Songbird Diversity in Oak Woodland and Riparian Habitats

In the Los Padres National Forest, San Luis Obispo County, California

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ABSTRACT

Diversity in songbirds (Passeriformes) between riparian and oak woodland habitats has not been studied before in the Los Padres National Forest around the Hi Mountain Lookout in San Luis Obispo County. Surveys of avian populations were conducted by point counts on fifty variable circular plots; surveys were performed between July and August of 2010. Diversity was calculated using the Shannon-Weiner method, and then squared for normality. No significant results were found when comparing the diversity values between riparian and oak woodland habitat ($F = 0.52$, $p = 0.472$). Although the results showed no significance, the data are still important, as they are part of a long term ecological monitoring project conducted between Cal Poly and the US Forest Service.

INTRODUCTION

The Los Padres National Forest, located on the Central Coast of California, is a very large and diverse National Forest. It stretches from the Monterey Bay to Santa Barbara, encompassing all the habitat types and climates between the two. With records of over 445 different species of birds within San Luis Obispo County, the county is a very diverse place for birds, from the shorebirds at Morro Bay to the cranes of Soda Lake (Edell, 2006). This study comparing songbird (Passeriformes) diversity in oak woodland and riparian habitat types was conducted in the Los Padres National Forest in the area surrounding the Hi Mountain Lookout.

This area of the LPNF is composed mostly of the Interior Santa Lucia Range (Goudy and Scott, 1998). It is characterized by steep, rocky slopes, with narrow canyons where water runoff occurs; the climate is mostly hot and subhumid. The vegetation is a mosaic of hard chaparral, blue oak woodland, and grassland, with dense Sycamore-live oak riparian corridors in the narrow canyons. Data was collected via point counts of 49 1-hectare plots. The data was then put through the Shannon-Wiener function to provide a diversity index for both riparian and oak woodland habitat types, it was then squared to attain normality.

The null hypothesis states that passerine diversity squared is equal between oak woodland and riparian habitat types. The alternative hypothesis is that passerine diversity squared is higher in riparian habitat types compared to oak woodland habitat. In 2003, a study was conducted in the exact same area, using the same methods, however looking at the avian population as a whole, as compared to just passerines (Tyner, 2004). This study focuses solely on passerines because the large numbers of non-passerines, mostly Acorn Woodpeckers, Mourning Doves, and Quail, present during the times that the surveys were being conducted could throw off the diversity index. Because the surveys were conducted outside of the breeding season, many of the breeding birds were no longer calling, and as such, surveyors heard a higher proportion of the non-passerines calling compared to the proportion of passerines calling (Tyner, 2004). Also, upland birds, such as doves and quail, can influence diversity within a riparian site, and we wanted to avoid that (Knopf and Sampson, 1994).

This study was conducted as a part of a long term study of the Los Padres National Forest by the US Forest Service and California Polytechnic State University. Starting in 2003, surveys have been conducted inventorying the avian, mammalian, herpetological, invertebrate and vegetative communities in the area around Hi Mountain Lookout. The long term study is the first one done in the area, as no other inventories have been attempted in the past.

MATERIALS AND METHODS

Experimental Design and Plot Selection

Because the project was using the same experimental design and plot selection as Tyner, the plots that Tyner randomly selected were the same plots that were used for the survey (Tyner, 2004). The original selection of vegetation types consisted of using ArcView software, a program that allows users to turn geographic data into information that is able to be queried. By overlaying forest boundaries, roads, and streams over a vegetation shapefile, Tyner was able to have a map of the Hi Mountain Area that could be queried. They then ran queries and separated out the vegetation into areas that could have one hectare plots on them.

The area around the Hi Mountain Lookout was broken down into chaparral, oak woodland and riparian using criteria for recognizing these communities as outlined in *California Vegetation* (Holland and Keil, 1995). In each vegetation type, one hectare plots were located; they had to be 150 meters from a road, they could not straddle any vegetation type boundaries, and could not be too steep or inaccessible (Tyner, 2004). The first 25 plots that met the criteria for each vegetation type were then randomly selected (Table 1). Unfortunately, one of the riparian plots, R10225, was inaccessible this year, due to being up a steep hillside and in the middle of a small plot of chaparral; this plot was then excluded from all surveys.

Avian Field Methods

The techniques for conducting the avian surveys were derived from the *Handbook of Field Methods for Monitoring Landbirds* (Ralph et al., 1993). The counts were conducted from as close to the center of the plot as possible. We used a handheld GPS device to get to the center of each plot. Each of the points was surveyed once. Surveys occured from 7 July 2010, to 9 August 2010 (Table 2). Data was collected from 15 minutes after sunrise until almost 10:00 AM, as after this time avian activity starts to decline (Ralph et al., 1993).

Plots were approached with every attempt being made to avoid disturbance of them. Any individuals that were flushed from the plot when the team approached were counted. When the center was reached, the survey team got their bearings and then started the count. A 5 minute count was performed, noting every species that was identified by ear or by sight during this time. Birds were noted as to whether they were identified during the first 3 minutes or the last 2 minutes. Individuals were noted as being less than 25 meters from the plot center, between 25 and 50 meters from the plot center, and over 50 meters from the plot center; birds flying over the plot were counted as flyovers (Table 3). This method of conducting point counts and also measuring distance from the plot is called a variable circular plot. Every effort was made to not double count birds.

Data Analysis

To calculate an index of diversity, the Shannon Wiener diversity function, $H= -\sum(p_i)(\log_2 p_i)$ was used. H is the index of diversity, found by the proportion *p* of the number of individuals in the total sample in the *i*th species. The Shannon Wiener index was determined to be the appropriate measure of diversity because it takes into account the evenness of the species between the plots as well as the number of individuals between plots (Eck, 1999). The H-value was computed using the online diversity calculator (Eck, 1999). As the point counts detected more than just songbirds, any bird not in Passeriformes was not counted in the calculation of the H-value, to obtain an H-value solely for songbirds (Table 4). All data (not just to 3 minutes, but to 5 minutes, and not just to 25 meters, but to 50 meters) were used.

After the individual H-values were obtained, they were compiled and entered into Minitab Statistical Software (Minitab 16.1.1). An Anderson-Darling normality test was run on the data to test for normality, and the data was squared to achieve normality (Figure 1). An ANOVA was then conducted on the two data sets.

RESULTS

The average songbird diversity values between the two habitat types were uneven, with the riparian habitat having an average diversity value of 1.724 and the oak woodland habitat having an average diversity value of 1.512 (Table 5). The original point count data did not meet normality requirements, so the data were squared to achieve normality (Figure 1). The data were only analyzed as one set, as the data sets needed for comparing point count data between different distances within the plots could not be normalized, and therefore could not be analyzed.

Using Minitab, an ANOVA was conducted comparing the habitats, using H for all songbird detections and with H squared to achieve normality. The ANOVA computed an F-value of 0.52 and a P-value of 0.472 meaning that the H^2 values of the two vegetation types were not significantly different, therefore accepting the null hypothesis that songbird diversity is equal between oak woodland and riparian habitat types (Table 6). The alternative hypothesis that songbird diversity is different between oak woodland and riparian habitat types was not supported.

DISCUSSION

The null hypothesis states that passerine diversity is equal between oak woodland and riparian habitat types. The alternative hypothesis is that passerine diversity is higher in riparian habitat types compared to oak woodland habitat. On average, the diversity of songbirds was indeed found to be higher in riparian habitats than in oak woodland habitats. Though the average H^2 was actually higher in the riparian plots compared to the oak woodland plots (Table 5), the ANOVA gave an F-value of 0.52 and a p-value of 0.472, indicating this difference is not a significant difference. This is quite contrary to many other studies conducted in which riparian zones are shown to have significantly higher species diversity and richness as compared to other habitat types (Stauffer and Best, 1980; Tyner, 2004; Knopf and Sampson, 1994).

There are many possible reasons why the study did not show that there was a significant difference between oak woodland and riparian areas. One of the most probable reasons is that the surveys were conducted between 7 July 2010 and 9 August 2010. This time period is in the summer, as opposed to the optimal time in the breeding season of May and June (Ralph et al., 1993). After the breeding season, songbird activity drops off, which makes detection of songbirds much less likely. There is also the possibility of non-resident breeding birds migrating out of the area post breeding, possibly skewing results away from more diverse plots. Tyner surveyed the plots 25 May to 3 June, well within the guidelines for doing surveys in the breeding season defined by Ralph et al., 1993 (Tyner, 2004).

Yet another reason that data could possibly be off is because of the experimental design. Tyner stated that due to plots being only 100 meters apart, the possibility of double counting birds is very high; this would lead to an incorrect diversity index, skewing results (Tyner, 2004). We agree with Tyner's argument for lack of independence between some of the plots. The plots are obviously grouped into 4 main geographic groups and the problem of being directly adjacent to neighboring plots affects around 37 of the 50 plots in all 4 of the separate areas and in both habitats (Figure 2). If this possible lack of independence between the neighboring plots affected our data, it would have artificially raised the H-value, because birds would be counted more than once. This could have caused a problem if the results indicated a significant difference; however since they do not show a significant difference, the possible lack of independence did not interfere with our results. A way to combat the possible problem would be to run an ANOVA that excluded plots only 100 meters away from other plots, however excluding plots that are only 100 meters away from neighboring plots does not leave enough data to be statistically useful.

To combat this possible lack of independence of plots, Tyner recommended that future studies should place plots a minimum of 250 meters apart (Tyner 2004). Using our data, it is not possible to analyze plots that are 250 meters or greater apart, as the data does not fulfill the assumptions required to perform an ANOVA. This was not done as no new plots were used; only the original plots were studied.

For future studies of the Los Padres National Forest, new vegetation analysis should be conducted, as the old studies were done in 2003. Using the latest aerial photography and ArcGIS, new vegetation analysis could find new areas of potential habitat to survey and could identify areas that have changed vegetation in the past 8 years. Just to remove the possibility of lack of independent plots, new plots should be found that are 250 meters apart to keep up with standards for point count plots, however the question of whether there is enough riparian habitat to actually make twenty five plots 250 meters apart would need to be addressed (Ralph et al., 1993).

One problem in surveying plots was the inaccessibility of the plots. One plot in particular, R10225, the survey teams attempted to find on 3 separate occasions, with the teams turning back each time due to an overly steep hill and thick brush. The plot was also over 200m away from any stream, bringing up the possibility of the plot being incorrectly placed. Because the survey teams could not find the plot center, there was no way to conduct a point count and so the riparian data only has 24 data points, instead of 25. This lack of a data point could affect the pooled H^2-value of the riparian vegetation type, however the impact of this one data point would most likely not affect the value much.

Using ArcMap 9.3.1, a map was created showing the different H-values for the point counts (Figure 2). This map shows that some of the higher H-values were found down Trout Creek and in Hi Valley, below the Hi Mountain Lookout. In the future, studies should focus on these areas, as they show the greatest diversity. Studies could also be conducted on seeing whether there is spatial auto-correlation between all of the points.

No species of special management concern were found during the point counts; however this does not mean that notable species are not present. In 2003, Messer found Cassin's Vireos and Western Tanagers breeding in Trout Creek (Messer, 2003). The Los Padres National Forest is not specifically managed for passerines; however there is no need for it to be. A concerned effort must be made to make sure that riparian areas are kept as healthy as possible as it is evident they are important for avian biodiversity (Stauffer and Best, 1980). For future researches, training should be conducted on proper point count techniques early in the season; so that practice can help the teams become more accurate surveyors.

This was the first study conducted in the Los Padres National Forest area since around 2003, and hopefully it restarts the biological monitoring program that Dr. Francis Villablanca and Forest Service Biologist Kevin Cooper have managed to start. If data are collected for consecutive years, it will become much more powerful than just a few scattered years. It is the hope of the researcher that the Hi Mountain Lookout Internship becomes a conduit for intensive study of not only the California Condor in the region of the Lookout but also the Los Padres National Forest around the Lookout.

Table 1 – The names and GPS coordinates of each plot that was selected (Tyner, 2004). The H represents an oak woodland plot and the R represents a riparian plot

Plot Name	Latitude	Longitude	Plot Name	Latitude	Longitude
H10097	35 14.638	120 21.530	R01114	35 15.004	120 25.337
H10134	35 14.842	120 21.790	R01115	35 15.000	120 25.275
H10145	35 14.736	120 21.725	R01116	35 14.974	120 25.214
H10147	35 14.736	120 21.595	R04173	35 15.141	120 22.755
H10148	35 14.895	120 21.725	R04174	35 15.141	120 22.960
H10151	35 14.842	120 21.530	R04208	35 15.141	120 22.820
H10166	35 14.842	120 21.595	R04223	35 14.982	120 22.365
H10178	35 14.630	120 21.660	R04236	35 14.929	120 22.300
H30015	35 16.829	120 24.108	R04237	35 14.929	120 22.235
H30016	35 16.829	120 24.043	R05181	35 15.278	120 23.244
H30019	35 16.988	120 24.303	R05182	35 15.276	120 23.181
H30030	35 16.640	120 24.124	R07077	35 14.915	120 24.611
H30031	35 16.776	120 24.108	R07078	35 14.915	120 24.546
H30032	35 16.776	120 24.043	R07079	35 14.915	120 24.481
H30054	35 16.882	120 24.108	R07098	35 14.968	120 25.066
H31181	35 15.740	120 24.624	R07099	35 14.968	120 25.001
H31182	35 15.740	120 24.559	R07102	35 14.968	120 24.806
H31184	35 15.740	120 24.429	R07103	35 14.968	120 24.741
H31234	35 15.846	120 24.624	R10187	35 14.471	120 21.465
H31235	35 15.846	120 24.559	R10188	35 14.736	120 21.855
H31245	35 15.793	120 24.949	R10189	35 14.683	120 21.790
H31250	35 15.793	120 24.624	R10190	35 14.418	120 21.400
H31251	35 15.793	120 24.559	R10191	35 14.736	120 21.790
H31252	35 15.793	120 24.429	R10192	35 14.630	120 21.725
H31253	35 15.793	120 24.303	R10225	35 14.482	120 21.855

Table 2 – The dates and start times of data collection performed on plots in areas of the Los Padres National Forest.

Plot Name	Date	Time	Plot Name	Date	Time
H10097	1-Aug-10	06:50	R01114	3-Aug-10	07:12
H10134	2-Aug-10	06:51	R01115	3-Aug-10	07:23
H10145	3-Aug-10	07:39	R01116	3-Aug-10	07:38
H10147	4-Aug-10	07:54	R04173	4-Aug-10	09:31
H10148	5-Aug-10	07:03	R04174	28-Jul-10	07:59
H10151	1-Aug-10	06:33	R04208	28-Jul-10	07:33
H10166	2-Aug-10	07:23	R04223	29-Jul-10	09:15
H10178	1-Aug-10	07:09	R04236	30-Jul-10	09:04
H30015	14-Jul-10	06:33	R04237	31-Jul-10	08:56
H30016	14-Jul-10	07:13	R05181	28-Jul-10	06:52
H30019	15-Jul-10	07:37	R05182	28-Jul-10	07:08
H30030	16-Jul-10	07:06	R07077	3-Aug-10	08:41
H30031	14-Jul-10	07:27	R07078	3-Aug-10	08:48
H30032	14-Jul-10	05:31	R07079	3-Aug-10	08:57
H30054	14-Jul-10	07:46	R07098	3-Aug-10	07:49
H31181	7-Jul-10	06:18	R07099	3-Aug-10	07:59
H31182	7-Jul-10	06:28	R07102	3-Aug-10	08:15
H31184	8-Aug-10	07:03	R07103	3-Aug-10	08:25
H31234	21-Jul-10	06:32	R10187	4-Aug-10	08:11
H31235	21-Jul-10	07:29	R10188	5-Aug-10	07:18
H31245	8-Aug-10	07:38	R10189	6-Aug-10	07:35
H31250	7-Jul-10	07:30	R10190	7-Aug-10	08:25
H31251	7-Jul-10	06:49	R10191	8-Aug-10	07:04
H31252	8-Aug-10	06:46	R10192	9-Aug-10	07:50
H31253	21-Jul-10	07:00	R10225	N/A	N/A

Table 3 – Results of the point counts in the Hi Mountain area of the Los Padres National Forest. Plot names starting with H are oak woodland plots, and plot names starting with R are riparian plots. Results are just for songbirds (Passeriformes).

Plot Name	Species	Individuals	Plot Name	Species	Individuals
H10097	3	3	R01114	5	8
H10134	5	9	R01115	4	6
H10145	6	8	R01116	4	4
H10147	7	10	R04173	3	3
H10148	6	10	R04174	5	8
H10151	1	1	R04208	3	4
H10166	7	11	R04223	5	5
H10178	6	7	R04236	6	11
H30015	4	4	R04237	8	11
H30016	3	3	R05181	5	7
H30019	5	11	R05182	3	4
H30030	6	9	R07077	4	5
H30031	3	3	R07078	0	0
H30032	5	6	R07079	5	8
H30054	4	4	R07098	5	6
H31181	4	6	R07099	4	6
H31182	3	5	R07102	3	7
H31184	4	6	R07103	5	8
H31234	3	4	R10187	5	5
H31235	3	5	R10188	1	1
H31245	4	6	R10189	5	5
H31250	3	3	R10190	4	5
H31251	2	4	R10191	5	6
H31252	4	6	R10192	5	7
H31253	3	4	R10225	N/A	N/A
Average	4.2	5.9	Average	4.3	5.8

Table 4 – The H^2-value calculated for songbirds in each plot. The H^2-value was calculated using the Shannon-Wiener index. In theory, the H^2 value can range from 0 to ~4.

Plot Name	Passerine H-Value	Plot Name	Passerine H-Value
H10097	1	R01114	1.8424
H10134	2.1971	R01115	1.7925
H10145	2.4056	R01116	2
H10147	2.5032	R04173	1.585
H10148	2.4464	R04174	2.25
H10151	0	R04208	1.5
H10166	2.7321	R04223	2.3219
H10178	2.1281	R04236	2.4464
H30015	2	R04237	2.914
H30016	1.585	R05181	2.2359
H30019	2.1181	R05182	1.5
H30030	2.4194	R07077	1.9219
H30031	1.585	R07078	0
H30032	1.9219	R07079	2.4056
H30054	2	R07098	2.2516
H31181	2.2516	R07099	1.9183
H31182	1.5219	R07102	1.3788
H31184	1.7925	R07103	2.1556
H31234	1.5	R10187	2.3219
H31235	1.9183	R10188	0
H31245	1.5219	R10189	2.3219
H31250	1.585	R10190	1.9219
H31251	1	R10191	2.2516
H31252	1.9183	R10192	2.2359
H31253	1.5	R10225	N/A

Table 5 – The descriptive statistics for the H^2-value for all songbird detections from the plot centers categorized by two habitat types in the Los Padres National Forest.

Descriptive Statistics: H^2 Value

Variable	Habitat	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
H Value	OAK	25	0	1.512	0.167	0.834	0.000	1.000	1.522	2.176	2.732
	Riparian	24	0	1.724	0.139	0.683	0.000	1.500	1.880	2.251	2.522

Table 6 – The ANOVA for the H²-values of Passerine diversity between Oak woodland and Riparian habitats in the area around the Hi Mountain Lookout in the Los Padres National Forest. All passerine detections were used and the data was squared for normality.

One-way ANOVA: Passerine H-Index (All detections, squared for normality)

Source	DF	SS	MS	F	P
Habitat	1	1.85	1.85	0.52	0.472
Error	47	165.24	3.52		
Total	48	167.09			

S = 1.875   R-Sq = 1.10%   R-Sq(adj) = 0.00%

```
                              Individual 95% CIs For Mean Based on
                              Pooled StDev
Level      N   Mean  StDev  --+---------+---------+---------+-------
OAK       25  3.648  1.829  (--------------*--------------)
Riparian  24  4.036  1.922         (---------------*--------------)
                            --+---------+---------+---------+-------
                            3.00      3.50      4.00      4.50
Pooled StDev = 1.875
```

Figure 1 – The probability plot of the H-Value squared of all songbird detections in both oak woodland and riparian habitat types. P-value = 0.299, indicating that the data are normal (H_o: data are normal).

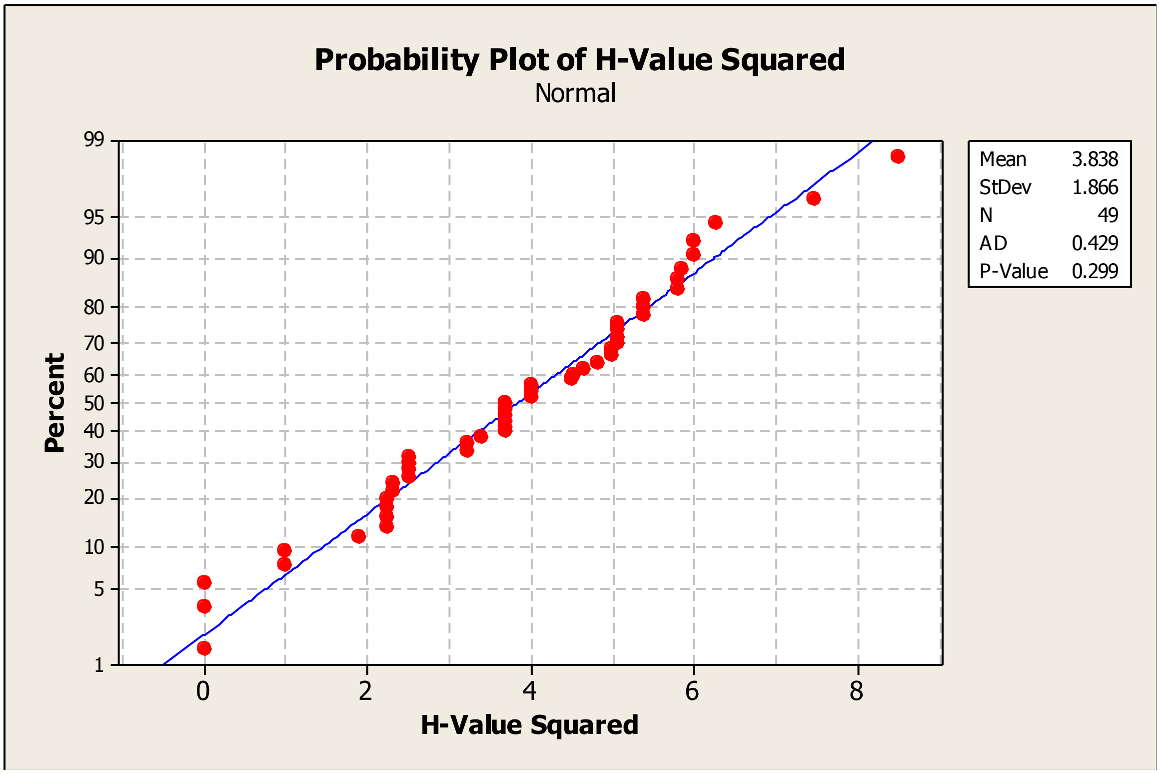
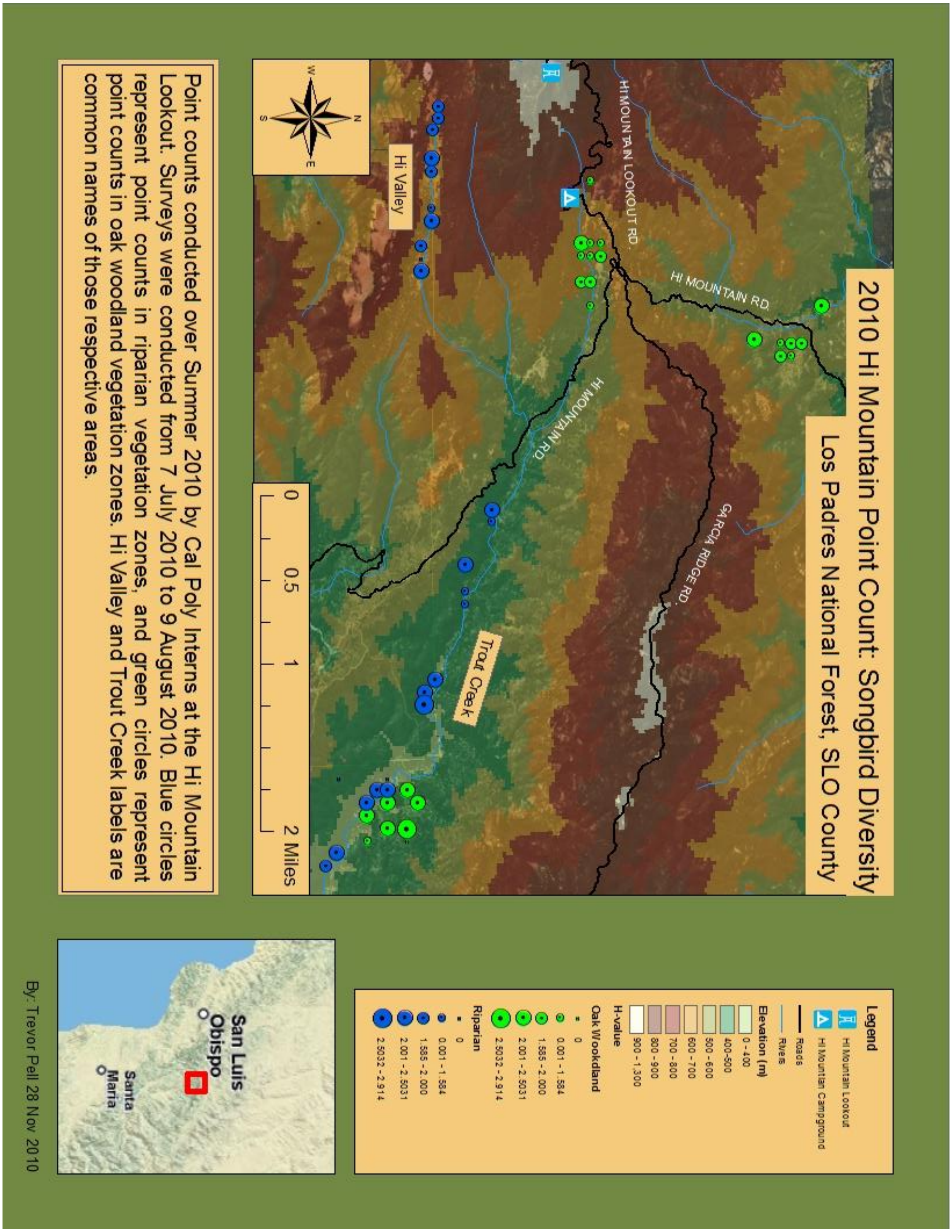


Figure 2 – An ArcMap 9.3.1 created map of the Los Padres National Forest area.



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APPENDIX

Appendix 1 – Point Counts - All Data. Species names follow the AOU code convention.

Station	Month	Day	Year	Visit	Names	
H10097	8	1	2010	1	Scott Salembier	
					Spenser Widin	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	6:50	ACWO		x		
3		NUWO			x	
3		MODO			x	
3		WESJ			x	
3		ACWO			x	
5		MODO		x		
5		Uknwn			x	
5		SPTO			x	

Station	Month	Day	Year	Visit	Names	
H10134	8	15	2010	1	Spenser Widin	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	6:51	ANHU	x			
3		WREN			x	
3		WEWP		x		
3		WREN			x	
3		ACWO			x	
3		ACWO			x	
3		WBNU			x	
5		OATI			x	
5		OATI		x		
5		SPTO			x	
5		WEWP		x		
5		WREN			x	

Station	Month	Day	Year	Visit	Names	
H10145	8	15	2010	1	Spenser Widin	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:39	WEWP		x		
3		WEWP		x		
3		NUWO			x	
3		HOWR		x		
3		CATO		x		
3		WBNU		x		
3		ACWO			x	
3		WESJ		x		
3		WEWP			x	
5		OATI		x		
5		ACWO		x		

Station	Month	Day	Year	Visit	Names	
H10147	8	15	2010	1	Spenser Widin	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:54	CAQU	x			
3		CAQU	x			
3		CAQU	x			
3		CAQU	x			
3		CAQU	x			
3		CAQU	x			
3		CAQU	x			
3		CAQU	x			
3		CAQU	x			
3		WREN			x	
3		MODO			x	
3		ACWO			x	
3		WREN			x	
3		SPTO			x	
3		RSFL			x	
3		ACWO		x		
3		WESJ			x	
3		WEWP		x		
3		HOWR	x			
5		OATI		x		
5		CATO		x		
5		SPTO			x	
5		OATI		x		
5		ANHU	x			

Station	Month	Day	Year	Visit	Names	
H10148	8	15	2010	1	Spenser Widin	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:03	WREN		x		
3		CATO		x		
3		CATO			x	
3		HOWR	x			
3		MODO			x	
3		WESJ		x		
3		HOWR			x	
3		ACWO		x		
3		ACWO			x	
3		OATI		x		
3		ACWO		x		
5		HOWR		x		
5		WEWP				x
5		ANHU	x			
5		WESJ			x	
5		ANHU	x			

Station	Month	Day	Year	Visit	Names	
H10151	8	1	2010	1	Scott Salembier	
					Spenser Widin	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	6:33	NUWO		x		
3	6:34	ACWO		x		
3	6:35	OATI		x		
3	6:35	ACWO		x		
5	6:36	MODO			x	
5	6:37	RSFL			x	

Station	Month	Day	Year	Visit	Names	
H10166	8	15	2010	1	Spenser Widin	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:23	WESJ			x	
3		WESJ			x	
3		DEJU			x	
3		DEJU			x	
3		WBNU		x		
3		ACWO			x	
3		OATI		x		
3		WREN			x	
3		WREN			x	
3		HOWR		x		
3		CAQU			x	
5		ACWO			x	
5		CATO		x		
5		HOWR			x	
5		ACWO			x	

Station	Month	Day	Year	Visit	Names	
H10178	8	1	2010	1	Scott Salembier	
					Spenser Widin	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:09	WREN			x	
3		PSFL		x		
3		ACWO	x			
3		WREN			x	
3		OATI		x		
3		HOWR		x		
5		WREN		x		
5		SPTO			x	
5		ACWO	x			

Station	Month	Day	Year	Visit	Names	
H30015	7	14	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	6:33	RTHA			x	
3		SPTO			x	
3		ACWO			x	
3		ACWO			x	
3		WREN		x		
3		RSHA			x	
5		ACWO		x		
5		ACWO		x		
5		BUSH		x		
5		WESJ		x		

Station	Month	Day	Year	Visit	Names	
H30016	7	14	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:13	PSFL	x			
3		ANHU	x			
3		WESJ			x	
3		ACWO			x	
5		BUSH		x		
					60F	0% cloud cover

Station	Month	Day	Year	Visit	Names	
H30019	8	14	2010	1	Spenser Widin	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:37	CATO	x			
3		ACWO			x	
3		CAQU			x	
3		WESJ		x		
3		WREN			x	
3		WREN			x	
3		WESJ	x			
3		WESJ				x
3		WESJ				x
3		LEGO			x	
3		CATO		x		
3		HOWR		x		
5		CAQU	x			
5		WREN		x		

Station	Month	Day	Year	Visit	Names	
H30030	8	14	2010	1	Spenser Widin	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:06	ACWO		x		
3		WREN			x	
3		WREN			x	
3		WESJ			x	
3		OATI		x		
3		SPTO			x	
3		WREN			x	
3		OATI			x	
3		ACWO			x	
3		ANHU				x
3		ACWO			x	
5		MODO			x	
5		HOWR			x	
5		WEWP			x	

Station	Month	Day	Year	Visit	Names	
H30031	7	14	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:27	PSFL		x		
3		ANHU	x			
3		CAQU		x		
5		CBCH	x			
5		WESJ	x			
				59 F	0% cloud cover	5mph

Station	Month	Day	Year	Visit	Names	
H30032	7	14	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	5:31	FOSP	x			
		WESJ	x			
		WESJ	x			
		BUSH	x			
		Unkwn		x		
		WREN		x		
		ACWO				x

Station	Month	Day	Year	Visit	Names	
H30054	7	14	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:46	WREN			x	
3		BUSH	x			
3		WESJ			x	
3		ACWO		x		
3		ACWO		x		
3		FOSP	x			

Station	Month	Day	Year	Visit	Names	
H31181	7	7	2010	1	Trevor Pell	
					Jeremy Pohlman	
					Lauren Anderson	
					Spenser Widin	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	6:18	SPTO		x		
3		CAQU			x	
3		WREN			x	
3		WESJ		x		
3		BUSH		x		
5		SPTO			x	
5		WREN			x	
5		ANHU	x			

Station	Month	Day	Year	Visit	Names	
H31182	7	7	2010	1	Trevor Pell	
					Jeremy Pohlman	
					Spenser Widin	
					Lauren Anderson	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	6:28	MODO			x	
3		ANHU	x			
3		MODO		x		
3		MODO		x		
3		WESJ			x	
3		WESJ		x		
3		WREN		x		
3		SPTO			x	
5		WREN		x		

Station	Month	Day	Year	Visit	Names	
H31184	8	8	2010	1	Spenser Widin	
					Scott Salembier	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:03	WREN		x		
3		OATI			x	
3		WREN		x		
3		BUSH	x			
3		WESJ			x	
5		ACWO		x		
5		WREN	x			
5		MODO				x

Station	Month	Day	Year	Visit	Names	
H31234	7	21	2010	1	Jeremy Pohlman	
					Trevor pell	
					Lauren Anderson	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	6:32	WREN			x	
3		CAQU		x		
3		WREN		x		
3		ACWO			x	
3		MODO			x	
3		WESJ			x	
3		RSFL		x		
5		SPTO			x	
5		ANHU	x			
			58F	0%cloud cover	0MPh	

Station	Month	Day	Year	Visit	Names	
H31235	7	21	2010	1	Jeremy Pohlman Trevor pell Lauren Anderson	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:29	PSFL		x		
3		ANHU		x		
3		BUSH	x			
3		WREN			x	
3		ACWO			x	
3		WESJ			x	
3		ANHU		x		
3		WREN			x	
3		ACWO		x		
3		BUSH	x			
			66F	0% cloud cover	1 mph	

Station	Month	Day	Year	Visit	Names	
H31245	8	8	2010	1	Spenser Widin Scott Salembier	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:38	WESJ		x		
3		WREN		x		
3		ANHU		x		
3		WESJ		x		
3		ACWO		x		
5		BUSH		x		
5		DEJU	x			
5		WREN		x		

Station	Month	Day	Year	Visit	Names	
H31250	7	7	2010	1	Trevor Pell	
					Spenser Widin	
					Jeremy Pohlman	
					Lauren Anderson	
3 or 5	**Time**	**Species**	**≤ 25**	**>25**	**>50**	**Fly over**
3	7:03	WESJ	x			
3		BUSH		x		
3		WBNU	x			
3		ACWO		x		

Station	Month	Day	Year	Visit	Names	
H31251	7	7	2010	1	Trevor Pell	
					Jeremy Pohlman	
					Spenser Widin	
					Lauren Anderson	
3 or 5	**Time**	**Species**	**≤ 25**	**>25**	**>50**	**Fly over**
3	6:49	WREN			x	
3		MODO			x	
3		ANHU	x			
3		HAWO			x	
5		WREN			x	
5		OATI		x		
5		OATI		x		

Station	Month	Day	Year	Visit	Names	
H31252	8	8	2010	1	Spenser Widin	
					Scott Salembier	
3 or 5	**Time**	**Species**	**≤ 25**	**>25**	**>50**	**Fly over**
3	6:46	ACWO		x		
3		RSFL		x		
3		RSFL		x		
3		HOWR		x		
3		WESJ			x	
3		OATI		x		
3		WREN			x	
3		OATI	x			
5		WESJ	x			
5		ANHU	x			
5		RSFL			x	

Station	Month	Day	Year	Visit	Names	
H31253	7	21	2010	1	Jeremy Pohlman Trevor pell Lauren Anderson	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:00	WESJ			x	
3		ANHU	x			
3		WESJ		x		
3		XXWO		x		
3		ACWO		x		
3		WREN			x	
3		SPTO			x	
			62F	0%cloud cover	2mph	

Station	Month	Day	Year	Visit	Names	
R01114	8	3	2010	1	Trevor Pell Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:12	WREN		x		
3		ACWO		x		
3		CATO	x			
3		WESJ		x		
3		WESJ	x			
3		SOSP		x		
3		WESJ	x			
5		WREN			x	
5		Unkwn		x		

Station	Month	Day	Year	Visit	Names	
R01115	8	3	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:23	WEWP		x		
3		ANHU	x			
3		ACWO			x	
3		WREN			x	
3		WREN			x	
3		BEWR			x	
3		WREN			x	
5		CAQU		x		
5		HOWR		x		

Station	Month	Day	Year	Visit	Names	
R01116	8	3	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:38	ACWO			x	
3		WBNU		x		
3		SPTO			x	
3		WREN			x	
3		WEWP			x	
3		ACWO		x		
3		MODO			x	

Station	Month	Day	Year	Visit	Names	
R04173	8	15	2010	1	Spenser Widin	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	9:31	HOWR		x		
3		MODO			x	
5		WESJ			x	
5		OATI		x		
5		ACWO			x	
5		ACWO		x		
5		MODO			x	

Station	Month	Day	Year	Visit	Names	
R04174	7	28	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:59	WESJ		x		
3		SPTO		x		
3		WBNU		x		
3		WREN			x	
3		WESJ			x	
3		WBNU		x		
3		AMCR			x	
3		AMCR			x	
3		ACWO			x	
3		ACWO			x	
5		ANHU	x			

Station	Month	Day	Year	Visit	Names	
R04208	7	28	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:33	WESJ			x	
3		ANHU		x		
3		WREN			x	
3		WEKB		x		
3		ACWO			x	
5		WREN			x	
			60F	0%cloud cover	0mph	

Station	Month	Day	Year	Visit	Names	
R04223	8	15	2010	1	Spenser Widin	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	9:15	RTHA			x	
3		WREN			x	
3		HOWR		x		
3		ACWO			x	
3		ACWO			x	
3		WBNU		x		
3		SPTO		x		
3		NUWO			x	
5		NUWO		x		
5		NUWO	x			
5		WESJ			x	

Station	Month	Day	Year	Visit	Names	
R04236	8	15	2010	1	Spenser Widin	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	9:04	OATI		x		
3		HOWR	x			
3		PSFL		x		
3		PSFL		x		
3		WESJ			x	
3		OATI			x	
3		WBNU		x		
3		ACWO			x	
3		WREN			x	
3		WESJ			x	
3		WREN		x		
5		WREN		x		

Station	Month	Day	Year	Visit	Names	
R04237	8	15	2010	1	Spenser Widin	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	8:56	WIWA	x			
3		WREN		x		
3		WREN	x			
3		PSFL			x	
3		ACWO			x	
3		MODO				x
3		WBNU		x		
3		HOWR	x			
3		WEWP	x			
5		WIWA			x	
5		WESJ		x		
5		OATI		x		
5		OATI		x		

Station	Month	Day	Year	Visit	Names	
R05181	7	28	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	6:52	WREN			x	
3		HOWR			x	
3		SPTO			x	
3		WEWP			x	
3		BLPH				x
3		WREN			x	
5		WEWP			x	
			54F	0% cloud cover	0mph	

Station	Month	Day	Year	Visit	Names	
R05182	7	28	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:08	WREN			x	
3		WREN		x		
3		PSFL			x	
5		WEWP	X			
			56F	0% cloud cover	0mph	

Station	Month	Day	Year	Visit	Names	
R07077	8	3	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	8:41	WREN			x	
3		WREN			x	
3		WEWP			x	
3		ACWO			x	
3		WESJ			x	
5		SPTO			x	
5		ACWO			x	
5		ACWO	x			

Station	Month	Day	Year	Visit	Names	
R07078	8	3	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	8:48	ACWO		x		
3		ACWO		x		
3		MODO				x
3		MODO				x
3		MODO				x
3		MODO				x
3		ANHU		x		
3		MODO				x

Station	Month	Day	Year	Visit	Names	
R07079	8	3	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	8:57	ANHU	x			
3		WBNU	x			
3		MODO				x
3		CATO		x		
3		WREN			x	
3		WREN			x	
3		WREN			x	
3		WAVI	x			
3		WESJ		x		
3		ACWO		x		
3		MODO			x	
5		ACWO	x			
5		OATI		x		

Station	Month	Day	Year	Visit	Names	
R07098	8	3	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:49	WREN			x	
3		WBNU		x		
3		ACWO			x	
3		WESJ			x	
3		ACWO		x		
3		WESJ			x	
3		WEWP			x	
3		ACWO				x
3		HOWR			x	
5		MODO			x	

Station	Month	Day	Year	Visit	Names	
R07099	8	3	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	Flush	CAQU	x			
3		CATO	x			
3	7:59	CAQU	x			
3		WESJ		x		
3		CATO	x			
3		WEWP	x			
3		ACWO				x
3		RSFL				x
3		WEWP		x		
3		WESJ		x		
3		SPTO		x		
3		ACWO				x
3		ACWO				x
5		CAQU		x		
5		ACWO		x		
5		ACWO		x		
5		ACWO		x		

Station	Month	Day	Year	Visit	Names	
R07102	8	3	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	8:15	WESJ		x		
3		ACWO		x		
3		ACWO		x		
3		ACWO		x		
3		WESJ			x	
3		BEWR		x		
3		WREN			x	
3		WESJ				x
5		WESJ		x		
5		WREN			x	
5		ANHU	x			

Station	Month	Day	Year	Visit	Names	
R07103	8	3	2010	1	Trevor Pell	
					Jeremy Pohlman	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	8:25	WESJ			x	
3		WREN			x	
3		ACWO			x	
3		WBNU		x		
3		WESJ		x		
3		WREN			x	
3		CAQU			x	
5		WESJ		x		
5		ANHU		x		
5		CATO		x		
5		LEGO				x

Station	Month	Day	Year	Visit	Names	
R10187	8	10	2010	1	Trevor Pell	
					Jeremy Pohlman	
					Lauren Anderson	
					Cayley Faurot-Daniels	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	8:11	WEWP		x		
3		WREN		x		
3		RSHA			x	
5		WESJ			x	
5		ANHU		x		
5		SPTO		x		
5		CAQU			x	
5		WBNU		x		

Station	Month	Day	Year	Visit	Names	
R10188	8	10	2010	1	Trevor Pell	
					Jeremy Pohlman	
					Lauren Anderson	
					Cayley Faurot-Daniels	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:18	ACWO			x	
3		ACWO			x	
3		WREN			x	
3		RTHA			x	
5		ACWO			x	
5		MODO			x	
5		CAQU			x	

Station	Month	Day	Year	Visit	Names	
R10189	8	10	2010	1	Trevor Pell	
					Jeremy Pohlman	
					Lauren Anderson	
					Cayley Faurot-Daniels	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:35	WEWP		x		
3		WESJ			x	
3		WREN			x	
3		MODO			x	
3		SPTO			x	
5		ANHU		x		
5		BEWR		x		

Station	Month	Day	Year	Visit	Names	
R10190	8	10	2010	1	Trevor Pell	
					Jeremy Pohlman	
					Lauren Anderson	
					Cayley Faurot-Daniels	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	8:25	BEWR	x			
3		WESJ			x	
5		WESJ			x	
5		WBNU		x		
5		OATI	x			

Station	Month	Day	Year	Visit	Names	
R10191	8	10	2010	1	Trevor Pell	
					Jeremy Pohlman	
					Lauren Anderson	
					Cayley Faurot-Daniels	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:04	WBNU			x	
3		SPTO			x	
3		WREN			x	
3		WREN			x	
3		ACWO		x		
3		BLPH			x	
5		XXFL			x	

Station	Month	Day	Year	Visit	Names	
R10192	8	10	2010	1	Trevor Pell	
					Jeremy Pohlman	
					Lauren Anderson	
					Cayley Faurot-Daniels	
3 or 5	Time	Species	≤ 25	>25	>50	Fly over
3	7:50	OATI		x		
3		WREN			x	
3		WBNU			x	
3		WEWP			x	
5		WREN		x		
5		LEGO		x		
5		LEGO		x		