Reports on Bull Creek and Gus Fruh Parks

Tim Fennell's Planet Earth Classes

LASA High School

Fall 2015

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Northern Mockingbird Proximity to Urbanization at Bull Creek District Park Austin

By Erick Medina (s2103056@gmail.com) and Isaac Stone (Isaacbstone@gmail.com)

Fall 2015,

Mr. Fennel periods 2/6

Changes to study

After three data sets were taken the el Niño storm system hit the park flooding the original transects of study. After the flooding new transects were established within the same park, though the new transects did not have the same characteristics as the old transects. The new transect with proximity to urbanization no longer bordered a residential district, in fact it ran along a road that led through the Bull Creek park. The second new transect wound around a lot, and had a higher elevation than the other. In addition the vegetation on that new transect was different and from this transect the highway was an obvious feature of the surroundings.

Conclusion

During the first three data collections 3.8 more birds were found on average in areas further from urbanization though in the last three, the opposite was true by a larger margin of 48.58 birds per 12.5 hectare. This is demonstrated by the graph of first three data sets versus last three data sets graph. Close to urbanization the new transect which was even more obviously urbanized had a larger number of detections than the old transect with a ratio of 58.33 to 40.29. On the transects farther from urbanization the original transect was more populated, though the newer transect had different sorts of vegetation and a higher elevation than the original transect. The original transect had a population estimate of 44.17, and the new transect had an estimate of 9.75. Overall the transects that were close to urbanization had a larger population estimate averaging 49.31 mockingbirds in 12.5 hectares as opposed to the transects that were farther from urbanization with an average population estimate of 26.96. Over time, birds far from urbanization tended to be less frequent though no weather correlations were found During the first three data collections 3.8 more birds were found on average in areas further from urbanization though in the last three, the opposite was true by a larger margin of 48.58 birds per 12.5 hectare. This is demonstrated by the graph of first three data sets versus last three data sets graph. Close to urbanization the new transect which was even more obviously urbanized had a larger number of detections than the old transect with a ratio of 58.33 to 40.29. On the transects farther from urbanization the original transect was more populated, though the newer transect had different sorts of vegetation and a higher elevation than the original transect. The original transect had a population estimate of 44.17, and the new transect had an estimate of 9.75.

Overall the transects that were close to urbanization had a larger population estimate averaging 49.31 mockingbirds in 12.5 hectares as opposed to the transects that were farther from urbanization with an average population estimate of 26.96. Over time, birds far from urbanization tended to be less frequent though no weather correlations were found

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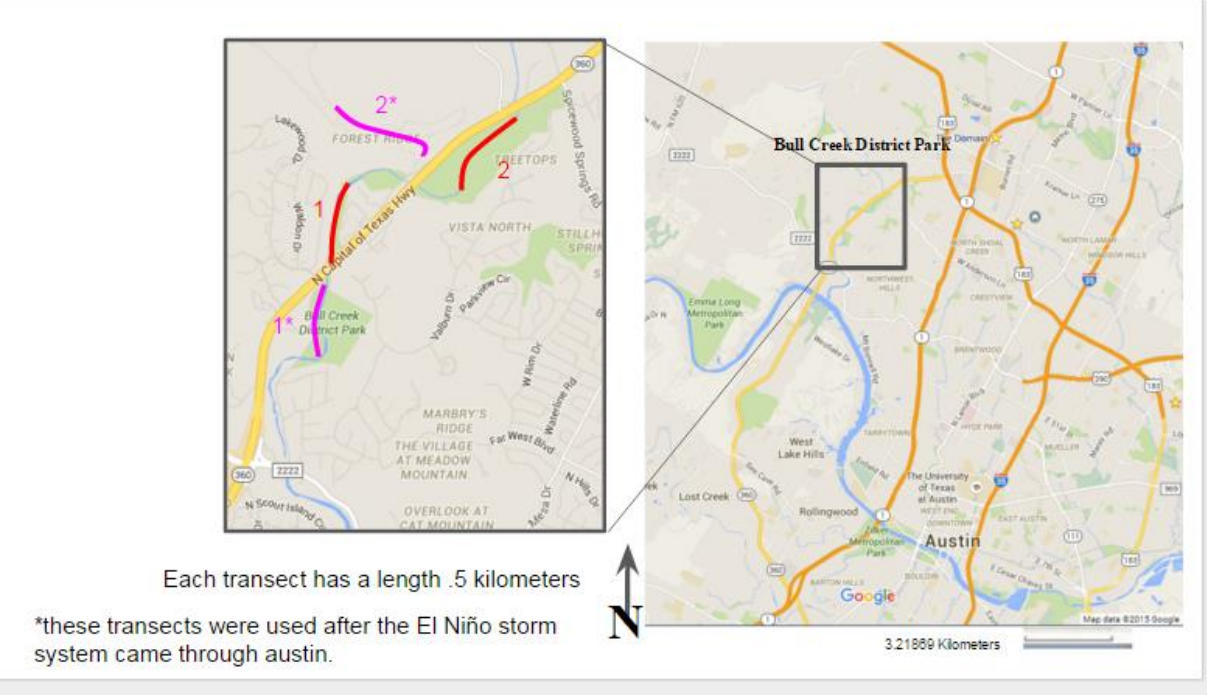

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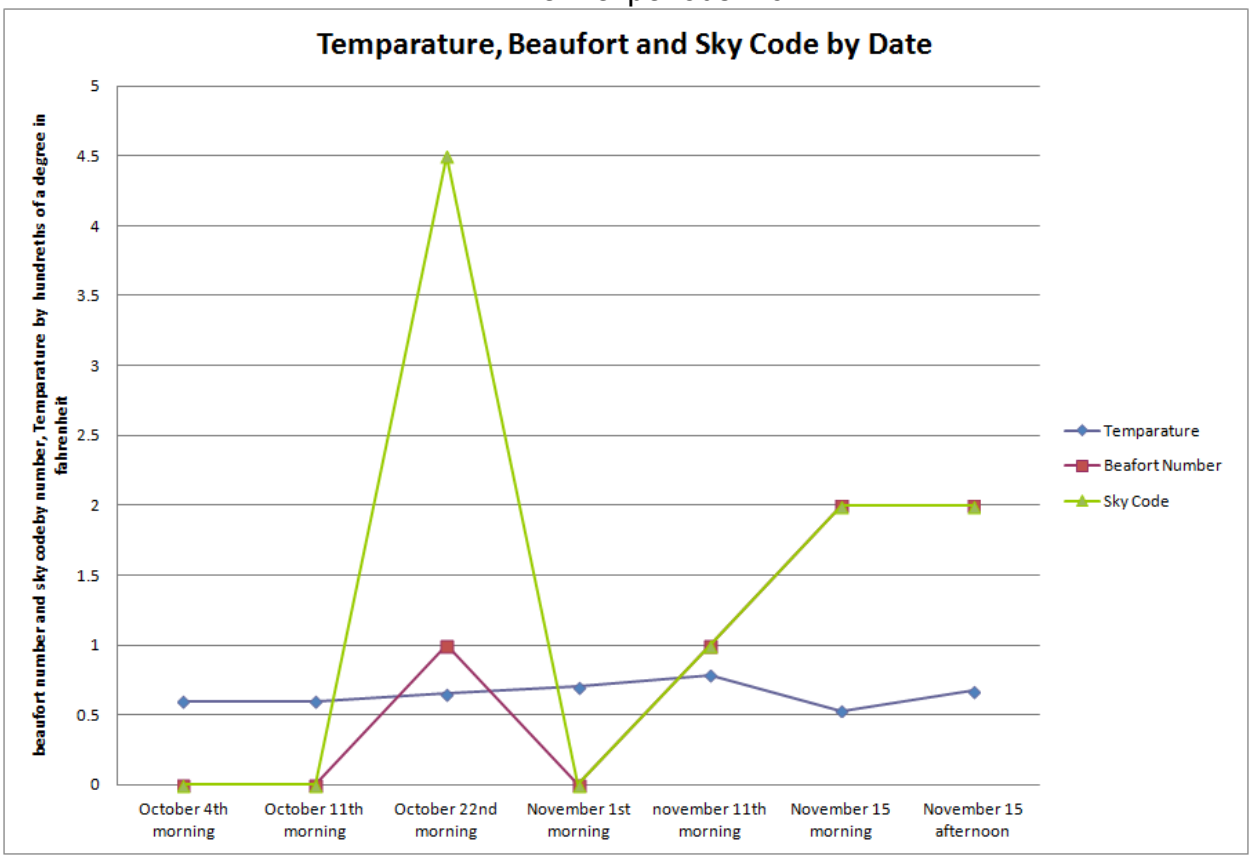

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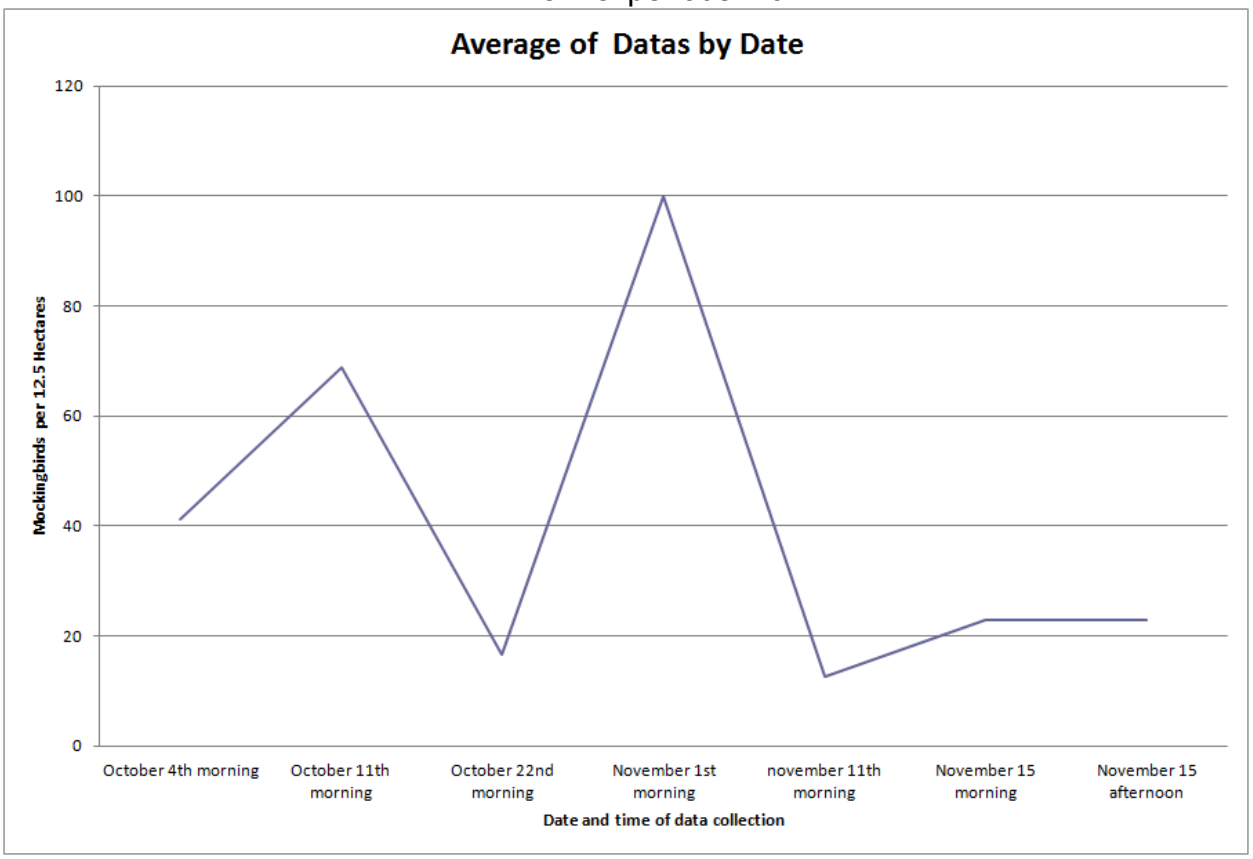

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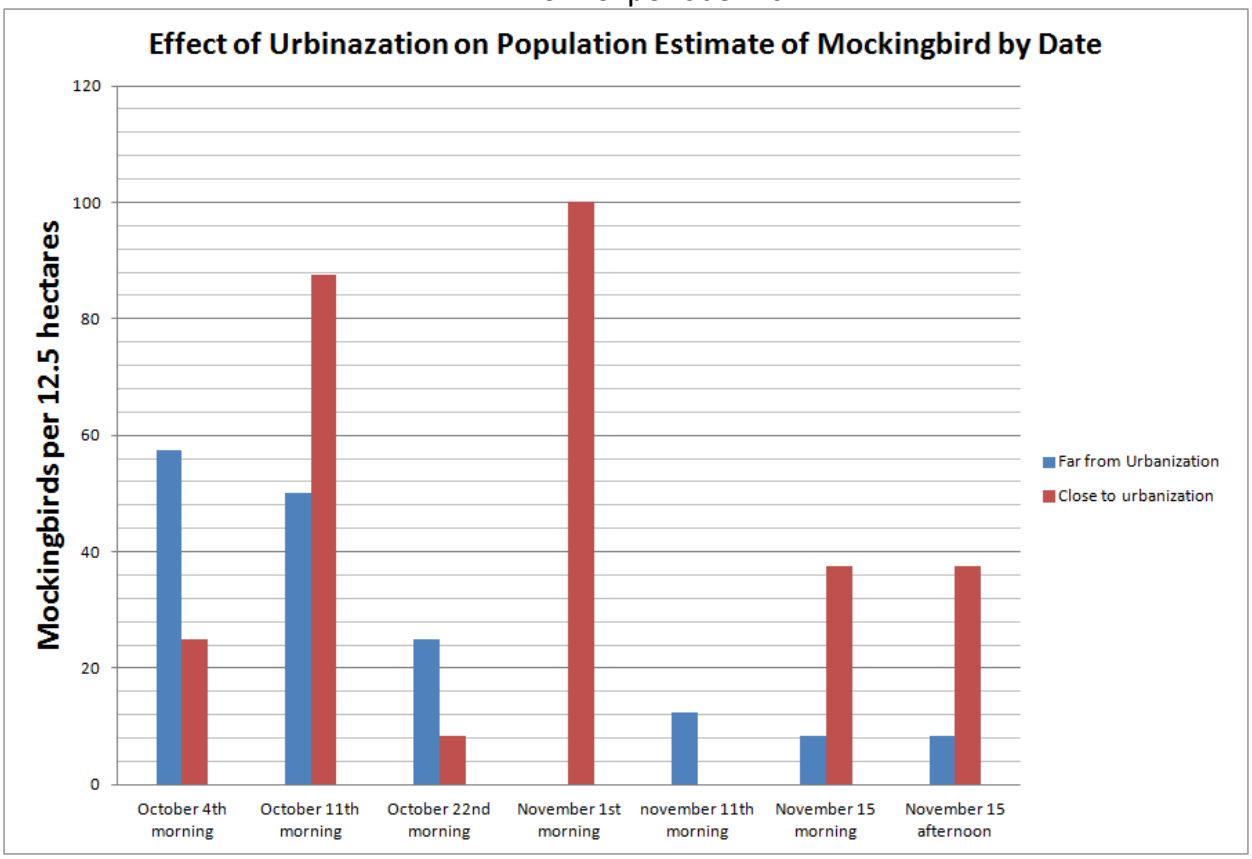

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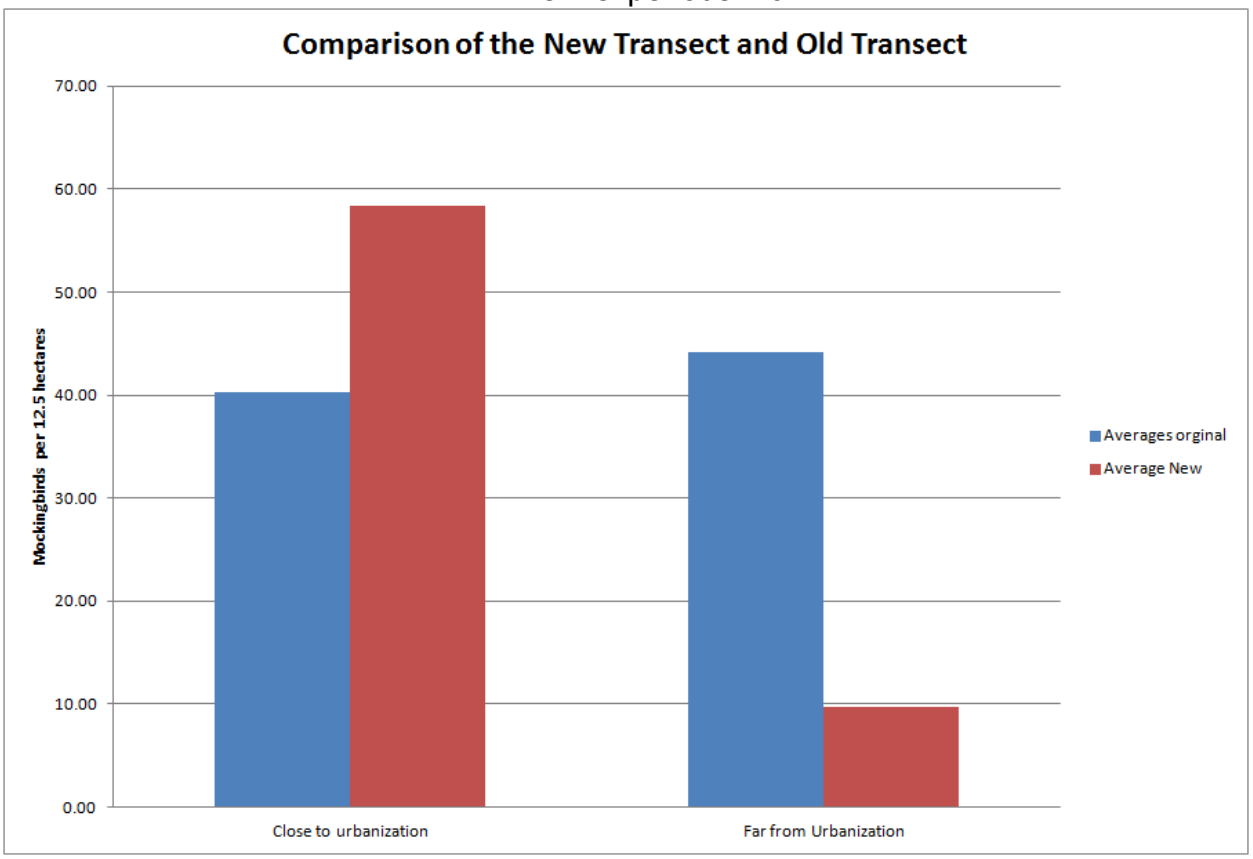

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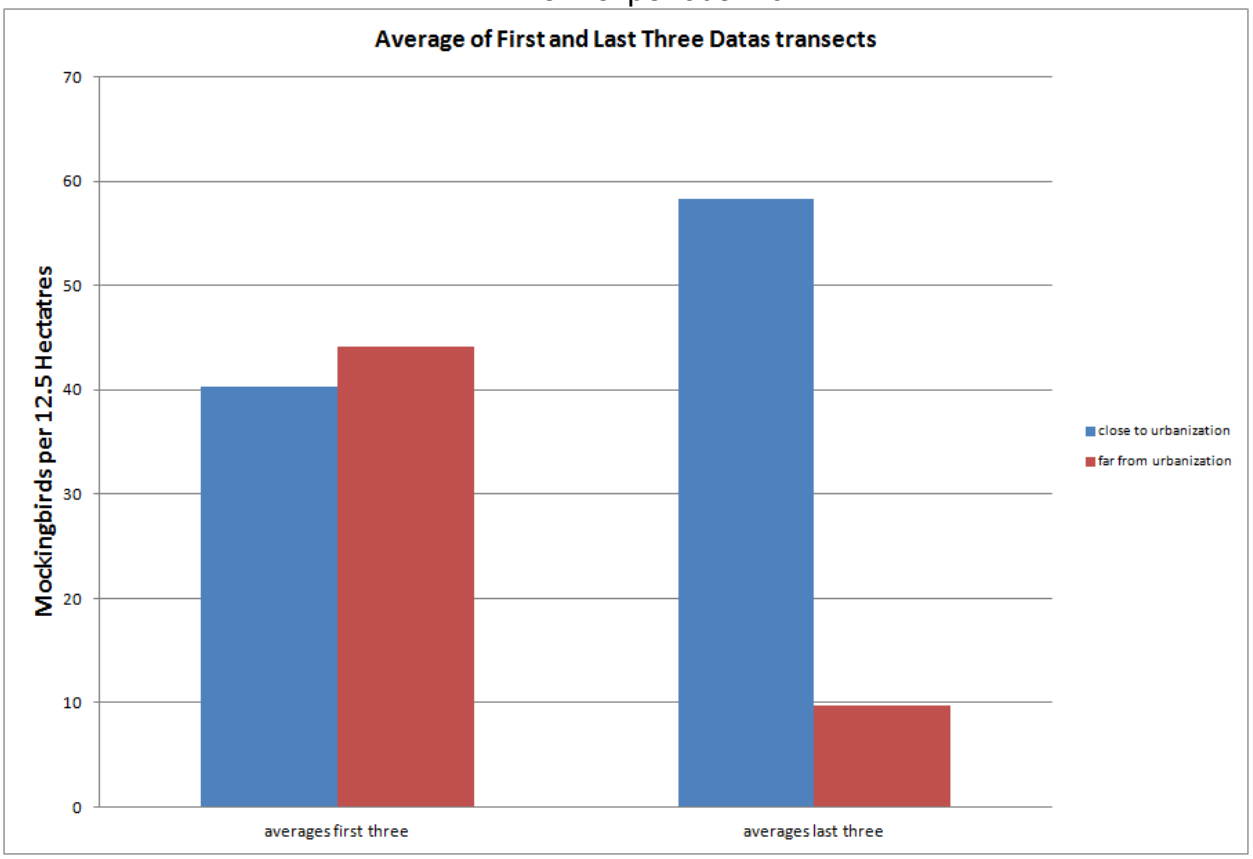

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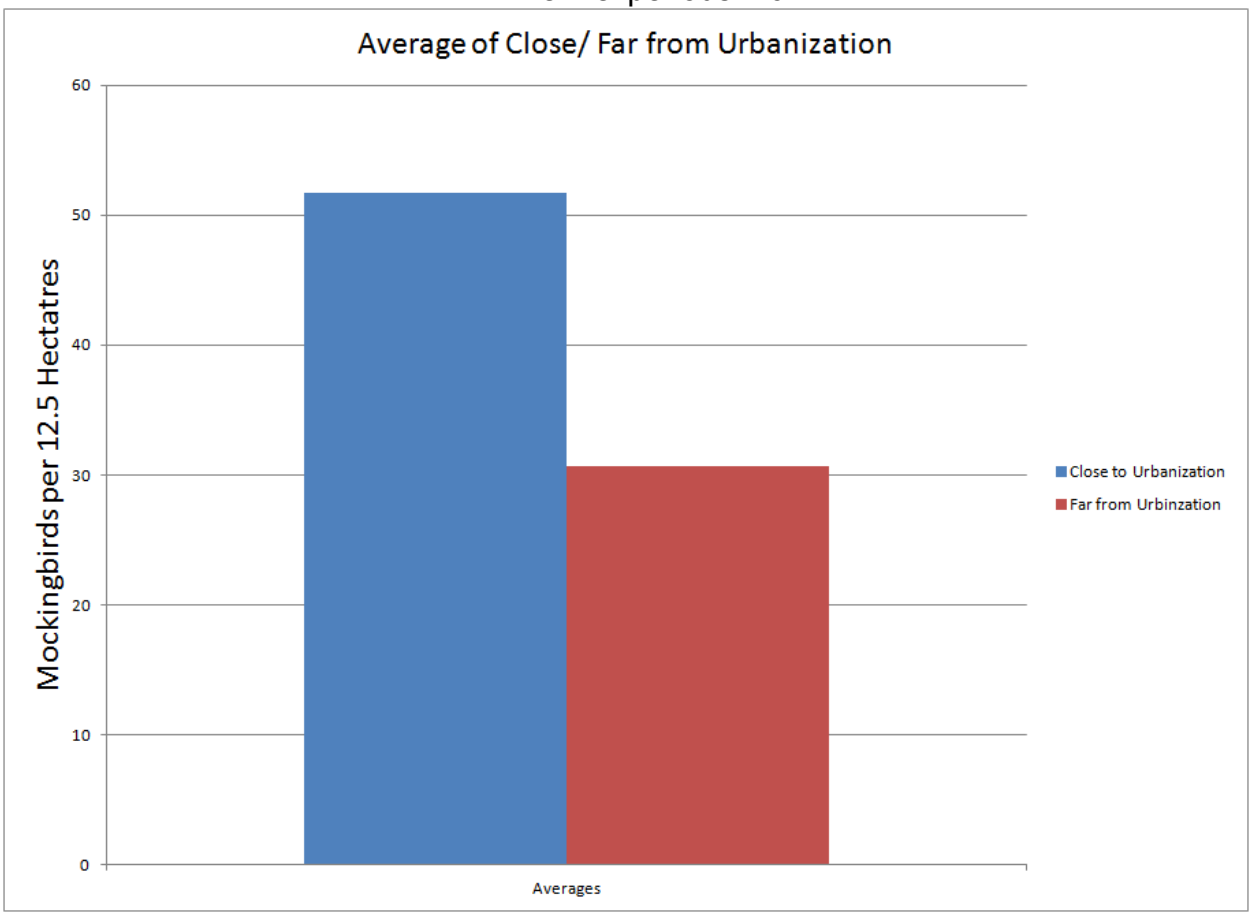

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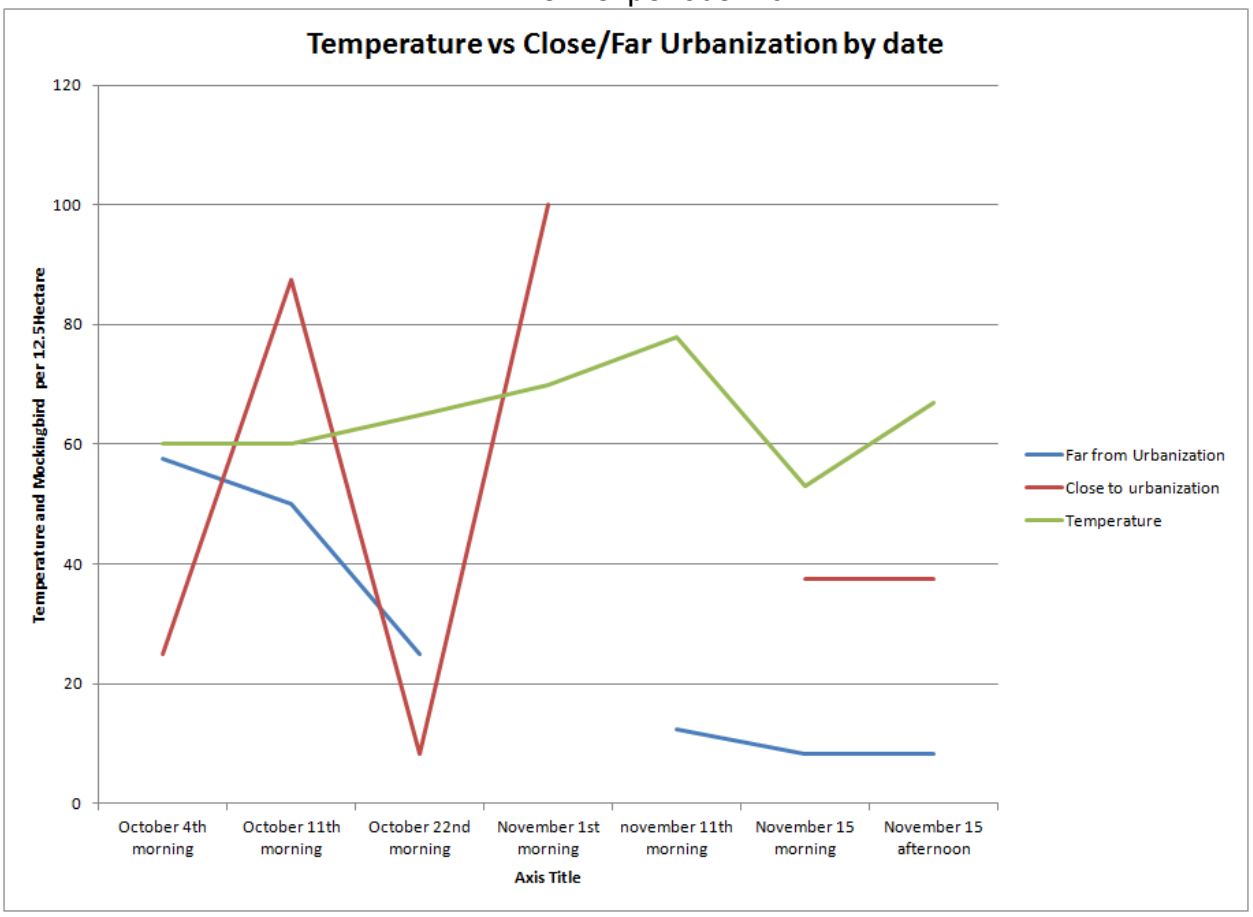

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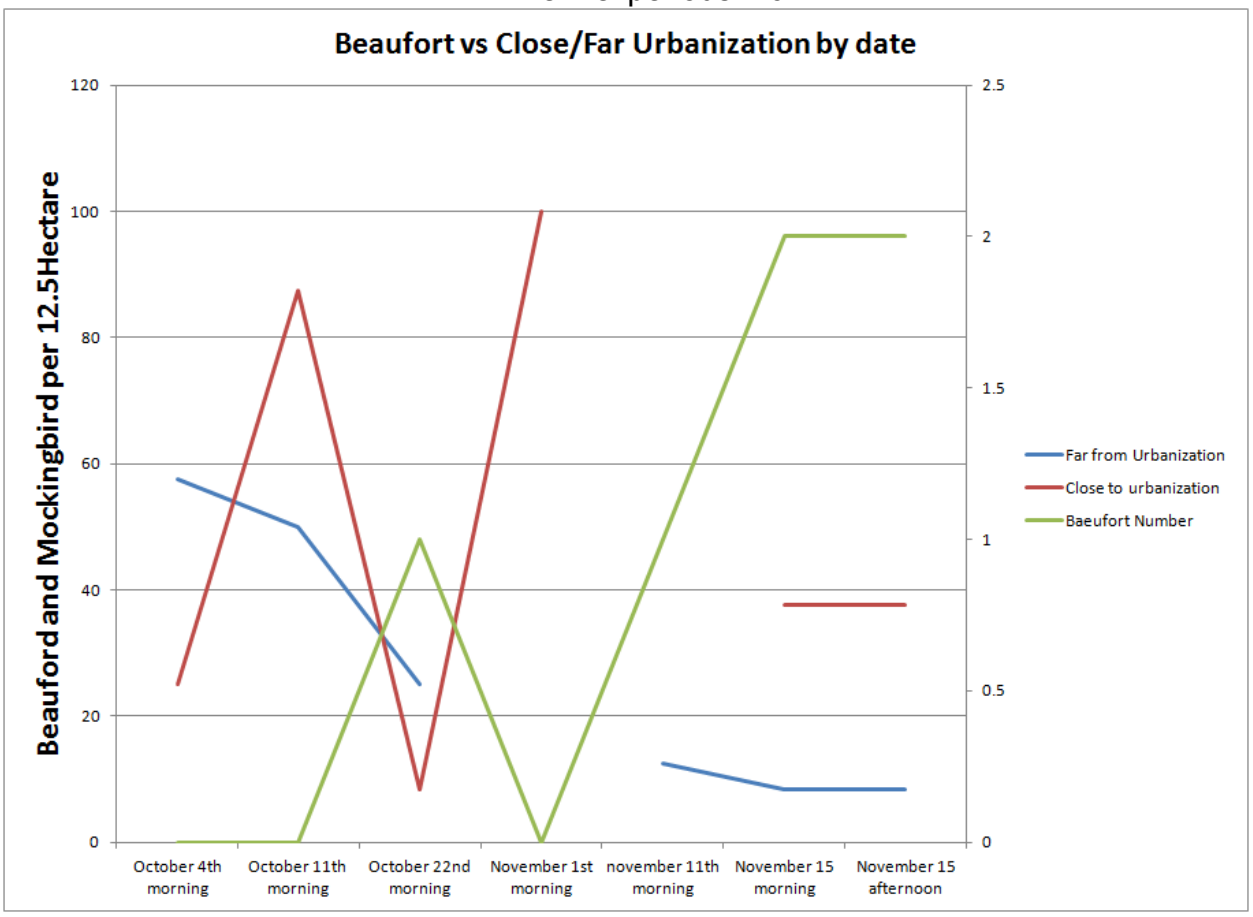

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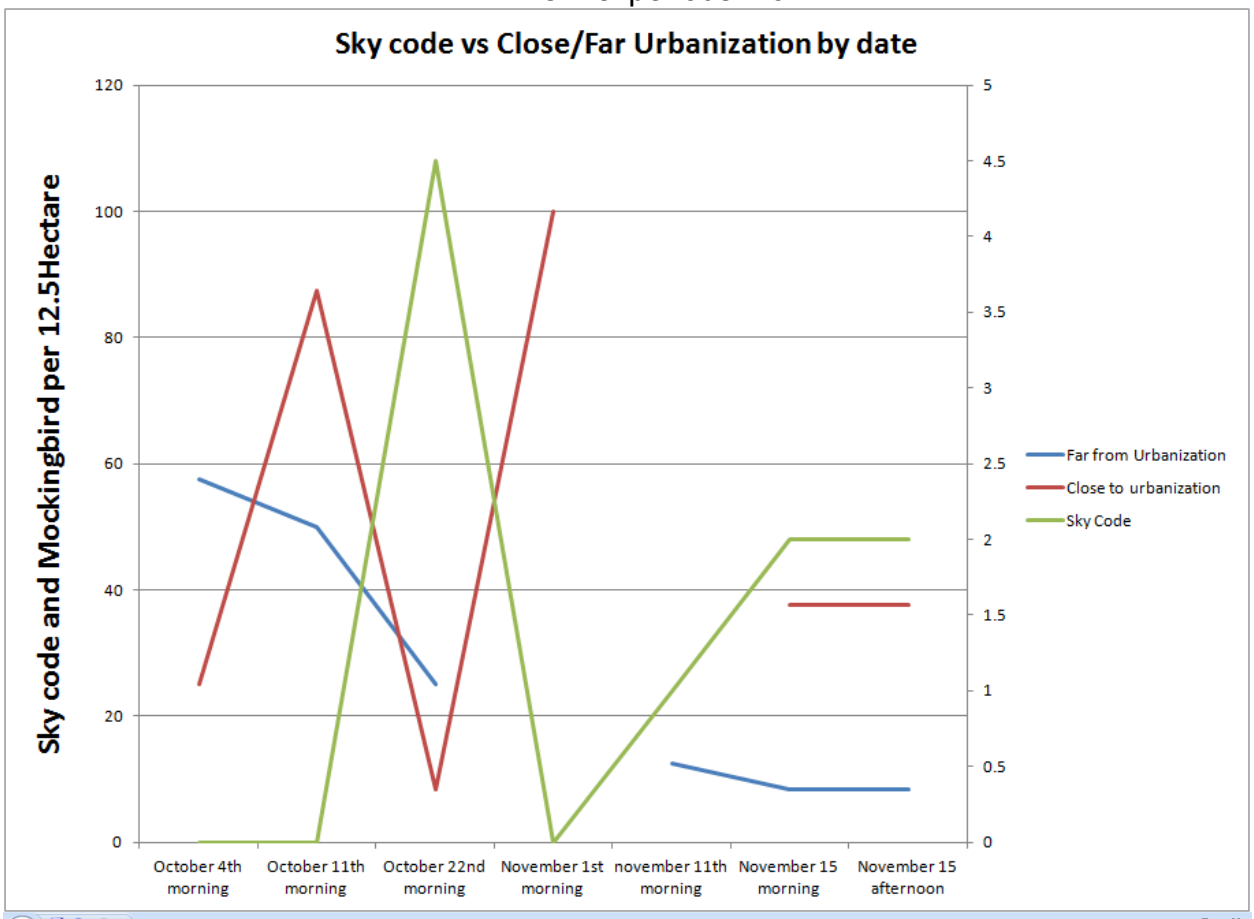

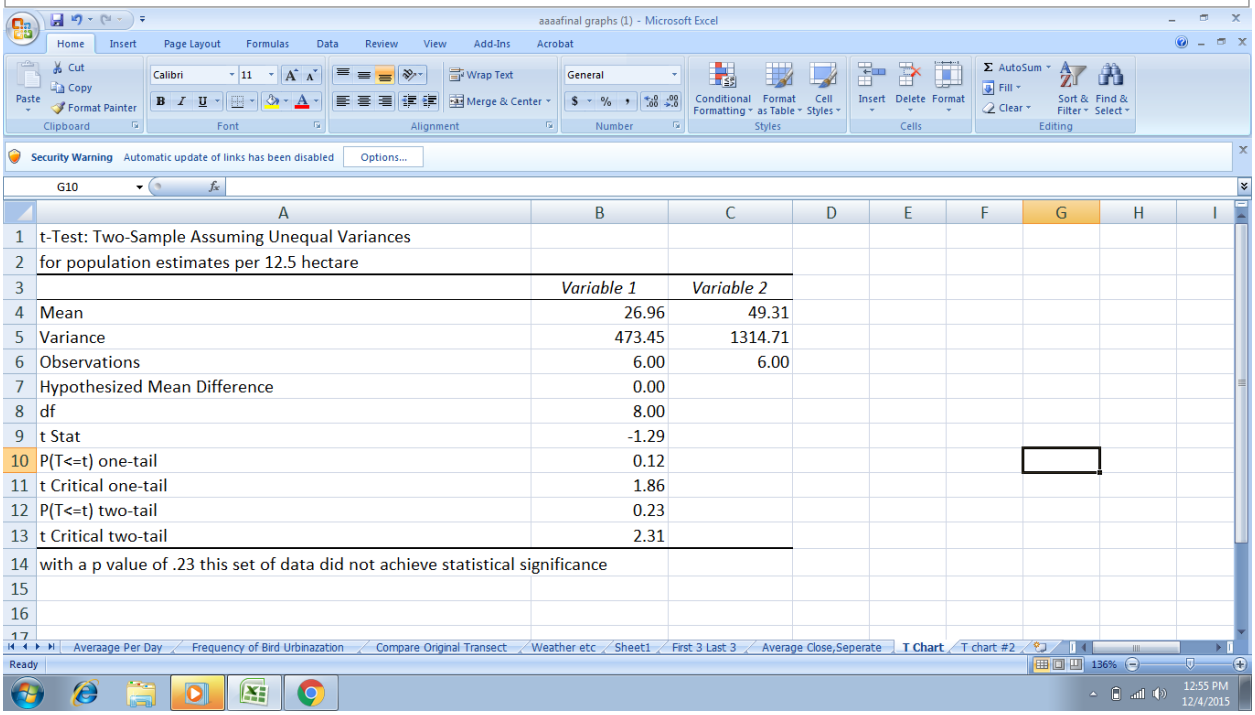

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	A	B	C	D	E	F	G	H	I
1	t-Test: Two-Sample Assuming Unequal Variances								
2	for population estimates per 12.5 hectare								
3		*Variable 1*	*Variable 2*						
4	Mean	26.96	49.31						
5	Variance	473.45	1314.71						
6	Observations	6.00	6.00						
7	Hypothesized Mean Difference	0.00							
8	df	8.00							
9	t Stat	-1.29							
10	P(T<=t) one-tail	0.12							
11	t Critical one-tail	1.86							
12	P(T<=t) two-tail	0.23							
13	t Critical two-tail	2.31							
14	with a p value of .23 this set of data did not achieve statistical significance								
15									
16									
17									

Average Per Day | Frequency of Bird Urbinazation | Compare Original Transect | Weather etc | Sheet1 | First 3 Last 3 | Average Close,Seperate | T Chart | T chart #2

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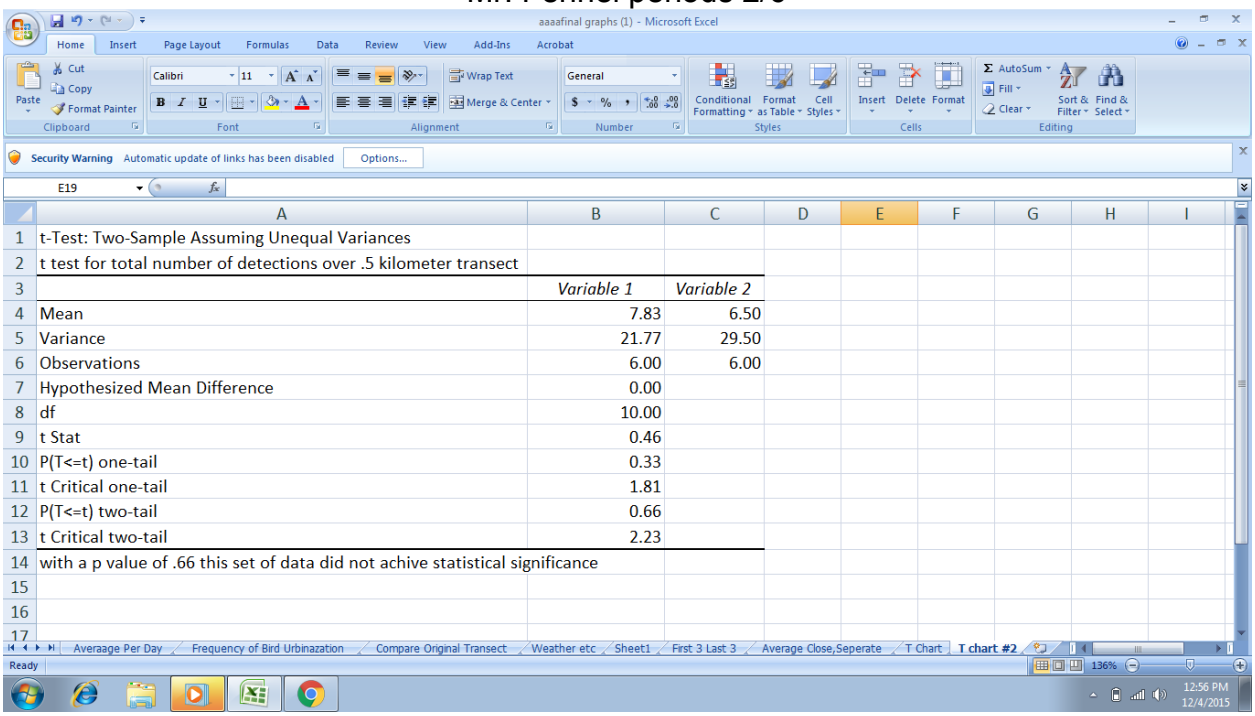

aaaafinal graphs (1) - Microsoft Excel

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E19

	A	B	C	D	E	F	G	H	I
1	t-Test: Two-Sample Assuming Unequal Variances								
2	t test for total number of detections over .5 kilometer transect								
3		*Variable 1*	*Variable 2*						
4	Mean	7.83	6.50						
5	Variance	21.77	29.50						
6	Observations	6.00	6.00						
7	Hypothesized Mean Difference	0.00							
8	df	10.00							
9	t Stat	0.46							
10	P(T<=t) one-tail	0.33							
11	t Critical one-tail	1.81							
12	P(T<=t) two-tail	0.66							
13	t Critical two-tail	2.23							
14	with a p value of .66 this set of data did not achive statistical significance								
15									
16									
17									

Averaage Per Day | Frequency of Bird Urbinazation | Compare Original Transect | Weather etc | Sheet1 | First 3 Last 3 | Average Close,Seperate | T Chart | T chart #2

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Effects of Proximity to Water on Diversity of Plants

By: Sreenidhi Tupuri (sreenidhi.tupuri@gmail.com)
and Kalyani Allums (kalyani@auspicious.net)

Conclusion

Results:

The original hypothesis was that the diversity of plant species would increase as the proximity to water increased. The results instead showed that the diversity of plants slightly increased further away from water. They were a total number of 11 species close to water and there was 12 species away from water. The two species that were prominent in a specific area are Ashe Juniper and Plateau Live oak. The Relative Density of Ashe Juniper over 50 meters away from water was 16.7 percent greater than the relative density of Ashe Juniper within 10 meters of the creek. The relative Density of Plateau live oak within 10 meters of the creek was 21.4 percent greater than the relative density of Plateau live oak over 50 meters away from the water.

Similarly, looking at the Relative Dominance graph, it is clear that Ashe Juniper is very dominant over 50 meters from the creek and Plateau Live oak is very dominant under 10 meter of the creek. All the species reacted with the proximity to water, though not necessarily in the same way. Some increased in the number of Individuals when they got farther away, some closer to the creek. In a study conducted by Gandiwa Edson, it was found that in Zimbabwe, as the distance away from 4 different water points increased, so did the diversity of the woody plants in the area (Edson).

It is shown in the Importance Value graph that Plateau Live oak, Honey Mesquite, and Sugar Hackberry were greatly affected by the proximity to water. Both Plateau Live Oak and Honey Mesquite had a higher importance value under 10 meter from the water, whereas Sugar Hackberry had a higher Importance Value over 50 meter from the water.

One of the species in the final data was invasive: *Nadina domestica*. This species probably did not affect the data because of its low importance value.

The data for the number of individuals was not statistically significant with a p-value of 0.95. The data for the number of species was not statistically significant with a p-value of 0.90. And the data for the relative density of Ashe Juniper was not statistically significant with a p-value of 0.54.

Discussion:

In a study in Zimbabwe, this diversity increased as the distance from the pond increased could be a model for the data found in the study. It is most likely that the data wasn’t varied much because

of the test group size being too small. The results reflect the study done in Zimbabwe, except the Zimbabwe study had a much larger test group size than the study conducted at Bull Creek.

A reason why the Ashe Juniper may have flourished farther away from the creek is because it appears to react positively to droughts, shown in a survey taken that concludes that droughts make it impossible for others to survive but allow hardier plants to have less competition. According to the study, "periodic droughts, particularly when associated with overgrazing, may also play a role in their spread. The weakened, open herbaceous cover could be less resistant to juniper invasion following droughts when favorable rainfall conditions return. On the other hand, long-term droughts, such as the one of the 1950's, can cause extensive mortality of large, mature, Ashe juniper, although, smaller size classes apparently survive droughts better than associated species such as live oak," explaining why Ashe Juniper would have been more predominant than Plateau live oak in the area (Smeins and Fuhlendorf).

It is seen that Plateau Live Oak thrives better with closer proximity to water because "Like most trees, live oak thrives on moist well-drained soils," and would value the water enriched soil in the area directly around the creek bed (Bartlett Tree Experts). At the site of Bull creek debris shows the flood line which encompasses places where the roots of most of the Plateau Live Oaks are located.

Many studies of woody plants show that the closer to water the less woody plants and the less diversity between them are present. A study done in Ethiopia by Gemedo Tussie showed that closer to the pond the study was conducted around, 1,433 plants per hectare were found near the pond, but 2,780 plants per hectare were found away from the pond with a greater number of plant species and plant density in the areas away from the pond (Tussie).

The most plausible explanation for the results is that diversity increases the further away from water because the areas too close to the water have soil that is often saturated with too much water. Also constant flooding may make it harder for smaller woody plants to survive.

In the original study modifications were made to change the distance away from water from 100 meters away to 50 meters away so that the data wouldn't be absurdly skewed with invasive species because it would have otherwise been very close to the neighborhood. Also, some for the data was taken on a day when the creek level was low and vast swathes of the creekbed were left exposed, but the other data sets were taken right after flooding in the area.

If the study was redone it could be modified to be a more valid study by taking more data, being more precise with the exact intercept on the transect, and perhaps taking studies only on the side of the creek that did not directly border the neighborhood so that there would not be any invasive species. The data could have all been taken at one time or at the same type of weather and water level conditions.

Other studies that could be done in the Bull Creek area could be a study about how elevation affects plant diversity. A study about proximity to urban or industrial areas affects the diversity of plants and the number of invasive species in the area could be a potential study that may shed light on the plant diversity in that area.

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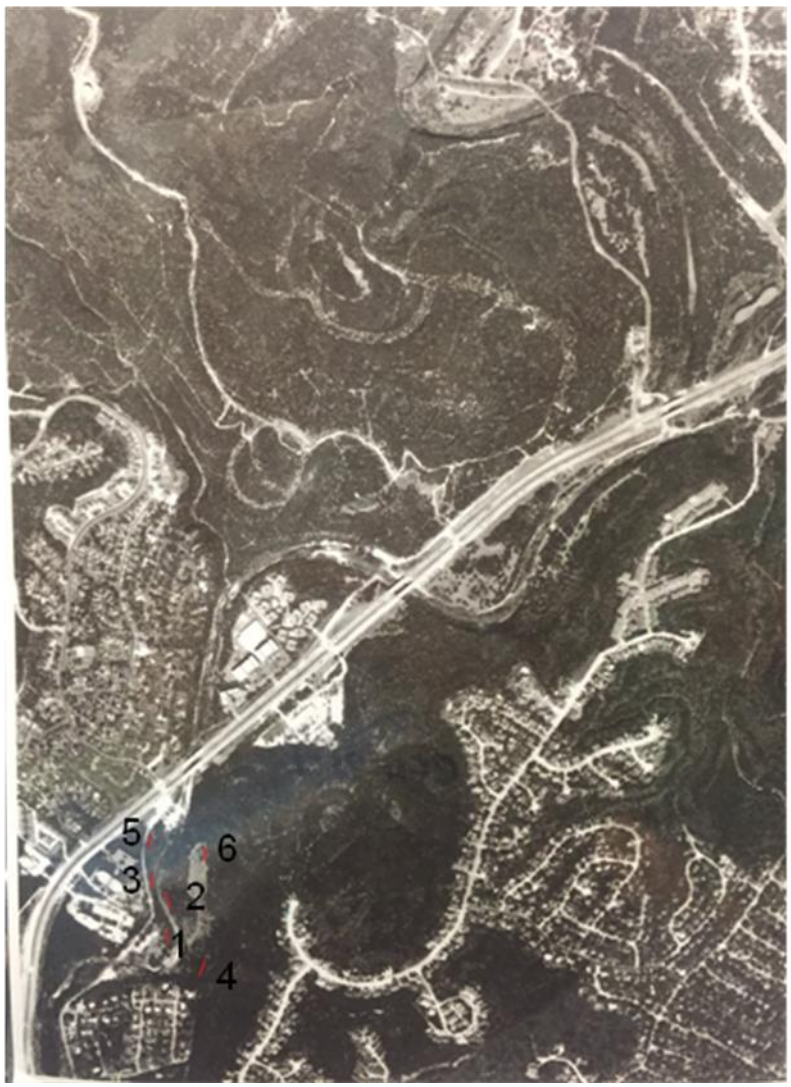
Tussie, Gemedo Dalle. *Vegetation Ecology, Rangeland Condition and Forage Resources Evaluation in the Borana Lowlands, Southern Oromia, Ethiopia*. Göttingen: Cuvillier, 2004. Print.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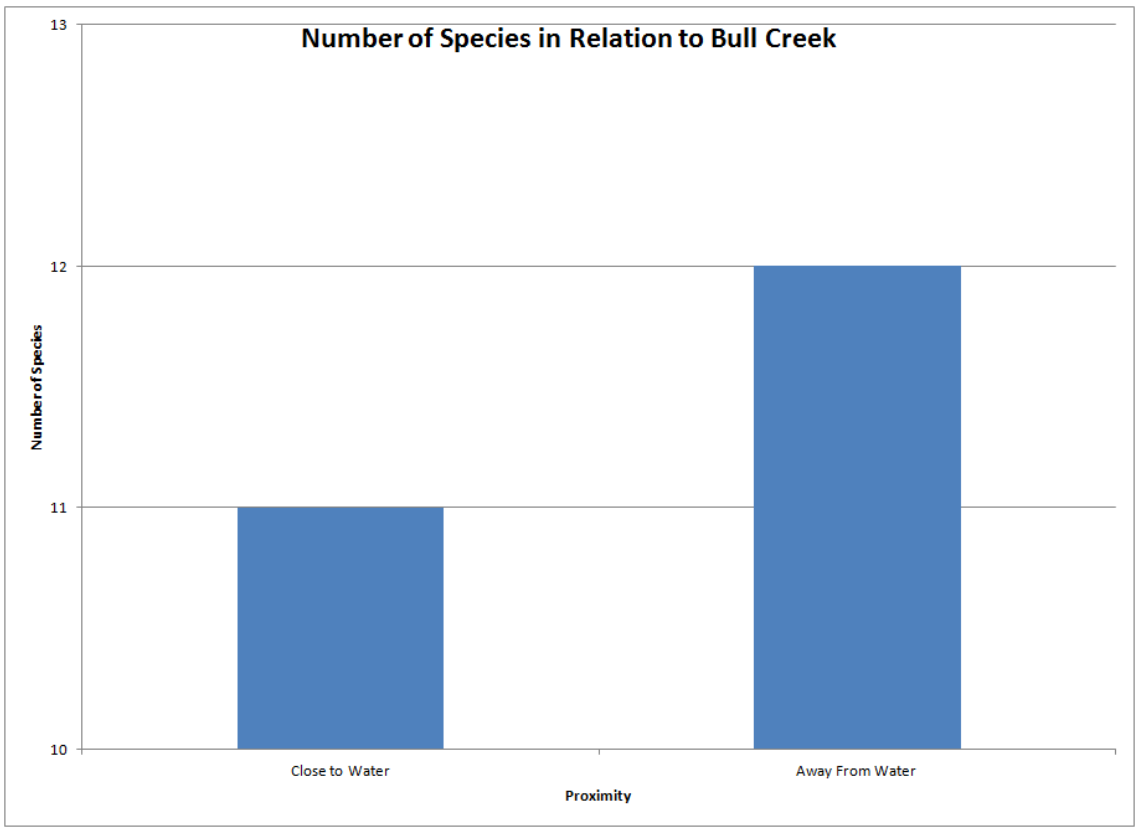
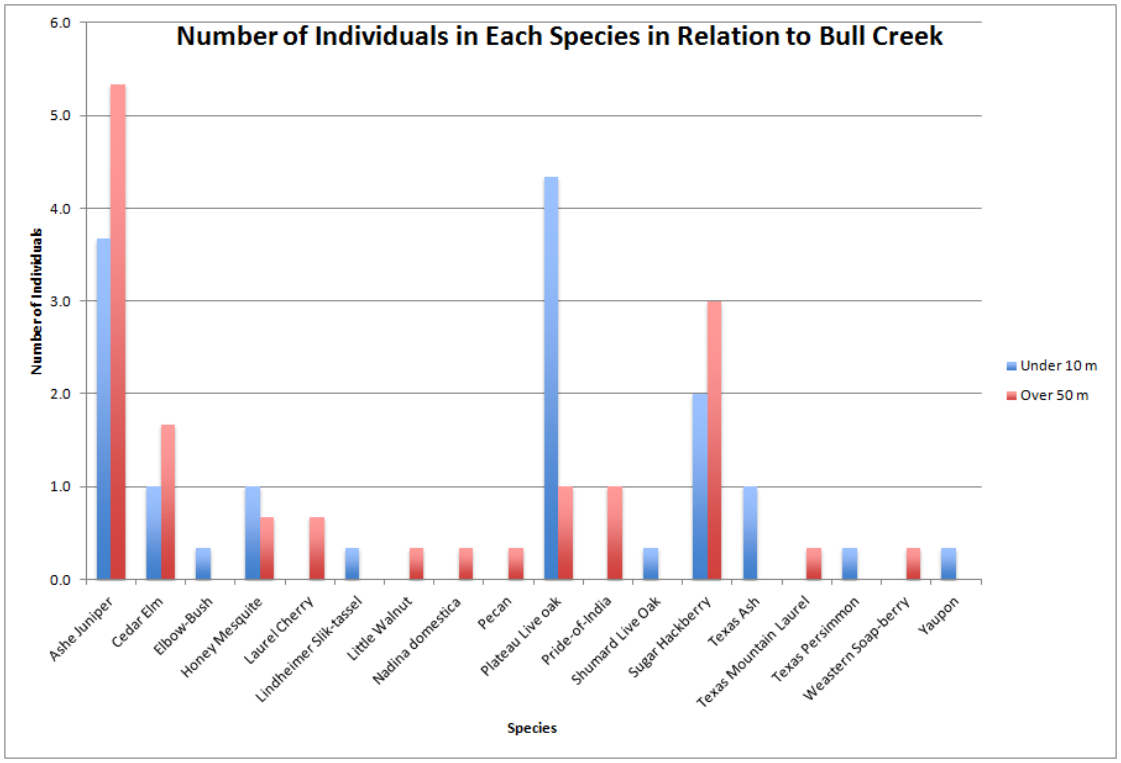
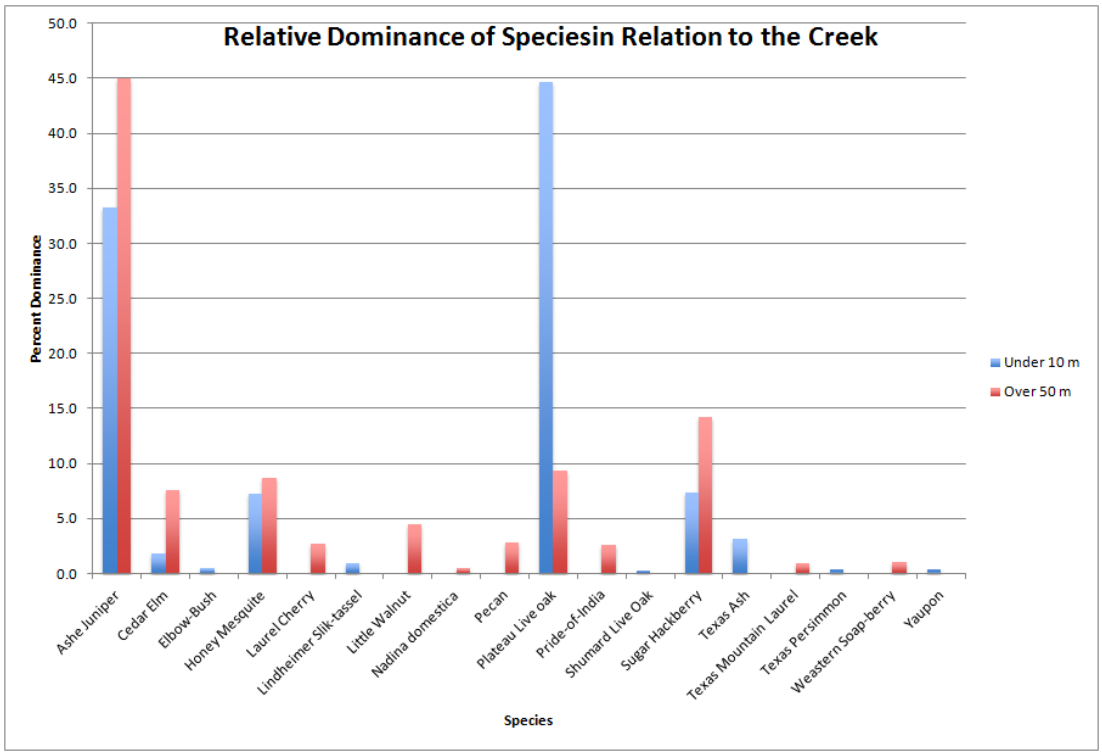
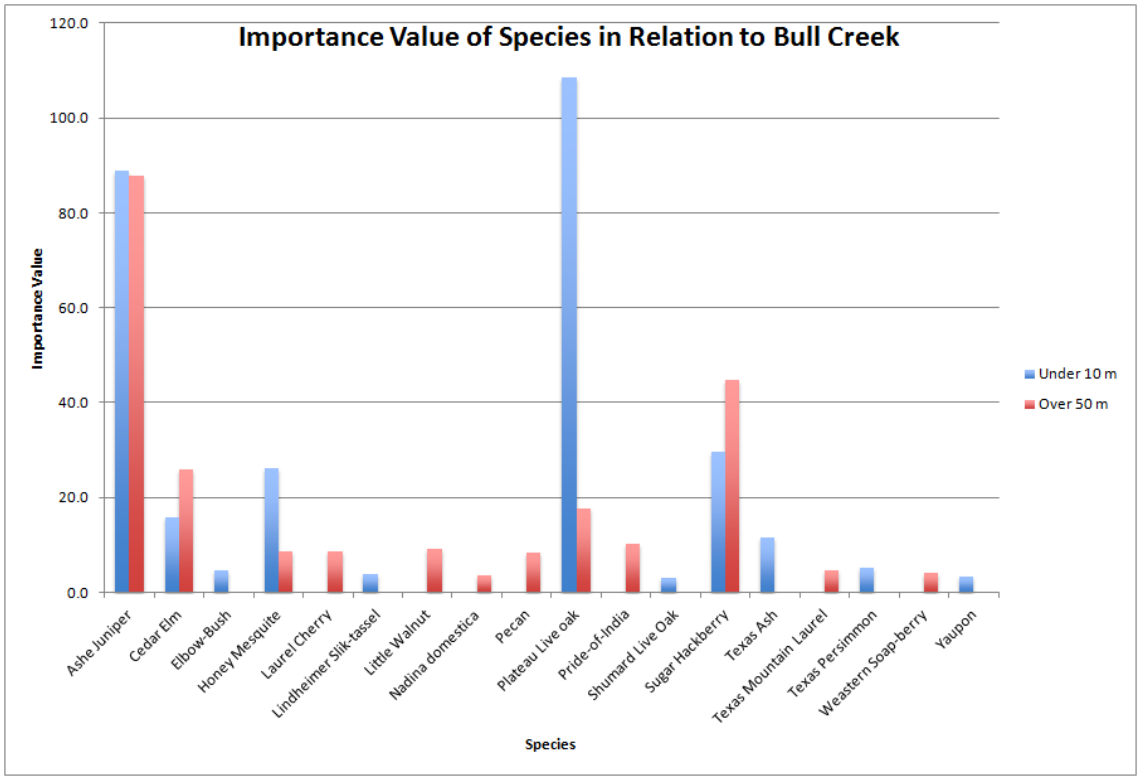
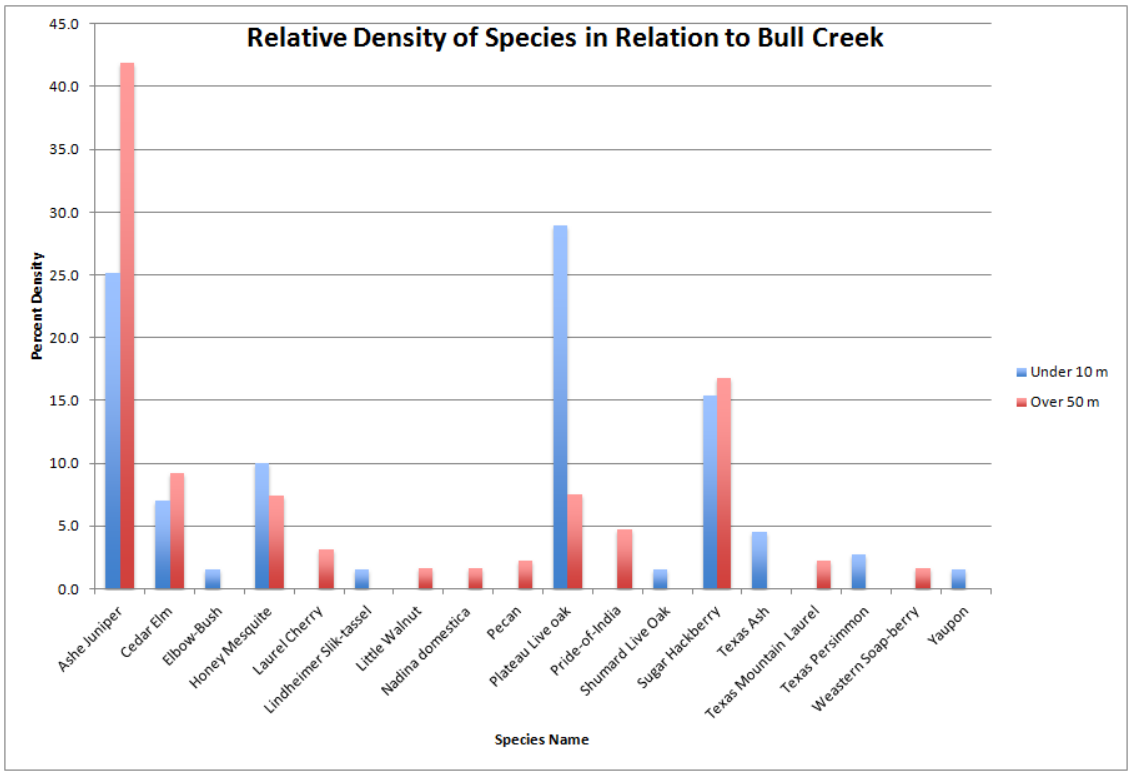
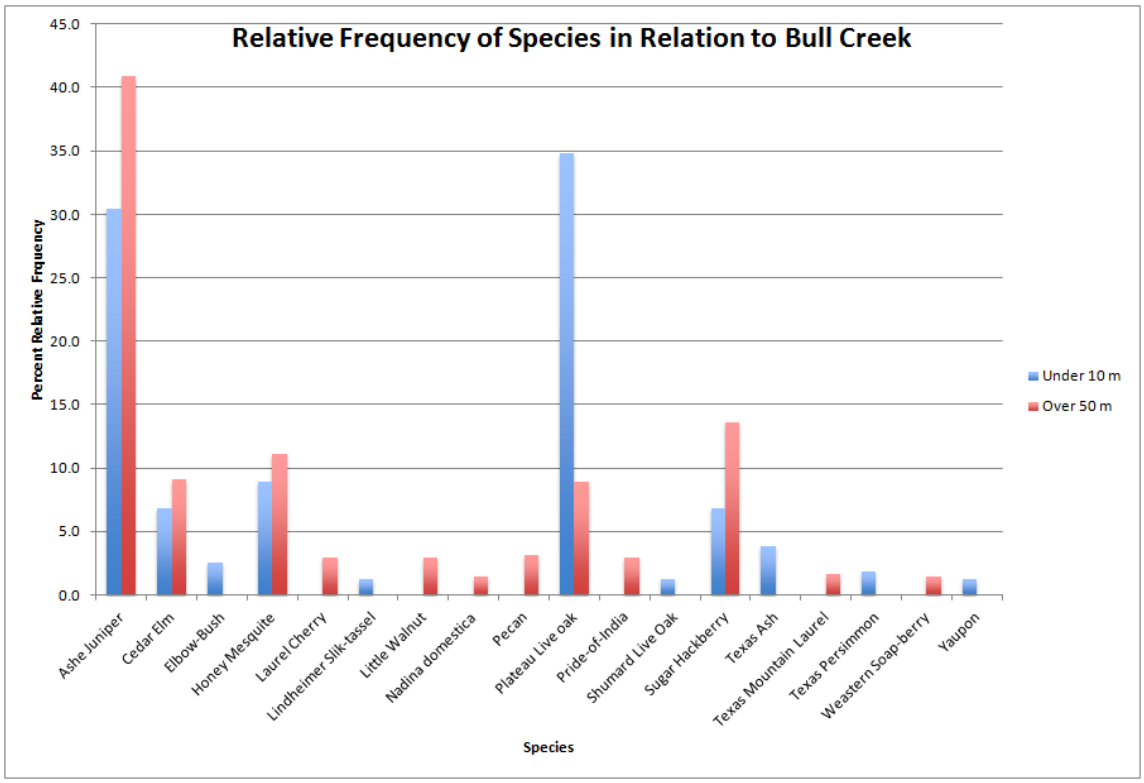

Number of Species in Relation to Bull Creek
13
12
11
10
Number of Species
Close to Water
Away From Water
Proximity


Number of Individuals in Each Species in Relation to Bull Creek
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Number of Individuals
Under 10 m
Over 50 m
Ashe Juniper
Cedar Elm
Elbow-Bush
Honey Mesquite
Laurel Cherry
Lindheimer Slik-tassel
Little Walnut
Nadina domestica
Pecan
Plateau Live oak
Pride-of-India
Shumard Live Oak
Sugar Hackberry
Texas Ash
Texas Mountain Laurel
Texas Persimmon
Weastern Soap-berry
Yaupon
Species


Relative Dominance of Speciesin Relation to the Creek
Percent Dominance
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Ashe Juniper
Cedar Elm
Elbow-Bush
Honey Mesquite
Laurel Cherry
Lindheimer Slik-tassel
Little Walnut
Nadina domestica
Pecan
Plateau Live oak
Pride-of-India
Shumard Live Oak
Sugar Hackberry
Texas Ash
Texas Mountain Laurel
Texas Persimmon
Weastern Soap-berry
Yaupon
Species
Under 10 m
Over 50 m


Importance Value of Species in Relation to Bull Creek
Importance Value
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Ashe Juniper
Cedar Elm
Elbow-Bush
Honey Mesquite
Laurel Cherry
Lindheimer Slik-tassel
Little Walnut
Nadina domestica
Pecan
Plateau Live oak
Pride-of-India
Shumard Live Oak
Sugar Hackberry
Texas Ash
Texas Mountain Laurel
Texas Persimmon
Weastern Soap-berry
Yaupon
Species
Under 10 m
Over 50 m


Relative Density of Species in Relation to Bull Creek
Percent Density
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Ashe Juniper
Cedar Elm
Elbow-Bush
Honey Mesquite
Laurel Cherry
Lindheimer Slik-tassel
Little Walnut
Nadina domestica
Pecan
Plateau Live oak
Pride-of-India
Shumard Live Oak
Sugar Hackberry
Texas Ash
Texas Mountain Laurel
Texas Persimmon
Weastern Soap-berry
Yaupon
Species Name
Under 10 m
Over 50 m


Relative Frequency of Species in Relation to Bull Creek
Percent Relative Frquency
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Ashe Juniper
Cedar Elm
Elbow-Bush
Honey Mesquite
Laurel Cherry
Lindheimer Slik-tassel
Little Walnut
Nadina domestica
Pecan
Plateau Live oak
Pride-of-India
Shumard Live Oak
Sugar Hackberry
Texas Ash
Texas Mountain Laurel
Texas Persimmon
Weastern Soap-berry
Yaupon
Species
Under 10 m
Over 50 m

	A	B	C
1	t-Test: Two-Sample Assuming Unequal Variances		
2			
3		*Near water*	*Away from water*
4	Mean	14.66666667	15
5	Variance	41.33333333	36
6	Observations	3	3
7	Hypothesized Me	0	
8	df	4	
9	t Stat	-0.06565322	
10	P(T<=t) one-tail	0.475402127	
11	t Critical one-tail	2.131846782	
12	P(T<=t) two-tail	0.950804255	
13	t Critical two-tail	2.776445105	

1	t-Test: Two-Sample Assuming Unequal Variances		
2			
3		*Near Water*	*Away from Water*
4	Mean	5.666666667	6
5	Variance	9.333333333	9
6	Observations	3	3
7	Hypothesized Me:	0	
8	df	4	
9	t Stat	-0.134839972	
10	P(T<=t) one-tail	0.449625635	
11	t Critical one-tail	2.131846782	
12	P(T<=t) two-tail	0.899251269	
13	t Critical two-tail	2.776445105	

1	t-Test: Two-Sample Assuming Unequal Variances		
2			
3		*Near Water*	*Away From Water*
4	Mean	30.43333333	40.86666667
5	Variance	454.5733333	283.6433333
6	Observations	3	3
7	Hypothesized Mean Difference	0	
8	df	4	
9	t Stat	-0.66510741	
10	P(T<=t) one-tail	0.271184451	
11	t Critical one-tail	2.131846782	
12	P(T<=t) two-tail	0.542368903	
13	t Critical two-tail	2.776445105	

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Effect of Water Proximity on Plant Diversity in Bull Creek Park

Results

The hypothesis for the study was, if transects are placed farther from the creek, then they will yield less plant diversity. The results of the data support this. The total number of species is higher less than 10m from the creek, compared to more than 100m from the creek, by 3 species. The five species found at both proximities are Cedar Elm, Ashe Juniper, Sugar Hackberry, Texas Ash, and Plateau Live Oak. Regarding number of species, the results were not statistically significant with a P-value of .89. Regarding number of individuals, the results were again not statistically significant, with a P-value of .75.

Overall, if a species is found both within 10m from the creek and more than 100m from the creek its average importance value, shown on the graph titled "Average Importance Value of Species at Different Proximities to Water", was much higher at one of the proximities. For example Ashe Juniper is found at both proximities yet the importance value further from the creek was 2.3x its importance value closer to the creek. However, Sugar Hackberry's average importance value is 2.3x greater when closer to the creek. The graph titled "Average Relative Dominance of Species at Different Proximities to Water" shows that the average relative dominance of species found at both sites is about 2.3x higher when further from the creek, such as Ashe Juniper and Plateau Live Oak. However Sugar Hackberry and Texas Ash are 3.8x and 1.8x higher when closer to the creek, respectively. Also to be noted, Elbow Bush had a 12.5x higher relative dominance within 10 m from the creek. Overall, a species relative density, shown on the graph titled, "Average Relative Density of Species at Different Proximities to Water"

housed differences on species-specific levels. Plateau Live Oak and Ashe Juniper both had much higher relative densities 100 m away from the creek, Plateau Live Oak's was 2.6x higher, and Ashe Juniper's was 2.4x higher. On the other hand, Elbow Bush had a much higher relative density 10 m close to the creek, being around 4x greater. Overall, a species' relative frequency, shown by the graph titles "Average Relative Frequency of Species at Different Proximities to Water" showed differences based upon different species. Plateau Live Oak and Ashe Juniper both had much greater relative frequencies 100 m away from the creek, Plateau Live Oaks' was 1.6x higher, and Ashe Junipers was 2.3x higher further from the creek. Elbow Bush (at 2.7x higher) and Sugar Hackberry (at 1.8x greater) both had much greater relative frequencies within 10 m of the creek.

Discussion

Riparian forests and areas, such as the one this data was collected in, typically maintains higher diversity than other woody plant areas because "the combination of water, lush vegetation and connections to other landscapes provides opportunities for many species." (2) This is most likely due to the individual species' proximity to water within the riparian forests. However, there are several outliers that show that this varies from species to species, since some species are more abundant further from the creek which impacts the data. Plateau Live Oak was a major outlier to this aforementioned trend. Plateau Live Oak tends to "tolerate(s) urban conditions including impacted or severely disturbed soils" (1) and is " is intolerant of excessive soil moisture due to poor drainage and excessive irrigation" (1). This may account for why Plateau Live Oak was more abundant further away from the creek. Ashe Juniper was another outlier to the trend of having greater biodiversity closer to the creek. Ashe Juniper is also very drought tolerant, allowing for it to grow farther away from the creek and still flourish, accounting for its higher

values at the increased distance (3).

The study includes many human errors and problems, such as this being the first time the researchers conducted a study of this kind. Other areas of the study, such as calculations and the data collection method the line intercept method, include other errors as well. The study could be modified by instead using other methods. These other methods include the belt transect method, systematic sampling, and random sampling. These other methods are more detailed and would take data at a more in depth level. The belt transect method, for example, is similar to the line intercept method, except it also gives data on abundance and absence of species. A belt transect is when a researcher lays out a transect across the area to be surveyed and a quadrat is placed on the first marked point on the line. The plants and/or animals inside the quadrat are then identified and their abundance estimated. The belt transect method supplies more data than the line intercept method, and provides more information on the relative densities of the plants. So, the belt transect method is better if more detailed information on density is required (4). Random Sampling gives a better sense of the area in question, and allows the researchers to gain a broader range of samples. Random Sampling is where the the area to be sampled is divided into sections with an equal number of random points in each, insuring an adequate distribution of sample points throughout the site. A tape measure and a compass are used to locate the ordered pairs (random or regular) designating field sample points. With transect lines, only a single baseline is required. A series of points along this baseline are selected using a random, stratified random, or systematic procedure (5). It is also a better method for when time is limited, and allows a large area to be covered quickly. Random sampling also removes any researcher bias when selecting the samples (4).

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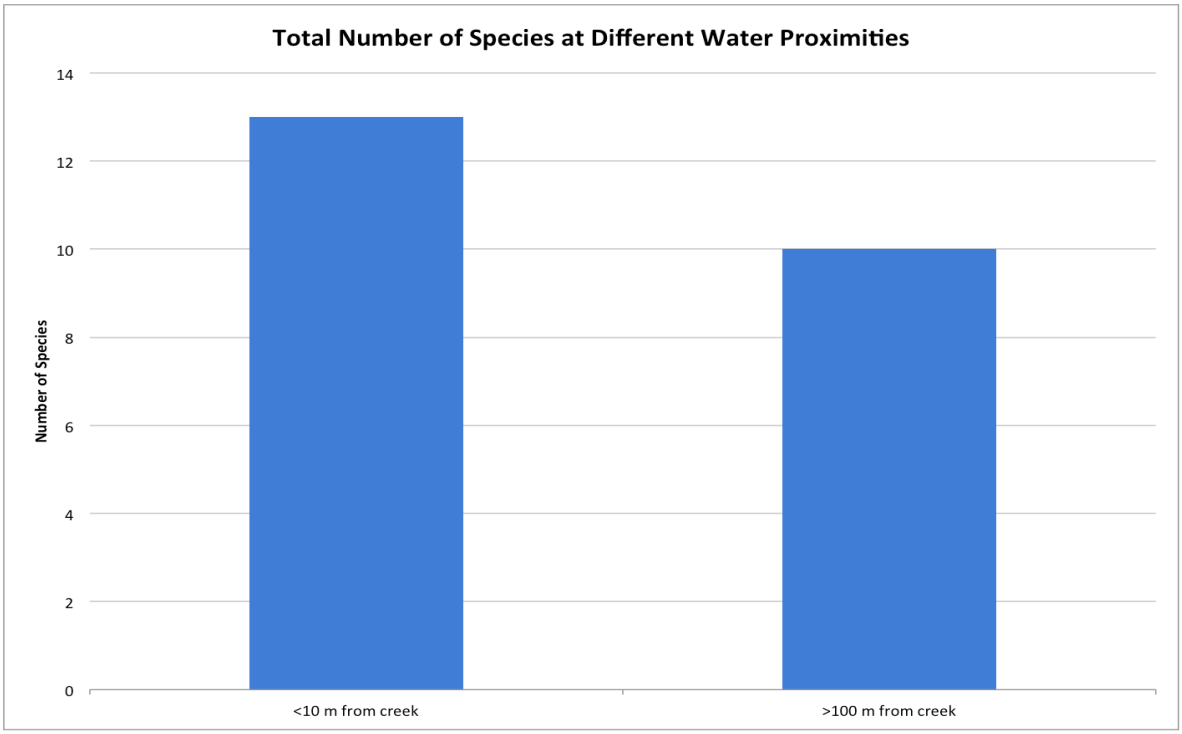
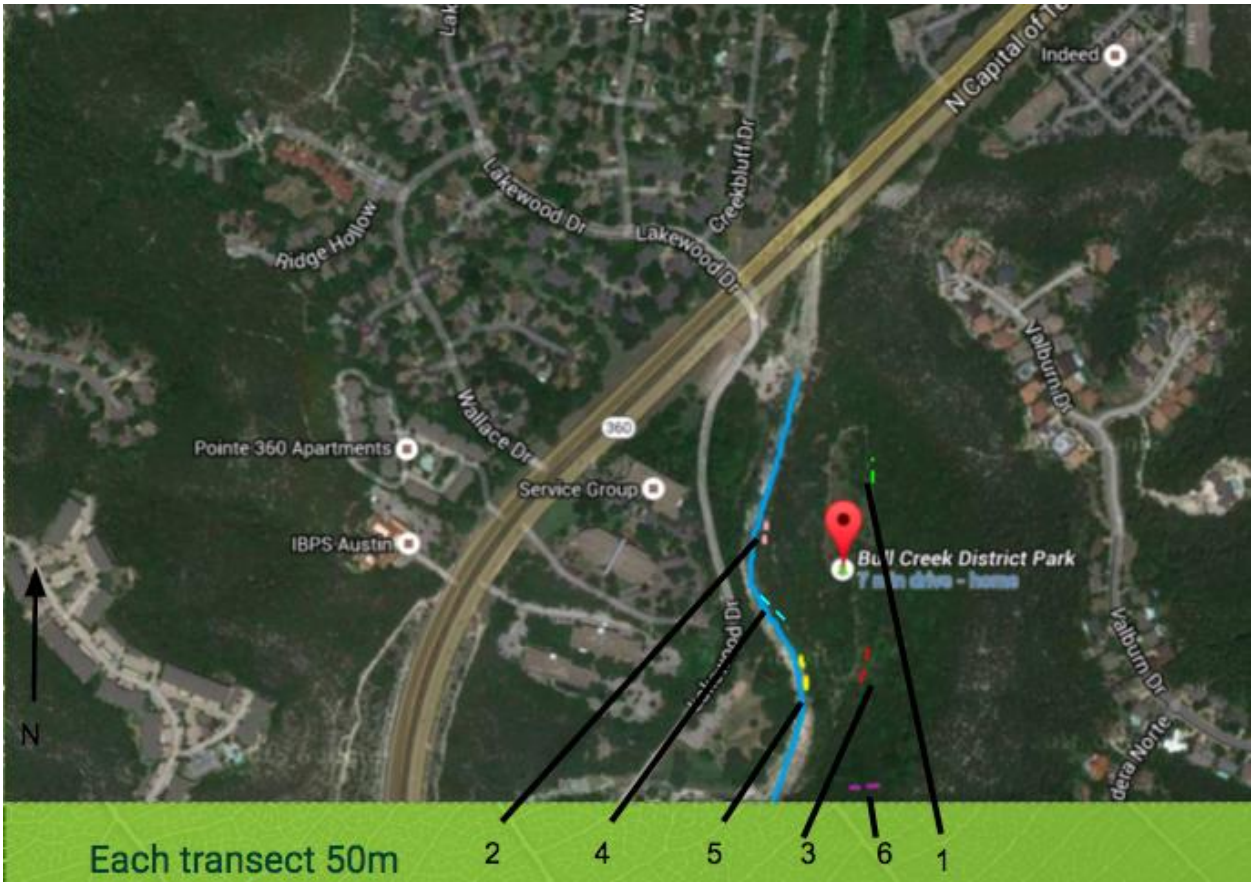
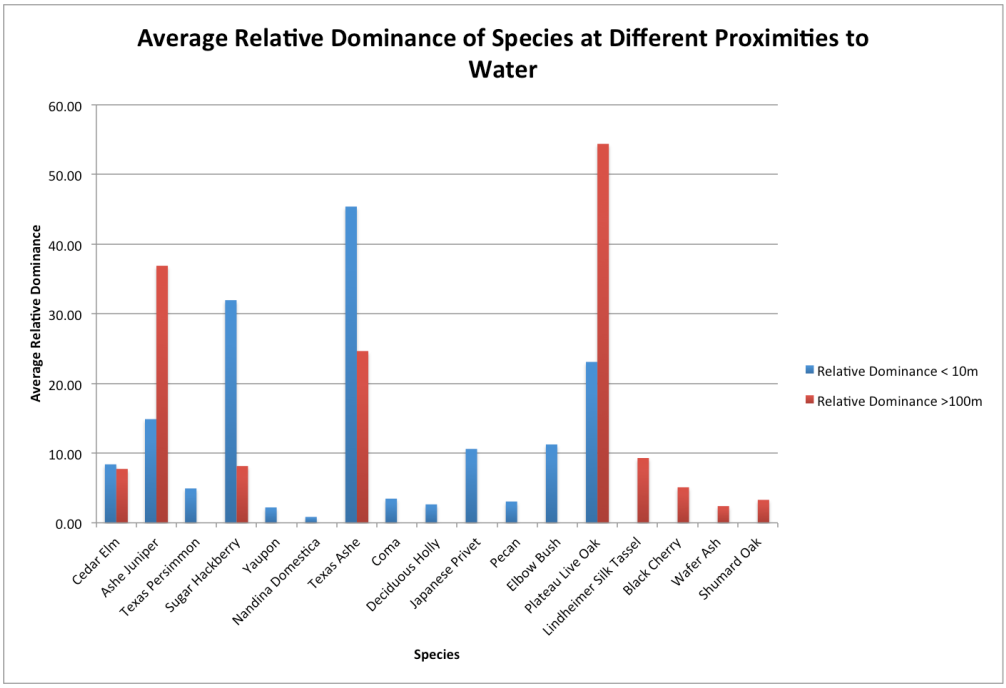
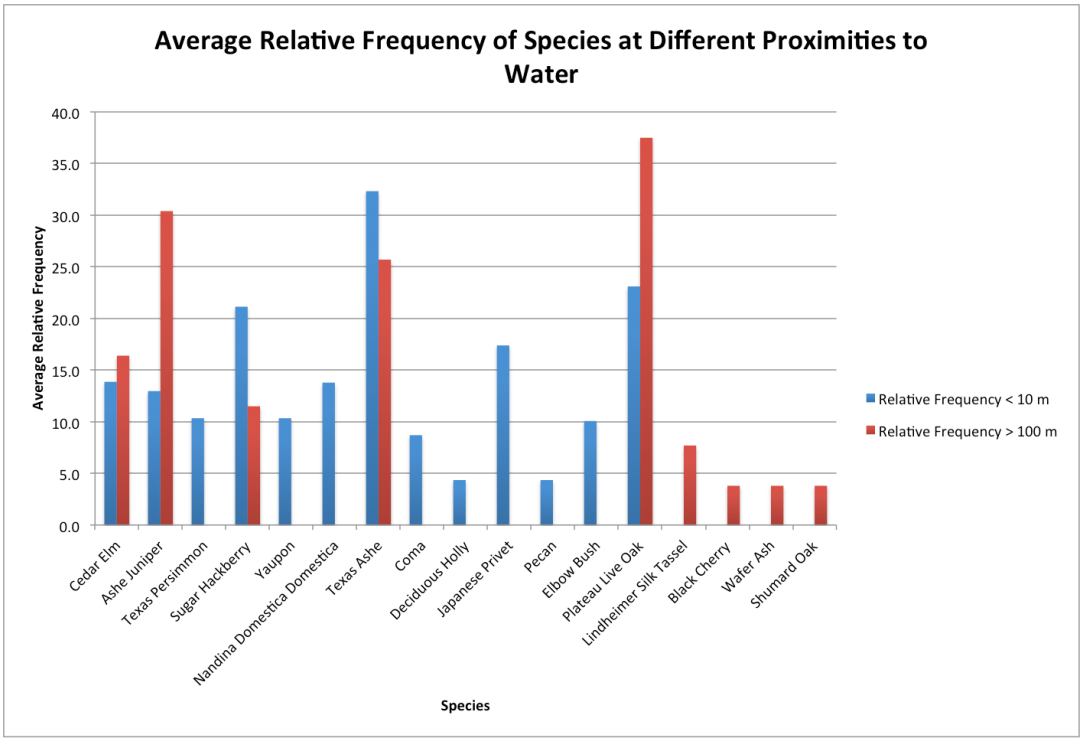
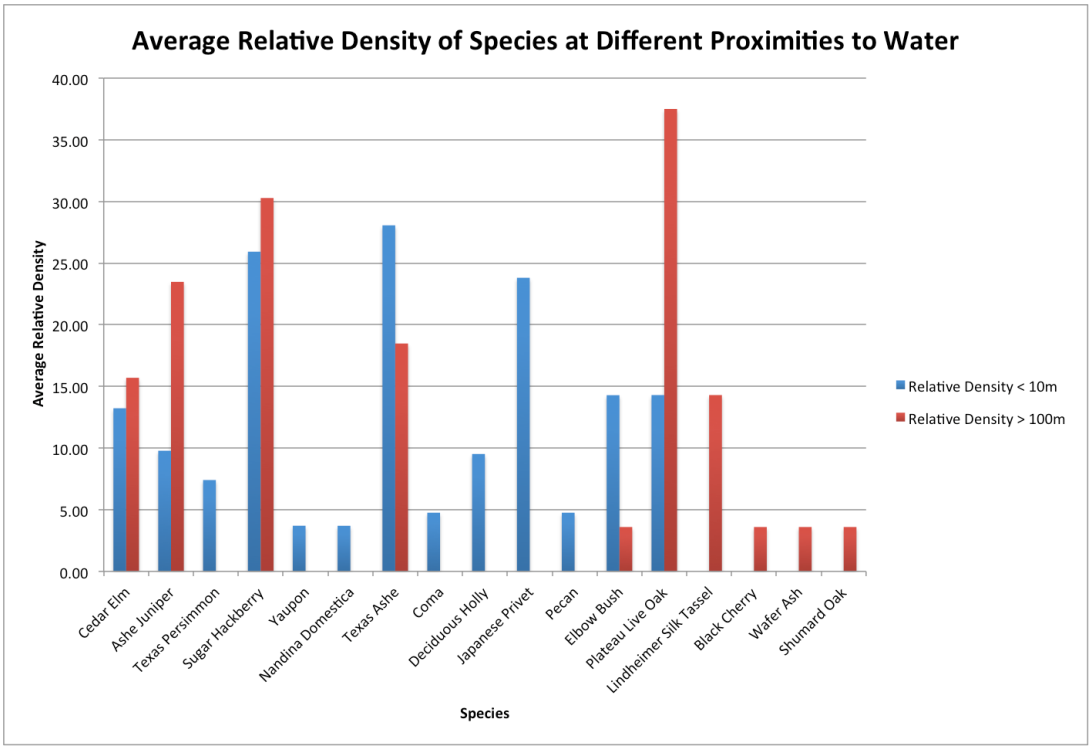
5. Mac Aller, Robert T.F., and Matthew W. Fidelibus. "Methods for Plant Sampling." *Restoration in the Colorado Desert: Management Notes*. California Department of Transportation, Oct. 1993. Web. 09 Dec. 2015.




Indeed
N Capital of Texas
Lakewood Dr
Creekbluff Dr
Ridge Hollow
Wallace Dr
360
Pointe 360 Apartments
Service Group
IBPS Austin
Bull Creek District Park
Valburn Dr
N
Each transect 50m
2
4
5
3
6
1


Average Relative Dominance of Species at Different Proximities to Water
Average Relative Dominance
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Cedar Elm
Ashe Juniper
Texas Persimmon
Sugar Hackberry
Yaupon
Nandina Domestica
Texas Ashe
Coma
Deciduous Holly
Japanese Privet
Pecan
Elbow Bush
Plateau Live Oak
Lindheimer Silk Tassel
Black Cherry
Wafer Ash
Shumard Oak
Species
Relative Dominance < 10m
Relative Dominance >100m


Average Relative Frequency of Species at Different Proximities to Water
Average Relative Frequency
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Cedar Elm
Ashe Juniper
Texas Persimmon
Sugar Hackberry
Yaupon
Nandina Domestica Domestica
Texas Ashe
Coma
Deciduous Holly
Japanese Privet
Pecan
Elbow Bush
Plateau Live Oak
Lindheimer Silk Tassel
Black Cherry
Wafer Ash
Shumard Oak
Species
Relative Frequency < 10 m
Relative Frequency > 100 m


Average Relative Density of Species at Different Proximities to Water
Average Relative Density
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Cedar Elm
Ashe Juniper
Texas Persimmon
Sugar Hackberry
Yaupon
Nandina Domestica
Texas Ashe
Coma
Deciduous Holly
Japanese Privet
Pecan
Elbow Bush
Plateau Live Oak
Lindheimer Silk Tassel
Black Cherry
Wafer Ash
Shumard Oak
Species
Relative Density < 10m
Relative Density > 100m

Northern Cardinal Population Estimates in Comparison to Urban Areas in Gus Fruh Park

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Fall Semester 2015

Gus Fruh: Northern Cardinals

Mr. Fennell Period 3A/7B

Conclusion:

Results:

The hypothesis was supported by the results, because it was stated that the population density at closer proximities will be higher. Within the data this trend also emerges. Within the population data that was taken, a few other important trends emerge. There is a positive correlation between the proximity to urban areas and the population estimate of Northern Cardinals. The average population estimate found changed from 6.63 birds/hectare near urban areas, to 3.18 birds/hectare further away from urban areas, to 2.29 birds/hectare furthest away. This population data remains remarkably consistent regardless of date and temperature, with 5 of the 6 data points showing the trend of increasing population estimate with proximity to urban areas. It is important to note that the final data point which broke the trend can be marked as an outlier, as it was taken after extreme weather conditions and does not seem to accurately reflect the population under normal circumstances. That day average population estimate was remarkably low (1.73 birds/hectare) and as such the data is not considered particularly useful in the analysis of the overall trends.

Another interesting observation is that while the population estimate differs drastically, and has a p-value that indicates statistical significance (0.000232), the overall number of detections doesn't indicate statistical significance (p=0.232034), with total detections differing from 117 to 97 to 80. While there is still a difference, it is not as pronounced as in the population estimate. This difference can be explained with the data taken at close proximities. Within 0-5 meters, the close proximity transect had an average of 4.33 detections, compared to 2.33 in the middle proximity and 1.83 in the far proximity. This seems to indicate that the birds in urban areas are more likely to be spotted at closer distances than the birds at a further proximity. This could be because the birds which nest near urban areas are more accustomed to human activity and thus do not instinctively nest away from trails or flee from human activity. Other methods of analysis do not yield particularly useful results, as there is no apparent correlation between weather, Sky Code condition, or Beaufort number.

Discussion:

The results support the conclusion that proximity to urban areas has a positive correlation with population estimate. There could be a number of reasons for this trend, but the most plausible explanations are that there is an increase in food abundance and a reduction in predation pressure nearby urban areas. Eyal Shochat, Susannah Lerman, and Esteban Fernández-Juricic concluded that there is an increase in bird density in urban areas, due to the "increase in food abundance, and probably to the reduction in predation pressure" (Shochat, Lerman, Fernández-Juricic, 75). These factors seem to correspond to the environment of the Barton Hills neighborhood, as there are few other bird species

and numerous food sources in the area. This is the most likely explanation for the correlation, but there are other explanations that are likely as the study wasn't fully controlled and external variables weren't fully eliminated.

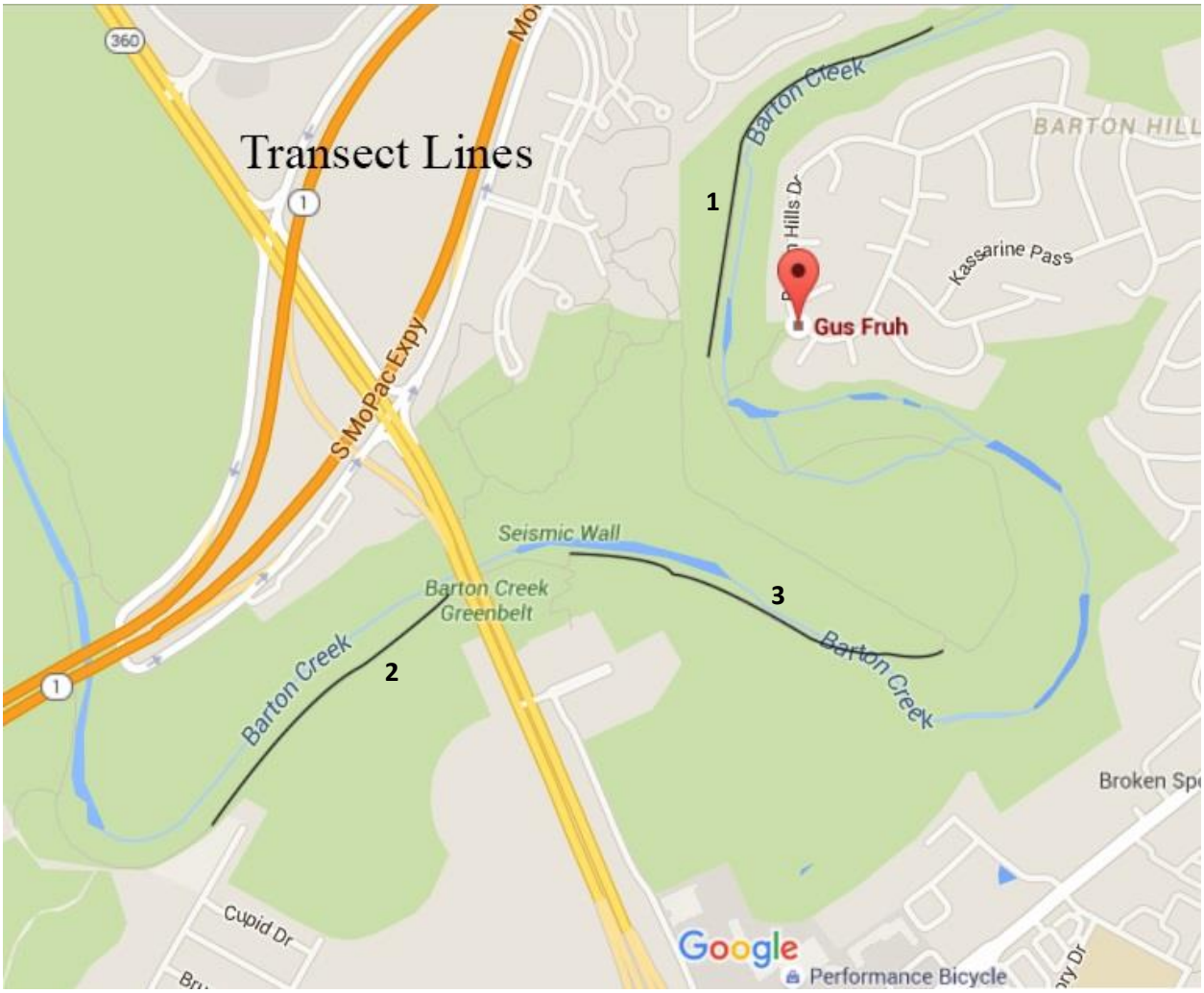
There are sources of error within the study which may skew the data and render it less valid. The transect proximities didn't increase linearly, with the second transect not double the distance away from the first transect and the third transect triple the distance away. Rather the distances increased irregularly, and each transect was not a definitive distance away from the neighborhood. Also, transects 2 and 3 are in close proximity to highway 360 at their endpoints. This greatly affects the two transects in ways including habitat loss, vehicle caused mortality, poisoning, and most significantly noise pollution. Transect 1, however, remains relatively unaffected by these factors because of its greater distance from the highway. This correlates with data taken by Francis, Ortega, and Cruz , who proved that "noise alone reduces nesting species richness and leads to different avian communities" (Francis, Ortega, and Cruz, 1). Noise pollution differences could likely have a large effect on the bird nesting habits in the area, and decrease the population estimate in transect 2 and 3.

A negative result that was found is that there were more people, hikers, bikers, and dogs at transect 1, but there were still more birds detected within the area. Logically, it is expected that in the area with more human activity there would be less bird activity, as the birds would avoid contact with humans. However, this is not the case. The disjunction can be explained because the birds perhaps have already been conditioned to the presence of humans, since Northern Cardinals have survival factors which allow for positive interactions with humans (Chace and Walsh, 48). Northern Cardinals could naturally be drawn to near urban environments and they likely have lost part of the instinct in avoiding humans.

If redone, the transects could be moved to more significant locations than the ones designed within these studies. Transect 2 and 3's proximity to urban areas are significant enough to show a measurable difference in the population of birds but could be improved. Transect 2 needs to be an average between both Transects 1 and 3. Instead Transect 2's proximity leans more towards Transect 3 than 1, but if done again Transect 2 could be moved to a more median distance. However, in the best case scenario multiple more transects could be added. This would help eliminate and reduce much of the error in the data, therefore providing a more notable conclusion. Several groups could do a continuous study observing the population of Northern Cardinals every semester. Data collected from these groups could be compiled and compared to see the effects of urban areas on the overall Northern Cardinal populations.

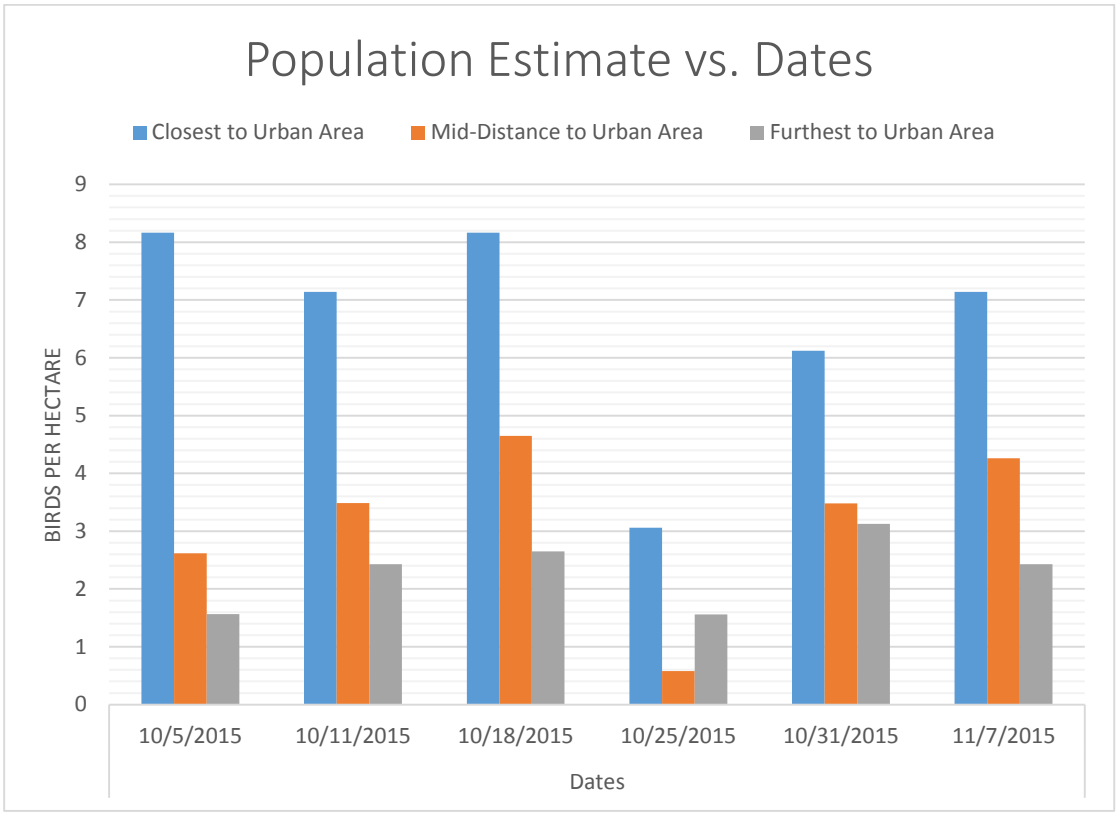
Other methods that could have been used in this project include a point transect, which would suit the high density population of the Cardinal within Gus Fruh. A point transect would have been completed by moving along the transect line and and only recording data at regular intervals (Gregory and Gibbons, 40). Observing point transects would favor the dense nature of Gus Fruh vegetation and allow for the birds to settle before observations.

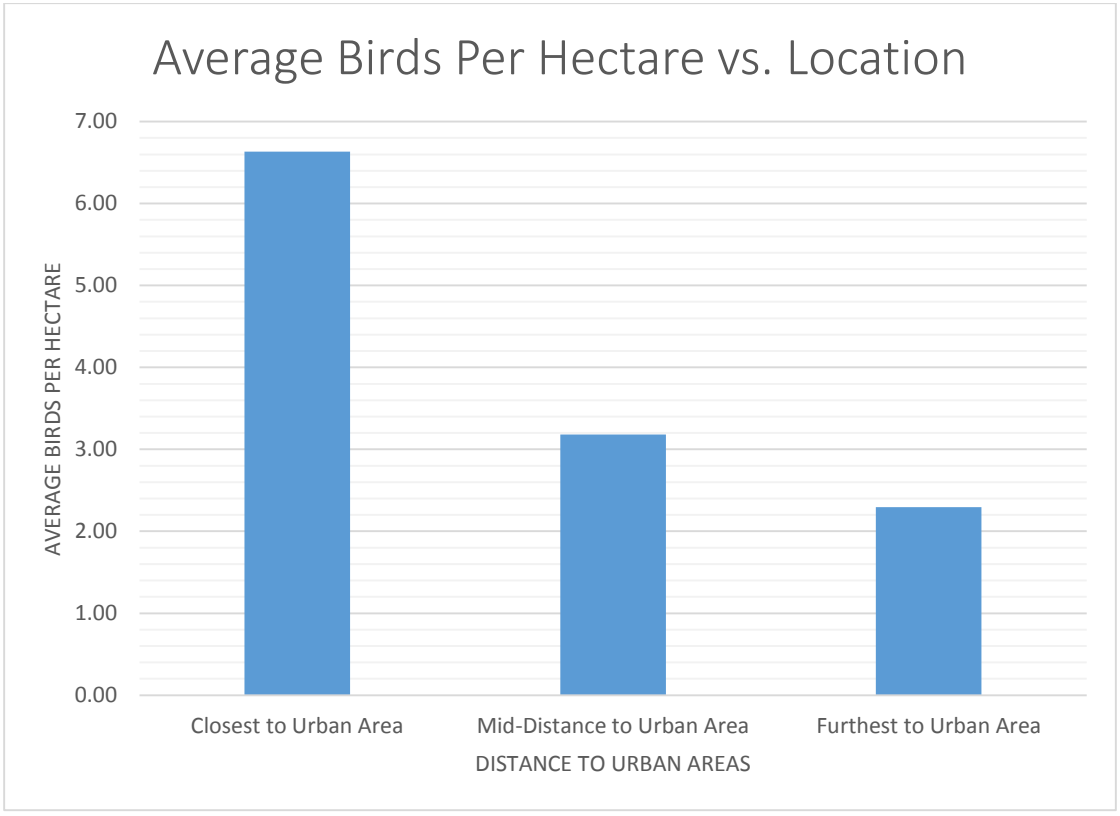
Maps/Photos with labeled Transects to Scale:

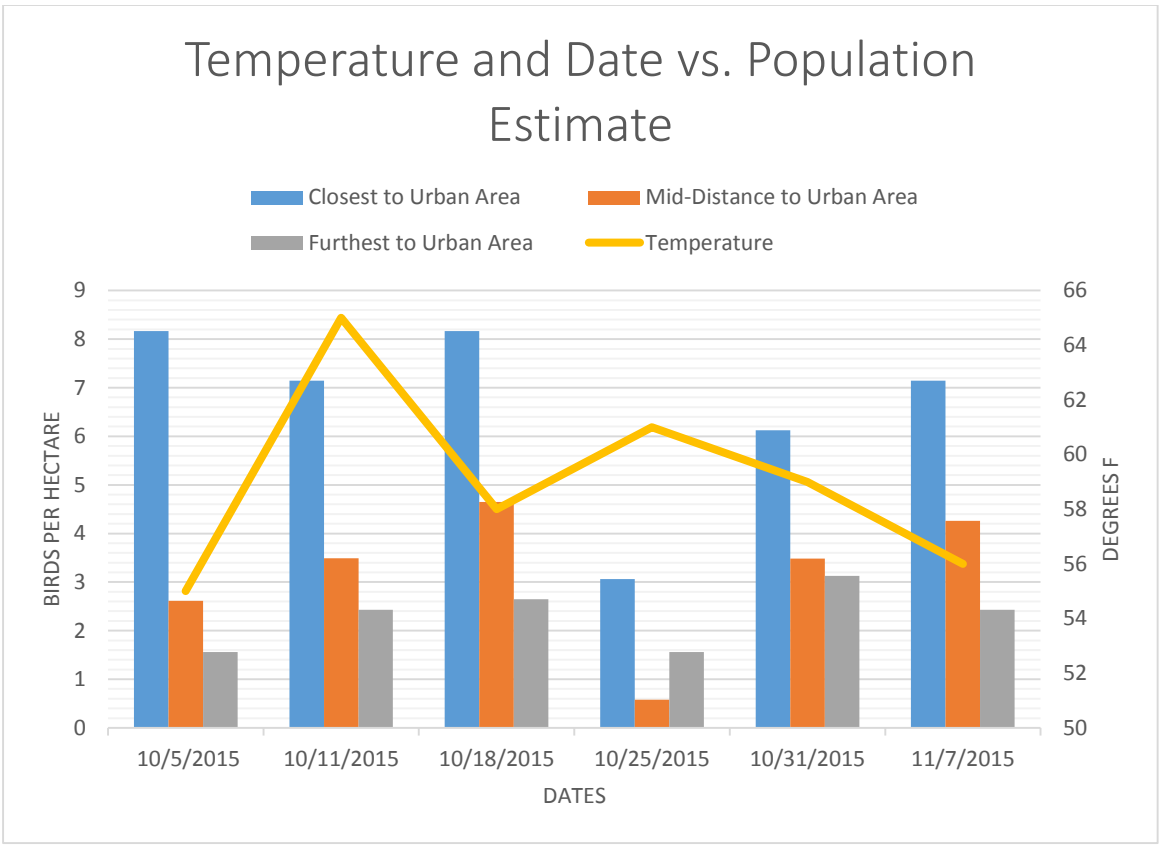


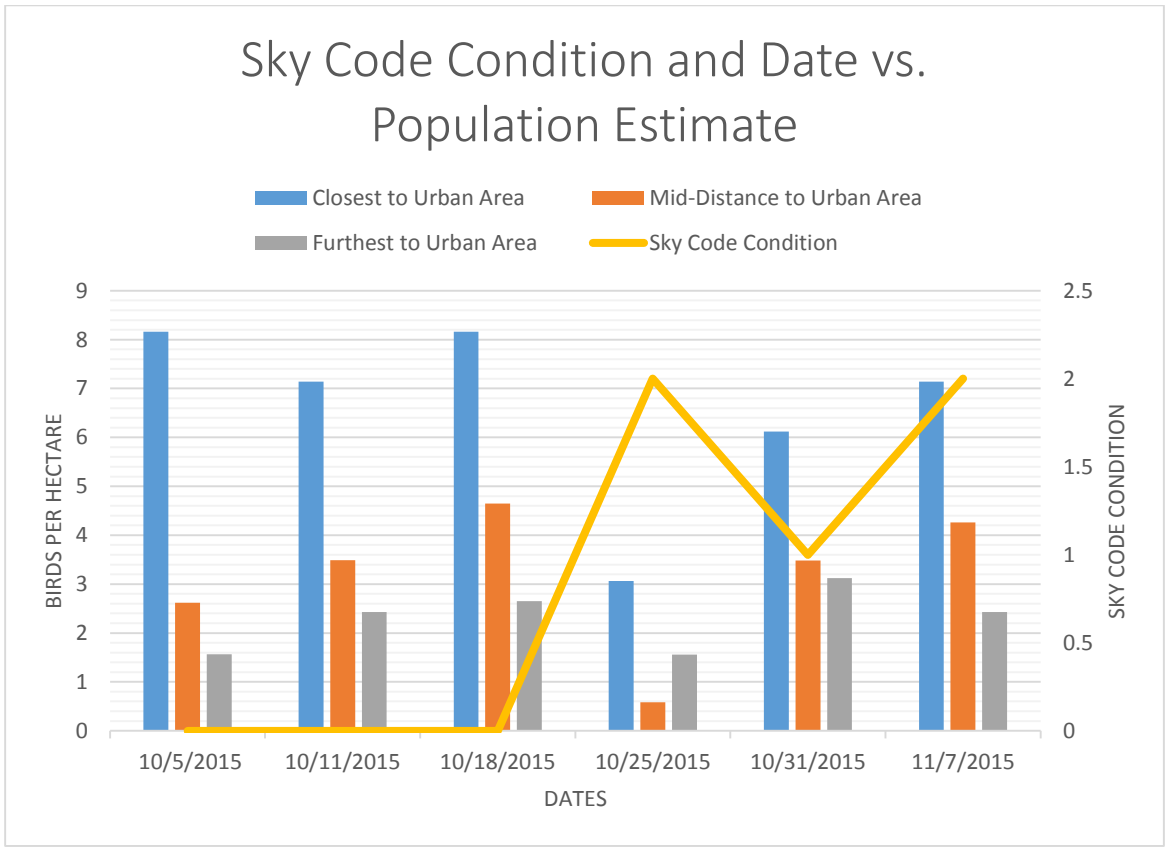
Transect 1 and 3 are 980 meters each, Transect 2 is 860 meters.

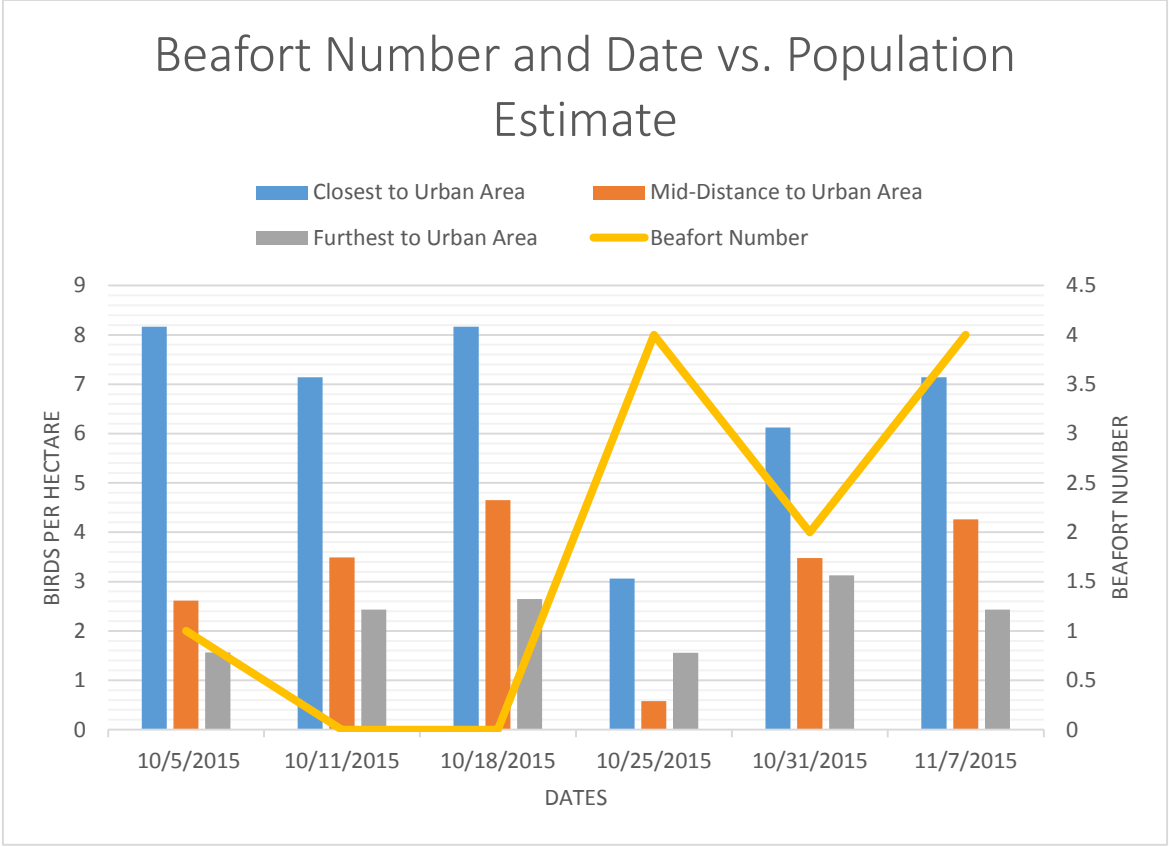
Graphs:

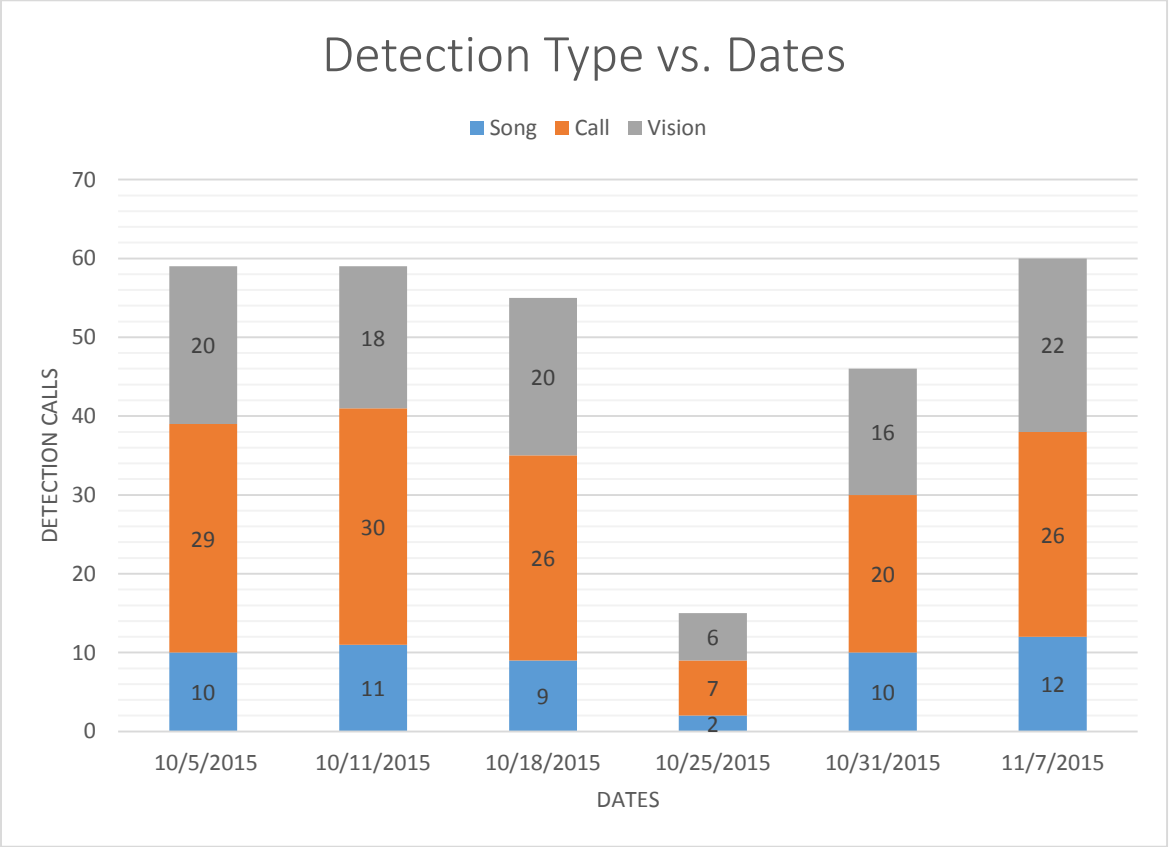

Population Estimate vs. Dates
Closest to Urban Area
Mid-Distance to Urban Area
Furthest to Urban Area
BIRDS PER HECTARE
9
8
7
6
5
4
3
2
1
0
10/5/2015
10/11/2015
10/18/2015
10/25/2015
10/31/2015
11/7/2015
Dates


Average Birds Per Hectare vs. Location
AVERAGE BIRDS PER HECTARE
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Closest to Urban Area
Mid-Distance to Urban Area
Furthest to Urban Area
DISTANCE TO URBAN AREAS


Temperature and Date vs. Population Estimate
Closest to Urban Area
Mid-Distance to Urban Area
Furthest to Urban Area
Temperature
BIRDS PER HECTARE
DEGREES F
DATES
10/5/2015
10/11/2015
10/18/2015
10/25/2015
10/31/2015
11/7/2015


Sky Code Condition and Date vs. Population Estimate
Closest to Urban Area
Mid-Distance to Urban Area
Furthest to Urban Area
Sky Code Condition
BIRDS PER HECTARE
SKY CODE CONDITION
DATES
10/5/2015
10/11/2015
10/18/2015
10/25/2015
10/31/2015
11/7/2015


Beafort Number and Date vs. Population Estimate
Closest to Urban Area
Mid-Distance to Urban Area
Furthest to Urban Area
Beafort Number
BIRDS PER HECTARE
BEAFORT NUMBER
0
1
2
3
4
5
6
7
8
9
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
10/5/2015
10/11/2015
10/18/2015
10/25/2015
10/31/2015
11/7/2015
DATES


Detection Type vs. Dates
Song
Call
Vision
DETECTION CALLS
0
10
20
30
40
50
60
70
10
29
20
11
30
18
9
26
20
2
7
6
10
20
16
12
26
22
10/5/2015
10/11/2015
10/18/2015
10/25/2015
10/31/2015
11/7/2015
DATES

Density and Diversity of Plants at Different Elevations in Gus Fruh Park

Alabel Chapin (alabelc@gmail.com), Sophie Dreslinski (scophied@gmail.com), Suzanna Metcalf (suzyg2000@gmail.com)

Results:

There is a greater total number of species at the highest elevation, evident by the abundance of Ashe Juniper, but a similar total number of species for both the lower elevations (fig 1). There is a significantly larger average dominance of Ashe Juniper at all elevations (fig 2,3). There is a greater average diversity of species at lower elevations versus higher elevations (fig 4). Twelve different species were recorded at the lowest elevation and only six different species were recorded at the highest elevation. At the lowest elevation there was a greater average density of every species except for Ashe Juniper and Agarito than at the highest elevation. Contrary to the hypothesis, the overall average woody plant density was greater at the highest elevation but Ashe Juniper accounted for the majority of this high elevation vegetation. Ashe Juniper is significantly denser at the highest elevation than at the two lower elevations. Four ANOVA tests were performed to look for significant differences between average number of Different Species for which there was not a significant difference and a p value of 0.32, Number of Plant Individuals for which there was not a significant difference and a p value of 0.36, Intercept Sums for which there was not a significant difference and a p value of 0.314, and finally, the average Ashe Juniper population for which there was a significant difference with a p value of 0.001. After determining the existence of a significant difference in average Ashe Juniper population, three T-tests were performed to further analyze the significant difference given by the ANOVA tests. The result of the t-test comparing ashe juniper population at high and medium elevations was 0.010. The result of the t-test comparing ashe juniper population at high and low elevations was

0.003. The result of the t-test comparing ashe juniper population at medium and low elevations was 0.059. These t-tests displayed that there was a significant difference between the average size of Ashe Juniper populations between high and low elevations, and high and middle elevations.

Discussion:

The high average density of ashe juniper in the higher elevation varies greatly when compared to the level at lower elevation. Ashe Juniper is able to exist in greater abundances further from water, at higher elevations because it is a drought-resistant plant and they are naturally drawn to an environment in which there is less water. The species is more prevalent in dry, arid, hot climates because of its ability to survive with little water or protection from wind and sun. Because it is drought tolerant Ashe Juniper is capable of out-competing other woody plants in arid environments. This accounts for the species' overwhelming dominance at higher elevations, further from water. But Ashe Juniper is less able to out-compete other woody plants in non-arid environments and for this reason it is less abundant at lower elevations closer to water.

A similar situation to the one observed in this study was observed in Oklahoma where the Ashe Juniper species invaded 3.5 million acres of arid Oklahoma land by 1985. This invasion resulted in a dangerous decrease in biodiversity and a "[destruction of] habitat for endemic species which by their nature are habitat specialists and can exist only under certain narrow habitat requirements" (Engle, 1985). This study concerning the range of invaded Oklahoma land concluded that a similar dynamic was taking place in other areas across the Great Plains and the western states. This spread of ashe juniper populations can be attributed to its ability to thrive in dry, arid, hot climates.

There is a greater average plant diversity at lower elevations because it is hard for most trees, with the exception of Ashe Juniper, to grow at higher elevations with more exposure to wind and reduced supply of soil nutrients. Some believe that a reason for this effect on plant diversity can be accounted for by the drop in temperatures and the elevation increases (Jump 2009). The study linked higher temperatures to higher density and diversity. There is no evidence that this is specifically linked to the data collected, but a drop in temperature may explain the lack of diversity at higher elevations in the park. A major difference between the data collected for the Jump study and the data collected at Gus Fruh is the location. The data from the study was collected in the mountains in Nepal where there is a much higher change in altitude, but even subtle changes could account for the slight changes in average diversity.

Woody plants are able to grow faster and larger and reproduce more successfully when they are close to water, as water provides them with nutrients and irrigation. In a study done over species richness with changing elevations in an alpine region, it was found that plant diversity decreases at higher elevations. It was also discovered that there is more species resistance at lower elevations rather than higher elevations (Dubuis 2012). This may explain the fact that there is less plant diversity at higher elevations. While these factors could have accounted for the decline in species diversity as elevation increases, the elevation changes were to small to tell if they actually made much of a difference.

There were of course problems with this study, for example the fact that only three sets of data for each elevation were taken and that they were not exactly on the predetermined transects or spread out well enough. The study was also not an accurate representation of plant growth changes with elevation because the elevation changes in Gus Fruh are not largely significant. For future studies in Gus Fruh, proximity to water or urban areas might be a better area of study than

elevation because of the insignificant elevation changes. For a more accurate study, data could have been collected in a larger, more spread out area with greater elevation changes. More data sets would have been taken, and during different seasons and weathers to get more rounded results.

Studies such as this should be conducted all over the Austin area to get an idea of plant growth in the area and to maintain the biodiversity. With a better idea of which species of plants are thriving and which aren't as well as how dense tree canopies are can help professional field workers decide what trees need to be planted to keep a variety present in the park.

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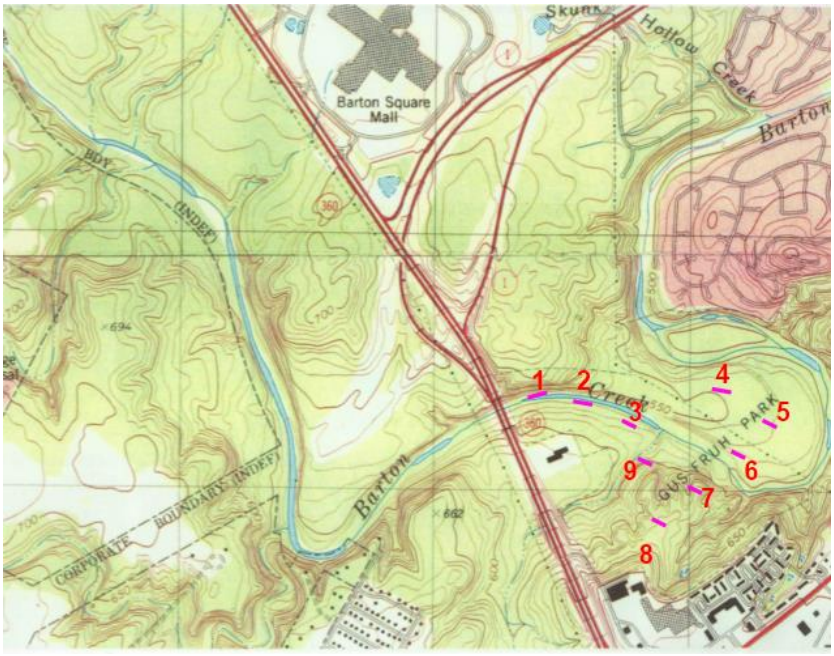
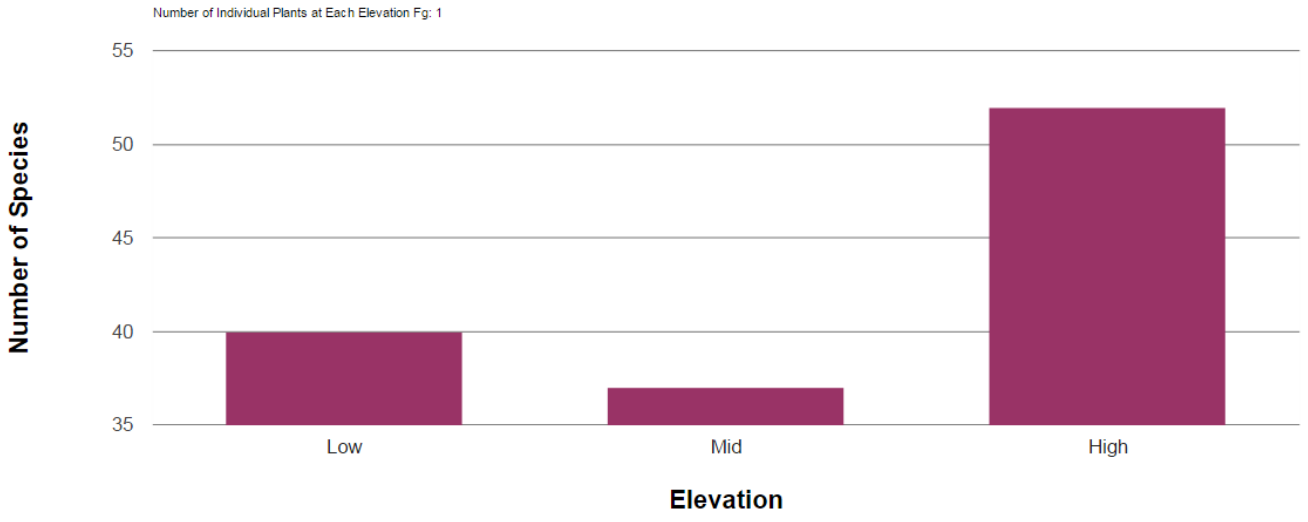
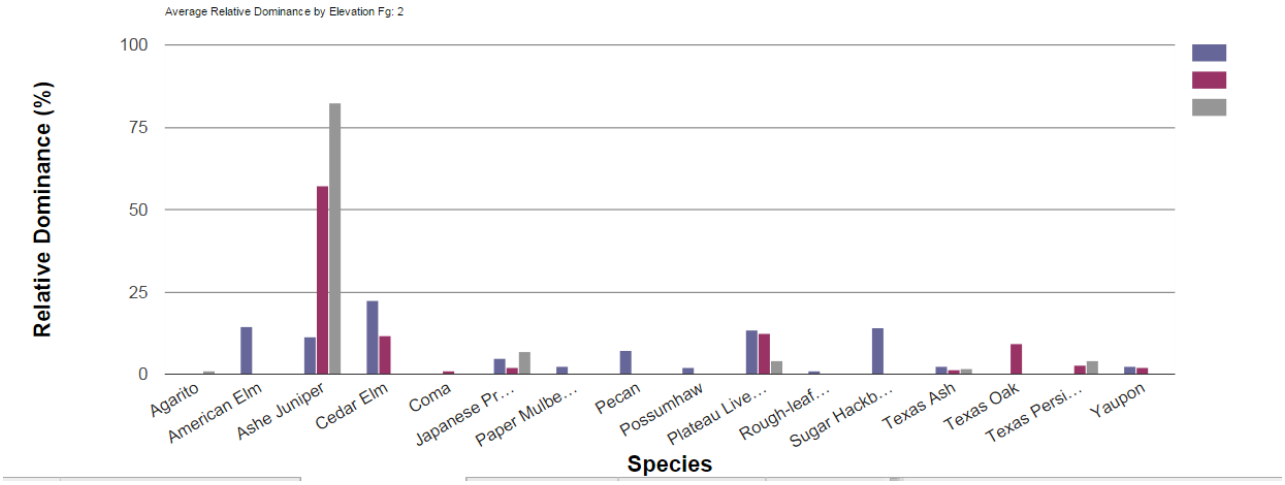
Jump, Alistair S., Csaba Matyas, and Penuelas Josep. "The Altitude-for-latitude Disparity in the Range Retractions of Woody Species." *Science Direct*. N.p., Dec. 2009. Web.

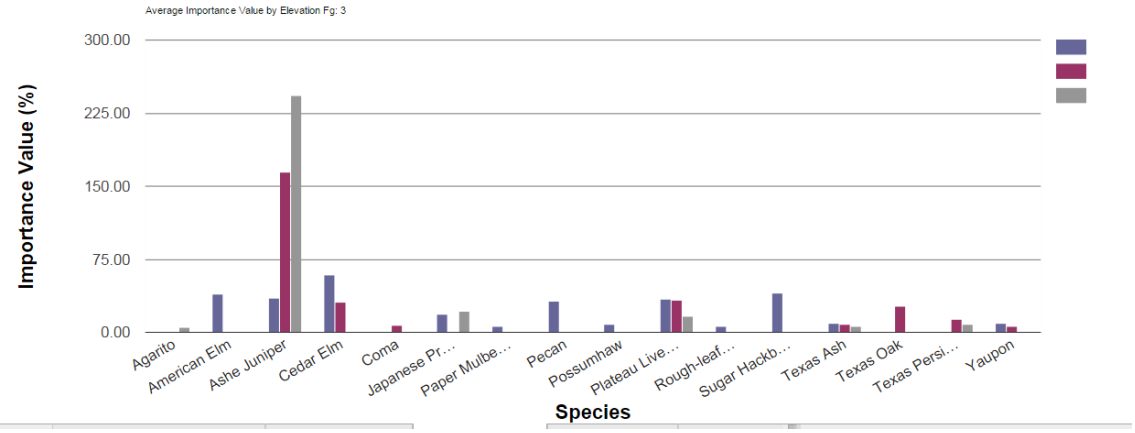
Pellissier, Loïc, Konrad Fiedler, Charlotte Ndribe, Anne Dubuis, Jean-Nicolas Pradervand, Antoine Guisan, and Sergio Rasmann. "Shifts in Species Richness, Herbivore Specialization, and Plant Resistance along Elevation Gradients." *Ecol Evol Ecology and Evolution* 2.8 (2012): 1818-825. Web.

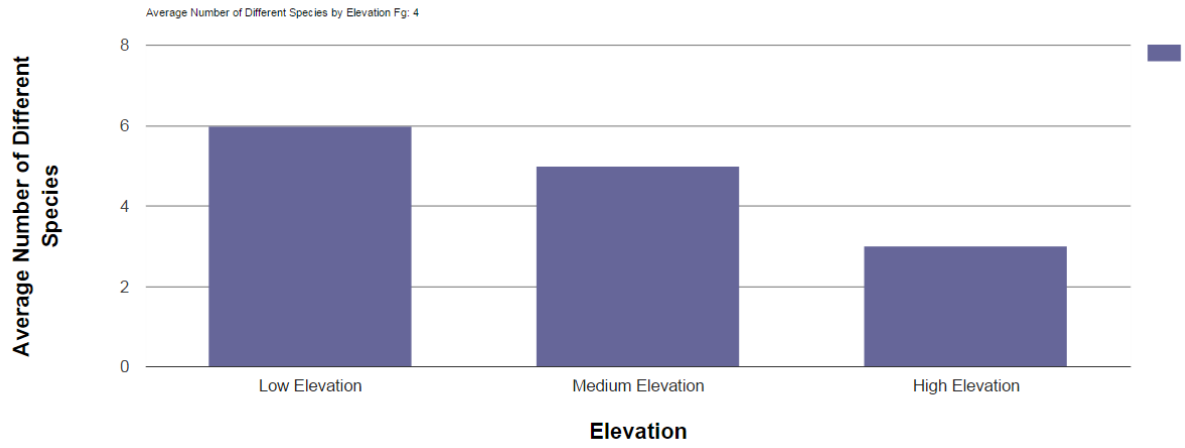


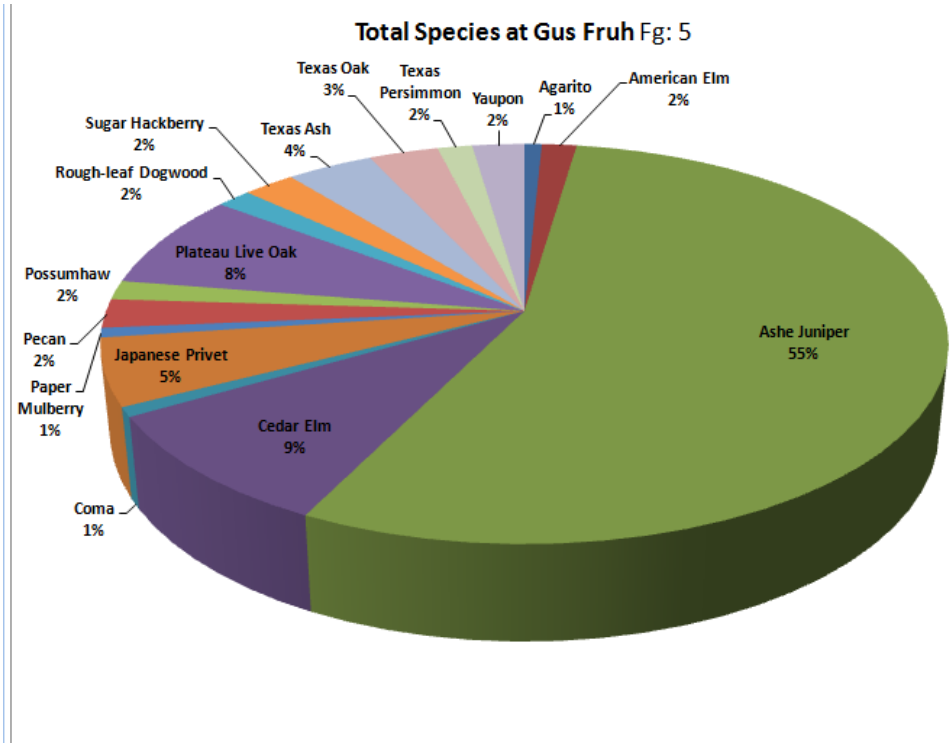
Each Transect = 50 meters




Average Relative Dominance by Elevation Fg: 2
Relative Dominance (%)
100
75
50
25
0
Agarito
American Elm
Ashe Juniper
Cedar Elm
Coma
Japanese Pr…
Paper Mulbe…
Pecan
Possumhaw
Plateau Live…
Rough-leaf…
Sugar Hackb…
Texas Ash
Texas Oak
Texas Persi…
Yaupon
Species


Average Importance Value by Elevation Fg: 3
Importance Value (%)
300.00
225.00
150.00
75.00
0.00
Agarito
American Elm
Ashe Juniper
Cedar Elm
Coma
Japanese Pr…
Paper Mulbe…
Pecan
Possumhaw
Plateau Live…
Rough-leaf…
Sugar Hackb…
Texas Ash
Texas Oak
Texas Persi…
Yaupon
Species


Average Number of Different Species by Elevation Fg: 4
Average Number of Different Species
8
6
4
2
0
Low Elevation
Medium Elevation
High Elevation
Elevation


Total Species at Gus Fruh Fg: 5
Texas Oak 3%
Texas Persimmon 2%
Yaupon 2%
Agarito 1%
American Elm 2%
Sugar Hackberry 2%
Texas Ash 4%
Rough-leaf Dogwood 2%
Plateau Live Oak 8%
Possumhaw 2%
Pecan 2%
Japanese Privet 5%
Paper Mulberry 1%
Cedar Elm 9%
Coma 1%
Ashe Juniper 55%

Effects of Water Proximity on Woody Plant Biodiversity in Gus Fruh Park

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Graham Stockton (grahamstockton50@gmail.com)
December 2015

Results

The data suggests that organisms in riparian zones had slightly more species diversity, with 14 species in Riparian zones compared to 13 in non-riparian zones, but that the total population of plants did not increase with distance from the creek, averaging 22 for riparian zones and 32 in non-riparian zones(see charts pages 4-5). This is due to the high populations of Ashe Juniper in transects further from the creek.

In graphs of Relative Dominance, Frequency, Density, and Importance, Ashe Juniper is incredibly prevalent in non-Riparian zones, with an average importance value of 175. This is a theme throughout the data, and is the primary plant encountered on the non-riparian transects(Charts 11).

Close to the creek, the average importance of different plant species becomes lower, and no species takes a majority of the importance. Cedar Elm, Japanese Privet, Pecan, and Ashe Juniper all have relatively high values, but none exceed 90(charts 11). In non-riparian zones, average relative density does not go above 10% for any plant except for Ashe Juniper, with Shumard Oak and Sugar Hackberry at 7.3% and 6.5% respectively. Ashe Juniper had an average importance value of 175. In the riparian transects, Cedar Elm and Japanese Privet were above 10%, with 26.5% and 20.7%, respectively. In addition, Yaupon, Elbow Bush, and Ashe Juniper all had values above 5%(charts 8). This shows a more equal distribution of plants in riparian zones, compared to non-riparian zones. In measures of average relative dominance for non-riparian zones, Ashe Juniper is once again dominant, and is the only plant with a value above

10%, coming in at 67%. In riparian transects, however, plants are more evenly distributed, with Cedar Elm, Japanese Privet, Pecan, and Ashe Juniper each over 10%(charts 9). Medium sized, common plants also valued highly in average relative density, such as Japanese Privet with a 20.7% value. Average relative frequency also shows the trend of Ashe Juniper dominance, with Ashe Juniper taking 45% frequency. In frequency, both riparian and non-riparian distributions of plants are more balanced, with smaller plants like the Japanese Privet and Yaupon earning higher percentages(charts 10).

In two T-tests of the data, the conclusion was shown to not be statistically significant(charts 12-13). The data for the number of species was not statistically significant, with a p value of 0.25. Data for the total number of individuals in each area was also not statistically significant, with a p value of 0.28.

Cedar Elm was dominant in riparian zones, but not to the degree of Ashe Juniper. It had an average of 26.5% relative density, 32.7% relative dominance, 28.8% relative frequency, and an average importance of 88.

Discussion

First, although the data supports the hypothesis that plant diversity increases with proximity to a creek, the change in diversity is not very large, and the data is not statistically significant(charts 12-13). The data also suggests that Riparian zones are less likely to be dominated by one species. In 1993, a study was conducted in Washington, which suggested that plant diversity becomes unusually high in riparian corridors(Naimans). If significant, the data would have supported this conclusion.

The abundance of ash juniper in non-riparian zones but not in riparian zones is likely because it has less need for water and grows very well in non-riparian zones, while it must

compete with a wider diversity of plants, because of the abundance of water. According to a study by Keith Owens and Jim Ansley, Ashe Juniper is successful and dominant in semiarid environments, and is able to adapt its transpiration rates to adapt to precipitation changes(Owens). This means that Ashe Juniper reacts better and dominates non-riparian zones, where it doesn't have to compete with plants adapted for steady access to water.

Cedar Elm was dominant in riparian zones. The Texas A&M Agrilife extension says that cedar elm competes with surrounding plants for water and sunlight. Since riparian zones have an abundance of water, plants must only compete for light with their neighbors(A&M Agrilife). Cedar Elm grows taller than the other plants of the area, dominating and restricting the sunlight that hits. Since other plants cannot find as much sunlight, they cannot grow in as much abundance.

During the study, several invasive species were encountered. Paper Mulberry and Japanese Privet were seen, and Japanese Privet was very common in the data. Japanese Privet had an importance value of 51.4 in riparian transects, and Paper Mulberry had an importance of 10.9 in riparian transects.

Errors in this investigation may stem from the transect method used and the low number of data points, which led to the data not being statistically significant. More accurate methods of plant transecting include using multiple line transects to form a grid, then using statistics to find plant populations, or enclosing a whole region of forest and then labelling and counting each plant within the area. A belt transect, where one follows a line but leaves to take data on quadrats (squares of analysis), and uses the quadrats for data. This method prevents anomalous areas of plant diversity that could contribute to error, and can be conducted along a trail while still measuring plants that could have been removed from the immediate edge of the trail(poison ivy,

poison oak, etc). These methods, however, were not reasonable given the time-parameters of the investigation. In addition, six data sets are not in any situation enough to reasonably and definitively show a trend in plant life in a region. Many more data points would be needed to conduct a conclusive and accurate experiment.

If redone, this experiment would have been more successful given more sets of data and the use of the belt transect method. More time would need to be spent on recording organisms, and measurements of ground water levels in regions would be helpful in determining the differences between riparian zones and non-riparian zones(for this, the borders of the zones were somewhat estimated).

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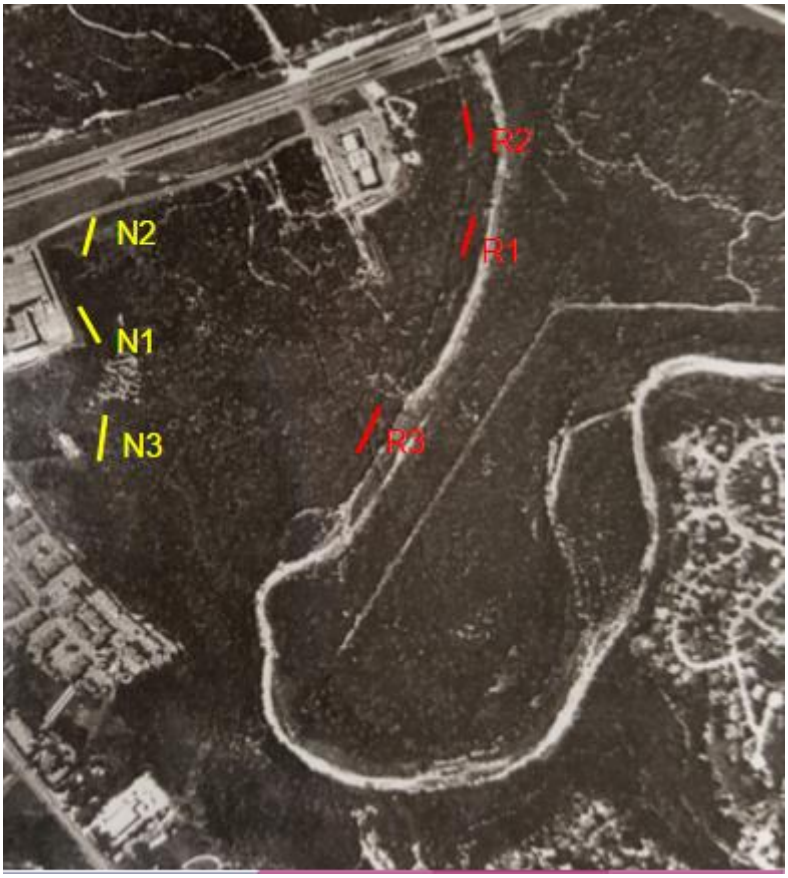
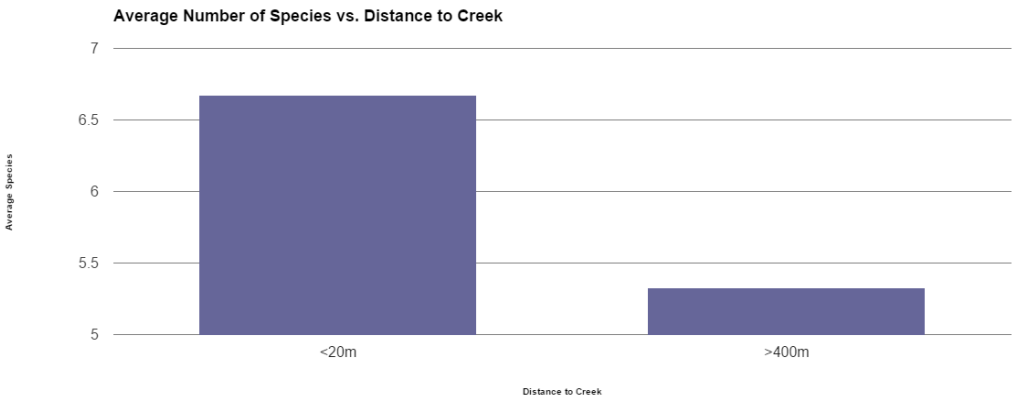
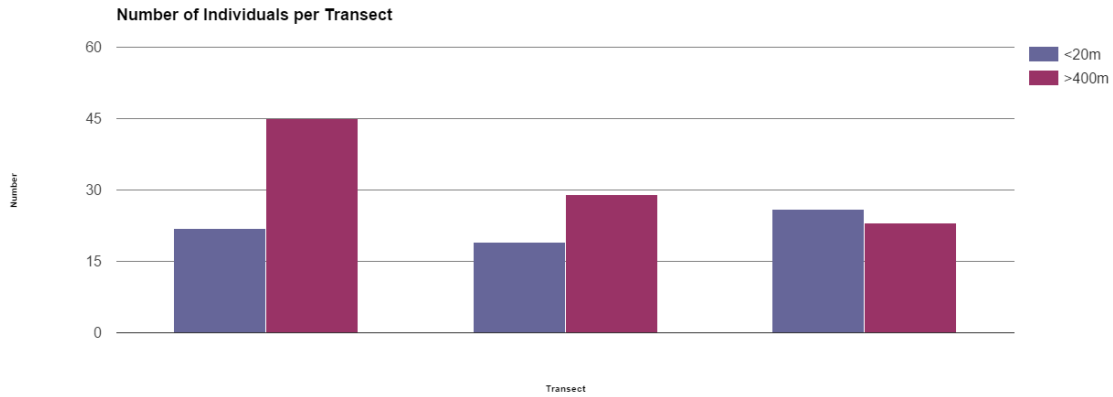
Naiman, Robert & Decamps, Henri. The Role of Riparian Corridors in Maintaining Regional Biodiversity. Web. 08 Dec. 2015

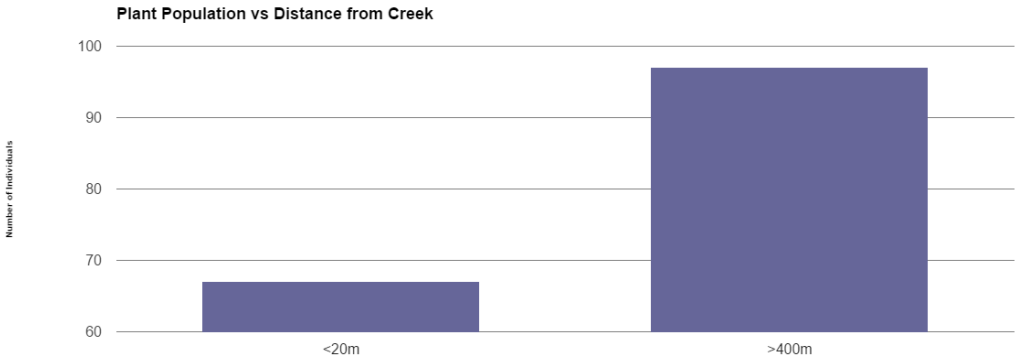


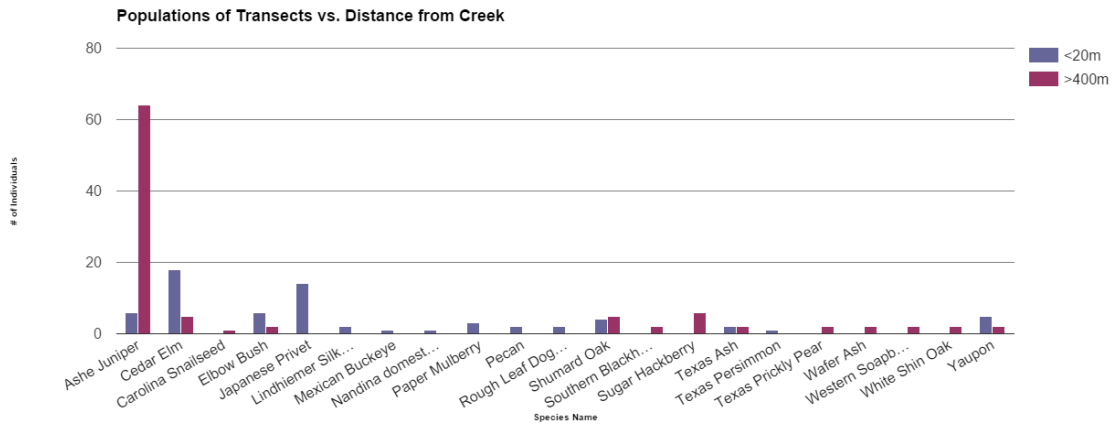
Map of Park with Transects

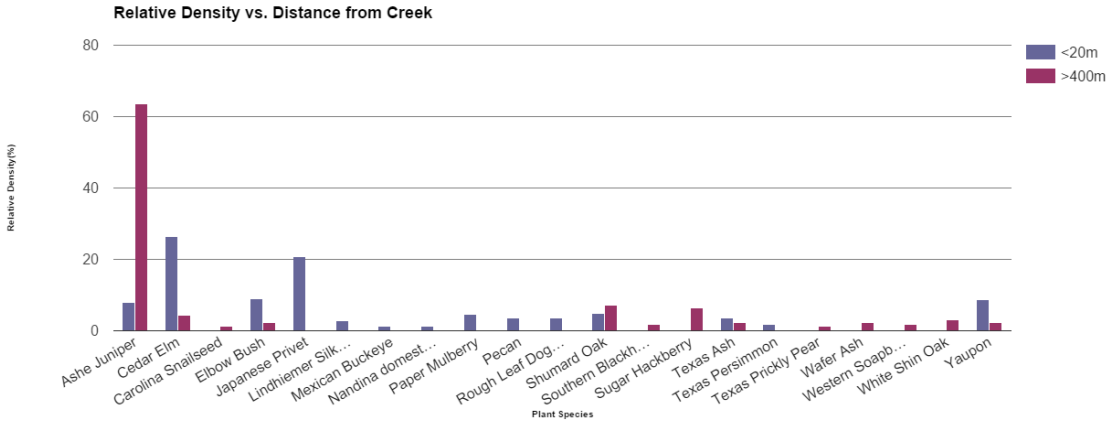
Each transect is 50m long

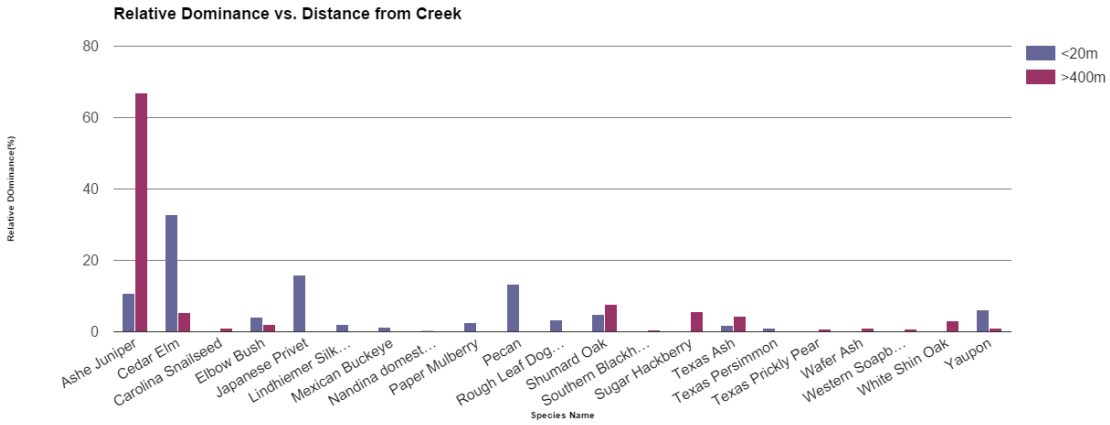


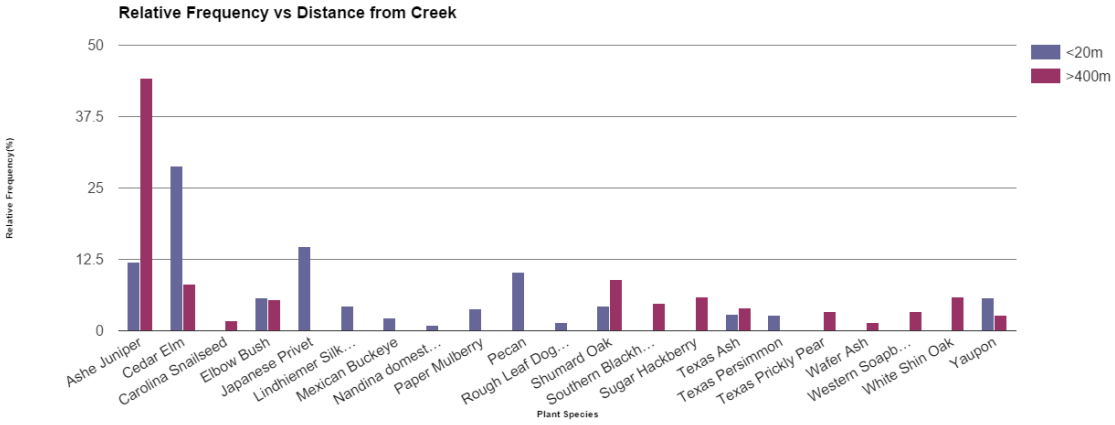

Number of Individuals per Transect
60
45
30
15
0
Number
Transect
<20m
>400m

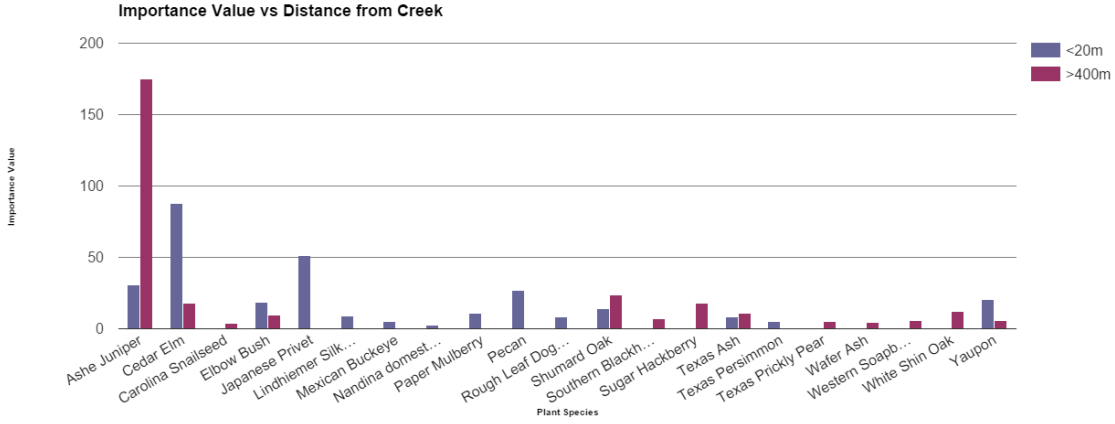

Plant Population vs Distance from Creek
100
90
80
70
60
Number of Individuals
<20m
>400m


Populations of Transects vs. Distance from Creek
80
60
40
20
0
# of Individuals
Ashe Juniper
Cedar Elm
Carolina Snailseed
Elbow Bush
Japanese Privet
Lindheimer Silk…
Mexican Buckeye
Nandina domest…
Paper Mulberry
Pecan
Rough Leaf Dog…
Shumard Oak
Southern Blackh…
Sugar Hackberry
Texas Ash
Texas Persimmon
Texas Prickly Pear
Wafer Ash
Western Soapb…
White Shin Oak
Yaupon
Species Name
<20m
>400m


Relative Density vs. Distance from Creek
80
60
40
20
0
Relative Density(%)
<20m
>400m
Ashe Juniper
Cedar Elm
Carolina Snailseed
Elbow Bush
Japanese Privet
Lindniemer Silk…
Mexican Buckeye
Nandina domest…
Paper Mulberry
Pecan
Rough Leaf Dog…
Shumard Oak
Southern Blackh…
Sugar Hackberry
Texas Ash
Texas Persimmon
Texas Prickly Pear
Wafer Ash
Western Soapb…
White Shin Oak
Yaupon
Plant Species


Relative Dominance vs. Distance from Creek
80
60
40
20
0
Relative DOminance(%)
<20m
>400m
Ashe Juniper
Cedar Elm
Carolina Snailseed
Elbow Bush
Japanese Privet
Lindniemer Silk…
Mexican Buckeye
Nandina domest…
Paper Mulberry
Pecan
Rough Leaf Dog…
Shumard Oak
Southern Blackh…
Sugar Hackberry
Texas Ash
Texas Persimmon
Texas Prickly Pear
Wafer Ash
Western Soapb…
White Shin Oak
Yaupon
Species Name


Relative Frequency vs Distance from Creek
50
37.5
25
12.5
0
Relative Frequency(%)
<20m
>400m
Ashe Juniper
Cedar Elm
Carolina Snailseed
Elbow Bush
Japanese Privet
Lindhiemer Silk…
Mexican Buckeye
Nandina domest…
Paper Mulberry
Pecan
Rough Leaf Dog…
Shumard Oak
Southern Blackh…
Sugar Hackberry
Texas Ash
Texas Persimmon
Texas Prickly Pear
Wafer Ash
Western Soapb…
White Shin Oak
Yaupon
Plant Species


Importance Value vs Distance from Creek
200
150
100
50
0
Importance Value
<20m
>400m
Ashe Juniper
Cedar Elm
Carolina Snailseed
Elbow Bush
Japanese Privet
Lindhiemer Silk…
Mexican Buckeye
Nandina domest…
Paper Mulberry
Pecan
Rough Leaf Dog…
Shumard Oak
Southern Blackh…
Sugar Hackberry
Texas Ash
Texas Persimmon
Texas Prickly Pear
Wafer Ash
Western Soapb…
White Shin Oak
Yaupon
Plant Species

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Ethan Lim- ethan.lim25@gmail.com
12/4/2015
Plearth 3A/7B
Gus Fruh Park

Results of Elevation on Number of Species Present in Gus Fruh Park

Results:

The hypothesis was, as the elevation of the current area of study increases the number of species will increase, which was unsupported by the findings. This is because the data collected showed that there were more species present at a lower elevation than a higher elevation, as shown by the collected data which showed 14 different species at a lower elevation (less than 150 meters) and 16 different species at a higher elevation (greater than 200 meters). However, t-test p values for the species and population of plants at Gus Fruh are .53908 and .205106. Since these values are above .05, the results are not statistically significant. Several patterns that occurred in the data include: Poison oak has a higher relative density, relative dominance and importance value in the high elevations than in the lower elevations. Sycamore has a higher relative dominance, relative frequency and importance value at higher elevations. Japanese Privet has a higher value in everything except relative dominance, when it is found below 150 meters.

Discussion:

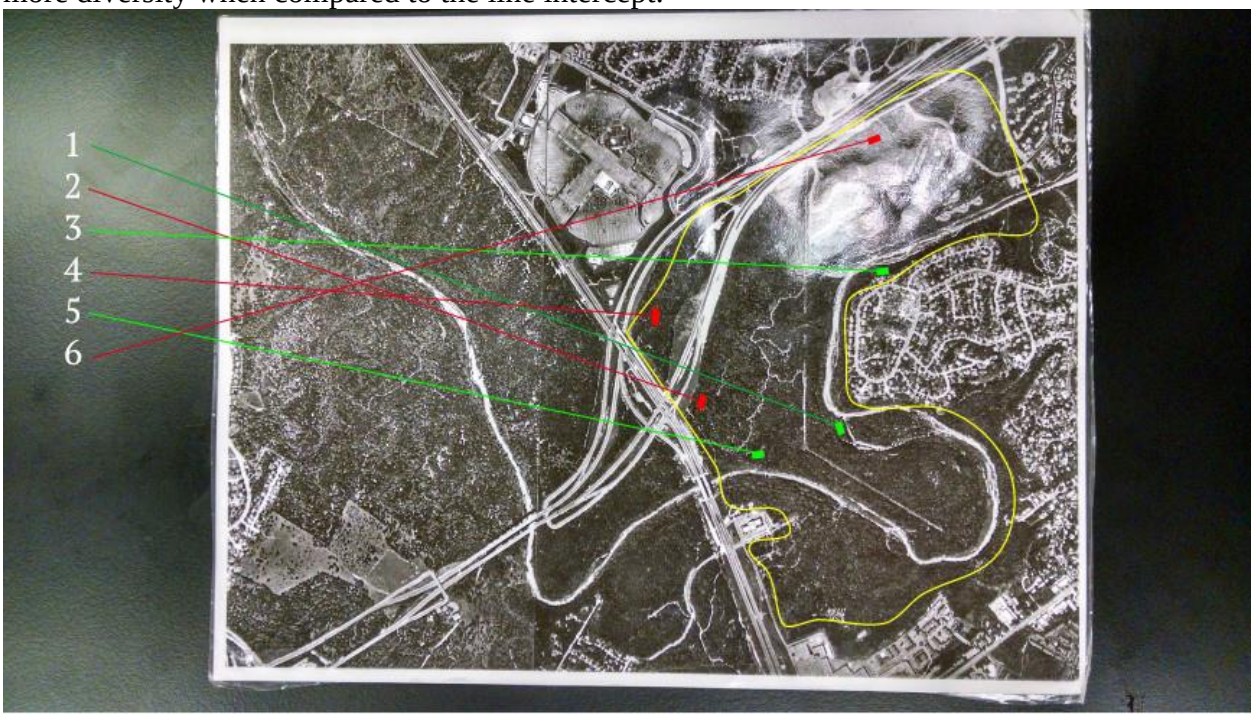
The data collected means that specific species have a higher number of species at lower altitudes however some species are an exception to this rule as they are better adapted to live at higher altitudes such as (greater than 200 meters) Cedar Elm with a higher relative density for the high elevation
versus the relative density of the low elevation (21 percent at high elevation vs 18.5 percent at low elevation).

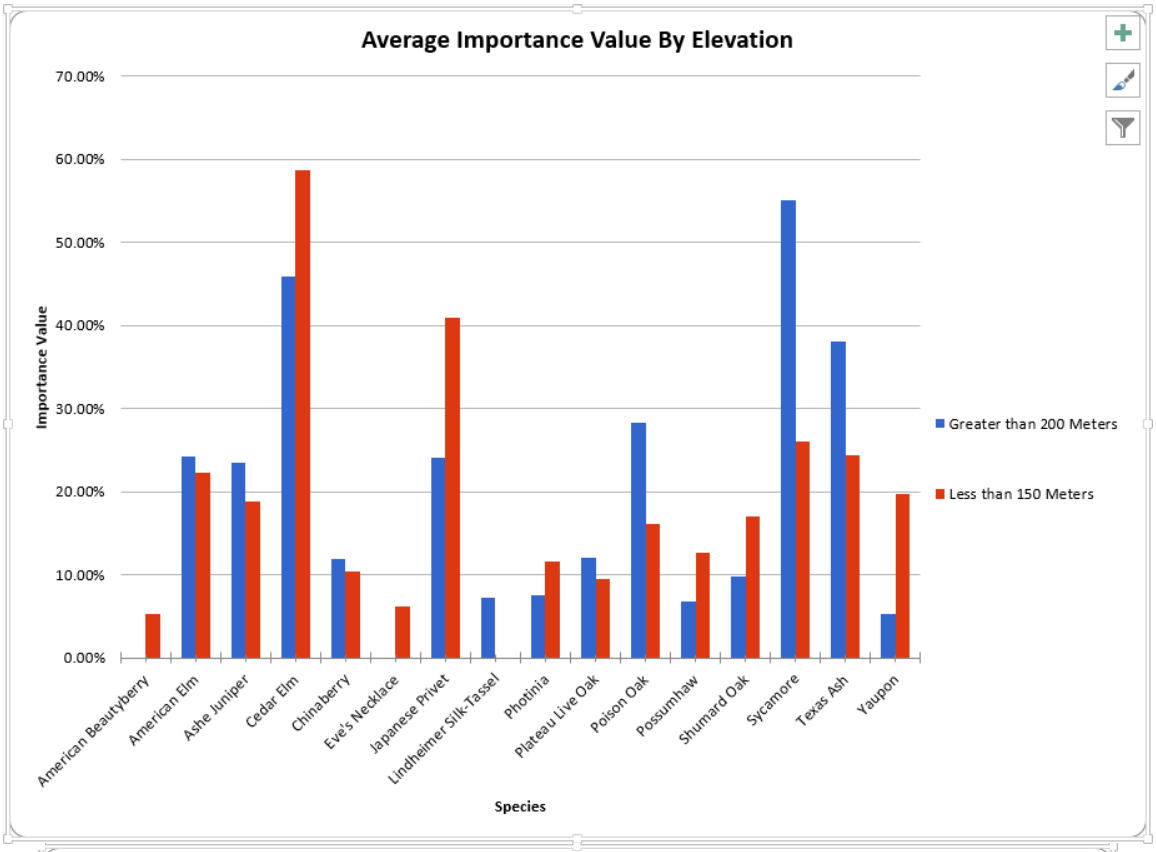
The most plausible explanation for the data would be that not enough data was taken to prove anything. Another problem that may have occurred could be the fact that all of the low elevation areas happened to be near the creek, which could have promoted the growth of the woody plants, throwing off the results. Invasive species such as Photinia, Chinaberry, and Japanese privet could have altered the results as well. Japanese Privet especially, as it had almost double the importance value at lower elevations and it could have crowded out many of the other species in the area, and it grows extremely quickly (1). Chinaberry may outcompete native species, as it can grow to be fairly tall to around 50 feet, and its leaves block out shade relatively well (2). Photinia does not grow nearly as tall as the other invasive species above, but it is more shade tolerant (3).

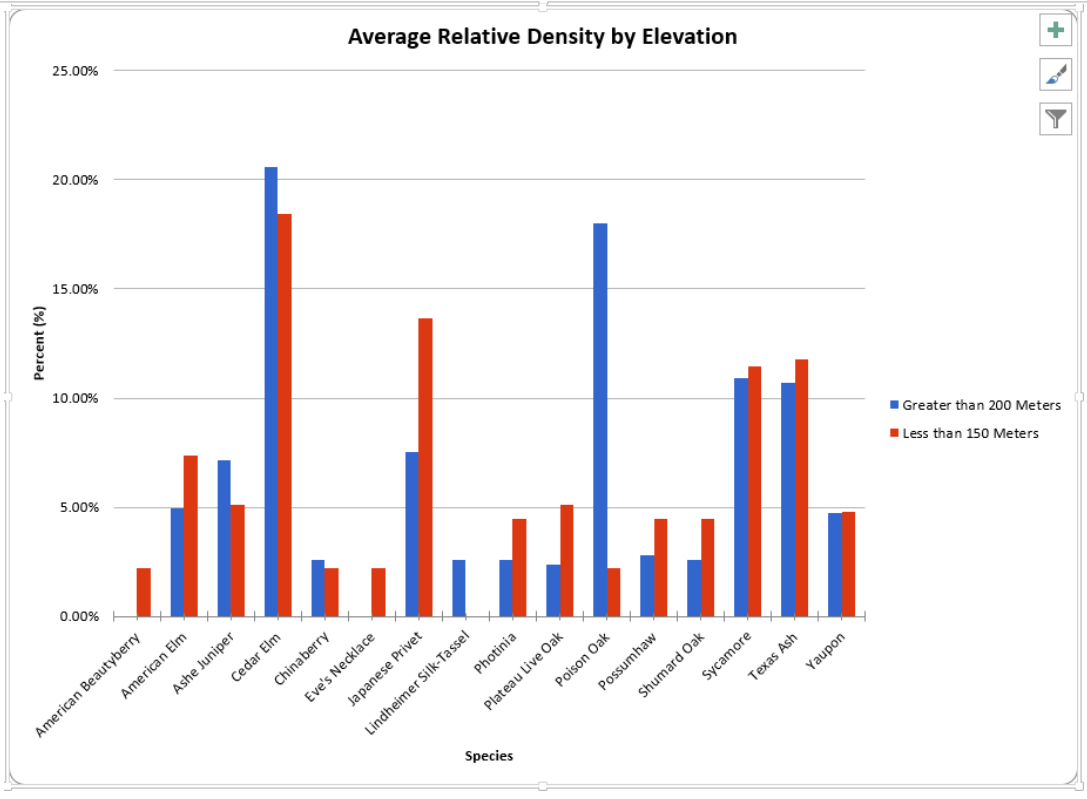
Sycamore had an importance value at greater than 200m that was more than double the value at lower elevations. Since Sycamore Trees can grow to extremely large sizes at a very fast rate, up to 100 feet tall and 70 feet tall (4), it could have easily blocked the sun from areas surrounding it, and subsequently stopping the growth of any non shade-tolerant species. This

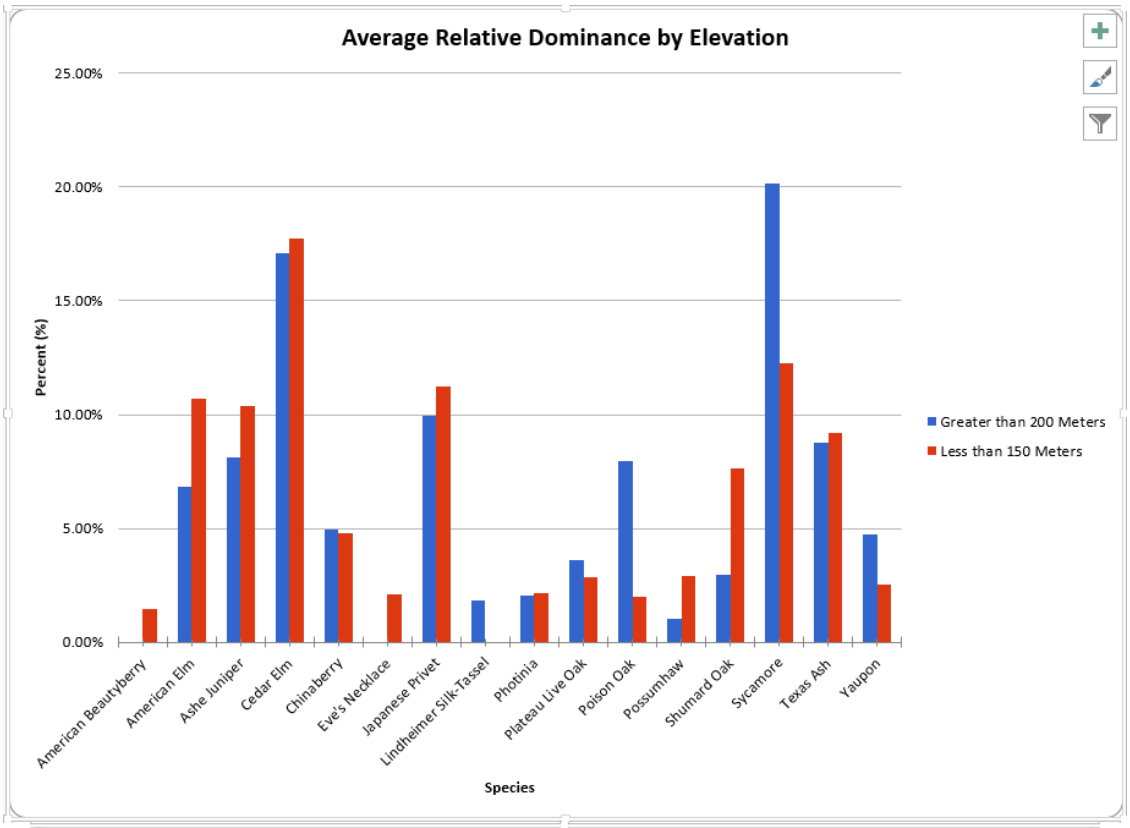
could dramatically decrease the amount of species present and could have accounted for the difference between species amounts at different elevations.

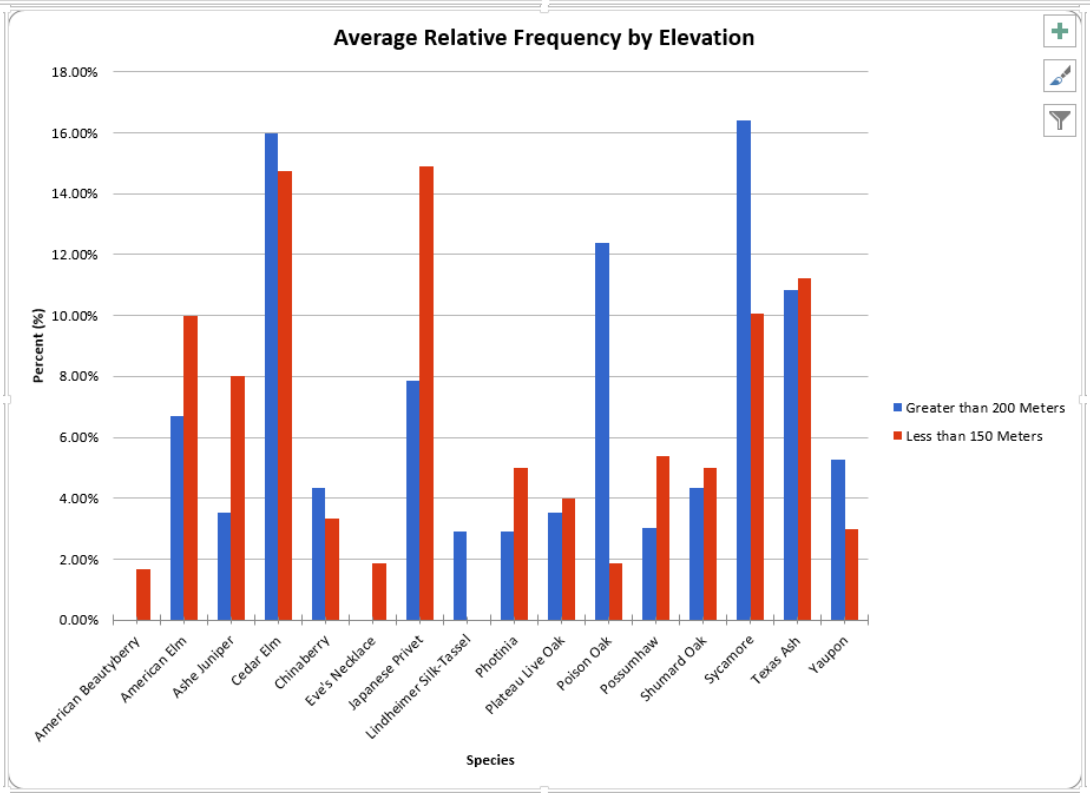
Problems encountered were: during the time when data was taken, large amounts of flooding occurred and may have taken away, destroyed or killed plants in the low elevation points as they were close to the Barton Creek creek-bed. This may have taken away several species or individuals which would have made the data collected more conclusive and more accurate. As for modifications that could be done to the study, the data could be taken at a time where the conditions are more stable or where there is less of a chance of rain and flooding to make the data less accurate. To fix the error of having all of the low elevation transects near the Barton Creek river bed, transects should be placed farther away and parallel to the creek bed while still having an altitude of under 150 meters. Other studies that would benefit the one taken would be one based on finding the amount of plants or species as proximity to water changes. Since bodies of water are typically lower in elevation, the number of species should change, thus adding insight to the study taken. Another method for collecting plants that could have yielded more statistically significant results is the quadrat method. The quadrat method is used to calculate plant population frequency. A quadrat or a sample plot of specific size is used for the study of population density or the amount of plants in the plot of land. Quadrats are always influenced by the size and shape of the plot of land and, because the area of data taken is a plot, the data and plant life could be more diverse (5). The quadrat method of data collection is potentially a better method of taking data because there is more land that plants may be present on a transect. Since the line intercept method is only taking note of plants on a line, the amount of plants on the line might be less than the amount of plants on a plot of land, as a plot has an area instead of just a length. Due to the plot of a quadrat method having more land and thus potentially more plants than the line intercept method, the quadrat method has potential to have more diversity when compared to the line intercept.

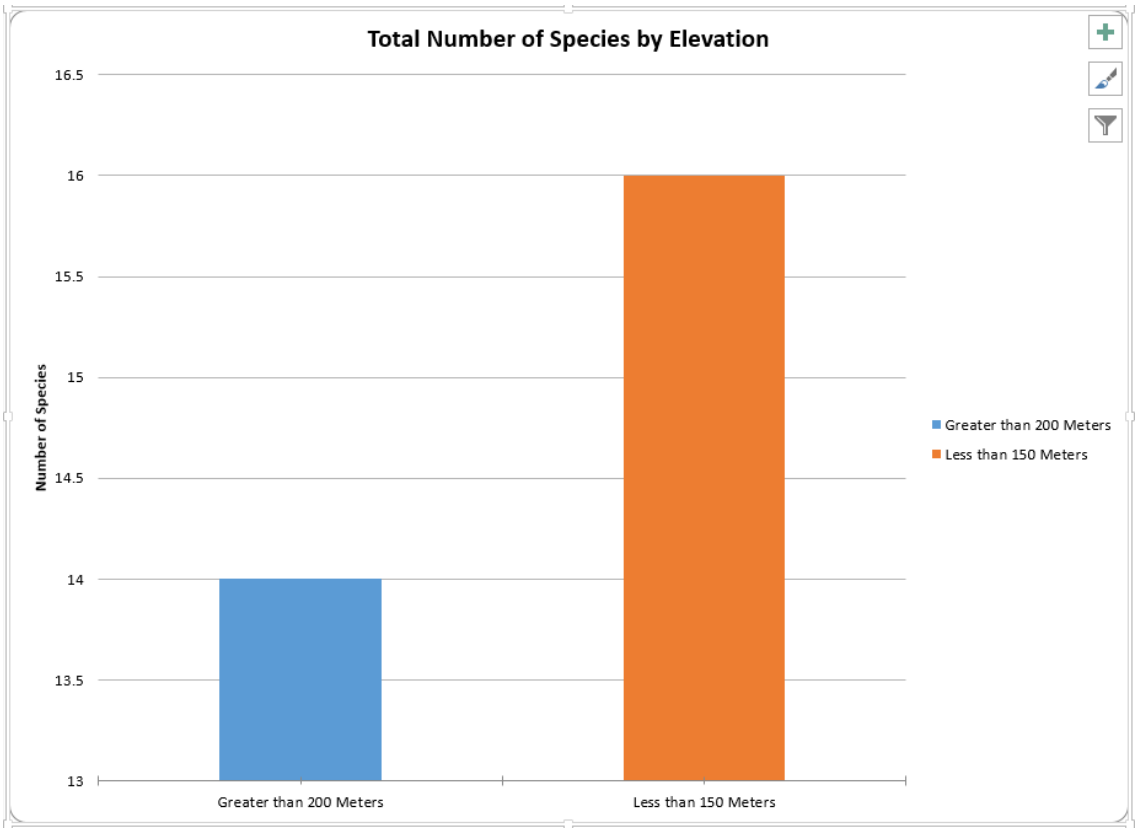



Average Importance Value By Elevation
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Importance Value
American Beautyberry
American Elm
Ashe Juniper
Cedar Elm
Chinaberry
Eve's Necklace
Japanese Privet
Lindheimer Silk-Tassel
Photinia
Plateau Live Oak
Poison Oak
Possumhaw
Shumard Oak
Sycamore
Texas Ash
Yaupon
Species
Greater than 200 Meters
Less than 150 Meters


Average Relative Density by Elevation
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Percent (%)
American Beautyberry
American Elm
Ashe Juniper
Cedar Elm
Chinaberry
Eve's Necklace
Japanese Privet
Lindheimer Silk-Tassel
Photinia
Plateau Live Oak
Poison Oak
Possumhaw
Shumard Oak
Sycamore
Texas Ash
Yaupon
Species
Greater than 200 Meters
Less than 150 Meters


Average Relative Dominance by Elevation
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Percent (%)
American Beautyberry
American Elm
Ashe Juniper
Cedar Elm
Chinaberry
Eve's Necklace
Japanese Privet
Lindheimer Silk-Tassel
Photinia
Plateau Live Oak
Poison Oak
Possumhaw
Shumard Oak
Sycamore
Texas Ash
Yaupon
Species
Greater than 200 Meters
Less than 150 Meters


Average Relative Frequency by Elevation
18.00%
16.00%
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
Percent (%)
American Beautyberry
American Elm
Ashe Juniper
Cedar Elm
Chinaberry
Eve's Necklace
Japanese Privet
Lindheimer Silk-Tassel
Photinia
Plateau Live Oak
Poison Oak
Possumhaw
Shumard Oak
Sycamore
Texas Ash
Yaupon
Species
Greater than 200 Meters
Less than 150 Meters



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Helena Pfluger pflugerhelena17@gmail.com
Hannah Porter hannah13porter@gmail.com

Effects of Proximity to a Water Source on Woody Plants in Gus Fruh Park

Conclusion

Results:

The hypothesis stated that the diversity of woody plants will increase if their proximity to a major water source is increased whereas the diversity will decrease if their proximity to the water source is decreased. "The interactions between woody plants and streamflow in drylands are complex" meaning streamflow usually decreases in response to encroachment of woody plants (Ecological Society of America, 4). The data does support the hypothesis, however the P-values 0.341575 for the number of species and 0.386465 for the number of individuals were too high to be recorded as statistically significant, seeing as data was only taken in a single park over a time span of less than a month. A study done in Austin shows "chloride and sulfate levels averaged 10.8 and 17.9 mg/L" and also shows that chlorophyll levels in Barton Creek were lower than usual, which could have an effect on plant diversity and growth (Twidwell, 9). Most of the plants that were prominent 5 meters away from the creek were seen in small numbers or not at all in areas around 200 to 300 meters away from the creek, and visa versa.

Ashe Juniper and Photinia, which were found to be only prominent furthest away from the creek, are recorded by plant databases on Texas Native Plants to grow "mainly in rocky limestone hills and canyons and is extremely drought resistant,"(Texas Native Plants) . On the other hand, American Elm is mostly found near riverbeds, but they usually have a much shorter lifespan than the American Elm found in the Eastern part of the U.S. in the Appalachian Mts because of they grow better in more moderate climates.

The invasive species of Gus Fruh Park include Encinilla, and Japanese Privet, which are both interestingly only found near the creek itself. They are both recorded by Invasive Species Databases to be extremely common in wetlands and stream banks. The Americas is believed to have been introduced to Japanese Privet by Benjamin Franklin in 1772 and because it has been present in the Americas for so long, it is now adapted to the climate and environmental conditions of Texas, South Carolina, and several other places in the United States. Privets " have the potential to replace mid-canopy trees in forests and completely dominate an area of forest" (austintx.gov, 14). Encinilla is the national tree of Spain and translates to Oak Tree. The introduction of the Encinilla tree is mostly unknown, and is mainly found in thick forests and is known to be most prominent intermediate states of moisture in the soil.

Discussion:

Although the results have not proven anything, the results of this project mean that proximity to water can impact the diversity of woody plants. The results show that the Japanese Privet is found very close to a water source and nowhere else, Shumard Oak is found between

250-300 meters, Yaupon and American Elm are only found close to water sources, American Beautyberry is found farther away from water sources, Ashe Juniper is not found close to water, Photinia, a non-native species, is found far away from water sources (250-300 meters away), Lindheimer Silktassel is found 100-150 meters away from water, and Encinilla is only found 100-150 meters away from water. The overall data shows that there are higher numbers of species closer to Barton Creek, which is understandable due to the fact that there is a larger abundance of resources closer to the creek, mainly more sunlight and water.

Problems in the original study include the transects being too close together. If redone, the study could be modified to provide a more valid study of the Gus Fruh area by having more data be taken over longer periods of time. The transects would have been placed farther apart, and longer transects would have been used. This would allow data from an area where water is much farther away than 300 meters, so the effects of having virtually no water near the woody plants can also be studied.

Another, possibly more effective, method of taking data is the Frequency Method, however, it is somewhat similar to the Line-Intercept Method used in the original study. This method is widely used for collecting data of smaller plants and shrubs, but can be "easily modified for larger woody plants by increasing the quadrat size"(Methods for Plant Sampling, 38) . The Frequency Method is also beneficial because it forces the study to be done over wider areas in general using the nested plot technique which requires two or three different sized quadrats to be used at once.

The Frequency Method is designed to "focus mainly on frequency of the different plant species present in the studied area by using random, different sized quadrats within a smaller region, allowing the data to record not only frequency of species overall,"(Methods of Plant Sampling, 42), but also frequency of individuals within a species. Thus making it easier for conclusions to be drawn and more information about the frequency of plants in a smaller quadrat in comparison to quadrats that cover a wider area. The Frequency Method also requires very little to no prior experience, lessening the chance of human error when taking data and analyzing it.

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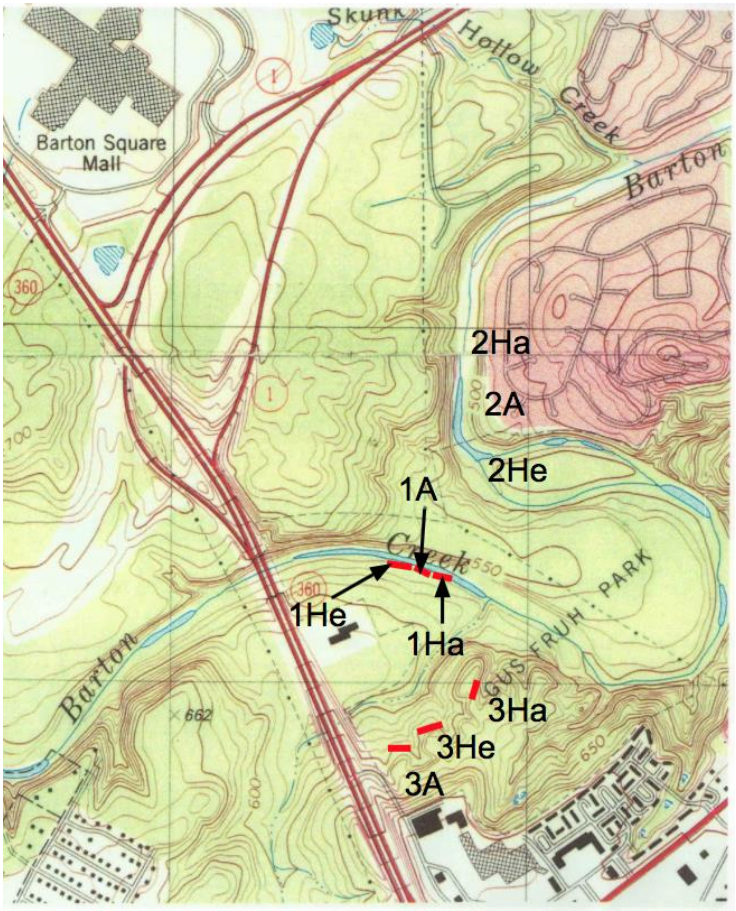
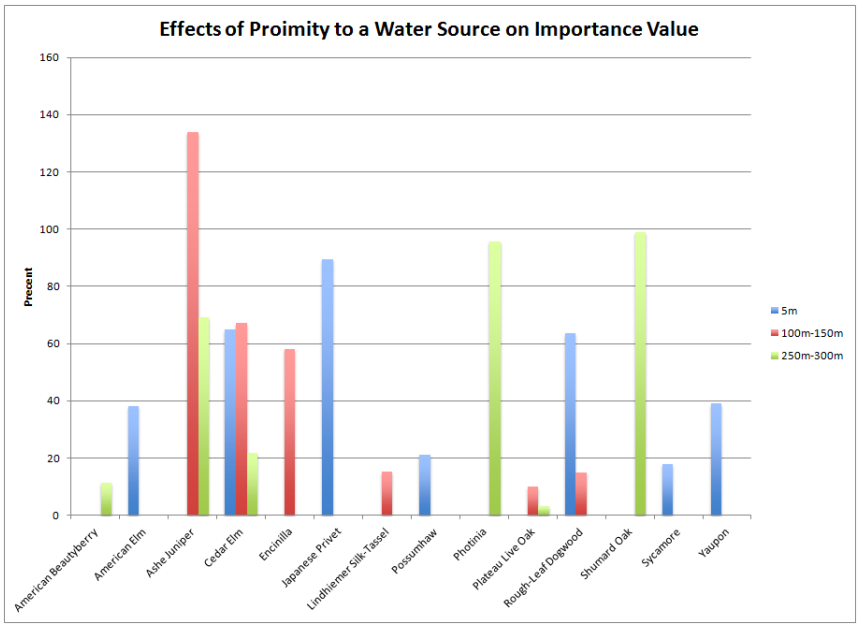
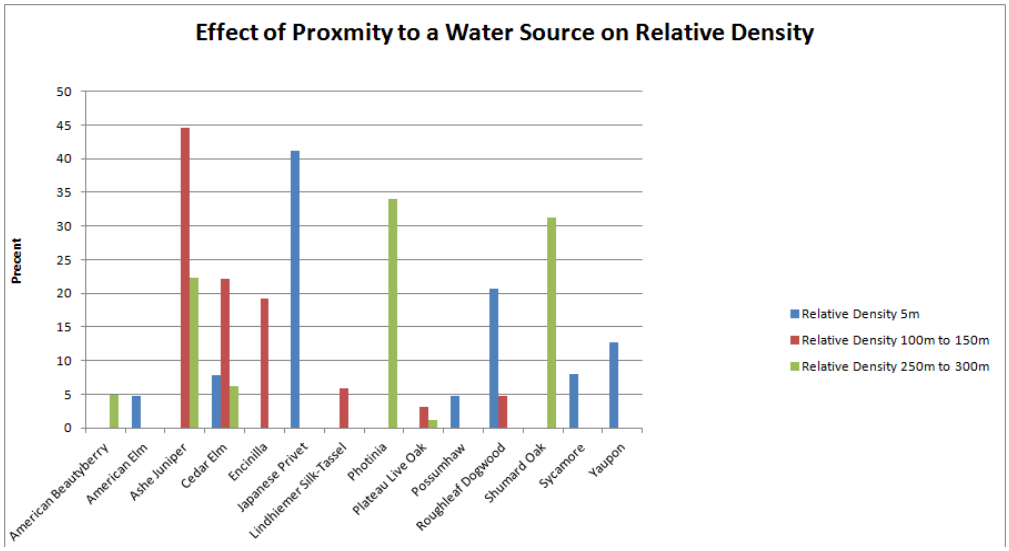
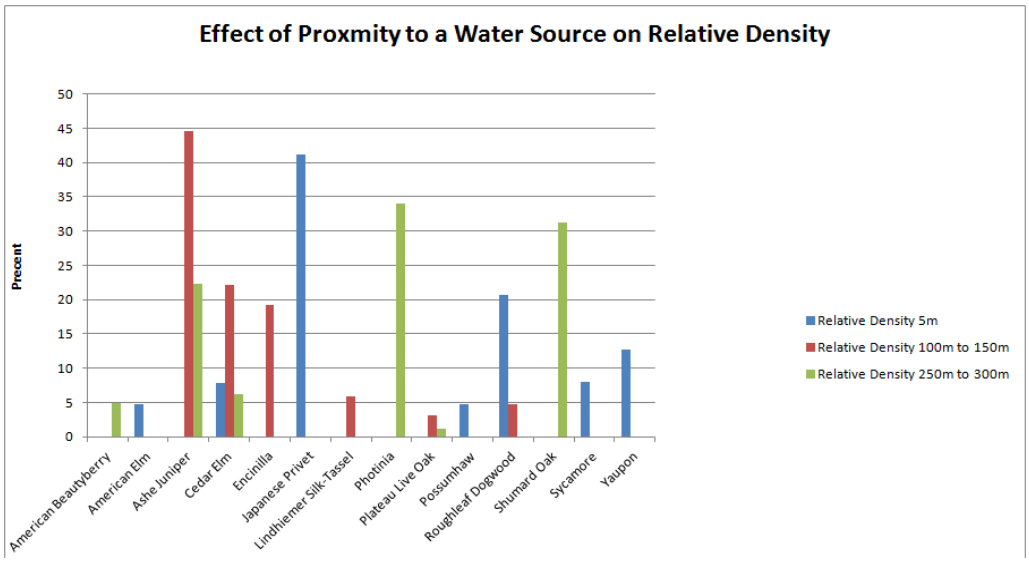


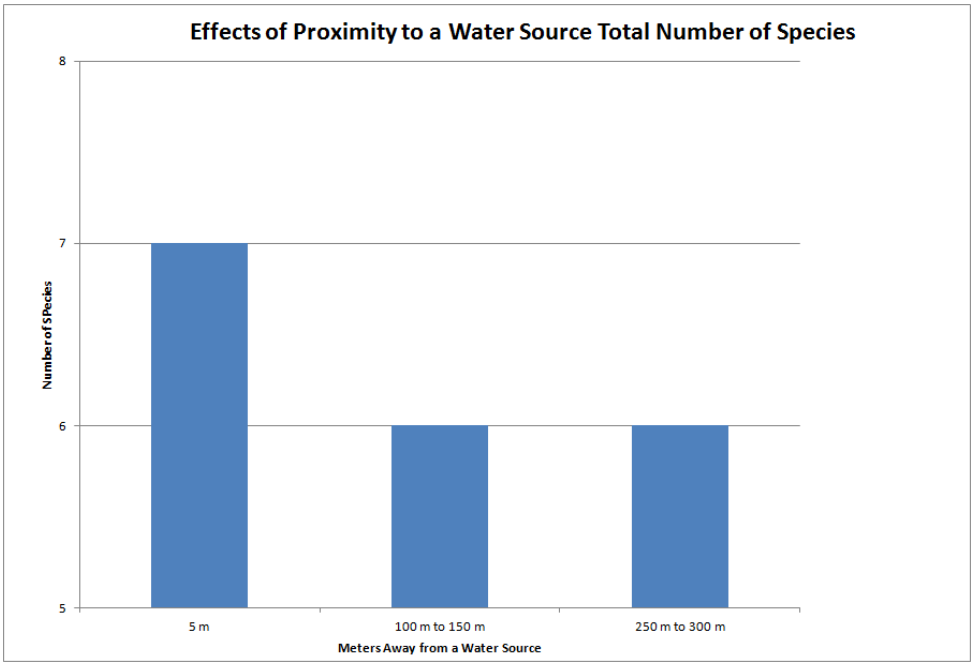
Each transect 50 meters

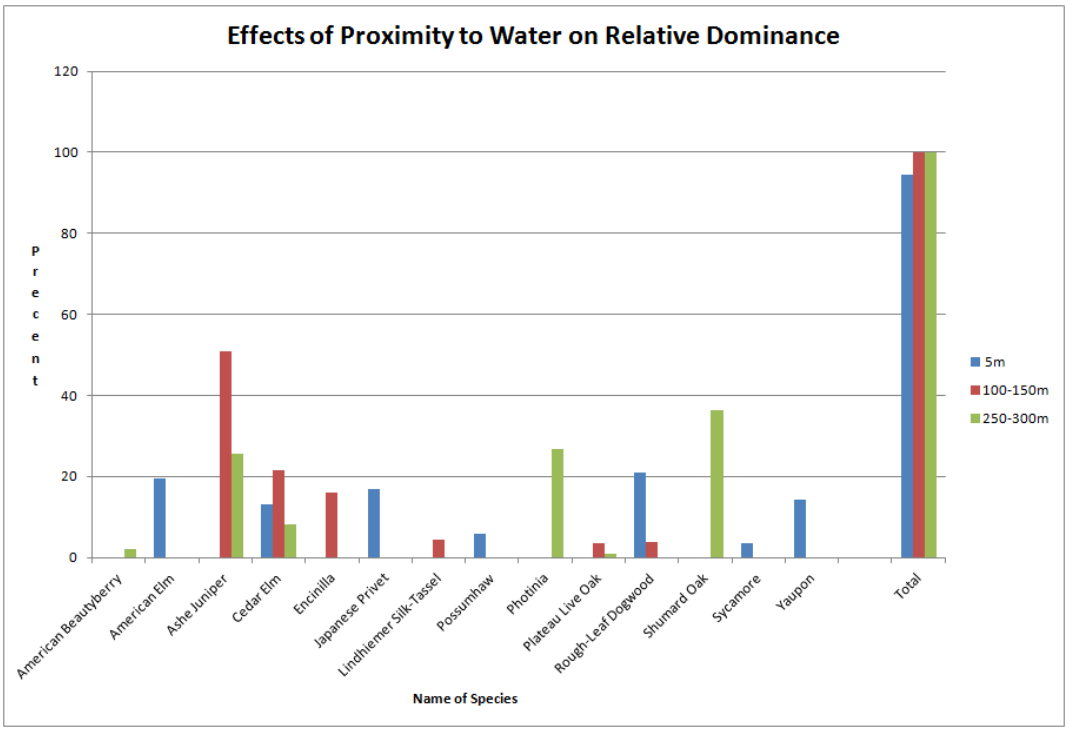
Graphs

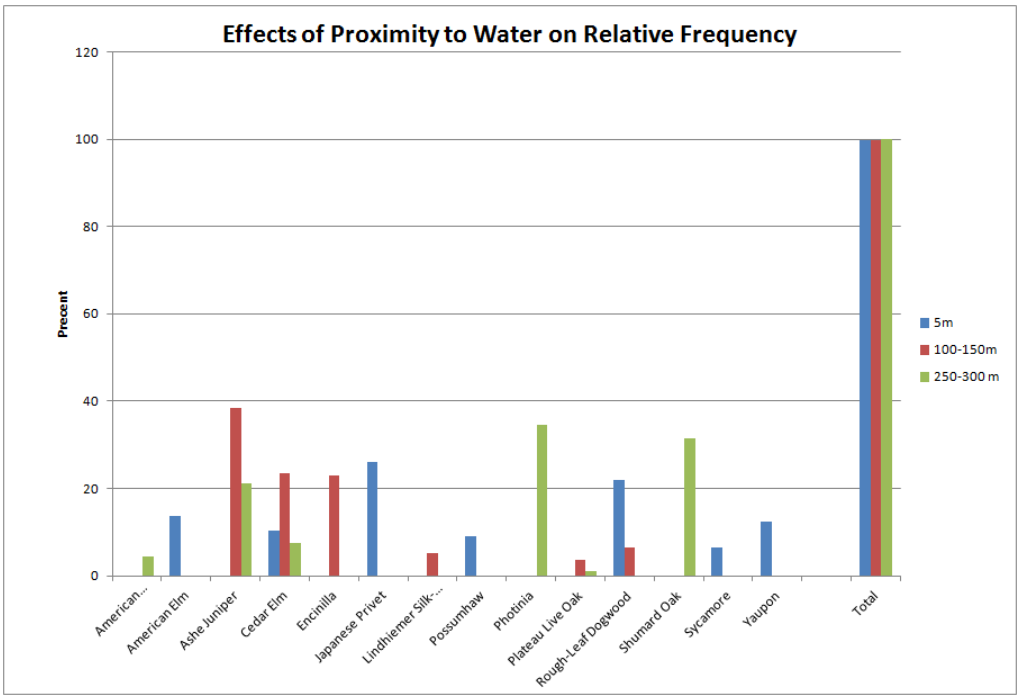

Effects of Proimity to a Water Source on Importance Value
Precent
160
140
120
100
80
60
40
20
0
American Beautyberry
American Elm
Ashe Juniper
Cedar Elm
Encinilla
Japanese Privet
Lindhiemer Silk-Tassel
Possumhaw
Photinia
Plateau Live Oak
Rough-Leaf Dogwood
Shumard Oak
Sycamore
Yaupon
5m
100m-150m
250m-300m

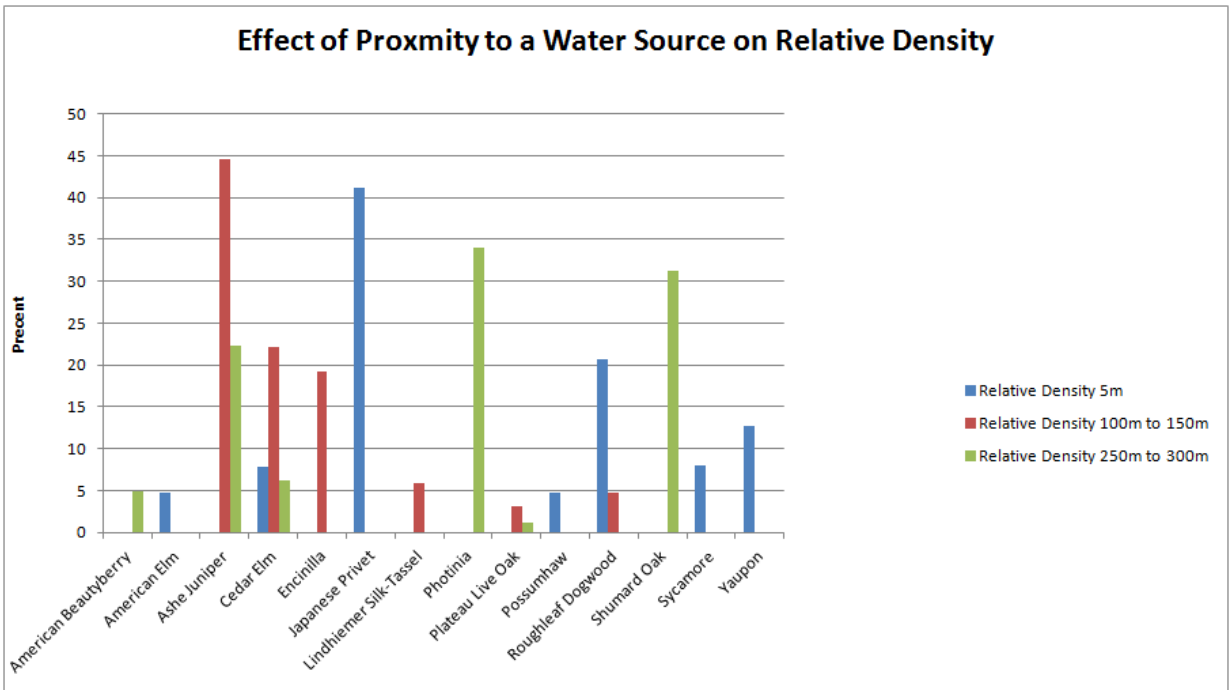

Effect of Proxmity to a Water Source on Relative Density
Precent
50
45
40
35
30
25
20
15
10
5
0
American Beautyberry
American Elm
Ashe Juniper
Cedar Elm
Encinilla
Japanese Privet
Lindhiemer Silk-Tassel
Photinia
Plateau Live Oak
Possumhaw
Roughleaf Dogwood
Shumard Oak
Sycamore
Yaupon
Relative Density 5m
Relative Density 100m to 150m
Relative Density 250m to 300m


Effect of Proxmity to a Water Source on Relative Density
Precent
50
45
40
35
30
25
20
15
10
5
0
American Beautyberry
American Elm
Ashe Juniper
Cedar Elm
Encinilla
Japanese Privet
Lindhiemer Silk-Tassel
Photinia
Plateau Live Oak
Possumhaw
Roughleaf Dogwood
Shumard Oak
Sycamore
Yaupon
Relative Density 5m
Relative Density 100m to 150m
Relative Density 250m to 300m


Effects of Proximity to a Water Source Total Number of Species
Number of SPecies
8
7
6
5
5 m
100 m to 150 m
250 m to 300 m
Meters Away from a Water Source


Effects of Proximity to Water on Relative Dominance
120
100
80
60
40
20
0
Percent
5m
100-150m
250-300m
American Beautyberry
American Elm
Ashe Juniper
Cedar Elm
Encinilla
Japanese Privet
Lindhiemer Silk-Tassel
Possumhaw
Photinia
Plateau Live Oak
Rough-Leaf Dogwood
Shumard Oak
Sycamore
Yaupon
Total
Name of Species


Effects of Proximity to Water on Relative Frequency
120
100
80
60
40
20
0
Precent
5m
100-150m
250-300 m
American...
American Elm
Ashe Juniper
Cedar Elm
Encinilla
Japanese Privet
Lindhiemer Silk-...
Possumhaw
Photinia
Plateau Live Oak
Rough-Leaf Dogwood
Shumard Oak
Sycamore
Yaupon
Total


Effect of Proxmity to a Water Source on Relative Density
Precent
50
45
40
35
30
25
20
15
10
5
0
American Beautyberry
American Elm
Ashe Juniper
Cedar Elm
Encinilla
Japanese Privet
Lindhiemer Silk-Tassel
Photinia
Plateau Live Oak
Possumhaw
Roughleaf Dogwood
Shumard Oak
Sycamore
Yaupon
Relative Density 5m
Relative Density 100m to 150m
Relative Density 250m to 300m

Anova: Single Factor-	Number of Species					
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Near Water	3	16	5.333333	1.333333		
Intermediate	3	10	3.333333	2.333333		
Far from Water	3	11	3.666667	4.333333		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	6.888889	2	3.444444	1.291667	0.341575	5.143253
Within Groups	16	6	2.666667			
Total	22.88889	8				

Anova: Single Factor-	Number of Individuals					
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Near Water	3	96	32	181		
Intermediate	3	71	23.66667	9.333333		
Far From Water	3	69	23	12		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	150.8889	2	75.44444	1.118616	0.386465	5.143253
Within Groups	404.6667	6	67.44444			
Total	555.5556	8				

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Diversity of Woody Plant Species and Proximity to Water

Conclusion:

The hypothesis that species diversity decreased as proximity to water decreased was supported by the data. The total number of species decreased the further from the creek bed the transects were taken. The number of species went from an average of 7 species per transect 10 meters or less from the creek bed to an average of 5 species per transect 150 meters from the creek bed. This could be due to more water being available by the creek bed which is able to accommodate the various water and other living requirements of multiple species of plants. Since most water evaporates out of the plant due to transpiration (95%), plants require more water to be present so that the small percentage of water they do absorb will keep them from wilting (Clemson 1).

The relative dominance of certain important species increased the farther away from the creek bed the transects were taken. The relative dominance of such species as Cedar Elm, Japanese Privet, and Shumard Oak all increase by 5-20% as the distance from the creek bed increase. The importance value of certain important species also increases as the transects were taken further from the creek bed. The relative frequency of the plant species found increases the further from the creek, this is due to the lower variation of vegetation the further the distance is from the creek allowing for the same species to re-appear at further distances. Texas ash goes from 7.9% to 24.2%

in terms of relative frequency with the greater of the two percentages being at a farther distance from the creek. The relative density per species varies due to their distance from the creek, this accounts for the fact that the relative density of certain plants is lower the further they are from the creek. Japanese privet is an example of a species that increases in relative density the farther away from the creek going from 18.1% to 25.94%. The importance value of such species as Cedar Elm, Japanese Privet, and Shumard Oak all increase by 12-45 points as the distance from the creek bed increases. These could both be due to the fact that since there are less species present, certain species of plants that find the less wet conditions favorable take the places of plants that can't survive in drier conditions (Krebs 1). Thus, more plant species living nearer to water means less dominance in any area of statistics taken for those species (Magurran 2).

If our study was to be redone, many more transects of data would have to be taken to make our data relevant and significant. Other studies that could be done to help the understanding of why more species live/grow nearer to water are studies as to how well certain species of woody plants retain water and which species retain water more effectively than others and studies as to how much water is actually required to do photosynthesis for plants. The size of leaf of certain woody plants could also be collected to see if there is a correlation between the efficiency of those plants to retain water and their leaf size.

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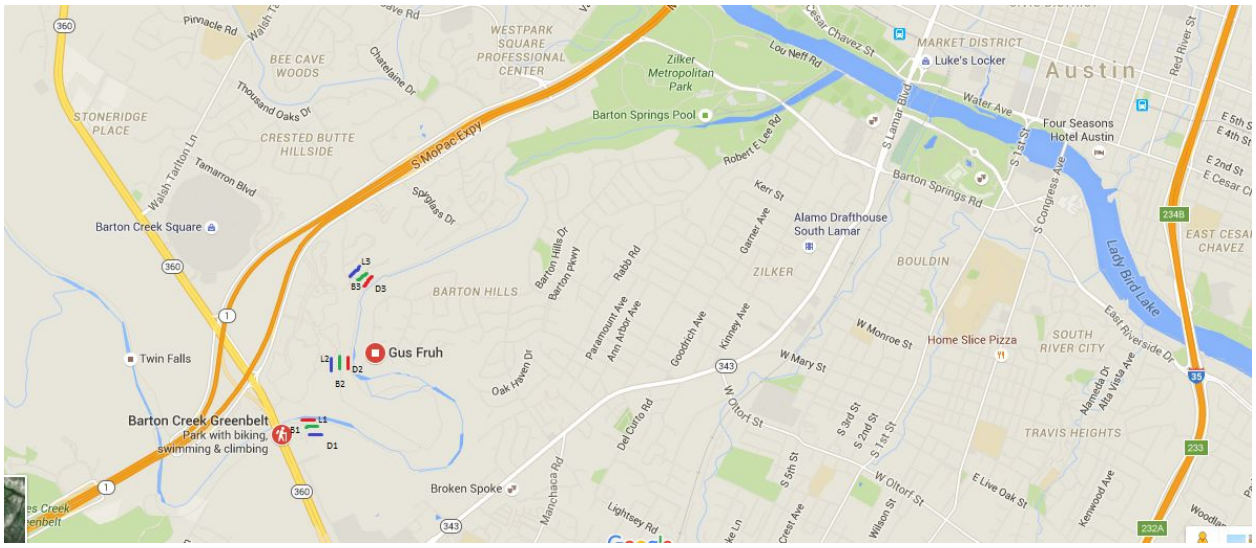
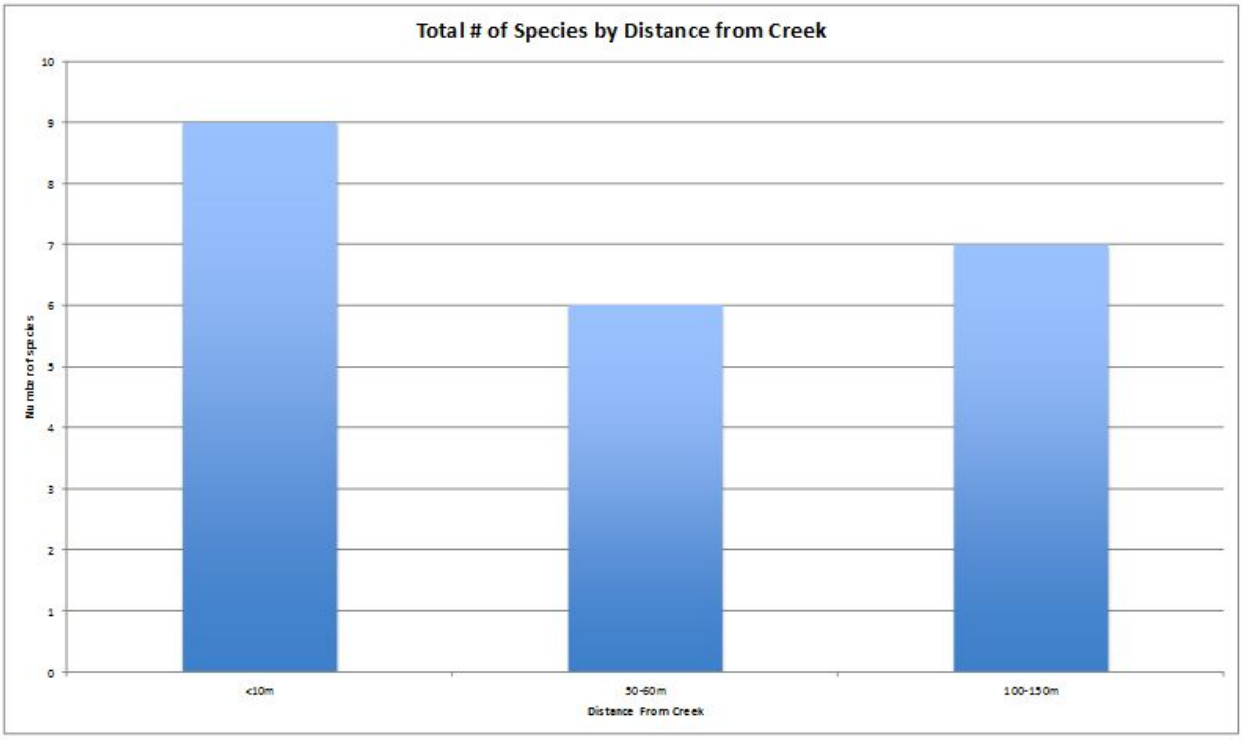
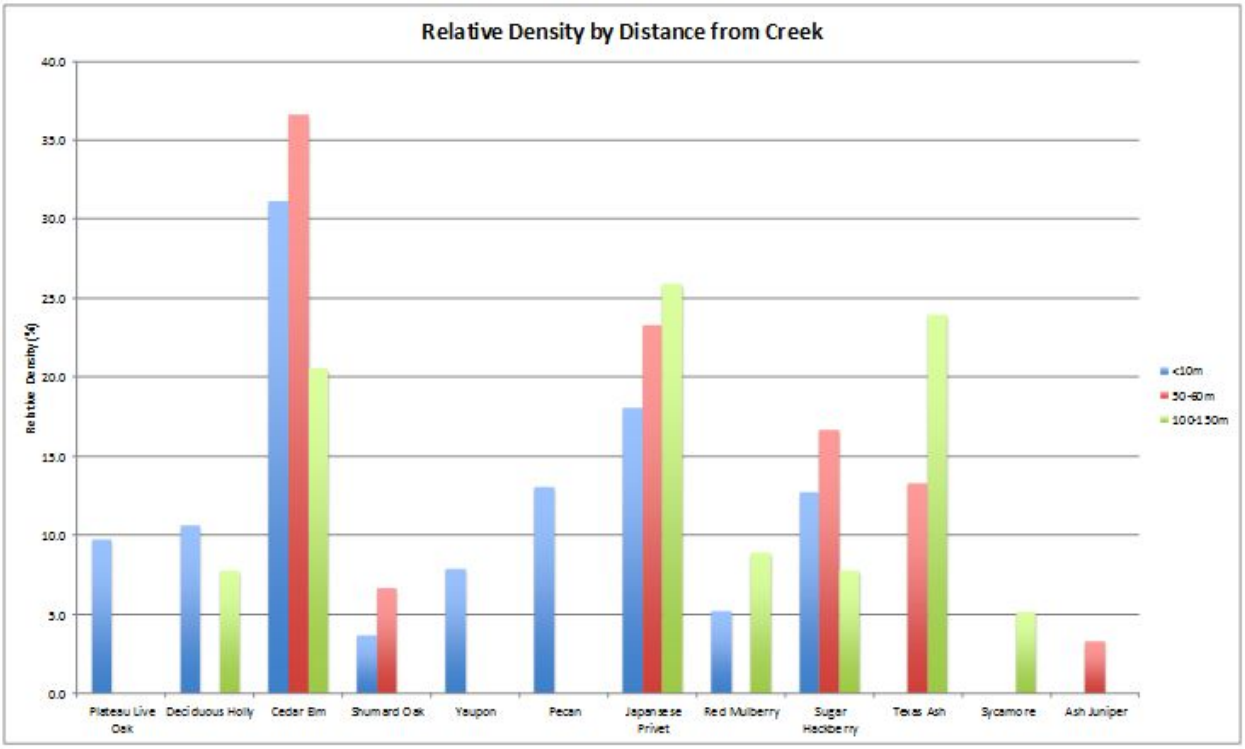
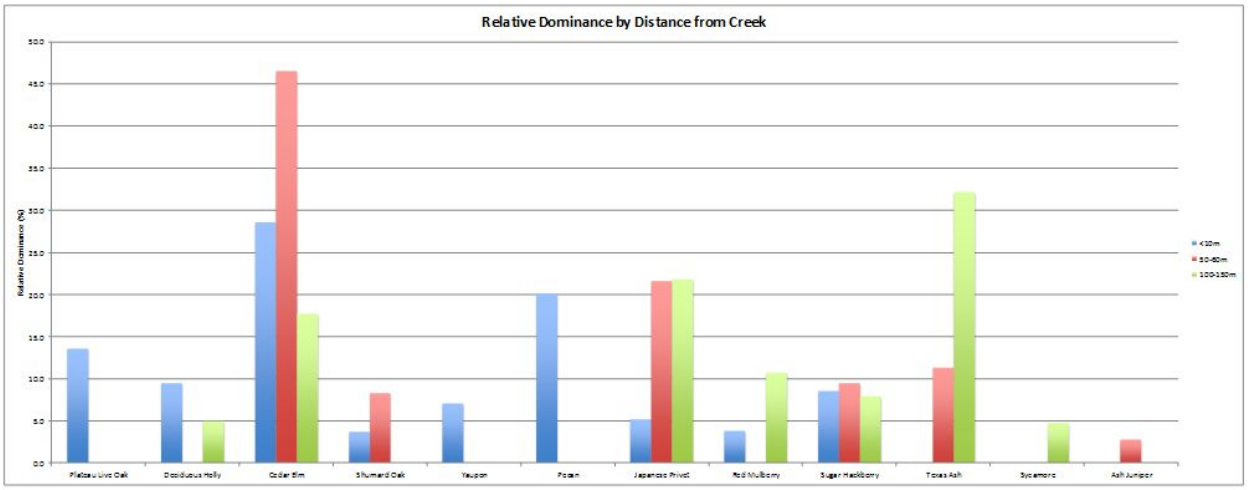
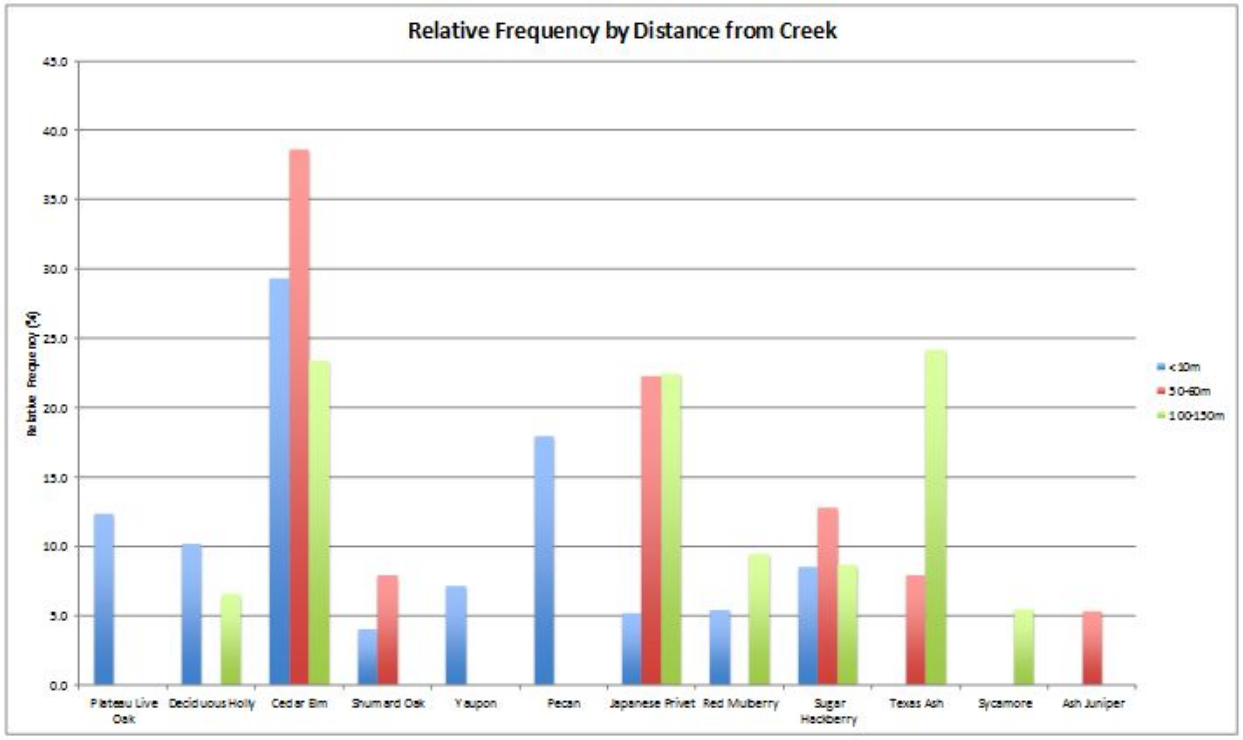


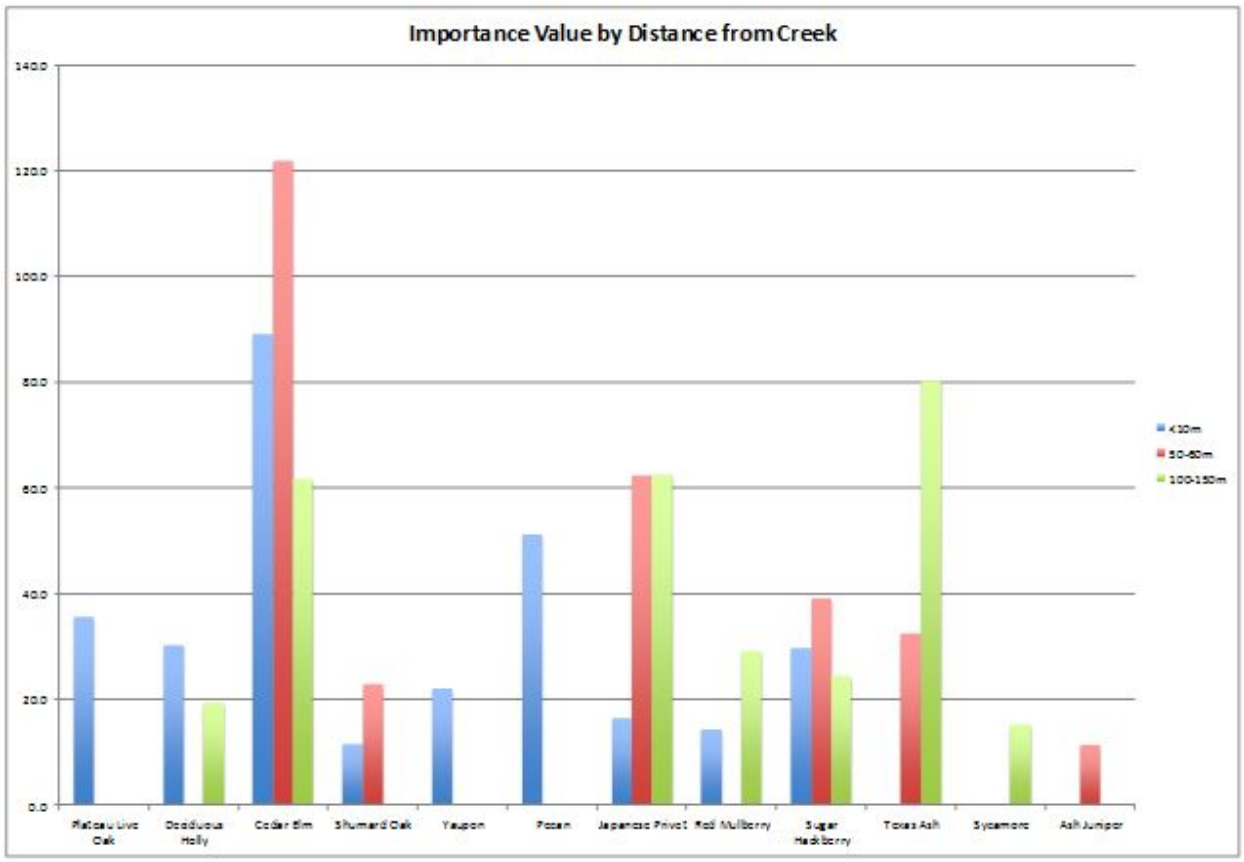
(50 meter transects)


Total # of Species by Distance from Creek
Number of species
0
1
2
3
4
5
6
7
8
9
10
<10m
50-60m
100-150m
Distance From Creek


Relative Density by Distance from Creek
Relative Density (%)
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
Plateau Live Oak
Deciduous Holly
Cedar Elm
Shumard Oak
Yaupon
Pecan
Japanese Privet
Red Mulberry
Sugar Hackberry
Texas Ash
Sycamore
Ash Juniper
<10m
50-60m
100-150m


Relative Dominance by Distance from Creek
Relative Dominance (%)
<10m
50-60m
100-150m


Relative Frequency by Distance from Creek
Relative Frequency (%)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
<10m
50-60m
100-150m
Plateau Live Oak
Deciduous Holly
Cedar Elm
Shumard Oak
Yaupon
Pecan
Japanese Privet
Red Mulberry
Sugar Hackberry
Texas Ash
Sycamore
Ash Juniper


Importance Value by Distance from Creek
1400
1200
1000
800
600
400
200
0.0
<10m
50-60m
100-150m
Plateau Live Oak
Deciduous Holly
Cedar Elm
Shumard Oak
Yaupon
Pecan
Japanese Privet
Red Mulberry
Sugar Hackberry
Texas Ash
Sycamore
Ash Juniper