence of galls. Since the outside of the fence had more time for poison ivy to grow, we have expected the average height for the mature plants to be higher. Since poison ivy can grow up to 4 feet and since inside the BFL has just now recovered for only two years, we expected a shorter average plant height inside the fence. However, our t-test showed otherwise concluding that there was no significant difference in height.

**Prickly pear cactus (Opuntia lindheimeri) at Brackenridge Field Lab: a 2017 follow up**

Scanlon – S17

Prickly pear cactus (Opuntia spp.) is found throughout south Texas and into northern Mexico in arid to semiarid, scrubland ecosystems. For this report, Lindheimer prickly pear cacti (Opuntia lindheimeri) is the specific focus. This study of Opuntia lindheimeri at BFL was replicated based on a previous student’s (Zahn 2004) study in order to determine the status of the current cacti population in open areas in 2017, 13 years later. Between these 13 years, multiple extreme droughts have occurred in Texas, greatly effecting the cacti populations at BFL. It has been determined that drought stress does reduce size and growth rates of Opuntia cacti. I hypothesize that the current population of adult and seedling Lindheimer prickly pear cacti population at BFL have decreased since 2004 but are still found in the same vegetation types defined by Zahn in 2004. Zahn’s 2004 locations were used to determine any changes. At each cactus location, the transect number, GPS coordinates, canopy cover (0-3), shrub cover (0-3), seedling or clump stage, number of alive (green) pads present, height of cactus, length of cactus, width of cactus, distance to nearest adult plant (if the cactus was a seedling), and if Dactylopius coccus was present or not were all recorded. In 2004, most adult cacti were found in areas with little canopy cover and intermediate shrub cover (Zahn 2004, BIO373L), while in 2017, most adult cacti were found in areas with little canopy cover and little shrub cover. Therefore, the
majority of adult cacti in these surveyed areas have stayed alive and have not died. This contradicts my hypothesis that the adult populations would decrease but supports the fact that they are found in the same areas still.

Survey of and Effects of Canopy and Shrub Cover on Chile Pequin Plants at Brackenridge Field Laboratory

Ashton – F17

The chile pequin, a cultivar of *Capsicum annuum* in the Solanaceae family, is an herbaceous perennial plant native to Central America. The chile pequin can be found at Brackenridge Field Lab where a population of white-tailed deer inhibited the growth of the plant on the property since 1990. Since the animal’s extirpation in 2016, however, the chile pequin has been able to flourish again. The purpose of this survey experiment is to determine the locations of chile pequin plants at BFL, examine the relationship between canopy and shrub cover on presence of chile pequin, and serve as a benchmark for future experiments. I hypothesized that chile pequin plants will be more prevalent in areas with moderate to high canopy cover. It is also hypothesized that chile pequin will be more present at low levels of surrounding shrub density due to competition interactions for resources. Chile pequin plants were searched for with an 8m swath along each of BFL’s ten transects. Canopy cover, shrub cover, and ground cover were recorded on a scale of 0-3 where 0 is little to no cover and 3 is dense cover. The canopy cover confidence interval does not include ‘moderate’ canopy cover (score of 2 or greater), so the initial hypothesis that chile pequin preferred shady areas must be rejected. Surprisingly, the entire confidence interval is within the ‘light’ canopy cover (0-2), which would reject the null hypothesis and support an alternative hypothesis saying that chile pequin prefer more open to shaded areas. Similarly, the shrub cover confidence interval does not include ‘dense’ shrub cover (score of 2 or greater), which supports the initial hypothesis and can be used to reject the null. One may conclude that chile pequin are more likely to be found in areas with few to no surrounding shrubs.
Analyzing the Distribution of *Solanum pseudocapsicum* at Brackenridge Field Laboratory and Determining the Habitat Characteristics Associated With its’ Invasion
Claudia Boisvert – F17

*Solanum pseudocapsicum* is an invasive species that was first found at Brackenridge Field Laboratory in 2001. Since its initial appearance in the quarry habitat, the species’ distribution has expanded across the quarry and into the edges of the pasture and river terrace habitats. The goal of this study is to assess changes in the species’ distribution compared to previous surveys, as well as to determine factors that influence this species’ patterns of invasion at BFL. Survey of transects revealed that the distribution has expanded in some habitats and declined in others, and chi-squared tests showed that the areas where *S. pseudocapsicum* was found were significantly related to levels of canopy and shrub cover, as well as to the type of canopy tree species nearest to the *S. pseudocapsicum* shrub.

Study of Three Nonnative Trees (*Triadica sebifera*, *Hovenia dulcis* and *Maclura pomifera*) at Brackenridge Field Laboratory: Natural History, Seed-Dispersal, and Abundance
Oren Bullock – F17

An invasive species is described as any type of living organism that is not native to an ecosystem and causes ecological harm. These relatively foreign fauna and flora can have an immense impact on the ecosystems they enter, altering the preexisting biodiversity and organismal niches. Three nonnative tree species (*Triadica sebifera*, *Hovenia dulcis* and *Maclura pomifera*) were studied at Brackenridge Field Lab to determine their natural history, seed-dispersal, and abundance. I predicted that ‘large’ mammals present at BFL, most notably coyotes and raccoons, are the seed-dispersal agents for *M. pomifera* in this environment. Like *M. pomifera*, I predict the seed-dispersal agents of *H. dulcis* to be coyotes and raccoons as well. Seedlings, saplings, and adult trees for each species were found and recorded. To determine the method of seed-dispersal, game cameras were set up near fruiting trees to capture any animals that may take the fruit. No observations were made indicating seed-dispersal vectors, thus, the hypothesis concerning *M. pomifera* was incorrect. Although many *H. dulcis* were documented within BFL, the cursory survey did not reveal any insights that could lead to conclusions about the trees’ preferred habitat within BFL. Similar to the *M. pomifera* observations, no direct seed-dispersal agent was identified on camera for *H. dulcis*. My observations and the corresponding
data for *T. sebifera* led me to the conclusion that they are extremely water-dependent, requiring a water source within a few meters. Overall, the combination of stable water sources, low disturbance rates formed by the fences and a central location seems to have made these plots extremely practical habitats for the invasive species to proliferate within BFL.

**Reassessing the distribution of Solenopsis Invicta and S. Geminata**

Caleb Fleischer – F17

Studying competition between organisms competing for the same resources is vital for creating models describing evolutionary and ecological change. It is a rare opportunity to document the direct competition between species, as most research on invaders is spent on controlling the invader rather than understanding why they succeed over the native rival. In 2002, Benjamin Labay surveyed Tarrytown to map out the distribution of *S. invicata* and *S. geminata* and found that the native fire ant, *S. geminata* was more prevalent throughout the neighborhood, which contrasted with the adjacent ant community at BFL. Since then, however, the area has undergone significant construction and development. These recent disturbances may have allowed *S. invicta* to gain grounds in Tarrytown previously held by *S. geminata*. I hypothesized that *S. invicta* will have encroached significantly more upon areas that last held *S. geminata*. Food baits were placed around routes in Tarrytown and left for 30 minutes. The baits were then collected, and the ant species were identified. The findings of this survey support the hypothesis that *S. invicta* will increase its territory within previously *S. geminata* dominated areas of Tarrytown. No *S. geminata* were found at any bait sites, and *S. invicta* was found in neighborhoods previously dominated by *S. geminata*. The dominance *S. geminata* showed over Tarrytown may have foreshadowed a slower invasion of *S. invicta* within Tarrytown, due to the constraint’s competition puts on colonization. The success of *S. invicta* over *S. geminata* within BFL. is still not completely understood, but factors such as pesticides and transported materials could have been utilized by *S. invicta* as an advantage over *S. geminata*. 
The Effects of Disturbance, Herbivory, and Habitat types on Plant Diversity and Productivity at Stengl Lost Pines
Sydney Gawlik – F17

Although plant diversity and productivity has been widely acknowledged and studied, little can be agreed upon to support a general theory on the relationship. I present the potential effects of disturbance, herbivory, and habitat types on this relationship by studying 3 sites with 3 separate land treatments including controls for herbivory to assess impacts on productivity and plant diversity. Quantifying plant diversity using species richness and calculating the Jaccard’s index of similarity and quantifying productivity by collecting above-ground biomass within specified quadrats, 18 samples were collected in total. The results show that habitat type significantly affects productivity at the ground layer and is a better indicator of plant diversity than environmental factors such as herbivory and disturbance. My study could not conclude a relationship between productivity and plant diversity, nor could it conclude that disturbance and herbivory significantly affect either productivity or plant diversity.

Assessment of Woodland Structure & Succession: Analyzing the Distribution of Fallen Trees Across BFL
Kate Korchek – F17

At the Brackenridge Field Laboratory (BFL), there is a vast number of treefalls spread throughout the facility with a wide variety of internal and external factors that could influence this number. In terms of internal (endogenous) factors, drought, insect attack, or disease may weaken the tree from the inside and cause a treefall, but this occurs often on a small-scale of one or a few individuals. External (exogenous) factors involve forces such as wind, lightening, and fires that can also cause treefalls, though at a grand scale of more than a few individuals. Assessing the type treefall in BFL can help to determine and narrow down what ecological processes are behind the abundance of fallen trees. Determining whether the tree was snapped/splintered or uprooted can ultimately give us a better understanding of the ecological and environmental impact on tree succession. In this study, I assessed the relative abundance of live to fallen trees in regard to the varying habitats at BFL in order to determine whether or not there is a relationship between the relative abundance of treefalls and habitat type. I hypothesized that there will be a significant difference in the relative abundance of tree falls with the quarry
habitat having the greatest ratio of fallen to living trees. Point-Quarter Analysis was used to acquire data such as Nearest Fallen Tree (m), Fall type (whether splintered or uprooted), Nearest Living Tree to Fallen Tree (m), and Habitat type. I have concluded that there is a significant difference in these abundances between each habitat and the following results support the cited literature. Across the habitats, the quarry habitat had the greatest relative abundance of fallen trees out of the total number of trees accounted for in this habitat, followed by the pasture habitat, and then the river terrace habitat. These results will contribute to the overall research of treefall and succession in the Brackenridge Field Laboratory and may help to discover more about the ecological factors influencing this facility’s tree and soil composition.

Tree-fall Communities and Vegetation Dynamics within Brackenridge Field Laboratory
Megan Tamez – F17

Bryophytes are an umbrella term for non-vascular land plants such as mosses and liverworts. They are known to prefer darker moist environments, seek as well as provide nutrients in soils, and have a relationship with tree decay and succession. In this experiment there will be a focus on tree fall dynamics in relation to moss presence. Using point-quarter analysis, it will be determined if there is a correlation between the vegetation community residing on fallen trees and the surrounding environment at Brackenridge Field Lab. The results from this experiment were that the moss within BFL tends to appear in areas in the old quarry and on decaying Juniper trees. It also showed that there was not a preference in terms of canopy or ground cover when it came to the presence of moss. The data points collected were along the transect line of BFL, which is a highly disturbed portion of the property. If this experiment were to be replicated or continued, it would be beneficial to collect data in the less disturbed areas of BFL.

The Effects of Ground Cover on Population Establishment in Solenopsis invicta
Whelan – F17

The effect of S. invicta on ecosystems as an invasive species has been profound. They have dramatically reduced the species richness of native ant populations and exerted an even stronger effect on the reduction of population sizes of native ant communities. Native fire ant species such as (Solenopsis geminata) have been pushed out of their territories. Tarrytown was
once sampled in November of 2017 to determine the relationship between ground cover and the presence of *S. invicta*. Given the trend of *S. invicta* to prefer areas with less vegetation, I predict it will be more prevalent in areas with lower ground cover specifically. 81 food baits were placed in Tarrytown and then collected after a minimum of 25 minutes. Ant species were then collected and identified. The ground cover and canopy cover were both assessed subjectively as well on a scale of 0-3, with 0 being the lowest canopy or ground cover and 3 being the highest. Consideration of the collected data suggested that, while a consistently higher proportion of sites in sparse ground cover conditions than in dense saw higher presence of *S. invicta*, the difference between the two categories was not statistically significant. This lack of significance rejected my hypothesis that a difference existed between *S. invicta* presence between dense and sparse ground cover areas, as sparse areas would exhibit more red imported fire ant colonies.

**Habitat Preference of *Paratrechina longicornis* and Distribution from Disturbance Sites**

Marissa Zamora – F17

*Paratrechina longicornis*, the longhorn crazy ant, is considered a tramp ant. Tramp ants are species that are commonly spread by human commerce and associate with human disturbance. The goals of this study are to determine habitat preference of *P. longicornis* by placing baits indoors and outdoors, and to map the distribution of *P. longicornis* to determine their range from human disturbance sites, which, in this study, are buildings at the University of Texas at Austin. I hypothesized that the presence of *P. longicornis* individuals will be greater on indoor baits than outdoor baits. I also hypothesized that the distribution of *P. longicornis* outside will be close to disturbance sites. Food baits were placed inside and outside of buildings and collected after 30 minutes. The presence or absence of *P. longicornis* was then recorded. The abundance of *P. longicornis* indoors was consistent with literature that showed *P. longicornis* is associated with areas of human disturbance such as inside buildings, houses, and greenhouses. Presence data on outdoor baits were lacking so intuitive conclusions were drawn from the distances in Table 1. Although my findings were limited, they were similar to a prior independent study that showed that with increasing distance from a disturbance site, or asphalt road, in his study, *P. longicornis* presence decreased.
Effects of Landscape Disturbance and Recent Construction on *Solenopsis invicta* Colonization in Tarrytown Neighborhood

Ivana Valdez – F17

Since the invasion of the invasive red fire ant, *Solenopsis invicta*, native ant biodiversity has decreased in Texas. Studies have shown that *S. invicta* can outcompete native ants in areas that have recently been disturbed. In this study, I examine Tarrytown, a neighborhood in Austin that has had recent construction done, to see if the invasive ants have taken hold of land that was once dominated by native ants. I hypothesized that high disturbance areas and areas with recent construction would have a significant correlation with *S. invicta* presence. A total of 100 Hotdog baits were placed throughout the neighborhood to get a large sample size of the ant species present. At each bait site, the disturbance level and whether there was construction or not was recorded. Results showed that the most abundant species found was *Pheidole dentata* followed by *S. invicta* and then *Monomorium Monomorium*. Contrary to what I predicted, chi-square testing showed no significant results between *S. invicta* presence and disturbance level or whether there was recent construction or not. Overall, this study did show that there was a change in species composition from 2003. Previously, Solenopsis geminata dominated the area, but was not found in this survey. Continued monitoring of Tarrytown could provide evidence that would suggest *P. dentata* could be a viable competitor to *S. invicta*.

Temperature, Elevation, Location, and Time of Day Affecting Butterfly Activity for Different Species

Taylor Loera – F17

Past studies have shown that Heliconius butterfly mimics will fly in similar habitats to the Heliconius butterfly while non-mimics will not and that palatable butterflies are active in the late morning while unpalatable butterflies are active more evenly across time. With this information, I compared the habits of five butterfly species located in a greenhouse at Brackenridge Field Laboratory. I hypothesized that there will be a difference in temperatures when comparing the time and day as well as when comparing the east and west sides of the greenhouse. I also predict that there will be differences in butterfly activity for each species in relation to elevation levels. The five species tested were *Heliconius atthis*, *Heliconius melopmene* and *Heliconius cydno* hybrids, *Heliconius charithonia*, *Heliconius ismenius*, and *Mycelia ethusa*. A total of 52 samples
were taken with activity, temperature, elevation levels, species, location, and time of day recorded for each. Overall, results showed that there was no significant difference between elevation levels or location in terms of east and west between the five species. There was a significant difference found between butterfly activity in relation to the time of day for the hybrid Heliconius, however, all other species had no significant difference.

**Habitat Preference and Presence of Pheidole tetra and Pheidole dentata at Brackenridge Field Laboratory (Hymenoptera: Formicidae)**

Jennifer Schlauch – F17

In the spring of 2017, Dr. Alex wild found an undescribed species of inquiline *Solenopsis* on the petiole of a *Pheidole tetra* queen at Brackenridge Field Laboratory. This has been the only specimen discovered as of yet. This study aims to identify the habitat preferences of *Pheidole tetra* and *Pheidole dentata* at BFL in order to potentially find more information on the undescribed *Solenopsis* species. An initial survey was done by looking under rocks for Pheidole colony presence. Baits were also placed along a transect in the quarry to determine where the ants are foraging. A total of 18 colonies of Pheidole ants were found after surveying was complete. *P. dentata* was found much more widespread in the sample range while *P. tetra* existed in a more constricted range. Continued monitoring of Pheidole ants may lead to new findings about the undescribed Solenopsis found earlier this year.

**Successional trends after Ligustrum removal**

Brady Lee – F17

Invasive species such as the Chinese privet (*Ligustrum sinense*) can have devastating impacts on native vegetation as they have no natural predators and can therefore grow with no threat. At Brackenridge Field Laboratory, certain sites were selected for privet removal in 2016. Since then, these sites have exhibited successional trends. I aim to survey these sites and determine if there is a difference in succession between cleared sites as well as uncleared sites that still have privet present. Two sites that were cleared and two sites adjacent to the cleared sites were chosen for my study. For each site, the distance of each cluster of privet and the species of the nearest canopy tree was recorded. Plant surveys were also conducted for each site. Based on results, the two cleared sites had significant differences in their new plant
compositions, and both had higher levels of species diversity. The canopy composition between the two sites varied, which I believe was the main cause for the differences seen between new growth. The uncleared sites were also different from each other indicating that the Ligustrum can invade a variety of habitats and that the vegetative compositions between sites differed before the arrival of the invasive plant. With continued removal, native vegetative communities can be restored, increasing the overall diversity of BFL.

2018

Land Mollusca Abundance Across Three Habitat Types of Brackenridge Field Laboratory
Alejandra Aburto – S18

Suitable environments for terrestrial snails have been identified as having a stable moisture supply, lack of major disturbances, and shelter from winds. A variety of habitats can be found at Brackenridge Field Lab in Austin, TX where snail species have been studied in the past. I focused on the species, *M. roemerii*, and what type of habitat they are found in and if there is a difference between recorded found habitats. Differences in the areas include canopy cover, leaf litter cover, disturbance level, and presence of mosquitos. I expect for snails to be most abundant in areas of closed canopy cover, high leaf litter, low disturbance and high mosquito presence. Snails were counted using a hand counter at 20 points in 2x2 foot squares on the ground. I counted the number of *M. roemerii* snails, *B. dealbatus* snails and others, but only *M. roemerii* numbers were used for the results. Canopy cover, leaf litter cover, and disturbance level in the area were rated from 0-3 (0 being lowest and 3 the highest). The mean, max, and min temperature and humidity for each site was recorded using HOBO data loggers. As hypothesized, snail abundance was significantly higher ($X^2=276.33$, $df=2$, p-value= 2.20E-61) in warm, moist habitats with high canopy cover. Disturbance level and leaf litter cover however, were insignificant to snail presence ($X^2=2.40$, $df=1$, p-value=0.12, $X^2=2.44$, $df=1$, p-value=0.18). It can be concluded that only the characteristics of the habitat that relate to humidity determine land snail abundance. Further studies concerning the soil types of these habitats would be beneficial to determine abundance patterns.
Differences in Insect Composition at Brackenridge Field Laboratory and a Nearby Neighborhood

Kiana Afkami – S18

Proximity to water and human disturbance are important factors that can influence insect composition at a given site. Caddisfly, moth, and mosquito population were compared across three different habitat types at Brackenridge Field Lab and a nearby neighborhood to better understand which habitat type is preferred. I hypothesized that insect composition would have the most variation near a body of water, and that the proportions of caddisflies would be greatest near bodies of water while moths and mosquitoes would more likely be present at areas with greater human disturbance. Hanging traps were set up in three different habitats at BFL and one at Dr. Larry Gilbert’s backyard in a neighborhood close to BFL to collect insects. I created rank abundance plots of the insect types found at each site, compared the proportions of caddisflies, mosquitoes, and moths at each of the sites, and performed an analysis similar to the Shannon Diversity Index. The Shannon value for the BFL river terrace site was 0.963, the Shannon value for the site in Larry’s backyard was 1.045, and the Shannon value for the BFL pasture site was 1.426. The third area at BFL (quarry site) did not collect any insects. These values lead to the interpretation that the pasture site at BFL had the highest diversity of insects. I also determined that the highest proportion of caddisflies was at the BFL river terrace site, the highest proportion of mosquitoes was at the BFL pasture site, and the highest proportion of moths was in Dr. Gilbert’s backyard.

Exclusion of Predators from an Aphid-Plant System

Alaimo – S18

When insecticides are used to control aphid predation on crops, aphid predators are also harmed. When aphid predators are no longer present, or present in lower numbers, aphid populations are much larger and do more harm to crops. In this study, I compared the abundance of aphids over time on plants protected from predators to plants left unprotected from predators. I predicted that the abundance of aphids at the experimental sites where predators are excluded will, over time, become higher overall than the abundance of aphids at the control sites due to protection of aphids from predation. 21 Sonchus oleraceus plants with initial counts of greater than ten aphids present at Brackenridge Field Lab were chosen for the study. The experimental
plant sections were contained in a fine mesh netting to exclude aphid predators from the plant but allow aphids to pass freely. Initial aphid presence was recorded and then abundance counts were made every other day for approximately a week. Results showed that both site types declined in aphid abundance, but control sites declined more rapidly and had a lower mean aphid abundance than the experimental sites. These declines in abundance are most likely because the *S. oleraceus* plants began to die and by the last day of the experiment many individuals were dead and had observed aphid abundances of zero. The more rapid decline, however, could be due to continued exposure to predation because the experimental sites, which were protected from predation, declined less rapidly.

**Evaluating Factors Contributing to Likelihood of Oak Wilt Tree Mortality in the BFL Quarry Habitat**

Louisa Angly – S18

The oak wilt pathogen (*Ceratocystis fagacearum*) produces phytotoxins that clog a tree’s xylem system, which, over time, causes the tree to become dehydrated and die. This pathogen has had devastating effects on the Brackenridge Field Lab live oak population. This study analyzes factors that may contribute to the likelihood of individual oak mortality. Characteristics such as diameter at breast height, the presence of wounding, proximity to the nearest live oak tree, proximity to disturbance, and ground cover vegetation density were recorded and analyzed in order to determine the relationship between these characteristics and oak mortality. Based on the results, it appears that a relatively isolated, small-diameter, wound-free tree with high ground cover vegetation density would have the best chance of surviving an oak wilt outbreak. This data could be useful for implementing management practices in order to avoid the spread of the pathogen and subsequent oak death.

**Differences in Soil and Habitat Type on Ant Diversity**

Blake Bringhurst – S18

When biodiversity is reduced, ecological efficiency is reduced as there are less species to fill niches within a system. Ants are an effective environmental indicator due to their large population sizes and sensitivity to ecological and human induced factors. Soils with high water retention and habitats with higher amounts of canopy cover are typically found to have higher
ant diversity. In this study, ant communities in areas with different soil types and different habitat types will be observed to see their impacts on biodiversity. I hypothesized that the Jaccard’s index of community similarity would be low for habitat types that differ greatly in the amount of shade they provide and that the Jaccard’s index would be highest between the soil types with either mostly clay or sand. I also hypothesized that the greatest species richness would occur in habitats with the greatest amount of shade and either clay or sandy soil. Three habitat types (mesquite savanna, pine-juniper and post oak-juniper) at Stengl “Lost Pines” Biological Station with 28 research points each were designated as data collection areas. Ants were collected using a protein-based bait, then counted and identified. Overall, the soil types had roughly similar Jaccard’s index values with the highest value between the loam and sandy-loam comparison and the lowest was between the loam and clay-loam comparison. This result goes against my hypothesis, since the highest index was not between sandy and clay soils. The Jaccard’s index value for habitat types yielded mixed results as well with the highest value between the post oak-juniper and pine-juniper comparison and the lowest between the mesquite savanna and pine-juniper habitat. The species richness analysis partially aligned with my hypothesis in that the sandy-loam soil species accumulation curve had not reached an asymptote which means there are more species present than were found. Studying factors that influence biodiversity is important in finding ways to maintain it and monitoring the ant community gives a small insight to such factors.

**Effects of Different Leaf Litter Types on Arthropod Community**

**Katherine Bui – S18**

The diversity of vegetation has often been associated with increased diversity of herbivores. Not much research has been done on the effects of tree diversity on arthropods that dwell in the decomposing organic matter, however. In this study, I examined how the diversity of vegetation, specifically trees, affect leaf-litter dwelling arthropods at Brackenridge Field Lab. Oak, juniper, and mixed leaf litter types were observed. Six samples were collected for each litter type on five different days. Samples were collected within a 1-meter radius of the tree, being careful not to select near a footpath as to minimize disturbance. The arthropods were collected from the litter samples using a Berlese funnel, then analyzed and identified. The Jaccard’s index value of similarity for the mixed v. oak litter was 1.57 and the index value for the mixed v.
juniper litter was also 1.57. This indicates that well more than half of the species were common between the two litter types. The final index value between oak and juniper was 2.00, which means showed the same species composition between the two sites. Overall, Jaccard’s index showed that there was not much of a difference between the litter types, but rather that there was great similarity in species. I found that tree diversity (which creates leaf-litter diversity) does not have a positive effect on the arthropod diversity which inhabits it.

**Spittlebug Plant Preference at Brackenridge Field Laboratory**

**TJ Bullock – S18**

Spittlebugs are considered to be one of the most damaging pests because of their wide range distribution and ability to cause outbreaks. These insects primarily feed on the xylem of plants which can cause the plants to suffer from phytotoxemia. This leads to a decrease in photosynthetic activity as well as production and quality of grasses and other foraging plants. It is important to know what plants are affected to evaluate spittlebug impact on crops and animal production for animals raised on pastures. I hypothesized that spittlebugs are preferentially associated with nitrogen-fixing plants due to the rich and reliable source of nitrogen compounds. Plants were selected randomly from firefly meadows and another cleared meadow at Brackenridge Field Lab. I walked in straight, parallel lines – each about 2-3 meters apart – and recorded the type of plant and if spittlebugs were present or not. The plants were then researched to determine if they were nitrogen-fixing or not. A chi-square test showed that there is a preference towards nitrogen-fixing plants ($p = 0.0059$). This preference could lead to additional studies in how spittlebugs affect plant growth or photosynthetic activity. This data could also be used to help quantify damage to agricultural crops such as legumes, or to help assess the quality of plants that are used for grazing.

**Loblolly Pine Sapling Growth by Canopy Openness and Ground Cover**

**Julianne Dewar – S18**

Resources such as light, water, and nutrients are fundamentally limiting factors for both woody and herbaceous species. I hypothesized that competition for these resources would cause an association between sapling abundance and ground cover, sapling abundance and the dominant pine sapling size class in an area, and canopy cover in size classes. 47 four by four meter transects were laid out in the northern part of the Stengl “Lost Pines” Biological Station.
For each transect, the number of saplings was counted, the dominant sapling height was categorized as 1-3, the canopy and ground cover were rated as 0-3, and fish-eye photos facing west were taken for gap-light analysis. Based on results from ANOVA tests, there was no relationship found between canopy cover and the gap-light analysis, so only canopy cover was used. It was determined that the relationship between sapling abundance and ground cover, sapling abundance and the dominant pine sapling size class in an area, and canopy cover in size classes were all not significant. Most of the canopies measured were in between 20% and 55% open, meaning the majority of points would have been ranked a 2. These results could have been caused by inadequate canopy sampling. In the field, we saw that dewberry patches seemed to exclude pine saplings from growing. As a future study, it would be interesting to see if the dewberry provided too much shade for pine sapling growth or if it changed the soil composition in some way.

Examining relationships between morphological features and invertebrate diversity within a slow-flowing stream at Brackenridge Field Lab

Thomas Johnston – S18

One of the most well supported drivers of macroinvertebrate diversity throughout aquatic ecosystems is hydrology. Stream flow regimes strongly influence aquatic ecosystems, affecting evolutionary processes, species composition, predator-prey relationships, and reproductive cycles. This study aims to assess aquatic macroinvertebrate diversity throughout Brackenridge Field Lab’s perennial stream portions. Four sites along the stream were chosen where velocity, stream width, stream depth, substrate composition, and canyon height were measured. Invertebrate communities were collected and identified at each site. Within the stream at BFL, invertebrate communities significantly diversified with shallower stream depths. Sites 3 and 4 had average depths of 15.4 cm and 16.7 cm and had greater invertebrate diversity when compared to sites 1 and 2, which had average depths of over 40 cm. Average stream depth was determined to be the sole significant factor that contributed to invertebrate abundance and richness.
Effects of a Broken Well System on Ground-Dwelling Arthropod Diversity at BFL

Bridget Harter – S18

Arthropods serve as ecological indicators as their populations fluctuate with ecosystem changes. Species richness is also known to be highest in low complexity habitats. At Brackenridge Field Lab, a number of artificial ponds were established and maintained. The system, however, recently broke which has left the ponds relatively dry. This disturbance created a new habitat for ground dwelling-arthropods to inhabit. In this study, I researched how arthropod diversity differed between the dry ponds and the adjacent forest cover and how habitat complexity influenced arthropod diversity. I hypothesized that because the dry pond systems are less complex than the adjacent forest cover, arthropod diversity would be greatest there. Pitfall traps were placed at each of the dry ponds and left for 48 hours. The traps were then collected and identified. At each trap, canopy cover, ground cover, and ground moisture were all recorded on scales from 0-3. Arthropod diversity was found to be similar to that of adjacent forested cover, indicating that habitat heterogeneity in the enclosed acres has minimal influence on a ground-dwelling arthropod distribution. This is evidenced by the similar Shannon diversity indices; the dry ponds had a diversity value of 1.41 while the forested area had a diversity value of 1.58. This result contradicts the initial hypothesis that ground dwelling arthropod diversity was greater in dry pond habitat.

The colonization of intermittently dry ponds by the invasive Triadica sebifera at Brackenridge Field Laboratory

Avery Lewis – S18

Invasive species can cause ecological changes in a habitat that have widespread effects. Triadica sebifera, the Chinese tallow tree, is one such invasive species that was introduced to Texas in the early 1900s. The spread of this invasive species has been shown to change the community types present and shift prairie lands away from graminoid and forb dominance to a community dominated by trees and shrubs. For this study, tallow trees and other native woody species were studied within the Brackenridge Field Laboratory in Austin, Texas. BFL contains eight artificially created ponds that have been begun to intermittently dry out and be colonized by tallow trees. A goal of this study is to analyze the differences in the BFL ponds in terms of moisture content, and the effects this has on the ability of tallow to colonize. I hypothesize that
the tallow trees will be able to successfully colonize the intermittently wet ponds, but not the ponds that consistently retain standing water, and that ponds with parent trees present will be able to colonize the pond easier. The eight ponds within the enclosed remnant pastures were surveyed using a square meter placed at the approximate center of the pond. Observational data such as the condition of the pond (dry or wet), evidence of parent tallow trees present, and the total number of woody species were recorded. When the tallow trees were isolated for analysis, there was a significant difference in the ratio of tallow trees between both wet and dry ponds, and those with and without parent trees. In summary, the successful colonization of Chinese tallow in the BFL ponds is significantly related to the water conditions and the presence of a parent tree. This data can be used to determine optimal growing conditions for tallows as well as be used to help manage their populations.

The Impact of Burn Regimes on Arthropod Biodiversity at the Lady Bird Johnson Wildflower Center
Grace Long – S18

The impacts that a fire regime can have on “invisible” biota—arthropods—has remained largely ignored and unstudied. Based on a previous study, fires could potentially result in unchanged richness, enhanced richness, or reduced richness through the interactions resulting from eliminating organisms and resources. The purpose of this study is to assess the impact of a fire regime on the Lady Bird Johnson Wildflower Center (LBJWFC)—a small-tree savanna. The fire would immediately decrease the resources and the number of arthropods in the area, and specialists would have to have a high potential for dispersal in order to fill new niches. I believe that generalists with a high potential for dispersal are more likely to repopulate an area than specialists with a high potential for dispersal, and I further believe that it would take a significant amount of time to recover from the immediate decrease in arthropod numbers. Thus, I hypothesize that every measure of biodiversity analyzed in this report (Shannon Diversity Index, richness, and evenness) would show a lower biodiversity in burned plots than in control plots at the LBJWFC. A sweep net was used at six control plots and seven burned plots. 100 continuous sweeps were performed at each plot and the arthropod samples were separated and grouped. The mean Shannon Diversity Indices of the burned plots and the control plots were both about 3.2. The mean richness of the burned plots was about 40.6 while the mean richness of the control
plots was about 46.8. The mean evenness of the burned plots was 0.9 while the mean evenness of the control plots was about 0.8. None of these results were significant, leading me to reject my hypothesis. A follow up study could be conducted at the burn sites right before the next burn to determine if biodiversity differs.

**Quantifying the host plant preferences of *Anaea andria* at Brackenridge Field Laboratory**

Apoorva Magadi – S18

Host plant preference has been shown to play a role in increasing the fitness of offspring in butterflies. The goatweed leafwing, *Anaea andria*, oviposits on one of its host plants, *Croton fruticulosus*, at Brackenridge Field Laboratory. I wanted to investigate, in a quantitative way, how factors such as light, habitat type (edge or wooded), distance to disturbance, plant height, and plant diameter might affect larval presence on plants and thereby host plant preference in *A. andria*. I hypothesize that *C. fruticulosus* that are taller, grow on the edge, and that are in areas with low canopy values will have greater total larval presence. Larval presence was carefully recorded by counting the number of partially eaten leaves, the number of rolled leaf tents, the number of frass chains, and the number of actual larvae. To quantify the total larval presence on each plant, the following formula was used: Tents + eaten leaves + frass chains + larvae present = total larval presence. The height of the plants surveyed was taken, canopy cover was assessed (0-3), and the distance of each plant from the trail edge was recorded. There was no significant correlation found between canopy cover or plant height and the total *A. andria* larval presence. There was a significant difference found in total larval presence between plants in edge and wooded habitats, however. As the adult butterflies are known to fly high in the canopy, host plants on the edge of wooded areas may be more likely to be seen. A replicate of the study with a larger plant sampling size may provide more accurate results.

**Characteristic of rocks, the surface area (cm^2) underneath each, and the impact on nesting arthropods**

Wong – S18

Rocks act as shelter and microhabitats for smaller organisms such as arthropods. Arthropods are also known to utilize them as part of their nesting sites. In this study, I address the hypothesis that the surface area under specific rock characteristics (flat or non-flat)
contributes to the number of species that nest under these rocks. 160 rocks were lifted, observed, and tagged at Brackenridge Field Lab. Canopy cover (noted as open (0) or closed (1)), ground cover (present (1) or not (0)), and the level of disturbance (present (1) or not (0)) were also factors recorded for each rock. The results from this experiment demonstrated that while the most common species found under the 160 rocks were ants, there was no significant difference and a failure to reject the majority of null hypothesis of the tests. However, there was a significant difference for the rocks that had a surface area of below 100cm^2 and species being present compared to rocks that had a surface area greater than 100cm^2. This may be due to smaller rocks being easier to defend for single species as compared to larger rocks. This data could be useful when investigating how the edge effect of smaller rocks impacts species nesting or colonizing a rock.

**Pine sapling growth through ground cover level and slope gradient**

**Farnaz Seddighzadeh – S18**

There are many factors that can affect pine sapling reproduction and growth within a pine-oak ecosystem. These include canopy, shrub, and ground cover as well as water availability. In this study, we will determine if (A) pine sapling abundance correlates with slope, (B) pine sapling size class associates with slope, and/or (C) pine sapling abundance associates with ground cover. We used point-quarter transects of 4 meters by 4 meters at Stengl Lost Pines Biological Station. At each point we counted the number of pine saplings present, rated the level of ground and canopy cover from 0 to 3 (0 being the lowest and 3 being the highest amount of cover), took hemispherical photos of the overhead canopy, and measured slope using an inclinometer and meterstick. The correlation and regression analysis of pine sapling abundance and slope revealed a strong and significant positive correlation between the two variables (p < 0.05). This showed that the higher the slope, the higher the pine sapling abundance in that area, confirming that soil wetness does have an effect on pine sapling reproduction. The analysis of the pine sapling size class and slope at each site revealed no significant relationship (p > 0.05), suggesting that soil saturation may affect pine germination (measured by abundance) more than pine sapling growth (measured by size class). Analysis of the relationship between pine sapling abundance and ground cover level also revealed no significant result (p > 0.05). Overall, this data
suggests that slope has more effect on pine sapling germination rather than growth, or that other factors left out of this study were at play within the ecosystem.

**Determining the Influence of Urbanization on BFL’s Stream Using Biological Indicators**

**Gabrielle Stedman – S18**

Diatoms are excellent indicators of the ecological condition of aquatic habitats. Diatom populations can be studied to determine how pollutants from urbanization have impacted an ecosystem. Waller Creek (WC) is a shallow, urban creek that runs along the North University area at the University of Texas and downtown Austin. All but 3% of the land along WC is developed making it a highly urbanized water body that is greatly impacted by sewage, fertilizer run-off, and wastewater. A comparative stream is located at Brackenridge Field Lab. As a field lab, however, it has been well preserved to represent Austin’s natural ecosystem. Both WC and BFL are similar in physical stream qualities including proneness to flooding, limestone beds and walls, high shade, stream depth, low stream velocity and stagnant waters. Therefore, they are quite comparable sites for diatom community composition irrespective of anthropogenic factors (Theriot *pers comm* 2018). Knowing that Waller Creek is an urbanized stream, how does BFL, a similar stream physically, compare? This experiment aimed to determine the diatom community composition at both BFL and WC in effort to determine if the stream at BFL can be considered unurbanized. It is expected that WC will represent a more urbanized and polluted stream system, while BFL will represent an area with a higher species richness and evenness. 15 diatomic samples were collected and identified from WC and BFL each and the pollution tolerance indices (PTI) for each location were determined. Based on the lower PTI for WC and the higher PTI for BFL, I concluded that WC represents a more urbanized system than BFL. The average PTI of WC represents a stream of moderate sensitivity, whereas the average PTI from BFL represents a pollution-sensitive stream. From these conclusions, we can verify that WC biotic integrity represents a more urbanized system than BFL due to its lower richness, evenness, and pollution sensitivity.
Texas Leaf Cutter Ant (*Atta texana*) – Effects of leaf-cutter ant mounds on ant species richness, plant richness, plant abundance & plant diversity at BFL

Brooke Bowman – F18

Leaf-cutter ants act as ecosystem engineers by creating massive, interconnected tunnel systems filled with fungal gardens and detritus that other arthropods take advantage of. They also alter soil properties, defoliate nearby plants, and harvest nearby seedlings. At Brackenridge Field Laboratory, hotdog baits were placed near *Atta texana* leaf-cutter mounds and at corresponding sites far from the mounds to test if proximity to mounds affected ant richness. In addition, transects were placed directly on top of and directly adjacent to leaf-cutter ant mounds to examine if richness, abundance or diversity was affected by direct contact with mounds. There were no relationships found between leaf-cutter ant mounds and ant richness, plant richness, plant abundance or plant diversity. Lack of comprehensive sampling methods, time of year, or small sample size might explain the results, but it is also possible that *A. texana* is not as influential an ecosystem engineer as its South American counterparts.

Chiquito Pero Poderoso

Aaron Duran – F18

The Chile Piquin (*Capsicum annuum glabriusculum*) is known to span from across Texas to Central Mexico. While Brackenridge Field Lab is a part of the pepper’s natural range, it is not a common component of the plant community found within the field station. Habitat preference and growth requirements of *Capsicum annuum glabriusculum* were recorded and observed using field survey methods throughout BFL. The purpose of this study was to determine the pepper’s range across the field station and to better understand its role in the ecosystem. From the data gathered, it was determined that the chili grows well in low canopy areas, and poorly in high canopy areas where it cannot acquire enough sunlight. Other patterns observed was its high level of success when competing in moderately shrubby areas with low canopy. This information is of great use for those interested in cultivating this pepper as a food source, and or establishing possible habitats for planting.
Community composition and size structure to analyze succession of Brackenridge Field Laboratory inside and outside of a fence barrier

Brianna Fogel – F18

Brackenridge Field Laboratory is influenced by biotic and abiotic factors that dictate the overall species composition and age structure of its established trees. In this experiment, the distribution, abundance, and size structure for dominant trees was analyzed from inside a man-made fence line and outside of the fence line in order to establish tree densities and canopy to sapling relative abundances. This was done using the point-quarter technique to collect data on trees along a transect line parallel to the fence, allowing for the estimated density of the trees in the community along six overall sample points. The results from this experiment included hackberry (Celtis spp.) as the highest relative abundance overall followed closely by rough leaf dogwood (Cornus drummondii). The chi-squared analysis showed there was not a significant difference in the proportions across the species of adults to saplings in both of the examined habitats. However, the Jaccard index displayed a difference in overall species richness between the inside and outside of the fence, with the outside of the fence having a greater diversity. This experiment highlights the differences in species composition that an anthropogenic boundary can impose on a natural habitat.

Impact of the invasive giant reed (Arundo donax) on the ground-dwelling arthropod diversity at Brackenridge Field Lab

Hannah Gilbreath – F18

Arundo donax, the giant reed originating from Asia, is a nonnative invader of riparian areas globally. Riparian edges of native vegetation are transformed into homogenous stands of A. donax, likely reducing the quality of habitat and other ecosystem processes in aquatic and wetland systems. In this study, I assessed the influence of A. donax on providing food for higher trophic levels and on arthropods at Brackenridge Field Lab. I used field collections with pitfall traps, Berlese funnels, and baited samples across areas containing A. donax or solely native vegetation. The Shannon’s diversity index and evenness for areas influenced by the reed was lower than those with native vegetation (H’=1.816, H’=2.183). Ants were particularly impacted by the presence of the reed, with reduced diversity in A. donax sites (H’=0.485, H’=1.336). Berlese funnels produced less biomass in influenced areas, but differences were not significant.
Although this study produced inconclusive data due to small sampling sizes and time frames, the trends consistently demonstrate loss in arthropod diversity and abundance in areas disrupted by *A. donax*, even if insignificantly. Expansion of sampling in this area is recommended to fully understand how this plant alters the vegetation structure and habitat quality of Brackenridge Field Lab.

**An update on the Recovery of Laurel Cherry (*Prunus caroliniana*) at Brackenridge Field Laboratory After Release from Browsing Pressure by Deer**

*Jaclyn Heiser – F18*

The North American White-tailed Deer (*Odocoileus virginianus*) represents a keystone species that is capable of initiating drastic change in occupied ecosystems. This is in large part due to uncontrolled browsing pressure on plant communities. Both woody and herbaceous plants have shown decreases in population size due to browsing by deer. Following the extinction of deer from habitats, herbaceous and woody species may be able to re-colonize and attempt population recovery. This study examined how the population of Laurel Cherry (*Prunus caroliniana*) at Brackenridge Field Laboratory (BFL) has been able to recover since the eradication of deer at the beginning of 2016. I utilized two sampling strategies across paired sites inside and outside BFL to test the hypotheses that laurel cherry populations would significantly differ across site locations. In the first sampling strategy, I replicated the methods used in two previous independent projects for quantifying canopy and sapling laurel cherry trees within quadrats. In the second strategy, I measured laurel cherry trunk diameters across transects. I found that there was a significant difference between laurel cherry population composition inside and outside the fence, and a significant difference between the average tree diameters of laurel cherry trees inside and outside the fence. Comparing my results to previous studies, it is evident that the relative abundance of laurel cherry individuals is recovering after removal of browsing pressure by deer within BFL. I observed 20% more canopy laurel cherries outside the fence, but the relative abundance and density of the combined laurel cherry population was very similar between sites inside and outside the fence. I concluded that the laurel cherry trees within BFL may be approaching maximum colonization already obtained by the trees outside BFL. However, the difference in size distribution suggests that there is a wider distribution of ages of laurel cherry individuals represented outside BFL, indicating that this population is further along in a
successional timeline. Comparatively, the population within BFL has a larger proportion of smaller, younger individuals, since this population was recently re-established after decimation by deer.

**Ant community diversity through time in Central Texas**

**Adrienne Loftus – F18**

Diversity on a global or regional scale is known as gamma diversity, whereas local diversity is referred to as alpha diversity. Beta diversity refers to *change* in diversity, whether that is over time on over space. Ant communities are a strong candidate for studying beta diversity because of the simplicity of ant surveys and their prevalence at most times of the year. In this study, I address the following research questions: 1) How has ant diversity changed through time? 2) What is the relationship between *S. invicta* and overall diversity? 3) What role do the habitats play in community turnover? Data for this analysis was gleaned from an archive of data from 2002 to 2018. Twice a year, approximately 10 acres were selected for sampling, each with 16-20 sampling points randomly spread throughout the acre. At each point, a hotdog bait was set out for 30 minutes, after which the bait and all attracted ants were collected and identified. Most years, abundance was recorded, but is not completely consistent. For continuity, only data since Fall 2009 was used. Overall, ant diversity decreased with the presence of *S. invicta*; however, this grouped all canopies and disturbance levels. A more thorough search into this pattern of diversity in the presence of invasive species is outside the scope of this study but worth exploring further.

**The distributions of two Opuntia species and the cactophagous cochineal insect at Brackenridge Field Lab**

**Kyle Simpson – F18**

The cochineal insect is an obligate herbivore of several *Opuntia* species. In this study, I surveyed Brackenridge Field Lab in Austin, TX and mapped the locations of all detectable *Opuntia* individuals and recorded the presence or absence of the cochineal insect on each cactus. Cacti were found most frequently growing in mesic conditions beneath an open canopy. Density of the cochineal insect was positively related to *Opuntia* density. However, between the two *Opuntia* species present at BFL, cochineal was present on 51% of *O. engelmannii* individuals
and only 3% of *O. macrorhiza* individuals. A study investigating the biology and ecology of each of these *Opuntia* species would provide valuable answers to how these species are affected by cochineal differently.

**Legume (Family: Fabaceae) distribution across soil types and habitat**

**Sarah Ortiz – F18**

Abiotic factors such as soil acidity, microbe community and soil pore size are all major determinants of whether a population can establish itself or not. Soil quality determines the rate of decomposition, water retention and nutrient supply that defines the population dynamics of an ecosystem. In this study, I examined the distribution of legume (N-fixer) populations (Family: *Fabaceae*) across different soil types at Stengl “Lost Pines” Biological Station to understand the effect soil might have on their distribution. This data will give insight on limits faced by N-fixers in temperate habitats based on soil type. I predict that legumes will be found in poorer soil types with low nutrient supply and that legumes will be found in more open habitats with low canopy cover. To collect data, four points were chosen for each of the ten soil types at Stengl. Each point was at least 100 meters away from any other collection point. At each point, plants in the *Fabaceae* family within a five-meter radius were recorded. Habitat type, canopy cover, and approximate distance from the center of the point was documented for each individual. The results of ANOVA and chi-square testing as a whole indicate that legumes do not show a preference for soil or habitat types, but specific genera do show some level of preference. This data implies that the ability to fix nitrogen assists in legumes’ ability to live in more variable habitats.

**Distribution and Patterns of Nine-Banded Armadillo Foraging Pits**

**Lindsay Ramirez – F18**

Where an animal forages is often dependent on a variety of factors such as relative location to natural and manmade structures and soil composition. The nine-banded armadillo’s (*Dasypus novemcinctus*) diet comprises mostly of invertebrates which they hunt for by digging the ground into conical-shaped holes. Given their choice of prey, I hypothesis that they will forage primarily near roads in Brackenridge Field Laboratory. Photographs were taken where armadillo foraging holes were evident across BFL. However, due to data gathering
complications, the experiment has been rendered inconclusive, however many noteworthy
observations have been made.

The impact of Austin development on the invasive fire ant population
Edwin Umanzor – F18

Native ants are beneficial ecosystem engineers, while invasive ant species can negatively
impact the ecosystem by displacing the native ant population. The invasive fire ant, Solenopsis
invicta has displaced several native ants as it moved its way west across The United States. It
was responsible for displacing the native fire ant, Solenopsis geminata from The Brackenridge
Field Laboratory (BFL), but there was still a surprisingly large population of S. geminata in the
old neighborhoods around BFL that lacked any S. invicta. The invasive fire ant has now moved
into parts of Tarrytown in the City of Austin that were once inhabited only by the native fire ant.
This could be related to the recent dramatic increase in development in that area. Native ants are
also found less frequently in recently developed properties, but the invasive fire ant is found
equally in both recently developed and undeveloped properties. The winter season and the low
number of ant samples did not make it possible to compare S. invicta with S. geminata.

The loss of a relic: how climate changes pine forest diversity and consequences for species
like Pine Warblers that rely on them
Dylan Winkler – F18

Climate change is a threat faced by organisms across the globe as it can influence and
change the distribution of species in certain habitats. One effect of climate change is prolonged
droughts. These droughts can stress species and cause dramatic shifts in vegetative communities
and those species that rely on them. Stengl is a biological research station located in the relic
“Lost Pines” region of central Texas. Recent droughts have caused the invasion of post oaks into
the pine forest. I wanted researched how pine-reliant species like Pine Warblers are reacting to
the changing forest diversity. I conducted 30 point-counts at Stengl over two days, and recorded
habitat and environmental variables. I used ANOVA and linear models to predict if tree habitat
type affected pine warbler abundance, as well as pileated woodpecker abundance. The models
did not predict the variation in the number of warblers, but pine habitat (vs. only juniper-post
oak) and low canopy cover were significant predictors of warbler abundance. The warblers
showed no significant preference for pure pine vs. post-oak invaded pine forests, suggesting the broader range of distribution in the winter. A follow-up study of pine warbler habitat preference in the summer breeding months, when they usually need pines, may show a stronger correlation to pure pine forests, or show flexibility of a species that can survive in a changing habitat.

**BFL Insecta: A family comparison of habitat preference and diversity analysis**

**Ryan Youngblood – F18**

Comparing insect diversity between native and invasive grasses will help determine whether a negative relationship exists between diversity and invasive species or not. In this study, I examined the insect communities of the invasive King Ranch bluestem (*Bothriochloa ischaemum*) and the native little bluestem (*Schizachyrium scoparium*). I predicted that the similarity in insect communities would be low between the native and invasive grass and that insect richness and evenness would be lower within the invasive grass. A sweep net was used to collect specimens at a dominant KR bluestem area and at a dominant little bluestem grass area. The Jaccard Similarity Index was 0.17 which indicates low similarity between insect composition of the native and invasive grass. While richness was similar between the sites, the native grass site showed higher evenness. Continued monitoring of native and invasive grass insect populations remains important so as to monitor any changes that occur.

**2019**

**Resource allocation in *Opuntia* in response to herbivory by a sessile parasite**

**Katherine Strain – S19**

*Opuntia* is a genus of plants in the family Cactaceae commonly called prickly pear. The locations of *Opuntia* at Brackenridge Field Lab were mapped by a student in 2018, which I used to conduct my study. Cochineal (*Dactylopius* spp.) is a genus of soft-bodied, sessile parasitic insects that lives on *Opuntia* species and feed on the pads. This study investigates the effects of herbivory by cochineal on *Opuntia* reproductive output. For each plant that was taller than 0.5m, I recorded whether the plant hosted cochineal or not. Reproductive effort was then measured by counting the number of buds, flowers, and fruit present on the *Opuntia* samples. Pads were counted to estimate the biomass of the plants. I predicted that *Opuntia* plants with cochineal present would have a significantly lower reproductive output than those with cochineal absent.
Using SAS 9.4 software, I used generalized mixed linear models to test my hypothesis. Total reproductive effort was significantly reduced by cochineal presence (P = 0.017) and the mean total reproduction effort was reduced by 72% in infested plants. This study supported my hypothesis as total reproduction effort was significantly reduced in Opuntia by cochineal presence.

**Quantifying Edge Effects and Differences in Forb Cover in the Meadow**

Rachel Hawkins – S19

Woody plant encroachment has been widely observed across North America over the past century due to grazing practices and fire suppression. This phenomenon reduces native grass diversity and has led to different management strategies to keep woody plant encroachment at a minimum to preserve native grasslands, such as Beno’er meadow found at Brackenridge Field Lab in Austin, TX. In this study, I quantify edge effects at Beno’er meadow and assess how forb cover differs according to different variables within the meadow. I recorded bunchgrass presence, forb cover (%) and woody plant presence in thirty 1 x 1 meter quadrats within the 11 x 16 meter area that makes up Beno’er meadow. I predicted that there will be more bunchgrass in center quadrants than edge quadrants, that there is a relationship between bunchgrass presence and woody plant presence, and that forb cover would be different between center and edge quadrants. A Mann-Whitney U test revealed that forb cover is in fact different between edge and center quadrats (W=123.4, p-value=0.008081, sig. level =0.05). Pearson’s chi square test concluded that there was not a significant relationship between forb cover and bunchgrass presence (X^2=3.2143, df=1, p-value=0.073). Contingency tables constructed for corner quadrats and center quadrats revealed that there is a strong edge effect in corner quadrats resulting in higher woody plant presence and reduced bunchgrass frequency, and that center quadrats exhibit lower proportions of woody plant presence and higher presence of bunchgrass. These findings confirm the negative edge effects of woody plant encroachment on herbaceous species diversity and show the importance of managing woody plant encroachment in order to preserve native grassland species.
Community assemblage of Beno’er Experimental Meadow: 30 years post-establishment
Thomas Samuelson – S19

Grass community assemblage can be affected by factors such as woody plant encroachment, shading, soil composition, and herbivory suppression. In this study, I assessed the current grass assemblage at Beno’er Experimental Meadow at Brackenridge Field Lab in Austin, TX, USA and how these factors have affected it. Box-quadrat transect sampling was the sole sampling technique used during the data collection phase. Transect lines were ran every 1 m moving horizontally in the 16 m direction length within the 11 x 16 m meadow. A total of fifteen 11 m transect lines were ran and a total of 161 1x1 m quadrats quantified 161 m$^2$ of the meadow. A complete survey of grass community composition was not able to be executed due to the effects from seasonality causing a differential expression (and lack thereof) of reproductive material across species. A similar survey should be completed in the fall in order to fully understand the factors currently dictating the grass community assemblage at the Beno’er Experimental Meadow.

Local Ecotone Transition Along Habitat Boundaries at Brackenridge Field Laboratory
Sierra Ehlers – S19

The vegetative community within spatially determined habitat boundaries may provide insight on the resiliency of habitat fluctuation. Additionally, this could allow for prediction in the ability for a once disturbed habitat to return to its original state. Lastly, examining community overlap amongst habitat boundaries can provide suggestions on locations of highest priority for conservation efforts. This study found regions that have been synthetically disturbed for maintenance purposes have the least community overlap in shorter-lived grasses, herbaceous dicots, and woody shrubs amongst the habitat boundary and the habitat patches surrounding the boundary. Additionally, this study revealed that though communities may have high species overlap, this does not always equate to high species richness. Overall, vegetative overlap, i.e. local ecotones, of shorter-lived grasses, herbaceous dicots, and woody shrubs at BFL at habitat boundaries regions is generally low and thus may not serve as an appropriate proxy for determining habitat boundary health and/or true resiliency.
Effects of privet invasion and removal on arthropod community composition at Brackenridge Field Laboratory

Samantha Hilty – S19

Chinese privet (Ligustrum sinense) is one of the most widespread exotic invasive plants in the U.S. Invasion of Chinese privet is known to cause a significant loss in native plant and animal biodiversity. However, after mechanical removal of privet, both native plant and animal diversity has shown significant recovery - suggesting that mechanical removal can be used to successfully restore native habitats. In this study, I aimed to examine the effects of privet invasion and mechanical removal on the arthropod species abundance, richness, evenness, and diversity at Brackenridge Field Lab in Austin, TX. Consistent with findings of previous studies, I hypothesized that privet invasion at BFL has resulted in significant losses in arthropod richness, evenness, and diversity. Using pitfall trapping, samples were collected at each habitat type and the specimens collected were separated into unique morphological groups. I found that, inconsistent with my expectations, species richness, evenness, and diversity were not significantly different depending on the habitat. However, trends in the richness and Shannon-weaver diversity values suggest that habitats with privet do show lower values in these parameters. Interestingly, the species evenness was lowest at the site with privet mechanically removed. Our results suggest that similar to other sites, privet invasion BFL may be negatively impacted the diversity of arthropods. Additionally, our results suggest higher abundance of S. invicta in newly disturbed sites, which may impact the evenness within sites, and could result in unintended negative ecological impacts. Further research is required to examine whether the effects of privet invasion and removal are actually insignificant, or if this is a product of small sample size.

Diet Analysis of Wild and Urban Coyotes

Quanit Ali – S19

Coyotes are an opportunistic canid mesopredator found all across the United States. Their diets have been observed as dependent to the types of habitat they inhabit, as their diet choice is linked directly to the availability of food items. In the fall of 2010, coyote diets were examined at Brackenridge Field Laboratory to determine diet composition. Since the 2010 study, key changes in the species composition of BFL have occurred such as the extirpation of white-tailed deer. Scat samples were collected in 2019 to re-examine the changes in their diets. Similarly, wild habitats
were also sampled to determine differences in different wild habitats and with urban environments. It was hypothesized that coyotes would have an increased reliance on small game due to deer reduction, increased diet diversity, that wild diets would be similar to one another and that wild diets would be more prey intensive than omnivorous for wild coyotes as compared to urban coyotes. Chi-squared tests determined statistical insignificance for all hypotheses, but partial support for diet supplementation was observed through prey item frequency increases.

Vine Host Tree Preference
J Shaukat – S19

Vines climb host structures in two broad categories: root climbers and tendril climbers. Root climbers adhere directly to the face of the structure, while tendril climbers twine around branches and protrusions using specialized stems. Factors that may influence the distribution of vines across tree species include those such as the climbing type of vine, whether the host tree is evergreen or deciduous, or the bark type of the tree. Three pre-existing transects at Brackenridge Field Lab with trees tagged 20 meters apart was used to provide an even sampling of the plant community of the area. This study compared the vine species of BFL and their respective host trees and found a significant association between these variables (p = 0.049). No other statistical tests comparing vine type, tree type, or vine presence showed any significant result, and no difference in mean host tree DBH was found between vine species and vine types. This may be due to a lurking variable present in the dataset, possibly proximity to water. Nevertheless, if an association between vine and tree species does exist, it may have implications about the roles vines play in ecological succession.

Colonization of Brackenridge Field Laboratory artificial ponds and changes observed over time
Hannah Simon – S19

Variations in biodiversity, water availability, and parent trees in pond ecosystems can impact whether ponds in the same area are colonized by the same species. This study gives a detailed account of the colonizing species, the edge species present, and the water level and soil type at each of Brackenridge Field Lab’s eight ponds. Panoramic photos were taken at the southeast corner of each pond as an overview of the overall status of the ponds. There was a census taken of
each tree species that had colonized the open area of the ponds, noting whether there was a parent tree present. Additional species found in the ponds were documented as well, along with prominent edge species and presence of standing water. The three dominant tree species that were found colonizing various ponds were willow, cottonwood and Chinese tallow. The counts of each tree varied among the different ponds, but each pond showed a dominant tree species. The results of this study can be used to further inform studies performed on the ponds at BFL in the future.

The Southern Dogface Butterfly (Zerene cesonia) and its’ Host Plant Selection of the Texas Kidneywood (Eysenhardtia texana)

Gracen Bivens – S19

On an evolutionary timescale, a community’s insects have experienced natural selection on their preference of oviposition (laying eggs) host plants and resources. However, these established ecological relationships now face increased challenges brought on by human disturbance such as, invasive plant introduction, native community loss, and lacking the ability to adapt quickly enough to avoid extinction with the rapidly changing environment. This study focuses on the southern dogface butterfly (Zerene cesonia) and the selection of its’ host plant, the Texas kidneywood (Eysenhardtia texana). Samples were collected from three trail sites at Brackenridge Field Lab in Austin, TX. For each kidneywood plant that I encountered, I recorded the degree canopy openness on a scale of 0 to 3, whether the proximity of the individual was located in a patch of other kidneywood or was isolated, the life stage of the individual (young/adult), the indirect (leaf damage) or direct presence of caterpillars, the presence of eggs, as well as the diameter and number of dead branches for the adult individuals. Chi-square analyses showed that the southern dogface butterfly’s host plant selection is more dependent on habitat type than the individual characteristics of the kidneywoods. Additionally, results showed that the southern dogface likely selects younger kidneywoods for oviposition based on increased offspring performance supported by higher food resource and predation avoidance. Future management recommendations and applications of this research are discussed.
Habitat preferences of fall flowering plants at Brackenridge Field Laboratory
Maddie Aalund – F19

The distribution of flowering plants and the composition of flower communities depend on a variety of environmental factors and are interwoven with the habitat preferences of many other species. This study investigates the distribution of different fall flowering plants around Brackenridge Field Laboratory in order to determine what environmental conditions different species prefer. We used a stratified random sampling technique to sample the flowering plant communities throughout different habitats in BFL. Using a series of Chi-squared tests of independence, we found that while some species preferred specific habitat types, disturbance levels, and canopy and shrub densities, there was also a good number of species that behaved like habitat generalists.

Factors that Influence the Foraging Behavior of Dasypus noveminctus
Ryan Almeida – F19

Property owners in the United States often complain about the holes in their yards dug by armadillos that are foraging for food at night. This foraging by armadillos can ruin lawns and irritate homeowners to the point at which we start to harm these animals. As humans and armadillos spread throughout the United States, this problem is worsening, and we need solutions that do not involve the killing of these armadillos. This study investigated various factors, such as soil water content, soil organic matter content, and ground vegetation cover, and how they might affect armadillo foraging activity. Although this study could not relate soil water content or soil organic matter content to armadillo foraging, we still generated some important conclusions about the arthropods that these armadillos are foraging for. Additionally, we found a significant interaction between ground vegetation cover and armadillo foraging, which helps us to understand why armadillos enjoy our front yards so much. With the conclusions in this study, people can be more educated about what attracts armadillos. Consequently, we can find improved solutions that enable us to control armadillo foraging without harming this species.
Distribution of Guinea Grass (*Megathyrsus maximus*) at Brackenridge Field Lab

Kate Cox – F19

This study looked at the distribution of the invasive grass *Megathyrsus maximus*, or Guinea grass, at Brackenridge Field Lab in Austin, Texas. Distribution was looked at both in terms of physical distribution (GPS points) as well as variables affecting habitat preference. A map was produced to show the physical distribution, highlighting a relatively high frequency of the grass at the front of the field lab, where there are high levels of disturbance and the land is frequently mowed. The species was also shown to occur more frequently in highly disturbed areas with low shrub and canopy cover, likely due to the decreased completion effects in these areas that allow an opening for Guinea grass to colonize.

A Survey of Sabal Mexicana Palms at Brackenridge Field Lab

Katherine Dunham – F19

*Sabal mexicana* has been often planted and used as an ornamental plant in areas outside of its native range, which has allowed it to spread into local ecosystems. In Austin, Texas, this is a common occurrence, although there is some evidence to indicate that this is recolonization rather than naturalization of the species. I conducted a survey of *S. mexicana* across Brackenridge Field Lab, collecting data such as palm size, habitat, canopy cover, ground cover, and leaf damage in an attempt to identify current habitat preferences of the species and thus where it might spread to in the future. 11 *S. mexicana* individuals were found and recorded when conducting the survey, with majority being located in the flood deposited terrace habitat. Trends shown in the data suggest the *S. mexicana* prefers relatively open areas that are close to a water source. Leaf damage done to the species by *Homaledra sabalella* was shown to be dependent on the size of the palm (p-value = 0.01515), with 7 of the 11 individuals showing leaf damage consistent with the moth species. While this is a good preliminary study of the species within Austin, a similar survey on a greater scale or in a location with more individuals would need to be conducted to confirm these results.
Characterizing the Growth Patterns of a Laurel Cherry Stand After Deer Extinction
Will Johnson – F19

This study characterizes two laurel cherry populations which are physically separated by a fence line, with one side having a history of herbivory. Density and DBH data were taken, while growth rates were estimated by counting the growth rings from tree slices. It was found that the population which was previously subject to herbivory was denser, younger, and had less variation in size. Future steps are suggested to monitor these two populations.

Ligustrum removal
Sally Jung – F19

Disturbances through the removal of invasive species influence changes in light availability to understory and ground plant communities. Brackenridge Field Laboratory has conducted many invasive species removals of Japanese privet (*Ligustrum japonicum*) and Heavenly bamboo (*Nandina domestica*). My study investigates how invasive species removal of Japanese privet affects understory plant diversity and how light availability affects what vegetation follows the disturbance. There was a statistically significant difference between mean canopy openness for disturbed and control sites and when comparing both disturbed sites. Disturbed sites have a higher richness and true Shannon diversity values as well as higher canopy openness percentages than control sites. There are positive correlations with richness vs. canopy openness and true Shannon diversity vs. canopy openness. The highest correlation was richness vs. canopy openness looking at June disturbed and June control ($R^2=0.76$). Jaccard's index were very low for June disturbed and control, and September disturbed and control.

Coyotes as Seed Dispersal Agents at Brackenridge Field Laboratory
Jake Marek – F19

Animals often act as unwitting seed dispersers for invasive plants in an ecosystem. At Brackenridge field Laboratory, it is possible that the coyote population is dispersing the seeds of Japanese Raisin and Palm trees throughout the facility. My research team mapped all of the parents and juveniles of each species and collected and analyzed the contents of coyote scat around BFL. I found that coyotes foraged under parental Japanese Raisins in varied intensities and distributed seeds far from the parent. However, distribution didn’t necessarily translate to an
abundant population of juvenile plants. I concluded that in many areas of the facility, coyotes actually inhibited the spread of Japanese Raisins and palms.

**Evidence of Homaledra sabalella, Bruchidae, and Coccotrypes Insect Impact on Austin Palm Tree Species**

Cole Pringle – F19

Pest species that interfere with the growth and spread of plants can have serious ramifications when they affect certain crop plants. Several such species negatively impact the growth and survival of palm trees. By examining the patterns of behavior of these pest species, methods of mitigating their impacts can potentially be determined. The species in question are *Homaledra sabalella*, also known as the palm-leaf skeletonizer, as well as species of the family *Bruchidae*, and species of the genus *Coccotrypes*. The effect of these species on palm trees across Austin, Texas was determined by finding palm trees in three separate sites across the city. Then the presence or absence of activity by one of these three types of pests was determined by examining the palm fronds of the trees, as well as palm seeds found at the base of palm trees or found in coyote scat. The majority of palm trees were identified at Laguna Gloria while the palm seeds were found both at Brackenridge Field Laboratory (BFL) and Laguna Gloria. The third location which was visited was Shoal Creek where a total of eight palm trees were observed. The results indicated that the impact of all three pest species was significantly less severe at Laguna Gloria than at the other two sites. The possible reasons for this are explored in greater detail throughout this paper.

**Fall Flower Communities in Central Texas**

Roxanna Shahraki – F19

Flowers are likely to grow in patches of diverse species so that they can attract varied pollinators. We were interested to see how varied flower communities within the Central Texas hill country were based on different conditions and how specialized different species were for the conditions of their habitat. Data were collected at Brackenridge Field Laboratory in collaboration with Madison Aalund. I found that species richness was significantly different for different shrub covers. I found that only camphorweed, goldenrods, prairie tea, straggler daisies, and Turk’s cap had preferences for habitat conditions.
Assessing the effectiveness of the coyote (*Canis latrans*) as a dispersal agent for introduced Japanese raisin trees (*Hovenia dulcis*)

Jenna Wadman – F19

The introduction of invasive plant species can result in negative ecological and socio-economic effects. In order to become invasive, introduced plants must have effective seed dispersal mechanisms. The Japanese raisin tree (*Hovenia dulcis*) is native to east Asia and has been introduced globally. Animal-mediated seed dispersal is common for this species in both its introduced and native ranges. As a result, *H. dulcis* has been able to spread and become invasive in several forests. In this study, I investigated the effectiveness of native coyotes (*Canis latrans*) as *H. dulcis* dispersal agents at Brackenridge Field Lab (BFL) in Austin, Texas. I hypothesized that coyotes are more effective at dispersing *H. dulcis* seeds long distances. Because of coyote foraging patterns and digestive behavior, though, I predicted that ingested *H. dulcis* seeds are less likely to germinate. By mapping the distribution of *H. dulcis* parents and juveniles, I found that seed dispersal and establishment varied greatly throughout the site. While coyotes consumed *H. dulcis* and distributed its seeds throughout BFL, they had relatively low dispersal efficiencies since they regularly defecated in areas unsuitable for germination. In the habitat dominated by gravity and wind dispersal, there was a higher concentration of juveniles around the parent tree. Thus, coyotes may prohibit the invasion of *H. dulcis* in modified landscapes. The distribution of *H. dulcis* in BFL should continue to be monitored to understand the potential impacts of the species on native biodiversity.

*Nandina domestica* characteristics as a function of habitat type and canopy cover

Wesley Williams – F19

Invasive species have become a worldwide problem due to the human technological advances in travel and trade, and these problem organisms are a major threat to biodiversity. *Nandina domestica* is one example of an invasive species, and it can be found throughout Brackenridge Field Lab. Using the field labs transect system the entire station was surveyed for nandina presence and characteristics of height and fruiting specifically. Using these counts as well as information regarding the characteristics of the sample sites, namely their habitat type and level of canopy cover, chi-square analysis and proportions were generated to analyze nandina presence and maturity. Open canopy areas were found to have higher proportions of
mature characteristics but lower counts on average than closed canopies, and the quarry habitat was found to have greater numbers of nandina present. These maturity characteristics are important to understand because mature plants reproduce and spread. Because nandina is invasive, knowing the environmental conditions the plant favors inform how its spread can be managed in the future.

**Soil Content and Ground Cover of Foraging vs. Non-foraging Sites of the nine-banded armadillo**

Morgan Kenyon – F19

In this study, I looked into the foraging habits of the nine-banded armadillo. Soil samples were collected from sites where armadillos foraged- indicated by shallow holes- and areas where they were not seen to forage. The samples were then analyzed and there was no significant difference between the water content and organic matter content in the soil between the foraging and non-foraging sites. There was a significant difference in ground cover between foraging and non-foraging sites (p-value<0.001). These results could be used in the future to further analyze armadillo foraging sites in order to discern what draws the armadillo to forage in that area.

**Analysis of the Presence of Parthenocissus quinquefolia (Virginia creeper) Compared to Toxicodendron radicans (Poison Ivy) Climbing Vines at the Brackenridge Field Laboratory**

Erica Barnett – F19

*Parthenocissus quinquefolia* (Virginia creeper) is a woody vine predominantly found throughout the temperate United States. Incidences of this vine were compared to that of *Toxicodendron radicans* (Poison ivy) climbing vines throughout the Brackenridge Field Laboratory (BFL). The goal was to determine whether Virginia creeper had a growing preference for certain tree species and habitat types. Results of this experiment revealed a statistically significant relationship between Virginia creeper climbing vine growth and habitat type. However, there was not a significant relationship between the type of climbing vine and the tree species at BFL. However, more research may find that *Celtis laevigata* (sugar hackberry) has tree bark that is ideal for growth of Virginia creeper.
Spatial and Temporal Changes of Fish Diversity in Waller Creek
Han Ooi – S20

Waller Creek is an entirely urban creek flowing through Austin, Texas into Ladybird Lake. Historic data was gathered from the Fishes of Texas Project database to compare the spatial and temporal changes in the fish diversity of the creek from 1976 to the present. The objective of the study was to reveal the extent to which urbanization has affected fish diversity in Waller Creek. The results show that fish species diversity has dramatically decreased since 1976 with an increasing abundance of exotic species inhabiting the creek. The fish fauna is now dominated by the seven species including Gambusia affinis, Camptostoma anomalum, Astyanax mexicanus, Lepomis megalotis, Lepomis cyanellus, Cyprinella lutrensis, and Herichthys cyanoguttatus. The established and most abundant non-natives include Xiphophorus variatus, Astyanax mexicanus and Herichthys cyanoguttatus. Most of the less common native species collected in the 1970’s are no longer present or rare based on the data. The decreasing biodiversity trend can be used as a tool to support protection and conservation of Waller Creek as well as highlight the adverse effects of further urban development. Additional holistic studies are needed to identify the discrete anthropogenic sources or processes impacting the Waller Creek environment to provide clear interpretation and insight regarding the effects of urbanization.

Impacts of white-tailed deer herbivory with a connection to Central Texas
Meagan Yates – S20

White-tailed deer herbivory has had an impact on the plant community by changing the distribution, abundance, composition, and dynamics of herbaceous and woody plants. The impacts that the deer are having on the plant community ripple out through the ecosystem. Visual and anecdotal evidence of deer effects at a research station in Central Texas have been included in this report and support a review of the available literature on the impacts of deer herbivory on plants. Deer density is an important moderator in the significance of these effects and managing deer grazing and population sizes will be important in protecting plant communities.
**Heterodon platirhinos: The ecological profile of the Eastern Hognose snake**

Antonio Bueno – S20

The purpose of this study is to explore the different aspects of *Heterodon platirhinos* ecology (spatial ecology, behavioral ecology, and thermal ecology) currently being studied and discuss what is known about each of them. The goal of this study is to show the scope of research that has been done over the past sixty years and provide a template of the research that is necessary for other reptiles/snakes that might be considered threatened and have less research conducted.

**Changing Ant Communities in the Face of Urban Sprawl**

Robert Estrada – S20

As urban and suburban areas expand, they begin to occupy more land which leads to habitat destruction, introduction of non-native species, and extirpation of local ecological communities. One area facing such changes is El Paso, Texas. Ants can be used as an indicator of environmental health as they occupy a wide variety of niches and exhibit high local distribution and endemicity. Therefore, to understand how urbanization is affecting the El Paso area, I conducted a study comparing ant diversity in urban and natural sites. A total of twelve sites were tested (six urban and six natural) with four hotdog baits at each site. The baits were collected after 20 minutes and any specimens were preserved and identified. Overall, eight any species were found across all twelve sites. Six were found in natural habitats while five were found in urban habitats, with three of the eight total species being found in both. This would suggest that the natural habitat hosts a slightly higher diversity than urban habitats, however, the species rank-abundance curves point to a large difference in the amount of these ants that are present.

**Literature Search on Ant Associations in the Lycaenidae Family: A close look at a few endangered butterflies**

Alejandra Rodriguez – S20

The larvae of many species in the butterfly Lycaenidae family have interactions with tending ant species. The mechanisms of communicating and food rewards are described, along with the costs and benefits for both the ants and the tended larvae. Research was compiled on the
existing literature of the ant associations of four endangered lycaenid species to observe whether tending ants or obligate hosts ants can play an important role in our conservation strategies for these butterflies. The Karner blue butterfly, Miami blue butterfly and the Fender’s blue butterfly are facultative mutualists with tending ant species and were all shown to have positive benefits to development, survival, or fecundity. The Large blue butterfly has an obligate parasitic relationship with Myrmica host ants, and management practices were shown to have drastic effects on the host ant species and the survival of the butterfly in Britain. The benefits of ant associations are apparent in the literature and future recovery plans for endangered lycaenid butterflies may target management activities that support these interactions.

**Evaluating invasive plant species success at BFL: a long-term, multi-variable approach**

**Amelia Nelson – S20**

Invasive plant species are one of the leading causes of native biodiversity loss. Invasive plants can quickly spread and displace native plants, preventing growth and creating monocultures. However, this process of invasion is long and influenced by several interacting factors. Invasive plants are able to take advantage of these factors when conditions are optimal. I evaluated this at Brackenridge Field Laboratory, an enclosed biological research station, by reviewing past projects performed on the invasive species at this site. I examined the success of these species as a factor of deer herbivory, habitat characteristics, seed dispersal mechanisms, and competition with native and nonnative plants. I also considered how these factors have changed over time. Overall, I found that deer can have both a facilitating and a controlling effect on plant species at BFL. The loss of deer has been shown to have both direct effects on invasive species, through loss of herbivory, and indirect effects, through habitat alteration. I also found that habitat characteristics, such as canopy cover and soil moisture, were a major limiting factor for some invasive plants studied. This study shows that a multi-variable, species-specific approach is needed when managing invasive plant species.

**The effects of fire and Spanish goat grazing on central Texas trees**

**Robert Bailey – S20**

The central Texas landscape holds many habitats that are important in preserving the species diversity of this area. Human interaction with this landscape has reshaped habitats for
centuries. Among these interactions are fire suppression and livestock grazing. These efforts have increased with time, and by focusing on the tree community of this area the effects can studied. Fire suppression has shifted mixed savanna to juniper-dominated woodlands, and livestock grazing has had potential to alter tree abundances and distribution. Here, the effects of fire suppression and Spanish goat grazing are investigated. Spanish goats are a common livestock species in this region due to their hardy nature and diet. Prescribing fires has gained traction in the past decades as an important ecological and range-clearing tool. For this study, the control piece of land used has not been manipulated by humans in at least 200 years. This control was compared to areas of land that have experienced prescribed burning and Spanish goat grazing to study their influence on the tree community.

The effects and biological control of *Cactoblasts cactorum* in the United States

Emily Verdoia – S20

*Cactoblastis cactorum* is a cactus-eating moth that has been used as a biological control of *Opuntia* in multiple regions. It has since invaded other regions and become a pesky invasive species. In Florida, the moth has colonized and proliferated, and been seen to feed on all of the rare *Opuntia* species that live there. It has spread rapidly westward throughout the southern states having made landfall in Texas in 2018. The ecological impacts of *C. cactorum* on *Opuntia* and the ecosystem has been variable, but populations of *Opuntia* have been decimated. The effects of this have yet to be fully realized, but plants and animals that rely on *Opuntia* are expected to decline quickly. There are several methods of employing biological control to curb *C. cactorum*, one of which is using parasitoids. The most likely candidate for this is *Apanteles opuntiarum*—although further studies are necessary before they are released. Monitoring and early detection are key in slowing the spread of *C. cactorum* before it reaches the *Opuntia spp.* biodiversity hotspot of southern Texas and Mexico. Not only is Mexico a biodiversity hotspot, but much of agricultural economy relies on *Opuntia*. Public outreach for agricultural communities and the general public will help early detection, and aid in the surveillance of *C. cactorum* as it spreads. The invasive species *C. cactorum* will continue its westward movement unless stopped by some method of biological control.
Comparative analysis of vegetation fire ecology and management in the Mediterranean and Central Texas

Athena Kovner – S20

The Mediterranean and Central Texas have relatively similar vegetation types but very different climates and fire regimes. While Mediterranean vegetation often experiences crown fire every year, Texan vegetation may experience either surface or crown fire every 0-10 years. The regions have also seen opposite trends in changes to their fire regimes, with Texas experiencing an increase in fire intervals due to fire suppression and many Mediterranean-climate areas experiencing shrinking fire intervals due to a variety of changes in management strategies. The resulting conditions favor propagule-persisters such as Ashe juniper in Texas and re-sprouters such as invasive and native annuals in the Mediterranean. Due to these differing conditions, management strategies in the two regions have gone in opposite directions, with Texan landscape managers favoring prescribed burns and Mediterranean managers favoring fire.

An Analysis of Diatom Diversity in Texas Lakes

Ginger Bennett – S20

Diatoms, a type of phytoplankton, are extremely important to both aquatic and terrestrial environments. This report details an analysis of diatom diversity in 49 Texas lakes using data from a 2007 EPA survey. It was hypothesized that larger, lower latitude, rural, mesotrophic lakes will have the highest Shannon Wiener diversity index values. Results found that diatom diversity in Texas was not affected by the analyzed variables, and future studies should consider the combined effects of multiple variables on diversity.

Meta-analysis of Deer impacts on arthropod communities within Brackenridge Field Laboratory

Ryan Nanowsky – S20

Deer can threaten an ecosystem’s biodiversity through over consumption of vegetation. This can lead to reductions in shrub/understory abundance and diversity which means less resources for the other organisms living throughout. Because of this herbaceous pressure provided by high density deer populations, communities such as arthropods are locked into direct competition and can face reductions in abundance and diversity. Throughout the history of
Brackenridge Field Laboratory numerous students have performed individual research projects focused on the effects of deer on arthropod communities because of this process. Six projects which focused on this issue were identified for this meta-analysis for further insight to their results. It was hypothesized by the students that the presence of deer within BFL would lower the available plant resources, and as a result reduce arthropod abundance and diversity. However, several of their results, and the results from this meta-analysis, found no significant evidence that deer impact the arthropod communities in terms of abundance. Although there was a significant difference between biomass of arthropods collected between enclosures.

**Foraging Preference in *Atta***

Maxwell Reeves – S20

Leafcutter ants (*Atta*) are a clade of foraging insects which pose considerable interest for both their potential as a pest as well as their role in vegetative habitat restructuring. They have been observed to forage plant material from a wide variety of species, which they use to cultivate underground gardens of mutualistic fungus. Qualities of the plant material as well as behavioral adaptations of these ants exert considerable influence on what plants they choose to forage from. Understanding this multitude of factors provides insight into this genuses tenacity and success in areas ranging from east Texas to the tropics, as well as points towards methods for its responsible management in an endemic context.

**Preferred habitat characteristics of leaf cutter ants: a literature review and observations***

Anamarie Capra – S20

Leaf cutter ants are important ecosystem engineers in the areas they occupy. They build large mounds of soil to protect their underground tunnels that are used to harvest leaves for fungus cultivation. The placement of their mounds is important to the survival of the colony, and many factors can influence where they decide to start building. The factors that could potentially affect where mounds are constructed include surrounding vegetation, soil type, and canopy cover. However, leaf ants are known to be generalists and the fungus they cultivate is not dependent on one source of nutrients, so the vegetation surrounding the mounds may only be a significant factor if the area has low diversity and extreme changes in vegetation seasonally. Additionally, the preferred soil type has been observed by Dr. Gilbert and other scientists to be a
mix of clay and sand since the sand is easy to excavate and the clay can be used to coat the inside of the tunnels for stability. Lastly, canopy cover seems to be dependent on the region in which the mound is located. For example, if the mound is in the Amazon the ants may prefer shaded areas to escape the heat, whereas in areas of higher latitude the mounds may prefer shade in the summer and exposed areas in the winter.

Comparing Water Quality and Benthic Macroinvertebrate Assemblages Between Two Central Texas Creeks
Sydney Phillips Grace – S20

Benthic macroinvertebrates are commonly used as bioindicators for water quality. Benthic Macroinvertebrate communities are strongly influenced by a number of biotic and abiotic factors, and the presence or absence of specific taxa can help determine the relative “health” of a waterbody. In this study, dissolved oxygen concentrations, pH, water temperature and benthic macroinvertebrate data were obtained for Gilleland Creek, and Barton Creek through the City of Austin Watershed Protection Department’s open data portal. Benthic macroinvertebrate assemblages and water quality parameters were analyzed and compared between creeks. Variations in taxa relative abundance, dissolved oxygen, pH, and water temperature were calculated. There was a significant difference in biodiversity between Gilleland Creek and Barton Creek. Barton Creeks higher biodiversity is likely attributed to its higher dissolved oxygen concentration and water temperature, and source of water. The lower biodiversity found in Gilleland Creek is likely attributed to its source of flow, lower dissolved oxygen concentrations, and silty substratum present. Overall, this study confirms that creeks flowing through ecoregions predominantly used for agricultural practices tend to be less diverse than creeks that receive flow from artesian aquifers.

Ladybird beetle population in Johnsongrass meadow
Carlie Anderson – F20

This work aimed to examine the causes of extreme spatial heterogeneity of a population of predatory, aphidophagous ladybird beetles (Coleoptera: Coccinellidae) at Brackenridge Field Laboratory (BFL) in Austin, Texas. Two observations were the exigence for this study. First, I observed an abundance of ladybird beetles in Susie’s meadow, an area dominated by invasive
Johnsongrass (*Sorghum halepense*), and an absence of the beetles in three comparable meadows. Secondly, despite abundant evidence of recent aphid activity, no live aphids were recovered from Susie’s meadow. I asked why the distribution of ladybirds at BFL exhibited such patchiness, and how these predators persisted without an observable population of aphids. To answer these questions, I first compared the herbaceous ground cover communities at Susie’s meadow and three other patches of Johnsongrass at BFL. The ground-covering dicot community in the meadow is distinct from the other patches, and four plant genera were found only in Susie’s meadow. Secondly, I examined the fine-scale spatial variation in ladybird abundance in Susie’s meadow and found that larvae abundance significantly increases with ground cover, but adult abundance does not. Lastly, I conducted behavioral observations of ladybird larvae and adults of two species to examine how each species and life stage may utilize the structure of the Johnsongrass meadow. I observed adult beetles of both species foraging significantly more on the grass’ flowers, while larvae spent more time on the herbaceous dicot ground cover. These results lead me to construct a narrative of an aphid boom and bust cycle, of which I have observed the latter stage, that has created an overabundance of predators that are driven to feed on atypical prey in the absence of aphids. More research is encouraged to determine the frequency, duration, and origination of such aphid population spikes. This work contributes to a larger body of research on predator-prey dynamics in an ecosystem dominated by an invasive species.

**Vertical habitat preference and the effect of temperature of Heliconious butterflies**

Wyatt Armstrong – F20

Differential habitat use across the vertical extent of a tropical forest is essential for the differentiation and niche partitioning of the habitat. This allows many species to coexist in the same geographical area. The vertical habitat preference of three *Heliconius* species of butterfly was observed within a greenhouse at The Brackenridge Field Lab. This study looked at the habitat preference of the three butterfly species and how temperature effects these preferences. It was determined that the elevation effected the number of individuals recorded more than temperature did. A second result relating temperature to elevation suggests that the habitat choices of the butterflies is based of elevation with the vertical extent of the forest and temperature effects overall activity of the species.
Age structure of Laurel Cherry population at BFL
Berit Batterton – F20

Deer, the main large herbivores in woodland ecosystems, have major negative impacts on understory woody vegetation through browsing and antler rubbing. Deer pressure causes a reduction in density and biomass of understory vegetation, leading to an open and simple vertical structure, but vegetation can regenerate following release from deer pressure. At Brackenridge Field Laboratory (BFL), an isolated deer population went extinct in 2015, releasing a local stand of laurel cherries from deer pressure. This study aims to quantify and compare the age structures of two laurel cherry populations with varying deer pressure on both sides of the northwest property boundary of BFL to assess regeneration dynamics. We established five age categories of laurel cherries and performed point-quarter sampling in transects along both sides of the fence. Each population had a relatively uniform age structure. There were no significant differences in the mean densities of laurel cherries in each age category on either side of the fence. This may indicate that the inside population of laurel cherries has regenerated enough to resemble an all-age, stable state population such as the one on the outside of the fence. More likely, this indicates that the methodology used did not provide a fine enough resolution to accurately characterize the age structures of the laurel cherry populations and therefore requires follow-up sampling efforts.

Density and distribution of Juniper trees at BFL
Zachary Blackburn – F20

There are two species of juniper at Brackenridge Field Lab: Juniperus ashei and Juniperus virginiana. The eastern red cedar (J. virginiana), as the name implies, has a range to the east in the United States. In Texas, it is generally east of I-35. Ashe’s juniper (J. ashei) is dominant around central Texas. There is a slight overlap of the species’ ranges, though. The object of this experiment is to determine the abundance and distribution of these two species in Brackenridge Field Lab, and also to estimate, if the habitats of the two species are changing, where the abundance and distribution of these trees will be in the future. To determine the spread and density, the Point-Quarter Method will be employed. Five transects in three habitat zones running parallel to the Colorado River are followed for data collection. The data shows that the Ashe’s juniper is relatively more abundant in the quarry zone and the eastern red cedar is
relatively more abundant in the lower river terrace. The abundance of both species’ canopy trees are equal in the pasture habitat, however there are more *J. virginiana* saplings. The future of both *Juniperus* species’ habitats will remain similar, as there is no significant difference in the proportion of canopies to saplings for both species. More data is needed to determine for certain the habitat preferences of the two species, and what causes their current habitats to be differentiated.

**Post deer succession of Cedar Elm and Laurel Cherry trees at BFL**

*Grant Cardwell – F20*

Deer have been known to significantly restructure and shift compositions of flora in various woodland and forest environments due to browsing pressure. At Brackenridge Field Laboratory, in light of the historical white-tailed deer population trends of the past 30 years, a study on the cedar elm tree, *Ulmus crassifolia*, and the laurel cherry tree, *Prunus caroliniana*, was undertaken to investigate how succession of these species is affected by deer browsing pressure. Several exclosures containing either species provided control groups for analyzing later recovery of trees unprotected by deer browsing. It was hypothesized that deer presence has dramatically altered the BFL understory abundance and age structure for preferred browsing species, while immediate sapling recruitment has followed their local extinction.

Dendrochronology and diameter at breast height (DBH) measurements were undertaken to approximate age-to-size relationships, which were then applied to size class observations of density and regression models for age structure. Results strongly supported deer browsing and succession relationships of both *Ulmus crassifolia* and *Prunus caroliniana*. It is evident that deer presence has dramatically affected the understory abundance and structure of the studied species, while their decline and absence precipitated clear trends of sapling recruitment and increased abundance.

**Vegetation Composition and Grass Community Development of the Beno’er Experimental Meadow**

*Tarryn Dal Santo – F20*

The purpose of this study was to perform an updated survey on the Beno’er experimental meadow at the Brackenridge Field Laboratory in Austin, Texas. Previous studies have been
completed of this meadow in 1988, 2003, and 2019. By using information and results from these studies, a continuation of observance of the grass community in the experimental meadow was able to be done. With the survey completed this fall, the vegetation composition was calculated, and the grass community was identified as best as possible. The time of the survey took place during mid-November 2020 and was done by using similar transect and sampling methods from previous studies. Effects from environmental factors such as drought and the lack of herbivory were used as possible predictors to the current vegetation composition, configuration, and the current grass community dynamics.

Qualitative analysis of the presence of Solenopsis invicta at BFL
Cameron Dickison – F20

*Solenopsis invicta* is a very successful invasive species that has a global range. Introduced to the United States in the 1930s, it has spread quickly to dominate much of the southern region. Many studies have been performed predicting the spread and effects of *Solenopsis invicta* on these ranges, with one area of focus being the Brackenridge Field Laboratory. This study involves the mapping of *Solenopsis invicta* presence through acres in BFL using student survey data from the past 10 years. The findings seem to correlate with past measures, also showing expansion of their range in BFL. The marked decrease in the frequency of fire ant capture may be attributed to a lack of ability to competitively suppress native species in undisturbed environments.

Oak Wilt Spread at BFL
Hannah Januszka – F20

Oak wilt has been a serious problem throughout the United States as it is devastating oak populations. While red oaks are more susceptible to the fungus, white oaks – live oaks in particular – have seen more loss as they connect their roots which allows the fungus to travel throughout the root network. Brackenridge Field Laboratory has been fighting the oak wilt epidemic since the 1960s and today, 60 years later, it has spread throughout nearly the entirety of BFL’s 82 acres. I sampled the live oak population of BFL’s ten transects using the Point-Quarter Method to determine where the current spread of oak wilt is. Each adult oak was assigned a status of alive (L), stressed (S), or dead (D). Stressed oaks were oak trees with signs and
symptoms of oak wilt. A chi-square test was performed to see if the spread of oak wilt has progressed past the epidemic’s front-line of between transects 7 and 8 that was determined in 2016 by another student. I hypothesize that the fungus has spread and that the front-line is now between transects 8 and 9. At each sample site, the presence of Spanish oaks was also recorded as I wanted to test if there was any relationship between dead live oaks and their proximity to the more susceptible red oaks. I hypothesize that sample sites that have Spanish oaks in close proximity would have more dead live oaks. Based on the results from the statistical analyses, oak wilt has spread to transects 8 and 9 as I predicted. I found no significant difference in the number of dead, stressed, and alive oaks in the presence of Spanish oaks when compared to in the absence of Spanish oaks, however. I recommend to only tag new oaks in the fall when Nitidulid beetles are less active and that oak wilt at BFL continues to be monitored for the progression of oak wilt and if new growth occurs.

Meta-analysis of S. invicta
Crespin Linton – F20

The red imported fire ant, Solenopsis Invicta, is an invasive species that was introduced to the southern United States from South American in the 1930’s. These invasive creatures have spread rapidly in North America, even establishing colonies in California and Arizona. Additionally, they have recently been discovered in parts of Australia and New Zealand. There are many factors for the expansion and colonization of fire ants in North American. Some of these factors include disturbance, lack of enemies, and biotic factors. In this meta-analysis, I look at one factor, temperature, and how it affects foraging intensity of the red imported fire ant. I use data from previous independent projects to determine if temperature is a major factor in foraging intensity of fire ants and if there are temperature limits for foraging in these invasive pests.

Carolina snailseed distribution at BFL
Alexia Martina – F20

Carolina Snailseed (Cocculus carolinus) is a native vine with weedy and invasive tendencies because it can spread quickly and is difficult to remove. This is an exploratory study to investigate the specific conditions that are conducive to the presence of Carolina Snailseed (Cocculus carolinus). Data was collected at the permanent T-posts, which were added to BFL in
the fall of 2020. At each T-post, ground cover, shrub cover, canopy cover, habitat type, presence of invasive species, presence of a nearby tree, presence of invasive vines, and presence of Carolina Snailseed was noted. Data analysis using logistic regression and Akaike’s Information Criterion (AIC) revealed that the four most important main effects in predicting the presence of Carolina Snailseed were ground cover, shrub cover, canopy cover, and habitat type. Stacked bar plots detailing the impact of each main effect on Carolina Snailseed site frequency indicated that the relative frequency of the vine was highest at sites with high ground cover, sites with high shrub cover, sites with low canopy cover, and sites located in the upper terrace habitat. The results of this study could be used as a jumping off point for future students investigating ecological questions about Carolina Snailseed and questions that require data collection at these T-posts.

Age structure of Opuntia engelmannii at BFL
Erin McGilvray – F20

Prickly pears are common, resilient, drought-adapted cactus species common in Texas. To better inform predictions of the future distribution of *Opuntia engelmannii* (*var. lindheimeri*), the Texas prickly pear cactus, I surveyed the *O. engelmannii* population at the Brackenridge Field Laboratory in Austin, Texas to identify relationships between environmental factors including canopy cover, ground cover, and cochineal presence and prickly pear age. I counted the number of cladodes, measured height and diameter of cacti, collected data on canopy cover, ground cover, cochineal presence, and recorded the nearest canopy tree species and the GPS coordinates of each cactus encountered along transects. I used the number of cladodes as a proxy for cactus age. Cacti were sorted into age classes based on previously established models relating age and cladode number. I performed linear regressions using R comparing each environmental factor to cactus age and used Fisher’s exact test to find significant differences between these environmental factors at different age classes. *Opuntia engelmannii* showed a preference for open canopies. Only cochineal presence differed significantly with respect to cactus age, with older prickly pears having higher cochineal presence. Limited data collection, a lack of understanding of the relationship between age and cladode number of *O. engelmannii* at this site, and lacking information on interactions between environmental factors likely contributed to the lack of definitive conclusions drawn about the relationships evaluated in this study.
Analysis of Solenopsis invicta research at BFL from 1999 to 2020
Avery McKitrick – F20

Solenopsis invicta is a species of invasive ant that has been wreaking havoc at Brackenridge Field Laboratory in Austin, Texas since the 1980s. Student research on S. invicta is plentiful, but the gaps in this research are not yet quantified. This study begins with a comprehensive literature review of student fire ant research followed by a two-method quantification of student fire ant paper topics from 1999 to 2020 in order to determine the findings of past student invicta research and potential directions for future student research. It was found that while topics such as fire ant foraging, communities, competition, and baiting, are plentiful, there is a lack of student research about the spread of fire ants within BFL, monogyne and polygene colonies, fire ant interactions with other species.

Effects of an invasive fern on the native fern community at BFL
Adam Zambie – F20

The introduction of the non-native fern species Cyrtomium falcatum into Central Texas for ornamental purposes has led to the plant establishing populations of itself outside sites of introduction. A population of C. falcatum occurring in Central Texas at Brackenridge Field Lab (BFL) was studied to examine ecological effects the non-native species has on native ferns. Field observations were made on three native fern species along with C. falcatum to quantify habitat preference, age class structure, and spore production. It was found that an overlap in habitat preference between A. capillus-veneris, T. ovata, and C. falcatum at intermediate levels of sunlight and moisture allowed for competition to take place in BFL’s fern community. This competition has led to alterations in age class structure and reproductive trends for native ferns at no expense to the invader. When in the presence of C. falcatum native ferns were observed to have comparatively low abundances of young sporophytes along with decreased spore production in mature sporophytes. With C. falcatum being observed to have negative ecological effects on the native fern community the invasive species should be identified as a threat to biodiversity at Brackenridge Field Lab and beyond.
Distribution and Abundance of Japanese privets (*Ligustrum japonicum*), Invasive Shrub, at Brackenridge Field Laboratory
Charlotte Lundberg – NODATE

The study examines the distribution and abundance of Japanese privets, *Ligustrum japonicum*, in a relatively undisturbed area, the Brackenridge Field Laboratory (BFL) of the University of Texas, Austin. The Japanese privet is an introduced ornamental plant species that is considered moderately to highly invasive. By using an established transect system at BFL, a number of $25m^2$ quadrats were investigated. The plant's size distribution throughout the area was determined by measuring the basal diameter of each *L. Japonicum* in the quadrats. Habitat characteristics such as rockiness of soil, canopy cover, and slope type were investigated in order to determine the 'preferred' habitat of the species. The plots were marked onto a map, that included approximate locations of old yards that were present in the area previous to the establishment of BFL, as having privets or no privets in order to determine whether the current distribution is correlated to previous human use of the area. No exact correlation with earlier human use of the area was found; however, older individuals of the species were most likely planted by humans and are currently dispersing seeds in the area. The preferred habitat type of Japanese privets was determined to be areas with low percentage rockiness and flat to moderately flat ground. The degree of canopy cover did not affect the distribution of the shade tolerant species.

The Effects of Size and Species Type on the Feeding Behavior of Birds
Sunetra Tarafdar – NODATE

The feeding behaviors of different bird species at Brackenridge Field Laboratory were investigated. The different focuses of this study included seed size preference with bird size, feeding location preference and bird size, competition gradient and specie type and size and competition gradient and density of the bird groups. It was found that there was no seed size preference found with the different sizes of the birds. Most birds, regardless of their size choose to eat small sized seeds. There was a preference for the location of feeding found, with larger birds eating at the center and smaller birds eating at the periphery. The competition gradient showed that larger birds were more dominant over smaller birds and there was no effect for
density of group size found in relation to the competitive gradient. These findings suggest that bird size does affect bird competitive feeding behavior.

Host preferences and correlated effects of *Tillandsia recurvata* presence and abundance as surveyed on the live oaks of Brackenridge Field Laboratory in Austin, TX

Courtney Greene – NODATE

*Tillandsia recurvata* and other atmospheric bromeliads have a unique evolution and ecophysiology. Much research concerning this epiphytic species has been conducted. The main objective of this experiment was to investigate the abundance of *T. recurvata* exclusively by its presence on 46 live oak individuals of BFL. Both the potential host preferences and effects of *T. recurvata* upon its host and immediate environment were examined. The possible correlation between *T. recurvata* abundance and various factors of the live oak host were determined using chi-squared values and 5x4 contingency tables. These variables included bark type, canopy cover, and the degree of foliage. With respect to the host preferences of *T. recurvata*, the degree of abundance could be positively correlated with the diameter and roughness of the live oak specimens. No significant correlation was indicated between epiphyte abundance and the canopy cover of the host. In regard to the potential effects of *T. recurvata*, a significant negative correlation was indicated between the abundance of *T. recurvata* and the foliage of the host. On the other hand, no marked relationship could be determined between *T. recurvata* abundance and the number of neighboring trees affected by ball moss. Based on the correlations observed at BFL, as their diameter increases, and bark grows coarser and more grooved, live oaks provide an increasingly favorable environment for the establishment and colonization of *T. recurvata*. Also, *T. recurvata*, when in abundance, can cause diminished or complete loss of foliation upon its live oak host.

**Diversity of Insects**

Jimmy Pribble –

Does the diversity of insects that are found around different species of trees vary? If so, what could be a logical explanation for this outcome? It is hypothesized that the diversity of the insects found around different types of trees varies, and that this is due largely to the fact that the trees contribute different materials to the surrounding soil. This is the alternative hypothesis, and
the null hypothesis that the diversity of insects does not vary between the different types of trees, and that the species richness is also relatively the same for each type of tree.

Woodpecker Abundance and Habitat Use in Brackenridge Field Laboratory

Alec Blair – NODATE

Brackenridge Field Laboratory (BFL) is home to five different woodpecker species: the Red-bellied woodpecker (*Melanerpes carolinus*), Ladder-backed woodpecker (*Dryobates scalaris*), Yellow-bellied sapsucker (*Sphyrapicus varius*), Downy woodpecker (*Picoides pubescens*), and Northern flicker (*Colaptes auratus*). All of these species rely on macroinvertebrates found on trees in woodland environments. BFL hosts three different habitat types: Quarry (Q), Pasture (P), and River terrace (R). Rapid bird surveys were conducted at random sites in each of the habitat types to better understand the woodpecker uses of different habitats and to gain a better understanding of potential species preferences for habitat, tree type, or tree survival state (dead or alive). Contingency tables were created to compare species to each environmental factor and chi-squared tests revealed that there were significant preferences between woodpecker species and habitat type and tree survival state. Tree species did not reveal any significant preference. There was an overall preference for dead trees over live trees. Woodpecker species diversity revealed highest abundance of Ladder-backed woodpeckers and Red-bellied woodpeckers, followed by Downy woodpeckers. Within each species, significant trends were identified: Red-bellied woodpecker density was highest in the River terrace and Ladder-backed woodpecker density was highest in the Pasture habitat. This was backed by a heavy preference for pecan trees by the Red-bellied woodpeckers and for sugar hackberries for the Ladder-backed woodpeckers. Other observed factors were also significant, such as the presence of avian predators reducing overall species richness within a single survey, and phenology impacting total species richness with significant preference for morning and evening.

The effects of mound disturbance on red imported fire ant, *Solenopsis invicta* Buren, food preferences

Melanie Oxley

This study investigated how mound disturbance affected food preferences of the red imported fire ant, *Solenopsis invicta*. I used twelve naturally occurring colonies. Six colonies
were left in their natural state; I disturbed the other six colonies by destroying the mound. Each independent ant colony was offered three food sources that represented one of three macromolecular groups: fats (boiled egg yolk), carbohydrates (honey), and proteins (boiled egg whites). Four ml of each food were placed on a tin foil square. The foods were randomly ordered at each trial and placed 8 cm from each other and 15 cm from the mound’s edge. I began timing when all foods were in place and after I disturbed the experimental mounds. The number of ants feeding at each food choice was counted every five minutes for 1h. I observed individual and colony reactions during the trials-to see how food preference and motivation was affected in disturbed and undisturbed mounds. Analysis of variance produced significant differences between the three macromolecular food groups (p-critical = 0.05) within the disturbed and undisturbed mounds (p-value = 0.019 and p-value = 6.43E-05 respectively); honey was preferred, fats were second and proteins were last. T-testing between the disturbed and undisturbed food preferences allowed no significant (t-critical = 4.302, t-value = 0.379); I observed that disturbed mounds were less motivated to recruit food and were more likely to tend to the destroyed nest and exposed brood. Individuals of undisturbed mounds increased in number over time at the preferred food source – honey.

Rapid bioassessment of two sites at the Brackenridge Field Laboratory using benthic macroinvertebrates
Anne Small

Macroinvertebrates are commonly used to determine the water quality of an area as they appear in large numbers in a wide variety of habitats and have a wide spectrum of responses to disturbances. In this study, I used taxa richness, enumerations, community diversity, and biotic indices to assess the water quality of Town Lake and Pond F at Brackenridge Field Laboratory. I predict that because Pond F is located within a natural preserve, it will have a higher water quality than Town Lake. I used aquatic nets and collected the first 100 insects I encountered at each location. When sorted, I found that the dominant taxon in Pond F was Libellulidae and the dominant taxon at Town Lake was the Asiatic clam (Family: Pelycypoda), which is an invasive species. Contrary to my original prediction, I found that Town Lake had a higher water quality than Pond F did which may have been due to sampling methods. Collected specimens were taken
from the water banks. Collecting from various points throughout both bodies of water may have yielded different results.

**The Effects of Fire Ant Abundance on Harvester Ant Colonies**

Christine Edeus

Invasive species are often successful because they have no natural predators and can thus grow unrestrained in their new environment. On top of this, some invasive species, such as the Imported Fire Ant (*Solenopsis invicta*), have other characteristics that help them succeed such as the preference for areas with high disturbance levels, a tolerance to a wide range of climactic conditions, and a polygyne colony form with multiple queens. *S. invicta* has already outcompeted Texas’ native fire ant, *Solenopsis geminata*, at Brackenridge Field Laboratory so in this study, I examine the impact the IFA has on another ant species – the Harvester ant. Ant baits were set out at known Harvester ant colonies at BFL and at Barton Springs public recreation area as the IFA impact is largely unknown in that area. Baits were also set out at suitable, unoccupied Harvester ant habitats and unsuitable, unoccupied Harvester ant habitats. Even though the Harvester and fire ants do not share a similar food source, my results show that Harvester ants are not immune to the fire ant invasion. Large numbers of fire ants were observed in the suitable, unoccupied habitats that were baited which may imply that the fire ants are pushing the Harvester ants further outwards. Continued monitoring of the spread of *S. invicta* will allow us to make predictions about not only the future of Harvester ants, but other native ant species as well.

**Territoriality response of northern cardinals (Cardinalis cardinalis) to male song recordings in a playback experiment**

Michelle Embleton

There are two types of bird vocalizations: calls and songs. Calls are short, simple and produced by both sexes throughout the year while songs are produced by males during the breeding season to attract a mate. Males use the loudness of the song and repetition as ways to defend their territory. In this study, I used a playback sound of five different recordings of bird songs to observe any territorial responses of cardinals in the area. Prior to each song, I observed the area for five minutes. I would then play the first song for five minutes, end it, and observe for five more minutes. I did this for four sites with a total of five different songs. Based on my
results, I found that there was less than a 5% chance of a male at a particular site having a greater response to the recording than a male would at a different site. After further research, I found that males will tend to ignore or have a weakened response to the abnormal repetition of a stimulus which could have impacted my results. A longer trial time with more data points may provide more valuable insight to the territorial response of male cardinals when faced with an unknown song.

**Juniperius Ashei**

**Kristin English**

In this study I aim to identify the distribution, abundance, and size structure of *Juniperius ashei* at Brackenridge Field Laboratory. In addition to this, I want to determine if *J. ashei* has reacted similarly to the microenvironments present at BFL. Ten random plots of 900 ft\(^2\) each were selected from each of the four terraces present at BFL and a survey of *J. ashei* was conducted. The features and characteristics of each plot were also recorded to use for comparison. Terraces 1 and 2 seemed to be favored by the juniper trees over terraces 3 or 4. This could be due to the fact that juniper trees require a well-drained area and terraces 3 and 4 are located near a stream which is prone to flooding. I also found that the trees favored areas with minimal soil rockiness and areas with a flat slope. Based on the collected data, it seems that *J. ashei* responds differently to the microenvironments at BFL.

**Aquatic Biomonitoring Suggests Unhealthy Water Conditions for Benthic Macroinvertebrates at BFL**

**Claude Murugen**

Macroinvertebrates are considered indicator organisms and their presence is telling on the quality of the ecosystem. I collected macroinvertebrates from two locations at Brackenridge Field Laboratory to check their water qualities. Samples were collected from town Lake and Pond F at BFL using an aquatic net. The first 100 insects I came across I collected and stored in vials for later identification. Based on my analyses, Town Lake had more species and a higher diversity than Pond F. From this, I believe Town Lake has a higher water quality than Pond F as the species richness is greater, although this could be due to the fact that Town Lake is much
larger than Pond F as well. Overall, continued biomonitoring is needed to view the changes in species compositions over time.

Leaf litter impact on soil moisture content
Ryan Bayer

Vegetation typically requires availability of sunlight, nutrients, and water in order to output the highest productivity rates. Water availability, or soil moisture levels, may be the most important of the three. I developed an experiment in Susie’s Meadow at BFL to determine the effects leaf litter has on soil moisture content. Soil samples were taken from inside five enclosures and from outside of the enclosures. The samples were weighed, dried, and then weighed again to determine the moisture content. Lead litter was also measured with each soil sample. I found a strong correlation between soil moisture content and amount of leaf litter within the enclosures; however, no correlation was found between the two outside of the enclosures. This may be due to the presence and overgrazing of white-tailed deer, however this result was still puzzling.