Avian, mammal, and user surveys of the Lakeshore Nature Preserve

A service-learning project final report

by

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Avian Diversity in the Lakeshore Nature Preserve

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Introduction

Humans continue to have an ever-increasing impact on the natural world. Ellis and Ramankutty (2008) estimate that over 75% of ice-free land on planet Earth show at least some alternation as the result of human activity. Of the remaining 25%, much is barren wasteland, unable to support much in the way of primary production or biodiversity (Ellis and Ramankutty 2008). Increased human-driven pressure on landscapes often results in a loss of biodiversity. Many human-dominated landscapes are unable to support many species of plants and animals (especially highly developed landscapes), or create impediments for species colonization due to high levels of disturbance such as noise, vehicle or foot traffic, and domestic pets (Huste and Boulinier 2011). Huste and Boulinier (2011) suggest that birds, especially migratory species, may be particularly sensitive to disturbance by humans in urban environments, causing some species to avoid urban landscapes altogether. Many cities make an effort to create green spaces for both human and non-human use, but the habitat suitability of these areas for sensitive species may be questionable (Francis and Lorimer 2011). The challenge of providing suitable habitat for migratory bird species is especially troublesome, as migrants often face strong competition by year-round residents of urban environments (Huste and Boulinier 2011). The Lakeshore Nature Preserve in Madison, WI offers an opportunity to study how bird species make use of a natural area in the midst of an urban environment.

The Lakeshore Nature Preserve occupies about 300 acres on the southern shore of Lake Mendota. The area has a long history of human use, and was likely settled by humans about 12,000 years ago. The Preserve contains a wide variety of habitat types including woodlands, prairies, marshes, meadows, and open water, as well as a suburban neighborhood (LNP 2012). Despite the dense urban landscape surrounding the preserve, over 255 bird species have been reported within the preserve. Many species use the Preserve as a migratory

stopover in the spring and fall (LNP 2012). Preserve managers have a strong interest in maintaining high biodiversity, for recreational, educational and aesthetic purposes.

This study constitutes the third year of an ongoing longitudinal study of avian diversity in the Lakeshore Nature Preserve, conducted as a service-learning project by the students of Environmental Studies 651-Conservation Biology at the University of Wisconsin- Madison. The purpose of this study was to measure avian species diversity within the Preserve and compare species diversity between habitat types and across years.

Methods

With the help of 14 undergraduates, we conducted point count surveys at 11 designated sites scattered throughout the Lakeshore Nature Preserve. The 300-acre Lakeshore Nature Preserve constitutes approximately 1/3 of the total acreage on the main University of Wisconsin-Madison campus (LNP 2012). We surveyed eleven of the twelve point count locations from 2012 in order to continue long-term data collection (Figure 1, Table 1). Eight of these points were delineated during the first service-learning study in 2011. Sites were originally selected in order to incorporate each of the following habitat types: mesic woods, marsh, and prairie (Anhalt et al. 2011). Four additional sites were added during the 2012 study to increase the sample size and incorporate more urban locations along the bike path, such as Muir Woods and Willow Creek (Barant et al. 2012). We dropped one point count location from our survey due to its location on private property (Eagle Heights Housing). We added no new point count locations to this year's survey.

Point Count Delineation

As indicated in both the 2011 and 2012 service learning reports, due to the small size of the Preserve, edge sampling was inevitable across sites (due to intersection with bike paths, trails, roads, etc). We spaced point counts 250 meters apart in order to avoid double-counting of species (Ralph et al. 1993). We located the sites using a hand-held GPS unit (Table 1) and marked the center of the plots with red/black flagging. A radius of 100 meters was chosen for each point count location. The graduate team placed 50 meter markers at a majority of the sites

to train the eye to survey within two separate distance bands: 0 to 50 meters and 50-100 meters. Again, due to the small size of the Preserve and heterogeneity of habitat types, many of the point count locations bisect multiple habitats. Using a GIS, we drew a 100 meter buffer around the center of each point to estimate habitat visually using aerial photography (Table 1). We defined five broad categories of habitat for sampling: prairie, woodland, wetland, open water, and urban. For instance, we classified developed, mowed, or cultivated areas as "urban" in this survey.

Data Collection

We organized seven teams of two undergraduates to collect data from the 11 point count locations. Four teams surveyed two locations each and three teams surveyed one site each. Each team received training and supervision from a graduate student author responsible for aggregating data. We conducted point counts between the hours of 06:00 and 09:30 between April 13th and April 28th. Due to inclement weather, such as snow and rain (further complicated by scheduling conflicts), teams conducted point counts on days with acceptable weather conditions that favored their schedules. Teams made sure to allow at least a three day grace period between survey dates. Every attempt was made to avoid conducting surveys during rainstorms and windy conditions. This is an important factor because climatic variability can strongly influence bird activity (Ralph et al. 1993). Upon arrival to the center of the point, each team allowed for a 5 minute acclimation period. Once completed, each official survey lasted 10 minutes (Hostelter & Main 2001). We estimated distance of individual species within a plot using two designated distance bands (0-50m and 50-100m). We recorded birds seen flying over the plot in a separate column (Hostelter & Main 2001). Additionally, teams recorded which habitat type the bird was seen occupying at the time of the count and their level of confidence in positively identifying a bird to species. Confidence ranged from a rank of 1 (least confident) to 3 (most confident). This helped account for the varying bird identification skills across the teams. We made note of any species that had a confidence level of 1 in our discussion.

To account for detection limitations with only one observer, we employed the use of a double observer method to ensure detection of birds within the 10 minute time frame. Research has shown that overall detection probabilities increase with the use of a double-observer approach (>0.95); providing more precise estimates of avian abundance (Nichols et al. 2000). Using this method, a designated “primary observer” indicates any birds seen within the plot during the 10 minute sampling period to a “secondary observer” who records the data. Additionally, the secondary observer records any birds undetected by the primary observer (Nichols et al. 2000); and also ensures that the primary observer is notified of this detection to avoid double-counting during the survey period. In this study, observers alternated roles between sites.

Walking Survey

Surveyors also conducted a walking survey that incorporates any birds seen while traveling between point count locations. Our teams did not record habitat type or confidence level during these informal surveys. We did not incorporate the results from these walking surveys into our formal data analysis, but rather compiled a list of species for reference (Table 14). This simple enumeration allows for an additional snapshot of species presence at the Preserve.

Data Analysis

Our analysis attempts to answer four questions: the average species richness across the 11 point counts; the average species richness across habitat types; the diversity of species across habitat types; and the most abundant species.

To analyze average species richness, we measured the number of species that were spotted at each site for each of the 3 point counts. We calculated the summary statistics (Table 2 and Table 3) for each point and also calculated the mean and median across all points. We also compared the summary statistics at each point in 2012 and ran two-tailed t-tests to measure any significant changes in species richness at each point.

This study considers five habitat types, with some point count locations bisecting multiple habitats. We also took a count of the species found in each habitat per point count along with the total number of species per habitat across all point counts. To calculate species diversity by habitat, we used the Gini-Simpson habitat index. This index is calculated by taking the proportion of each species found in a habitat, then subtracting the sum of the squared proportions from 1. A higher value means more diversity. We ran two-tailed t-tests to test the hypothesis that each habitat's species richness and diversity was equal. We set significance at $p<0.05$. Due to varying degrees of habitat coverage across the 11 points, we also measured the ratio of species richness and diversity to habitat area to determine if one habitat type has more species richness or diversity by area.

Finally, we measured the total number of species observed during the survey to determine the most abundant species. We recorded the habitat of each bird sighting and we compared the number of habitats in which the five most abundant species were found to determine if they are generalists or specialists.

Results

The University Bay Marsh (Point 1) was the only point that had higher mean and median species richness in 2013 than in 2012. All other points in 2013 had lower mean and median species richness (Table 2). 2013 also had a smaller median standard deviation over all 11 point counts. In order to test if there were statistically significant differences between the point counts in 2012 and 2013, we ran a Welch's two tailed, 2-sample t-test on species richness between points. We used a Welch test because 2012 and 2013 datasets did not have the same variance. Willow Creek was the only point count with a p-value of less than 0.05, meaning that the species richness at that point was not equal, with a certainty of 95 percent (Table 4).

Wooded habitats and wetland habitats had the highest species richness, with median values of 13 species each (Table 5). The results of our two-tailed t-tests show that open water, prairie, and urban habitats had significantly lower species richness than wetland and wooded habitats (Table 6 and Table 7). Open water was also significantly different from urban, wetland,

and wooded habitats by species diversity. Urban habitat had very close to significant differences with wetland and wooded habitats, with p-values just above 0.05.

Wooded areas had the highest species richness, with 24 unique species identified over the course of our survey. However, wooded habitats accounted for over 54% (change throughout) of the area surveyed. Wetland habitats had 22 unique species yet only accounted for approximately 10 percent of the total area in the survey. To calculate which habitat had the highest richness of species per area, we took the total species in a habitat and divided it by the area (1,000 m^2). The species richness per 1,000 m^2 of habitat in wetlands was nearly 5 times as high as the species richness per 1,000 m^2 in wooded areas (Table 8, 9).

The five most abundant species included the American coot, red winged blackbird, mallard, bufflehead, and American robin. While the American coot was the most abundant, red-winged blackbirds were the most ubiquitous, with sightings in most habitats preserve-wide. Ninety-five percent of the American coot sightings were in open water, whereas 63% of red-winged blackbird sightings occurred in wetland habitats, 19% in wooded habitats, 15% in prairie, and 3 percent in urban areas (Table 11, 12). The three least abundant species included the great egret, morning dove, and sandhill crane.

Discussion

Wooded habitat had the highest average species richness and diversity with the exception of point 7, Frautschi Point (Figure 1). Frautschi Point had the lowest species richness among all of the sites (Tables 8, 9). A high species richness and diversity within wetland habitat types was also observed (Tables 8, 9). Although we surveyed five times as much wooded habitat as wetland habitat, wetlands were five times as diverse. This contrasts with results from 2012 in which urban habitats were found to contain the highest species richness and diversity (Barant et al. 2012). One possible reason for the discrepancy is that we omitted a survey point from last year that was considered 100% urban habitat. Although some of the points included urban habitat coverage, the total, area surveyed was less in 2013. Another discrepancy between methods was that in 2012 students surveyed only one habitat type within each point

(based on the predominance of one habitat type found at the location). We felt that habitat differences within transects were unavoidable and included point count transects that bisect one or more habitat types. Three sites: Bill's Woods, Frautschi Point, and Eagle Heights Woods (Points 5, 7, and 8 respectively, Figure 1) are comprised entirely of one habitat type—woodlands (Table 1).

The red-winged blackbird was the most ubiquitous and among the most abundant species; with a presence in every habitat type except open water (Table 13). Tree swallows were also present in all habitats except open water but were less abundant than red-winged blackbirds. These abundances were mostly consistent with the data from 2012. In 2012, the five most abundant species were ringed-necked duck, red-winged blackbird, American coot, Canada goose, and mallard (Barant et al. 2012). No ring-necked ducks were seen in the Preserve in 2013. In 2011, the American coot and red-winged blackbird were the two most common species seen throughout the Preserve (Anhalt et al. 2011). Bufflehead, American robin, mallard, and ring-necked duck were also observed in 2011 (Anhalt et al. 2001) Open water and wetlands had the highest proportions of the five most abundant species (Table 11). Although open water habitat had the largest abundances of birds, these areas tended to be low in species diversity. These findings suggest that Lakeshore Nature Preserve is an important habitat for migrating waterfowl that travel in large flocks.

The Class of 1918 Marsh (point 5, Figure 1), had the highest diversity across all sites. University Bay Marsh and Willow Creek followed close behind (Table 2). The Class of 1918 Marsh is the result of a 40-year restoration effort. Students and managers are also actively engaged in enhancing the University Bay Marsh (Cronon 2006, Saiki 2006). The marsh is intended to inform researchers on how to restore wetlands. We find the high species richness and diversity at these three sites interesting due their close proximity to urban areas and intersection with high-traffic paths or grassy fields. The species diversity at these three locations could be a result of the high heterogeneity of habitat types within these plots; benefiting species that occupy multiple habitats. If this is the case, these results are consistent with impacts of

urban biodiversity observed in 2012. Point count locations surrounded by more than 40% urban habitat (i.e. Class of 1918 Marsh), tend to have increased species richness due to their suitability to species that use urban and suburban environments (Donnelly and Marzluff 2004).

Frautschi Point (point 7, Figure 1) had the lowest species diversity and richness in 2012 and 2013. Edge-effects influence the diversity across all points in the Preserve because each transect contains more than one habitat type. Because the Preserve is small and edge-effects and habitat fragmentation are unavoidable, some sites (Class of 1918 Marsh and University Bay) showed high species diversity of birds. Transects that contained predominantly one habitat type (i.e. Eagle Heights Woods) might be too small to support more sensitive bird species. A site that is predominantly wooded is not appealing to birds that thrive in urban areas because of reduced edge. At the same time, these areas are often not large enough to support bird species that thrive in forest interiors (Villard 1998). This may be one reason for the relatively low species richness at Frautschi Point. Lower species richness at these points could also be limited by reduced visibility created by dense woody cover in forested plots. We found that Bill's Woods and Eagle Heights Woods (Points 5 and 8 respectively, Figure 1), had low species richness measures compared to other sites across the Preserve (Table 2). It should be noted that two birds of the same species (brown thrasher) identified at Eagle Heights Woods (point 8) had a confidence level of 1. We decided not to exclude the data points because they were a new species at the site and it is important to include different species in our measurement of species richness.

We observed 44 avian species over the course of the study and 13 additional species during walking surveys (Table 13). In 2012, 57 species were observed during point counts and 5 additional species during walking surveys (Barant et al. 2012). In 2011, 75 species were observed during point counts and 6 additional species during walking surveys (Anhalt et al. 2011). Overall, the total species richness has declined over the past three years. Average species richness in 2011 was 13.63, 7.00 in 2012, and 4.52 in 2013 (Anhalt et al. 2011, Barant et al. 2012). There are a few possible reasons for the decline. First, the 2011 service-learning

team recorded birds heard within each plot during their 10-minute counts (Anhalt et al 2011). Because of this difference we did not include data from 2011 in our longitudinal study. Also, weather patterns varied greatly over the past three years. 2012 had an unusually warm winter and early spring, while 2013 experienced colder than average temperatures (WSCO 2012). An early spring in 2012 could have triggered an earlier migration, thereby increasing species richness and diversity across point locations. Reported bird migrations in 2013 were later than usual, especially when compared to last year's early arrival of migratory birds (Korducki 2013).

We expect a high margin of error associated with our results due to certain unavoidable limitations. Students taking part in the survey possess a wide range of birding skills which compromises the accuracy to which species are identified. Although every effort was made to distribute knowledge evenly, we could not ensure complete accuracy of species identification in the field. Another factor that contributed to both this year and last year's data was the small sample size. A sample size of 33 did not provide a large enough dataset to confidently assess species richness and diversity, especially considering the high variability in migration patterns from year to year (Korducki 2013). A larger dataset could broaden the scope of statistical analyses for a more robust longitudinal comparison. Further limiting our results is the challenge that point counts were completed on different days due to scheduling conflicts and inclement weather conditions. Although each point was surveyed on three different days, the days varied between points. This may have increased error because weather conditions varied between point counts conducted on different days. Rain, wind, and cold temperatures throughout the survey period could have negatively impacted bird presence and visibility during point counts. Studies have shown that inclement weather can decrease the number of birds detected on counts (Ralph et al. 1995). Several of the point counts were completed during windy or drizzling conditions.

To create an accurate longitudinal dataset, methods must be standardized. We also suggest that future studies increase the sample size to obtain a more accurate measurement of species richness and diversity. It is difficult to determine if the decline in species richness over

the past three years is correlated with methodology, weather variation, or other factors. Consistent data collection and subsequent analyses can benefit the Preserve in the long run by providing monitoring data that can be used to determine if management interventions have improved avian biodiversity. We also suggest that the Preserve propose more specific questions so that future service-learning projects can gather and analyze data that is both applicable and useful for Preserve managers. For example, are Preserve managers interested in avian species richness and biodiversity in specific habitat types or in specific regions of the Preserve itself? Or, have management interventions such as invasive species removal improved overall species richness and diversity in certain sites in the Preserve? A consistent and standardized longitudinal study can assist Preserve managers by providing avian species richness and abundance data. Managers can use this data to track progress in certain areas of the Preserve or within certain habitat types. Long term monitoring could help managers adaptively manage restoration work throughout the Preserve to enhance areas with high avian species richness and diversity.

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Figures and Tables:

Figure 1. Point count locations in study area

Table 1. 2013 Point count locations with corresponding name, number, UTM coordinates (Datum WGS84, NAD83), and estimated habitat coverage

Point Count Number	Description	GPS Coordinates		Habitat Coverage
		X	Y	
1	University Bay Marsh	319239	4773089	50% wetland; 30% wooded; 20% urban
2	Picnic Point	303408	4773615	66% open water; 34% wooded
3	Picnic Point Marsh	302750	4773341	60% wooded; 40% open water
4	Forest near old field	302486	4773402	66% wooded; 34% prairie
5	1918 Marsh	302034	4772959	60% wetland; 40% urban
6	Biocore Prairie/ gardens	302189	4773489	70% prairie; 30% urban
7	Frautschi Point	302013	4773855	98% wooded; 2% open water
8	Eagle Heights Woods	301118	4773357	100% wooded
9	Muir Woods	304311	4772132	100% wooded
10	Willow Creek	302923	4772334	40% urban; 35% open water; 25% wooded
11	Bill's Woods	302213	4773195	100% wooded

Table 2. Mean, median, standard deviation, maximum and minimum for species richness across all sites in 2013.

	2013				
Name	**Mean**	**Median**	**Standard Deviation**	**Max**	**Min**
University Bay	7.00	7.00	1.00	8	6
Picnic Point	4.67	5.00	1.53	6	3
Picnic Point Marsh	4.00	4.00	0.00	4	4
Old Orchard and Field	3.00	4.00	1.73	4	1
Class of 1918 Marsh	7.67	7.00	1.15	9	7
Biocore Prairie	5.00	5.00	1.00	6	4
Frautschi Point	2.67	2.00	1.15	4	2
Eagle Heights Woods	3.67	3.00	1.15	5	3
Muir Woods	2.33	3	1.15	3	1
Willow Creek	6	6	1	7	5
Bill's Woods	3.67	4	0.58	4	3
All sites	4.52	4.00			

Table 3. Mean, median, standard deviation, maximum and minimum for species richness across all sites in 2012.

	2012				
Name	**Mean**	**Median**	**Standard Deviation**	**Max**	**Min**
University Bay	5.33	6.00	1.15	6	4
Picnic Point	6.67	6.00	2.08	9	5
Picnic Point Marsh	5.33	5.00	0.58	6	5
Old Orchard and Field	10.00	8.00	4.36	15	7
Class of 1918 Marsh	9.67	9.00	2.08	12	8
Biocore Prairie	8.33	9.00	3.06	11	5
Frautschi Point	3.33	3.00	3.51	7	0
Eagle Heights Woods	7.33	5.00	4.04	12	5
Muir Woods	3.67	4.00	1.53	5	2
Willow Creek	8.67	9.00	0.58	9	8
Bill's Woods	10.00	9.00	4.58	15	6
All sites	7.12	6.00			

Table 4. Welch t-test comparing species richness between the same eleven points in 2012 and 2013, p-values below 0.05 are considered to be significant.

Point	P-value
Point 1	0.1332
Point 2	0.2567
Point 3	0.0572
Point 4	0.0936
Point 5	0.2381
Point 6	0.1918
Point 7	0.7796
Point 8	0.2529
Point 9	0.2988
Point 10	0.0248
Point 11	0.1369

Table 5. Species richness in each habitat type, across each point count.

Count	Open Water	Prairie	Urban	Wetland	Wooded
Count 1	3	3	2	14	13
Count 2	5	4	2	13	17
Count 3	4	2	4	13	11
Median per habitat	4	3	2	13	13

Table 6. t-test comparing species richness between habitat type. Significant differences are in bold text.

	Prairie	Urban	Wetland	Wooded
Open Water	0.2254	0.2697	**0.0088**	**0.0219**
Prairie	.	0.8075	**0.0041**	**0.0125**
Urban	.	.	**0.0068**	**0.0414**
Wetland	.	.	.	0.874

Table 7. t-test comparing species diversity between habitats. Significant differences are in bold text.

	Prairie	Urban	Wetland	Wooded
Open Water	0.1564	**0.0140**	**0.0062**	**0.0075**
Prairie	.	0.9897	0.1134	**0.0646**
Urban	.	.	0.0536	0.0639
Wetland	.	.	.	0.2592

Table 8. Overall species richness and species richness per 1,000 sq meters in each habitat type.

Habitat	Percentage of total area surveyed	Species Richness	sq meters (in thousands)	Species Richness per 1,000 sq meters of habitat
Wooded	54.23%	24	183	0.13
Open Water	13.77%	8	46	0.17
Urban	13.02%	6	44	0.14
Wetland	10.23%	22	35	0.64
Prairie	8.74%	5	30	0.17

Table 9. Overall species diversity and species diversity per 1,000 sq meters in each habitat type.

Habitat	Percentage of total area surveyed	Mean Gini-Simpson Diversity Index	sq meters (in thousands)	Diversity index per thousand sq meters of habitat
Wooded	54.23%	0.893	183	0.0049
Open Water	13.77%	0.254	46	0.0055
Urban	13.02%	0.571	44	0.0130
Wetland	10.23%	0.856	35	0.0248
Prairie	8.74%	0.568	30	0.0192

Table 10. Gini-Simpson species diversity index in each habitat type across three sampling days.

Count	Open Water	Prairie	Urban	Wetland	Wooded
Count 1	0.17	0.64	0.49	0.86	0.89
Count 2	0.25	0.69	0.50	0.84	0.92
Count 3	0.34	0.38	0.72	0.87	0.87
mean	0.25	0.57	0.57	0.86	0.89

Table 11. Five most abundant species sighted in 2013, by total occurrence and the number of sightings in each habitat type.

Species	Total	Open Water	Prairie	urban	Wetland	Wooded
AMCO	82	78	0	0	4	0
RWBL	62	0	9	2	39	12
MALL	39	5	0	0	25	9
BUFF	33	30	0	0	3	0
AMRO	30	0	0	6	8	16

Table 12. Five most abundant species sighted in 2013, by total occurrence and the percent of sightings in each habitat type.

Species	Total	Open Water	Prairie	urban	Wetland	Wooded
AMCO	82	95%	0%	0%	5%	0%
RWBL	62	0%	15%	3%	63%	19%
MALL	39	13%	0%	0%	64%	23%
BUFF	33	91%	0%	0%	9%	0%
AMRO	30	0%	0%	20%	27%	53%

Table 13. List of bird species sighted in the Preserve, with habitat type indicated.

Family	Species	Common Name	Open Water	Prairie	Urban	Wetland	Wooded	Fly Over
Accipitridae	Haliaeetus leucocephalus	bald eagle						X
Anatidae	Aix sponsa	wood duck					X	
	Anas clypeata	northern shoveler				X		
	Anas discors	blue-winged teal				X		
	Anas platyrhynchos	mallard	X			X	X	X
	Anas rubripes	American black duck						X
	Bucephala albeola	bufflehead	X			X		
	Aythya marila	greater scaup				X		
	Branta canadensis	Canada goose	X		X	X	X	
Ardeidae	Ardea alba	great egret	X					
Cardinalidae	Cardinalis cardinalis	northern cardinal					X	
Cathartidae	Cathartes aura	turkey vulture						X
Columbidae	Zenaida macroura	mourning dove		X				
Corvidae	Corvus brachyrhynchos	American crow				X		X
Emberizidae	Junco hyemalis	dark-eyed junco			X	X	X	
	Melospiza melodia	song sparrow				X	X	
	Spizella pusilla	field sparrow				X		
Fringillidae	Spinus tritis	American goldfinch		X		X		X
	Haemorhous mexicanus	house finch					X	
Gaviidae	Gavia immer	common loon	X				X	
Gruidae	Grus canadensis	sandhill crane			X			X
Hirundinidae	Hirundo rustica	barn swallow		X				
	Tachycineta bicolor	tree swallow		X	X	X	X	X

Icteridae	Agelaius phoeniceus	red-winged blackbird		X	X	X	X	X
	Quiscalus quiscula	common grackle				X	X	
Laridae	Larus argentatus	herring gull						X
	Larus delawarensis	ring-billed gull	X					X
Mimidae	Toxostoma rufum	brown thrasher					X	
Paridae	Baeolophus bicolor	tufted titmouse					X	
	Poecile atricapillus	black-capped chickadee				X	X	
Parulidae	Dendroica caerulescens	black-throated warbler					X	
	Dendroica coronata	yellow-rumped warbler					X	
	Mniotilta varia	black and white warbler					X	
Picidae	Melanerpes carolinus	red-bellied woodpecker					X	
	Melanerpes erythrocephal	red-headed woodpecker					X	
	Picoides pubescens	downy woodpecker					X	
	Picoides villosus	hairy woodpecker					X	X
Podicipedidae	Podiceps auritus	horned grebe	X					
	Podilymbus podiceps	pied-billed grebe				X		
Rallidae	Fulica americana	American coot	X			X		
Sittidae	Sitta carolinesis	white-breasted nuthatch					X	
Sturnidae	Sturnus vulgari	European starling					X	X
Troglodytidae	Cistothorus palustris	marsh wren				X		
Turdidae	Turdus migratorius	American robin			X	X	X	

Table 14. List of bird species sighted in the Preserve on walking surveys.

Family	**Species**	**Common Name**
Accipitridae	Buteo jamaicensis	red-tailed hawk
Anatidae	Aythya valisineria	canvasback
Bombycillidae	Bombycilla cedrorum	cedar waxwing
Emberizidae	Pipilo erythrophthalmus	eastern towhee
Icteridae	Molothrus ater	brown-headed cowbird
Parulidae	Setophaga palmarum	palm warbler
Picidae	Colaptes auratus	northern flicker
Regulidae	Regulus calendula	ruby-crowned kinglet
Troglodytidae	Troglodytes aedon	house wren
Turdidae	Catharus guttatus	hermit thrush
	Sialia sialis	eastern bluebird
Tyrannidae	Sayornis phoebe	eastern phoebe
Vireonidae	Vireo gilvus	warbling vireo

Appendix A:

Point Count Protocol

You will need:

-Binoculars

-A clipboard

-Pencil

-Data sheets

-Stopwatch

-Map of point count

Step-by-step directions:

1. Arrive at point count. (Prior to arriving, be sure to determine who will be the primary and secondary observer to start!)
2. Stand still for 5 minutes at the point, allowing birds to acclimate around you.
3. Start the stopwatch. Facing north, the primary observer moves slowly in a clockwise direction and indicates to the secondary observer all the birds detected (making sure to pay attention to distance of birds within the plot & habitat type). The secondary observer records all the detections of the primary observer as well as any birds not detected by the primary observer (please make a note of this on the data sheet). Survey for 10 minutes.
4. Switch roles at the second point count.

(While walking from point to point, record any birds seen on the reverse side of the data sheet)

Appendix B:

List of data collectors

Drew Bantlin, Justin Clements, Jennifer Frisinger, Andrew Helm, Amanda Hrabovsky, Stephanie Hu, Richard Isham, Bob Kramer, Maddie Krasno, Kathryn Merriman, Dave Short, Catherine Turng, Gretchen Twietmeyer, and Chelsea Zegler

Appendix C:

Data sheet used for 2013 point counts

Lakeshore Nature Preserve

Avian Point Counts

Observers

Date	
Weather Condition	
Location (description)	

POINT NO.	TIME	SPECIES	0-50 m	50-100 m	fly-over	habitat type	Confidence level	Note

Confidence Level

1 = Not confident

2 = Some doubt

3 = Confident

Habitat Types

OW = Open Water P = Prairie U = Urban We = Wetland Wo = Wooded

50 meters = ~164 feet; 100 meters = ~328 feet

Camera Trap Survey of Mammal Diversity, Activity Patterns, and Human Interaction in the Lakeshore Nature Preserve

Cynthia Malone, Matthew Axler, Ming Hua, Ellen Kujawa and Mee-La Lee

Introduction

The Lakeshore Nature Preserve is a 300 acre protected area that occupies nearly a third of the University of Wisconsin-Madison campus. The Preserve both serves and is served by the university and according to its mission “shelters biologically significant plant and animal communities for teaching, research, outreach, and environmentally sensitive use, and safeguards beloved cultural landscapes” (Lakeshore Nature Preserve 2013).

As an intentionally multi-functional landscape, the Preserve provides a unique lens to explore biodiversity in an urban setting and effective conservation monitoring and management that satisfies multiple stakeholders. Through an annual Conservation Biology course (Environmental Studies 651), course instructor Dr. Adrian Treves has provided students with the opportunity to steer a Service Learning Project centered on this exploration as an application of classroom lessons. It is also an opportunity to assist the preserve with monitoring preserve users and two taxa groups: birds and mammals.

The Lakeshore Nature Preserve hosts prairies, wetlands, and woodlands and a diversity of mammal species including coyotes, eastern gray squirrels, and muskrats (See Appendix Table II for full species list). To better understand and contribute to the monitoring and conservation of mammals on the preserve, the Mammal Survey Team has been conducting surveys every spring since 2010. The surveys include basic biological assessments of species diversity and activity patterns that allow for a longitudinal study of the Preserve’s mammal species. This dataset allows the Preserve managers and UW researchers to uncover patterns that might assist in improving monitoring of the entire mammalian community or a particular species. We conducted biological assessments of diversity and activity patterns to contribute to this longitudinal dataset.

The survey teams (Mammals, Birds, and Users) also engage with participatory planning and adaptive management. Every year before designing the project, each survey team meets with the Preserve manager to incorporate their suggestions and any desired additional components related to ecology or species-human interactions. This year, during our meeting with the manager, three novel objectives were identified and incorporated into the study.

A recent concern of the manager was users that walk their dogs in the Preserve. Despite the Preserve rule requiring that all dogs be kept on leash, reinforced through signage, the 2012 User Survey Team observed 46% of dogs without a leash. Because of this, we sought to employ camera traps as a more discrete assessment of leash compliance and whether leash compliance was associated with particular locations in the preserve. We hypothesized that user leash compliance would be significantly dependent on location within the Preserve.

Preserve managers were interested in the activity of coyotes (*Canis latrans*) on the Preserve, particularly in connection with domestic dogs (*Canis familiaris*). We have highlighted interesting trends in coyote captures and activity patterns to address this objective.

The Preserve manager was also interested in assessing wildlife activity within the Eagle Heights Community Gardens. These gardens, established in 1962, are provided to Eagle Heights' residents and the larger Madison community as a free, shared space for organic gardening in the preserve (Eagle Heights Community Gardens 2013). This years' team was the first Mammal Survey Team to install cameras within the gardens. We were interested in determining what species of wildlife are passing through or using the gardens.

Methods

The Mammal Survey Team consists of five graduate students and 19 undergraduates (Appendix Table I). Graduate students were in charge of project design, oversight of progress and final completion of the project. Each graduate guided four to five undergraduates throughout the project. After training from graduate students, undergraduates entered all camera photos and sorted into a sheet

Camera Trap Set Up

A total of 16 camera traps were placed in the Lakeshore Nature Preserve, Madison, Wisconsin between March 20th and April 27th, 2013 (See Figure 1 for map of camera locations). Thirteen of these cameras were set up on March 20th and March 21st. With the aim of maximizing comparability with the 2012 Mammal Survey Team dataset, twelve cameras (camera 1, camera 2, camera 3, camera 4, camera 5, camera 6, camera 7, camera 9, camera 10, camera 12, and camera 13; note there is no camera 8) were set up throughout the Preserve relatively near the 2012 locations based on GPS coordinate records. A member of the 2012 Mammal Survey Team (Zachary Voyles) assisted the team in reaching the relative location of last year's camera traps.

In addition to these twelve cameras, four additional cameras were added to this years study. Camera 14 was added at the beginning of the trail leading to Bio-Core Prairie in order to capture potential differences in leash compliance along a human trail. Per the Preserve Manager's suggestion, three additional camera traps were set up within the Eagle Heights Community Gardens on March 30th. The camera traps in gardens, hereafter referred to as garden camera 1, garden camera 2, and garden camera 3, were set up on March 30th 2013. GPS coordinates were recorded for all 16 camera trap sites (Appendix Table II).

Figure 1. The locations of the sixteen camera traps around the Lakeshore Nature Preserve (March 20th – April 27th)

At each location, undergraduate and graduate students set up and programmed the camera traps. In accordance with camera trap protocol (Rawcliffe et al 2011), camera traps were affixed with rope to the tree approximately 1.5 meters above the ground and angled downward, occasionally with the use of sticks and leaves. To verify the angle and range of the device's view, students used the camera trap "walk test". Before locking the devices for the duration of the study, cameras were checked for ample battery life and set to "normal mode".

In the last week of April 2013 (04/21- 04/27) undergraduates removed all devices from trees and downloaded the photos from the camera traps' scan disk (SD) cards. In order to minimize data entry errors, every undergraduate team used the labeling program *ReNamer*, a free open software package, in order to rename each photo by time and date (Sanderson 2001). Photos were then organized into a hierarchal tree-branch structure with four levels: 1. Location Folder (i.e. Camera 1), 2. Time Block (See Table 1), 3. Species Folder (i.e. Deer), and 4. Number of Individuals (i.e. 0, 1, 2).

Species Identification

Species were identified and entered on the spreadsheet with the assistance of a guide created by the graduate team leaders (Appendix Table II). Species included in the analysis were all identified mammal species (including domestic dogs), one bird species (wild turkey, *Meleagris gallopavo*), and humans. Even though mammals were the primary focus of this study, wild turkeys were included in analysis because they are large enough to be captured by camera traps and were thought to provide an example of bird/mammal interactions. All photos of team members and those associated with set up were discarded. Photos where no species was discernible and/or those triggered by wind were also discarded.

When triggered, a camera trap takes three consecutive photos, which automatically record time and temperature. If there are three photos of the same individuals, this can only logically be considered one independent capture, or event, for the purpose of analysis. In considering a set

of photos, the team employed an established definition of an event given by O'Brien et al (2011) to guide classification of photos of the same individual and photos that include different species. To identify each capture in a series of photos, according to O´Brien (2011), an independent capture is defined in this study as:

- Consecutive photos of individuals of different species
- Consecutive photos of noticeably different individuals of the same species
- Consecutive photos of individuals of the same species taken more than 30 min apart
- Nonconsecutive photos of individuals of the same species

Statistical Analysis

A total of 28 active days of data were collected, resulting in a total of 448 (16 * 28 = 448) trap-days. Capture frequency, activity patterns, and Gini-Simpson Diversity Index (DeJong 1975) were calculated in accordance with the basic biological assessment component of the Mammal Survey Team. Dog leash compliance was also assessed.

Species capture frequency is the calculation of the frequency of species captured by camera traps. It is also used as a means to approximate species abundance across different camera traps. The frequency was calculated as 100 days (for results per 100 trap days) · total species captures ÷ (number of traps · days recorded by each trap). Overall species capture frequency was estimated from the sum of all camera trap data, and also estimated separately for camera traps 1-14 and the garden camera traps.

An analysis of activity patterns was used to measure the active time of species through a calculation of frequency of appearance in one active camera trap day. The length of each time block was defined as 4 hours in this study, organized into six time blocks detailed in the following table (Table 1).

Table 1. Time Block Organization for Species Capture Frequency Analysis

Time Block	Start Time	End Time
1	12 AM	4 AM
2	4 AM	8 AM
3	8 AM	12 PM
4	12 PM	4 PM
5	4 PM	8 PM
6	8 PM	12 AM

Activity patterns are measured for all species and comparisons are made between nocturnal and diurnal species, dogs and people, and dogs and coyotes. A d test was utilized to test the hypothesis that leash compliance is significantly dependent on Preserve location.

The Gini-Simpson Diversity Index provides a combined measure of species richness (total number of species present in a location) and species evenness (the number of individual captures per species). An index was measured for each camera trap. This index is often used to compare diversity between different habitat types (De Jong 1975). This year, habitat assessments were not conducted to allow for such comparison.

Results

Species capture frequency

Five species were captured within the survey period and included in subsequent analysis. The species consisted of *Procyon lotor* (raccoon), coyote, *Sylvilagus floridanus* (eastern cottontail rabbit), wild turkey, and *Sciurus carolinensis* (eastern gray squirrel). Raccoons had the highest number of captures at 46 total events, followed by coyotes with 32 events, and eastern cottontail rabbits with 29 events (Table 2).

Table 2. Species captured in the 13 camera traps not including the gardens, the number of independent photographic captures and, the capture frequency for photographic events over the 13 camera traps over 28 days per 100 trap days.

Capture Frequency			
Species	**Species Captured**	**Captures**	**Capture Frequency**
Procyon lotor	raccoon	46	12.64
Canis latrans	royote	32	8.79
Sylvilagus floridanus	eastern cottontail rabbit	25	6.87
Meleagris gallopavo	wild turkey	20	5.49
Sciurus carolinensis	squirrel	18	4.95

A comparison of capture frequencies between the three garden camera traps to the 13 other camera traps revealed a disparity in capture frequency for a number of species. The garden cameras recorded a capture frequency of 0 for raccoons, coyotes, and wild turkeys while the 13 other cameras recorded capture frequencies of 12.64, 8.79, and 5.49 respectively for these species (Table 3). Notably, squirrels had a higher capture frequency in the gardens than the preserve cameras.

Table 3. The species captured in the garden camera traps, the number of independent photographic captures and, the capture frequency for photographic events over the 3 camera traps over 28 days per 100 trap days.

Garden Capture Frequency			
Species	**Species Captured**	**Captures**	**Capture Frequency**
Sciurus carolinensis	squirrel	10	11.90
Sylvilagus floridanus	eastern cottontail rabbit	4	4.76
Procyon lotor	raccoon	0	0
Canis latrans	coyote	0	0
Meleagris gallopavo	wild turkey	0	0

Table 4. The species captured for all 16 camera traps, the number of independent photographic events and, the capture frequency for photographic events over the 16 camera traps over 28 days per 100 trap days.

Overall Capture Frequency			
Species	**Species Captured**	**Events**	**Capture Frequency**
Procyon lotor	raccoon	46	10.27
Canis latrans	coyote	32	7.14
Sylvilagus floridanus	eastern cottontail rabbit	29	6.47
Sciurus carolinensis	squirrel	28	6.25
Meleagris gallopavo	wild turkey	20	4.46

Overall, the most independent captures are of raccoons, (Table 4) followed by coyotes and eastern cottontail rabbits. These results differ from the 2012 capture frequencies, where squirrels, rabbits and raccoons are the most captured species (Figure 2). Additionally, the 2012 study recorded mice, opossums, and eastern chipmunks none of which were captured in the 2013 study.

Figure 3. Comparison of capture frequencies between the 2012 mammal team survey and the 2013 mammal team survey.

Dog Owner Leash Compliance

There were 133 independent dog events recorded in the duration of this study. Of these, 50 (37.6%) involved the use of a leash. A χ^2 test of independence was conducted to compare leash compliance between cameras 5, camera 6, and camera 14. These were the only cameras that contained over 5 dog captures, the minimum sample size per camera trap necessary to perform the analysis. Camera 5 was located along the edge of the Bio-core Prairie, camera 6 was located about 20 feet into the woods on the path leading from the gardens to Frautschi Point, and camera 14 was located next to a heavily-used path southeast of the Bio-core Prairie (Figure

1). The test revealed that there is no significant relationship between the camera locations and leash usage at d = 1.57 on 2 degrees of freedom, p = 0.46.

Table 5. Independent captures of dogs on and off leash at cameras 5, 6, and 14.

Camera	Dogs on Leash	Dogs off Leash	Total
Camera 5	34	9	43
Camera 6	7	4	11
Camera 14	89	37	126
Total	130	50	180

Activity patterns

Squirrels and wild turkeys were found to be predominantly diurnal while raccoons, coyotes, and rabbits were found to be mostly nocturnal. Interestingly, coyotes were captured in the daytime, with two events recorded during the 8AM-12PM and 4PM-8PM time blocks respectively.

Species were categorized as either nocturnal or diurnal to uncover any potential temporal patterns or species interactions. While coyotes and raccoons are sometimes considered to be crepuscular, the structure of time blocks did not allow for analysis of activity at dawn and dusk. Thus, raccoons, coyotes, and eastern cottontail rabbits are all categorized nocturnal species. Squirrels and wild turkeys are categorized as diurnal species.

Figure 4: Activity patterns for nocturnal and diurnal species.

By pooling counts of species listed as nocturnal and species listed as diurnal independently, activity patterns were compared across 4 hour time blocks (Figure 4). The results matched expectations of nocturnal and diurnal activity. Nocturnal species are active primarily in the 12-4AM, 4-8AM and 8PM-12AM time slots. The diurnal species are active in the nighttime blocks, with the majority of activity in the 8AM-12PM blocks. The 4PM-8PM block reveals the most parity, with eight nocturnal species events and 9 diurnal species events.

The activity patterns of humans and dogs were compared for any potential unpredictable interactions (Figure 5). Dogs always occurred with their human owners. The highest number of human captures occurred during the 12PM-4PM block (37.81% of total human captures), the 4PM-8PM block (35.26% of total human captures), and the 8AM-12PM block (24.01% of total human captures). Dog activity was also concentrated in the daytime hours and no domestic dogs were captured during the nighttime blocks.

Figure 5: Activity patterns by dogs and people.

An additional comparison of dog and coyote activity provided very little evidence of temporal overlap (Figure 8). There are no photos that directly display a dog-coyote interaction. Dog activity was concentrated in the daytime hours whereas coyote activity occurs primarily during the nighttime hours.

Figure 8: Activity patterns of dogs and coyotes.

Gini-Simpson Diversity Index

The cameras with the highest Gini-Simpson Index (camera 2, camera 7, and camera 6, Figure 1) had four species total each, with high rates of capture of each species. Cameras with a Gini-Simpson Index of 0 (camera G2, camera 10, camera 11, Figure 1) captured only one species each (eastern cottontail rabbit, squirrel, and raccoon, respectively). Cameras with Gini-Simpson Index of N/A had zero captures of any wild species; therefore the Gini-Simpson Index for these locations is incalculable (Table 6).

Table 6. The Gini-Simpson biodiversity index values for all 16 camera trap sites.

Camera Name	Gini-Simpson Index
Garden Camera 1	0.50
Garden Camera 2	0
Garden Camera 3	0.20
Camera 1	0.44
Camera 2	0.60
Camera 3	0.32
Camera 4	N/A
Camera 5	N/A
Camera 6	0.51
Camera 7	0.51
Camera 9	0.15
Camera 10	0
Camera 11	0
Camera 12	0.28
Camera 13	0.20
Camera 14	0.47

Discussion

Longitudinal Comparison

In comparing this year's data with those of the 2012 Mammal Survey Team (Ohrens et al 2012), interesting patterns emerge. The total number of events, 141, was only 25% of the 2012 total photo events. Comparing frequency distributions across species, smaller mammals - squirrels (77%) and rabbits (21%) - made up the majority of events in 2012, while this year, squirrels accounted for only 13% of captures and 55% of photos were raccoons and coyotes. The discrepancy between surveys may be explained by a number of technical and broader seasonal patterns.

Given that the capture frequency of squirrels and rabbits was lower in 2013 than in 2012 and that smaller species, in number, numerically accounted for the difference between years in overall events, we suggest that the camera positioning on the tree may have played a substantial role in the kinds of species we were able to capture. Camera traps are ideally placed at 1.5 m on a tree at a 45 angle, this is particularly important for capturing smaller animals (Rawcliffe 2011). Not all of our cameras fit this description and during trips to pick up batteries

we noticed that camera position shifted during our study. This was likely partially due to snowfall and wind. The undergraduate team also observed photos of a toddler moving a camera. We suggest that future surveys ensure that cameras are securely positioned at the appropriate position and angle.

Weather patterns may have had an impact on the phenological components of species distribution. The State Climatology office reports (citation) that 2013 temperatures across Wisconsin were regularly 5 degrees or more below normal between March 1-April 15. In southern Wisconsin, 90% of day-time high temperatures were below seasonal normal temperatures and April precipitation amounts “ranked far above normal.” The capture frequencies of this years survey might reflect a response of Preserve animals to climatic changes. Comprehensive longitudinal research on the demography and distribution of species could shed more light on ecological explanations.

Uneven Species Distributions Revealed by Capture Frequencies

Unlike squirrels and wild turkeys, raccoon and coyote captures were not evenly distributed across camera locations. The majority of coyotes, 72%, were located at camera 14, which we added for the first time to this study. There are also many human captures at this site.

Many raccoon captures, 43%, were at camera 2, located near the picnic point entrance. In urban and suburban areas, raccoon distributions are known to be smaller and more concentrated in response to abundant, stable artificial resources concentrated in distinct, rich patches (Prange et al 2004). The picnic point entrance is normally an area of persistent human activity. A member of the mammal survey team noticed litter located around the camera and along the human trail, in addition to the garbage cans a few meters away. Raccoons may be attracted to refuse at these points.

Garden Capture Frequencies

The capture frequency for wildlife species in the garden was low, with only 14 total events. Squirrels are a notable exception, with the highest number of events in the gardens. Squirrels are tolerant to human activity and disturbance, but also prefer wooded areas (Dill and

Houtman 1989). The 2012 mammal survey found a strong positive correlation between squirrels and canopy cover. Our results show the highest number of squirrels in the gardens at garden camera 3, which is located near the edge of Bill's Woods (Figure 1).

An important consideration for Preserve managers is that the timing of our survey may not be entirely representative of mammal activity in the gardens, as it was completed before spring planting (which notably was later this year due to the cold spring, April 21st according to the EHCG website). Fruits, vegetables, and flowers may lure in more mammal species later in the growing season, particularly directly from Bill's Woods. In the future, the Preserve could set up cameras during, and after planting season to capture more wildlife activity. Cameras set up throughout the year could even allow for a comprehensive view of wildlife activity that could aid garden members in deterring species (such as rabbits) that might affect certain crops when in season.

Activity Patterns

Across all species, activity patterns revealed the expected time allocations for the nocturnal and diurnal species captured. Nocturnal and crepuscular species (coyotes, raccoons, and cottontail rabbits) were active almost entirely at night, dawn, and dusk (in the 8PM-12AM, 12-4AM, and 4-8AM blocks). Figure 6 demonstrates that nocturnal and diurnal species may overlap in the dawn (4-8AM) and dusk blocks (4-8PM). The structure of our time blocks did not allow for analysis of potential species interaction during dawn and dusk. Future surveys could structure their design to explore temporal overlap more precisely.

Interaction between coyotes, dogs, and humans

The Preserve managers suggested our team look into whether coyotes were interacting with humans and dogs and in what capacity. Our data suggests that dog/coyote interactions were infrequent. There were no photos that contain both a dog and a coyote. The activity pattern analysis reveals different periods of activity - dogs were exclusively active from x to y hours and coyotes are mostly active from y to z hours. Dog and coyote interaction may occur,

but would be difficult to capture without more concentrated camera effort in areas of high coyote presence.

At camera 14, the highest number of coyote captures coincided with the highest number of human and dog events, which were % and % of all total events. Future surveys should place more cameras in this location for a longer period to determine if our sample was unusual or if this may be near a coyote pack's core area of activity. Coyote attacks on humans are infrequent, White and Gehrt (2009) report an extremely low hazard rate when coyote and human proximity are considered with frequency of attack. For precaution, the Preserve may want to set out photo-luminescent signage (visible to those present at sunset) near camera 14 (Figure 1). There were no coyotes captured by cameras 9 and 10 nearest to the Eagle Heights (Figure 1).

Camera traps may not be the most efficient method to detect coyote abundance or distribution. A study of noninvasive techniques to survey carnivores in upstate New York (Gompper et al) demonstrated that coyotes had a low probability of detection for camera traps and abundance was represented significantly more by scat surveys. We recommend that basic research on coyote ecology and ranging patterns become a greater priority of the Preserve, perhaps through testing multiple non-invasive methods.

Dogs and Leash Compliance

Our analysis revealed that 72% of all dogs were on a leash. The interviews conducted by the 2013 User Survey Team support this result. Of all users observed by the user team with dogs, 82% had their dogs on leash. When asked what people believe was the most effective way to enforce leash compliance, the majority of users responded that signage would be most effective. Data from the camera traps of this study and in the future might assist in directing where signage should be placed.

The results of the χ^2 hypothesis test suggest that location within the Preserve did not have a significant affect on whether dogs were kept on a leash. As only three cameras had photos of dogs, the statistical power of was limited by the low sample size. Notably, camera 14 had the highest percentage of human sightings, coyote sightings, and of dogs off leash (74%).

An immediate goal of the Preserve might be placing signs near the former location of camera 14, the beginning of the trail to Bio-core Prairie.

When we qualitatively assess dog events between the three cameras dogs were pictured, there is a spatial trend. From camera 14, the southernmost camera of the three cameras with dogs, to camera 6, the northernmost camera, there is a decrease in the total number of dogs (always accompanied by an owner) and a decrease in the number of dogs off-leash. This might reflect a user preference for dog walking on trails near the lower entrance of the Preserve rather than in the interior. We recommend that more camera traps be placed south of camera 14 and between cameras 5 and 6 to better understand whether there is a difference in the frequency of dog walking throughout the preserve. Future user survey efforts could collaborate with the mammal survey team to interview dog owners in these locations. These combined efforts could enhance our understanding of leash compliance in the Preserve and where best to focus efforts such as signage.

Conclusions

The results of the 2013 mammal survey reaffirm the utility of camera traps as a means to assess which species are present on the Preserve and, generally, in what frequency. In addition to providing the Preserve with a current perspective of mammal diversity, this study was also able to successfully address three objectives related to current concerns of the Preserve.

An analysis of leash compliance within dog captures revealed a potential spatial trend of decreased leash compliance towards the Preserve's entrance. We suggest this warrants further research through additional camera traps and collaboration with the User Survey Team.

The two carnivores captured in this study, raccoons and coyotes, were concentrated at two particular camera trap sites in the Preserve. An investigation of the area surrounding camera 2, where 43% of raccoons were captured, could lend more insight into whether raccoons are being lured by trash at this site. If this is the case, signage deterring littering could be placed around this location.

Studies (such as Gompper et al 2006) suggest that camera traps are not the most effective method to assess coyote activity. In order to better understand coyote activity on the Preserve, in particular the high capture frequency at camera 14, we recommend that other non-invasive methods, such as scat surveys, be explored.

In our assessment of leash compliance, coyote activity, and wildlife activity in the gardens, greater collaboration with the user survey team could have enhanced our perspective and quantitative interpretation of our results. We recommend that future Mammal Survey Teams work more closely with the User Survey Team to consider user perception of wildlife and any human-wildlife interactions more comprehensively.

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Appendix

List of undergraduate members of the 2013 Mammal Survey Team

Becca Huff

Kalia Xiong

Joe Sullivan

Juliana Montero

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Stephan Terry

Aszya Summers

Joanna Gellerman

Matt Bruley

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Andy Delman

Joseph Chase

Katie Roehl

Jessica Lund

Annalise Black

Julie Louvrier

Paige Pederson

Kerri Fuchs

Adam Winegarden

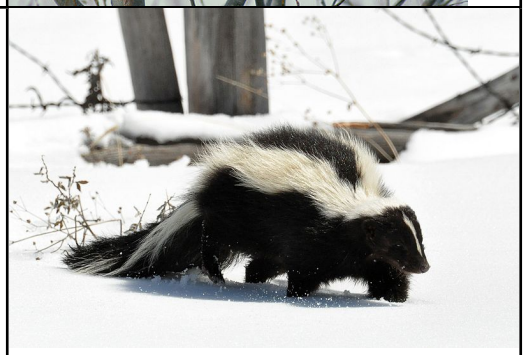
Appendix 2 Supplementary Tables

Table I. GPS Coordinates of 2013 Camera Trap Sites

Camera Trap Coordinates		
Camera	**Latitude**	**Longitude**
1	43.08463	-89.42809
2	43.08631	-89.42242
3	43.08711	-89.42561
4	43.0855806	-89.432874
5	43.08889	-89.42911
6	43.09144	-89.42948
7	43.08995	-89.43194
9	43.084655	-89.444735
10	43.085187	-89.445468
11	43.088248	-89.44160848
12	43.08467	-89.43635
13	43.08521	-89.43531
14	43.08751	-89.42811
G1	43.08754	-89.43226
G2	43.08827	-89.43182
G3	43.08684	-89.43167

Table III. Species Identification List. Description info sourced from Kays and Wilson (2009).

Species	Common Name	Description	Photo
Sciurus carolinensis	Eastern Gray Squirrel	A small gray squirrel with a bushy tail edged in white. Belly is whitish. Gray back may have a red-brown tinge.	

Sylvilagus floridanus	Eastern Cottontail	Most common cottontail.	
Procyon lotor	Raccoon	Well known for its dark mask and ringed tail.	
Mephitis mephitis	Striped Skunk	Unmistakable and well known due to unique color pattern, dorsal stripes converge to a V at the nape.A pair of dorsal stripes typically mark the back, but these may be so variable in size and shape that skunks look all white, all black, or spotted.	

Meleagris gallopavo	Wild Turkey	Very easy.	
Canis latrans	Coyote	Smaller than wolves, with a smaller nose pad but relatively larger ears. Upperparts are typically brownish, often with redish highlights on legs. Belly and throat are pale. Tail usually held down when running.	
Peromyscus maniculatus	North America Deermouse	Most common mouse. Has large black bulging eyes, relatively large, naked ears, fine, smooth-lying fur, and white feet.	

Didelphis virginiana	Virginia Opossum	Unique with white head and long, scaly, prehensile tail.	
Tamias striatus	Eastern Chipmunk	This red-rumped rodent is the only chipmunk in most of eastern North America. Largest chipmunk. Color of back varies.	

Table IV. Camera Trap Data – Total Independent Captures of Species for all 16 Cameras

Camera #	Squirrel	Raccoon	Chipmunk	Coyote	Rabbit	Skunk	Mouse	Opossum	Turkey	People	Dogs	On leash
Garden1	2	0	0	0	2	0	0	0	0	178	0	0
Garden2	0	0	0	0	1	0	0	0	0	6	1	0
Garden3	8	0	0	0	1	0	0	0	0	1	0	0
Camera1	1	2	0	0	0	0	0	0	0	14	0	0
Camera2	0	20	0	2	21	0	0	0	3	30	0	0
Camera3	0	0	0	4	0	0	0	0	1	2	1	0
Camera4	0	0	0	0	0	0	0	0	0	2	0	0
Camera5	0	0	0	0	0	0	0	0	0	109	34	9
Camera6	0	7	0	1	0	0	0	0	3	37	7	4
Camera7	1	8	0	1	2	0	0	0	0	6	1	0
Camera9	11	0	0	0	1	0	0	0	0	3	0	0
Camera 10	2	0	0	0	0	0	0	0	0	0	0	0
Camera 11	0	2	0	0	0	0	0	0	0	1	0	0
Camera 12	1	0	0	0	0	0	0	0	5	13	0	0
Camera 13	0	0	0	1	0	0	0	0	8	9	0	0
Camera 14	2	7	0	23	1	0	0	0	0	646	89	37

Attitudes Survey of Lakeshore Nature Preserve Users 2013

Paula Henríquez, Amanda Jacobson, Kassandra Lang

Introduction

The University of Wisconsin-Madison Lakeshore Nature Preserve protects plant and animal communities for teaching, research, and outreach as part of the University's Land Grant mission. The Preserve's mission statement includes its goal to "permanently protect[] the undeveloped lands along the shore of Lake Mendota where members of the campus community have long experienced the intellectual and aesthetic benefits of interacting with the natural world." Over the years the Lakeshore Nature Preserve has become an integral part of the University and surrounding community. Many enjoy the Preserve on a regular basis through activities such as walking, running or biking on the trails for leisure or commute, fishing, bird watching, gardening, and other outdoor activities.

The easiest way to protect the Preserve lands is to close them from public access and only allow university activities; however this runs counter to the mission of outreach and community education prevalent in the Preserve's mission and the larger Land Grant mission the University strives to uphold. The multiple purposes served by the Preserve lead to management challenges which can be best addressed by incorporating community input and priorities.

Project Description

Dr. Adrian Treves' spring Conservation Biology 651 course has assisted the Lakeshore Nature Preserve in planning and implementing a longitudinal study of preserve users' attitudes and opinions to allow preserve managers to make informed management decisions that allow the Preserve's ecosystem to flourish while providing a community space for learning and exploring nature. Users of the Preserve include people from many backgrounds who use the space for many different purposes. Therefore, it is important to identify tensions between types of users to improve adaptive management of the Preserve. The study began in 2007 and is expected to continue for the foreseeable future in this course or others.

Similar to past years' processes, the project team again included four groups: initial team, core team, advisors, and stakeholders. The initial team was made up of three graduate students, and the core team consisted of an additional eighteen undergraduate students. Advisors were Dr. Adrian Treves, Teaching Assistant Jeong Eun (Anya) Lim, and Preserve Manager Cathie Bruner. Identified stakeholders consisted of the Preserve managers, Preserve users, those who live in neighborhoods surrounded by and near the Preserve, and the University of Wisconsin-Madison at large.

Our Preserve user survey covered the entire Preserve, broken down into 4 areas, A through D (Figure 1). Our core team of undergraduates surveyed at the sites for four weeks in late March through late April. As in years past, we evaluated (1) tensions amongst users, (2) the impact of new signage in the Preserve, and (3) opinions regarding management concerns. In addition, we added a few new areas of focus to the survey this year, based on conversations with Preserve Manager Cathie Brunner. Namely, we asked users about (1) their use and knowledge of the Preserve website, and (2) their knowledge of and opinions about coyotes in the Preserve.

Methods

Survey Design & Procedures

To maintain continuity, we followed a similar process to that which has been used in the user survey from previous years (Treves et al. 2007, Anhalt et al. 2011, Barant et al. 2012). We sent out undergraduate teams of two to interview orally and tally users between March 23 and April 19, 2013. Surveys were completed in 4 locations: (A) the bike rack along the Lakeshore Bike Trail, (B) the entrance to Picnic Point, (C) the entrance to Eagle Heights Community Garden, and (D) the intersection of Lake Mendota Drive and Eagle Heights Drive (Figure 1). Undergraduate teams surveyed in each of the locations on both weekdays and weekends in 2-hour shifts of 7:00 to 9:00 am, 11:00 to 1:00 pm, 2:00 to 4:00 pm, and 5:00 to 7:00 pm as in 2012. Each undergraduate student was responsible for completing six shifts, for a total of twelve hours of surveying time per individual, and 216 hours for the group.

Surveying consisted of two parts: an orally administered questionnaire as well as a simple tally to keep track of the activities and group sizes of each group that passed the survey point. We created the survey, incorporating the recommendations for improvement from 2012 (Barant et al. 2012). To provide for direct comparison between years, many of the survey questions were the same as those used in 2012. To reflect the changing interests of the Preserve Managers, we removed older questions and added a new question about the Preserve website and two questions about coyotes. Our survey is included in Appendix 2.

In an attempt to improve response rates to the survey and lend credibility to the undergraduates, they were provided a name tag with the Lakeshore Nature Preserve and University of Wisconsin logos. In order to solicit responses students were instructed to greet and approach every third individual or group and ask them if they would have time to participate in a brief survey about the Lakeshore Nature Preserve and their uses within it. While one undergraduate attempted to administer the oral questionnaire to every third user (many people refused to take the survey, but quantitative data was not collected properly across all survey groups to determine how many), the other undergraduate kept a tally sheet that recorded group size, gender composition, activity, presence or absence of a dog, and whether the dog was leashed. These data were collected for every group that passed the survey location in either direction. It is possible that this type of method resulted in double counting of groups or individuals but we wished to maintain compatibility with data collection in years past.

After surveying shifts, the undergraduates input the data from the survey and tally sheets into a spreadsheet that we developed. After compiling the coded data, we randomly compared the coded data to that from the hard copies to check for errors. We checked 45 sheets of entries - 30 survey sheets and 15 tally sheets – and found an error percentage of 6.6% for surveys and 2.8% for tallies. When creating the spreadsheet, we added drop-down boxes for each entry, thereby limiting the type and range of data that the undergraduates could insert to avoid major data entry errors. This process worked well for us, and we recommend that future user survey teams use a similar technique.

Analysis

We conducted statistical analysis using Microsoft Excel Data Analysis extension. For the data collected through the tally sheets, descriptive statistics as well as Analysis of Variances (ANOVAs) were performed to evaluate the associations between the group size of users and the survey sites (A, B, C, D), time of the survey (7-9 am, 11-1 pm, 2-4 pm, 5-7 pm) and type of day (weekend, weekday).

We calculated descriptive statistics for each of the questions. We ran Pearson's Chi Square Test to assess the dependency of the following variables: user types (walking, running, biking) and their attitude towards leashed dogs within the Preserve; age of the respondent and their attitude towards leashed dogs in the Preserve; users' awareness of the Preserve website and their age; awareness of the respondents that they were currently within the Preserve and the frequency they declared they visit the Preserve; whether respondents have seen or ridden a bike during the last year at Picnic Point and the location where they were surveyed; helpfulness of the signage and the location where users were surveyed. To meet the assumption of the chi-square test, that is, that each category should have a frequency higher than 5, we grouped some of the variables tested. See the Appendix 8 for the details of the variables and categories considered for the tests we ran.

Results

We conducted the survey during 24 days between March 23 and April 19, 2013, of which 7 were weekend days and 17 weekdays. The sampling effort included 54 shifts distributed among the 4 locations described (A: 13 shifts, B: 12 shifts, C: 15 shifts, D: 14 shifts) and 4 periods of the day (7-9 am: 9 shifts, 11-1 pm: 13 shifts, 2-4 pm: 20 shifts, 5-7 pm: 12 shifts). Each shift lasted 2 hours, making a total of 108 hours of sampling, and a time effort of 216 hours since each group had 2 members (see Appendix 4 for more details of the schedule).

User Tally Results

We tallied 2637 groups across all the locations, with an average size of 1.3 people each. Additionally, we recorded a total of 3471 individuals (1857 males and 1614 females). Survey

sites differed significantly in average group size (ANOVA $F_{3,2633} = 2.61$, $p < 0.0001$), with location B visited by the largest groups and D by the smallest groups (A: 1.226 ind, B: 1.500 ind, C: 1.292 ind, D: 1.212 ind.. See Appendix 3). Significant differences were also found when comparing time and group size (ANOVA $F_{3,2633} = 2.61$, $p<0.0001$), with larger groups more common between 2 and 4 pm, and smaller groups between 5 and 7 pm (7-9 am: 1.289 ind, 11-1 pm: 1.308 ind, 2-4 pm: 1.399 ind, 5-7 pm: 1.195 ind. See Appendix 3). The groups of users were significantly larger on weekends than on weekdays (ANOVA $F_{1,2635} = 3.84$, $p=<0.0001$) (weekend: 1.517 ind, weekdays: 1.165 ind. Appendix 3). Location D was the least visited with 7 users per hour, while location A was the most used with 39 users per hour (Figure 3).

Overall, the most frequent activity conducted by the users at the Preserve was walking, followed very closely by running and then biking. At sites A and B this same pattern was observed, however at sites C and D the most frequent activity was running, followed by walking and then biking (Appendix 3). Differences between weekdays and weekends were also detected. Though walking was the most common activity reported for weekdays at sites A and C, during the weekends the most common activity was running. We detected the opposite situation at site B where running was the most common activity on weekdays and walking during the weekends. Finally, at site D running was more frequently practiced on weekdays, although on weekends the frequency of the three activities was very similar (Appendix 3).

Interview Results

Over the course of the project, undergraduate students surveyed 236 users. Of those surveyed, 51.7% were male, which is similar to the 53.5% males recorded in the user tally (Figure 5).

Over 80% of respondents had connections to the University of Wisconsin (Figure 6). Over 40% were in the 18-24 age range, with another 20% in the 25-34 age range. Approximately 83% of the users surveyed were aware that they were in the Lakeshore Nature Preserve (Figure 11). Sites A and B were the sites most commonly frequented by those surveyed, with over 80% of respondents reported that they use the sites (Figure 7); 47% report

using area C and 29% use area D (Figure 7). A new question we asked this year aimed to determine whether survey respondents were passing through the Preserve to another destination or using the Preserve itself. Differences were seen over each of the four sites with 72% of users surveyed at site A just passing through and 74% of users surveyed at site B using the Preserve itself (Figure 12). Respondents are most likely to use the Preserve more than once a week (36%), while the second most common reported frequency of use was daily (21%) (Figure 8). Of those completing the survey, 76% were engaged in walking in the Preserve at the time they were approached with an additional 15% who were running and 9% who were biking (Figure 10). This represents and under-sampling of runners and bikers who comprised 39% and 21% of the user tally, respectively (Figure 10).

Top management concerns

The management concerns of users have been fairly consistent since 2011 (Figure 13). Development pressure remains the top concern of respondents, followed closely by a slowly increasing concern with invasive species over the years. Decaying infrastructure, management of human uses, and disappearing views remained lower-priority concerns.

The Preserve Manager was also interested in users' thoughts on the use of controlled burns as a method to control vegetation, especially since the Preserve has a number of burns scheduled. 73% of respondents agreed with the use of prescribed burns whereas only 7% disagreed (Figure 14).

User tensions: dogs

Early versions of this study highlighted tensions between respondents with and without dogs. We continued asking the same questions that were asked in previous years. 95% of dog walkers had a positive view of dogs in the Preserve while 62% of the other users had a positive view of dogs in the Preserve (Figure 15). No dog walkers had a negative view, while 11% of other users had a negative view of dogs in the Preserve (Figure 15). Despite this, only 2% of non-dog walking users thought that dogs should not be allowed anywhere in the Preserve (Figure 16). 76% of respondents felt that increased signage was an appropriate method of

reducing incidence of unleashed dogs and only 33% felt that fines were an appropriate method (Figure 17).

Use of signs

Most users reported examining the signs in the Preserve for maps to determine their location or distance (66%) or for the rules of the Preserve (55%) (Figure 18). In addition, 58% of respondents found the signs helpful in conveying the rules of the Preserve and 15% said they were not helpful (Figure 19). Similarly, 73% of respondents reported that they understand the preserve rules, with 8% of respondents who did not understand the rules and 19% who were unsure (Figure 20). At location A 60% of the 92 respondents; at location B 79% of the 70 respondents; at location C 78% of the 46 respondents, and at location D 96% of the 28 respondents stated they understand the rules. Despite a general feeling of understanding the rules of the Preserve, 36% of respondents have ridden or seen a bike ridden in the Picnic Point area in the last year – where they have not been allowed since mid-2012 (Figure 21).

New questions for 2013: website and coyotes

The Preserve has a newly updated website that provides information about the Preserve. Unfortunately, our surveys showed that only 15% said the website impacted their use of the Preserve (Figure 22). Over half of those surveyed were unaware of the Preserve website (53%) (Figure 22). Further analysis demonstrated that UW students (62%) and visitors from out of town (75%) were the two demographic sectors that were least aware of the website, with a total of 60% of respondents being unaware (Figure 23).

We also added 2 questions about coyotes in the Preserve, in part due to some pet dog depredations that have happened recently in the area immediately surrounding the Preserve. Only 8% of respondents reported having seen a coyote in the Preserve in the last 5 years (Figure 24). Our survey also revealed that 74% of respondents felt that wild coyotes should be allowed to live in the Preserve, whereas 16% of respondents thought coyotes should not be allowed, and 10% were unsure (Figure 25).

Discussion

Between 2012 and 2013, the top three concerns of the Preserve users have not changed. In both years the shoreline erosion, pressure for development and management of invasive species have remained as the most mentioned concerns by the respondents. Runoff disappeared off the list of top 3 concerns over the last 3 years while the management over invasive species has increased in importance. Regarding dogs, we found a positive attitude for leashed dogs within the Preserve, especially from younger respondents, between 18 and 24 years old. With relation to the signs, most respondents found them useful, especially for location/maps/distance and rules purposes. From the pool of respondents, a little more than half declared to be unaware of the Preserve's website, especially young respondents between 18 and 24 years old. Finally, while just a few respondents have seen a coyote in the Preserve during the last five years (8%), almost all of them were agree that coyotes should be allowed to live in it. This trend includes the residents of the Eagle Heights and Shorewood Hills area.

User Tally

This year we experienced a surprisingly cold and rainy March and April. On more than one occasion, frigid temperatures and heavy rain prevented our undergraduates from going out to survey and required rescheduling. Even with rescheduling, 14 out of the 24 days the survey was conducted reported overcast/raining/snowing weather. Likely because of the lingering snow and cold temperatures, the number of users we recorded and surveyed this year is lower than that of 2012, when April temperatures hit the 80s on multiple occasions. We recorded more passersby and surveyed more individuals than in 2011 (Anhalt et al. 2011), but in 2012, they recorded over 7000 passersby (Barant et al. 2012) while we had only 3471 this year. Similarly, in 2012, they surveyed 321 users while we surveyed 236 users this year. Despite our lower numbers, this is a strong effort considering that last year user survey team consisted of 30 undergraduates and 6 graduate students while we had only 18 undergraduates and 3 graduate students on the team this year.

Interview

Top management concerns

When comparing our results to those obtained last year, we found that in both, the top three concerns of users were the same but they had a different order. Indeed, while in 2012 the top concern was the shoreline erosion, followed by pressure for development and management of invasive species, this year the top concern was pressure for development, followed by invasive species management and the shoreline erosion (Figure 13). Runoff has disappeared off the list of top 3 concerns over the last 3 years while there has been a consistent growth in concern over invasive species. On a related note, there seemed to be a strong consensus among our respondents that prescribed burning is an appropriate way of managing vegetation growth (Figure 14).

Among the top three management issues, it is important to mention that even when development pressure was the top issue among respondents in 2013 it was not the one with the highest frequency of response. Shoreline erosion was the third most important concern when considering only surveys that indicated it as the highest-priority (ranked 1), but when the total number of respondents that mentioned it is taken into account shoreline erosion is the most frequently indicated management issue (Figure 26). Similarly, runoff is the fourth most important issue when considering only the responses that indicated it as the highest-priority (ranked 1). However, when considering responses assigning it medium or low importance (ranked 2 or 3), runoff is the third most frequent management issue detected.

With respect to the comments, 23 out of 77 were related to the management of the Preserve. Of those, 6 mentioned human development within the Preserve and the cutting of trees as something to avoid. Additionally, another 3 users suggested an improvement of the waste management, increasing the number of containers and frequency of litter removal.

User tension: dogs

A vast majority of the respondents, 93%, declared that leashed dogs should be allowed everywhere or in certain areas of the Preserve (54% and 39% respectively). Just a small fraction stated that leashed dogs should not be allowed in the Preserve (2%), whereas 6% of respondents did not express an opinion about this issue. When comparing these results

regarding the activity the user was doing at the moment of the interview (walking, running or biking), no relationship was found (Pearson's Chi Square Test; $\chi 2=0.16$, df=2, p =0.92). However, a significant correlation was detected between age and the attitude towards the presence of leashed dogs within the Preserve (Pearson's Chi Square Test; $\chi 2=14.13$, df=4, p =0.01). Indeed, respondents under 24 years old were more inclined to accept leashed dogs everywhere within the Preserve, while respondents between 35 and 44 years old and 55 and 64 years old were not. When asked what would be a more appropriate management technique to minimize unleashed dogs in the Preserve, respondents overwhelmingly preferred the use of increased signs as opposed to fines (Figure 17).

Overall, we found a positive attitude towards the presence of leashed dogs. In fact, 62% of the respondents without dogs, think that the activity 'dog walking' have a positive impact on their own activities within the Preserve (Figure 15). Also, 12 out of 77 comments were related to dogs, and only two of them expressed a negative opinion. Those two comments supported the exercise of fines over the people that do not comply with the rule of leashed dogs (Appendix 5).

Use of signs

The top two purposes respondents used signs for, are location/maps/distance and rules, while the least frequent answers were audio tour and volunteering (Figure 18). Respondents found that the signs were generally helpful in conveying the rules of the Preserve but only 73% reported that they understand the rules (Figure 20). A significant association was detected between the helpfulness the respondents attributed to the signage and the location where they were surveyed, suggesting that in location A users find them less useful, while in location D they think signs are more helpful than the expected (Pearson's Chi Square Test; $\chi 2=13.27$, df=6, p =0.04) (Figure 28).

No correlation was found between respondents that have seen or ridden a bike in the Picnic Point during the last year and the location where they were surveyed (Pearson's Chi Square Test; $\chi 2=5.75$, df=4, p =0.22).

Ten comments from respondents referred to signage, with most of them desiring increased signage, especially for maps and distance markers (Appendix 5). This is an area where there is room for improvement.

Management: website and coyotes

The majority of the respondents were unaware of the Preserve's website (53%). Moreover, a significant relationship was found between the age of the respondents and the use of the website (Pearson's Chi Square Test; $\chi 2=23.67$, df=6, $p < 0.01$), as many UW students did not know about its existence and, therefore, did not use it (Figure 23). In this regard, announcements on campus, in places commonly visited by students, especially undergraduate students, could be useful to promote this tool.

A positive attitude was found regarding coyotes in the Preserve. Indeed, despite only 8% reported having seen a coyote within the Preserve in the last 5 years (Figure 24), 74% thought that coyotes should be allowed to live in it (Figure 25). Additionally, two out of three comments about coyotes (77 in total) expressed a positive attitude towards them.

35% of individuals who said they had seen a coyote in the Preserve in the last 5 years live in either Eagle Heights or Shorewood Hills. Finally, all the residents of Shorewood Hills (n=13) and 71% of the residents of Eagle Heights (n=35) that we surveyed were in favor of coyotes in the Preserve (Appendix 6).

Recommendations and Conclusion

According to qualitative data collected from comments provided by respondents the Preserve is a valued resource by the people of Madison. Indeed, 19 out of the 77 comments we obtained from respondents (Appendix 5) were positive observations towards the management of the Preserve and the great activities they experience in it, such as walking and enjoying nature.

In general, the results show that the top three management issues of users have remained consistent between 2012 and 2013 (pressure for development, invasive species management and shoreline erosion), with only their relative priorities changing. We found a

positive attitude towards the presence of leashed dogs within the Preserve, as more than half of the respondents thought they should be allowed everywhere in the Preserve. To increase the compliance of leashed dogs in the Preserve, the majority of the respondents preferred signage over fines.

Regarding signage, respondents relied on them for location/maps/distance and rules. Almost 30% of the respondents reported not understanding the rules of the Preserve or were unsure if all the rules were clear to them.

More than half of the respondents were unaware about the existence of the website of the Preserve; therefore, it has not impacted their uses. The group of respondents that was not affiliated with UW Madison but currently live in Madison was the group that used the website most. Even when users were aware of the website, it often did not impact their use of the Preserve. Perhaps some shortcut links on the main page will make it easier for users to utilize.

8% of respondents had seen a coyote in the Preserve in the last 5 years. There was a general consensus among all respondents that coyotes should be allowed to live within the Preserve (74%).

We suggest the following management interventions or actions:

- Increase the number of signs. Comments expressed a desire for more location and distance marker signs in particular.

- Invasive species was an issue whose importance has progressively grown during the last two years. Therefore, more information through the website or in the Preserve is recommended to inform users about the measures that have been taken to control invasive species.

- Promote the website of the Preserve, especially on campus, among undergraduate students.

- Overall we found that very few users have a problem with dogs in the Preserve, so dogs should continue to be allowed everywhere. For addressing dogs off leash, additional

signage was indicated as the preferred way of encouraging compliance by respondents. An educational campaign with a focus on fear of dogs by some individuals and cultures, and how dogs could potentially damage the natural habitat could be beneficial in promoting dog owners' understanding of the importance of keeping dogs on leash even if well trained.

- 36% of respondents had seen a bike ridden or had ridden a bike on Picnic Point within the last year; however 73% of respondents indicated they understand the Preserve's rules. With these results it appears that some individuals are choosing to not follow the rules. Aside from increasing human presence for enforcement we are unsure how to improve compliance in bike restricted areas.

We also have a few recommendations for the user survey team next year. Regarding the format of the tally sheet, we have added a field to assess the refusal of people to take the survey. In training, we instructed our undergraduate team to record refusals but without a designated area for doing so; as a result we obtained almost no refusal data. For the coding of the data, maintain the drop-down boxes for each entry option to limit the type and range of data that can be inserted in each cell, and therefore, reducing major data entry errors.

Acknowledgments

We would like to thank the undergraduate members of our user survey team (Appendix 7) for all of their hard work.

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Barant et al. 2012. Environmental Studies 651 Conservation Biology Service-learning project with the Lakeshore Nature Preserve. http://nelson.wisc.edu/people/treves/courses.php

Treves et al. 2007. Environmental Studies 651 Conservation Biology Service-learning project with the Lakeshore Nature Preserve. http://nelson.wisc.edu/people/treves/courses.php

Figure 1. Lakeshore Nature Preserve Map with survey locations: A) Howard Temin Lakeshore Path, B) Picnic Point, C) Community Gardens, D) Eagle Heights Woods

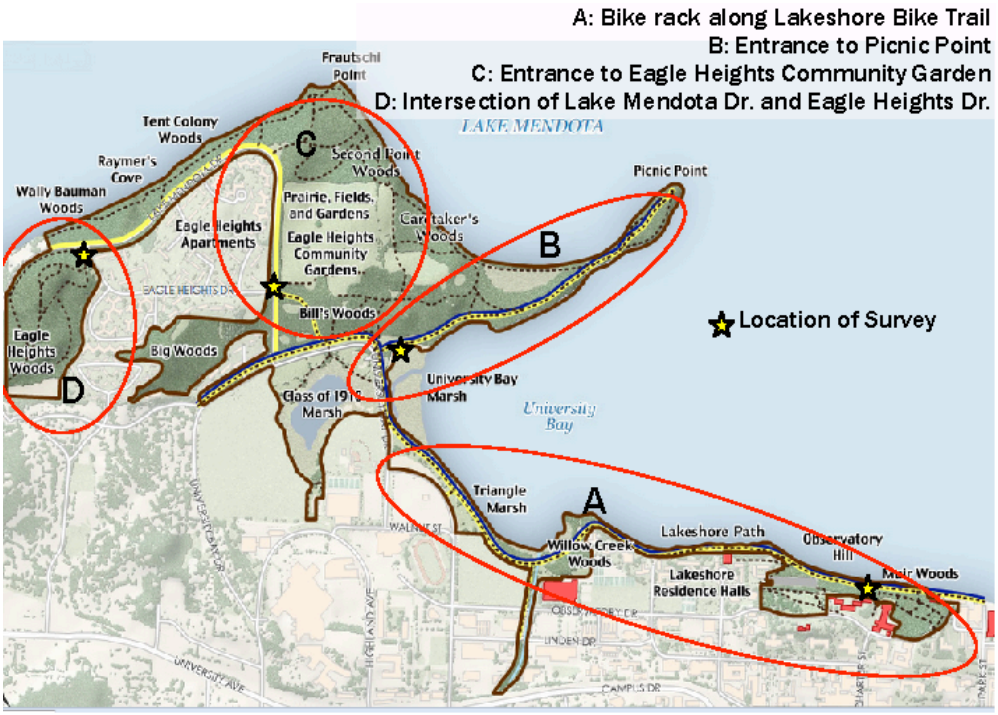
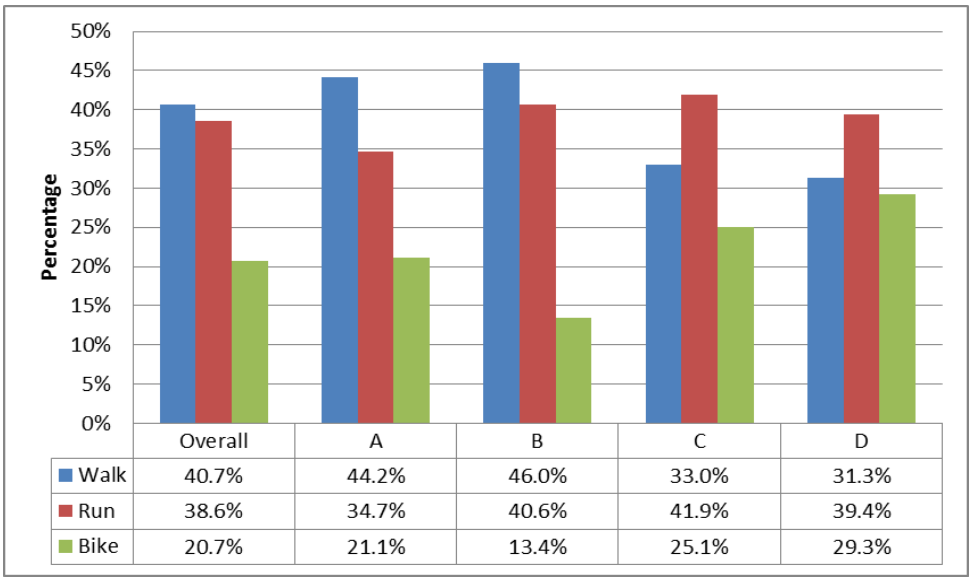


Figure 2. User activity at different sites (overall n=2634; site A n=1025; site B n=709; site C n=702; site D n=198) recorded by interview teams at different survey sites



	Overall	A	B	C	D
Walk	40.7%	44.2%	46.0%	33.0%	31.3%
Run	38.6%	34.7%	40.6%	41.9%	39.4%
Bike	20.7%	21.1%	13.4%	25.1%	29.3%

Figure 3. Users per hour (overall n=2634; site A n=1025; site B n=709; site C n=702; site D n=198) recorded by interview teams at different survey sites

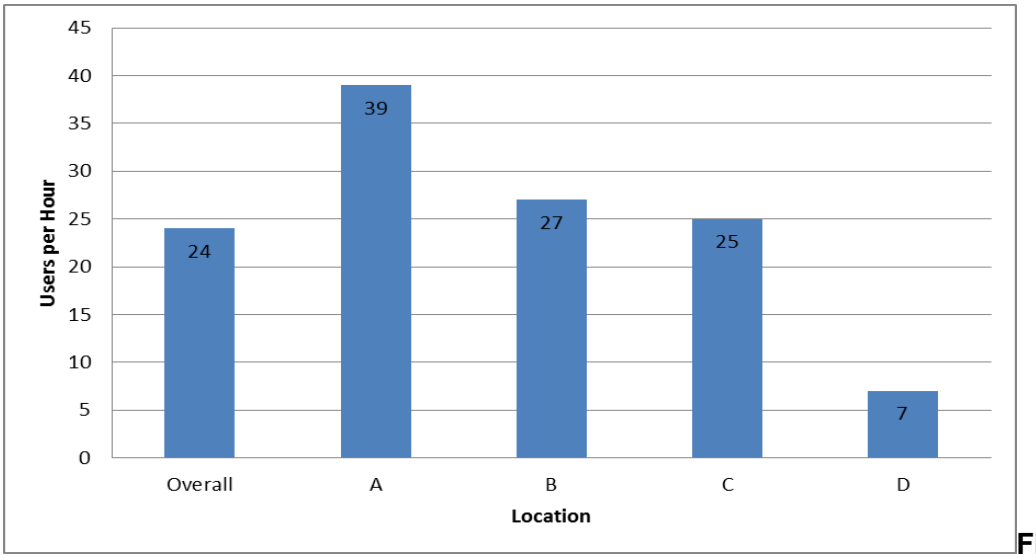


Figure 4. Average user group size recorded by interview teams at each of the survey sites

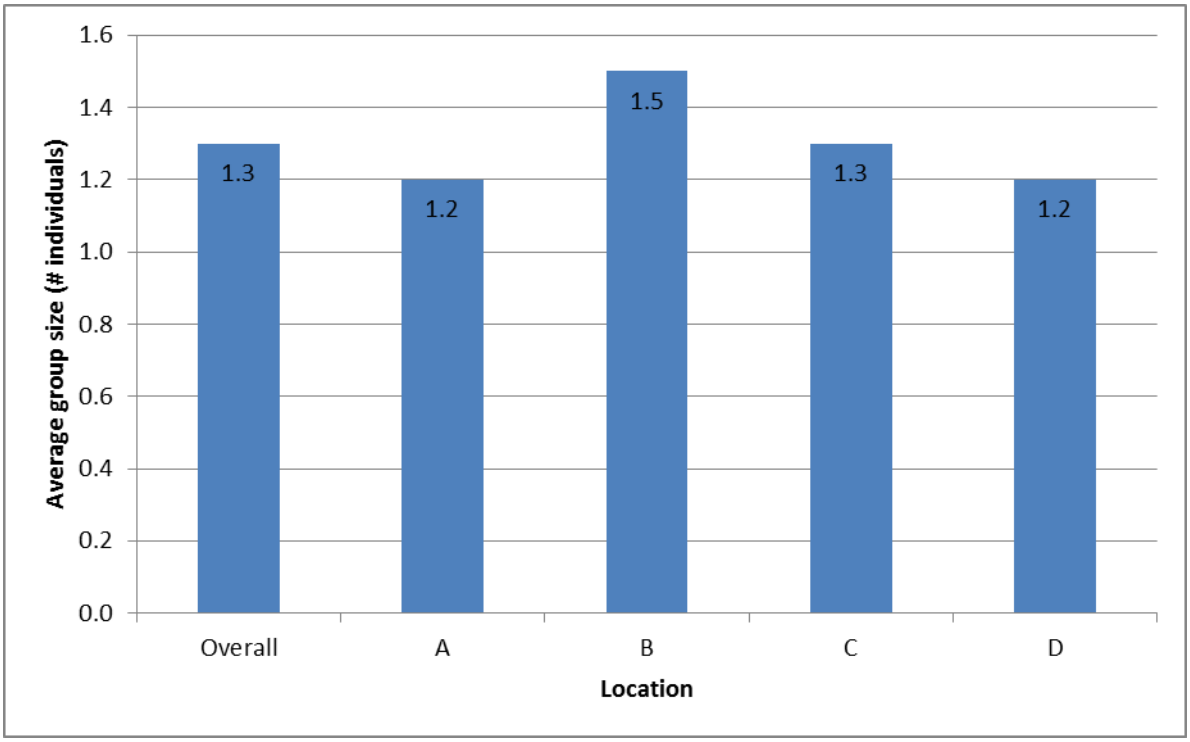


Figure 5. Gender of survey respondents (n=236) and users from user tallies (n=3471).

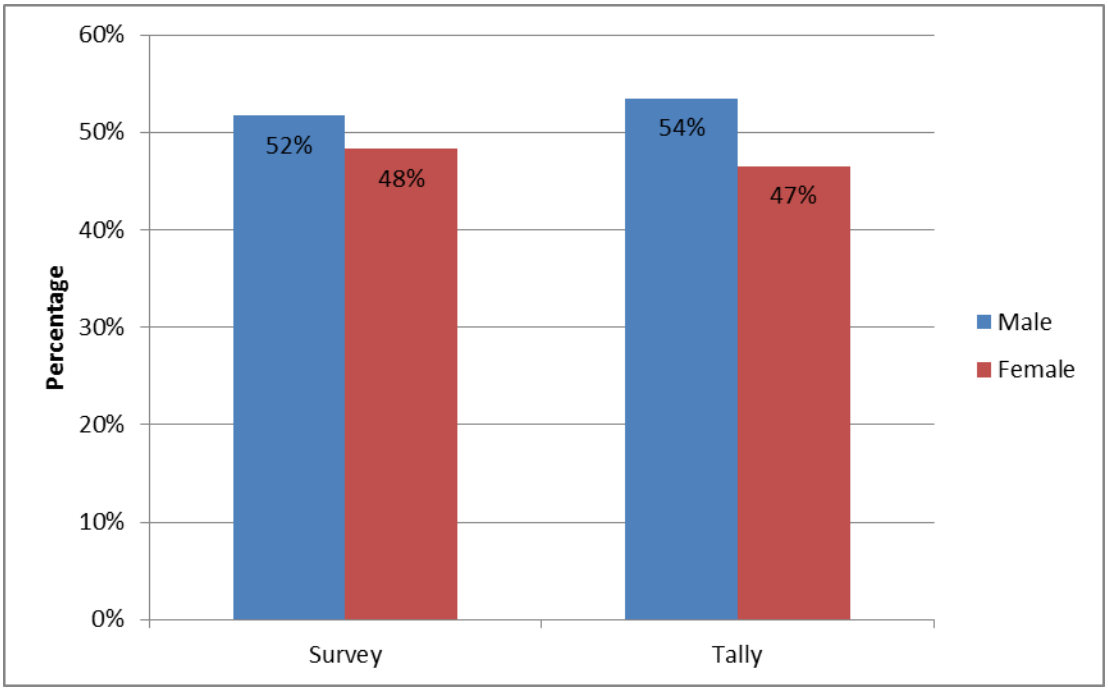


Figure 6. University of Wisconsin affiliations of survey respondents (n=236).

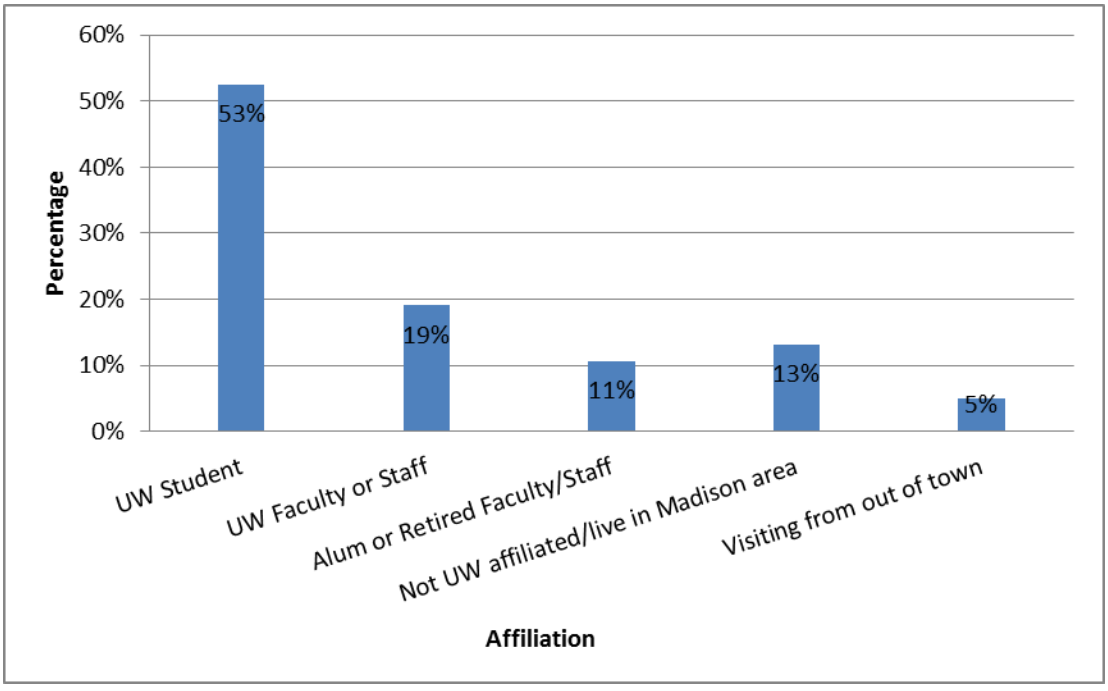


Figure 7. Areas of the Preserve used by survey respondents (n=236).

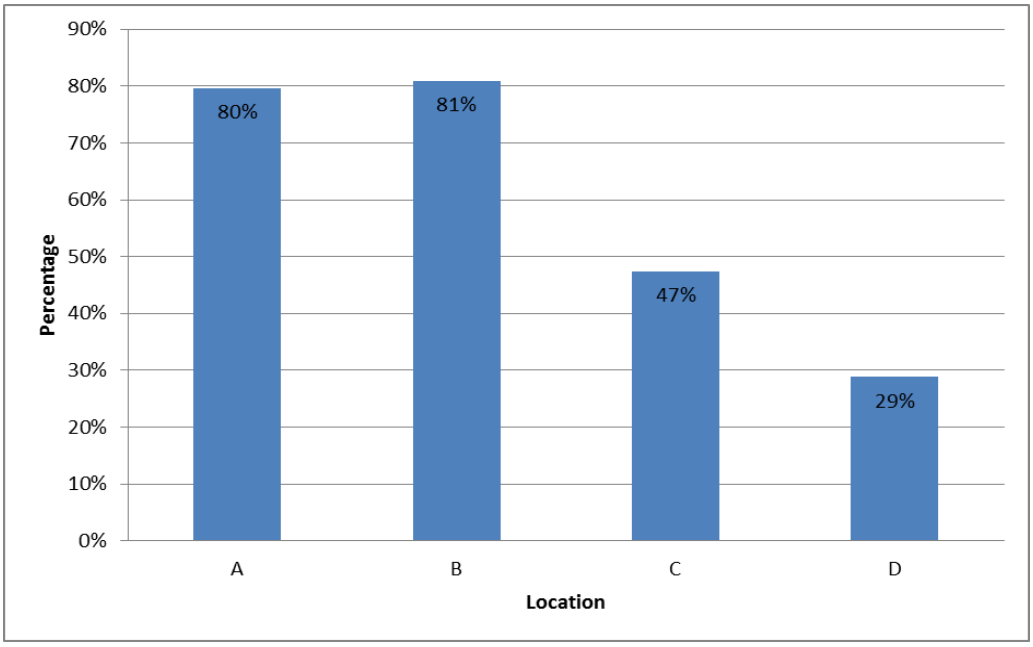


Figure 8. Frequency of Preserve use reported by survey respondents (n=236).

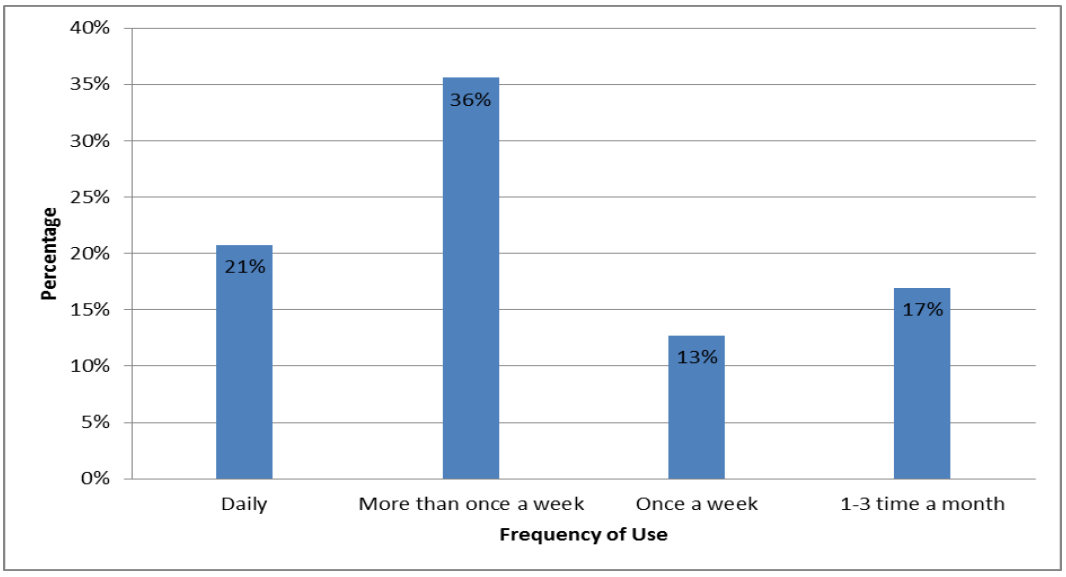


Figure 9. Activities that survey respondents (n=236) report performing in the Preserve.

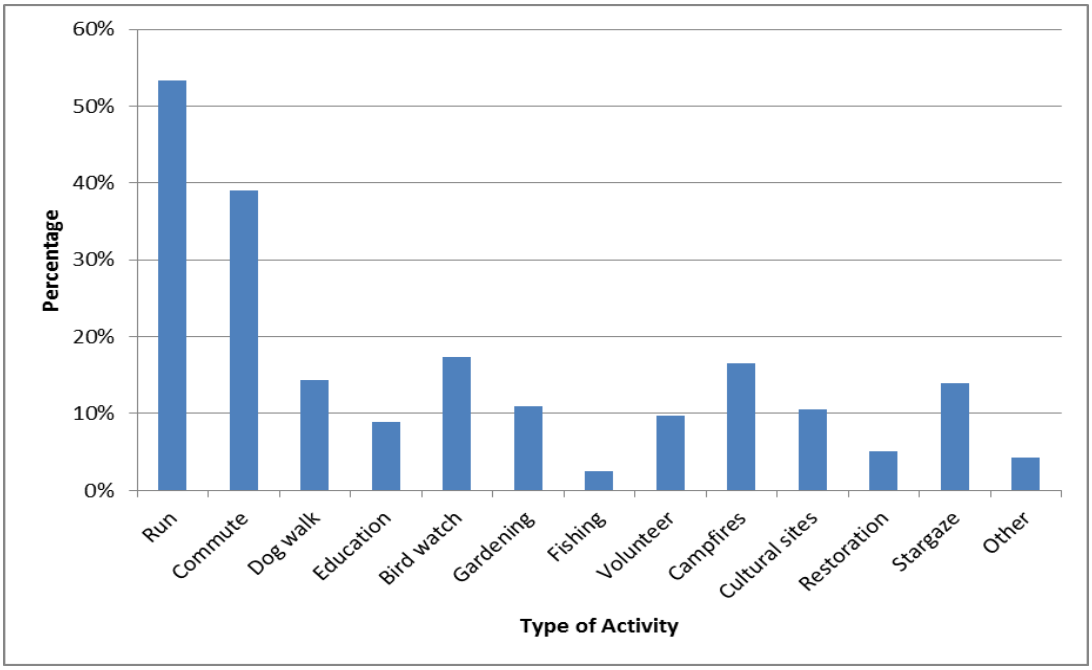


Figure 10. Current activity of survey respondents (n=236) compared to the current activities of users recorded in user tallies.

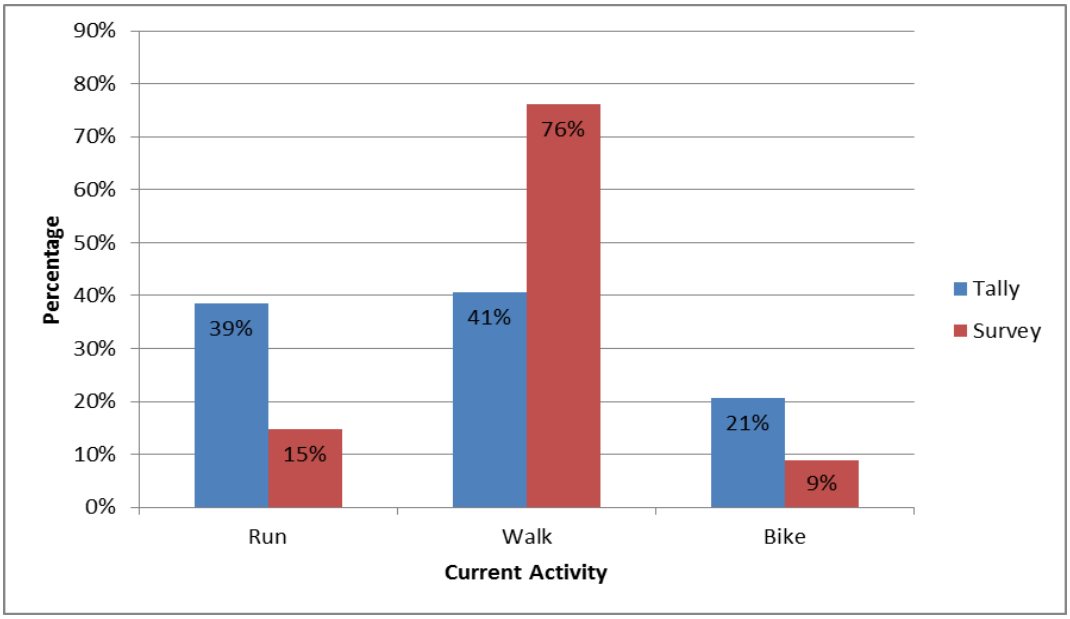


Figure 11. Knowledge of survey respondents about currently being in the Preserve.

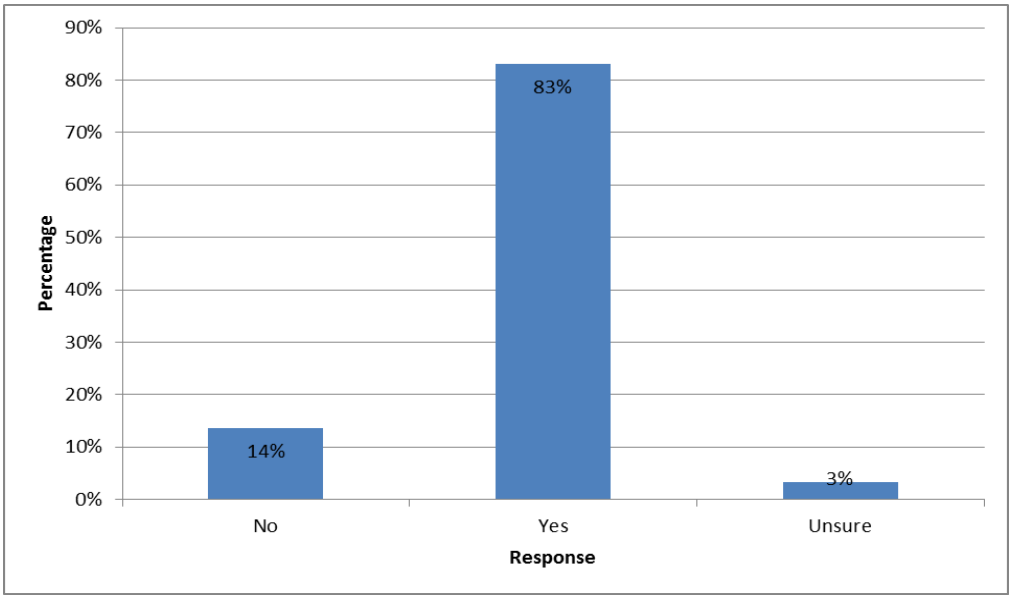


Figure 12. Responses of users to the question "Are you passing through the Preserve to a different destination?" by survey site (site A n=92, site B n=70, site C n=46, site D n=28).

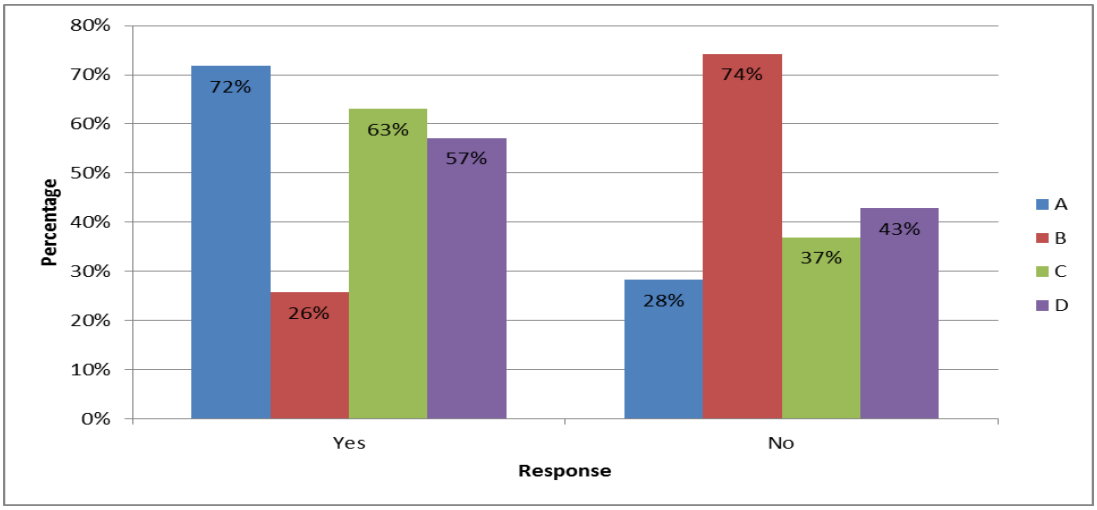


Figure 13. Top Preserve management issues for survey respondents in 2011 (n=190), 2012 (n=319), and 2013 (n=236).

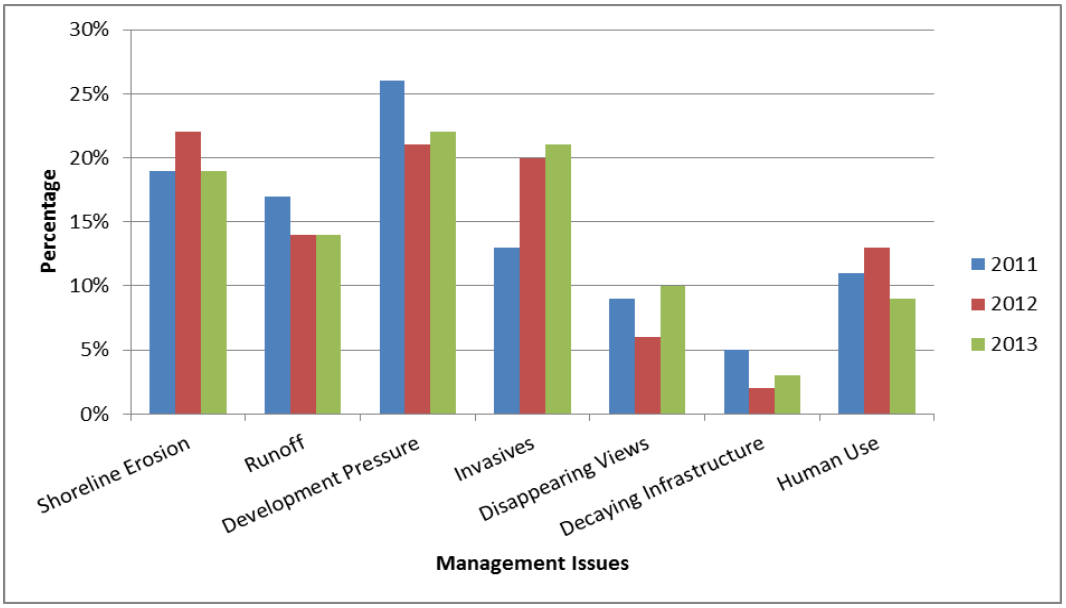


Figure 14. Views of survey respondents towards the use of prescribed burning to manage vegetation.

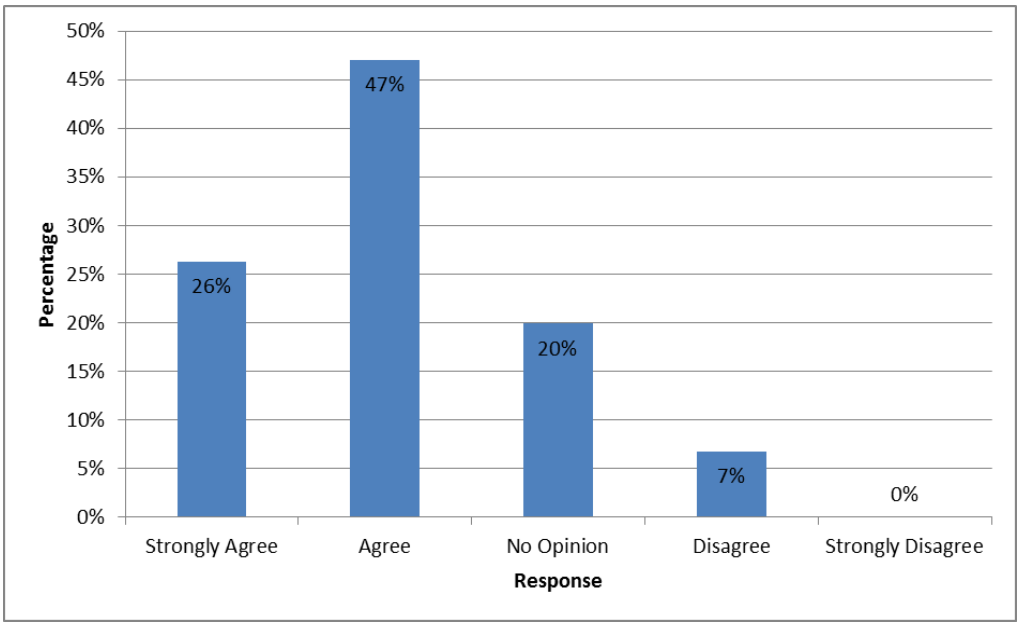
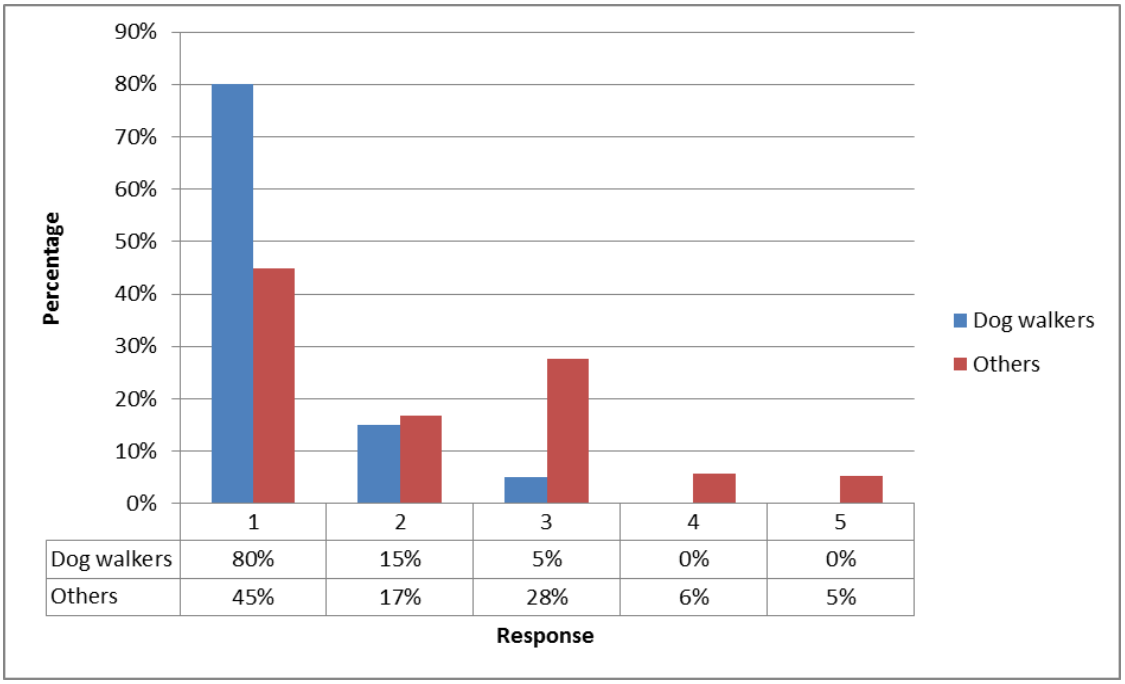


Figure 15. Views of dogs by dog walkers (n=20) and others (n=214) with 1 being the most positive.



	1	2	3	4	5
Dog walkers	80%	15%	5%	0%	0%
Others	45%	17%	28%	6%	5%

Figure 16. Views of dog walkers (n=20) and others (n=214) regarding where dogs should be allowed in the Preserve.

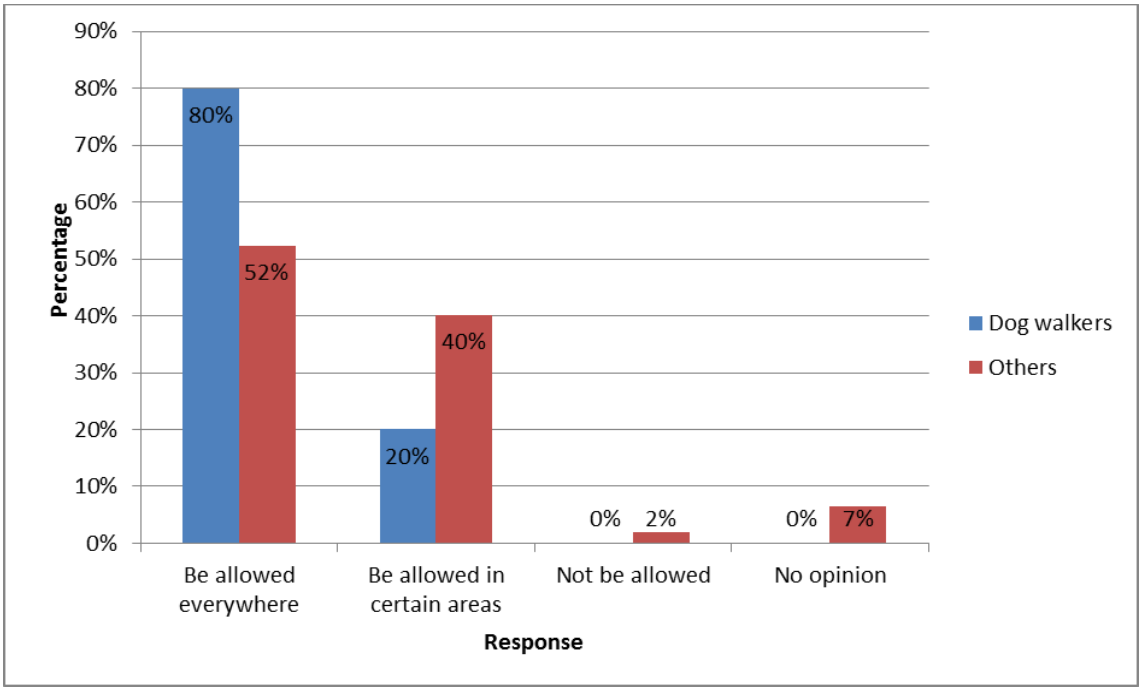


Figure 17. Appropriateness of signs versus fines for keeping dogs on leashes with 1 being the most appropriate.

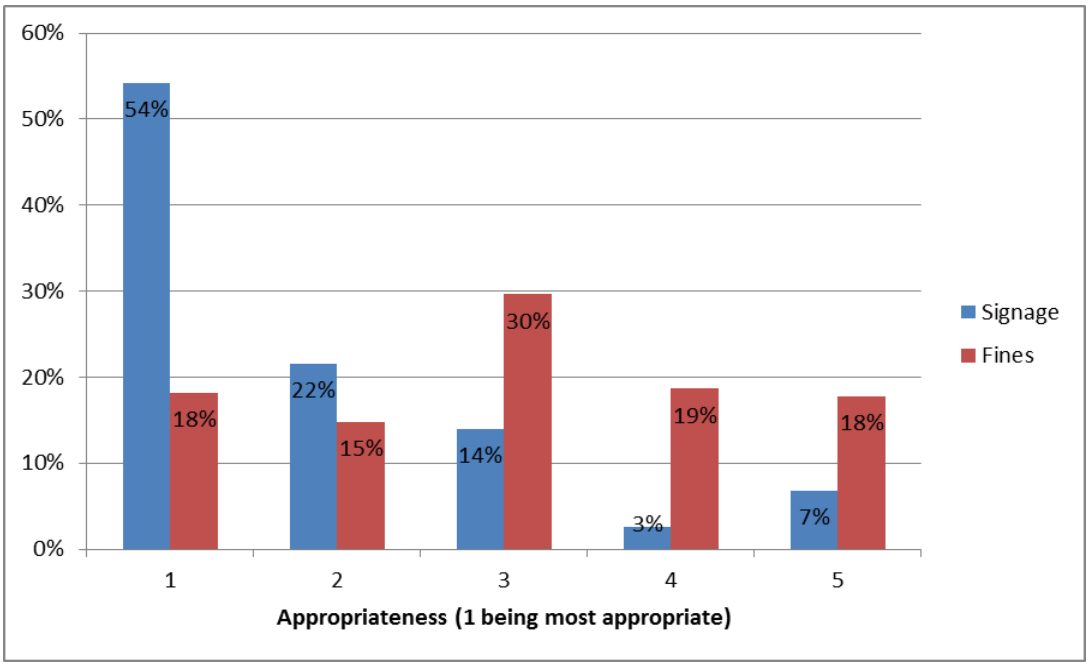


Figure 18. Types of Preserve signs that respondents (n=236) report relying on for information.

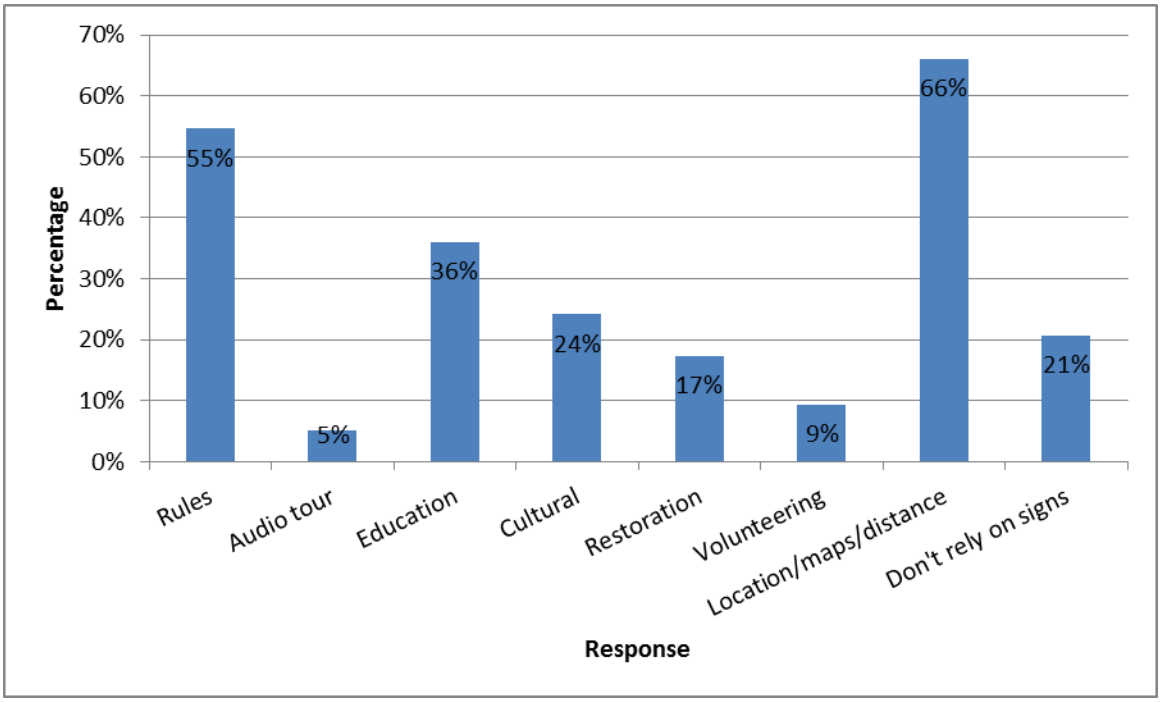


Figure 19. How helpful survey respondents (n=236) find the Preserve signs on a scale of 1 (most helpful) to 5 (least helpful) in conveying the rules of the Preserve.

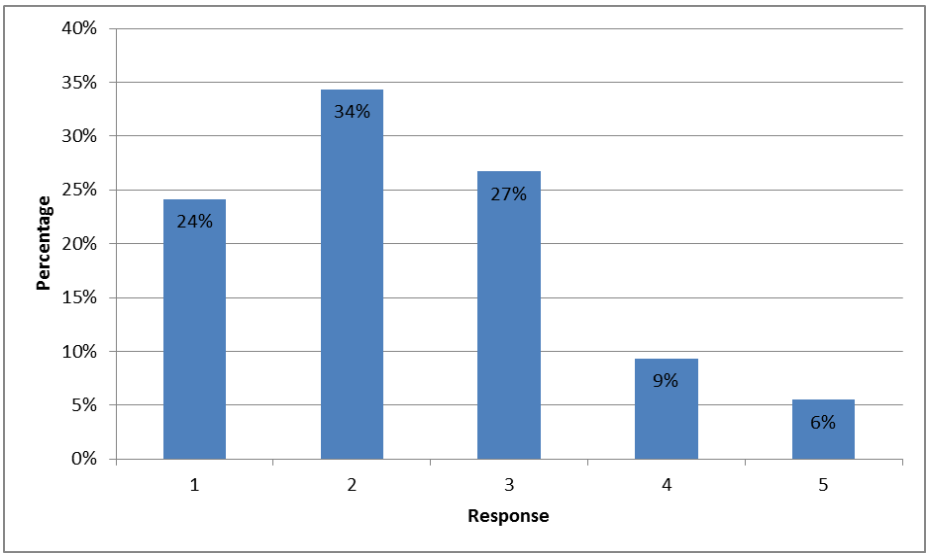


Figure 20. Perceived understanding level of Preserve rules as reported by respondents (n=236).

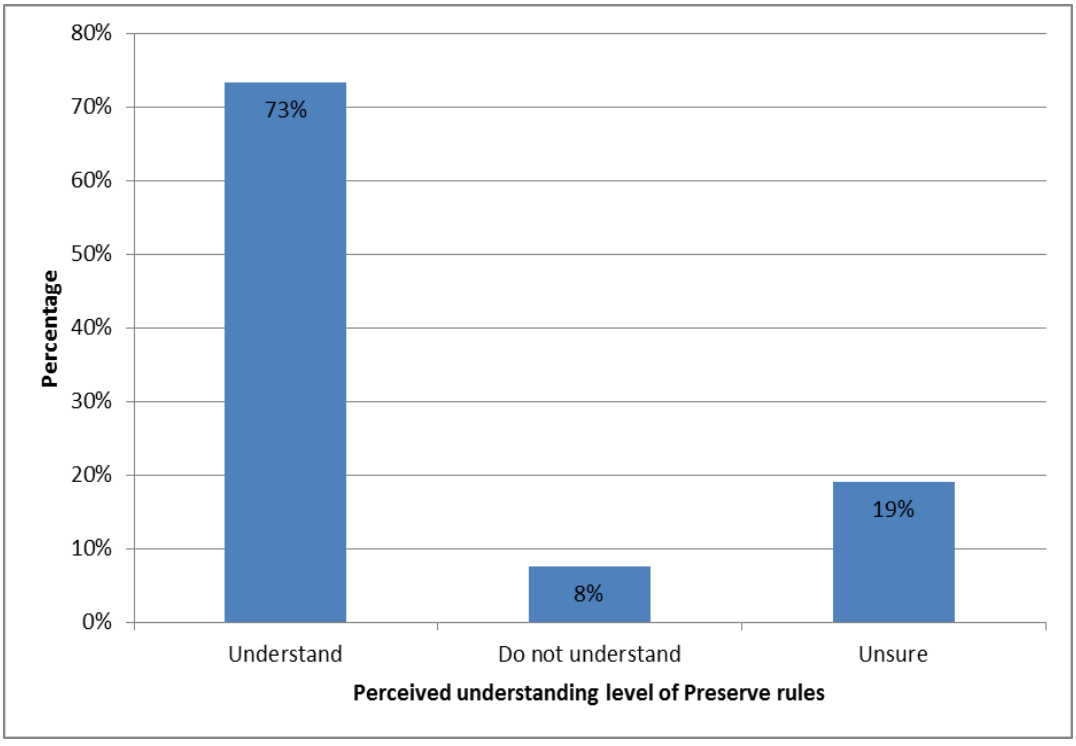


Figure 21. Responses to the question “Have you ridden a bike or seen bikes ridden to Picnic Point within the last year?” (n=236).

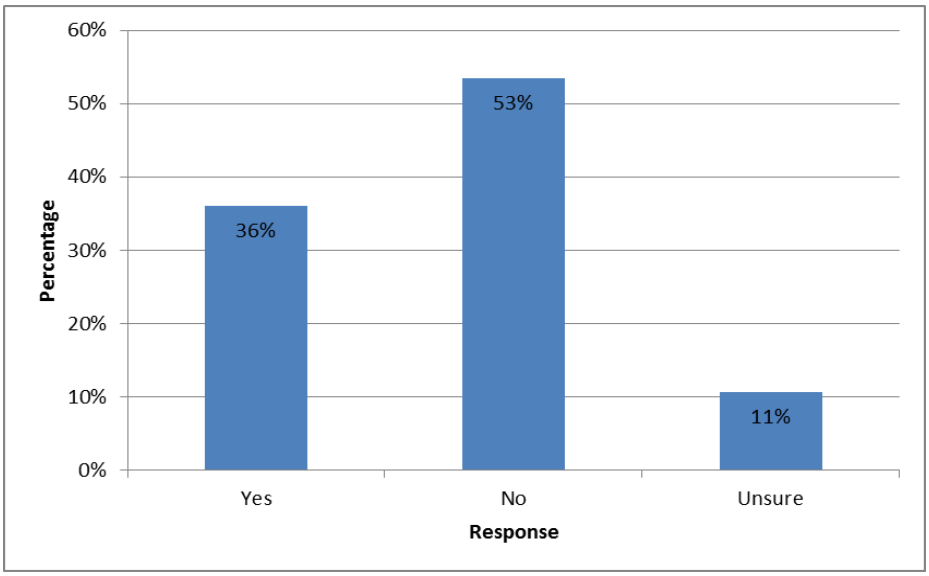


Figure 22. Whether the Preserve website has impacted the use of the Preserve by respondents (n=236).

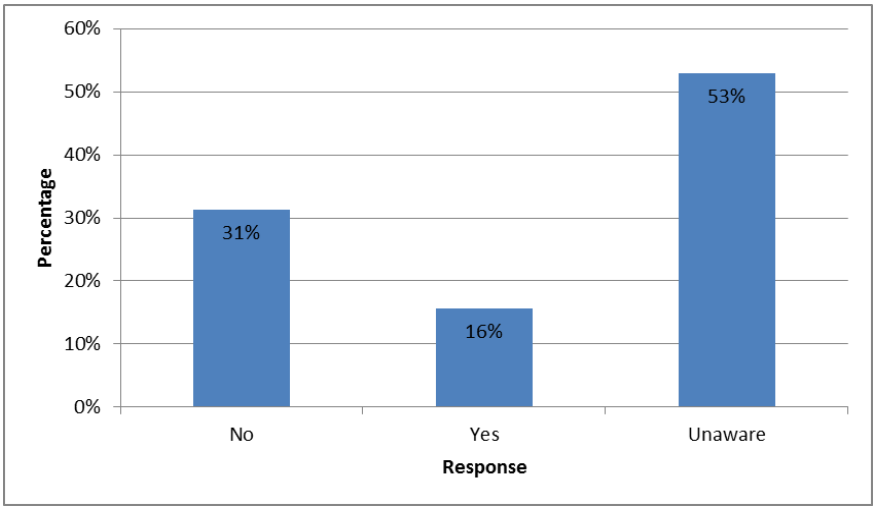


Figure 23. Knowledge of and use of the Preserve website by University of Wisconsin affiliation

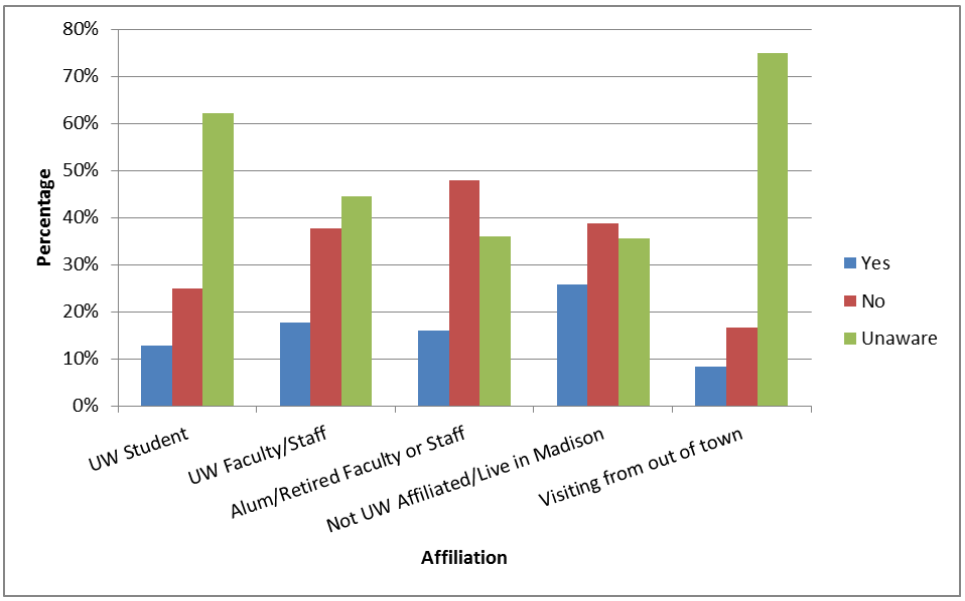


Figure 24. Respondents' responses on the question of whether they have seen a coyote in the Preserve in the last five years.

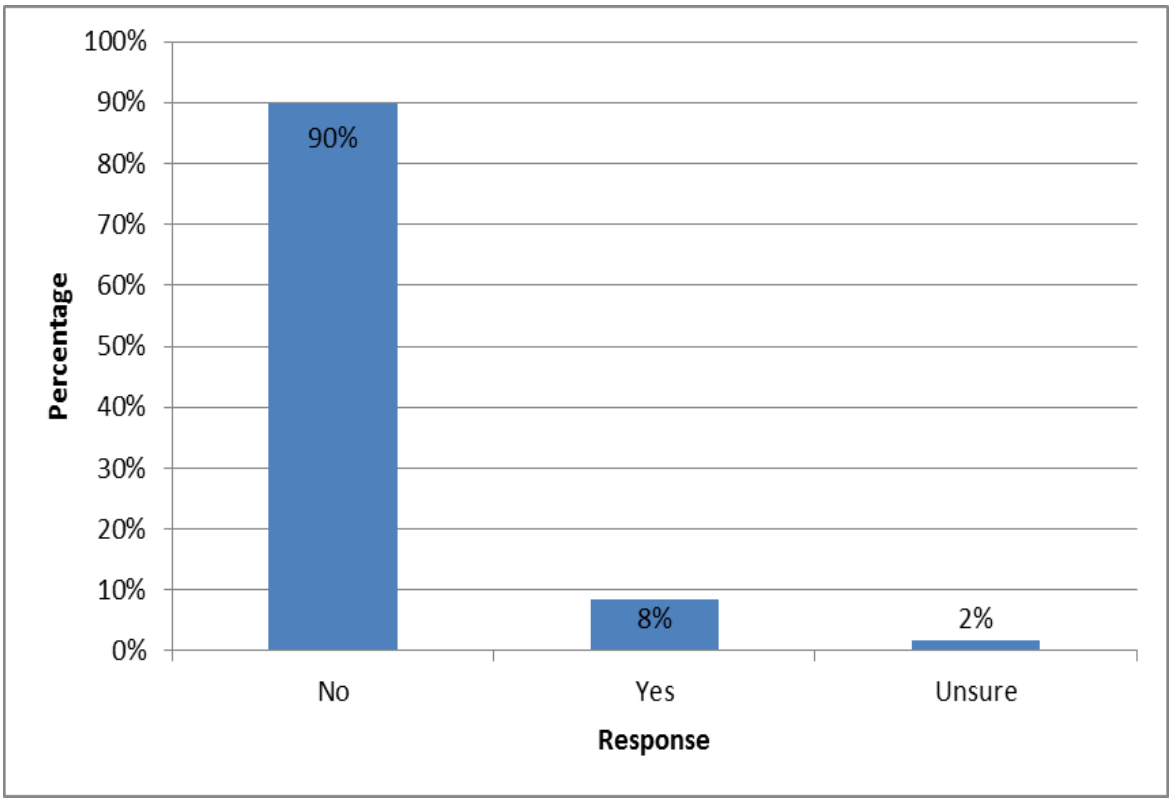


Figure 25. Respondents' views on whether wild coyotes should be allowed to live in the Preserve.

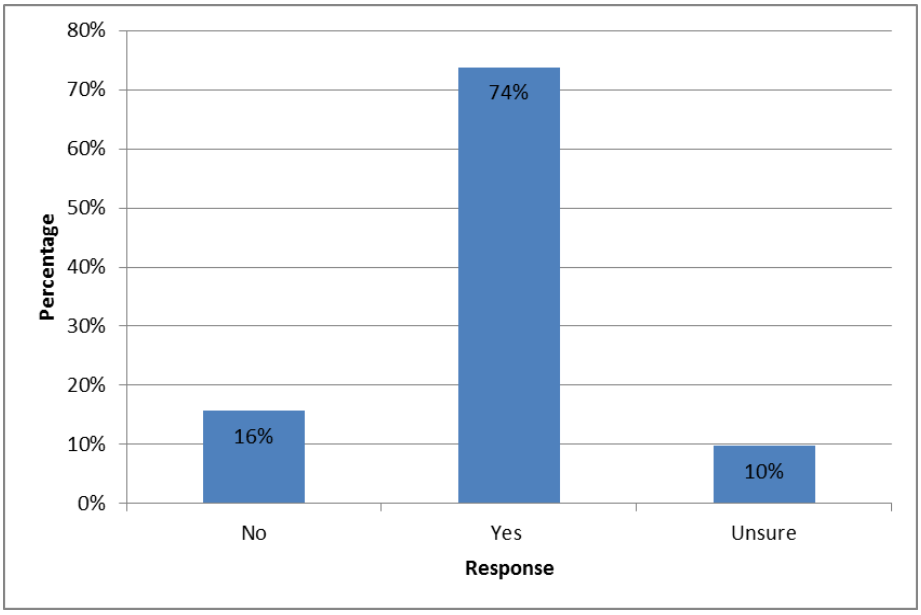


Figure 26. Management issues and the importance respondents gave them.

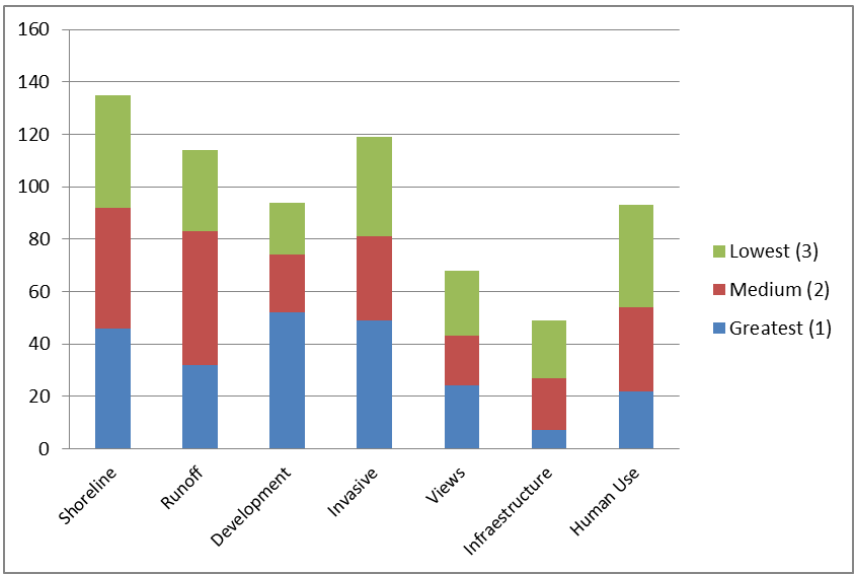


Figure 27. Responses to the question “Have you ridden a bike or seen bikes ridden to Picnic Point within the last year?” regarding location (n=236).

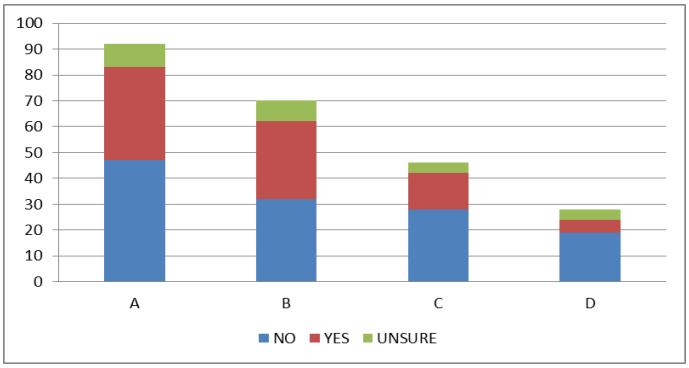
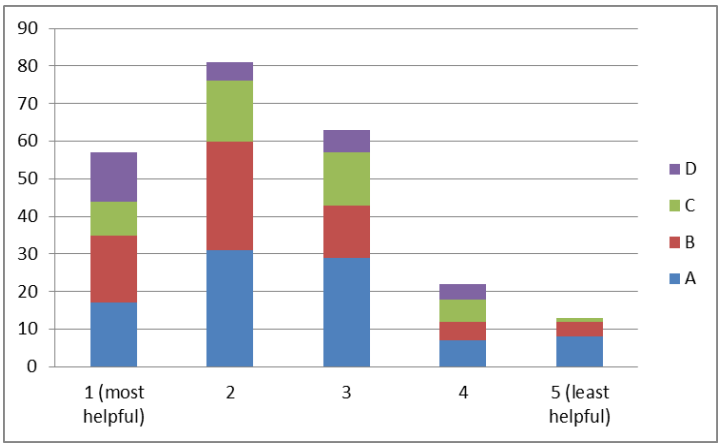


Figure 28. Responses to the question “helpfulness of signage” regarding location (n=236).



Appendix 1. Surveying Basics and Definitions

SURVEYING BASICS

Introduce yourself and what you're doing

> Good morning/afternoon/evening, I'm a student from the University of Wisconsin and I'm working on a survey for a class regarding usage of the Lakeshore Nature Preserve.

What you are asking from them

> Would you mind stopping for a few minutes to answer some questions about your usage of the Preserve?

Thank them whether they participate or not

DEFINITIONS FOR QUESTION 8

Shoreline erosion- loss of material such as sand from the shore. Some erosion is healthy and natural, excessive erosion can cause serious problems such as ecosystem damage and loss of soil.

Runoff from buildings and houses- water flow that occurs when the soil is infiltrated with excess water. Runoff often includes soil contaminants such as petroleum, pesticides, fertilizers, etc.

Pressure for development use- perhaps more housing needed for students, expansion of local communities, etc.

Invasive/exotic species- non-native plant species that out-compete native vegetation for nutrients, sunlight and space, ex. honeysuckle, buckthorn

Disappearing views- the loss of vistas due to growth of trees

Decaying infrastructure- dirt trails and parking lots eroding etc.

Poorly managed or inappropriate human use- such as people not following the rules of the preserve

DEFINITIONS FOR QUESTION 9

Prescribed burning- fire applied in a skillful manner under certain weather conditions in a designated place to achieve specific results, typically used to control undesired vegetation, improve wildlife forage and habitat, reduce potential wildfire hazard, and improve access and natural beauty

Native vegetation- vegetation that grows naturally in the region

Invasive/exotic species- non-native plant species that out-compete native vegetation for nutrients, sunlight and space, ex. honeysuckle, buckthorn

Appendix 2. **UW-Madison Conservation Biology 651 Questionnaire**

Surveyor Name: Date: Time:

Location: A B C D

[Sex] F M [Current Activity] W R B [Dog] Y N [Leash] Y N

1.) What is your age range?

A. Under 18 B. 18-24 C. 25-34 D. 35-44 E. 45-54

F. 55-64 G. 65-74 H. 75+

2.) Which best describes you?

UW Student UW Faculty/Staff Alum or Retired Faculty/Staff Not UW Affiliated/Live in Madison Area Visiting from Out of Town

3.) Are you aware you are currently within the Lakeshore Nature Preserve? Y N Unsure

4.) Are you passing through the Preserve to another destination? Y N

5.) How often do you use the Preserve?

A. Daily B. More than once a week C. Once a week

D. 1-3 times a month E. Less than 1 time a month

6.) What sections of the Preserve do you use? Mark all that apply. (See Map A B C D

7.) What activities do you do within the Preserve? Mark all that apply.

_____Walk _____Dog Walk _____ Fish _____Visit Cultural Sites

_____Bike _____Education _____Volunteer _____Restoration Work

_____Run _____Bird Watch _____Campfires _____Stargaze

_____Commute Gardening Other: _____

8.) The Preserve has identified the following management issues to be addressed within their Master Plan. Please rank the top 3 issues of greatest importance to you with 1 being most important. Shoreline Erosion Disappearing Views

Runoff from Buildings & Houses Decaying Infrastructure

Pressure for Development Use Poorly Managed Human Use

Invasive/Exotic Species

9.) Increased use of prescribed, a.k.a. controlled, burning within the Preserve is an acceptable form of vegetation management. A. Strongly Agree B. Agree C. No opinion D. Disagree E. Strongly Disagree

10.) What impact does each of the following have on your experience within the Preserve, with 1 being positive?

Walking 1 2 3 4 5 Trail Biking (mountain) 1 2 3 4 5

Dog Walking 1 2 3 4 5 Bike Path Biking (leisure/commuting) 1 2 3 4 5

Running 1 2 3 4 5

11.) Leashed dogs should be _____ within the Preserve. (Choose one of the following)

A. Allowed everywhere B. Allowed in certain areas

C. Not allowed. D. No opinion.

12.) What is the appropriateness of the following alternatives to improve compliance with dogs being kept on leash within the Preserve, with 1 being most appropriate?

Increased Signage 1 2 3 4 5 Fines 1 2 3 4 5Suggestions:

13.) For what purpose(s) do you rely on signs within the Preserve? Mark all that apply.

Rules	Education	Restoration	Location/Maps/	
Distance	Audio Tour	Cultural	Volunteering	Don't rely on signs

14.) How clearly do you understand the rules set forth by the Preserve? (Includes leashed dogs, no biking zones)

A. Understand B. Do not understand C. Unsure

15.) How helpful is existing signage in conveying the rules of the Preserve, with 1 being the most helpful? 1 2 3 4 5

16.) Has the Preserve's website impacted your uses?

Yes No Unaware of website

17.) Have you ridden a bike or seen bikes ridden to Picnic Point within the last year?

Yes No Unsure

18.) Have you seen a coyote in the Preserve in the last 5 years?

Y N Unsure

19.) Do you think wild coyotes should be allowed to live in the Preserve?

Y N Unsure

20.) Do you have any comments you would like the Lakeshore Nature Preserve management to consider?

Appendix 3. Summary descriptive statistics.

		Site				Day of Week		Survey Time Period			
	Overall	*A*	*B*	*C*	*D*	*WD*	*WE*	*7 AM to 9 AM*	*11 AM to 1 PM*	*2 PM to 4 PM*	*5 PM to 7 PM*
Group Size (SE)	*1.3*	1.2	1.5	1.3	1.2	1.1	1.4	1.3	1.3	1.4	1.2
Users/hour	*24*	39	27	25	7	25	51	19	17	31	30
Male (%)	*53.5*	55.3	52.9	48.9	63.8	56.4	50.6	52.6	55.3	51.2	57.1
Run (%)	*38.5*	34.7	40.6	41.8	39.4	30.8	42.1	56.3	42.1	9.9	43.2
Walk (%)	*40.7*	44.2	45.9	33.0	31.3	33.2	43.3	17.4	39.0	16.9	35.3
Bike (%)	*20.7*	21.1	13.4	25.0	29.3	21.8	14.4	26.3	18.6	6.5	21.5
Dogs Present (%)	*3.8*	0.4	7.2	4.3	7.1	2.4	5.0	2.6	5.5	1.2	3.2
Dogs on Leash (% Total)	*3.1*	0.4	5.9	3.8	5.1	1.9	4.3	2.6	4.2	1.1	2.4
Dogs observed on Leash (%)	*83.8*	100.0	82.4	90.0	71.4	80.9	85.9	100.0	76.0	90.7	73.9

Appendix 4. User Survey Schedule

	7 to 9	7 to 9	11 to 1	11 to 1	2 to 4	2 to 4	5 to 7	5 to 7
Mar 23	----------	----------	Mai Houa, D	Gunnar, D	Jessica, B	Jamie, B	----------	----------
Mar 24	----------	----------	Jessica, B	Gunnar, B	----------	----------	----------	----------
Mar 25	----------	----------	Paula, C	Jamie, C	----------	----------	----------	----------
Mar 26	----------	----------	----------	----------	----------	----------	----------	----------
Mar 27	----------	----------	----------	----------	----------	----------	----------	----------
Mar 28	----------	----------	----------	----------	----------	----------	----------	----------
Mar 29	----------	----------	Mai Houa, D	Gunnar, D	----------	----------	----------	----------
Mar 30	----------	----------	----------	----------	Ryan, D	Gunnar, D	----------	----------
Mar 31	----------	----------	----------	----------	Jamie, C	Gunnar, C	Hannah, C	Apriel, C
Apr 1	----------	----------	----------	----------	Ryan, A	Hannah, A	----------	----------
	----------	----------	----------	----------	Leah, D	Erik, D	----------	----------
Apr 2	----------	----------	----------	----------	----------	----------	----------	----------
Apr 3	----------	----------	----------	----------	----------	----------	Erik, D	Ryan, D
Apr 4	Jessica, A	Anna, A	----------	----------	Gabby, C	Apriel, C	----------	----------
Apr 5	----------	----------	Gabby, C Hannah, A	Jessica, C	----------	----------	----------	----------
Apr 6	----------	----------		Ryan, A	----------	----------	----------	----------
	----------	----------	Katey, D	Evan, D	----------	----------	----------	----------
Apr 7	Jamie, C	Katey, C	----------	----------	Alyssa, B	Erik, B	----------	----------
Apr 8	Alyssa, C	Brandon, C	----------	----------	Hannah, A	Leah, A	Apriel, D	Brandon, D
	----------	----------	----------	----------	Jamie, D	Amanda, D	----------	----------
Apr 9	----------	----------	----------	----------	----------	----------	Brandon, A	Shen, A
	----------	----------	----------	----------	----------	----------	Evan, C	Amanda, C
Apr 10	Alyssa, B	Brandon, B	Katey, A	Evan, A	----------	----------	Leah, B	Erik, B
	----------	----------	----------	----------	Amanda, A	Apriel, A	Shen, C	Stephani, C
Apr 11	----------	----------	----------	----------	----------	----------	Mai Houa, B	Jamie, B
Apr 12	Alyssa, D	Brandon, D	Gabby, B	Mai Houa, B	Evan, A	Amanda, A	----------	----------
	----------	----------	Jessica, C	Anna, C	----------	----------	----------	----------
Apr 13	----------	----------	Alyssa, A	Ryan, A	Hannah, B	Leah, B	----------	----------
	----------	----------	----------	----------	Shen, C	Stephani, C	----------	----------
Apr 14	Shen, C	Stephani, C	Anna, B	Hannah, B	Alyssa, D	Ryan, D	----------	----------
	----------	----------	Evan, C	Gunnar, C	Shen, A	Stephani, A	----------	----------
Apr 15	----------	----------	----------	----------	----------	----------	Katey, A	Evan, A
Apr 16	Katey, D	Mai Houa, D	----------	----------	----------	----------	Brandon, D	Stephani D
	Jessica, B	Anna, B	----------	----------	----------	----------	----------	----------
	----------	----------	----------	----------	Leah, B	Erik, B	Leah, B	Erik, B
Apr 17	----------	----------	----------	----------	Amanda, D	Jamie, D	Apriel, A	Katey, A
Apr 18	Mai Houa, A	Anna, A	----------	----------	Gabby, C	Apriel, C	----------	----------
	----------	----------	----------	----------	Gabby, D	Anna, D	----------	----------
Apr 19	----------	----------	----------	----------	Shen, C	Stephani, C	----------	----------

Appendix 5. Comments from user survey

1. I wish people would use fire rings more as well as increase awareness of the ability for the general public to use these fire rings.
2. Likes the resources the University has put toward the Lakeshore Nature Preserve.
3. Keep things more natural within the preserve. For example, do not add extra "brickwork."
4. I love the preserve! I was also once bitten by an unleashed dog while walking my dog in the preserve.
5. Thanks for existing.
6. Bike access should be allowed within the Picnic Point area of the preserve.
7. It's a beautiful place to spend the afternoon and we are so happy the University decided to create it!
8. More Educational Signs!!!
9. Gardening is awesome.
10. The Preserve was fundamental to her experience as an undergrad. There should be continued funding so it can be there for the future and not look bad (be well taken care of). Also, was wondering about a kiln by picnic point because she thought that was really cool. Not enough signs.
11. I love walking my dog here, it is so beautiful.
12. Speeding bikes are a problem, should go same speed as walkers. Signs about events are nice, inspires to volunteer. Signs saying what volunteers are doing and when might be nice.
13 Enjoys it, is well preserved, sees lots of wildlife - great job with preserve.
14. People don't always pay attention to signs distinguishing between pedestrian and bike sections.
15. Allow coyotes as long as it is safe. Loves the preserve.
16. Don't like when trees are cut down.
17. Should have shoe wash area. Let dogs walk on the trail!
18. No dogs!
19. Very happy with the Lakeshore Preserve just keep maintaining it.
20. Very well managed.
21. Does not like how management uses Roundup spray to get rid of invasives. He thinks that should use a different way to get rid of them. He thinks the preserve should just leave the invasive alone because he does not see a good way to end. Instead time should be taken to brainstorm for this idea.
22. Dumpsters over flowing too much garbage being left in them. This makes raccoons want to go in the garbage. There are spots with poison ivy that need to be tended to around here. There should be a shoulder on the road for walking.
23. The preserve is managed beautifully.
24. They should turn up the heat on signage on volunteering, and dogs should always be allowed everywhere on a leash. Madison is the most dog unfriendly city, and goes against what I think Madison is.
25. I love that this space is here.

26. I think the preserve group is doing a wonderful job. The issue is people not following the rules.
27. Finance the preserve from a $1500 fine on dogs, and if they don't pay chop off [the dogs] head!
28. I liked it when it was more natural. I think they've done too much construction on picnic point.
29. Keep it up! It's a great resource!
30. More distance signs (every 1/2 mile to 1 mile).
31. Distance markers for runners/walkers.
32. Interviewee was on the management board of another park in Madison. She said there are similar debates about dogs and biking. Very passionate about dogs not being allowed in the preserve and more stringent enforcement of biking rules.
33. Would like to see nicer bathrooms.
34. Would like to see expansion/widening of trails.
35. Would like to see more wild animals.
36. Bike riding to picnic point is frustrating. Expresses need for more than a sign, possibly explicit fine warnings.
37. Coyote is visible almost every morning; also foxes, cranes. Turkeys more common than before; deer & pheasant less common now.
38. Wonderful addition to University; amazing. Fines for unleashed dogs would be good but there's no way to enforce it.
39. Less human intervention (doesn't like refurbished fire pits).
40. I appreciate the preserve.
41. Do something about ice blocking entrance to Picnic Point.
42. Whales & dogs not allowed.
43. Good job preserving! It's nice to have an area like this so close to campus.
44. Needs to be more maintenance of burned sites. Really enjoy the preserve, I'm glad to see students like you doing this research. Please keep it as nice as it is.
45. People are not following the leash rules.
46. Coyotes would be a problem if group became too large and they were unable to feed themselves. Unsure originally about the fire pits that got put in, but they have really changed his mind after they went in. Now he considers them a beautiful thing to run by.
47. Wish they had outhouse/building to change clothes at location B.
48. Wants less signs on picnic point. Signs are interruptive in natural areas. Signs should clearly say no bikes at beginning of picnic point to make rules clear right away. "Most wonderful resource in Madison".
49. Beautiful way to walk to work.
50. I have fun here. It's a great place to hang out.
51. Rules are not very clear.
52. Having a place for dogs to be allowed off leash might help people keep them leashed in other areas. "Great place to run".
53. Great place to experience nature.
54. “Bucky (dog) loves this path”. Don't develop closer to the preserve. You can already hear too much traffic/construction noise - ruins the experience.

55. Been using the preserve for years - really enjoys it.
56. Little kids like coming to see nature, hope it can stay wild - doesn't feel like in Madison.
57. Thank you for the people who work to preserve it, it is amazing - the dedication and energy is great! The work on the marsh has been great. Hats off to them! Trail mulch/ wood chips are very nice on paths. Feel lucky to live close by. An occasional waste container would be great so people don't litter.
58. Clean up the litter!
59. Lakeshore is awesome yeaaaah!
60. Restoration is important for our natural areas.
61. I want coyotes everywhere that'd be so cool!
62. Worried about invasive species; something about carpenter birds not being around as much.
63. Rules about fires are a little nonsensical (until midnight on weekdays and 10 PM on weekends).
64. Make more mile marker signs.
65. We need education on coyotes. Everyone is doing a good job so far. Cars need to slow down on the road because a lot of people is walking in this area and there is not much area to walk on. May lower speed limit? Please keep residents updated from surveys done. Maybe put updates on website?
66. It's awesome. Everything is beautiful and nice.
67. Everything is fine. Increase signs about cleaning up after yourself. Tell pet owners to pick up after pets.
68. Most freshman do not know about Lakeshore Nature Preserve.
69. Get the trees back.
70. Aware of dog leash laws but to quote "his dog is well trained".
71. Would be nice to have clear mile markers along path.
72. Turkeys have increased from about 2 to about 10 and eat the vegetation.
73. I wish Picnic Point would have stayed the way it was 3 years ago and not lost all of the trees.
74. Thanks.
75. Give rules to 5K racers.
76. Path in Eagle Heights woods that should be developed more for safety reasons. Dog waste receptacle and dog bags should be available and maybe then more people would pick up more dog waste.
77. Water is not clean enough.

Appendix 6. Attitude of residents of Eagle Heights and Shorewood Hills towards coyotes.

Resident	Question 18: Seen a coyote in the last 5 years in the Preserve			Question 19: Coyotes should be allowed to live in the Preserve		
	No	Yes	Unsure	No	Yes	Unsure
Not resident of those areas	174	13	1	33	136	17
Eagle Heights	29	4	2	4	25	6
Shorewood Hills	9	3	1		13	

Appendix 7. Undergraduate students of the User Survey Team

Amanda	Akers
Brandon	Austin
Anna	Boatman
Apriel	Campbell
Jessica	Churchill
Evan	Eifler
Gabrielle	Friedland
Gunnar	Jeppson
Jamie	Jutrzonka
Erik	Kramer
Stephani	Miller
Ryan	Papendorf
Katey	Smith
Hannah	Sterling
Alyssa	Studer
Mai Houa	Vue
Leah	Wachowski
Shen (Linda)	Wang

Appendix 8. Variables and categories tested in each Chi Square test.

Variables tested	Categories Var. 1	Categories Var. 2	X2	df	p
Presence of dogs in the Preserve v/s activity of the respondent	Allowed everywhere Allowed in certain areas + Not allowed + No opinion	Walking Running Biking	0.16	2	0.92
Presence of dogs in the Preserve v/s age of the respondent	Allowed everywhere Allowed in certain areas + Not allowed + No opinion	Under 24 25-34 35-44 45-54 Older than 55	14.13	4	0.01
Use of the website v/s age of the respondent	No Yes Unaware	Under 24 25-34 35-44 Older than 45	23.67	6	0.001
Awareness of the Preserve v/s frequency repondent visits the Preserve	No + Unsure Yes	Daily More than once a week Once a week 1-3 times a month Less than 1 time a month	3.34	4	0.5
Whether respondent has seen a bike in Picnic Point v/s location respondent	No Yes Unsure	A B C + D (Eagle Heights Area)	5.75	4	0.22
Helpfulness signage v/s location respondent	A B C D	1 (most helpful) 2 3 + 4 + 5 (least helpful)	13.27	6	0.04

Appendix 9. Examples of datasheet set-up for data entry and analysis

Date	Time	Location	Yes_No	Gender	Activity	Dog	Leash	Occupation	Awareness	Destination	Section	Activity	Management	Burning	Impact	Leashed_dogs	Dogs_comp	Signs	Signage	Website	Day	Weather	Refused	Leas_
3/23/2013	1	1	0	0	1	0	--	0	0	0	0	0	0	0	1	0	1	0	1	0	Weekend	Sunny	0	0
3/24/2013	2	2	1	1	2	1	Yes	1	1	1	1	1	1	1	2	1	2	1	2	1	Weekday	Partly Sunn	1	1
3/25/2013	3	3			3		No		2				2		3		3		3	2		Cloudy		2
3/26/2013	4	4											3		4		4		4			Raining/Overcast		
3/27/2013															5		5		5			Snowing		
3/28/2013																								
3/29/2013																								
3/30/2013																								
3/31/2013																								
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4/18/2013																								
4/19/2013																								

EDIT LISTS AS NEEDED TO FIT SURVEY CATEGORIES FOR 2014

									1 (0 =negative answer, 1 = positive answer)							
N°	Surveyor	Date	Time (1=7-9am, 2=11-1pm, 3=2-4pm,	Location (A=1, B=2, C=3, D=4)	Gender (Female=0, Male=1)	Activity (1=Walking, 2=Running, 3=Biking)	Dog (0 = No, 1 = Yes)	Leash? (0 = No, 1 = Yes, 2 = N/A)	Under 18	18-24	25-34	35-44	45-54	55-64	65-74	75+
1																
2																
3																
4																
5																
6																
7																