

Glacier National Park Site History: Logan Pass



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1. Data and reports pertaining to Logan Pass

The reconstruction of the Going to the Sun Road (GTTSR) in Glacier National Park (GNP) highlights the need for information about impacts on visitor behavior, use levels and patterns of use within the Park, before, during, and following the construction activity. A long-term study of visitor behavior on the GTTSR has been underway since 2005. The content of this site history is a compilation of data collected and reports generated over the course of this long-term study pertaining to Logan Pass and the Hidden Lake Trail.

The initial 2005 study involved observing visitor behavior and conducting interviews at 13 viewpoints. Variables measured included length of stay, group size, residence, activity participation, reason for stopping at the viewpoint and potential use of the proposed shuttle bus. However, the 2005 study did not examine Logan Pass; therefore, no data from this study is included in this report.

In 2006, observations were made at the high-use destination areas including Avalanche Creek, Logan Pass, McDonald Lake Lodge, as well as the lesser-used area of Sun Point. Observations and interviews were part of a park-wide study to gather baseline data about existing use on the Going to the Sun Road, and 107 interviews were conducted at Logan Pass. The 2006 research was designed to provide insight on potential shuttle use through interviews with visitors regarding their support for and likelihood of using a shuttle system on the GTTSR.

In an effort to reduce traffic and decrease wait times due to construction on the GTTSR, the shuttle system was implemented in 2007. Research conducted in the summer of 2007 examined the intersection of the experiences sought by park visitors and the experience of riding a shuttle in Glacier National Park. A sample of park visitors was drawn during pre-determined and randomly chosen sample locations, days, and times between August 18 and September 2, 2007, and visitors were administered an onsite questionnaire and a take-home questionnaire. Since sampling was concentrated on the west side of the park, visitors accessing only areas of the park east of Logan Pass were not sampled. It should be noted, however, that 53% of participants who indicated that they had used the shuttle during their visit also indicated using one or more shuttle stops east of Logan Pass.

In addition to the 2007 visitor use study, a stakeholder evaluation was conducted in the same year to provide a synthesis of stakeholders' comments regarding effects of implementing a park-operated shuttle system within Glacier National Park. Information was gathered from a variety of constituencies, including park visitors, local constituents and concessionaires, park volunteers, shuttle drivers, traffic management personnel on the GTTSR construction team, and park staff.

In 2008, research focused on two roadside viewpoints: Avalanche Lake and Sunrift Gorge. Researchers observed visitors with the goals of comparing viewpoint usage before and after the shuttle service commenced and providing information regarding parking lot use at these two areas, which had been recognized by Park staff as having parking and pedestrian/traffic flow issues. Observations gathered data on vehicle state of origin (including rental versus non-rental vehicles when possible), number of visitors in a group, type of group (pair, family, friends, etc.), and the perceived types of activities in which the group participated while parked at the site. All vehicles in the designated parking area during the sampling period were observed. As 2008

research focuses on Avalanche Lake and Sunrift Gorge, no data from this study is included in this report.

Research conducted in 2009 used three different surveys to examine how the shuttle was used. One survey was given to hikers and focused on intercepting hikers on the Highline Trail, a backcountry hike that has been made more accessible by the shuttle. A second survey was given to shuttle riders and a third to non-shuttle riders. Surveys were implemented at Logan Pass and The Loop, which are busy roadside pullouts on the GTTSR and provide access to the Highline Trail.

The 2011 study conducted parking lot observations at Avalanche and Sunrift Gorge and collected data at St. Mary Falls and Hidden Lake trailheads. Additionally, the study included the calibration of eight trail counters installed to assess trail use levels at locations along The Loop, Siyeh Bend Pass, and the Highline trail. Trails close to the pass (The Loop, Highline and Hidden Lake trails) were only monitored during a short window in the summer season when the snow was cleared enough for hiking. GPS units were also used to track hikes on the St. Mary Falls and Hidden Lake trails. Visitors to the Hidden Lake trail were asked to carry a GPS unit on their hikes during the week of August 20th to 24th. A total of 184 visitors were approached at the trailhead during the five days of the study. Of those, 51 visitors rejected and 133 agreed to participate in the study.

In 2012, three different surveys were applied (hikers, shuttle riders, and non-shuttle riders) with the aim of providing an inventory and descriptive analysis of visitor's perceptions regarding management practices and visitor services in the park. The hiker survey administered in 2012 asked visitors to complete surveys about their hiking experience as they departed the Avalanche Lake, The Loop, Highline and Sunrift Gorge Trails. A total of 1084 visitors were approached resulting in 826 completed surveys, evenly distributed across the four sample sites. Overall, there were 7 sampling periods at Highline trail, 10 sampling periods at The Loop, 5 sampling periods at the Avalanche Lake trail, and 10 sampling periods at Sunrift Gorge. These sampling periods were split between morning and afternoon sessions and between weekends and weekdays. Additionally, 16 trail counters were installed throughout the park in 2012. On The Loop trail, 33 days throughout the summer were monitored. Vehicle counters were also installed at the entrance and exit to the Logan Pass parking lot as well as on both sides of the road east and west of Logan Pass.

2. Site description

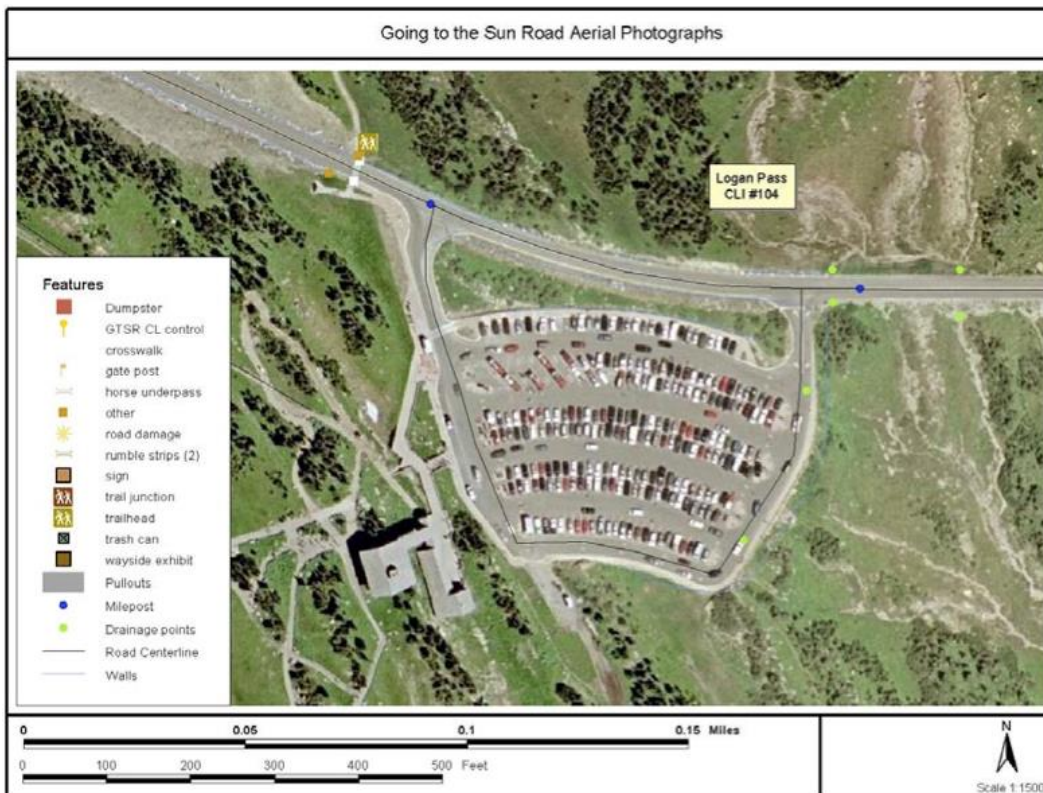
Logan pass is a unique area along the GTTSR. Logan Pass has a popular visitor center with ranger programs, a good opportunity to view wildlife, and it is the starting point of several trails, including Hidden Lake.

This is also an area where wildlife interactions are common. When wildlife comes into the parking area, it is common to see visitors following the animals around taking pictures.

Most visitors come to Logan Pass during times that the visitor's center is open. Some visitors, however, arrive before the visitor's center opens and after it closes. Those arriving early are often hikers. During the hours after the visitor center is closed, many visitors are taking pictures

and observing wildlife.

Figure 1: An aerial photograph of Logan Pass



3. What are the parking patterns at Logan Pass?

3.1 How long do visitors stop at the Logan Pass parking lot?

In 2006, the mean duration of stops at Logan Pass was 34 minutes (Table 1) with a median of 62 minutes. Twenty-five percent of visitors were in the lot for 17 minutes or less, and 25% were there longer than 86 minutes.

Table 1: Logan Pass parking data: 2006

Variable	
Median duration of stops (mins.)	34
Mean duration of stops (mins.) ¹	62
% of observations exceeding observation period	36%
% of observations during which lot was full ²	13%

¹Understates mean because some use exceeded the observation period

²Not equivalent to the amount of real time the lot was full

In 2012, researchers found through watching a limited segment of the parking lot through a plot watcher camera that during peak hours, (10:00 AM to 2:00 PM) average wait time to park in the Logan Pass parking area was about 13 minutes, while average parking time was 136 minutes. Onsite assessment of waiting times with an improved methodology in 2013 indicated that average wait time during the hours of 11:00-2:00 was 4.1 minutes with 95 % of the cars finding a parking spot within 11.6 minutes. In 2013, 37% (49% 12:00-1:00, 48% from 1:00-2:00) departed without parking between 11:00 and 2:00. Between 11:00-2:00, if a visitor did not find a parking spot within 7 minutes, 57% left rather than parking.

3.2 When is the Logan Pass parking lot full?

The 2006 study reports that fill time at Logan Pass was generally around 11:00 am and remained full until after 2:00 pm. The lot was full for an average of three hours; thirty-six percent of observations exceeded the observation period and the lot was full during 13% of observations.

During times when the parking lot is full, many motorists circle the lot looking for a spot. Often these visitors will drop off members of their group and circle the lot or stop along the perimeter of the lot while waiting for their party.

Also, the 2006 report noted that while the motorcycle spots in the front of the parking lot are often in use, the ones located at the back of the lot are empty for the majority of the day.

The 2012 study found that the Logan Pass parking lot entrance and exit areas averaged 1,764 vehicles day and 1,758 vehicles a day respectively. In 2012, researchers also found through watching a limited segment of the parking lot through a plot watcher camera that peak hours, (10:00 AM to 2:00 PM) average wait time to park in the Logan Pass parking area was about 13 minutes, while average parking time was 136 minutes. Onsite assessment of waiting times with an improved methodology in 2013 indicated that average wait time during the hours of 11:00-2:00 was 4.1 minutes with 95 % of the cars finding a parking spot within 11.6 minutes. In 2013, 37% (49% 12:00-1:00, 48% from 1:00-2:00) departed without parking between 11:00 and 2:00. Between 11:00-2:00, if a visitor did not find a parking spot within 7 minutes, 57% left rather than parking.

3.3 Where do Logan Pass visitors park?

In 2006, visitors who indicated that they planned to hike from Logan Pass were also asked if they had left a car in another location. Ten percent of hikers from Logan Pass indicated that they had left a car at another location. These visitors indicated that they left their cars at Jackson Glacier Overlook (one respondent), Avalanche (one respondent), Saint Mary Pullout (one respondent), Lake McDonald Lodge (one respondent), Rising Sun (two respondents), and Oberlin (one respondent).

The 2009 study surveyed visitors at both Logan Pass and The Loop. Seventy-four percent of all hikers surveyed parkwide left a car somewhere else in the park while taking their hike. Of those who left a car elsewhere in the park, 50% of left their car at Logan Pass. The Loop was the second most common parking location; 20% of hikers left a car there. This suggests that people who are using the shuttle to facilitate a hike are still driving on the road and parking in heavily

congested parking areas. In conversations with people at survey sites, surveyors found that park rangers had recommended that visitors who wanted to hike the Highline Trail one way should park at The Loop or Logan Pass.

In addition, hikers who were waiting to catch the shuttle at The Loop in order to get up to the Logan Pass trailhead to begin a hike or to return to the Logan Pass parking lot to retrieve their vehicle after completing their hike had great difficulty getting on a shuttle. Shuttles coming up to The Loop from the west side of the park were usually full when they reached The Loop because very few passengers get off at shuttle stops lower down the road. Therefore, hikers were often stranded at The Loop for a considerable amount of time waiting to get a shuttle to Logan Pass.

4. What are the traffic flow patterns near Logan Pass?

In 2012, 15 vehicle counters were installed along the GTTSR corridor in an effort to understand the dynamics of human use between trail use and the amount of vehicle traffic flowing through the corridor at various locations. Tables 2 and 5 display vehicle counter data collected at Logan Pass locations during the summer and fall of 2012. Data analysis was completed using the TRAFx DataNet (<http://www.trafx.net/>) and Microsoft Excel.

The Logan Pass 1A, Logan Pass 1B, Logan Pass 2A, and Logan Pass 2B vehicles counters were installed on the west side and east side of Logan Pass respectively in order to determine travel dynamics near Logan Pass. Logan Pass 1A counted traffic traveling east and was located west of Logan Pass. Logan Pass 1A averaged 1,765 vehicles a day. Logan Pass 2A, which counted traffic traveling east and was located east of Logan Pass averaged 1,616 vehicles a day. This indicates that there was an average of an 8% loss in traffic beyond Logan Pass if traveling east. Logan Pass 1B counted traffic traveling west and was located west of Logan Pass and Logan Pass 2B counted traffic traveling west and was located east of Logan Pass. Logan Pass 1B averaged 1,333 vehicles a day and Logan Pass 2B averaged 1,561 vehicles, which indicates about a 15% loss in vehicle traffic west of Logan Pass when traveling west.

4.1 What are the traffic flow patterns near the Logan Pass parking lot?

The installation date of the Logan Pass entrance vehicle counter was delayed until most of the snow had melted at the pass in order to locate a suitable installation site. The counter was installed July 21st, 2012 and data collection began on July 22nd, 2012. Data collection ended on September 12th and the counter was removed September 13th. The purpose of the vehicle counter was to get a count of vehicles entering the Logan Pass parking lot. Similar to the Logan Pass exit counter, the entrance counter often experienced long queues of traffic during peak hours. Because cars often stopped in front of the counter due to backed up traffic, vehicles had the potential to be counted twice. Additionally, the parking lot is a main hub for bus activity and these vehicles may be counted twice because of their length. However, after much experimentation, the device counted at 102% accuracy with a slight over-count. An adjustment factor of 0.98128 was derived by dividing the manual count by the vehicle counter data.

Table 2: Road counter data from the Logan Pass entrance and exit: 2012

Variable	Logan Pass Entrance	Logan Pass Exit
Total number of days monitored	53	51
Total visitation registered	93,478	89,657
Daily average	1,764	1,758
Total visitation estimated	163,416	162,736
Maximum visitation in a single day	2,340	2,373
Minimum visitation in a single day	1,102	1,074

4.1.1 What are the traffic flow patterns near the Logan Pass parking lot entrance?

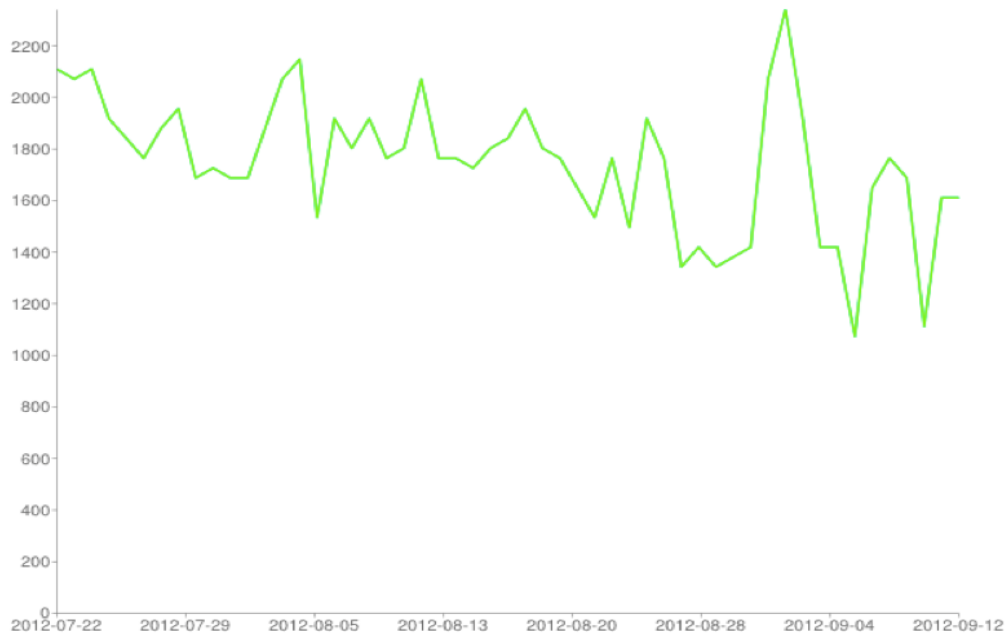
Table 3 summarizes 53 days of data collection carried out at the Logan Pass entrance. July tallied 19,238 vehicles over 10 days with a mean daily average of 1,924 vehicles. Our estimate for the entire month of July would bring the count up to 59,368 vehicles. Average daily vehicle activity in August was 1,754 vehicles per day with a total of 54,368 vehicles recorded over the entire month of August. The vehicle counter recorded data during the first 12 days of September for a vehicle total of 19,872 and an average of 1,656 vehicles per day. Our estimates suggest 49,680 vehicles entered the Logan Pass parking lot in September. Our total vehicle estimate for the Logan Pass entrance from the beginning of July to the end of September is 163,416 (Table 3).

Table 3: Logan Pass entrance vehicle count statistics: 2012

Month	VC data	# days monitored	Daily average	Total estimate
July	19,238	10	1,924	59,368
August	54,368	31	1,754	54,368
September	19,872	12	1,656	49,680
Total	93,478	53	1,764	163,416

The Logan Pass entrance averaged 1,764 vehicles per day over the course of the monitoring season. The median was 1,776 vehicles. The maximum vehicle count occurred on September 2nd, 2012 with 2,340 vehicles recorded. Minimum vehicle count took place on September 6th, 2012 with 1,102 vehicles recorded. Figure 2 displays a relatively steady level of vehicle activity until near the end of August, when activity begins to drop. Use rises to its high point during Labor Day weekend and erratically rises and falls for the remainder of September.

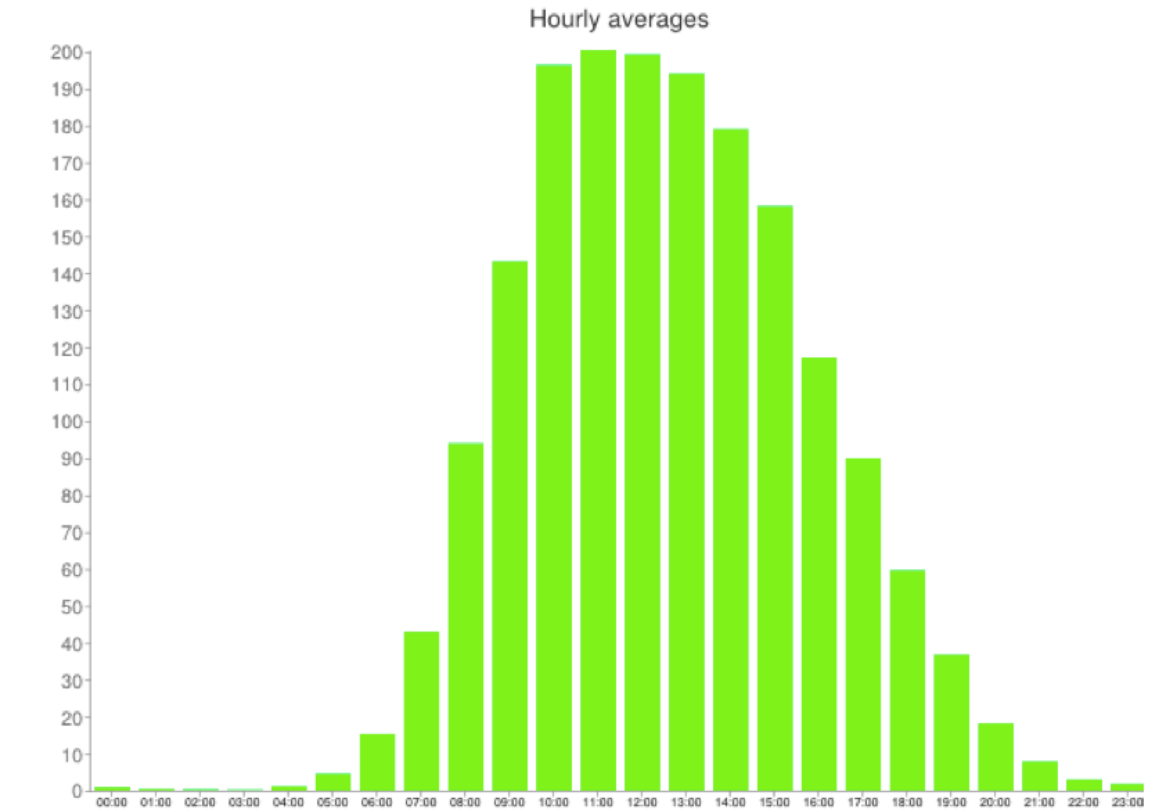
Figure 2: Daily use across the season at the Logan Pass entrance: 2012



On average, Saturday and Sunday experienced the highest level of vehicle activity by day of week with 15.7% and 16.2% respectively. Mean daily values for Saturday and Sunday were 1,940 vehicles and 2,001 vehicles respectively. Tuesday and Friday ranked closely together in terms of average activity by day of the week with 13.9% and 13.8% respectively. Mean vehicle activity for Tuesday was 1,717 vehicles. Mean activity for Friday was 1,708 vehicles. Monday, Wednesday and Thursday experienced similar levels of vehicle activity with, 13.8%, 13.9%, and 13.8% respectively.

Figure 3 displays average hourly vehicle activity at the Logan Pass entrance. The hourly average was 74 vehicles, with a median of 40 vehicles per hour. The standard deviation was 76.9 vehicles, indicating that hourly vehicle activity varied greatly. Use rises steeply from 7 AM to 10 AM, peaking at 11 AM with an average of 200 vehicles for the hour. Vehicle activity at the Logan Pass entrance remains near peak levels from 10 AM to 1 PM. Activity begins to gradually decline after 1 PM. The shape of the curve is skewed right, as use rises in the morning much quicker than it drops in the afternoon and evening.

Figure 3: Logan Pass entrance hourly vehicle activity averages: 2012



4.1.2 What are the traffic flow patterns near the Logan Pass parking lot exit?

The installation date of the Logan Pass exit vehicle counter was delayed until most of the snow had melted at the pass in order to locate a suitable installation site. The counter was installed near the exit in the Logan Pass parking lot July 21st, 2012 and data collection began on July 22nd, 2012. Data collection ended on September 12th and the counter was removed September 13th. The purpose of the vehicle counter was to get a count of vehicles exiting the Logan Pass parking lot. The device was installed 20 feet from the exit sign. The counter was installed this distance from the exit sign in an attempt to count passing cars rather than queued vehicles because lined up vehicles had the potential to be counted more than once. However, this was unavoidable during peak hours because large, slow-moving lines of cars formed at the exit when the parking lot was full. The vehicle counter was set to parking lot mode, and tests were run to determine the most appropriate delay and threshold values. Our calibration determined that the vehicle counter was highly accurate, with a very slight over-count, which indicates that vehicle queuing was not an issue. An adjustment factor of 0.98715 was derived by dividing the manual count by the vehicle counter data.

Table 4 summarizes 51 days of data collection carried out at the location. July tallied 19,543 vehicles over 10 days with a mean daily average of 1,954 vehicles. Our estimate for the entire month of July would bring the count up to 60,583 vehicles. Average daily vehicle activity dropped in August to 1,762 vehicles per day with a total of 51,104 vehicles recorded over 29 days of August. Two days were not recorded because the counter memory was full. We estimate

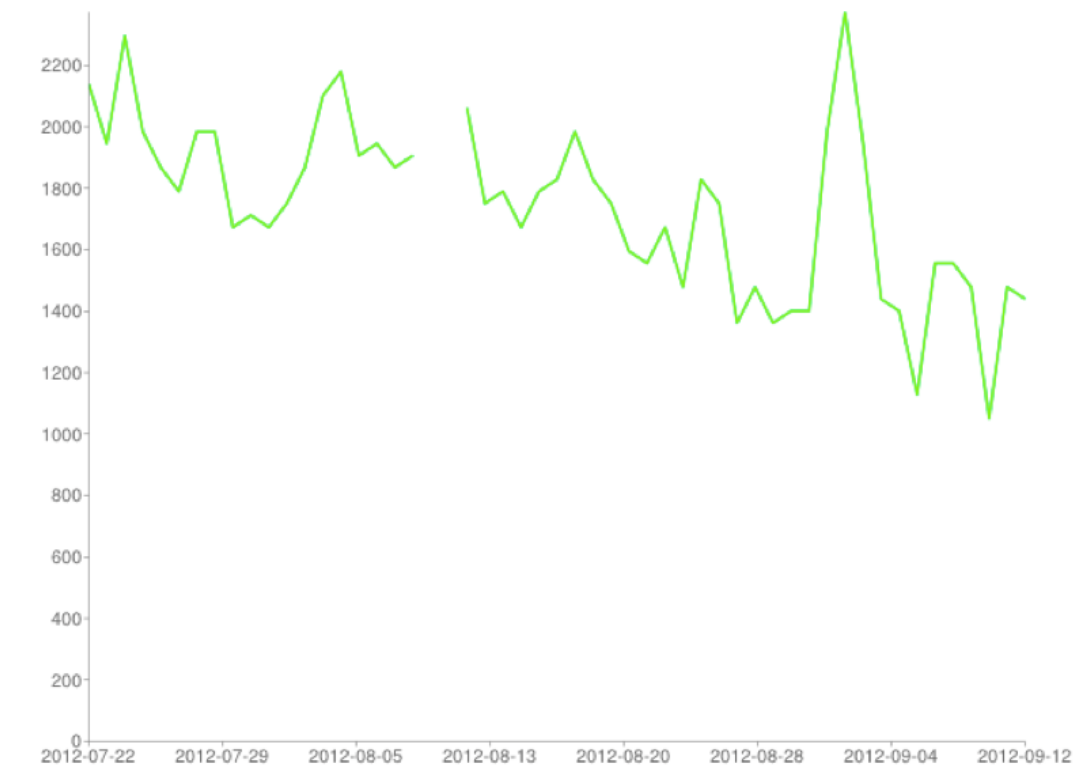
that a total of 54,628 vehicles exited the Logan Pass Parking lot in August. The vehicle counter recorded data during the first 12 days of September for a vehicle total of 19,010 and an average of 1,584 vehicles per day. Our estimates suggest 47,525 vehicles exited the Logan Pass parking lot in September. Our total vehicle estimate for the Logan Pass exit from the beginning of July to the end of September is 162,736 (Table 4).

Table 4: Logan Pass exit vehicle count statistics: 2012

Month	VC data	# days monitored	Daily average	Total estimate
July	19,543	10	1,954	60,583
August	51,104	29	1,762	54,628
September	19,010	12	1,584	47,525
Total	89,657	51	1,758	162,736

The Logan Pass exit averaged 1,758 vehicles per day over the course of the monitoring season. The median was 1,773 vehicles. The maximum vehicle count occurred on September 2nd with 2,373 vehicles recorded. The minimum vehicle count took place on September 10th with 1,074 vehicles recorded. Figure 4 displays a steady level of vehicle activity through July followed by a decline in numbers beginning in August. Use spiked over Labor Day weekend and then continued a downward trend thereafter.

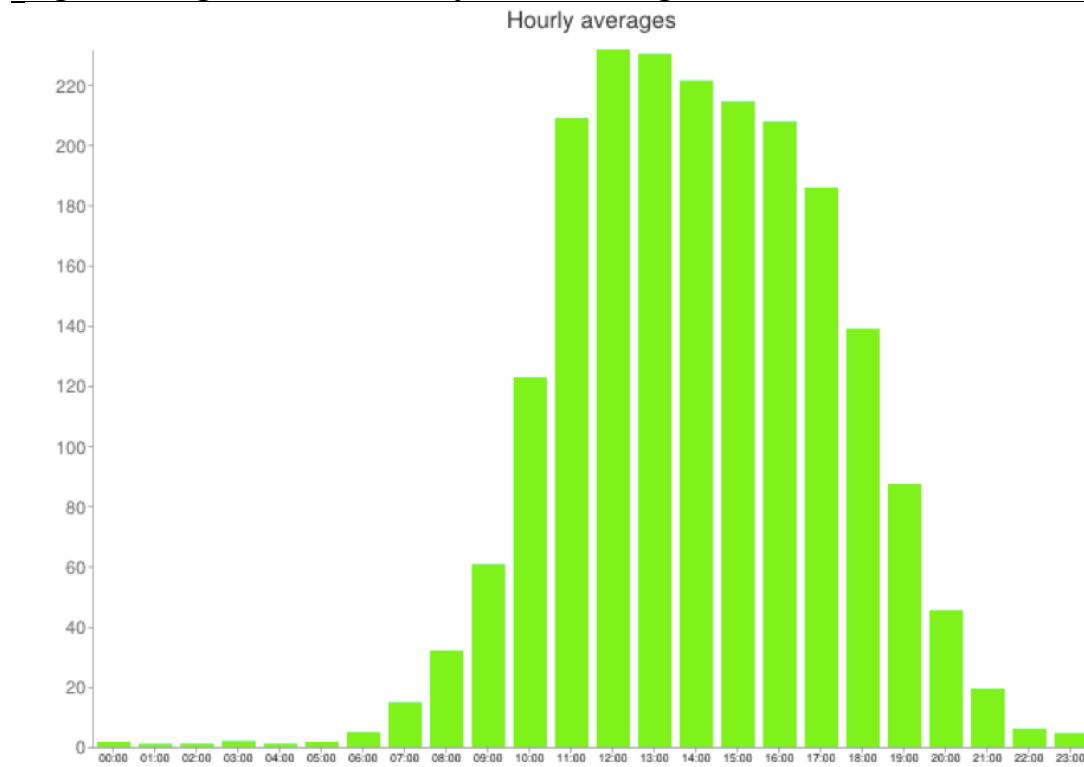
Figure 4: Daily use across the season at the Logan Pass exit: 2012



Over the course of the monitoring season the weekend experienced the highest average level of vehicle activity. Saturday and Sunday received 15.7% and 16.2% respectively of average vehicle activity every week. Mean daily values for Saturday and Sunday were 1,929 vehicles and 1,991 vehicles respectively. Monday and Tuesday received the second highest percentages of vehicle activity with 13.8% and 14% respectively. Monday averaged 1,697 vehicles and Tuesday averaged 1,727 vehicles. Average vehicle activity was lowest in the middle of the week on Wednesday with an average of 1,634 vehicles a day. Wednesday averaged 13.4% of vehicle use by day of week.

Figure 5 displays average hourly vehicle activity at the Logan Pass exit. The hourly average was 85 vehicles, with a median of 39 vehicles per hour. The standard deviation was 91 vehicles, indicating that hourly vehicle activity varied greatly. The shape of the curve is skewed right, as vehicle activity tended to rise steeply from 9 AM to noon and drop at a slower rate until around 7 PM. Maximum vehicle activity tended to occur between 12 noon and 1 PM with an average of 232 vehicles for the hour.

Figure 5: Logan Pass exit hourly vehicle averages: 2012



4.2 What are the traffic flow patterns on the GTTSR at Logan Pass?

Four vehicle counters were installed on the Going to the Sun Road near Logan Pass. They were set up for the purpose of analyzing traffic flow in the Logan Pass area. Two counters were set up about a quarter mile west of Logan Pass; this location was named Logan Pass 1. The other two counters were installed about a quarter mile east of Logan Pass; this location was named Logan

Pass 2. Each installation location contained vehicle counters that counted traffic traveling east and west. Vehicles counters that counted traffic flowing east were denoted with the letter 'A'. Vehicle counters that counted traffic traveling west were denoted with the letter 'B'. For example, the vehicle counter named 'Logan Pass 1A' was located a quarter mile west of Logan Pass and counted traffic traveling east.

Logan Pass 1A counted vehicle traffic traveling east on the Going to the Sun Road and was located about a quarter mile west of Logan Pass. The counter was installed July 21st and data collection began July 22nd. Data collection ended September 12th and the counter was removed September 13th.

Manual calibration occurred in two-hour blocks on July 27th, August 4th, August 11th, and August 12th. Total manual count during calibration was 948 vehicles. The vehicle counter recorded 978 vehicles during that time frame for a difference of 30 vehicles. An adjustment factor of 0.96933 was derived by dividing the manual count by the vehicle counter data. Table 5 shows 2012 road counter data results for all four locations.

Table 5: Logan Pass road counter data: 2012

Variable	Counter location at Logan Pass			
	<u>1A</u>	<u>1B</u>	<u>2A</u>	<u>2B</u>
# of days monitored	51	50	55	53
Visitation registered	90,012	66,638	89,480	82,708
Daily average	1,765	1,333	1,616	1,561
Visitation estimated	165,333	118,527	148,788	140,805
Maximum visitation in a single day	2,445	2,730	2,152	2,487
Minimum visitation in a single day	1,020	729	1,072	961

4.2.1 What are the traffic flow patterns for eastbound traffic west of Logan Pass?

Logan Pass 1A counted vehicle traffic traveling east on the Going to the Sun Road and was located about a quarter mile west of Logan Pass. The counter was installed July 21st and data collection began July 22nd. Data collection ended September 12th and the counter was removed September 13th. An adjustment factor of 0.96933 was derived by dividing the manual count by the vehicle counter data.

Table 6 summarizes 51 days of data collection for Logan Pass 1A. Although data collection began July 22nd, only 8 days worth of data was collected in July due to a malfunction in the counter over a two day period. A vehicle count of 16,674 was registered during July. Average daily vehicle count in July was 2,084. Our vehicle count estimate for the entire month of July is 64,612. The entire month of August was monitored, with a total vehicle count of 55,083 and an average daily value of 1,777 vehicles. The vehicle counter recorded data during the first 12 days of September for a vehicle total of 18,255 and an average of 1,521 vehicles per day. Our

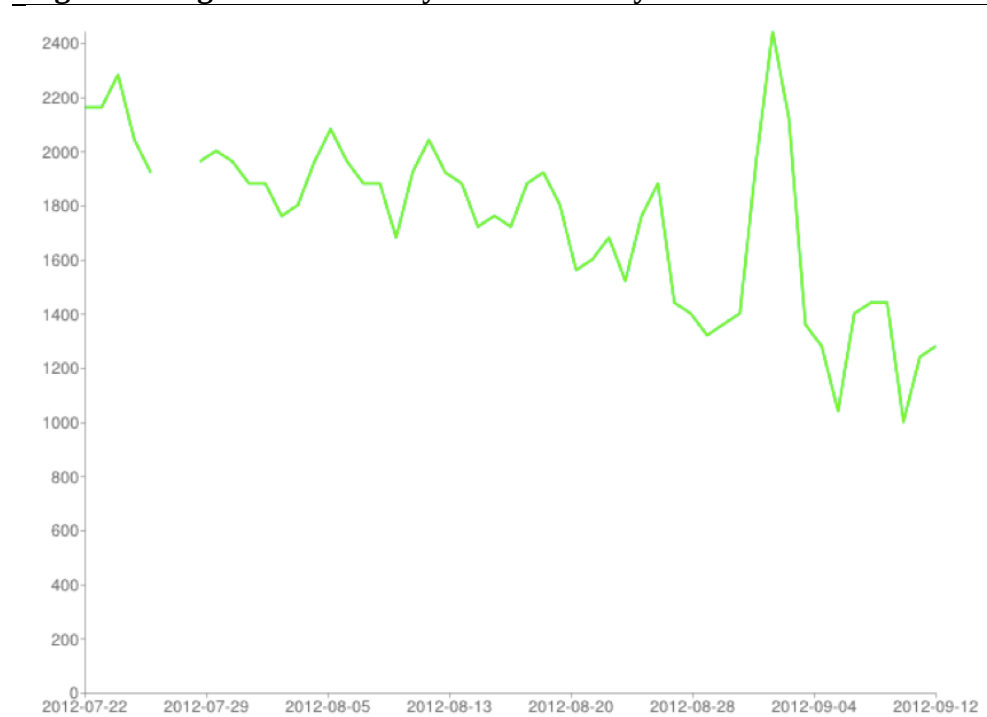
estimates suggest 45,638 vehicles were registered at this location for the month of September, although the estimate is likely inaccurate because the road was closed west of Logan Pass in late September. Our total vehicle estimate for the Logan Pass exit from the beginning of July to the end of September is 165,333 (Table 6).

Table 6: Eastbound traffic west of Logan Pass (Logan Pass 1A) vehicle count statistics: 2012

Month	VC data	# days monitored	Daily average	Total estimate
July	16,674	8	2,084	64,612
August	55,083	31	1,777	55,083
September	18,255	12	1,521	45,638
Total	90,012	51	1,765	165,333

Vehicle activity at the Logan Pass 1A vehicle counter averaged 1,765 vehicles per day over the course of the monitoring season. The median was 1,803 vehicles. The maximum vehicle count occurred on September 2nd with 2,445 vehicles recorded. Minimum vehicle count took place on September 10th with 1,020 vehicles recorded (Figure 6).

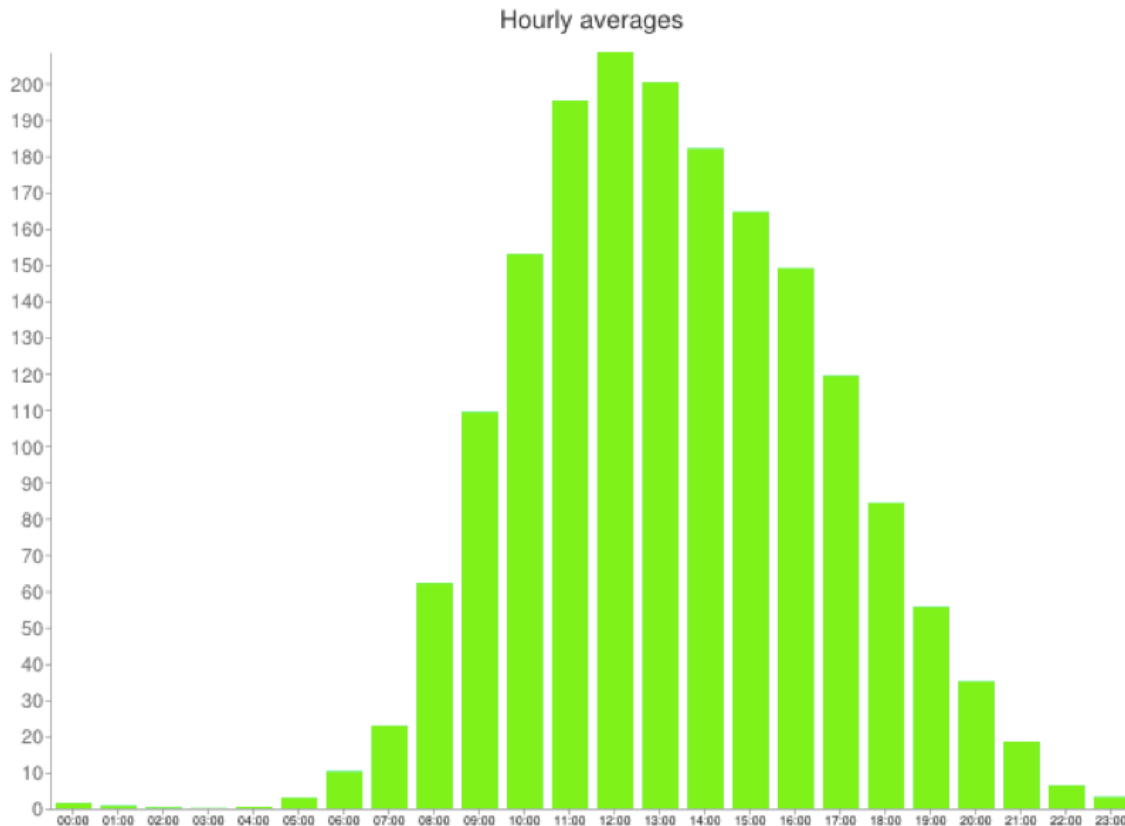
Figure 6: Logan Pass 1A daily vehicle activity across the 2012 Season



Sunday averaged the highest percent of weekly vehicle activity with an average of 16.2% of weekly vehicle activity. The mean vehicle activity for Sunday was 1,995. Saturday and Monday ranked closely together with 14.8% and 14.9% respectively. Saturday averaged 1,827 vehicles and Monday averaged 1,841 vehicles. Friday averaged the lowest percent vehicle activity by day of the week with 13% and a mean of 1,599 vehicles.

Figure 7 displays average hourly vehicle activity at the Logan Pass 1A vehicle counter. The hourly average was 74 vehicles, with a median of 45 vehicles per hour. The standard deviation was 75.6 vehicles, indicating that hourly vehicle activity varied greatly. The shape of the graph is skewed to the right. Vehicle activity tended to rise sharply from 8:00 AM until activity peaked at 12:00 PM. A gradual decline in vehicle activity tended to occur from 1:00 PM until 8:00 PM. The maximum vehicle activity tended to occur between 12:00 PM and 1:00 PM with an average maximum value of 209 vehicles for the hour.

Figure 7: Logan Pass 1A hourly vehicle activity averages: 2012



4.2.2 What are the traffic flow patterns for westbound traffic west of Logan Pass?

Logan Pass 1B counted vehicle traffic traveling west on the Going to the Sun Road and was located about a quarter mile west of Logan Pass. The counter was installed July 21st and data collection began July 22nd. Data collection ended September 12th and the counter was removed September 13th.

Manual calibration occurred in two hour blocks on July 27th, August 4th, August 11th, and August 12th. Total manual count during calibration was 754 vehicles. The vehicle counter recorded 887 vehicles during that time frame for a difference of 133 vehicles. An adjustment factor of 0.85006 was derived by dividing the manual count by the vehicle counter data.

Table 7 summarizes 51 days of data collection for Logan Pass 1B. A vehicle count of 13,657 was registered during the final 10 days of July. Average daily vehicle count in July was 1,366. Our vehicle count estimate for the entire month of July is 42,337. The total vehicle count for August was 40,394. There were three days in August that were not counted because the counter's memory was full. Therefore, 28 days were monitored in August with an average daily value of 1,443 vehicles. Our total vehicle estimate for the month of August would bring the total to 44,722 vehicles in August. The vehicle counter recorded data during the first 12 days of September with a vehicle total of 12,587 and an average of 1,048 vehicles per day. Our estimates suggest 31,468 vehicles were registered at this location for the month of September, although the estimate is likely inaccurate because the road was closed west of Logan Pass in late September. Our total vehicle estimate for the Logan Pass 1B vehicle counter from the beginning of July to the end of September is 118,527.

Table 7: Logan Pass 1B vehicle count statistics: 2012

Month	VC data	# days monitored	Daily average	Total estimate
July	13,657	10	1,366	42,337
August	40,394	28	1,443	44,722
September	12,587	12	1,048	31,468
Total	66,638	50	1,333	118,527

Vehicle activity at the Logan Pass 1B vehicle counter averaged 1,333 vehicles per day over the course of the monitoring season. The median was 1,223 vehicles. The maximum vehicle count occurred on August 5th with 2,730 vehicles recorded. Minimum vehicle count took place on September 10th with 729 vehicles recorded (Figure 8).

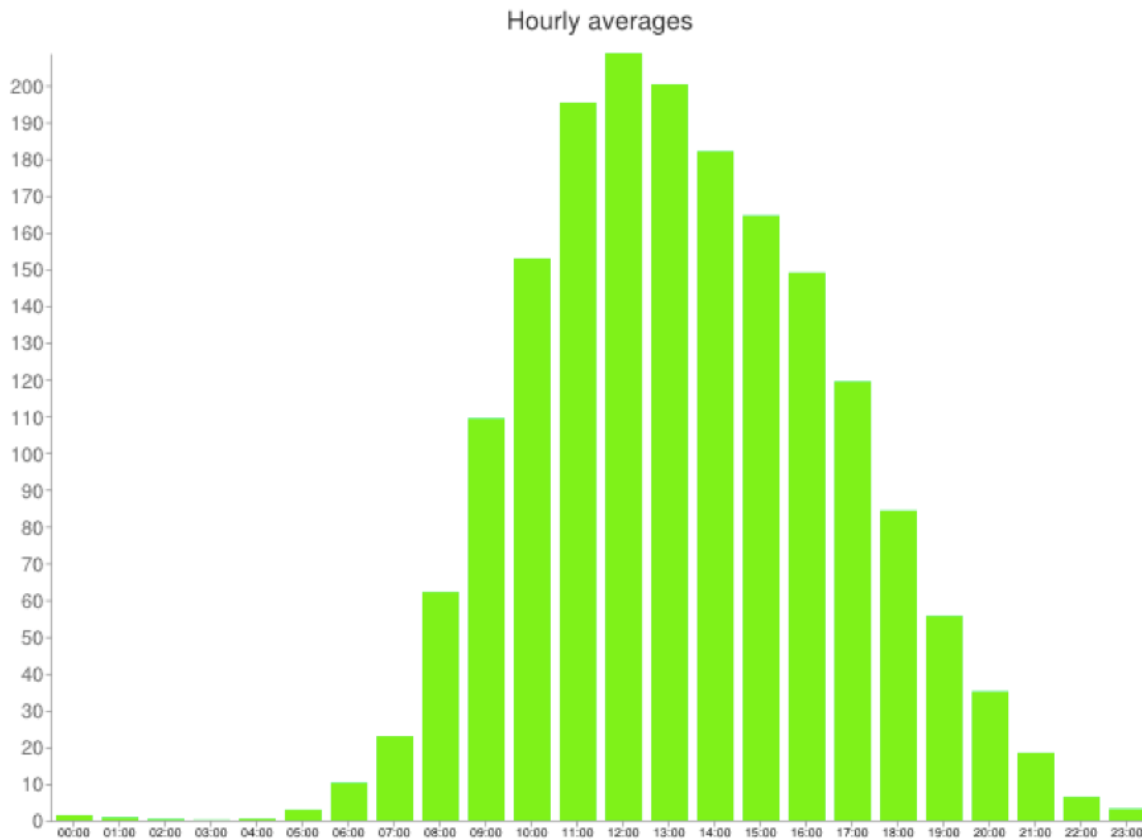
Figure 8: Logan Pass 1B daily vehicle activity across the 2012 Season



Sunday averaged the highest percent of weekly vehicle activity with an average of 16.2% of percent weekly vehicle activity. The mean vehicle activity for Sunday was 1,995. Saturday and Monday ranked closely together with 14.8% and 14.9% respectively. Saturday averaged 1,827 vehicles and Monday averaged 1,841 vehicles. Friday averaged the lowest percent vehicle activity by week with 13% and a mean of 1,599 vehicles.

Figure 9 displays average hourly vehicle activity at the Logan Pass 1B vehicle counter. The hourly average was 74 vehicles, with a median of 45 vehicles per hour. The standard deviation was 75.6 vehicles, indicating that hourly vehicle activity varied greatly. The shape of the graph is skewed to the right. Vehicle activity tended to rise sharply from 8:00 AM until activity peaked at 12:00 PM. A gradual decline in vehicle activity tended to occur from 1:00 PM until 8:00 PM. Maximum vehicle activity tended to occur between 12:00 PM and 1:00 PM with an average maximum value of 209 vehicles for the hour.

Figure 9: Logan Pass 1B hourly vehicle activity averages: 2012



4.2.3 What are the traffic flow patterns for eastbound traffic east of Logan Pass?

Logan Pass 2A counted vehicle traffic traveling east on the Going to the Sun Road and was located about a quarter mile east of Logan Pass. Installation of the counter was delayed until mid-July due to lingering. The counter was installed July 19th and data collection began July 20th. Data collection ended September 12th and the counter was removed September 13th.

Manual calibration occurred on July 23rd from 9:49 AM to 11:49 AM. Total manual count during calibration was 228 vehicles. The vehicle counter recorded 217 vehicles during that time for a difference of 11 vehicles. An adjustment factor of 1.05069 was derived by dividing the manual count by the vehicle counter data.

Table 8 summarizes 55 days of data collection for Logan Pass 2A. A vehicle count of 20,913 was registered over the final 12 days of July. Average daily vehicle count in July was 1,743. Our estimated total vehicle count for the entire month of July is 54,025. The entire month of August was monitored, with a total vehicle count of 51,113 and an average daily count of 1,649 vehicles. The vehicle counter recorded data during the first 12 days of September for a vehicle total of 17,454 and an average of 1,455 vehicles per day. Our estimates suggest a total of 43,650 vehicles were registered at this location for the month of September, although the estimate is likely inaccurate because the road was closed west of Logan Pass in late September, thus altering typical traffic flow. Our total vehicle estimate at Logan Pass 2A from the beginning of July to the

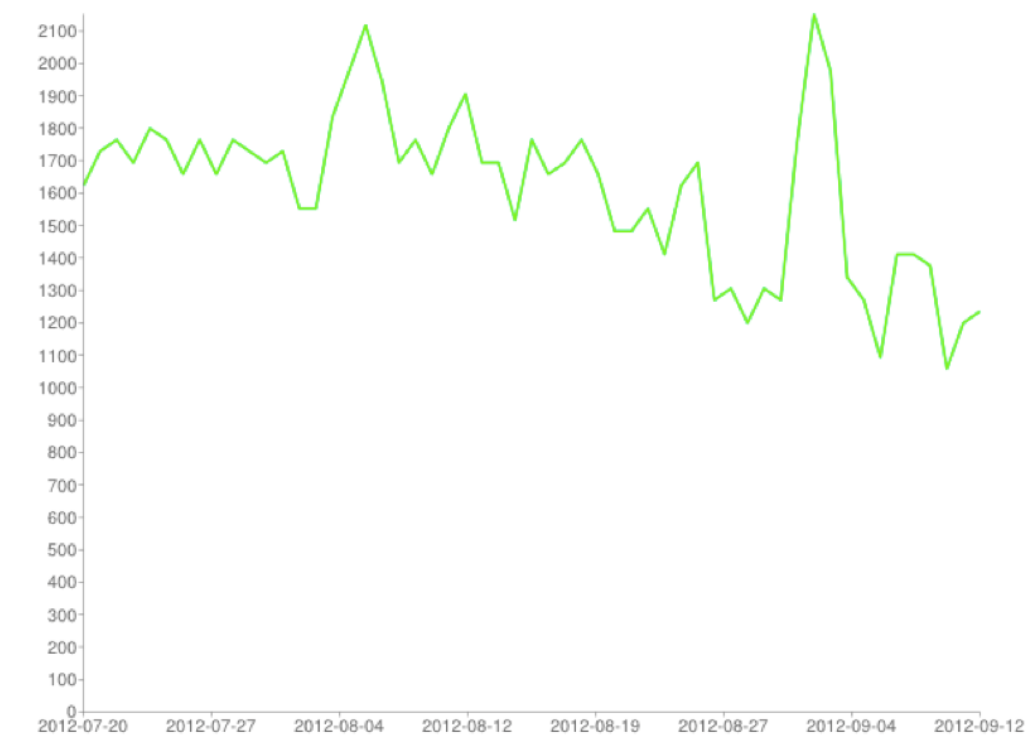
end of September is 148,788.

Table 8: Logan Pass 2A vehicle count statistics: 2012

Month	VC data	# days monitored	Daily average	Total estimate
July	20,913	12	1,743	54,025
August	51,113	31	1,649	52,113
September	17,454	12	1,455	43,650
Total	89,480	55	1,616	148,788

Vehicle activity at the Logan Pass 2A vehicle counter averaged 1,616 vehicles per day over the course of the monitoring season. The median was 1,691 vehicles. The maximum vehicle count occurred on September 2nd with 2,152 vehicles recorded. Minimum vehicle count took place on September 10th with 1,072 vehicles recorded (Figure 10).

Figure 10: Logan Pass 2A daily vehicle activity across the 2012 Season

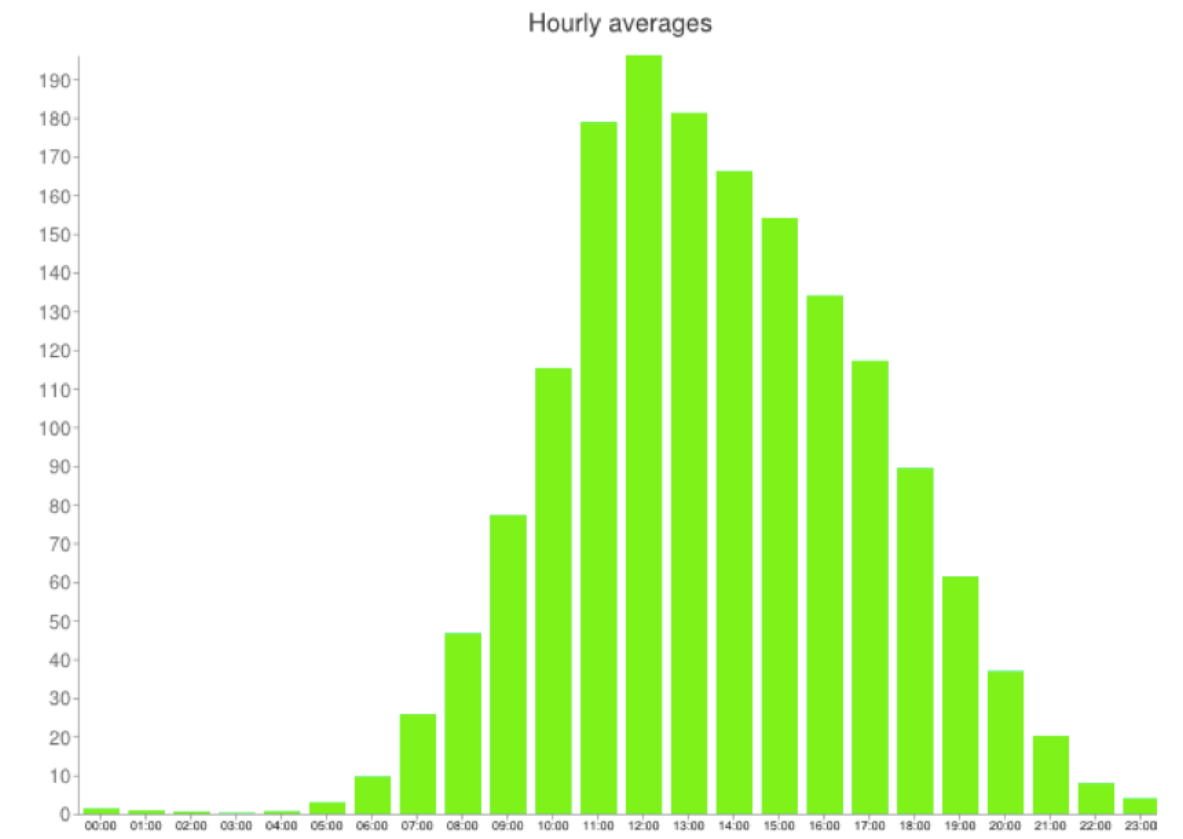


Saturday and Sunday averaged the highest percent of weekly vehicle activity, averaging 15% and 15.9% of use by day of week respectively. The mean vehicle activity for Saturday was 1,712, and the mean vehicle activity on Sunday was 1,811. Monday averaged 1,665 vehicles, averaging 14.6% of vehicle activity by day of week. Tuesday, Thursday and Friday averaged similar percentages with 13.9%, 13.6% and 13.7% respectively. Wednesday averaged the lowest amount of vehicle activity by day of week with 13.2% and averaging 1,501 vehicles.

Figure 11 displays average hourly vehicle activity at the Logan Pass 2A vehicle counter. The

hourly average was 68 vehicles, with a median of 41.7 vehicles per hour. The shape of the graph is skewed to the right, indicating that vehicle activity tended to rise sharply from 6:00 AM until activity peaked at 12:00 PM, then declined more steadily thereafter. Maximum vehicle activity tended to occur between 12:00 PM and 1:00 PM with an average maximum value of 196 vehicles for the hour.

Figure 11: Logan Pass 2A hourly vehicle activity averages: 2012



4.2.4 What are the traffic flow patterns for westbound traffic east of Logan Pass?

Logan Pass 2B counted vehicle traffic traveling west on the Going to the Sun Road and was located about a quarter mile east of Logan Pass. Installation of the counter was delayed until mid-July due to a lingering snowfield in the area that hindered our ability to install the counter. The final location of the counter was located a few hundred feet west of the Logan Pass 2A counter. We originally planned for Logan Pass 2A and Logan Pass 2B to be located across the

road from each other, but we could not find a suitable location near Logan Pass 2A, thus a suitable location for Logan Pass 2B was found closer to the Logan Pass parking area. The counter was installed July 21st and data collection began July 22nd. Data collection ended September 12th and the counter was removed September 13th.

Manual calibration occurred for two hour periods on July 23rd, August 11th and August 12th. Total manual count during calibration was 692 vehicles. The vehicle counter recorded 608 vehicles during that time for a difference of 84 vehicles. An adjustment factor of 1.13815 was derived by dividing the manual count by the vehicle counter data.

Table 9 summarizes 53 days of data collection for Logan Pass 2B. A vehicle count of 15,905 was registered over the last 10 days of July. Average daily vehicle count in July was 1,591. Our estimated total vehicle count for the entire month of July is 49,321. The entire month of August was monitored, with a total vehicle count of 50,354 with an average daily count of 1,624 vehicles. The vehicle counter recorded data during the first 12 days of September for a vehicle total of 16,449 and an average of 1,371 vehicles per day. Our estimates suggest a total of 41,130 vehicles were registered at this location for the month of September; although, similar to the other road counters for this time period, the estimate is likely inaccurate because the road was closed west of Logan Pass in late September, thus altering typical traffic flows. Our total vehicle estimate at Logan Pass 2B from the beginning of July to the end of September is 140,805.

Table 9: Logan Pass 2B vehicle count statistics: 2012

Month	VC data	# days monitored	Daily average	Total estimate
July	15,905	10	1,591	49,321
August	50,354	31	1,624	50,354
September	16,449	12	1,371	41,130
Total	82,708	53	1,561	140,805

The Logan Pass 2B vehicle counter registered an average of 1,561 vehicles a day. The median was 1,483 vehicles. The maximum vehicle count occurred on August 4th with 2,487 vehicles recorded. Minimum vehicle count took place on September 10th with 961 vehicles recorded (Figure 12).

Saturday and Sunday averaged the highest percent of weekly vehicle activity, averaging 16.2% and 16% of use by day of week respectively. The mean vehicle activity for Saturday was 1,769, and mean vehicle activity on Sunday was 1,756. Friday was the third heaviest used day of the week, averaging 1,622 vehicles, and comprising 14.6% of vehicle activity by day of week. Monday averaged 13.8% of use by day of week with an average of 1,513 vehicles. Tuesday and Thursday ranked closely together with 13.1% and 13.3% of use by day of week. Wednesday averaged the lowest with a mean of 1,394 visitors and an average of 12.7% of use by day of week.

Figure 13 displays average hourly vehicle activity at the Logan Pass 2B vehicle counter. The hourly average was 66 vehicles, with a median of 50.8 vehicles. The shape of the graph is

roughly uniform. Activity tended to rise starting at 6:00 AM, until it peaked at 2:00 PM. Vehicle activity was generally very high from 10:00 AM to about 4:00 PM. Use tended to begin to decline beginning at 4:00 PM. Maximum vehicle activity typically occurred from 2:00 PM to 3:00 PM with an average maximum value of 159 vehicles for the hour.

Figure 12: Logan Pass 2B daily vehicle activity across the 2012 Season

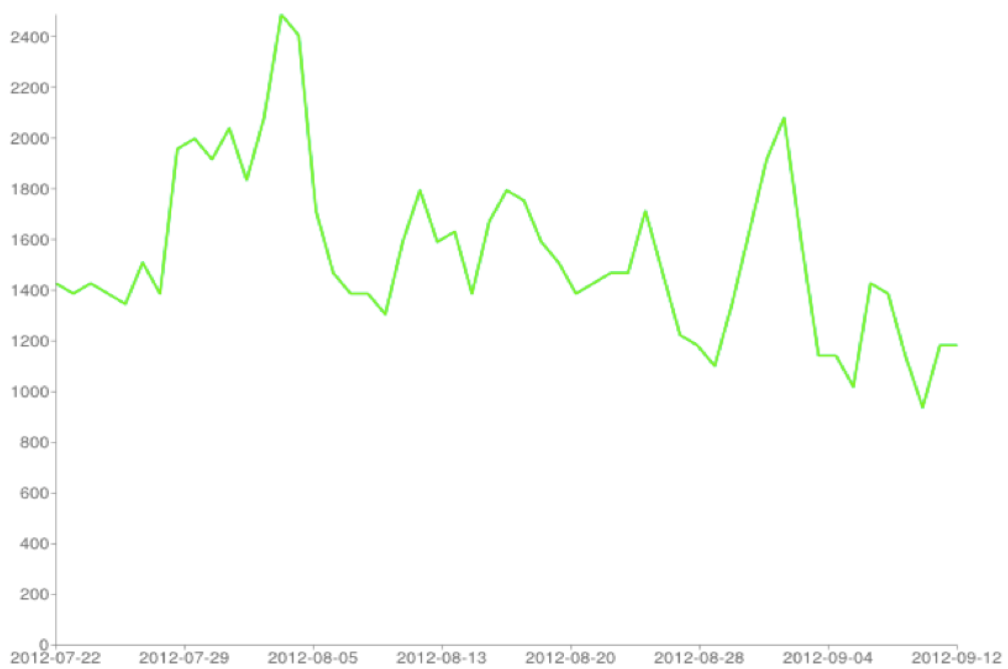
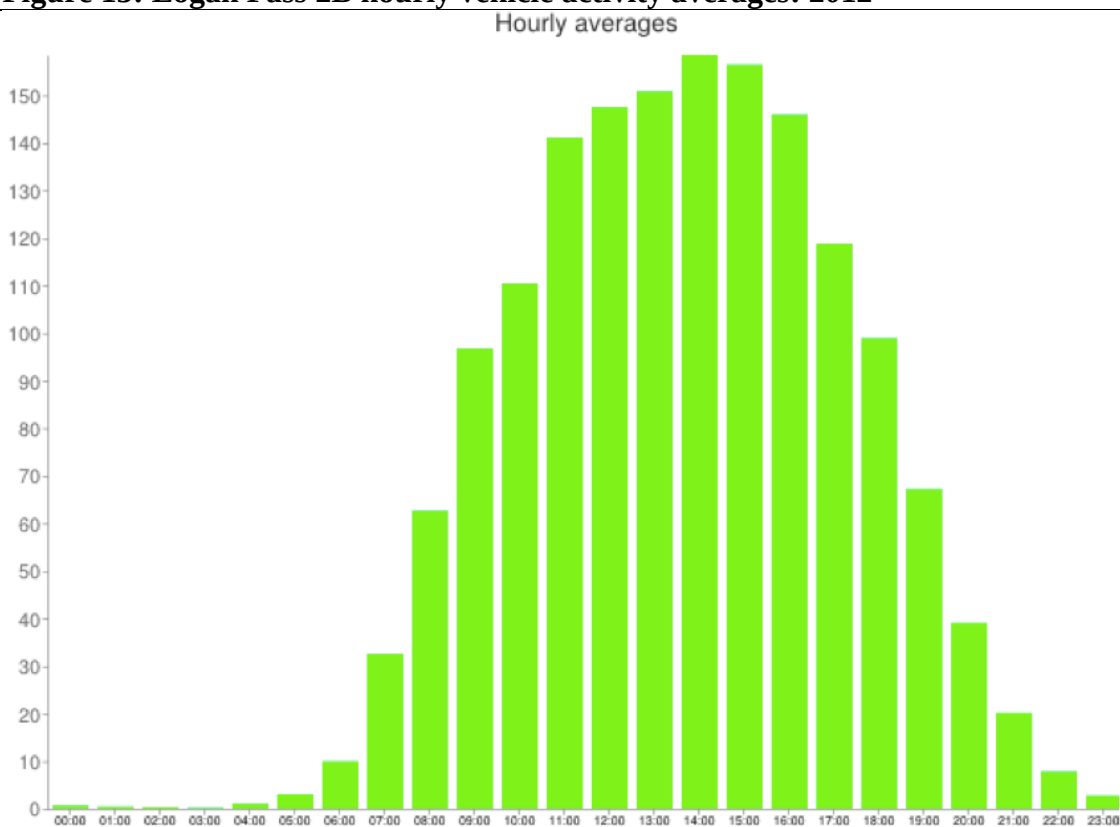


Figure 13: Logan Pass 2B hourly vehicle activity averages: 2012



5. How do visitors use and experience the shuttle?

In 2006, 73% of visitors interviewed at Logan Pass indicated a willingness to take a shuttle.

In the first year of the shuttle, 2007, visitors were asked to indicate all of the locations where they had gotten off the shuttle during their visit. Logan Pass was the most popular location for visitors to get off the shuttle (84.6%), followed by Apgar Transit Center (36.3%) and Avalanche Creek (28%). It was the 3rd most popular location to board the shuttle (6.6% of visitors boarded at Logan Pass) after Apgar Transit Center (66.9%) and the St. Mary Visitor Center (12.7%). Logan Pass was the transfer point for visitors traveling the entire road by shuttle. Visitors traveling from the west side of the park (blue route) transferred to the red route to continue their journey to the east side of the park. Some visitors may have considered this an initial boarding of the red route.

The most popular shuttle stops for beginning loop hikes in 2007 were Logan Pass (38.5%), St. Mary Falls (15.4%), and The Loop (12.3%). In addition, visitors were asked to indicate at which shuttle stop they ended their loop hike. The most popular responses were The Loop (29.7%), Logan Pass (18.8%), and Sunrift Gorge (18.8%).

The 2007 Stakeholder Evaluation interviewed both visitors and shuttle drivers. Stakeholders commented that crowding on the shuttles was sometimes problematic.

Shuttle drivers suggested implementing additional routes specifically for the purpose of accommodating more visitors. Specifically, they suggested additional express routes from Apgar Transit Center to The Loop and from Apgar Transit Center to Logan Pass during peak times (i.e. mid-morning and in the afternoon) and that they would like more information about the shuttle to be available to visitors at Logan Pass.

Visitor suggestions related to Logan Pass showed a desire for earlier bus service to Logan Pass for hikers.

In contrast to suggestions made by visitors, volunteers and shuttle drivers, park employee suggestions for shuttle capacity problems were not focused on accommodating greater numbers of riders. Instead, park personnel suggested improving visitor understanding of goals of the shuttle system. Park employees also expressed concern over shuttle drivers not stopping at appropriate queuing areas, especially at Logan Pass.

One of the adjustments made to the shuttle system at Logan Pass during the 2007 season was the implementation of the “load eight” policy on the west side of the park. Implemented to ensure that seating would be available to visitors at shuttle stops down the road, the policy allowed buses to load only eight passengers at a time at the Apgar Transit Center and Logan Pass, thus leaving four empty seats for passengers at other shuttle stops.

The load eight policy received mixed reviews from park visitors. While some visitors suggested continuing to leave seats on the bus so visitors would be able to board buses at shuttle stops between Apgar Transit Center and Logan Pass, others suggested filling the buses up at Apgar Transit Center. Some visitors noted that there was no way of knowing if visitors along the road had been waiting longer than those at Apgar Transit Center, so it was unfair to hold seats for them.

The primary nature of the comments in the 2007 Stakeholder Evaluation on shuttle stop design at Logan Pass were in reference to signage and queuing. Initially signage for both the westbound and eastbound routes was located in the same area. This created a situation where visitors did not understand where to line up for loading. To remedy this, the park placed separate signs indicating where the queue for each route was located. These signs, however, were located below eye level and were often hidden when visitors stood in front of the sign while waiting for a bus. Stakeholders suggested replacing the existing signage with larger, more noticeable queuing signs.

The 2009 study surveyed both shuttle and non-shuttle riders at Logan Pass and The Loop. Shuttle riders were significantly more likely to make planned than unplanned stops. Ninety-three percent of shuttle rider stops at Logan Pass and The Loop were stops planned in advance. For non-shuttle riders, only 66% of stops at Logan Pass and The Loop were planned.

Shuttle riders at Logan Pass in 2009 were also asked if their decisions on where and how often to stop at roadside pullouts were influenced by the fact that they were riding the shuttle. Specifically shuttle riders were asked if the shuttle influenced their decisions about where to stop. If it did, shuttle riders were asked if riding the shuttle influenced them to stop at more stops, fewer stops, or different stops than they would have if they had been driving their own vehicle.

Almost 50% of shuttle riders surveyed said that riding the shuttle did not influence their decision about where to stop. However, for those who were influenced by riding the shuttle, most were influenced to stop less than if they had driven their own vehicle.

Shuttle riders in the 2009 survey were also asked if riding the shuttle influenced activity decisions when they stopped at Logan Pass or The Loop. A large majority (86%) said that riding the shuttle did not influence what they did at these stops. Shuttle riders who did change their activity were asked to explain how their activities changed. Of the 45 respondents who did say that the riding shuttle influenced their activities, eight mentioned that they were not able to do what they wanted to do at the stop because they were afraid of missing the next shuttle or that they had to shorten their visit to catch a shuttle. Eight said that riding the shuttle influenced them to take a hike that they would not have otherwise taken. Six said that the shuttle allowed them to stop when they might not have otherwise because they did not have to park in congested parking area. It should be noted that not all of the respondents who said riding the shuttle changed their activity choice(s) provided an explanation of how their activities were changed.

Hikers who were waiting to catch the shuttle at The Loop in order to get up to the Logan Pass trailhead to begin a hike or to return to the Logan Pass parking lot to retrieve their vehicle after completing their hike had great difficulty getting on a shuttle. Shuttles coming up to The Loop from the west side of the park were usually full when they reached The Loop because very few passengers get off at shuttle stops lower down the road. Therefore, hikers were often stranded at The Loop for a long time waiting to get a shuttle to Logan Pass.

6. What are the characteristics of Logan Pass visitors?

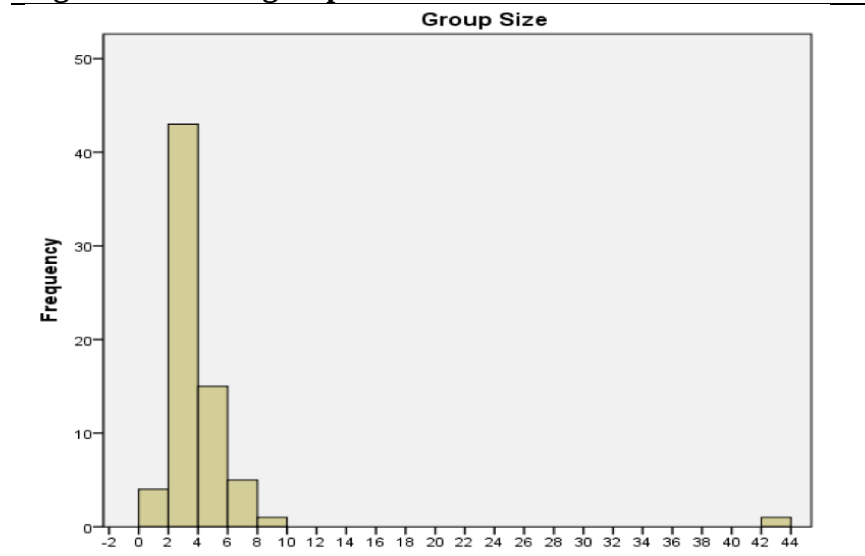
6.1 What is the typical group size and composition of Logan Pass visitors?

In 2006, the mean group size was 4.27 visitors. By 2011, the median group size was two and the mean group size was 3.55 (out of 69 total observations) (Table 10). Approximately 51% of the total groups participating in the GPS study were groups of two people, followed by groups of four (14.5%), and groups of three (11.6%) (Figure 14).

Table 10: Hiker group size on the Hidden Lake Trail: 2011

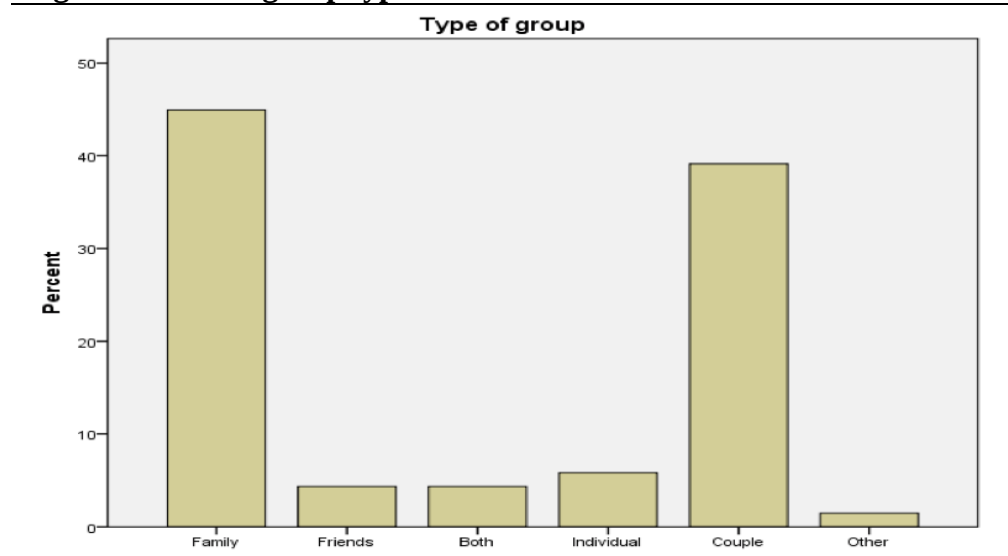
Variable	
Mean	3.55
Median	2.00
Mode	2
Standard deviation	4.954
Minimum	1
Maximum	42

Figure 14: Hiker group size on the Hidden Lake Trail: 2011



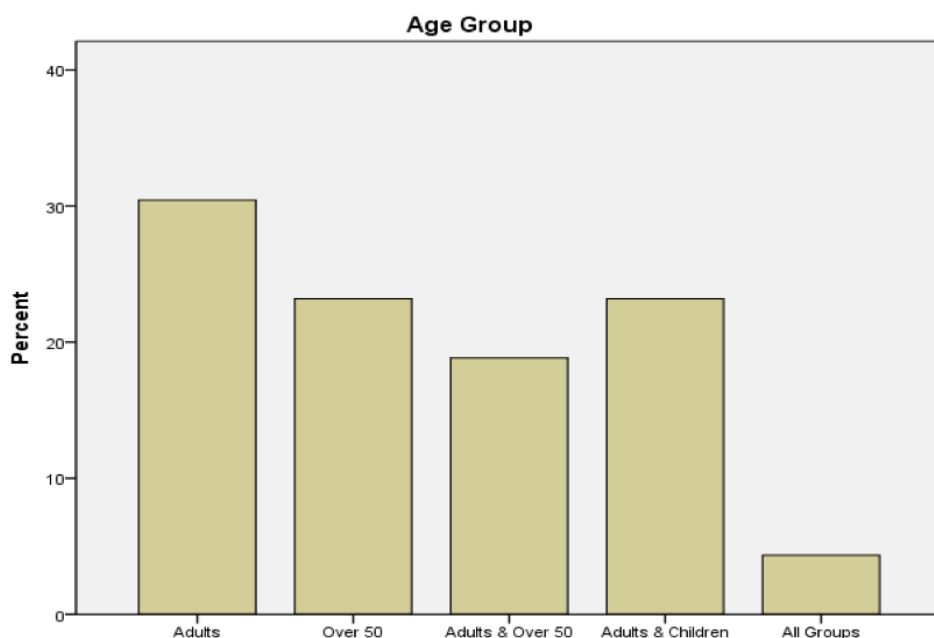
In 2011, visitors at Hidden Lake were recorded in one of the following categories: alone, couples, friends, family, or family and friends (both), shuttle groups, red bus tour groups, and other, which included organized groups. Forty-five percent of visitors observed were part of a group of family members and 39% were couples (Figure 15).

Figure 15: Hiker group types at the Hidden Lake Trail: 2011



Hikers were placed into 3 age categories: children, adults, and adults over fifty (figure 16). Thirty percent of the hikers were in groups of just adults. Groups of adults over fifty and also groups of adults with children occurred in 23% of the observations. Nineteen percent were groups of adults and people over fifty. Groups composed of people representing all three categories were observed 4.3% of the time.

Figure 16: Hiker age group on the Hidden Lake Trail: 2011



6.2 Why do visitors stop at Logan Pass?

In 2006, 85% of visitors interviewed had planned to stop at Logan Pass. The top two reasons people indicated for stopping at Logan Pass were to look at the view and because a hike started there. These were followed by visitors who indicated “other,” which was comprised of other reasons including this was my destination, meeting party here, and photography. The following table shows the reasons cited by respondents for stopping at Logan Pass (Table 11). The cumulative percent is larger than 100 because some visitors cited multiple reasons for stopping.

Table 11: Reasons cited by respondents for stopping at Logan Pass: 2006

Reason for stopping ¹	Number	Percent ²
Look at this particular view	44	41.1%
Starting a hike here	39	36.4%
Needed the facilities here	12	11.2%
Photograph this particular view	12	11.2%
To see the interpretive exhibit	11	10.3%
This was my destination ³	5	4.7%
First spot available	4	3.7%
Needed a break from driving	4	3.7%
Wildlife nearby	3	2.8%
Been here before ³	3	2.8%
Kids need a break	2	1.9%
Jammer tour ³	2	1.9%
Fishing ³	2	1.9%
Group wanted to stop ³	2	1.9%

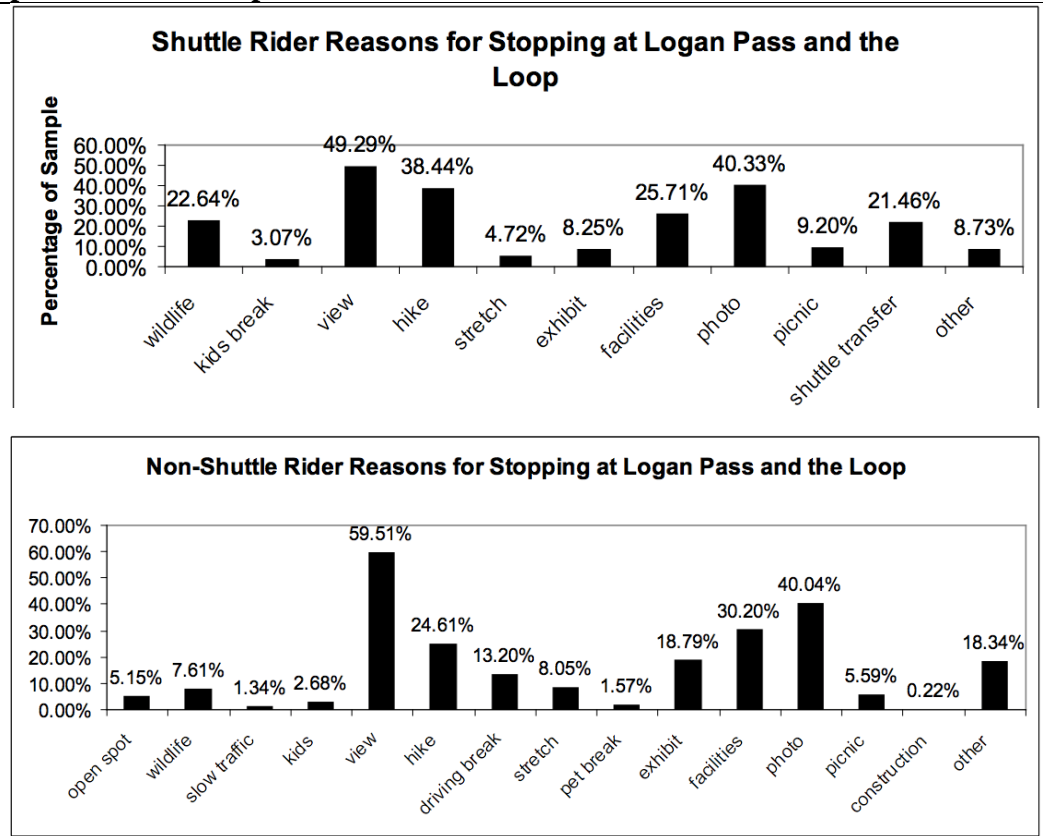
¹Items cited by less than one percent of respondents are not included.

²Cumulative percent may be greater than 100% due to respondents' ability to cite multiple reasons for stopping.

³Reasons given under the category of "other".

The 2009 study, which surveyed visitors at Logan Pass and The Loop, found that for both shuttle and non-shuttle riders, the most common reasons for stopping were to look at the view, to start a hike, and to take a photo (figure 17). However, shuttle riders were slightly more likely than non-shuttle riders to stop at The Loop or Logan Pass to start a hike (38% vs. 25% respectively).

Figure 17: Shuttle And non-shuttle rider reasons for stopping at Logan pass and The Loop: 2009



7. How do hikers use and experience Logan Pass?

7.1 How popular is Logan Pass as a hiking destination?

In the 2007 Visitor Use Study, The trails at Logan pass, and the pass itself are among the most popular hiking destinations in the corridor (table 12).

Table 12: Top 5 anticipated hiking destinations reported by survey respondents: 2007

Hiking destination	Number	Percent ¹
Hidden Lake	36	24.8%
Avalanche	30	20.7%
Highline Trail	22	15.2%
Grinnell Glacier	12	8.3%
Logan Pass	12	8.3%

¹Many visitors indicated more than one hiking destination

In 2011, the trail counter at the Hidden Lake trail was installed on August 17th, 2011 and it stopped collecting data on September 3rd, 2011. The adjustment factor obtained from the calibration was 1.1354 (4,294 counts from the visual observations divided by the 3,782 trail counter's counts). Those results suggested that the trail counter was 88 percent accurate.

Observers noted that it is a busy trail, and many visitors walk side-by-side or in tight clusters. Thus, the underestimation registered by the trail counter is reasonable.

The 2011 study found that during the summer season, the Hidden Lake trail was the most heavily used within the corridor (mean = 811 people per day) followed by Avalanche Lake (mean = 796 people per day) and the Highline trail (mean = 623 people per day). In contrast, the Siyeh Bend and Sunrift Gorge trails averaged 50 or fewer visitors per day in the summer. Table 13 shows trail counter data from 8 trails along the GTTSR corridor monitored in 2011.

Table 13: Trail counter data from 8 trails along the GTTSR corridor: 2011

Trail	Variable					
	<u># of days monitored</u>	<u>Visitation registered</u>	<u>Daily average</u>	<u>Total visitation estimated</u>	<u>Max. visitation¹</u>	<u>Min. visitation¹</u>
Avalanche	103	45,620	443	68,238	1,185	8
The Loop	36	9,678	269	15,652	418	98
Highline	15	9,338	623	19,299	779	353
Hidden Lake	16	12,971	811	40,280	1,054	51
Siyeh Bend	69	3,416	50	6,853	186	0
Sunrift Gorge	87	4,019	46	6,090	156	0
St. Mary Falls	100	37,005	370	45,465	856	3
Virginia Falls	100	13,960	140	17,833	605	0

¹Visitation for a single day

The same trails were monitored again in 2012. Table 14 displays 2011 and 2012 trail data during similar time frames in order to develop accurate comparisons, and table 15 displays 2011 and 2012 trail counter data for the entire length of time monitored.

Table 14: 2011 and 2012 trail counter comparisons over a similar time period

Trail	Year	# of days monitored	Visitation registered	Daily average	Max.	Min.
Avalanche Lake (July 14 – Nov. 1)	2011	112	53,891	485	1,489	2
	2012	101	45,591	456	1,185	8
The Loop (July 20 – Aug. 16)	2011	26	7,668	295	459	152
	2012	28	7,599	271	418	98
Highline (Aug. 10 – Aug. 24)	2011	15	8,671	578	829	117
	2012	15	9,338	623	779	353
Hidden Lake (Aug. 18 – Sept. 22)	2011	16	16,801	1,005	1,289	413
	2012	16	12,971	811	1,054	51
Siyeh Bend (Aug. 18 – Sept. 29)	2011	43	2,406	56	163	3
	2012	43	2,634	61	186	0
Sunrift Gorge (July 20 – Aug. 26)	2011	31	2,785	90	145	47
	2012	31	2,525	81	156	24
St. Mary Falls (July 13 – Sept. 26)	2011	76	38,222	503	872	85
	2012	76	36,340	478	856	34
Virginia Falls (July 13 – Sept 25)	2011	78	16,367	210	507	10
	2012	78	13,851	178	605	4

Table 15: 2011 and 2012 trail counter comparisons over length of the monitoring period

Trail	Year	# of days monitored	Visitation registered	Daily average	Max.	Min.
Avalanche Lake	2011	142	70,398	496	1,489	2
	2012	103	45,620	443	1,185	8
The Loop	2011	33	8,501	258	459	20
	2012	36	9,678	269	418	98
Highline	2011	47	26,410	562	865	68
	2012	15	9,338	623	779	353
Hidden Lake	2011	38	38,865	1,023	1,499	206
	2012	16	12,971	811	1,054	51
Siyeh Bend	2011	83	5,807	83	218	3
	2012	69	3,416	50	186	0
Sunrift Gorge	2011	58	4,168	72	246	21
	2012	87	4,019	46	156	0
St. Mary Falls	2011	95	48,080	506	872	85
	2012	100	37,005	307	856	3
Virginia Falls	2011	87	19,597	225	507	10
	2012	100	13,960	140	605	0

7.2 How many hikers use the Logan Pass trails?

The 2011 study found that during the summer season, the Hidden Lake Trail was the most heavily used within the corridor, with 12,971 visitors recorded over a 16-day monitoring period and a mean of 811 people per day. Table 13 (above) shows trail counter data from 8 trails along the GTTSR corridor monitored in 2011.

The trail counter at the Hidden Lake trail was installed on August 17th, 2011 and it stopped collecting data on September 3rd, 2011. The adjustment factor obtained from the calibration was 1.1354 (4,294 counts from the visual observations divided by the 3,782 trail counter's counts). Those results suggested that the trail counter was 88 percent accurate. Observers noted that it is a busy trail, and many visitors walk side-by-side or in tight clusters. Thus, the underestimation registered by the trail counter is reasonable (Table 16).

Table 16: Estimated visitation on the Hidden Lake Trail in August and September 2011

Month	TC Data	# days monitored	Daily average	Total estimate
August	12,067	14	862	26,720
September	904	2	452	13,560
Total	12,971	16	811	40,280

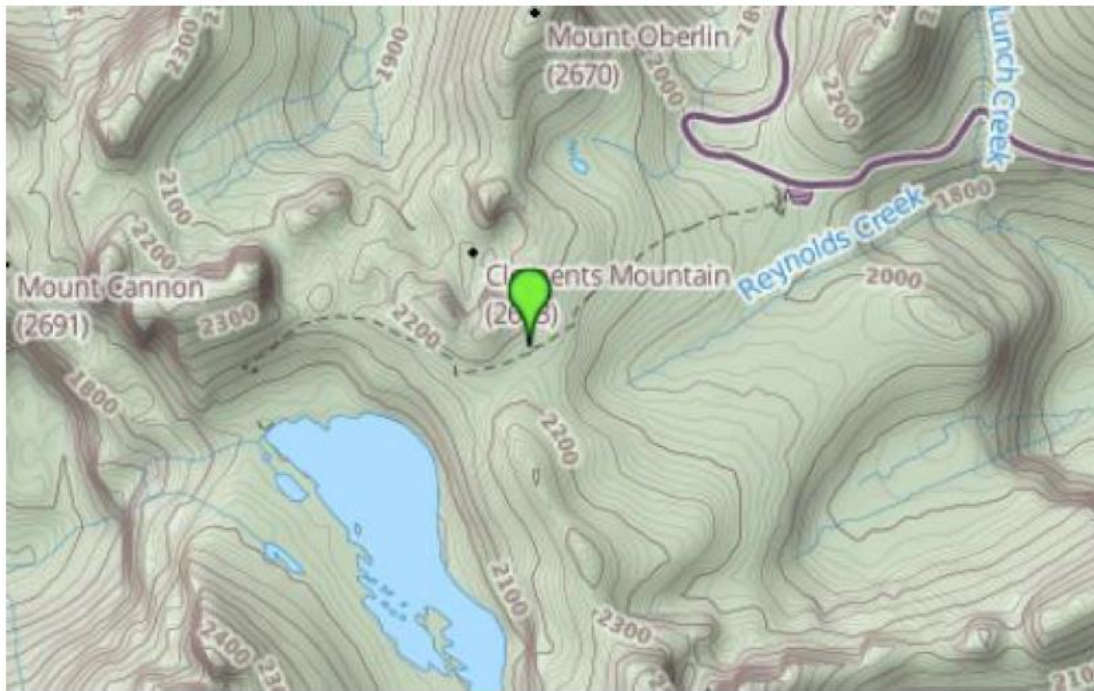
In addition, the 2011 study monitored use on the Highline Trail as well as the direction of travel. This study found that 69.45% of the hikers observed on the Highline Trail were walking toward the Chalet and only 30.55% hiked toward to Logan Pass. The trail counts were multiplied by 1.09 to adjust the results of the calibration. The estimate from the trail counter in table 17 shows that the total use on The Highline Trail during the month monitored (August) was 19,299 visitors.

Table 17: August trail counter data and observed route direction on the Highline Trail: 2011

Month	TC data	# days monitored	Daily average	Total estimate
August	9,338	15	623	19,299
Mornings		Toward Chalet		Toward Logan Pass
August 13 from 9 AM to 2 PM		441		87
August 15 from 9 AM to 2PM		392		85
Total observations		833		172
Percent		82.89%		17.11%
Afternoons		Toward Chalet		Toward Logan Pass
August 14 from 2 PM to 7 PM		76		147
August 16 from 2 PM to 7 PM		57		106
Total observations		133		253
Percent		34.46%		65.54%
Total observations The Loop		966		425
Total percent		69.45		30.55

In 2012, the trail counter on the Hidden Lake trail was installed August 3rd and data collection began on August 4th. Data collection ended on September 12th and the counter was removed on September 13th. The counter was located near a footbridge about a 5-minute walk from the Hidden Lake overlook (Figure 18). The purpose of this counter was to collect data on users who hike to the overlook. An adjustment factor of 1.084399 was derived by dividing the total cameral count by the trail counter data.

Figure 18: Location of the 2012 trail counter



Visitor counts for the Hidden Lake trail were divided by two because we believe most visitors use this trail as an out and back hike. Additionally, 2012 counts have been multiplied by 1.084399 in order to adjust for the results of the calibration. Table 18 summarizes 38 days of data collection carried out on the trail from August 4th to September 12th, 2012. The counter registered 29,773 visitors over 26 days during the month of August for a daily average of 1,145 visitors. We estimate that a total of 35,499 visitors hiked this trail during the entire month of August based on the daily average. The counter monitored visitor counts for the first 12 days of September with a total of 9,092 visitors recorded, averaging 758 visitors a day during those days. We estimate that 22,730 visitors hiked this trail in September as calculated from the daily average. Our total use estimate from the beginning of August to the end of September is 58,229 users.

Table 18: Hidden Lake Trail use statistics: 2012

Month	TC data	# days monitored	Daily average	Total estimate
August	29,773	26	1,145	35,499
September	9,092	12	758	22,730
Total	38,865	38	1,023	58,229

7.3 How does use vary hourly at Hidden Lake?

Over the 2011 season, the average number of visitors per hour was 51.6 people with a median of 38.2 people and a standard deviation of 47 people (demonstrating variation throughout the day).

Figure 19 shows that, in 2011, the trail started to see considerable use around 10:00 AM and remained highly visited until 5:00 PM. The maximum use occurred at 12:00 PM with 120.4 people per hour on average, followed by 1:00 PM with 115.6 people per hour. Although the graph shows the presence of visitors late in the night and early in the morning, those counts may have been caused by wildlife.

Figure 19: Hourly hiker visitation averages on the Hidden Lake Trail: 2011

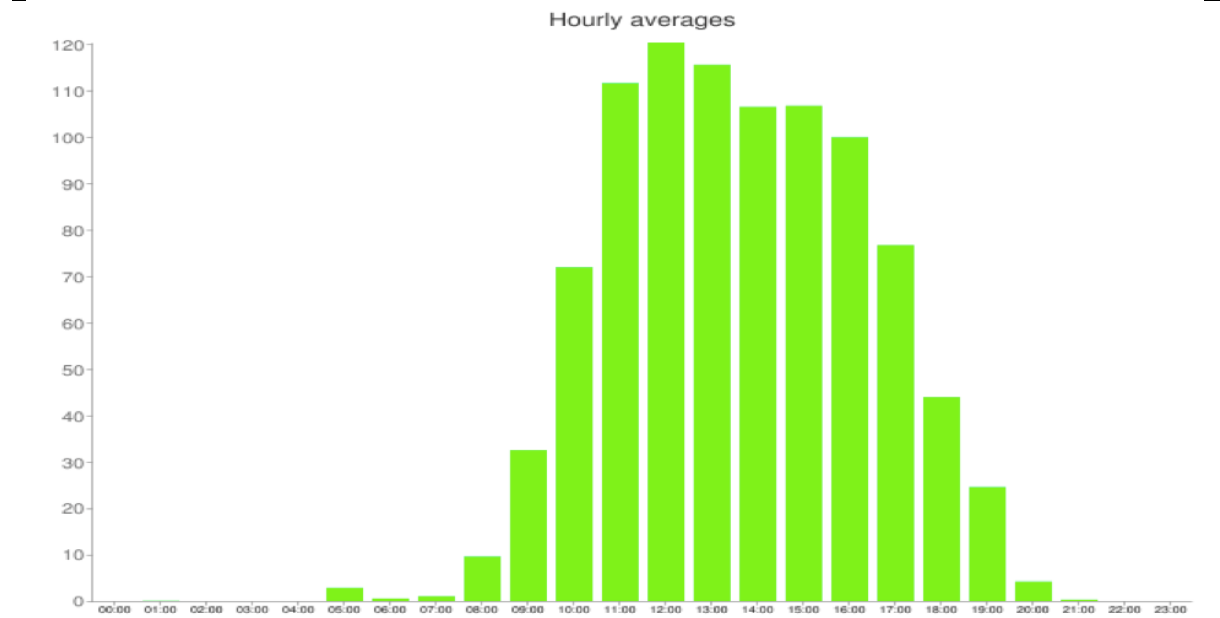
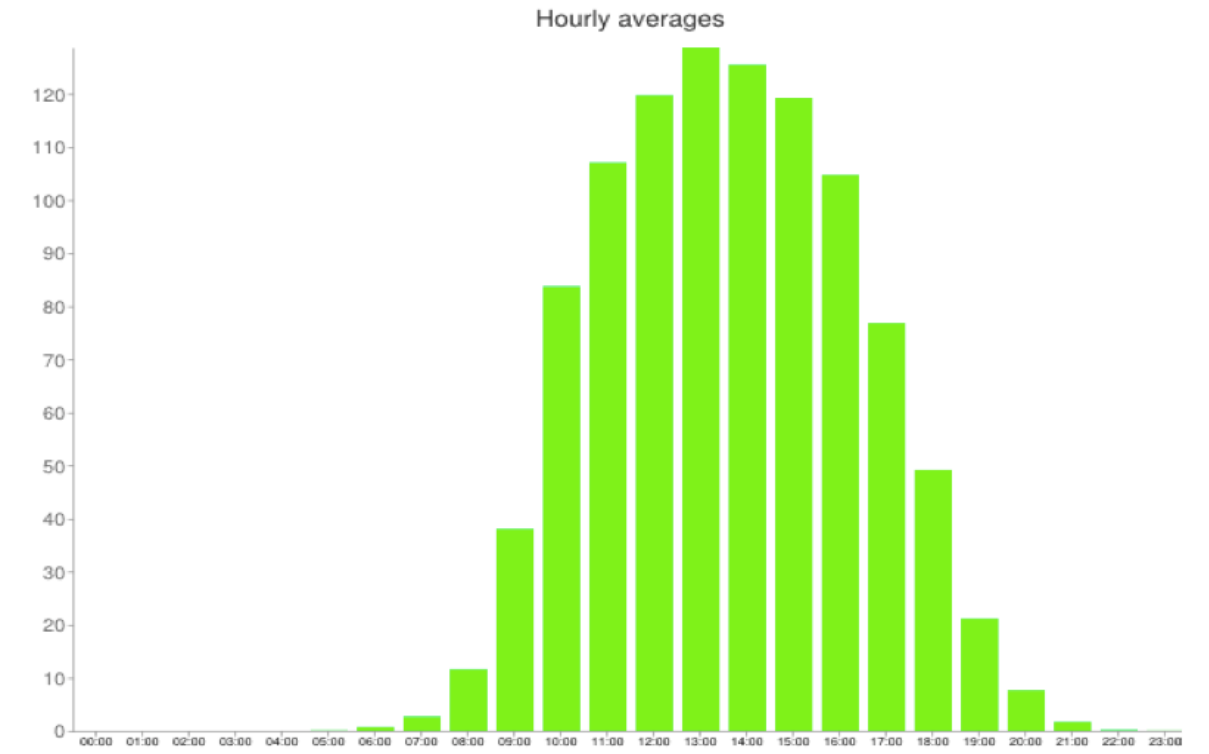


Figure 20 displays average hourly use for the Hidden Lake trail in 2012. The hourly average from 8:00 AM to 8:00 PM was 76 visitors with a median of 84 visitors per hour. Figure 20 displays an hourly use pattern that is roughly bell-shaped. Visitation tended to peak at 1:00 PM with an average of 129 visitors for the hour.

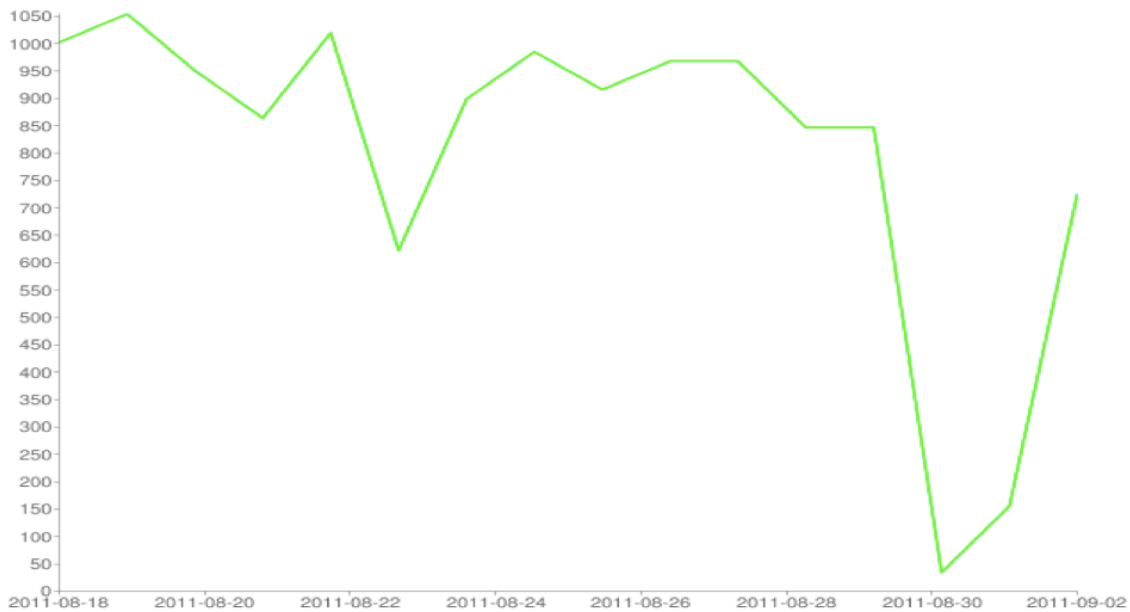
Figure 20: Hourly hiker visitation averages on the Hidden Lake Trail: 2012



7.4 How does use vary seasonally at Hidden Lake?

Figure 21 portrays the trend in daily number of visitors during August along 16 days of the trail counter's operation in 2011. The average daily use from the original data is 810.7 visitors with a median of 910 visitors. The maximum day of visitation registered by the trail counter was August 19th with 1,054 people. The minimum day was August 31st with 51 people. This day was colder than the other days in the sample. The trend shown in the figure reflects the high demand of the trail during the second half of the month. Use gradually decreased at the end of month with a recovery for the Labor Day holiday weekend.

Figure 21: Monthly trend in daily number of visitors on the Hidden Lake Trail: August 2011

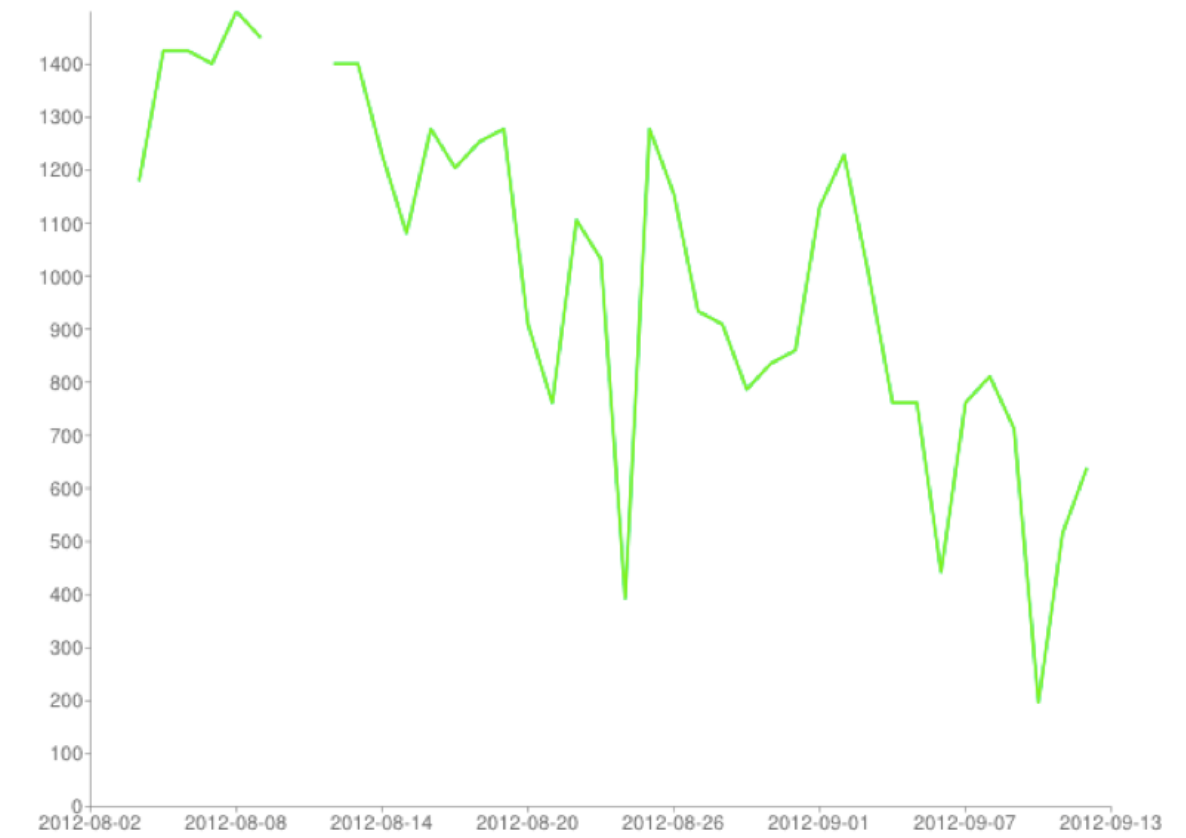


During the 16 days of operation in 2011, the trail counter registered the most visitors on Saturdays with 17% of hikers visiting on this day (mean 962), followed by Mondays and Sundays with 16.6% (mean 943) and 16.4% (mean 928) of visitors respectively. The lowest visitation was on Wednesdays with 8.4% (mean 478).

In 2012, the Hidden Lake trail averaged 1,023 visitors per day over the course of the monitoring season. Median visitation was 1,067 users. The maximum visitation count occurred on August 8th with 1,499 visitors recorded. The minimum visitation was 206 and occurred on September 10th. Figure 22 displays daily use trends on the Hidden Lake trail over the monitoring season. Use peaked near the beginning of August and appeared to trend downward as the season progressed (figure 22).

Over the course of the monitoring season, Saturday and Sunday averaged the largest percent visitation by day of week, averaging 16.1% and 17% of weekly use respectively (Figure 24). Saturday averaged 1,145 visitors and Sunday averaged 1,212 visitors. Thursday accounted for an average of 14.4% of weekly visitation and averaged 986 visitors. Monday and Wednesday both accounted for an average of 13.9% of weekly use. Tuesday and Friday typically accounted for the lowest percentages of weekly use averaging 13.3% and 11.5%, respectively.

**Figure 22: Monthly trend in daily number of visitors on the Hidden Lake Trail:
August 2012**



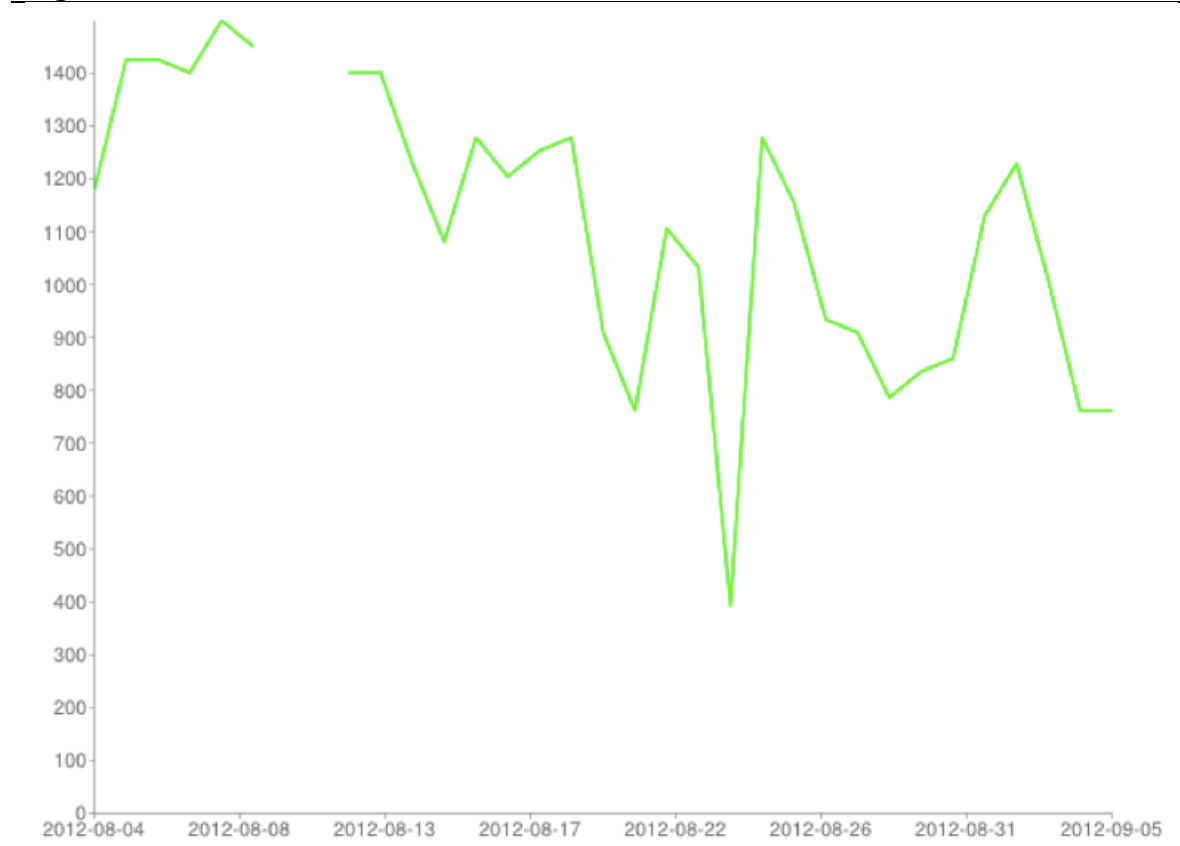
Summer season for the Hidden Lake trail in 2012 includes 31 days of data recorded between August 4th and September 5th 2012. The total visitor count during this period was 34,718 (table 19). The average daily use was 1,120 visitors with a median of 1,175 visitors. The maximum daily use was 1,408 users on August 13th and minimum daily summer use was 413 visitors on August 24th. Use appeared to decline slowly throughout the summer season, although the daily average indicates that average daily visitation was very high despite the decline (Figure 23).

Table 19: Hidden Lake Trail summer 2012 use statistics

Month	TC data	# days monitored	Daily average
August	29,773	26	1,145
September ¹	4,945	5	989
Total	34,718	31	1,120

¹Dates are September 1st to September 5th only

Figure 23: Hidden Lake Trail summer 2012 trends

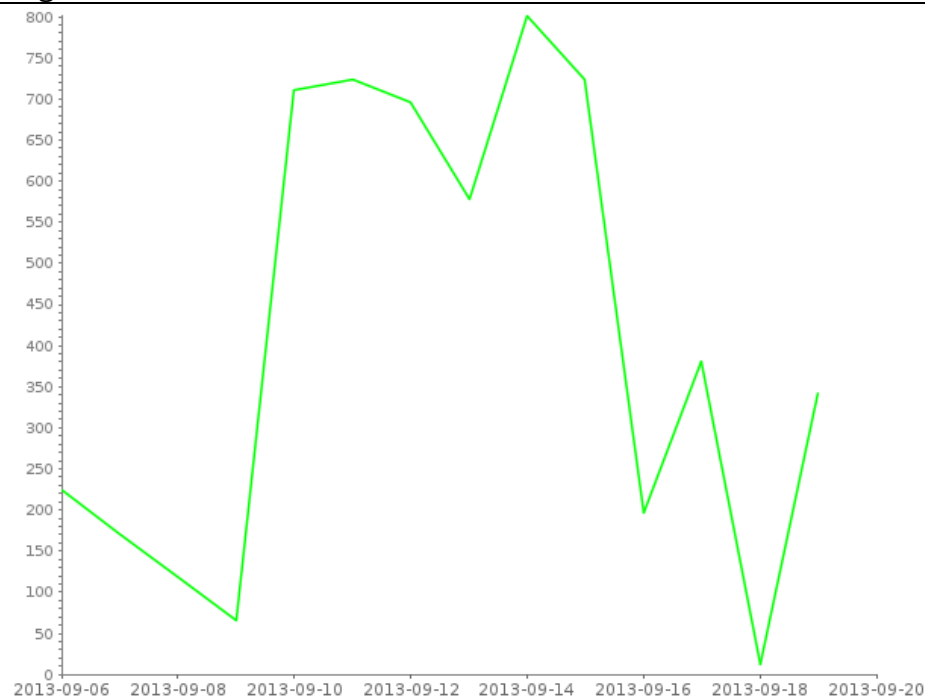


Over the course of the summer monitoring season, Saturday and Sunday averaged the highest percentages of use by day of week with 15.8% and 16.9% respectively. Monday and Thursday averaged similar percentages of weekly use by day of week accounting for 14.7% and 15% of weekly use, respectively. Tuesday and Wednesday averaged 13.2% and 13.6% of weekly use respectively. Friday averaged the lowest percent of weekly use with 10.7% and averaged 832 visitors.

Fall data was collected over a 7-day period from September 5th to September 12th, 2012. It is difficult to draw inferences concerning fall use due to the limited amount of data collected during the fall season, but a basic analysis is still possible. The daily use average during the fall period was 592 users with a median of 17 visitors. Total fall visitation was 4,147 visitors. The maximum day of fall visitation took place on September 8th, with 811 visitors. Minimum visitation was 206 and it occurred on September 10th (Figure 28).

The Hidden Lake trail received the highest percent of fall season visitation in 2012 on Friday, Saturday and Sunday. Those days accounted for 18.5%, 19.6% and 17.7% of weekly use respectively. Friday averaged 766 visitors, Saturday averaged 811 visitors and Sunday averaged 733 visitors. Tuesday and Wednesday accounted for 12.7% and 15.5% of weekly use respectively. Monday and Thursday accounted for the lowest percentages of weekly use averaging 5% and 11.1%, respectively.

Figure 24: Hidden Lake Trail Fall 2012 trends



7.5 Where do Logan Pass hikers plan to go?

In 2006, visitors were asked a series of questions about hiking from Logan Pass. Sixty- one percent of interview respondents planned to hike from Logan Pass. The reported mean estimate for hiking time was 3 hours and the median was 2 hours.

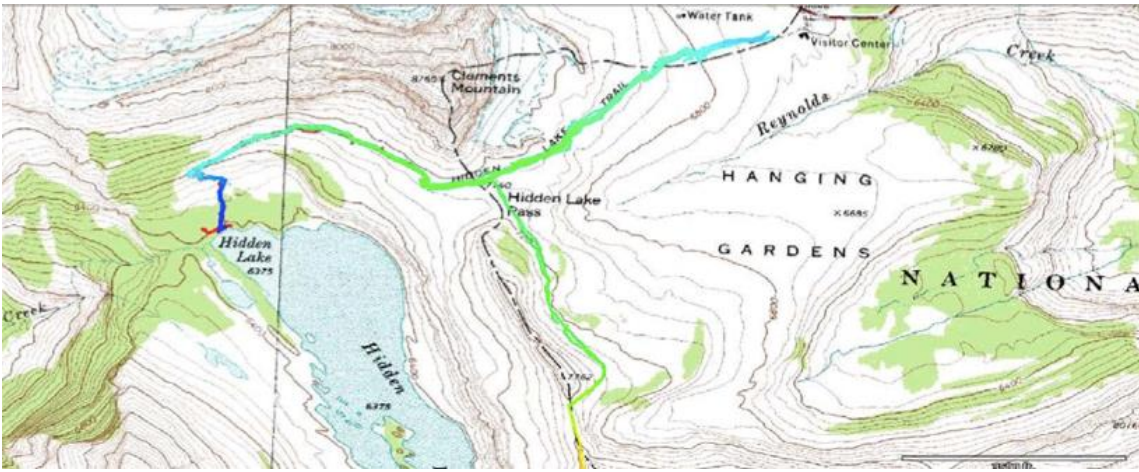
Eighty-one percent of visitors who planned to hike from Logan Pass had a planned destination for their hike. These destinations included: Hidden Lake (38%), Hidden Lake Overlook (18%), Granite Chalet (5%), Highline Trail (10%), Garden Wall (2%), Swift Current (2%), St. Mary Falls (2%), Mt. Oberlin (5%), and Bear Hat Mountain (2%).

7.6 How do hikers experience the Hidden Lake Trail?

During the week of August 20th to 24th, 2011, visitors to Hidden Lake were asked to carry a GPS unit during their hikes. A total of 184 visitors were approached at the trailhead during the five days of the study. Of those, 51 visitors rejected and 133 agreed to participate in the study. Of those 133 tracks saved 64 were not useable due to trouble with GPS units (e.g. the batteries died part way, poor satellite reception, or human error). In total, 69 tracks fulfilled the requirements for the statistical analysis of trail use in the area.

Figure 25 illustrates the routes that visitors explored within the area of interest. Access to Hidden Lake itself was closed on the 21st and 24th, so data on hikes to the actual lake were recorded only on August 20th.

Figure 25: Routes taken by hikers on the Hidden Lake Trail: 2011



The Overlook was the most popular destination on the Hidden Lake Trail with 71% of the visitors electing to visit the Overlook and then turning around. The top of the boardwalk was the second favorite destination with 10% of the visitors turning around there. Hidden Lake and halfway up the boardwalk were both destinations for 5.8% of the visitors (Figures 26 and 27). These results indicate that in the data presented above about the visitors desired destination, that they either confuse the lake with the overlook or underestimate the time or energy needed to hike all the way to the lake.

Figure 26: Popular destinations on the Hidden Lake Trail: 2011

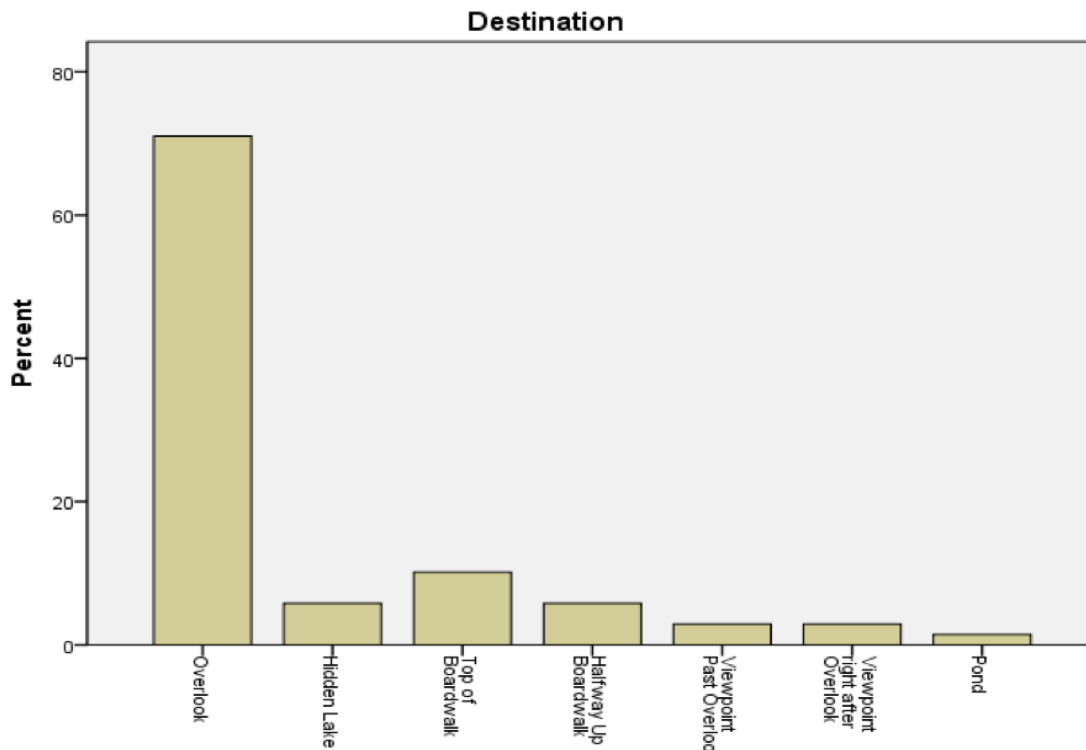
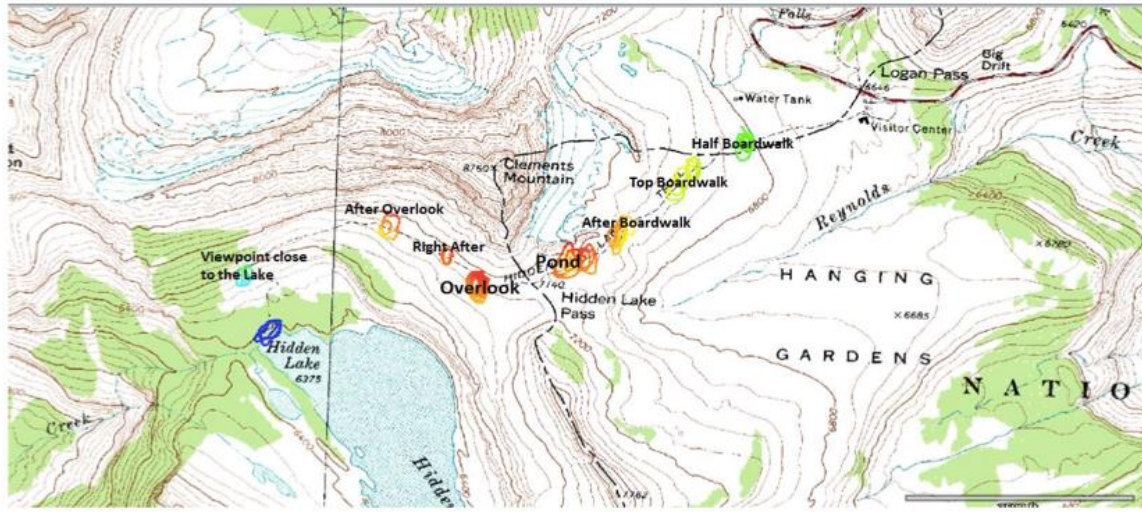


Figure 27: Map of the popular destinations and stops on the Hidden Lake Trail: 2011



Overall, the mean duration of stops at hiking destinations on the Hidden Lake trail was approximately 16 minutes, with a median of 13 minutes. The maximum length of stop was 48 minutes, and seven cases reported no stop at the destination. Table 20 displays time stopped at each location. Note that averages vary significantly by destination.

Table 20: Time (in minutes) stopped at Hidden Lake Trail destinations: 2011

Destination	#	Mean	Std. dev.	Median	Min.	Max.
Overlook	49	16.94	12.345	15	0	48
Hidden Lake	4	29.50	11.818	33	13	39
Top of Boardwalk	7	6.29	5.619	6	0	16
Halfway up Boardwalk	4	4.25	4.924	4	0	9
Viewpoint past overlook	2	14.00	4.243	14	11	17
Viewpoint right after overlook	2	19.00	9.899	19	12	26
Pond	1	0	--	--	0	0
Total	69	15.58	12.347	13	0	48

According to the aggregated information from 69 visitors' tracks in 2011, the average round trip distance walked at the Hidden Lake trail was 2.44 miles with a median of 2.5 miles. This distance corresponds with the length from the Visitor Center to the Overlook. However, access to

the lake from the overlook was closed during four of the five days of the study, which may have reduced the overall average length of trip. In fact, the maximum length was 5.7 miles, which was taken from a track to the lake. Table 21 shows the average length for each destination.

Table 21: Length in miles (round trip) per destination on the Hidden Lake Trail: 2011

Destination	#	Mean	Std. dev.	Median	Min.	Max.
Overlook	49	2.54	0.129	2.51	2.26	3.00
Hidden Lake	4	5.08	0.419	4.90	4.80	5.70
Top of Boardwalk	7	0.9829	0.245	1.03	0.57	1.32
Halfway up Boardwalk	4	0.75	0.579	0.50	0.35	1.60
Viewpoint past overlook	2	3.30	0.141	3.30	3.20	3.40
Viewpoint right after overlook	2	2.93	0.042	2.93	2.90	2.96
Pond	1	1.93	--	1.93	1.93	1.93
Total	69	2.45	0.936	2.50	0.35	5.70

Table 22 displays the average time spent at the Hidden Lake trail based on 69 hikes tracked. Data suggested that visitors moved at an average of speed of 1.84 miles per hour. The aggregated mean hike time was 106 minutes, with a median hike time of 100 minutes. In addition, visitors moved 81 minutes on average and stopped for about 25 minutes on average. The total stopped time includes all non-moving time along the trail. According to the topography of this hike, visitors spent on average 33 minutes going uphill, 32 minutes descending, and 16 minutes going over flat ground.

Table 22: Averages of time (in minutes) spent on the Hidden Lake Trail: 2011

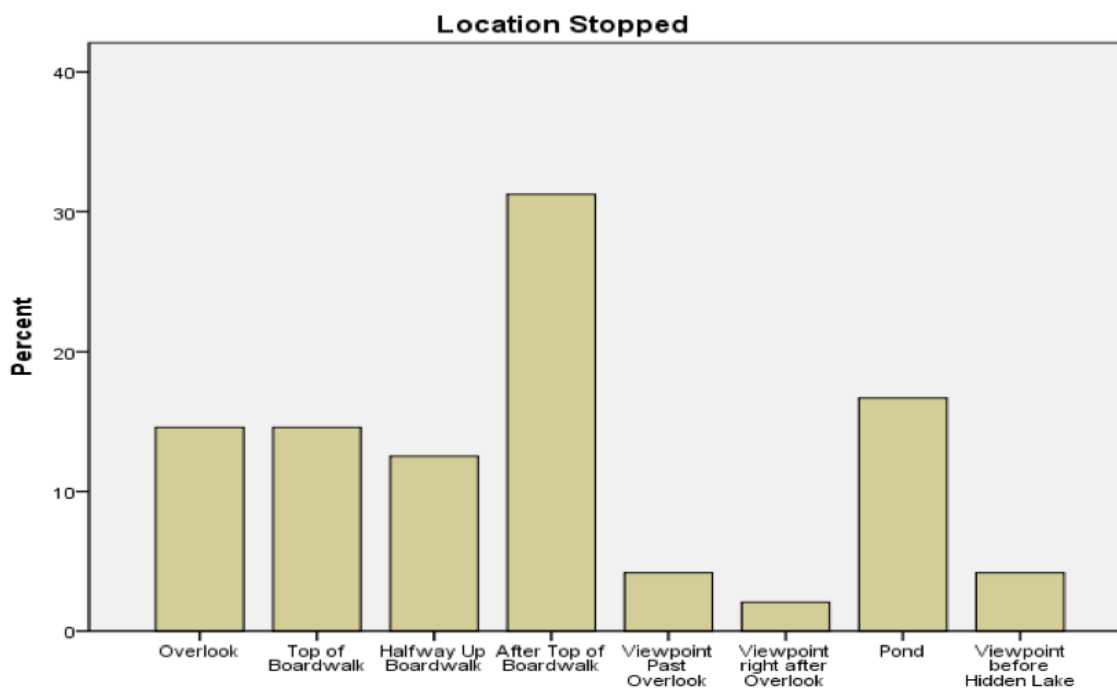
Statistics	Average speed (MPH)	Total hike time	Total moving time	Total stopped time	Total uphill time	Total downhill time	Total flat time
N	69	69	69	69	69	69	69
Mean	1.842	106.12	81.20	24.45	33.30	31.67	15.57
Median	1.90	100	79	19	35	32	10
Mode	1.9	105	74 ¹	6 ¹	32 ¹	33	10
Std. dev.	0.31	53.09	37.33	20.85	17.19	15.80	30.56
Min.	1.1	17	14	1	0	0	1
Max.	2.5	298	235	95	91	73	235

¹Multiple modes exist. The smallest value is shown.

Visitors stopped for more than three minutes at eight discrete locations while on the Hidden Lake trail (figure 28). Thirty-one percent of visitors stopped after the top of the boardwalk. Nearly

17% of visitors stopped at the pond between the boardwalk and the overlook. The next most popular sites to stop were the overlook and top of boardwalk with 14.6% each, and the halfway up the boardwalk (12.5%). Nevertheless, the crew observed that visitors stopped at any place where they encountered wildlife along the trail.

Figure 28: Popular stops on the Hidden Lake Trail: 2011



In addition, the groups stopped on average 0.7 times during their hike (standard deviation of 1.28 times). Forty-six groups (66%) of 69 groups sampled made no stops for more than three minutes during their hike (table 23). In those locations visitors stayed an average of 7.77 minutes (with a median of 7 minutes). Table 24 demonstrates the stop length at each location.

Table 23: Stops of three minutes or longer per group sampled at the Hidden Lake Trail: 2011

Number of stops	Frequency	Percent	Cumulative percent
0	46	66.7%	66.67%
1	12	17.4%	84.1%
2	4	5.8%	89.9%
3	2	2.9%	92.8%
4	3	4.3%	97.1%
5	2	2.9%	100%
Total	69	100%	

Table 24: Average time of stops (in minutes) at locations on the Hidden Lake Trail: 2011

Location stopped	Mean	Std. dev.	Median	Min.	Max.
Overlook	12.71	8.71	11	4	30
Top of Boardwalk	5.14	1.22	5	4	7
Halfway up Boardwalk	6.50	2.59	6	4	10
After top of boardwalk	6.33	2.53	5	4	11
Viewpoint past overlook	4	1.41	4	3	5
Viewpoint right after overlook	8	--	8	8	8
Pond	9.5	4.96	8	4	18
Viewpoint before Hidden Lake	11	--	11	11	11
Total	7.77	4.83	7	3	30

8. How do visitors and Mountain Goats interact at Logan Pass?

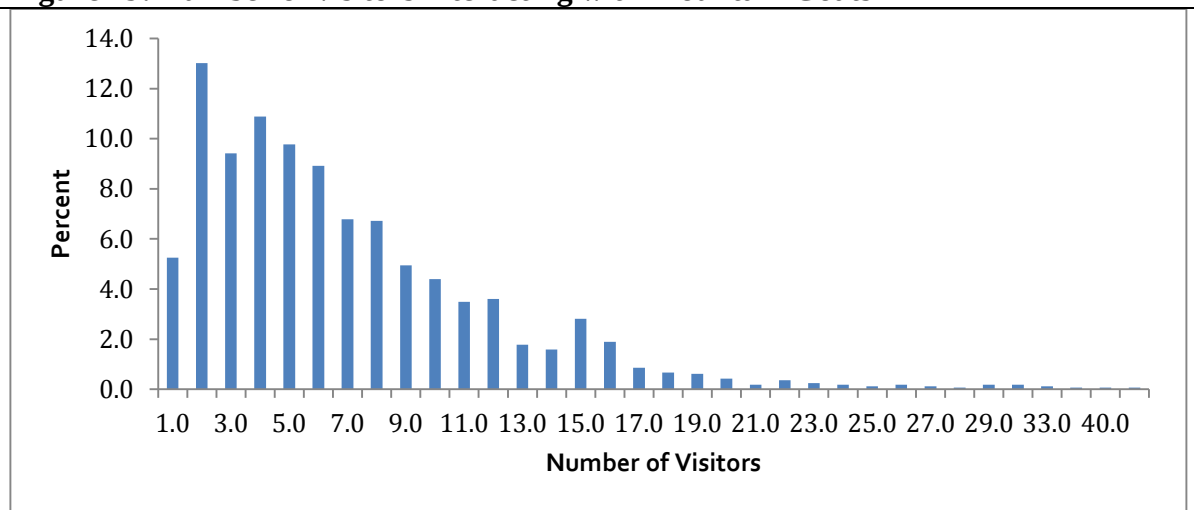
During the summer of 2013, a University of Montana study was initiated to investigate interactions between mountain goats and visitors along the Hidden Lake trail in the popular Logan Pass area of Glacier National Park, Montana. Concerns about public safety and mountain goat welfare served as the impetus for the study, as the Hidden Lake trail is known for frequent and close-proximity interactions between hikers and mountain goats. The primary goal of the study was to understand both goat and visitor behaviors along this trail during interactions with one another. Additionally, we hoped to learn where interactions occur along the trail, the distance between goats and visitors during an interaction and the nature of both goat and visitor group compositions involved in interactions.

Observations began on June 28th, 2013 and ended on August 23rd, 2013. Two sampling methods were employed. The first method, scan sampling, was used primarily to understand behaviors, distances between visitors and goats and group compositions during an interaction, as well as goat behaviors, group compositions and distances from the trail when visitors were not viewing them. Observations were recorded every three minutes during a randomly chosen 3-4 hour time period between the hours of 8:00 AM and 8:00 PM. The second sampling method, focal sampling, was employed to understand visitors' emotional responses and durations of interactions. In this type of sampling, one visitor group was chosen randomly to be observed throughout their interaction with a mountain goat group. Once the chosen visitors ended their

interaction with the goat(s), the next visitor group that approached was observed. Focal sampling occurred for 2 hours chosen randomly between 8:00 AM and 8:00 PM

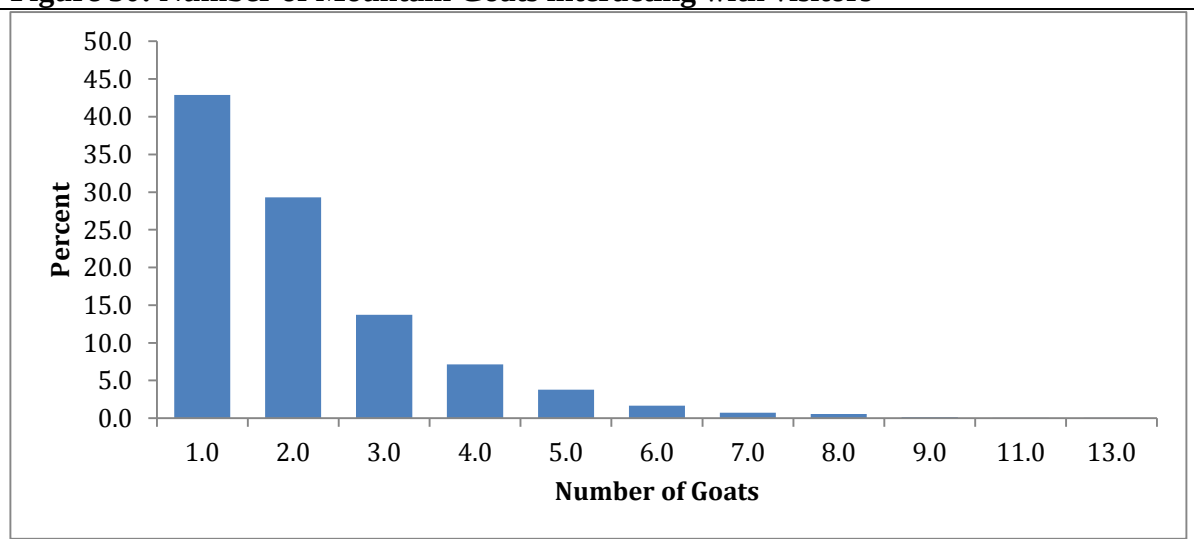
The mean visitor group size during an interaction was 7 people, and the median was 6 people. Group size refers to any variety of visitor compositions. It could be one family group composed of 5 people, or it could be 5 individuals that are not visiting together. The frequency distribution was right-skewed, and in 48% of the interactions visitor groups were composed of 5 people or less. Thirteen percent of interactions involved only 2 visitors (Figure 29).

Figure 29: Number of visitors interacting with Mountain Goats



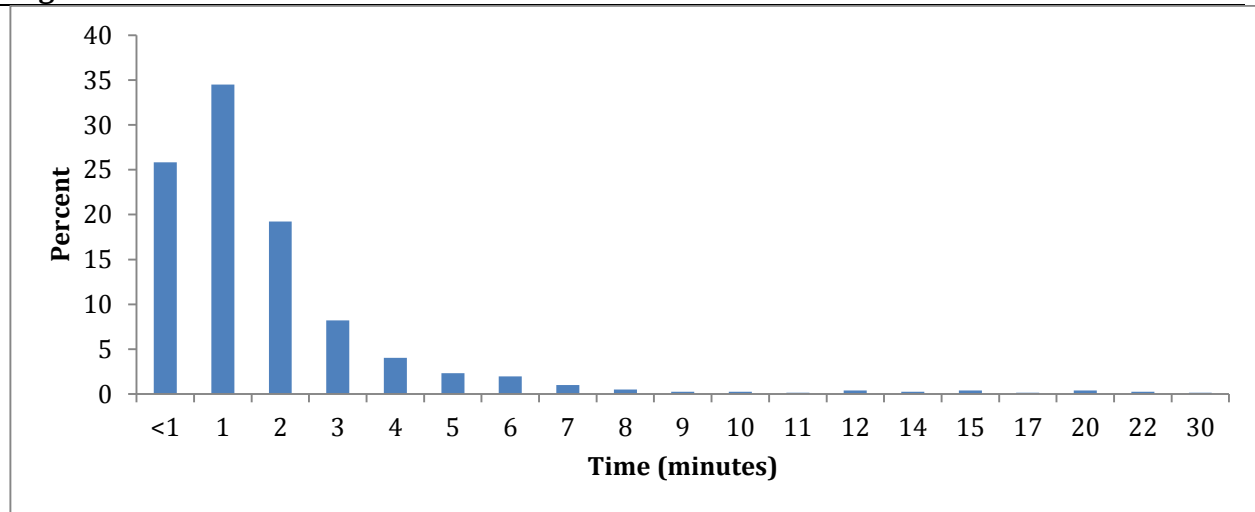
The average mountain-goat group size during an interaction was 2 goats (either two billies or a nanny and her kid). In 43% of interactions, only one goat was involved, and in 93% of interactions, the group size was 4 goats or less (Figure 30).

Figure 30: Number of Mountain Goats interacting with visitors



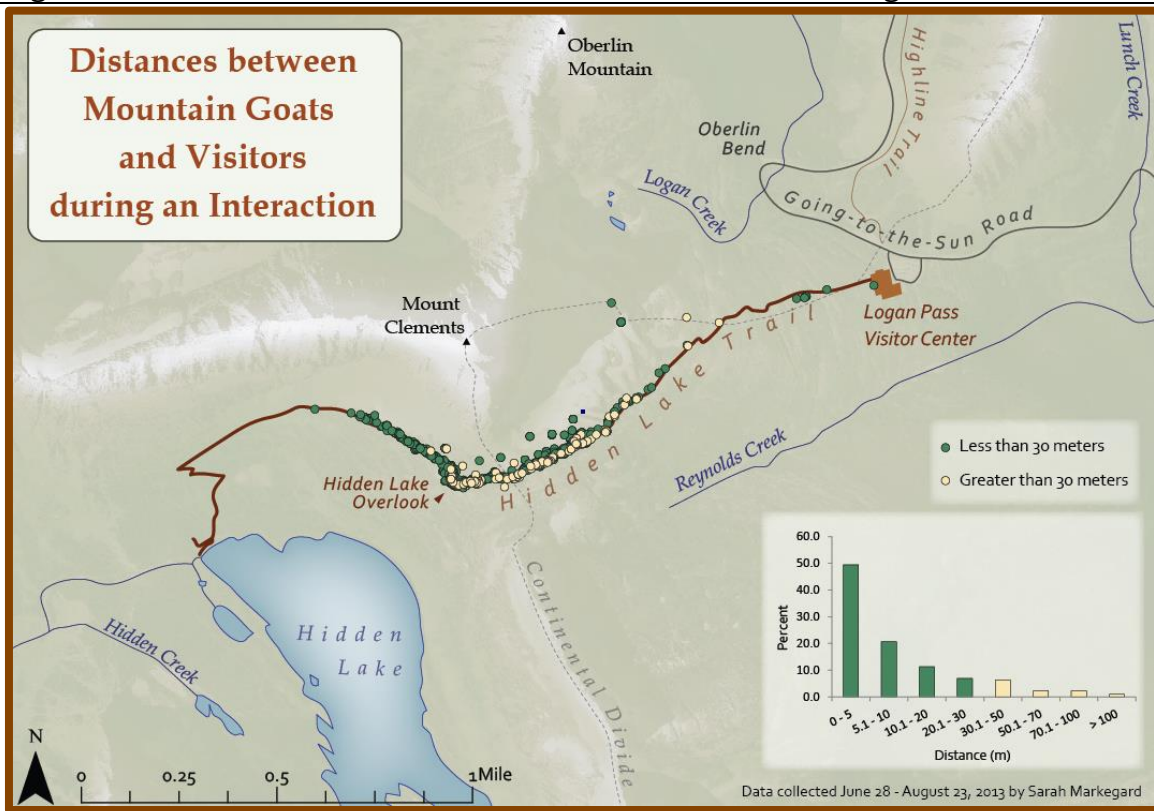
Thirty-five percent of observed interactions lasted between 60 and 90 seconds (n=817), and 26% lasted less than 60 seconds. The mean duration of interactions was 2 minutes and the median was 1 minute. Only 20% of interactions lasted 2 ½ minutes or longer, and 2% of interactions were 10 minutes or longer (Figure 31).

Figure 31: Duration of Mountain Goat-visitor interactions



In half of all observed interactions, visitors were less than 5 meters from a mountain goat, and in 88% of interactions, visitors were observed less than 30 meters from a goat (n=1,640). When no interaction was occurring, 27% of goat groups were observed less than 5 meters from the trail, and 74% of goat groups were less than 30 meters from the trail (n=458) (Figure 32).

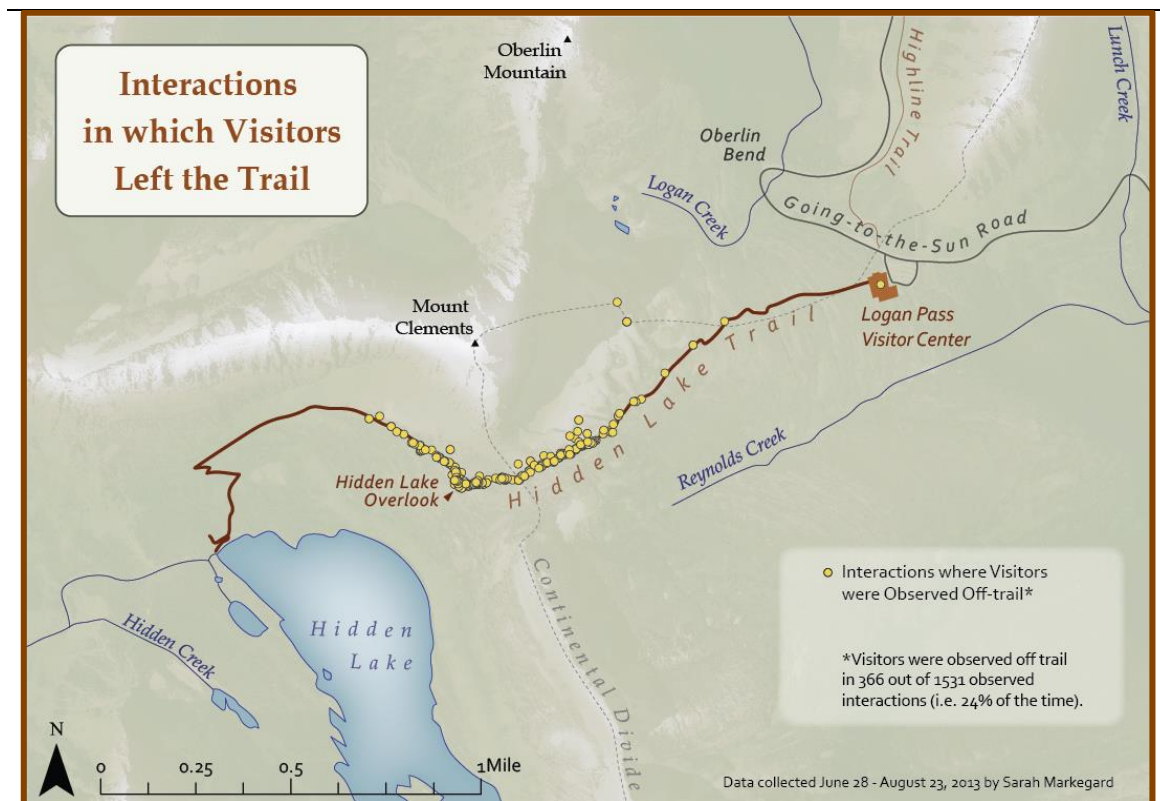
Figure 32: Distances between Mountain Goats and visitors during an interaction



8.1 What are visitors' behaviors during interactions with Mountain Goats?

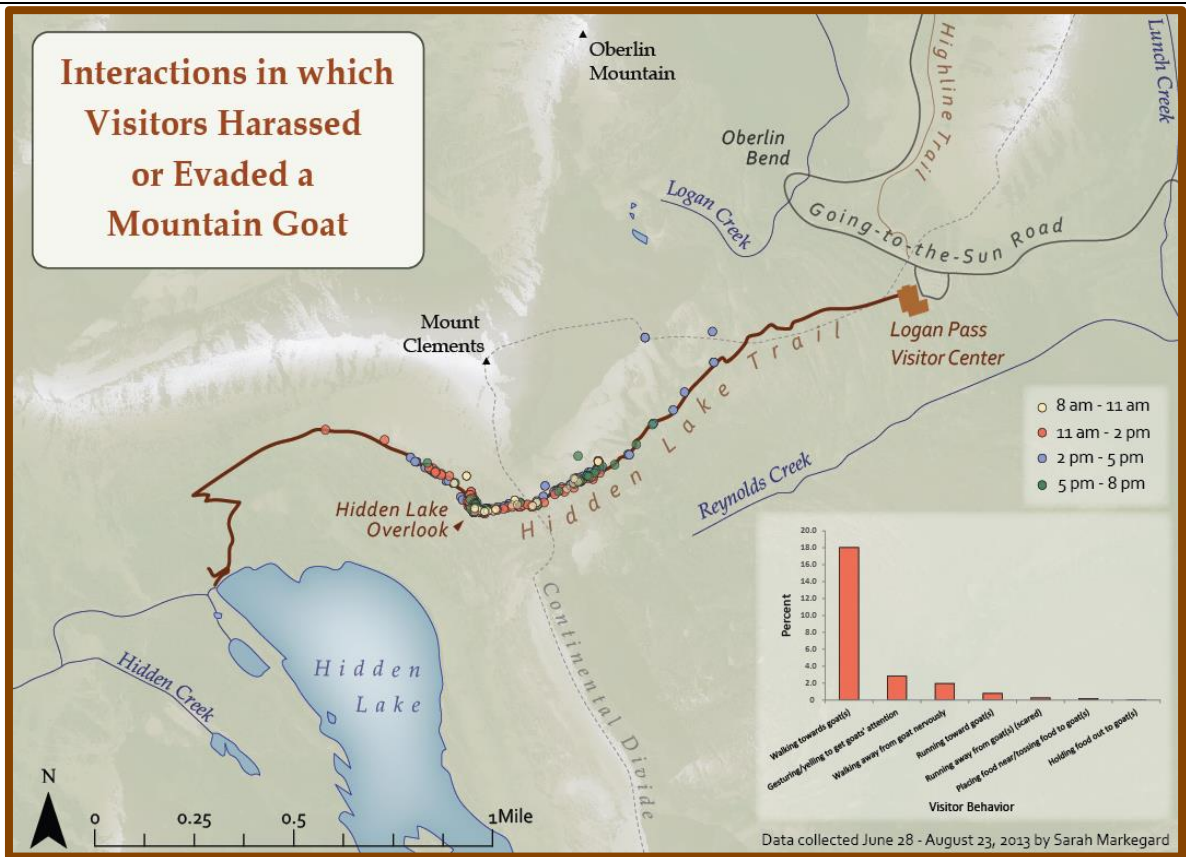
The three most frequently observed visitor behaviors during an interaction were: viewing/watching goats (84%), photographing (78%) and talking with others (about goats) (59%). Almost a quarter of the time (24%), visitors were observed stepping off of the trail during an interaction with a mountain goat (Figure 33), and 18% of the time visitors were observed walking towards a goat. Out of 1,637 observations, only 4 instances of visitors holding food out to or placing/throwing food near a mountain goat were recorded (0.2%).

Figure 33: Map of interactions on Hidden Lake Trail during which visitors stepped off of the trail



Approximately 8% of the time, hikers noticed mountain goats and continued hiking without interacting. In three percent of interactions, visitors were seen yelling or gesturing at a mountain goat to get its attention, and thirteen people were observed running towards a goat (0.8%). Two percent of the time, visitors were observed walking nervously away from a goat, and 4 people were seen running from a goat (0.2%). Thirty-one instances were recorded in which a visitor reprimanded another individual about something related to mountain goats (2%) (Figure 34).

Figure 34: Map of interactions on Hidden Lake Trail during which visitors harassed or evaded a Mountain Goat

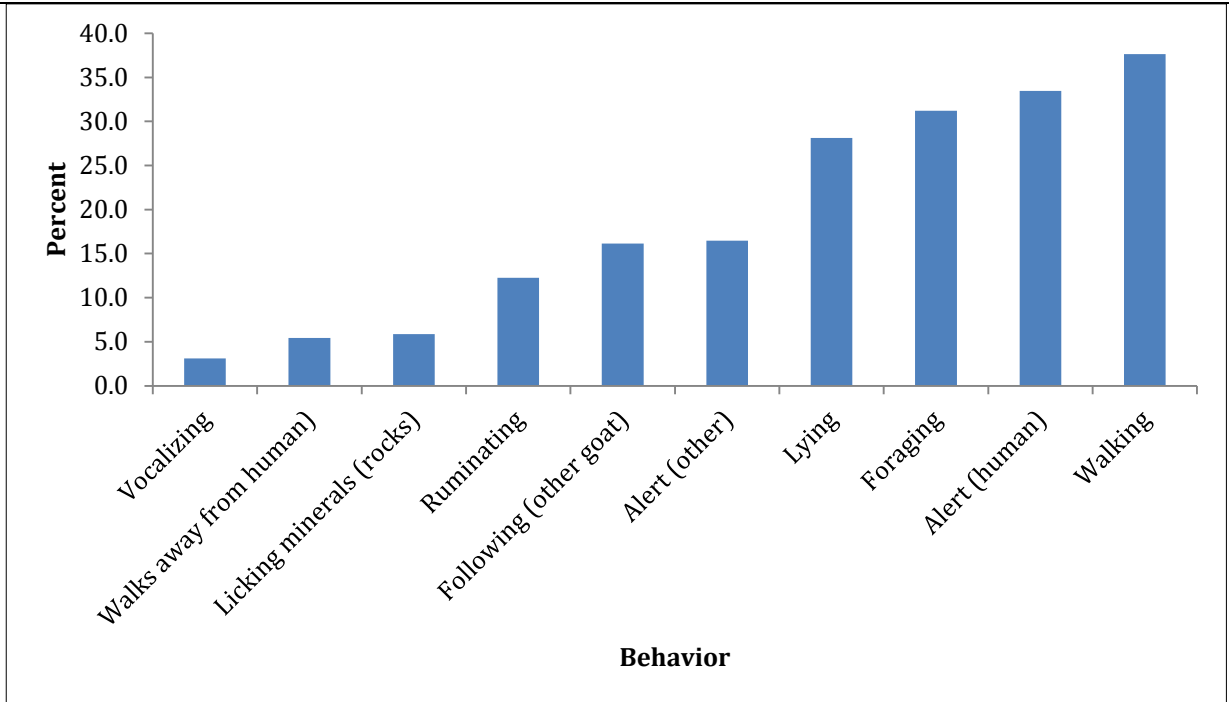


Emotional responses were observed 90% of the time, whereas cognitive (non-emotional) responses were observed only 10% of the time ($n=505$). Of the emotional responses, 95% were positive and 5% were negative ($n=505$).

8.2 What are Mountain Goats' behaviors during interactions with visitors?

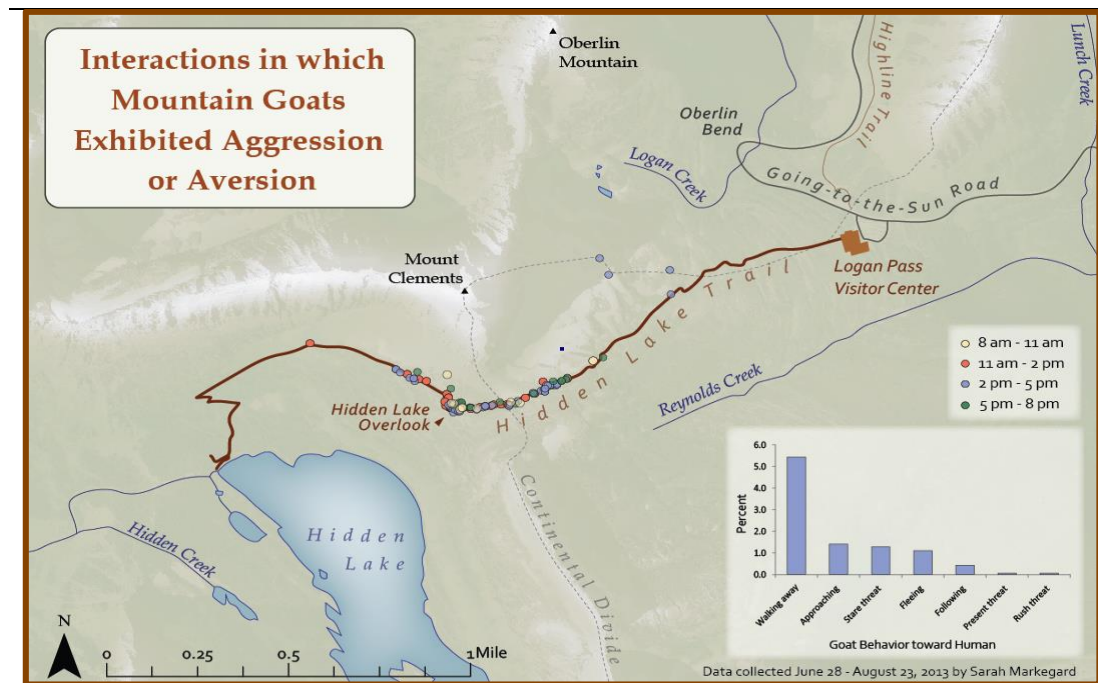
The four most commonly observed goat behaviors during an interaction were walking (38%), alert to humans (34%), foraging (31%) and lying down (28%) ($n=1,640$) (Figure 35).

Figure 35: Most frequently observed Mountain Goat behaviors during an interaction with visitors



In 89 instances, goats walked away from a human (5%) and in 18 instances, a goat fled a human (1%). Thirty observations of a goat approaching or following a human occurred (2%), and there were 21 observations of a goat exhibiting a stare threat toward a visitor (1%). One goat exhibited a rush threat toward a visitor, and one goat exhibited a present threat toward a visitor (Figure 36).

Figure 36: Aggressive or aversive behavior by Mountain Goats towards visitors



When no visitors were viewing goats, the four most common goat behaviors were foraging (36%), lying down (29%), walking (27%) and alert to something other than a human (20%) (n=457) (Figure 37). In 6% of observations, goats were seen licking rocks or soil (likely for minerals left behind by humans) (n=2097).

Figure 37: Most frequently observed Mountain Goat behaviors when no visitor interactions were occurring

