Open Space and Mountain Parks

Chautauqua Study Area

Visitation Monitoring Report

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January 2016

City of Boulder
OPEN SPACE & MOUNTAIN PARKS

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Chautauqua Study Area Visitation Monitoring
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I. Data Collection Dates: August 1, 2015 – November 30, 2015.

II. Project Goal: To understand visitation levels and the distribution of visitation over four months within the Chautauqua study area. Amongst other future applications, this data will be used to support the forthcoming process to develop a Chautauqua Access Management Plan.

Generally, land managers can use visitation data to:

1. Understand visitation patterns (e.g., annual, seasonal, weekly or daily) and apply this understanding to management.
2. Develop indicators of visitor experience and resource quality using one of several carrying capacity/visitor management frameworks (e.g., Recreation Opportunity Spectrum (ROS), Limits of Acceptable Change (LAC), and Visitor Experience and Resource Protection (VERP).
3. Develop an understanding of the relationship between spatial-temporal visitation patterns and integrity of natural, recreational and cultural resources.
4. Inform the budget, such as staffing levels or infrastructure development.
5. Substantiate the need for visitor management actions such as increased outreach, visitor kiosks or enforcement.
6. Determine facility needs (e.g. parking, bathrooms, trash cans or dog stations).
7. Create visitation thresholds for infrastructure and facility (level of) development classes.

III. Monitoring Objective: To estimate the number of summer season (but, August only) and fall season (September-November) person-visits to the Chautauqua study area.

IV. Key Findings: Open Space and Mountain Parks (OSMP) staff has drawn the following conclusions about visitation to the Chautauqua study area. The study area includes the Chautauqua meadow as well as the Enchanted Mesa sub-areas (**Figures 1-2**).

- The current study estimates more than 300,000 visits between August 1 and November 30, 2015**.** This number is more than double the visitation to the area during the same timeframe in 2004 (~132,000 visits). Moreover, visitation over an entire year, measured in 2004/2005, was estimated at 330,000-350,000 visits, around the same number of visits as recorded in just 4 months in the current study.
- August was the busiest month and November the slowest of the four monitored months. Between 2004/2005 and 2015, monthly visitation in August increased 147% and visitation in November increased 185%.
- In 2015, the number of daily visits to the entire study area ranged from 188 to 5,126, with a daily average of 2,570. Weekend days had consistently higher visitation than weekdays. In the Chautauqua meadow sub-area, Saturdays were the busiest during both summer and

fall seasons. For the Enchanted Mesa sub-area, Sundays received the most visits during both seasons.

- The Chautauqua Trail monitor station captured the greatest number of visits across the entire study area. This location received approximately double the number of visits captured at the Bluebell Road location, which was the next busiest location. Staff estimates that low numbers of visits to the Chautauqua Meadow sub-area orginate or end at the 6th Street access point and the unmonitored locations along Baseline Road. Staff also estimates that these levels have generally remained the same between 2004/2005 and 2015 for the months of August-November.
- Information on visitor demographics or experiences was not collected during this 2015 study. However, this type of data is available from past OSMP studies conducted over a year from 2004 to 2005 and from 2010 to 2011. A sample of relevant findings from those studies is included in **Appendix A**.

Note: OSMP conducted only a visitor survey in 2010/2011; visitation counts were not collected during this study period. Therefore, an estimate cannot be made using the studies represented in this report about when or in what period of time within the last eleven years visitation has increased at the Chautauqua study area.

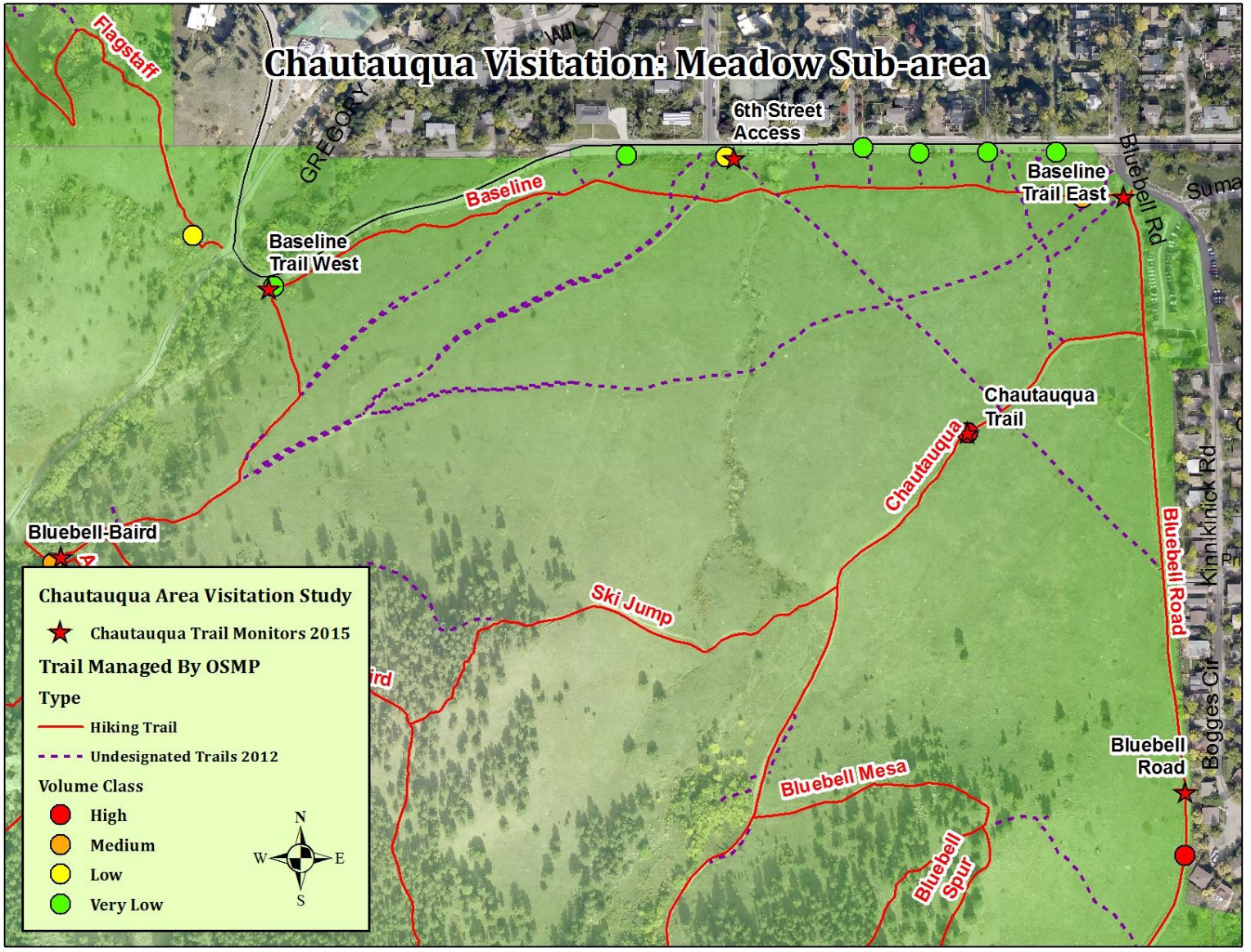


Figure 1. Chautauqua meadow sub-area visitation monitor station locations

Figure 2. Enchanted Mesa sub-area visitation monitor station locations

V. Definitions

Access point: Where a visitor enters or exits OSMP. Often this is the trailhead or beginning of a designated or undesignated trail.

Calibration: A field test conducted on the monitor to determine the average level of operational accuracy and concomitant data error. To calibrate a monitor, actual visitor counts (as observed by field staff) are compared with the counts recorded by the monitor for a minimum of one hour (per calibration period) to determine the percentage of counts not recorded or over recorded.

Count: A count refers to the record collected by the monitor when the infrared beam is broken whether it is broken by a human or another object (e.g., wildlife, blowing vegetation or falling snow).

Daily monitor count (or daily count, or daily count total): The daily monitor count refers to the sum of all the counts on a given day for a given monitor.

EMC: Estimated Monitor Count. The EMC is the total number of counts at a given monitor for a set period of time after outliers have been removed and replaced, missing values have been replaced, and the ratio inflation factor (RIF) has been applied.

Missing (or missed) value: Missing value refers to an hourly or daily monitoring count of zero believed by staff to represent a monitor malfunction (e.g., low battery, the monitor was vandalized, the monitor reached capacity, etc.) or staff error (e.g., staff accidentally erased the data during download). Missed values do not represent a daily record of zero counts which normally indicates days when no visitors travelled past the monitor.

Open Space and Mountain Parks visitation volume classes: Ranges of visitation used to classify OSMP access points. Current classes and associated annual visitation ranges are:

- High: ≥75,000
- Medium: 25,000 – 74,999
- Low: 10,000 – 24,999
- Very Low: 1,000 – 9,999
- Very Very Low: <1,000

Order of magnitude: A factor of ten (i.e., 1, 10, 100, 1000).

Outlier: An outlier is an observation that lies outside the overall pattern of a distribution (Vaske, Shelby & Donnelly, 2009). For this visitation estimate project, outliers were defined as: 1) any daily monitor count that is two or more orders of magnitude larger than the typical value for a day at that monitor; 2) any single value for a given hour (i.e., the sum of all the counts for a given hour) that was identified through the "tsclean" function of the "forecast" library in R (see methods).

Passive infrared monitor (also referred to as "visitation monitor" or simply "monitor" throughout this report): The TRAFx Generation III monitor (**Figure 3**) is a one-piece unit consisting of a passive infrared receiver. A passive infrared receiver operates by detecting rapid changes in

temperature within its field of view. On a trail, a rapid change will occur when a warm object, such as a person, dog, or horse, passes in front of the receiver. Because the object is warmer than the surrounding environment and the change is very fast, the receiver records the change as one "count". The TRAFx monitor is one brand and model of infrared trail monitor currently used during site specific visitation estimate projects. The TRAFx monitor has a memory capacity to record 14,000 counts.

Distance from IR scope to trail	2m (6.5 ft.)	4m (13 ft.)	6m (20 ft.)
Diameter of detection zone	0.3m (1 ft.)	0.7m (2.3 ft.)	1.0m (3.3 ft.)

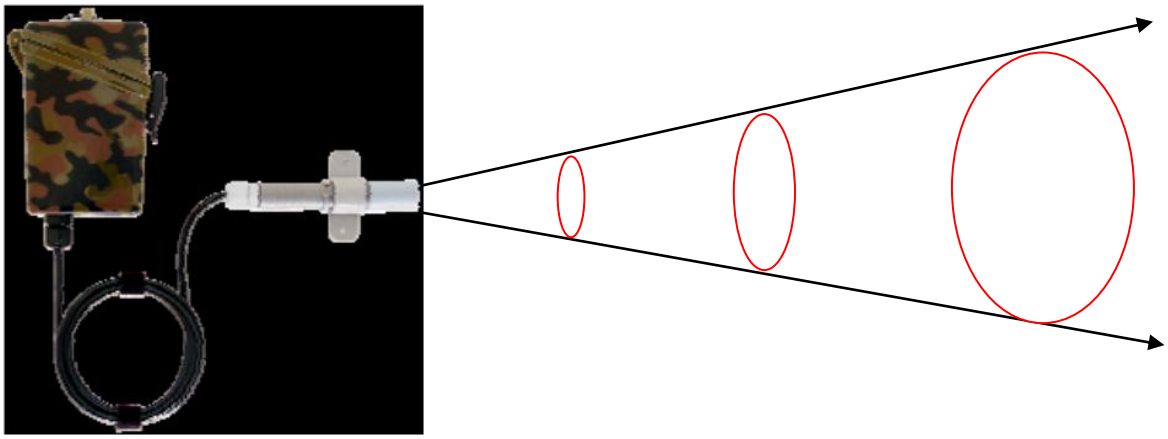


Figure 3. TRAFx Generation III monitor showing the beam's detection zone variability at different distances from scope to trail

Person-visit: A person-visit is the unit of measure reported for visitation estimates. A person-visit represents a trip to the study area, regardless of how much time a visitor spent on OSMP during their trip.

RIF: Ratio Inflation Factor. The RIF is an inflation factor applied to the data set after outliers and missing values have been replaced that accounts for error due to undercounting/overcounting visitors that pass the monitors. The RIF is calculated from the results of calibration sessions and can be shown as: *m/a*

> Where "*m*" equals the counts captured by the monitor and "*a*" equals the actual counts observed by staff during the calibration sessions.

TRAFx Communicator: Computer software designed for use when configuring TRAFx monitors with the G3 dock and when uploading data files (i.e. shuttle files) from the G3 dock for transfer to the Datanet software.

TRAFx Datanet: Online computer software designed specifically for use with the TRAFx monitor and G3 dock to initially clean, analyze and report count data. Accessed at https://www.trafx.net/Datanet/login .

Visitation estimate: The estimated number of person-visits for a given area for a specified period of time.

Visitor: A visitor is the person actually visiting OSMP. Visitors may make multiple *person-visits* to OSMP, each resulting in one or more *counts* (Vaske et al., 2009).

VI. Methods

The "Chautauqua study area" was divided into two sub-areas for monitoring purposes; the meadow area and the Enchanted Mesa area (**Figures 1, 2**). Staff installed a monitor at eight locations across the two sub-areas. Six monitors were installed in the Chautauqua meadow sub-area and two were installed in the Enchanted Mesa sub-area. The monitors were placed to capture the most possible visits to each study area. Six monitors were placed on designated trails and two monitors were placed on current undesignated trails; one intended for future designation (6^{th} Street) and one to be closed (Baseline Trail West) per the West Trail Study Area Plan. Visitation estimates were calculated using monitor count data collected at these locations along with system-wide averages (Vaske et al. 2009) for unmonitored locations (five very low volume undesignated access points along Baseline Road).

Days with documented problems (such as low batteries or vandalism) resulting in an abnormally low number or a zero were replaced using the average count value measured for the matching combination of day of the week, season, and hour. Substitution of daily count sums with estimated values was infrequent. Across the entire study area for the duration of the study period, 20 days (2% of the 976 total days; 8 locations multiplied by 122 days each) of the daily count sums were replaced.

Monitor data comprised of counts and associated time stamps were downloaded twice weekly. Counts were summed by hour (and day) resulting in 2,928 hourly count totals for each of the locations (122 days multiplied by 24 hours). Outliers (43 total individual hours out of 2,928; 1%) were removed and replaced for each location using the "tsclean" function of the "forecast" library in R. Briefly, a smoothed line relating the number of visits per hour (y variable) and time (x variable) is fit using a local regression technique called "loess", and outliers are identified as those outside +/- 2 ($q_{0.9}$-$q_{0.1}$), where q_p is the p-quantile of the residuals; these outliers were replaced with the fitted value for that time point (Chen, C, and Liu, L. 1993. Forecasting time series with outliers. Journal of Forecasting 12: 13-35).

The daily count totals from each location were then summed. This sum was then inflated by multiplying by a ratio inflation factor (RIF) calculated from the Chautauqua study area calibration periods (**Appendix B**).

After the RIF is applied, the daily sum for each location is then divided by 2, and the resulting 8 total monitor counts are summed to estimate the number of person-visits to the study area. This calculation assumes that every visitor that goes into the monitored area must exit the area.

Table 1. Steps for estimating visitation using active infrared visitation monitors

1. VISUAL SCAN OF DAILY COUNTS
a. Flag obvious outliers (daily values two or more orders of magnitude higher than typical for each station)
b. Flag missing values (untrue zeros)
c. Remove flagged days from the data set
2. DATA REPLACEMENT FOR MISSING VALUE DAYS
a. Calculate the average value for each location by season, day of week and hour
b. Replace removed hours with the respective value
3. QUANTITATIVE OUTLIER TEST
a. Identify and replace hourly outliers identified using the "tsclean" function of the "forecast" library in R
4. MONITOR COUNTS TO PERSON-VISIT CONVERSION
a. Sum daily counts at each location
b. Multiply by Ratio Inflation Factor to compute Estimated Monitor Count (EMC)
c. Divide summed EMCs by 2 to estimate annual person-visits for specified geographic area
d. Calculate the bounds of the estimate

Recognizing Measurement Error (Vaske et al. 2009)
Although infrared monitors offer advantages (e.g., low maintenance, continuous operation), measurement errors can occur. The accuracy and reliability of the data are influenced by errors associated with: (a) the counts obtained from the monitors and (b) the procedures used in estimating visitation from the count data. The following are *some* common measurement errors that can occur.

Counting Errors (i.e., monitor functionality)
1. Placement of equipment; miscounts occur when the receiving "eye" is struck by direct sunlight.
2. Soil, dust or snow accumulating on the transmitter or receiver.
3. Blowing vegetation or heavy falling snow.

Estimation Errors (i.e., converting counts to visits)
1. OSMP installs monitors to accommodate an average adult human waist height of three feet, and to avoid counting most dogs. Consequently people shorter than 36 inches (e.g., small children) are not included in the estimate.
2. People walking side-by-side, in large groups or visitor parties passing the monitor at the same time can be missed.
3. Monitors cannot differentiate humans from non-human presence (e.g., livestock, wildlife or vehicles).

The methodology used for this study minimizes and/or accounts for many of these measurement errors. However, the estimate does ***not*** address people who travel within the study area but do not pass a monitor (e.g. walk around the monitor or enter via a non-trailed area).

VII. Results

All results reflect visits during August 1, 2015 – November 30, 2015 only and *should not be used to estimate annual visitation* to the study area. These results also *should not be used to make individual trail estimates*. Lastly, an unknown portion of visits (likely minimal) can be attributed to staff, contractors or volunteers that passed a monitor during the study period. Overall results (**Table 2**) are explained and analyzed by season, day of week and hour in the following section.

Table 2. Estimated number of visits for the Chautauqua visitation study, during August 1, 2015 - November 30, 2015 by location

Location	Number of Visits	Lower and Upper Bounds
Entire study area	317,561	(291,573 to 335,515)
Meadow sub-area	281,317	(261,605 to 301, 029)
Enchanted Mesa sub-area	32,227	(29,968 to 34,485)
Unmonitored access points*	4,017	N/A

*Not included in bounds estimate, or season, day of week or hourly calculations

Daily totals

Across the study period, the number of daily visits to the entire study area ranged from 188 to 5,126 (**Figure 4**). The low point (October 21st) occurred during a prolonged heavy rainstorm and the high point occurred on Sunday, September 6th (Labor Day weekend) The average number of visits per day within the entire study area, for the months of August through November, is 2,570. Weekend days had consistently higher visitation than weekday days.

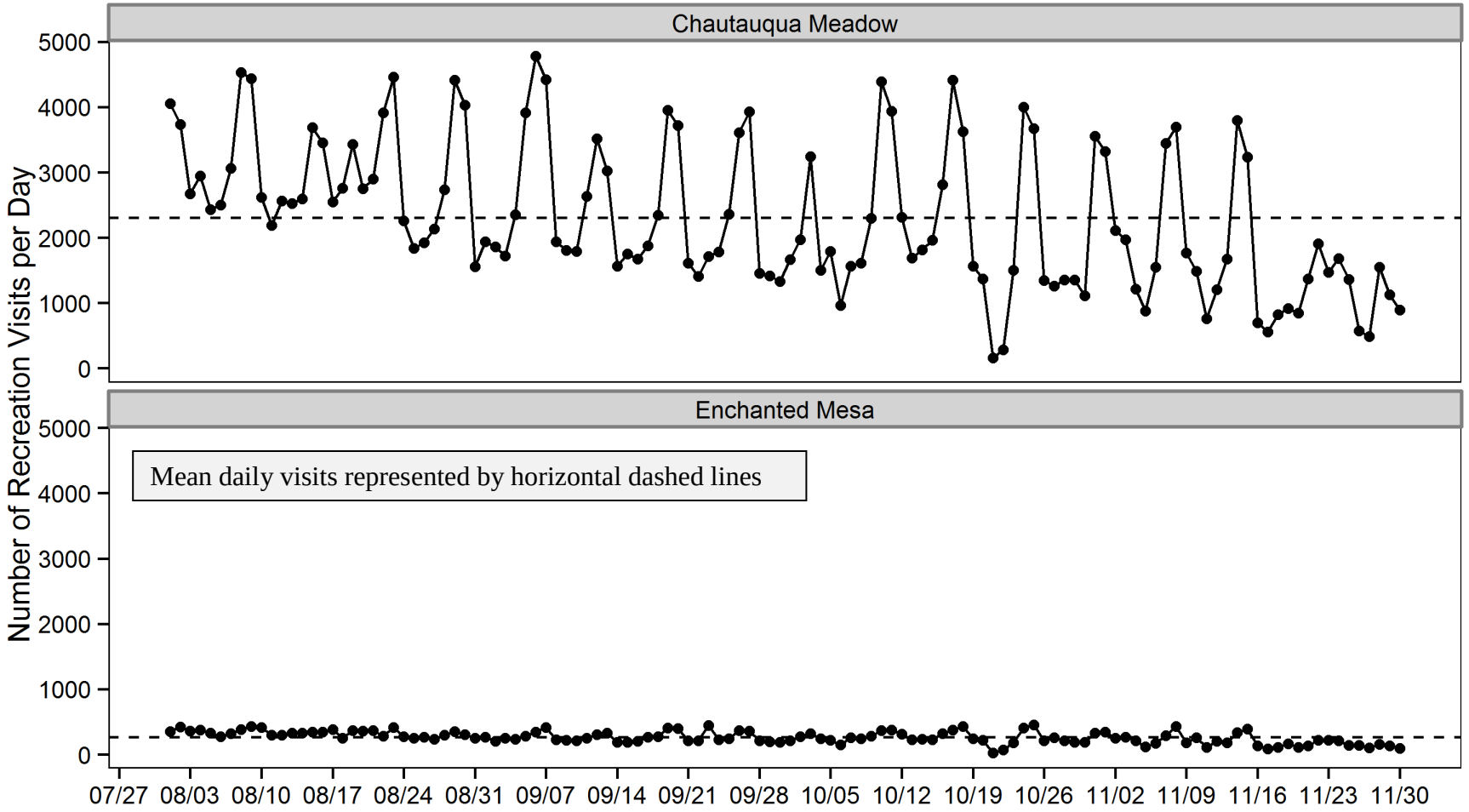


Figure 4. Total number of recreation visits per day from August 1, 2015 – November 30, 2015 for the two sub-areas

Day of the week distribution

In the Chautauqua meadow sub-area, Saturdays were the busiest during both summer and fall seasons (**Figure 5**). Mondays and Friday were busier than Tuesdays-Thursdays and Fall Wednesdays were the lowest overall.

For the Enchanted Mesa sub-area, Sundays received the most visits during both seasons and Mondays were relatively high during the summer season compared to other weekdays due to the Meadow Music events conducted.

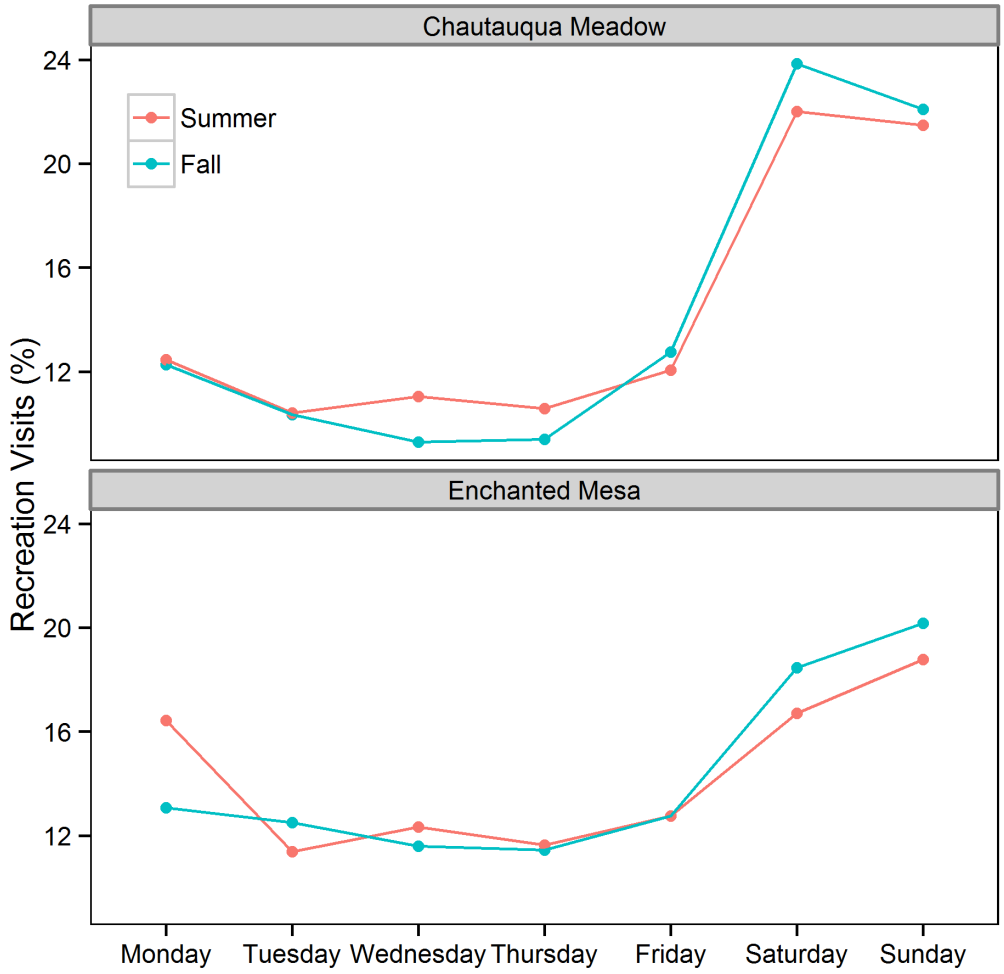


Figure 5. Proportion of total visits by season, day of week and sub-area

Monthly distribution

August was by far the busiest, and November the slowest, of the four monitored months (**Figure 6**). August contributed over one third of the total visits and November less than one tenth within the Chautauqua sub-area. November was proportionately busier within the Enchanted Mesa sub-area – something that *could be* attributed to factors such as a more steady local population regularly visiting the area, better trail conditions, or group events.

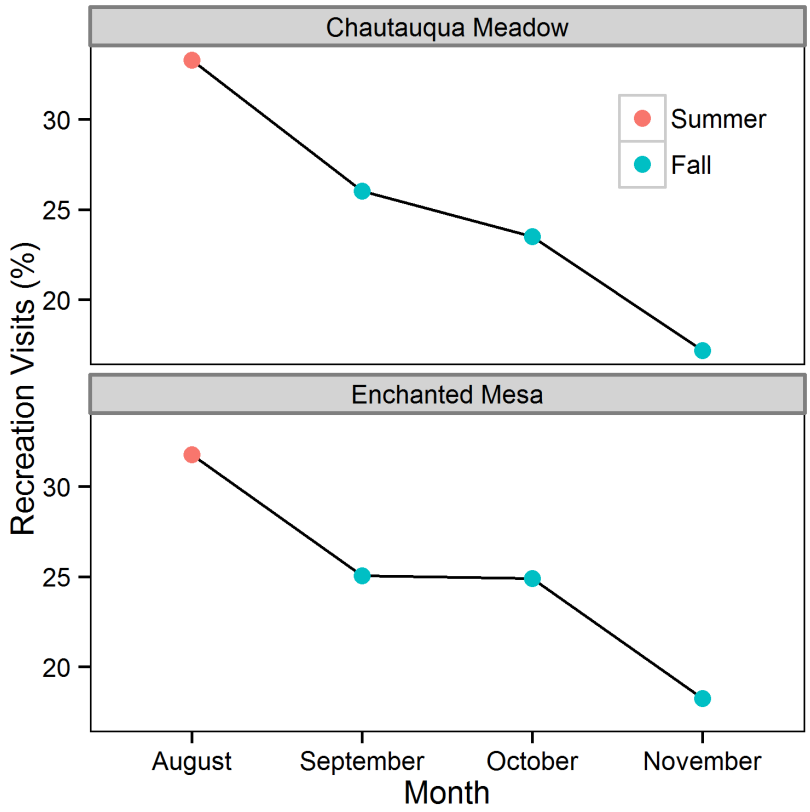


Figure 6. Proportion of total visits by season, month and sub-area

By month for the study area (not including 4,017 visits from unmonitored access points)

Monthly distributions are fairly similar to 2004/2005, with some increase proportionately for November 2015. Fall season (September-November) visits in 2004 were ~90,000 and in 2015 they were ~210,000 (**Table 3**).

Table 3. Total number of visits for entire Chautauqua study area by month, for 2004 and 2015

Month	2004 Visits	2015 Visits	Increase
August	42,000	103,905	147%
September	36,000	81,270	126%
October	35,000	74,125	112%
November	19,000	54,244	185%

Hourly distribution

Within the Chautauqua meadow sub-area, hourly distributions were fairly similar across weekdays and the greatest number of hourly visits occurred from mid-day to early evening (**Figure 7**). Weekends days included a much steeper mid-day spike.

While less busy overall, the Enchanted Mesa sub-area also had fairly similar weekday hourly distributions and weekends included a mid-day increase. Generally speaking, the daily peaks occurred earlier in the day within this sub-area.

Hourly distributions for the entire study area, by individual day, are included in **Appendix C**.

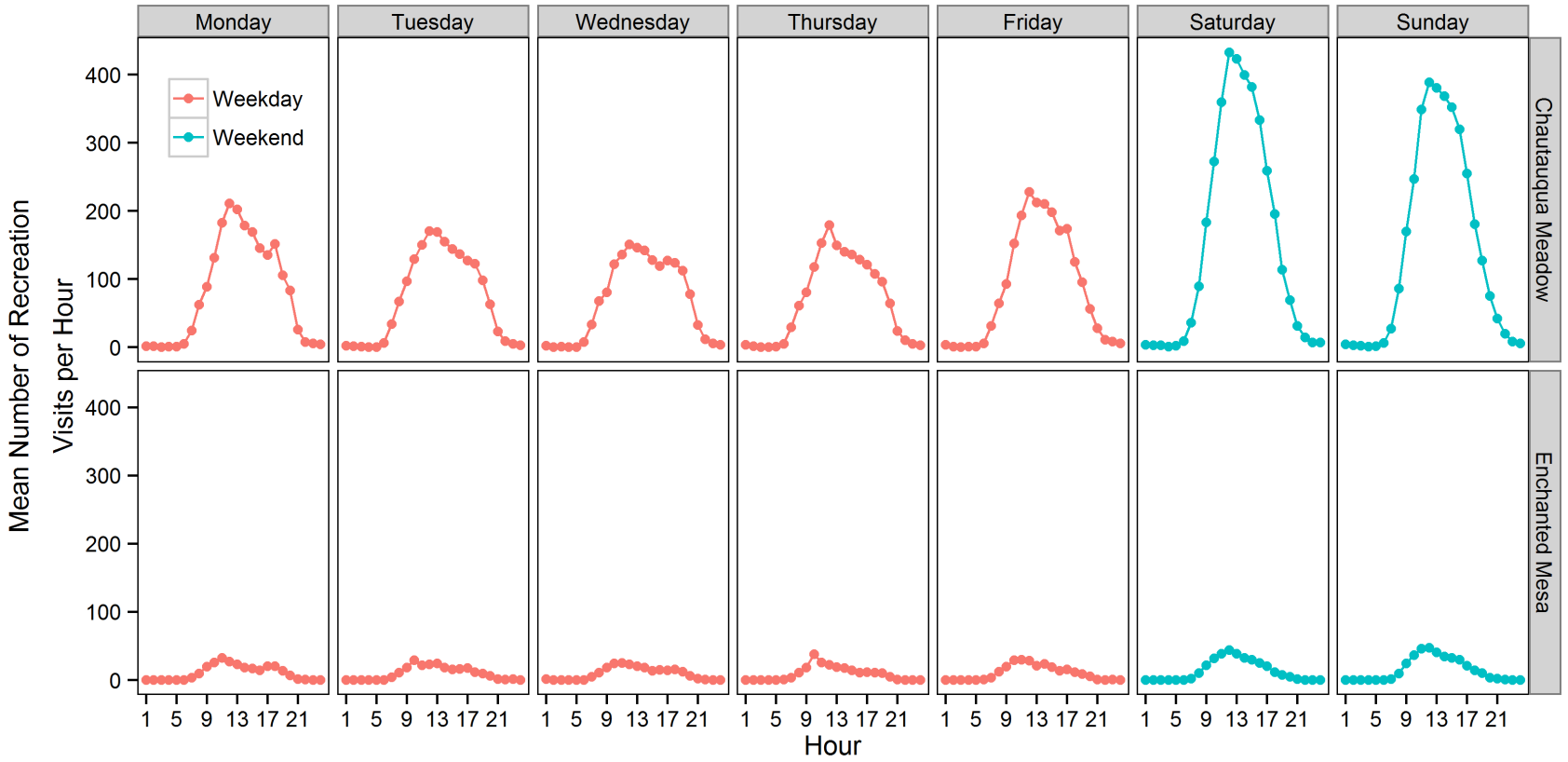


Figure 7. Average number of visits per hour across each sub-area for each day of the week

The Chautauqua Trail monitor captured by far the greatest number of visits across the entire study area (**Figure 8**). This location received approximately double the number of visits captured at the Bluebell Road location, which was the second busiest location. Baseline West, a currently undesignated very low access point located near the first hairpin turn on Flagstaff Road, received the lowest number of visits, followed by the 6th Street and McClintock Lower access points. The Baseline East and Bluebell-Baird locations received a fairly similar proportion of total visits (~10%) across the entire study area.

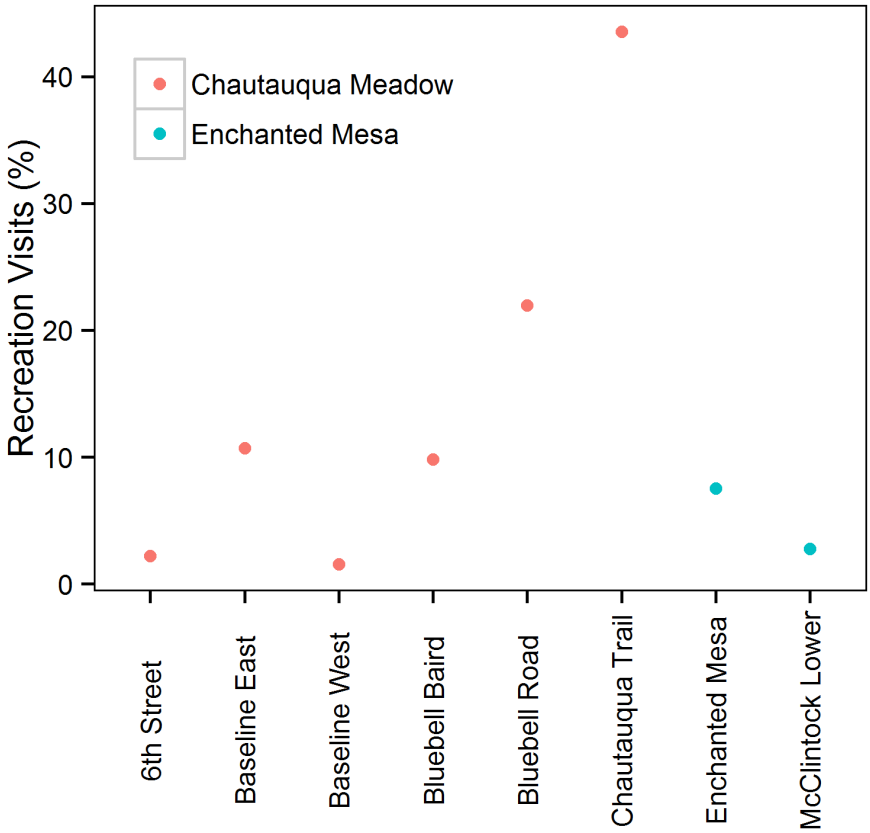


Figure 8. Proportion of total visits attributed to each monitored location during the study period

Estimates at unmonitored very low locations

Monitors were not installed at five previously identified (Vaske et al. 2009) undesignated trail access points along Baseline Road (**Figure 9**). To estimate visitation at these locations, staff used the average number of visits at very low locations, as estimated during the 2004/2005 system-wide visitation study. At this time, very low access points averaged an annual 2,132 visits. Staff then used the average monthly distributions from the same study to determine the average number of visits per August-November (803 visits). This number was then multiplied by five, to estimate the total number of visits during the study period at these unmonitored locations (4,017). This estimate is considered conservative as there are many short undesignated trail segments connecting the street parking along Baseline Road and Baseline Trail within OSMP that were not included in this estimate. Staff believes that all undesignated trails along

Baseline Road are intermittently used, and concluded that including five locations within the estimate was reasonable.

Figure 9. Five unmonitored very low access points along Baseline Road, shown as green dots

Comparison to 2004/2005 visitation estimates

The last monitoring interval conducted within the Chautauqua study area occurred during the system-wide OSMP visitation study of 2004/2005. At this time, *annual visitation* to the Chautauqua study area was an estimated 330,000-350,000 visits. This estimate was the result of automated monitor counts at selected locations (**Appendix D**) along with best professional judgment on unmonitored locations. Results of the current project show a number of visits greater than 300,000 *within just August-November*, 2015**. This indicates that visitation to the area has more than doubled within the past 10 years.**

References Cited

Chen, C, and Liu, L. 1993. Forecasting time series with outliers. *Journal of Forecasting*, 12: 13-35.

Giolitto, M. 2012. *City of Boulder Open Space and Mountain Parks Department 2010-2011 Visitor Survey Report ver. 1.0*. City of Boulder, Open Space and Mountain Parks Department, Boulder, Colorado.

Vaske, J. J., & Donnelly, M. P. (2008). *Visitor characteristics and beliefs about Boulder Open Space and Mountain Parks*. (HDNRU Report No. 78). Report for Boulder Open Space and Mountain Parks. Fort Collins: Colorado State University, Human Dimensions of Natural Resources.

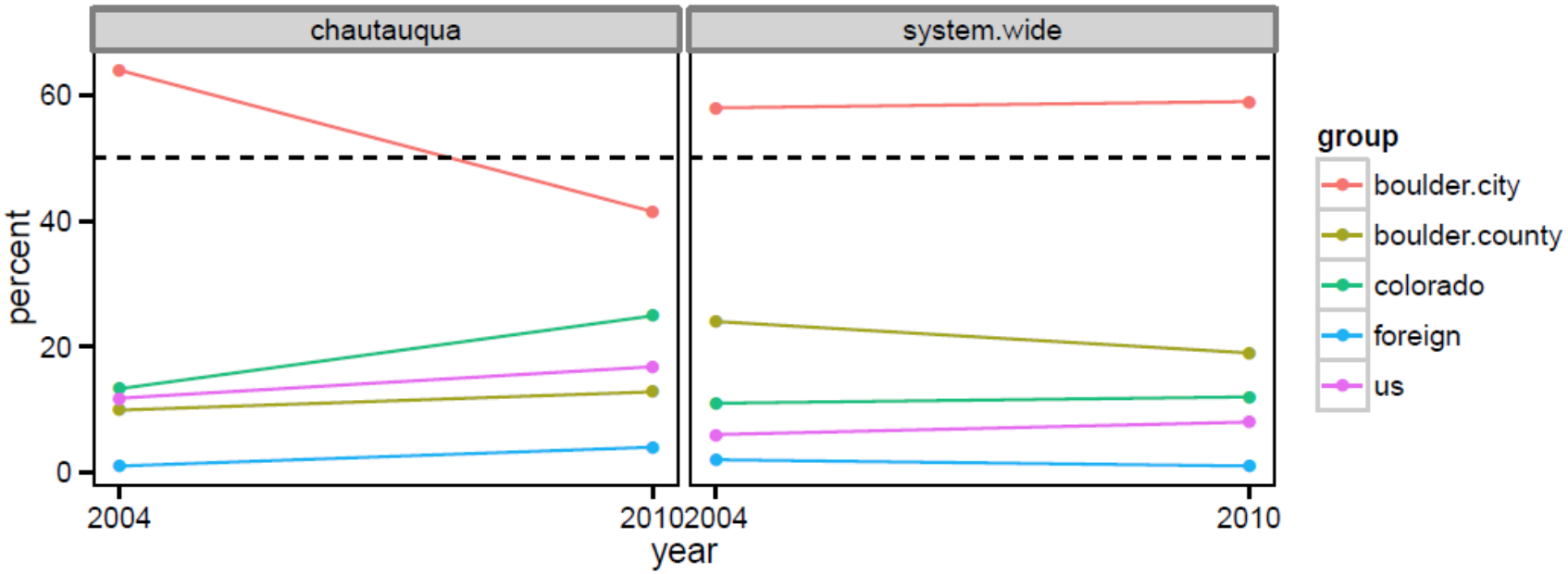
Vaske, J. J., Shelby, L. B., & Donnelly, M. P. 2009. *Estimating visitation to Boulder Open Space and Mountain Parks*. (HDNRU Report No. 80). Report for Boulder Open Space and Mountain Parks. Fort Collins: Colorado State University, Human Dimensions of Natural Resources.

Appendix A. Key Findings from 2004/2005 and 2010/2011 OSMP Visitor Surveys

- The proportion of city of Boulder residents visiting the Chautauqua study area dropped quite a bit between 2004 and 2010.
- The proportion of visitors accessing the Chautauqua study area by vehicle is much higher than the OSMP system-wide average.
- The most important reason people visit the Chautauqua study area is to enjoy the place itself, followed by enjoying activities and enjoying time with family or friends.
- Visitors to the Enchanted Mesa sub-area have been visiting OSMP for more years than visitors to the Chautauqua meadow sub-area, and are generally older.
- The Chautauqua study area receives a greater proportion of large visitor parties (3 or more visitors) than across OSMP.
- The proportion of visitors to the Chautauqua study area with dogs is less than across OSMP.

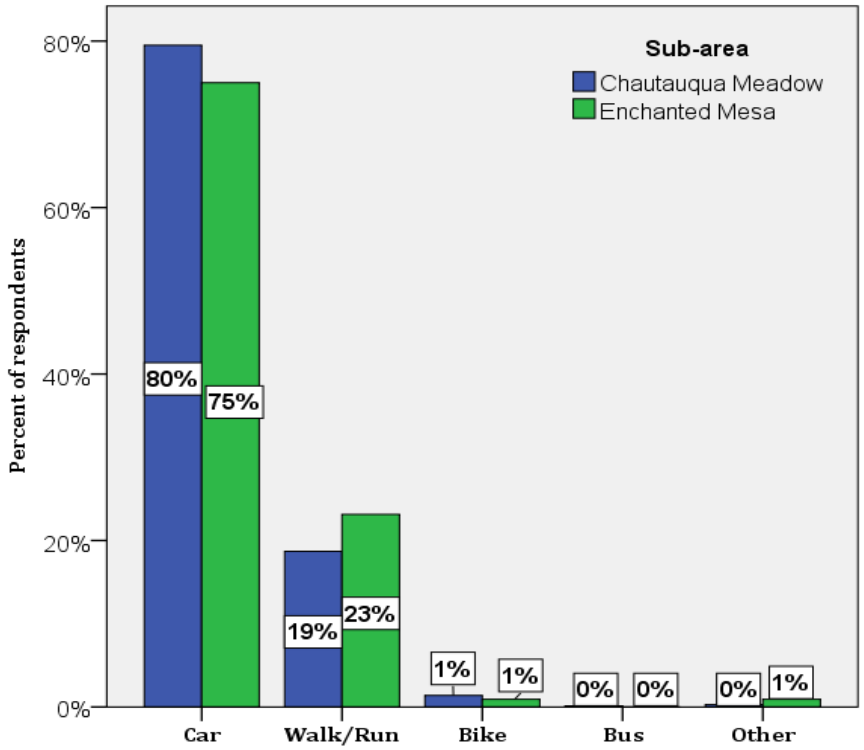
Appendix A. Additional information from the 2004/2005 and 2010/2011 OSMP Visitor Surveys

Residency of visitors to Chautauqua study area over time



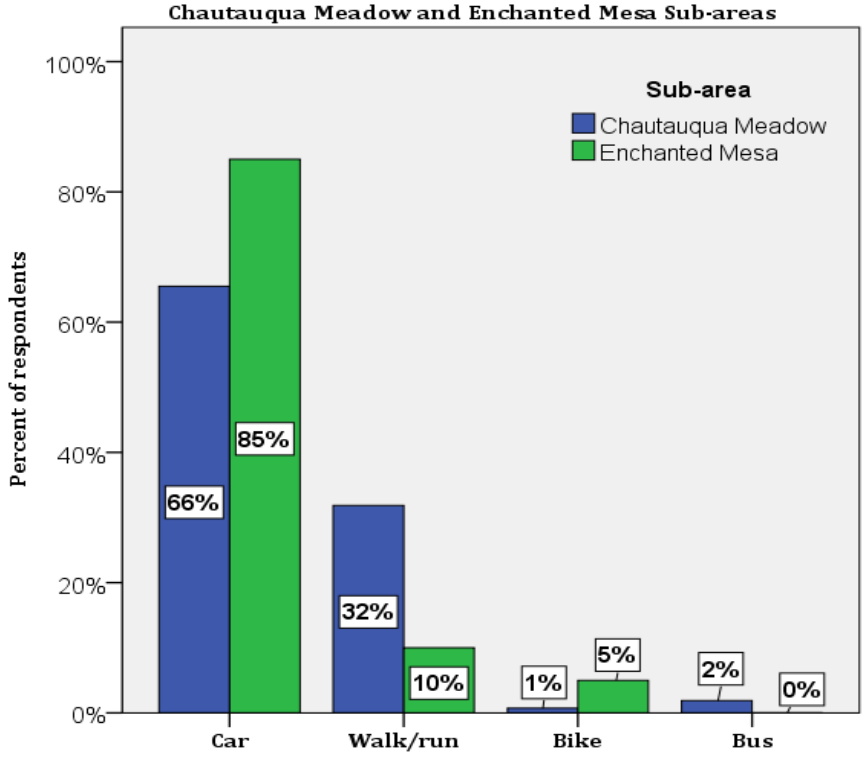
2010 Chautauqua Visitor Mode of Access to OSMP

Chautauqua Meadow and Enchanted Mesa Sub-areas



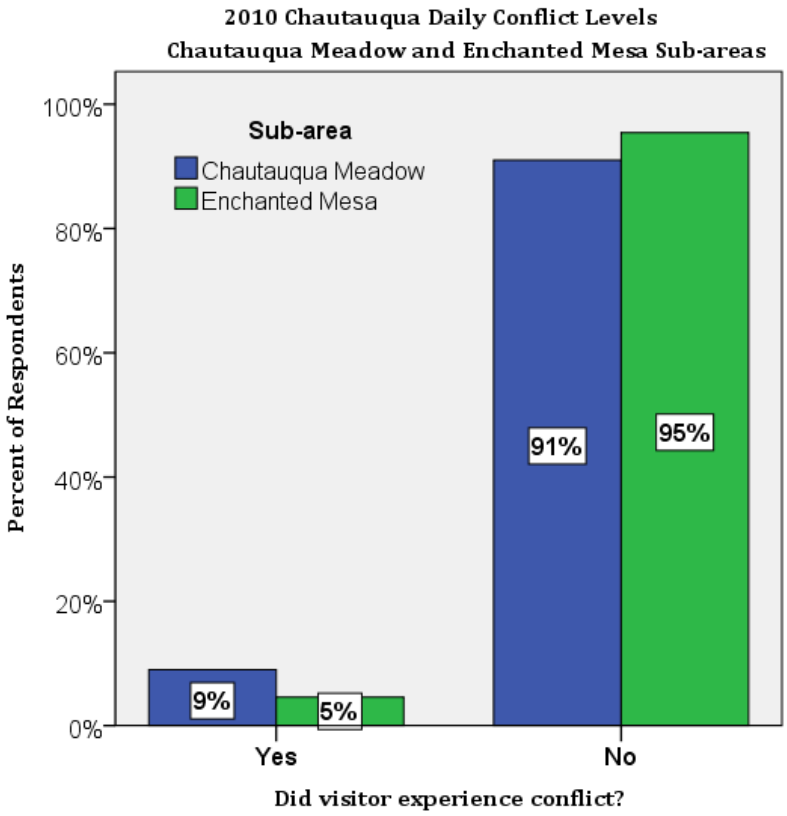
2004 Chautauqua Visitor Mode of Access to OSMP

Chautauqua Meadow and Enchanted Mesa Sub-areas



OSMP System-wide Visitor mode of access to OSMP - comparison of 2010-2011 results to 2004-2005 results

Mode of access	2010-2011	2004-2005
Car	57%	58%
Walk/Run	34%	32%
Bike	9%	9%
Other	<1%	NA
Bus	<1%	1%

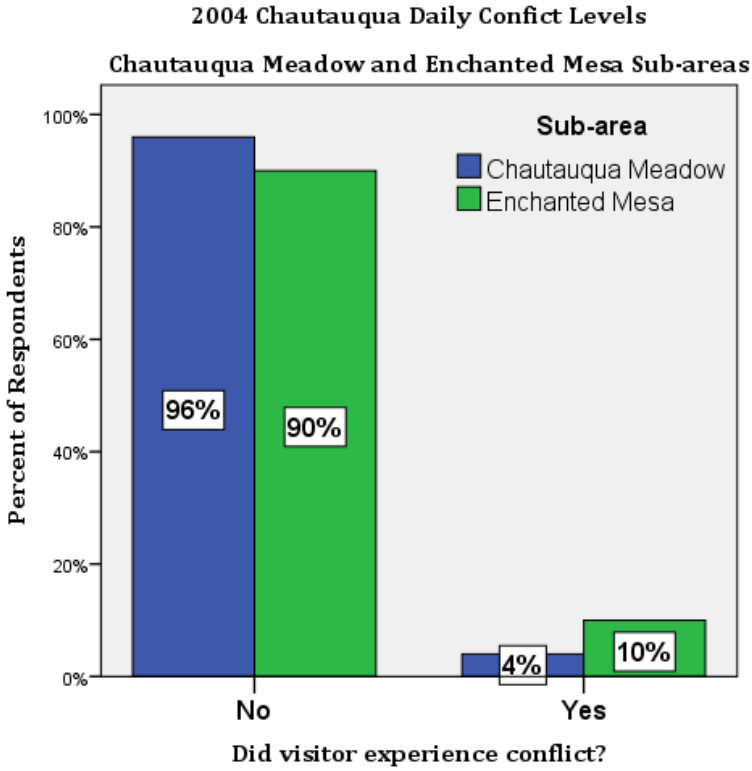


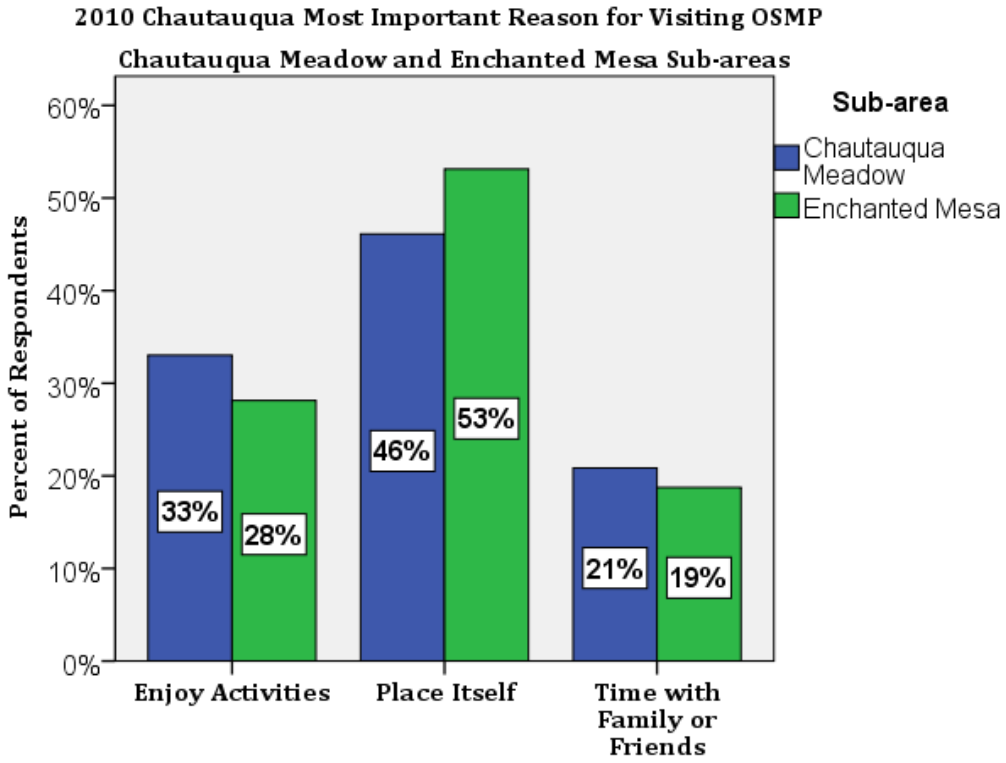
OSMP System-wide

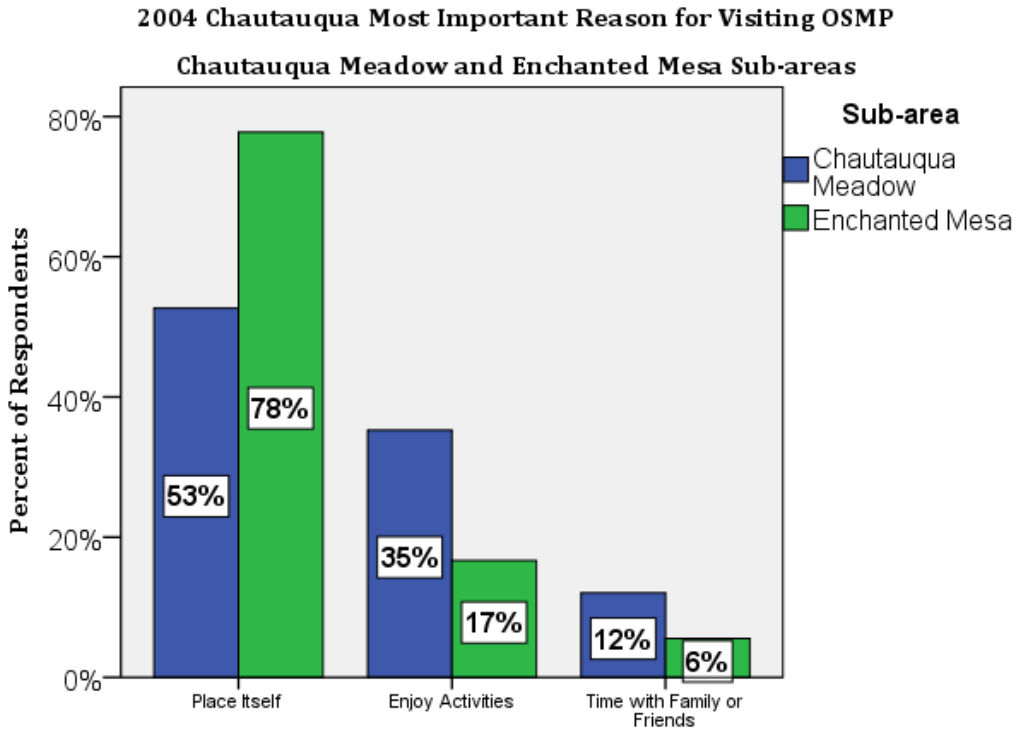
Percentage of visitors who report experiencing recreational conflict ***on the day of their visit*** - comparison of 2010-2011 results to 2004-2005 results*

Conflict?	2010-2011	2004-2005
Yes	7%	4%
No	93%	96%

***Question was worded differently during each survey year

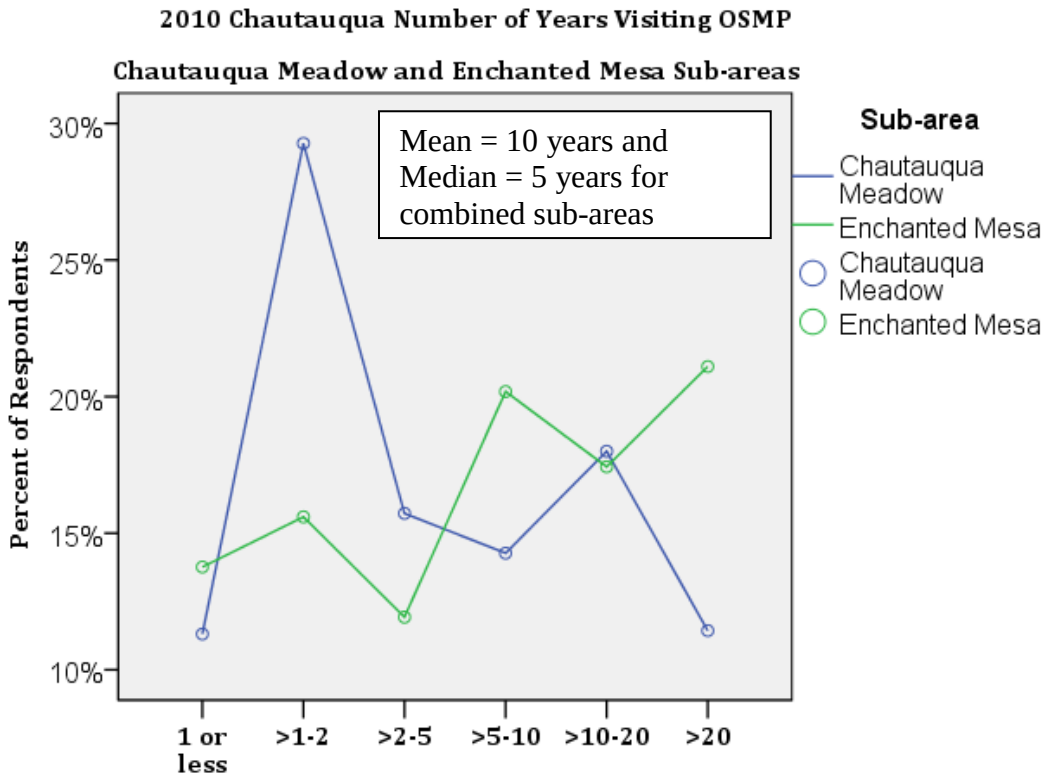

2004 Chautauqua Daily Confict Levels
Chautauqua Meadow and Enchanted Mesa Sub-areas
Sub-area
Chautauqua Meadow
Enchanted Mesa
Percent of Respondents
100%
80%
60%
40%
20%
0%
96%
90%
4%
10%
No
Yes
Did visitor experience conflict?

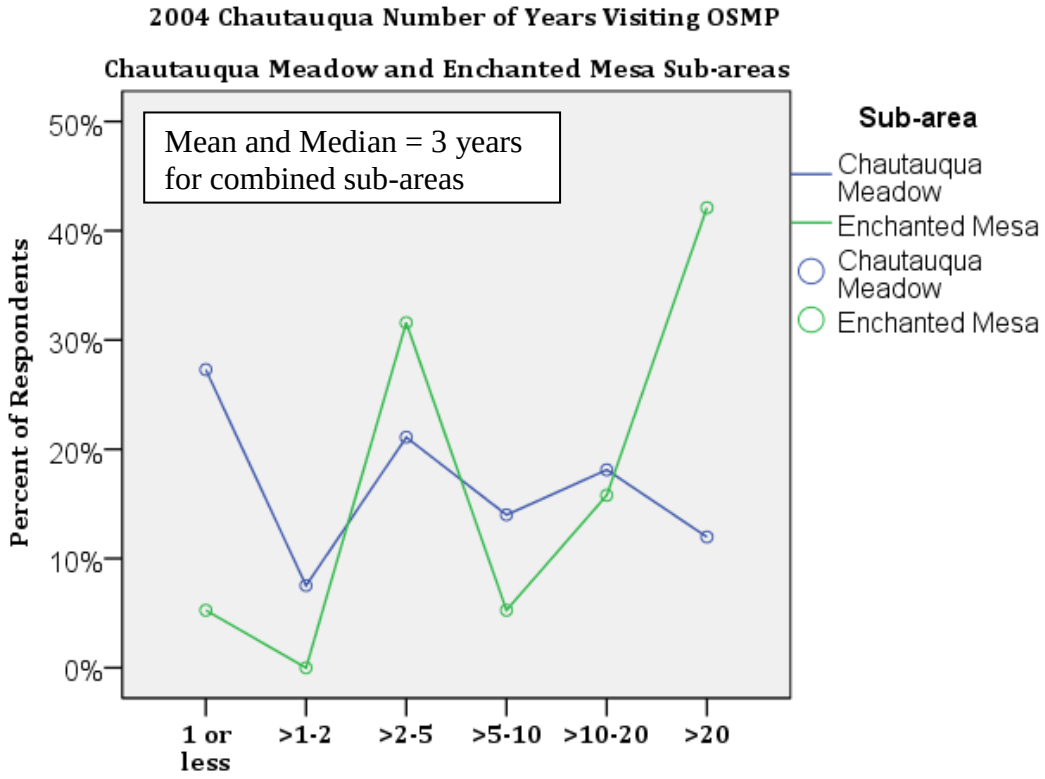

2010 Chautauqua Most Important Reason for Visiting OSMP
Chautauqua Meadow and Enchanted Mesa Sub-areas
Sub-area
Chautauqua Meadow
Enchanted Mesa
Percent of Respondents
60%
50%
40%
30%
20%
10%
0%
33%
28%
46%
53%
21%
19%
Enjoy Activities
Place Itself
Time with Family or Friends



OSMP System-wide Most important reason for visiting OSMP - comparison of 2010-2011 results to 2004-2005 results

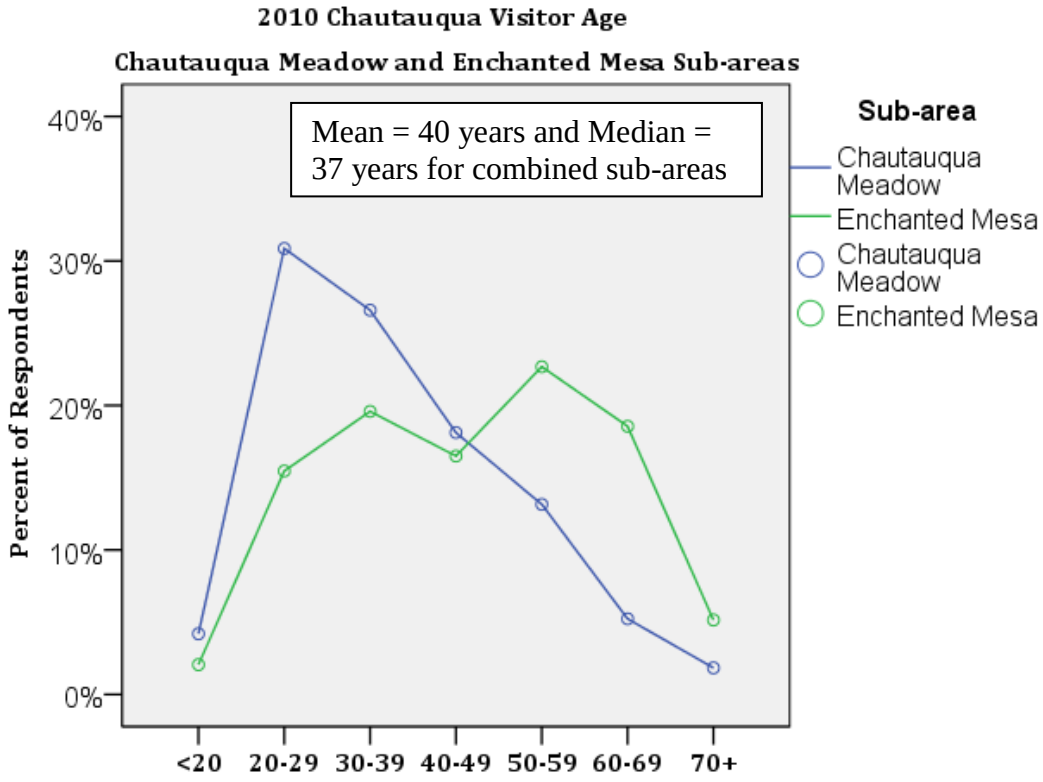
Reason	2010-2011	2004-2005
To do the activities I enjoy	49%	48%
To enjoy the place itself	42%	44%
To spend time with family or friends	9%	8%

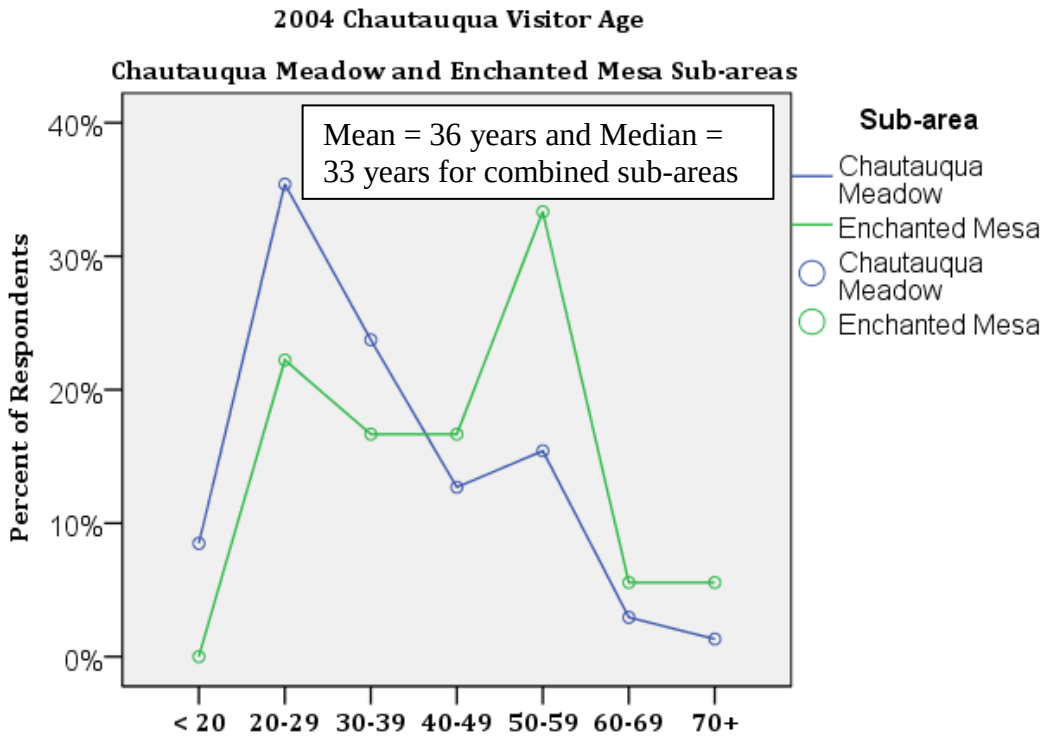

2010 Chautauqua Number of Years Visiting OSMP
Chautauqua Meadow and Enchanted Mesa Sub-areas
Mean = 10 years and Median = 5 years for combined sub-areas
Percent of Respondents
30%
25%
20%
15%
10%
1 or less
>1-2
>2-5
>5-10
>10-20
>20
Sub-area
Chautauqua Meadow
Enchanted Mesa
Chautauqua Meadow
Enchanted Mesa


2004 Chautauqua Number of Years Visiting OSMP
Chautauqua Meadow and Enchanted Mesa Sub-areas
Mean and Median = 3 years for combined sub-areas
Percent of Respondents
50%
40%
30%
20%
10%
0%
1 or less
>1-2
>2-5
>5-10
>10-20
>20
Sub-area
Chautauqua Meadow
Enchanted Mesa
Chautauqua Meadow
Enchanted Mesa

OSMP System-wide Number of years respondents have visited OSMP - comparison of 2010-2011 results to 2004-2005 results

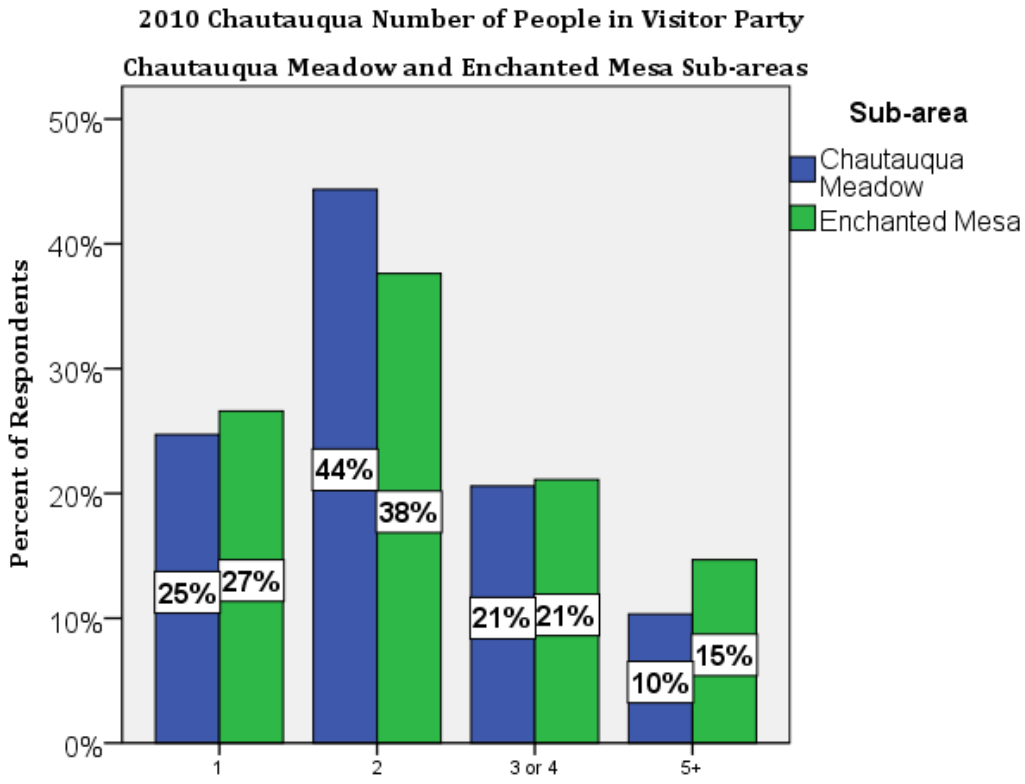
Years visiting OSMP	2010-2011	2004-2005
Fewer than or equal to 1	15%	21%
Greater than 1 year up to 2	6%	
Greater than 2 years up to 5	14%	20%
Greater than 5 years up to 10	16%	22%
Greater than 10 years up to 20	25%	24%
Greater than 20 years	24%	13%
Median	**10**	**8**
Mean	**14**	**11**





OSMP System-wide Visitor age in 10 year categories - comparison of 2010-2011 results to 2004-2005 results.

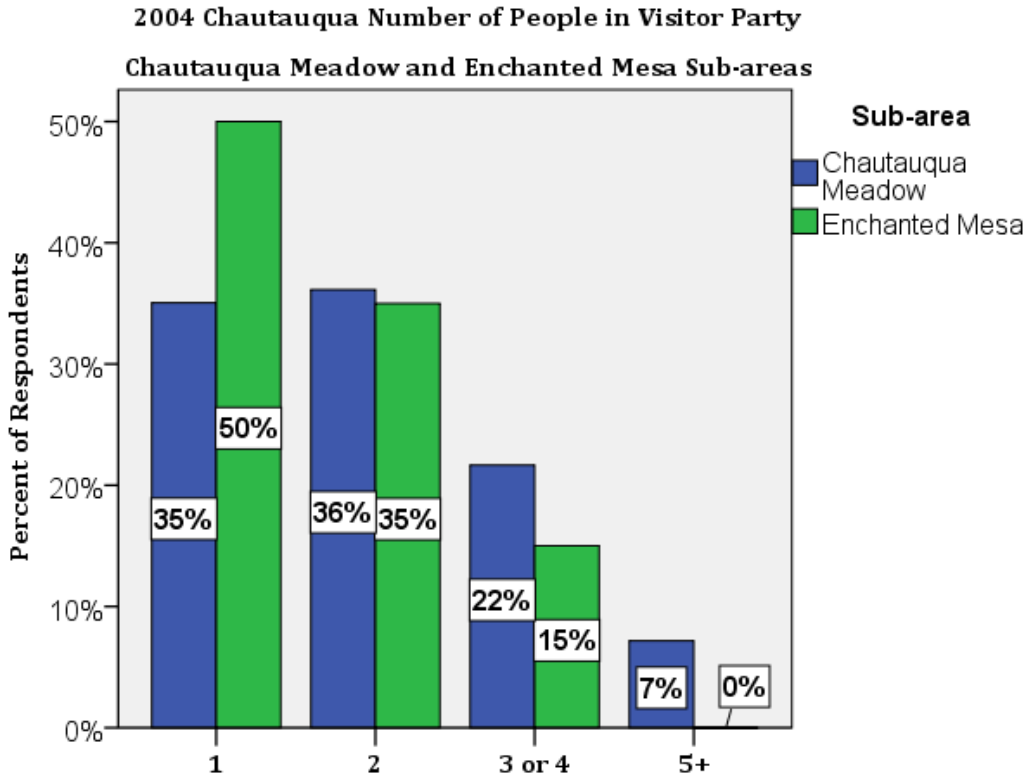
Age	2010-2011	2004-2005
<20	2%	3%
20-29	17%	23%
30-39	21%	25%
40-49	21%	23%
50-59	22%	18%
60-69	13%	6%
70+	4%	2%
Median	**42**	**39**
Mean	**44**	**40**

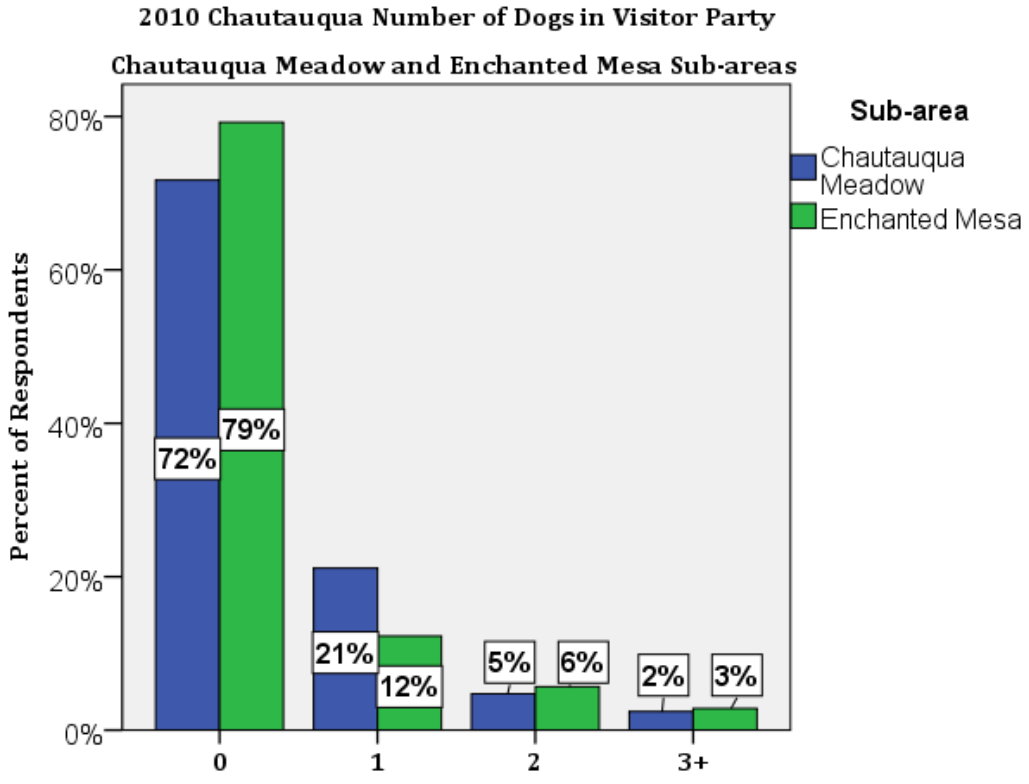


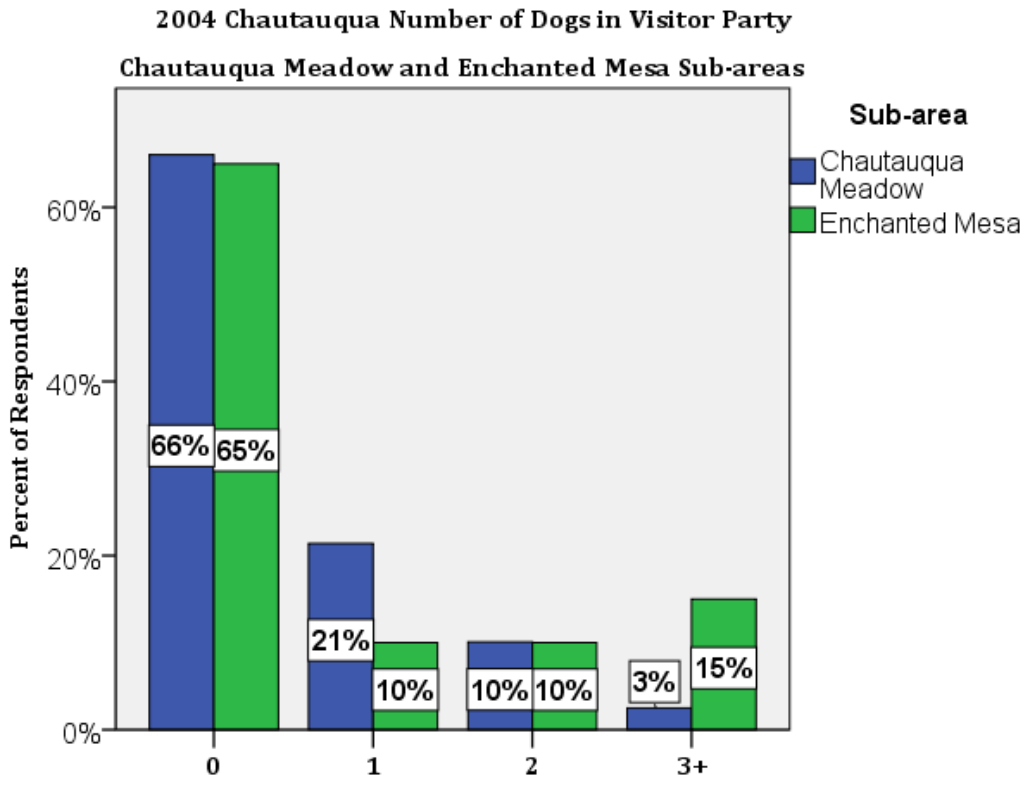
System-wide

Responses to the question "How many people are in your group?" - comparison of 2010-2011 results to 2004-2005 results

Response	2010-2011	2004-2005
1	47%	44%
2	37%	40%
3 or 4	11%	13%
5+	5%	3%


2004 Chautauqua Number of People in Visitor Party
Chautauqua Meadow and Enchanted Mesa Sub-areas
Percent of Respondents
50%
40%
30%
20%
10%
0%
35%
50%
36%
35%
22%
15%
7%
0%
1
2
3 or 4
5+
Sub-area
Chautauqua Meadow
Enchanted Mesa


2010 Chautauqua Number of Dogs in Visitor Party
Chautauqua Meadow and Enchanted Mesa Sub-areas
Percent of Respondents
80%
60%
40%
20%
0%
72%
79%
21%
12%
5%
6%
2%
3%
0
1
2
3+
Sub-area
Chautauqua Meadow
Enchanted Mesa



OSMP System-wide Percentage of respondents with dog(s) them on the day of their visit - comparison of 2010-2011 results to 2004-2005 results

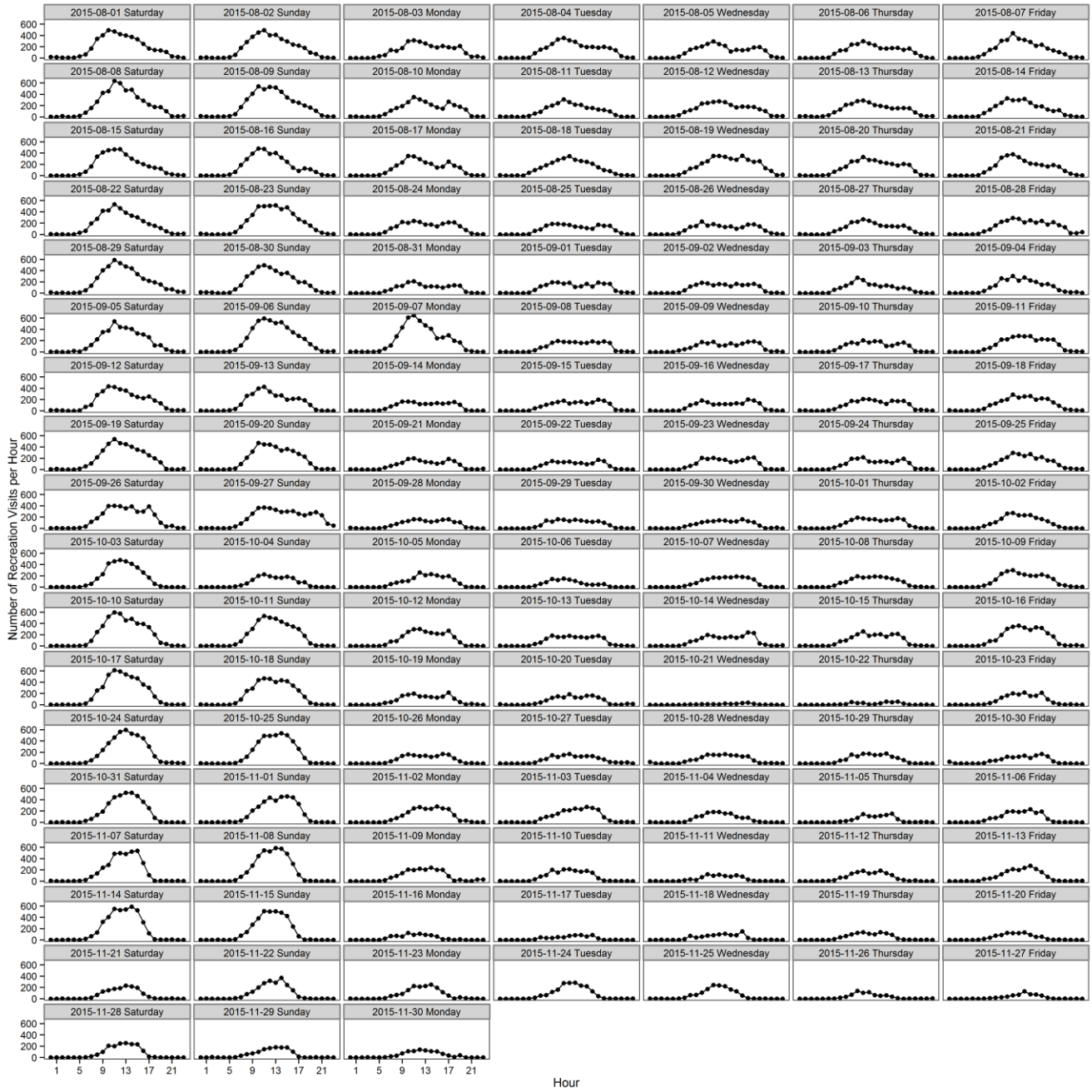
# of dogs	2010-2011	2004-2005
0	69%	66%
1	24%	22%
2	6%	9%
3+	1%	2%

Appendix B. Calibration session data for the 2015 Chautauqua area study

2015 Chautauqua TRAFx Visitation Monitor Calibrations

Date_Monitored	Day of Week	Time_Monitored	Location	Monitor_Type	People Counted by Observer	People Counted by Monitor	% Accurate	RIF	Average RIF by Location
8/1/2015	Saturday	11:15 AM	6th Street Access	TRAFx IR	46	43	93%	1.069767	
8/3/2015	Monday	12:52 PM	6th Street Access	TRAFx IR	56	53	95%	1.056604	**1.086996**
11/9/2015	Monday	3:51 PM	6th Street Access	TRAFx IR	59	52	88%	1.134615	
			Total		**161**	**148**	**92%**		
8/1/2015	Saturday	11:35 AM	Baseline East	TRAFx IR	47	36	77%	1.305556	
8/3/2015	Monday	12:20 PM	Baseline East	TRAFx IR	50	32	64%	1.562500	**1.361816**
11/9/2015	Monday	4:12 PM	Baseline East	TRAFx IR	56	46	82%	1.217391	
			Total		**153**	**114**	**75%**		
8/1/2015	Saturday	10:45 AM	Baseline West	TRAFx IR	47	38	81%	1.236842	**1.320549**
11/9/2015	Monday	3:28 PM	Baseline West	TRAFx IR	66	47	71%	1.404255	
			Total		**113**	**85**	**75%**		
8/1/2015	Saturday	9:22 AM	Bluebell Road	TRAFx IR	52	36	69%	1.444444	
9/24/2015	Thursday	11:00 AM	Bluebell Road	TRAFx IR	55	38	69%	1.447368	**1.639151**
11/9/2015	Monday	1:50 PM	Bluebell Road	TRAFx IR	79	39	49%	2.025641	
			Total		**186**	**113**	**61%**		
8/1/2015	Saturday	10:15 AM	Bluebell-Baird	TRAFx IR	53	35	66%	1.514286	**1.390476**
11/9/2015	Monday	2:59 PM	Bluebell-Baird	TRAFx IR	57	45	79%	1.266667	
			Total		**110**	**80**	**73%**		
8/1/2015	Saturday	9:45 AM	Chautauqua Trail	TRAFx IR	51	39	76%	1.307692	
9/24/2015	Thursday	11:50 AM	Chautauqua Trail	TRAFx IR	74	55	74%	1.345455	**1.439938**
11/9/2015	Monday	2:21 PM	Chautauqua Trail	TRAFx IR	70	42	60%	1.666667	
			Total		**195**	**136**	**70%**		
8/3/2015	Monday	10:26 AM	Enchanted Mesa	TRAFx IR	98	74	76%	1.324324	**1.439940**
11/9/2015	Monday	12:40 PM	Enchanted Mesa	TRAFx IR	70	45	64%	1.555556	
			Total		**168**	**119**	**71%**		
8/3/2015	Monday	9:30 AM	McClintock Lower	TRAFx IR	89	73	82%	1.219178	**1.327538**
11/9/2015	Monday	1:10 PM	McClintock Lower	TRAFx IR	56	39	70%	1.435897	
			Total		**145**	**112**	**77%**		
			Grand Totals	**TRAFx IR total**	**1231**	**907**	**74%**	Overall RIF	**1.354458**

Appendix C. Total number of visits by hour by individual day for the entire study area



Appendix D. Estimated annual number of visits at monitored access locations during the 2004/2005 OSMP system-wide visitation study (Vaske et al. 2009); 2015 re-monitored locations in grey

	Volume	Estimated Number of Visitors	Lower Bound	Upper Bound
Boulder Falls	VH	106,213	101,517	110,909
Bluebell Rd	VH	95,858	91,620	100,096
Chautauqua Trail	VH	114,921	109,841	120,002
Mt Sanitas Trail	H	99,224	94,837	103,611
Sanitas Valley Trail	H	114,130	109,085	119,176
Sanitas Valley View Trail	H	64,575	61,720	67,430
Wonderland Trail - Poplar Ave	H	98,375	94,026	102,725
Eagle Trailhead	H	38,887	37,168	40,606
Bobolink Trailhead	H	153,479	146,693	160,264
Dry Creek Trailhead	H	117,507	112,312	122,702
Marshall Mesa Trailhead	H	69,076	66,022	72,130
Doudy Draw Trailhead	H	32,773	31,324	34,222
South Mesa Trailhead	H	81,569	77,963	85,176
Gregory Canyon Trail	H	49,617	47,423	51,810
Settlers Trailhead - West	M	80,191	76,646	83,737
Wonderland Trail - Utica East	M	108,426	103,632	113,220
Fourmile Trailhead	M	90,638	86,631	94,645
Foothills Trail - Near US 36	M	23,770	22,719	24,821
Eagle Trail West	M	52,716	50,386	55,047
Boulder Valley Ranch - South	M	69,168	66,110	72,225
East Boulder Trail - White Rocks	M	32,808	31,357	34,258
Sawhill Entrance West	M	20,035	19,150	20,921
East Boulder Trail - Valmont	M	60,058	57,403	62,714
South Boulder Creek - Community Center	M	79,569	76,051	83,086
South Boulder Creek - Marshall	M	73,398	70,153	76,643
Greenbelt Plateau Trailhead	M	29,145	27,856	30,433
Flatirons Vista Trailhead	M	31,576	30,180	32,972
North Fork Shanahan Trail	M	45,308	43,305	47,311
Lower Bear Canyon Trail	M	42,038	40,179	43,896
Ranger Trail	M	14,236	13,606	14,865
Upper Crown Rock	M	24,916	23,814	26,017
Foothills Trail - Locust Place	L	16,550	15,818	17,281
Lefthand Trailhead	L	11,784	11,263	12,305
Cottontail Trail South	L	12,355	11,809	12,902
Steinbach Continental View	L	10,587	10,119	11,055
South Boulder Creek - Broadway	L	25,564	24,434	26,694
6th St	L	22,466	21,473	23,459
Ute Trail	L	9,972	9,531	10,413
Boy Scout Trail	L	3,024	2,890	3,158