Pacific Northwest National Scenic Trail: 2022 Trail Monitoring Report

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Introduction

In 2009, Congress designated the Pacific Northwest Trail as one of America's 11 National Scenic Trails. The Pacific Northwest National Scenic Trail (PNNST) offers outstanding opportunities for long-distance non-motorized recreation throughout its 1200-mile route. The PNNST crosses a diverse landscape; beginning at the Continental Divide at Chief Mountain Trailhead in Glacier National Park, Montana and finishing at the Pacific Ocean on Cape Alava in Olympic National Park, Washington. Approximately 70% of the PNNST spans throughout seven national forests and three national parks, and over 300 miles of the trail cross through six wilderness areas. Currently, 67% of the PNNST is covered via trails and 33% is on roads. One goal of the USFS is to work toward a continuous, non-motorized trail route, to meet the intent for National Scenic Trails in the National Trails System Act.

When the PNNST gained its National Scenic Trail status, Congress required the USFS to develop a comprehensive plan that would provide various land management agencies with a common vision for the long-term development and management of the trail. The required components of a comprehensive plan are 1) objectives and practices for the management of the trail, including an identified carrying capacity and a plan for its implementation, 2) an acquisition or protection plan for lands along the trail, and 3) general and site-specific development plans. The long-term monitoring of the PNNST provides critical information to inform the PNNST's carrying capacity and other management actions for the trail.

The 2022 field season data builds on previous monitoring since 2017 to identify trends and changes over time. Throughout the summer of 2022, the University of Montana (UM) conducted a visitor monitoring project to collect data on the number and timing of trail visits along various sections of the PNNST. In addition to monitoring five of the previously established Montana sites, three new monitoring sites in the Idaho Panhandle were added in 2021. The monitoring of these new sites was delayed from prior plans to begin their monitoring in 2020, which were impacted by the COVID-19 pandemic and associated travel restrictions. The sections of the PNNST that were monitored are located within Kootenai National Forest (KNF) in Montana and Idaho Panhandle National Forests in Idaho. ***Trail visits*** included trail use by people on foot, as well as people on horses or bicycles, who may be:

- thru hikers, who are completing an end-to-end hike of the PNNST in one season (in this report, these are included in counts for overnight hikers);
- section hikers, who are traversing the length of the PNNST as a series of shorter trips usually over a longer time frame (in this report, these are included in counts for overnight hikers);
- day hikers or horse/bike riders and overnight/multi-day hikers or horse/bike riders whose visits are not part of an attempt to complete the PNNST (sometimes called "local

users" to differentiate them from thru hikers or section hikers, though they may or may not be from the local area);

- trail crew members and other government employees and volunteers using trails to perform administrative duties such as maintenance, monitoring, patrols, and other work.

Trail visits are estimates based on a calibration of raw counter data when possible and on available camera data when counter data has been lost, as described in the methods section below. "Out-and-back" trips, wherein a trail user returns to the same trailhead from which they started using the same trail (and passing by the same trail counter twice) on either the same day or a different day, are counted as two trail visits.

Additionally, the research team was able to have cameras up at all sites throughout the 2022 season and analyze camera data for number of parties per week, party size, and type of recreational users. During 2022, party size was measured as the number of individuals that appeared to be traveling together (based on being the same type of users and traveling in the same direction) that passed by the camera within two minutes of each other, such that there was at least two minutes between one party and the next. This measurement differs from the way party size was measured during the 2020 season. During 2020's pilot effort to analyze this measure, party size was operationalized as the number of people of the same user type traveling in the same direction to pass a camera within 30 seconds of each other. Camera data from the 2019 field season was also analyzed noting party size and user type, although these cameras were only up for select times at each site.

This report details findings related to trail use during 2022 at the following locations: Whitefish Divide, Vinal Creek[1], Canuck Peak, Garver Mountain, Pyramid-Ball Lakes, Parker Ridge, and Brush Lake. Blue Sky Lake and Pyramid-Ball Lakes were omitted from the analysis due to fire closures significantly interrupting the collection of data and rendering the data deficient. These sites were prioritized for monitoring during this field season over some other locations that had been monitored before, including Bluebird Lake, Boulder Lake, Green Mountain, Gypsy Meadow, and Midge Creek. Pyramid-Ball Lakes, Parker Ridge, and Brush Lake are three new sites that are along sections of the PNNST in Idaho and added this season.

[1] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

Methods

This study has generally replicated the methodology used in the University of Montana's initial monitoring project from the summer of 2017, thus allowing for the comparison of trail use data between 2017 and 2022. However, when making these comparisons it is important to note that the calibration factors for 2017-2022 were calculated in somewhat different ways. Calibration factors for 2019 and 2020 accounted for all trail users (including overnight hikers, day hikers, horse riders, bike riders, and trail/administrative crew members). In contrast, 2018 data was calibrated only for day and overnight hikers (thus excluding trail/administrative crew members, horse riders, and bike riders). Moreover, because no calibration factors were available from 2017, the 2018 calibration factors were also applied to 2017 data. Therefore, while the percentage of trail users that were trail/administrative crew members, horse riders and bike riders is relatively small, comparisons between 2017, 2018, 2019, 2020, 2021, and 2022 are not entirely equivalent. Trail user estimates for 2017 and 2018 would likely be at least slightly higher than the reported hiking visit estimates.

Data collection took place from June 14, 2022 to September 30, 2022. During this time, the researchers made six trips into the field. Each trip lasted between three and four days. Eight sites (Whitefish Divide, Blue Sky Creek, Garver Mountain, Vinal Creek[2], Canuck Peak, Pyramid-Ball Lakes, Parker Ridge, and Brush Lake) were monitored in 2022. The Montana sites included Whitefish Divide, Blue Sky Creek, Canuck Peak, Garver Mountain, and Vinal Creek[2], and all of these sites are located within Kootenai National Forest. The Idaho sites included Pyramid-Ball Lakes, Parker Ridge, and Brush Lake, which are all located within Idaho Panhandle National Forests. The decision to monitor a subsample of the Montana sites that have been monitored in previous years was determined due to limitations in the number of sites that can be monitored logistically and the prioritization of extending data collection into the Idaho Panhandle. Thus, sites that have been previously monitored, but were not monitored in 2022 include Bluebird Lake, Green Mountain, Gypsy Meadow, Midge Creek, and Boulder Lake.

Data was gathered using infrared trail counters and software from the company TRAFx. The trail counters were calibrated using infrared trail cameras that took photographs when a motion was detected.

Information from these infrared counters can help determine the level of use along the trails for the selected sites; however, there are standard limitations to how these counters record data that are typical to similar kinds of studies. The trail counters have infrared detectors that register a count each time an individual or animal passes by its receptive range. A trail counter reading alone cannot distinguish between a count for an animal and a count for a hiker. The use

[2] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

of trail camera photos helped us to differentiate people from wildlife and gain a sense of which trails might be frequented more by wildlife than others.

Most of the cameras and counters spent approximately ten to thirteen weeks at each site throughout the monitoring period. However, monitoring equipment at Whitefish Divide and Canuck Peak were only present for about 10 and 11 weeks respectively, due to these sites being less accessible due to snow until later in the season. Logistical difficulties during the first trip and memory card issues also limited Vinal Creek[3] to being monitored for only 11 weeks. Additionally, fire closures affected collecting data at Blue Sky Lake and Pyramid-Ball Lakes resulting in deficient data for measurements for the 2022 season.

Trail cameras ensured that the movement throughout the trail was captured from several directions, and the footage was later watched to calibrate the infrared counts. Footage did provide valuable information with which to adjust the infrared counts. For example, Canuck Peak is frequented by wildlife, which get counted when walking on a trail past a counter. Similarly, a hiker walking with a dog would result in both the dog and the hiker being counted. In some cases, hikers walking side by side would only be counted as one hiker.

All available footage from cameras were used this year to determine calibration factors. While going through the camera data, researchers noted whether it was an animal, overnight or day hiker, bike rider, horse rider, trail crew, car, ATV, motorized bike/motorcycle rider, or phantom count that was registered by the counter as a count. Phantom counts can occur when infrared counters are triggered by extraneous factors (not people, animals, or vehicles), such as the movement of tree or plant branches in the wind. The observed count of trail users was then divided by all infrared counts in the calibration period to yield a calibration factor. If the calibration factor remains constant over time, then multiplying the calibration factor by the infrared counts yields the observed count of trail visits. This use of the calibration factors allows us to remove approximate erroneous measures of counts due to the infrared counters capturing movement from wind, wild animals, cattle, etc. These measures excluded dogs that may have been accompanying users and adjusted for how horses can often trigger two counts. During 2020, 2021 and 2022, newer cameras were used at three sites. These cameras had a shorter interval of 0 seconds, which may have been able to better capture hikers that were moving quickly than old cameras used at other sites and in past years. Older infrared cameras had a 5-second minimum interval, which might be too long to capture fast-moving hikers, bike riders, horse riders, animals, and motorized vehicles. This might have resulted in some counts being missed on the camera data and reduced accuracy for calibration factors.

The calibration factors in this study ranged from approximately 0.27 to 0.55 as shown in Table 1. Low hiker traffic and frequent wildlife on the trails could be factors contributing to lower calibration factors. Because the calibration factors are generated from a sample, we should formally refer to trail visits as estimated trail visits, but for brevity we will use the term trail

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visits in most places. Moreover, due to technical issues, raw counter data was lost for several days at two monitoring sites and three did not begin until July due to snowpack. For days where counter data was missing, trail visit estimates utilized camera data estimates instead. The limitations of comparing these methods of trail use estimates should be kept in mind when interpreting findings, as camera data may be more likely to underestimate trail use compared to the calibrated counter data.

Table 1 Calibration Dates and Calculated Calibration Factors

Site	Calibration Dates	Calibration Factor
Whitefish Divide	7/22-10/2	0.54945055
Garver Mountain	6/28-9/30	0.38
Vinal Creek[4]	7/5-7/25; 8/5-9/30	0.52564103
Canuck Peak	7/14-8/4; 8/23-9/10	0.49618
Parker Ridge	6/15-9/30	0.26553672
Brush Lake	6/14-9/30	0.45098

It is important to note that the infrared counters are not distinguishing between thru hikers, section hikers, day users, overnight/multi-day users, and trail crew/administrative users. Rather, the infrared counters are providing counts for overall use on the trail sections that are being monitored. Thus, camera data was used by researchers to determine trail user types through observed differences in gear (such as the size and type of backpack) and party composition (such as families with young children) that were suggestive of day-use versus overnight use. No information about direction of travel can be gleaned from the infrared counts. Therefore, a trail user on an out-and-back hike who passes the infrared camera on the way in and then again on the way out is counted as two trail visits. Qualitative data, like an electronic survey, or chronologically mapping hiker registrations, might help increase the accuracy in determining the number of thru hikers and section hikers versus other users, as well as westbound versus eastbound PNNST thru hikers.

This year, the research study also addressed the distribution of user type, party size, and parties per week for each location. Party size was measured as the number of individuals that appeared to be traveling together (based on being the same type of users and traveling in the same direction) that passed by the camera within two minutes of each other, such that there was at least two minutes between one party and the next. Trail users were also categorized

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into overnight hikers, day hikers, horse riders, bike riders, and trail crew members. Additionally, some additional types of users were noted at Brush Lake, including ATVs, cars, and motorized bikes/motorcycle riders. Camera data helped researchers to distinguish between overnight hikers, which could often be seen with larger backpacks and overnight equipment like sleeping pads (Image 1), compared to day hikers (Image 2). In these observations the overnight hikers category included overnight/multi-day backpackers as well as any PNNST thru hikers and/or section hikers, as it was not possible to reliably distinguish between these users from the camera data alone. Trail crew members were also determined via camera data, and were often seen wearing hardhats and carrying equipment such as shovels.

Image 1: Overnight hiker

Image 2: Day use hiker

Comparison Across Sites

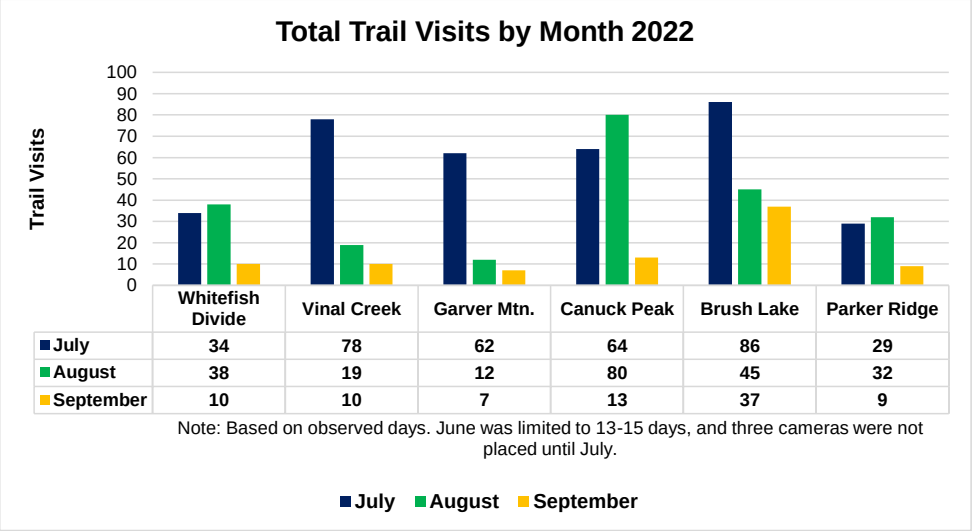
Locations monitored include, from east to west: Whitefish Divide, Blue Sky Creek, Vinal Creek[5], Canuck Peak, Garver Mountain, Pyramid-Ball Lakes, Parker Ridge, and Brush Lake. Due to extensive fire closures Blue Sky Creek and Pyramid-Ball Lakes were omitted from the analysis because of data deficiencies.

Figure 1 displays the total number of trail visits across all sites in July, August, and September. The sites appear in these graphs running from east to west which is the typical direction of thru hiker travel on the PNNST.

For all sites except Canuck Peak, July 2022 had the most trail visits, compared to August and September 2022. These use patterns are likely influenced in part by west-bound thru-hikers typically passing through these areas earlier in the season in order to complete their end-to-end hike of the PNNST during the window of time when trails are snow-free (from snowmelt in the high passes along the PNNST in Glacier National Park and before snow falls in the high passes along the PNNST in Olympic National Park). In July 2022, Vinal Creek and Brush Lake had the highest use among the sites with over 78 and 86 trail visits each. During July and August, Canuck Peak also had a relatively high number of visits, with approximately 64 and 80 trail visits, but the trail visits of August may be a data outlier. In contrast, Garver Mountain and Vinal Creek had the lowest use during August, with under 20 trail visits each. In September, all site showed a significant drop off from their highest use, with below 20 trail visits. In contrast, Brush Lake had very high relative use during September compared to the other sites, with under 38 trail visits consisting of mainly other users accessing the trail with motorized vehicles.

[5] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

Figure 1: Comparison of use across all sites during June-September 2022[6]



	Whitefish Divide	Vinal Creek	Garver Mtn.	Canuck Peak	Brush Lake	Parker Ridge
July	34	78	62	64	86	29
August	38	19	12	80	45	32
September	10	10	7	13	37	9

Note: Based on observed days. June was limited to 13-15 days, and three cameras were not placed until July.

Figure 2 shows a comparison of weekday and weekend use across each site. To stay consistent with the previous years' monitoring reports, Mondays, Tuesdays, Wednesdays, and Thursdays were counted as weekdays and Fridays, Saturdays and Sundays were considered weekend days.

Overall, Canuck Peak had the greatest difference between weekday and weekend use. Weekdays averaged about 2.4 users per day of traffic at Canuck Peak, whereas only 1.1 users per day of traffic occurred during the weekends. No other site had greater weekday use than weekend use. Which can be the result of a limited data set in the months of August and September. This variation among the daily weekend and weekday averages, which suggests increased use of the trails on the weekdays, may indicate a primarily thru hiker presence.

Brush Lake had the greatest disparity of trail visits between weekend and weekday, this has been influenced by the large number of other trail users on motorized vehicles in the latter half of the season. Also, of note in the case of Brush Lake is its high average weekday use 1.825, higher average use than any other site's weekend average, on the weekends use of the Brush Lake Trail increased to 2.6 users. Similarly, Whitefish Divide and Parker Ridge saw a notably higher average number of users on weekends compared to weekdays as well, with about .38 and .25 more traffic at both sites using the trail during the weekend versus during weekdays. At Garver Mountain average daily trail visits increased from .77 on weekdays to 1.03 daily trail visits on weekends. Notable increases in use on weekends suggests that these sites were very

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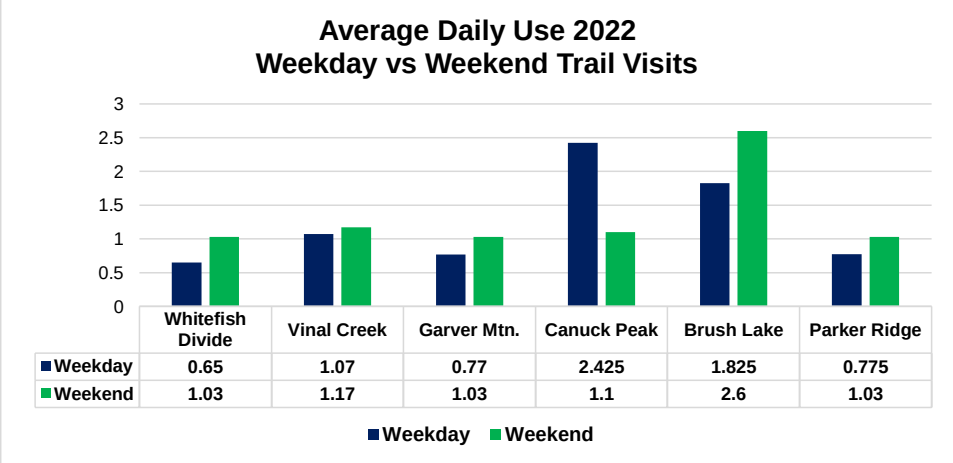
popular for day hikers. Higher weekend use may also indicate trails being a more easily accessible with higher trail use by working folks that have more free time on the weekends.

Alternatively, there seemed to be little difference in use between weekend days and weekdays for the Vinal Creek site. At Vinal Creek daily weekend use averaged 1.17 trail visits compared to a weekday daily use of 1.07 trail visits. This lack of variation among the daily weekend and weekday averages, which suggests consistent use of the trails throughout the weeks, may indicate a primarily thru hiker presence or consistent day hiker use. For example, Whitefish Divide is not as easily accessible and takes more time to get to compared to some other sites. Thus, they may be largely used by thru-hikers on long-term trips or by retirees/people taking time off with more flexible schedules. These users may result in weekday and weekend use patterns that would not vary as widely. Conversely, the Vinal Creek[7] site's trail is more accessible and convenient for short-term trips. It has shown to have more use by groups and organizations (ex. school groups) that may utilize it during the week, thus balancing weekday versus weekend use patterns.

Figure 2: Comparison of Weekend and Weekday use across all sites in 2022[7]



Figures 3, 4, 5, 6, 7, and 8 show a comparison of the percentage of different types of users across each site for July, August, and September. These graphs include overnight hikers, day hikers, and other types of users (which includes horse riders, crew members, and bike riders). Graphs 3, 5 and 7 distinguish between the percentage of different types of users at each site for

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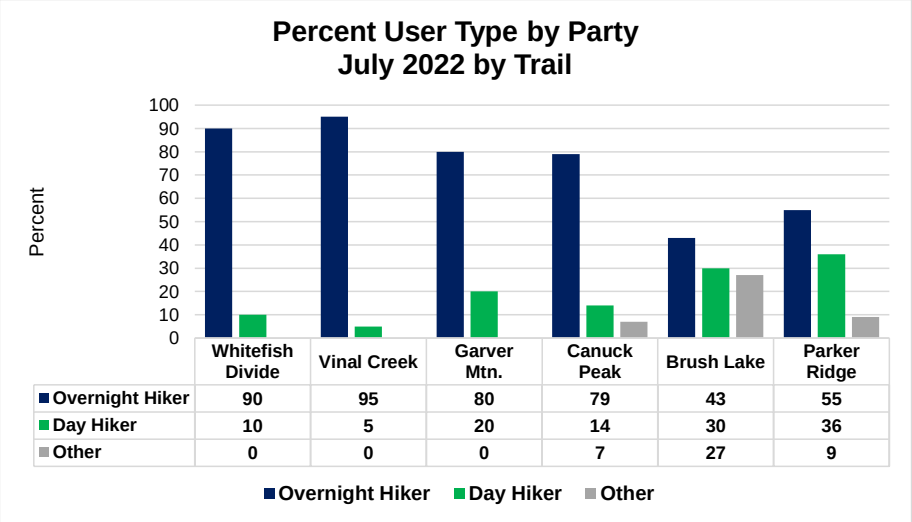
each month, with observations at the party level. In contrast, graphs 4, 6, and 8 show the percentage of different types of users for each site for each month when measured at the individual level. Differences in these types of measures may result from the extent to which different trails tend to be used by smaller versus larger groups of trail users. For example, thru-hikers may be more likely to travel solo or in small groups, while it may be easier and more common for day hikers and users to travel in larger parties (large families, school groups, tour groups, etc.).

Figure 3 shows that during July overnight hikers were the most common type of user for all sites when measured at the party level. During July, 95% of parties at Vinal Creek were overnight hikers, as well as 90% at Whitefish Divide. When compared by party, Garver Mountain and Canuck Peak also had notably more overnight hikers than day hikers during July, with about 80% of parties at each of these sites being composed of overnight hikers. At Parker Ridge 55% of users were overnight hikers, with a notably high 36% day hiker use and a small group of other users. Brush Lake had a similar percentage of parties being composed of overnight hikers, day hikers, and other users with all groups composing under 43% of the observed parties. "Other" types of users, besides overnight hikers and day hikers, were present at Canuck Peak during July, but composed a relatively small percentage of parties at these sites. Brush Lake had the greatest percentage of parties composed of "other" types of users, with nearly 27%.

Figure 3: Percentage of Types of Users by Party across all sites during July 2022[8]



	Whitefish Divide	Vinal Creek	Garver Mtn.	Canuck Peak	Brush Lake	Parker Ridge
Overnight Hiker	90	95	80	79	43	55
Day Hiker	10	5	20	14	30	36
Other	0	0	0	7	27	9

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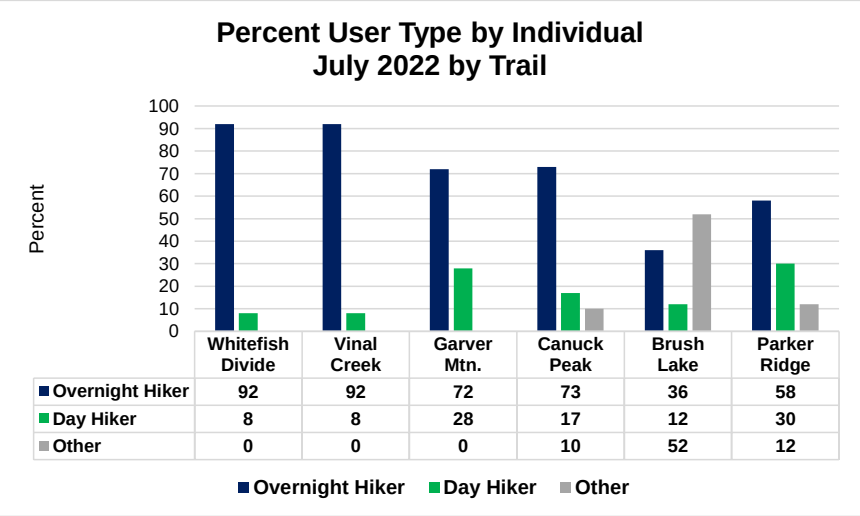
Figure 4 shows that, when measured by individual trail user, overnight hikers were the most common type of user for Whitefish Divide, Vinal Creek, Garver Mountain, Canuck Peak and Parker Ridge during July. For example, 92% of observed users at Whitefish Divide and Vinal Creek were overnight hikers, with a very small number of groups making up the day hikers. Garver Mountain and Canuck Peak were also mostly visited by overnight hikers, with around 73% of users at each of these sites being overnight hikers. Day hikers were slightly more common at Garver Mountain, with 28% of individual users at this site being day hikers. These four sites follow a similar user distribution pattern when measured at the party level where significantly more parties were composed of overnight hikers than day hikers. Parker Ridge had mixed usage with a slightly higher percentage of overnight hikers at the individual level. Due to Brush Lake being visited by some larger parties of other users it has a majority of the individual trail users. "Other" users made up the smallest percentage of users at two sites they were present at, and did not appear at three sites.

Figure 4: Percentage of Types of Users by Individual across all sites during July 2022

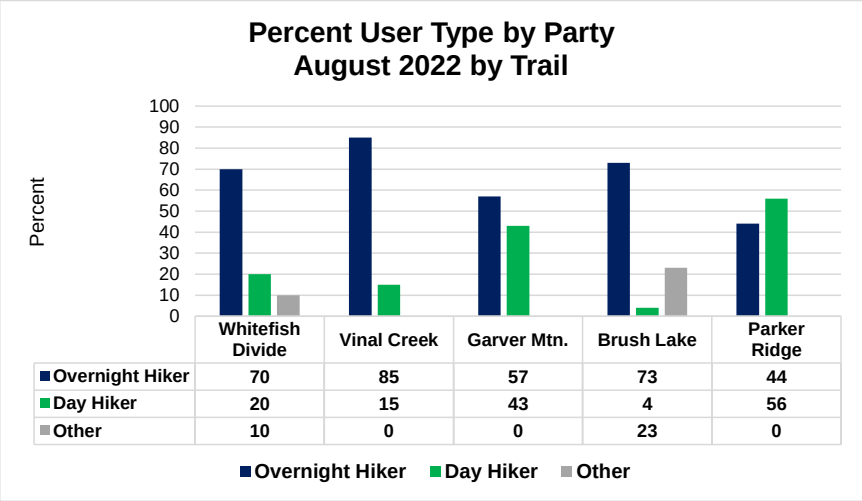


	Whitefish Divide	Vinal Creek	Garver Mtn.	Canuck Peak	Brush Lake	Parker Ridge
Overnight Hiker	92	92	72	73	36	58
Day Hiker	8	8	28	17	12	30
Other	0	0	0	10	52	12

Figure 5 shows that overnight hikers were the most common type of user for four sites during August, when measured at the party level. During August, 85% of parties at Vinal Creek were composed of overnight hikers, Whitefish Divide and Brush Lake parties were also composed on nearly 73% overnight hikers. When compared by party, Parker Ridge had the greatest percentage of day hikers, with over 50% of parties at this site being composed of day hikers. Garver Mountain had a tighter margin 57% overnight hiker parties and 43% day hiker parties.

Canuck Peak encounter camera malfunctions in the month of August and was only able to capture less than half the month.

Figure 5: Percentage of Types of Users by Party across all sites during August 2022[9]



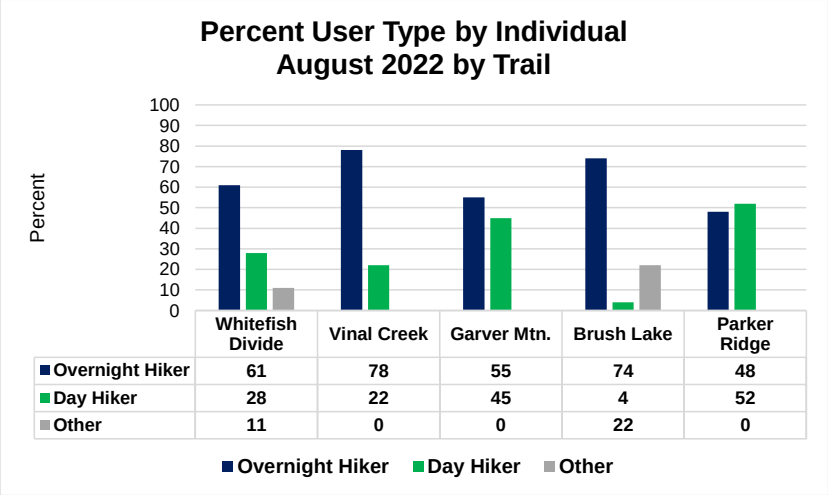
	Whitefish Divide	Vinal Creek	Garver Mtn.	Brush Lake	Parker Ridge
Overnight Hiker	70	85	57	73	44
Day Hiker	20	15	43	4	56
Other	10	0	0	23	0

Figure 6 shows that the percentage distribution of user types for August analyzed at the individual level followed similar trends to those analyzed at the party level. Again, 75% or more overnight hikers composed of the vast majority of Vinal Creek and Brush Lake trail users. Garver Mountain had a notably low number of twelve total trail visits in the month of August and had the similar balance of overnight hikers to day hikers among sites when compared to party size distribution. Whitefish Divide users were composed of around 61% of overnight hikers, and 28% of users being day hikers with a small percentage of other users. Brush Lake was the only other site to have a percentage of other users, with 22%, higher than the percentage of day hikers. Parker Ridge was the only site to register a higher percentage of day hikers, at 52%, to overnight hikers, at 52%. Canuck Peak recorded less than half the days of the month due to camera malfunctions.

Commented [TJ1]: Instead of having zeros, put N/A in all tables/figures where there was not enough data available otherwise it looks like there was just zero users overall

[9] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

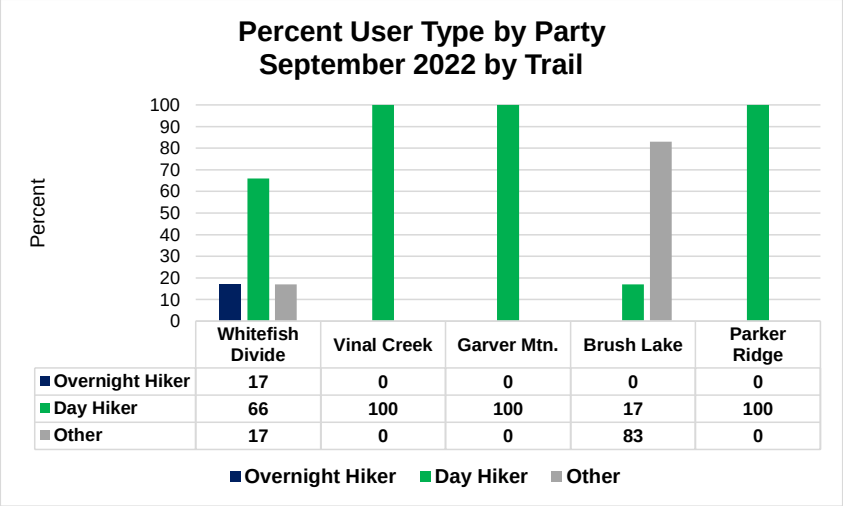
Figure 6: Percentage of Types of Users by Individual across all sites during August 2022



	Whitefish Divide	Vinal Creek	Garver Mtn.	Brush Lake	Parker Ridge
Overnight Hiker	61	78	55	74	48
Day Hiker	28	22	45	4	52
Other	11	0	0	22	0

Figure 7 shows that during September day hikers were the most common type of user when measured at the party level for all of the sites, except Brush Lake. Brush Lake counted a percentage of other users at 83%, mainly consisting of four-wheel drive vehicles and other motorized users. This appears to have had an impact on hiker user, as the remaining 17% of trail user parties were all day hikers. While 100% of parties at Parker Ridge, Vinal Creek, and Garver Mountain were composed of overnight hikers during September, notably very parties were recorded at these sites during the month. Whitefish Divide also had mostly day hiker parties, with about 66% of their parties being made up of day hikers, but with their remaining parties bring about 17% overnight hikers and 17% “other” users. Canuck Peak was only observable for ten days during the month of September due to camera error.

Figure 7: Percentage of Types of Users by Party across all sites during September 2022[10]

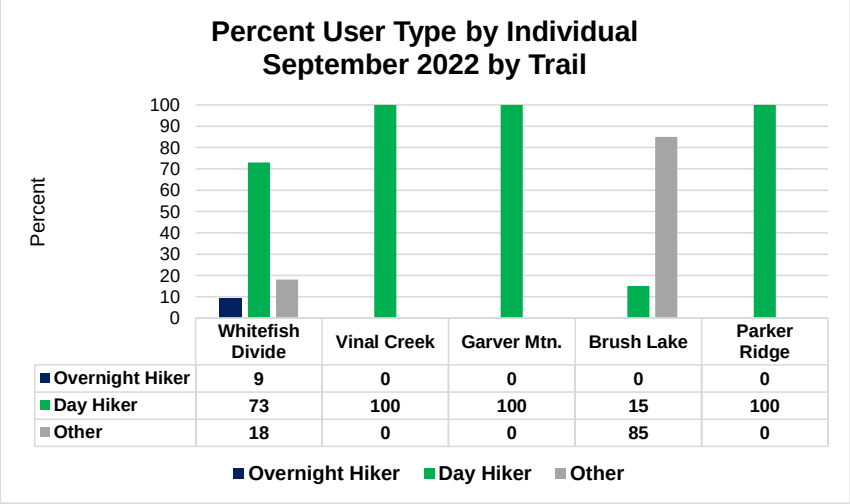


	Whitefish Divide	Vinal Creek	Garver Mtn.	Brush Lake	Parker Ridge
Overnight Hiker	17	0	0	0	0
Day Hiker	66	100	100	17	100
Other	17	0	0	83	0

Figure 8 shows that the percentage distribution of user types for September analyzed at the individual level mostly followed similar trends to those analyzed at the party level. 100% of Vinal Creek, Garver Mountain, and Parker Ridge users were overnight hikers. However, only a small number of users were observed at these sites during September. Brush Lake slightly increased its percentage of other users when looking at the individual and party distributions for September, it is again important to note that most of the other users were on or in motorized vehicles. About 73% of users at Whitefish Divide were day hikers, followed by about 18% being "other" users, and about 9% being overnight users. Lastly, during September, only ten days were covered by the Canuck Peak camera due to camera error.

[10] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

Figure 8: Percentage of Types of Users by Individuals across all sites during September 2022



	Whitefish Divide	Vinal Creek	Garver Mtn.	Brush Lake	Parker Ridge
Overnight Hiker	9	0	0	0	0
Day Hiker	73	100	100	15	100
Other	18	0	0	85	0

Table 2 provides the number of days monitored, monthly counts, daily averages, and maximum daily counts for each site for June-September 2022.

Table 2: Monitoring Data for June, July, August, and September 2022

Site	*Days Monitored (Monthly)*	*Count (Monthly)*	*Daily Average*	*Max (Daily)*
June				
Whitefish Divide Trail	-	-	-	-
Vinal Creek Trail[1]	-	-	-	-
Garver Mountain Trail	14	28	2	11
Canuck Peak Trail	-	-	-	-
Brush Lake Trail	15	115	7.67	14
Parker Ridge Trail	15	44	2.93	8
July				
Whitefish Divide Trail	10	34	3.4	5
Vinal Creek Trail[1]	27	78	2.89	5
Garver Mountain Trail	31	62	2	8
Canuck Peak Trail	18	64	3.56	11
Brush Lake Trail	31	86	2.77	10
Parker Ridge Trail	31	29	0.93	4
August				
Whitefish Divide Trail	31	38	1.23	11
Vinal Creek Trail[1]	26	19	0.73	2
Garver Mountain Trail	31	12	0.39	3
Canuck Peak Trail	14	80	5.71	19
Brush Lake Trail	31	45	1.45	4
Parker Ridge Trail	31	32	1.03	5
September				
Whitefish Divide Trail	30	10	0.33	2
Vinal Creek Trail[1]	30	10	0.33	2
Garver Mountain Trail	30	7	0.23	2
Canuck Peak Trail	10	13	1.3	2
Brush Lake Trail	30	37	1.23	7
Parker Ridge Trail	30	9	0.3	6

[1] Vinal Creek Trail is not part of the PNNST.

Trail Use by Site

Whitefish Divide 2022

Whitefish Divide Trail (#26) follows the western border of Glacier View Ranger District. The Whitefish Divide monitoring site trailhead can be found by taking Olney Crossover Rd (which turns into Red Meadow Rd/NF-115) off of US-93 N for about 17 miles to where it intersects with the PNNST on the left, and then following this road section of the PNNST another 1.5 miles. The monitoring site is then located about 0.5 miles from the trailhead, which begins on the west side of the road. During 2022, the counter and camera were set up on the north side of the trail.

Commented [SS2]: Need Camera and Counter Photos

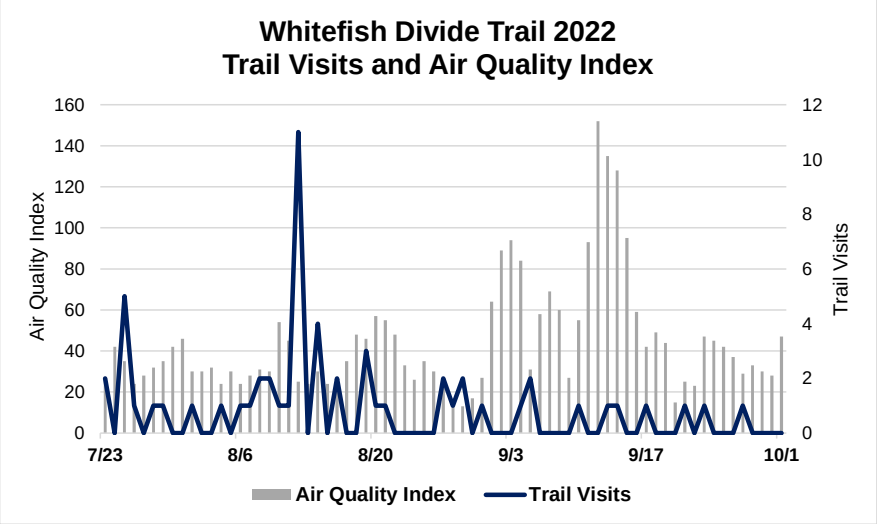
Commented [TJ3R2]: Are these photos okay or are they not updated?

2022 counter location.
Counter to climber's left.

2022 camera location.
Camera to climber's left.

From July 22, 2022, through October 1, 2022, an estimated 82 trail visits were recorded on Whitefish Divide Trail. Figure 10.1 displays the daily trail visit counts for the Whitefish Divide site, as well as the corresponding air quality in Kalispell. Wildfires during July and August 2022 may have contributed to lower numbers of trail visits during these months.

Figure 10.1 Whitefish Divide Daily Trail Visit Counts and Air Quality



Note: Whitefish Divide Trail, Kalispell Air Quality. AQI 0-50 Good, 51-100 Moderate, 101-150 Unhealthy for Sensitive Groups, 151+ Unhealthy.

Figure 10.2 shows the total weekly trail visits at the Whitefish Divide site. The week with the highest use was August 8-14, with 21 trail visits. A weekly average of 5.73 trail visits were recorded at the Whitefish Divide site during the weeks monitored.

Figure 10.2 Whitefish Divide Weekly Counts

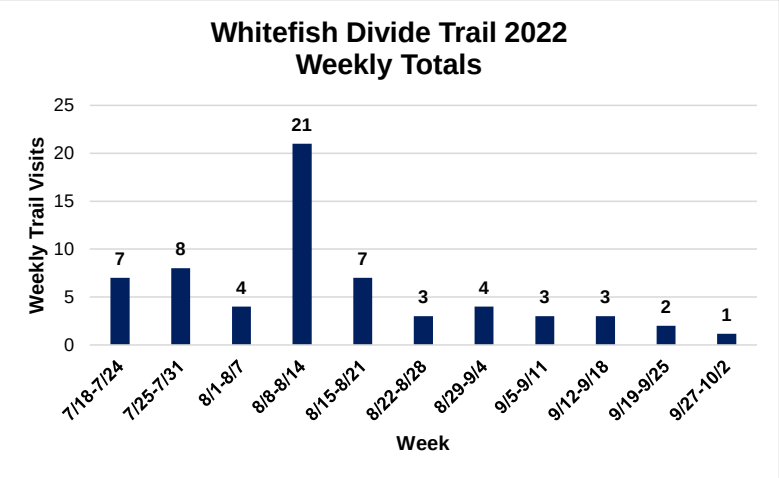
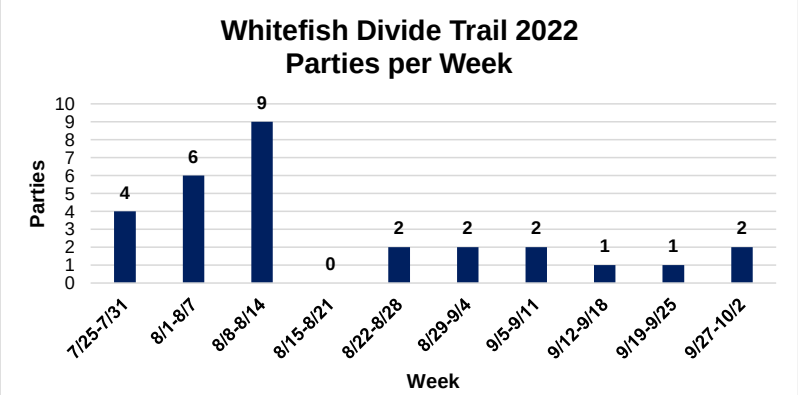


Figure 10.3 shows the parties per week at the Whitefish Divide monitoring site. Camera data was missing for this site between July 8th-20th, and only full weeks of data were assessed for party totals per week. Of the observable weeks, those with the largest number of parties were August 8-14, which had 9 and August 1-7, which had 6 parties pass by during the week.

Figure 10.3 Whitefish Divide Parties per Week



Note:Includes only full weeks (Monday through Sunday) of observation

Figure 10.4 includes the daily average number of trail visits by the day of the week at the Whitefish Divide site. The highest use day was Tuesday, with an average of 1.6 visitors per day. The lowest use day was Thursday with an average of 0.3 and Wednesday with 0.4 visitors per day. The remaining days of the weak were all averaged relatively close to 1 visitor per day.

Figure 10.4 Whitefish Divide Daily Averages by Day of the Week

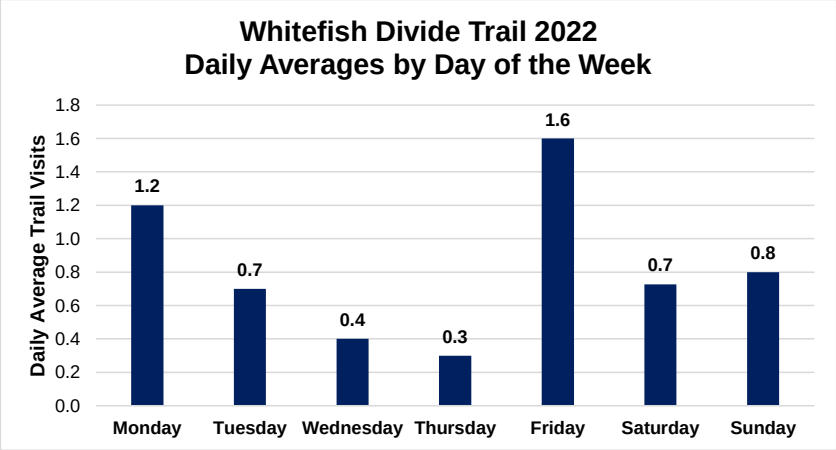


Figure 10.5 shows the percentage distribution of party sizes at Whitefish Divide during 2022. The graph shows that party sizes were relatively small, with 61.1% of parties involving solo users, 33.3.0% of parties being pairs of individuals, and 5.5% of parties containing trios.

Figure 10.5 Whitefish Divide Percentage Distribution of Party Size

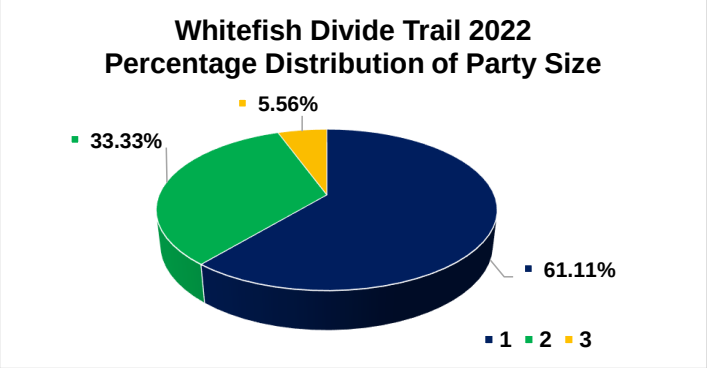


Figure 10.6 shows the distribution of user types at the party level observed at Whitefish Divide over 2022. The most common type of party included overnight hikers, which composed about 2/3 of parties. This was followed by day hikers, which made up 25.0% of the parties at this site. Other users composed the remaining 8.3% of parties at this site.

Figure 10.6 Whitefish Divide Percentage Distribution of User Types by Party

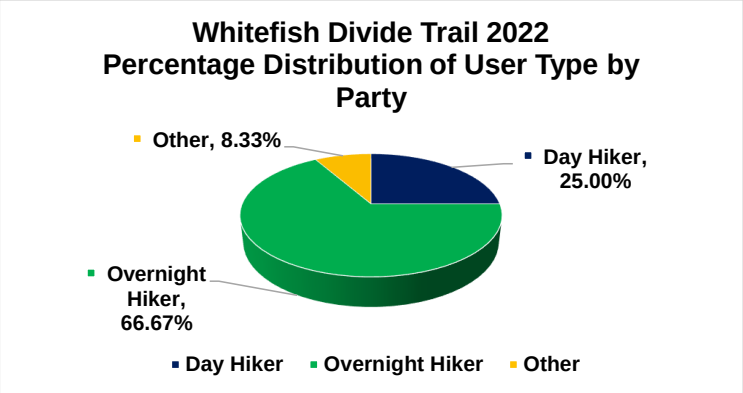
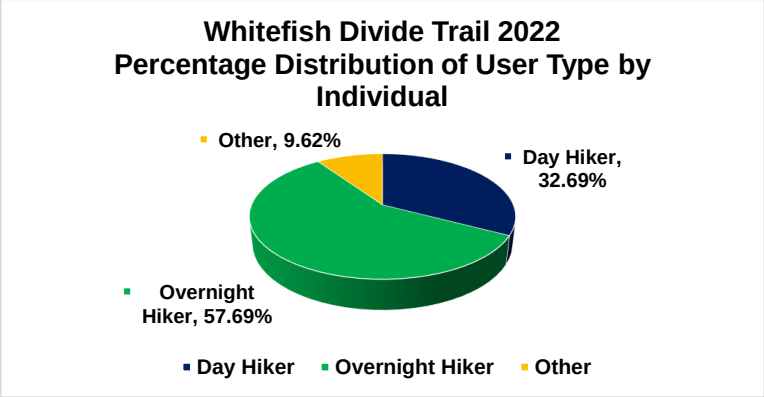


Figure 10.7 shows the distribution of user types at the individual level that were recorded at Whitefish Divide. This graph follows a similar trend to the distribution of the percentage of users measured at the party level. The most common type of user included overnight hikers, which composed about 57.6% of users. This was followed by day hikers, which included 32.6% of the parties at Whitefish Divide. Lastly, other users composed 9.6% of trail users.

Figure 10.7 Whitefish Divide Percentage Distribution of User Types by Individual



Garver Mountain 2022

Garver Mountain Trail can be found from Highway 92 by traveling north on NF-338 for 10 miles, with the trailhead found on the righthand side of the road. The Garver Mountain monitoring site is located approximately .6 miles from the parking site.

Commented [SS4]: Rewritten to the best of my ability with the information available

Commented [TJ5]: I think we should take these out- the writing on them makes it hard to read and it is not very helpful

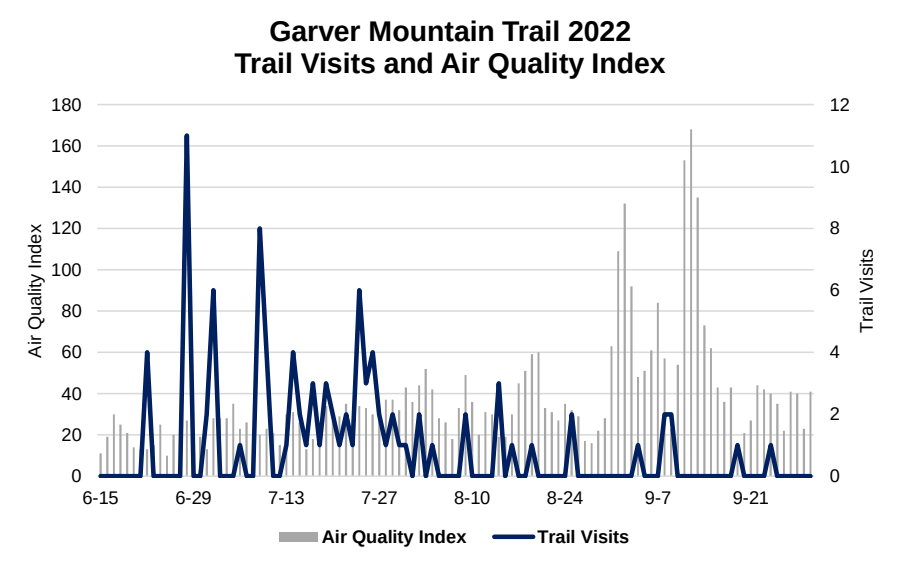
2022 counter location.
Counter to climber's right.

2022 camera location.
Camera to climber's left.

From June 28, 2022, through September 30, 2022, an estimated 81 trail visits were recorded on the Garver Mountain Trail. Figure 12.1 shows the estimated daily trail visit counts for the

Garver Mountain site and the relative air quality in Libby. Low air quality may have affected trail use for part of early September, where use was lower during one set of high AQI recordings.

Figure 12.1 Garver Mountain Daily Trail Visit Counts and Air Quality



Note: Garver Mountain Trail, Libby Air Quality. AQI: 0-50 Good. 51-100 Moderate, 101-150 Unhealthy for Sensitive Groups. 151+ Unhealthy.

Figure 12.2 shows the total weekly trail visits at the Garver Mountain site. The week with the highest use was June 27th- July 3rd, with 19 visits. The weeks of July 4th-10th, July 18th-24th, and July 25th-31st also had relatively high use, with each of these weeks having between 13-16 trail visits. A weekly average of 7.1 trail visits were recorded at the Garver Mountain site during the weeks monitored.

Figure 12.2 Garver Mountain Weekly Counts

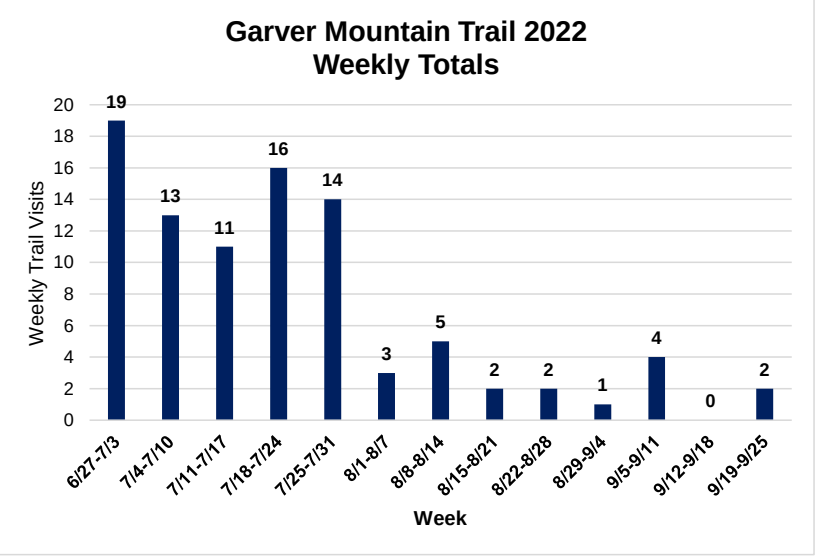
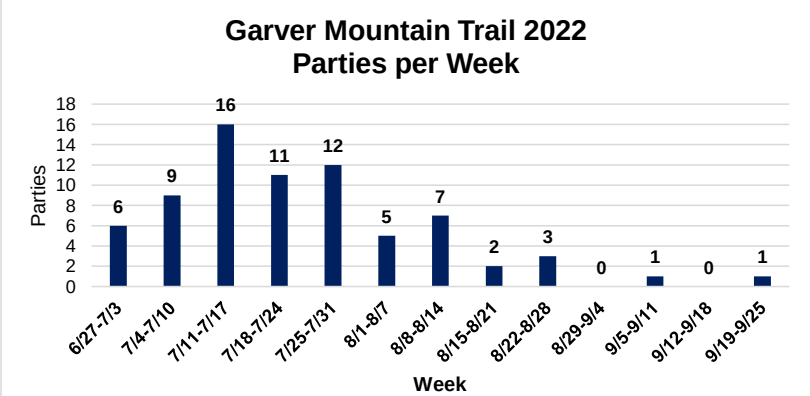


Figure 12.3 shows the parties per week at Garver Mountain, and only full weeks of data were assessed for party totals per week. The weeks observed to have the largest number of parties were July 11th-17th during which 16 parties pass by.

Figure 12.3 Garver Mountain Parties per Week



Note: Includes only full weeks (Monday through Sunday) of observations

Figure 12.4 includes the daily average number of trail visits by the day of the week at the Garver Mountain site. The highest use day was Tuesday, with an average of 1.5 visitors per day, also of note is the second highest days being Saturday and Sunday, both averaging 1.2 visitors per day.

Figure 12.4 Garver Mountain Daily Averages by Day of the Week

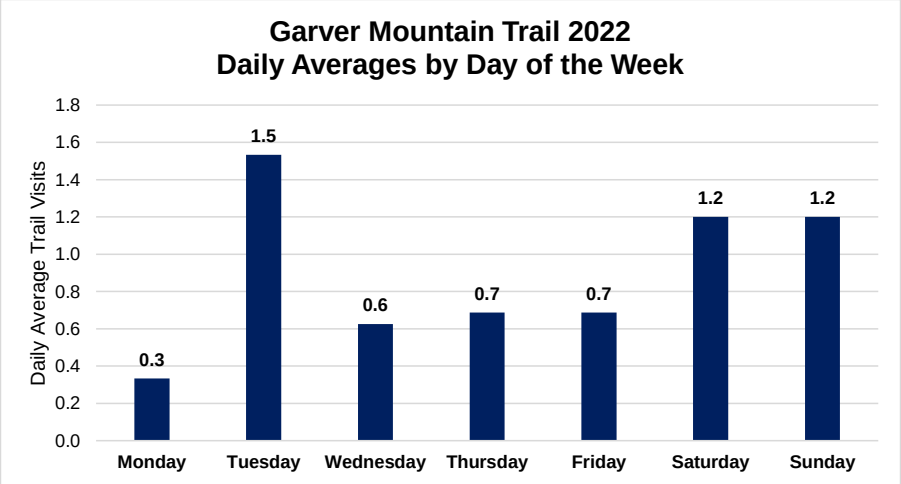


Figure 12.5 shows the percentage distribution of party sizes at Garver Mountain. Overall, the most common party sizes were solo users, making up 58.1% of parties, followed by pairs of trail users, which composed 33.9% of parties, and small numbers of 3- or 5-member party sizes.

Figure 12.5 Garver Mountain Percentage Distribution of Party Size

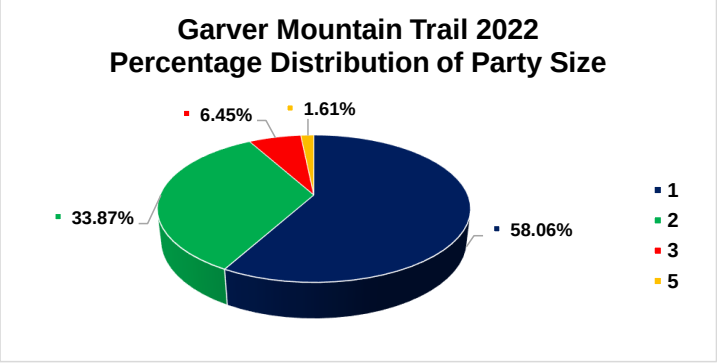


Figure 12.6 shows the distribution of user types observed at the party level at the Boulder Lake site. The most common type of party was composed of overnight hikers, which composed about 69.3% of parties. This was followed by day hikers which made up 25.8% of parties. A smaller number of crew made up 4.8% of parties at Garver Mountain during 2022.

Figure 12.6 Garver Mountain Percentage Distribution of User Types by Party

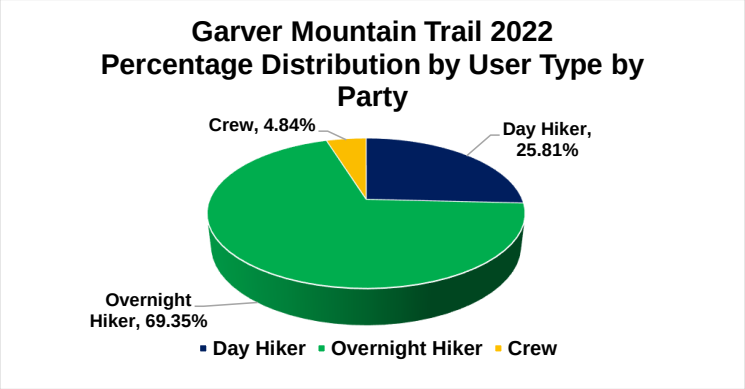
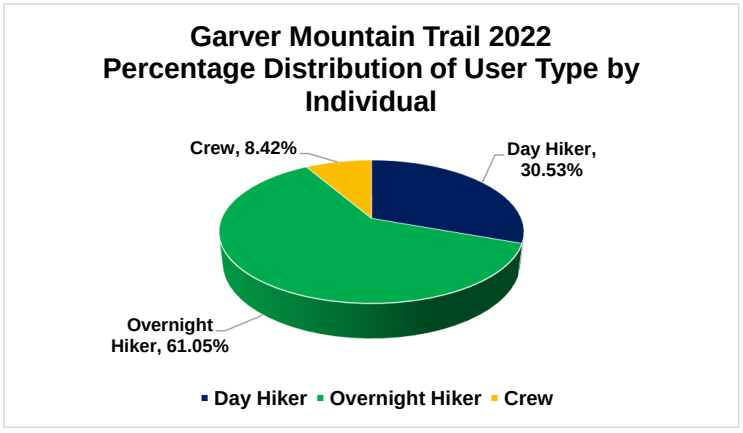


Figure 12.7 shows the distribution of user types at the individual level that were recorded at Garver Mountain over 2022. This graph follows a similar trend to the distribution of the percentage of users measured at the party level. The most common type of user at this site included overnight hikers, which made up 61% of trail visits, followed by day hikers at 30.5%, and the remaining 8.2% being trail crew.

Figure 12.7 Garver Mountain Percentage Distribution of User Types by Individual

Commented [TJ6]: Is there an extra page that is blank that needs to be deleted?



Vinal Creek 2022

The Vinal Creek monitoring site is not on the PNNST. The monitoring site is located on Vinal Creek Trail #9 and to the west of where the PNNST is co-located on this trail. Data presented for the Vinal Creek site is not PNNST use data.

Vinal Creek Trail #9 is part of the Vinal Creek/Mt. Henry National Recreation Trail. A portion of PNNST hikers may utilize the monitored section of the Vinal Creek #9 trail en route to stock up on supplies in Yaak, Montana, or to circumvent a section of the PNNST on Trail #41 between Fish Lakes and the Yaak River that climbs in elevation. Thus, the monitoring site may still provide useful information on some trail use patterns that are relevant to the PNNST. Additionally, Vinal Lake Trail #9 trail use from the trailhead to Fish Lakes is important to monitor for the Kootenai National Forest's grizzly bear management.

The start of Vinal Creek Trail #9 can be found on the east side of NF-746, off of CR 508. It is about 8 miles south of the Canadian border. The Vinal Creek monitoring site was located about 0.5 miles up from the trailhead during 2022. During 2022, the counter and camera were set up on the south side of the trail.

Vinal Creek Trailhead Parking

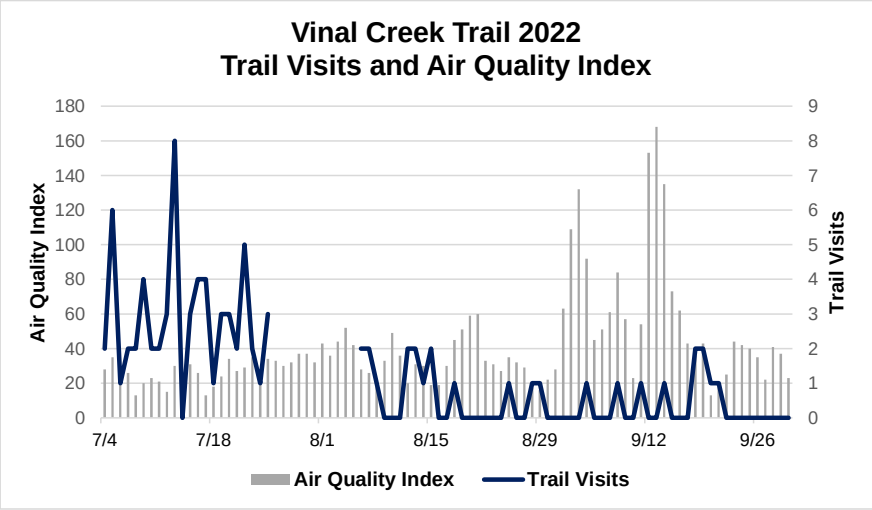
2022 counter location.
Counter to climber's right.

2022 camera location.
Camera to climber's left.

Commented [TJ7]: Same comment- I don't think these images with writing is helpful so delete- can provide GPS coordinates and map instead from the app that was used

From July 5, 2022, through September 30, 2022, an estimated 107 trail visits were recorded at the Vinal Creek site[11]. Figure 13.1 displays the daily trail visit counts for this site as well as the corresponding air quality measured in Libby. Higher AQI from lower air quality due to wildfires may have impacted trail use during September 2022 as trail visits appear to have dipped during periods of higher AQI for this site.

Figure 13.1 Vinal Creek Daily Trail Visit Counts and Air Quality[12]



Note: Vinal Creek Trail, Libby Air Quality. AQI 0-50 Good, 51-100 Moderate, 101-150 Unhealthy for Sensitive Groups, 151+ Unhealthy. Camera data from 7/25-8/5 was lost due to windy conditions creating false triggers on the camera until the memory card was full.

Figure 13.2 shows the total weekly trail visits observed at the Vinal Creek site. The week with the highest use was July 11th-17th, with this week having 24 trail visits. A weekly average of 9.75 trail visits were recorded at the Vinal Creek site during the weeks monitored.

[11] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.
[12] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

Figure 13.2 Vinal Creek Weekly Counts

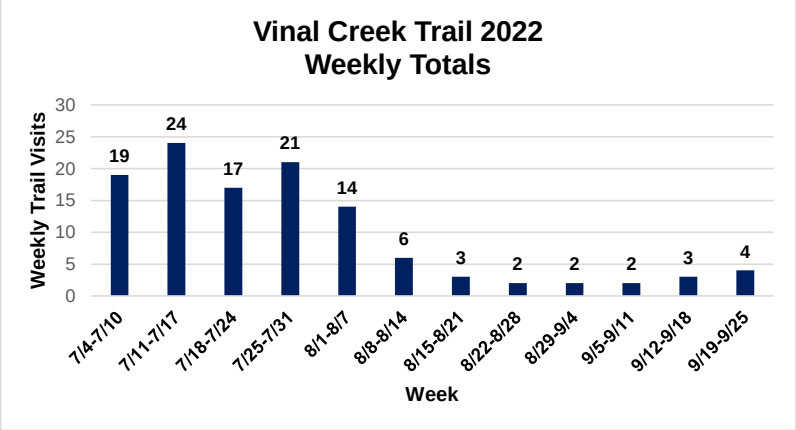
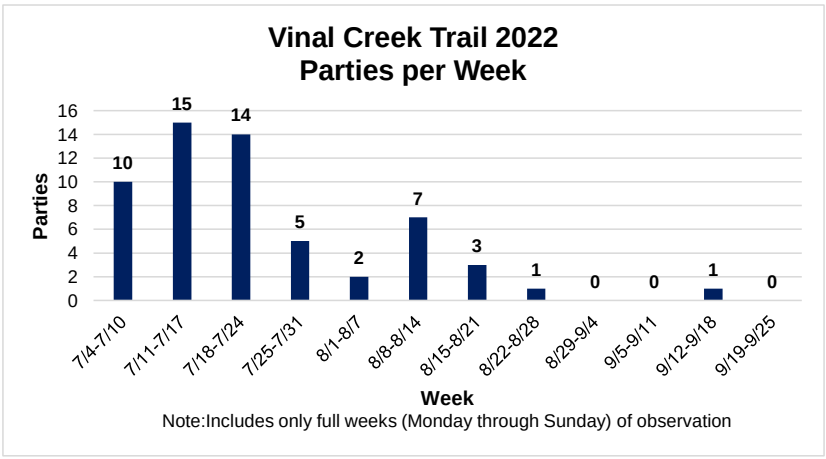


Figure 13.3 shows the parties per week observed at the Vinal Creek site. The observed week with the largest number of parties was July 11th-17th, during which 15 parties passed by, with the next highest, July 18th-24th observed 15 fourteen parties. By late August trail usage drops off dramatically.

Figure 13.3 Vinal Creek Parties per Week[13]



[13] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

Figure 13.4 includes the daily averages number of trail visits by the day of the week at the Vinal Creek site. The highest use day at this site was Sunday, with an average of 1.4 visitors per day and most other days coming close to that daily average.

Figure 13.4 Vinal Creek Daily Averages by Day of the Week

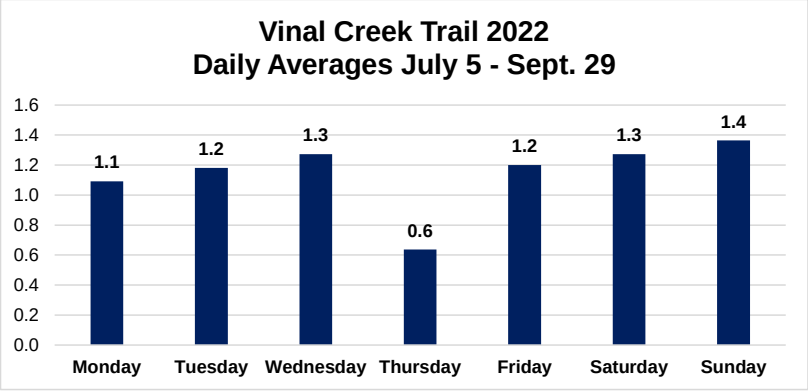
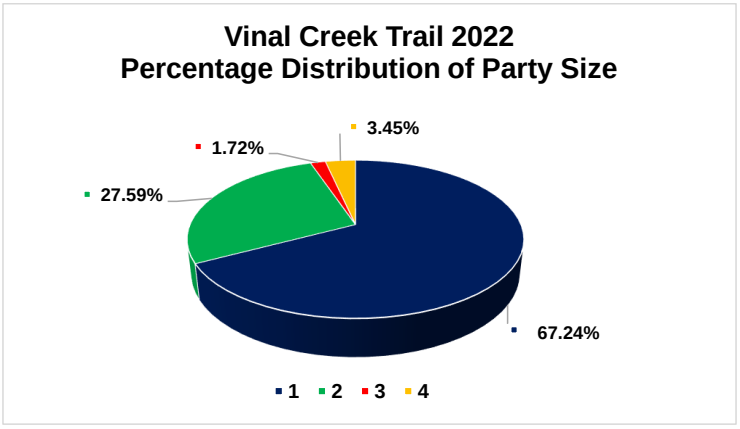


Figure 13.5 shows the percentage distribution of party sizes at the Vinal Creek Site. Overall, the most common party sizes were solo users, which made up 67.2% of parties. The next most common party size was pairs of two users, which made up 27.6% of parties. Party sizes did have a relatively wide range at this site, with parties of over ten people observed in past years. For example, groups of four and groups of three combined made up another 5.1% of parties.

Figure 13.5 Vinal Creek Percentage Distribution of Party Size[14]



[14] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

Figure 13.6 shows the distribution of user types observed at the party level at Vinal Creek. This site only had hikers observed during the 2022 season. Overnight hikers were by far most common, with 91.2% of parties including overnight hikers, compared to 8.7% of parties being made of day hikers.

Figure 13.6 Vinal Creek Percentage Distribution of User Types by Party

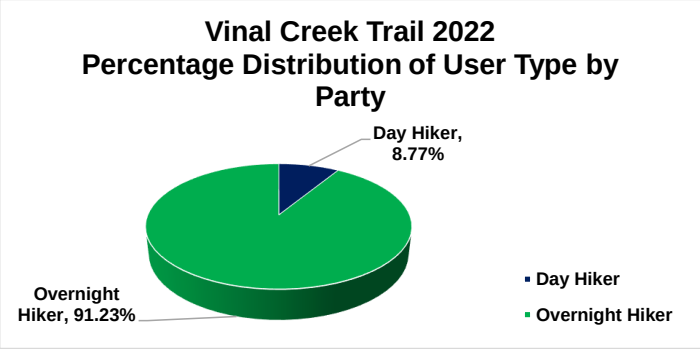
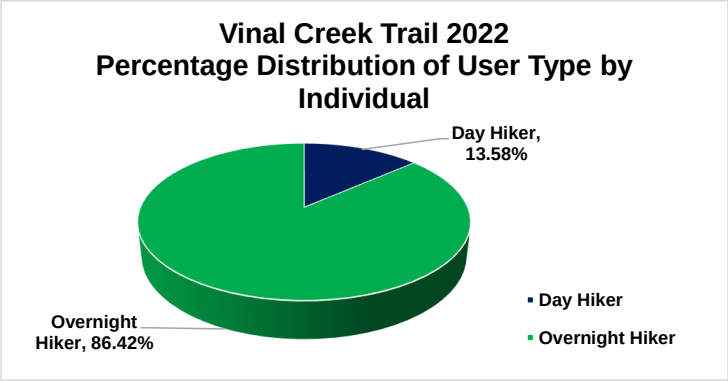


Figure 13.7 shows the distribution of user types at the individual level that were recorded at Vinal Creek over 2022. Like the analysis for percentage distribution of user type by party, the percentage distribution of user type by individual showed overnight hikers being more common than day hikers. Overnight hikers made up 86.4% of trail visits, followed by day hikers at 13.6%.

Figure 13.7 Vinal Creek Percentage Distribution of User Types by Individual[15]



[15] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

Canuck Peak 2022

Canuck Peak Trail can be found by following Spread Creek Road (NF-4354 and 435) up to the summit, where the road then continues into Idaho. The trailhead is on the north side. The Canuck Peak monitoring site was located about 0.6 miles from the trailhead during 2022.

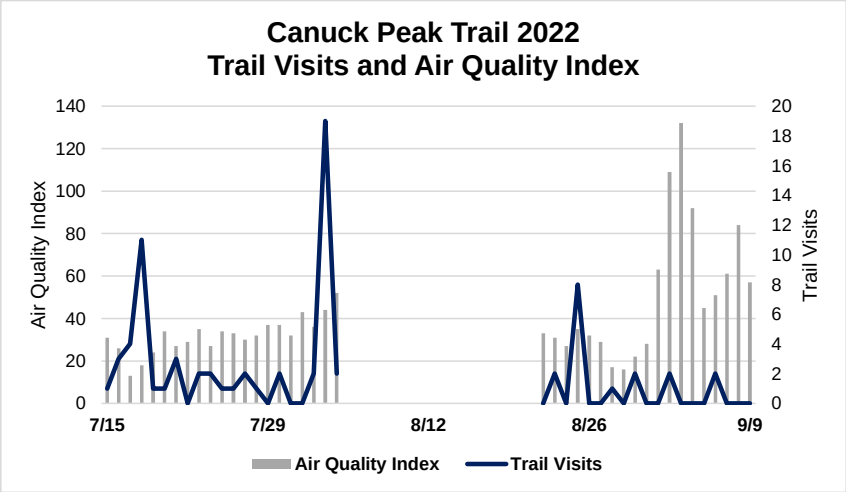
Looking west. Canuck Peak Trailhead Parking

2022 counter location.
Counter to climber's left.

2022 camera location.
Camera to climber's left.

From June 14-August 4, 2022, and August 23 to September 10, 2021, an estimated 157 trail visits were recorded at the Canuck Peak site. Figure 14.1 displays the daily trail visit counts for the Canuck Peak site as well as the corresponding air quality measures from Libby. Canuck Peak visitation was relatively low during this season, and the lack of use during late August may have been related to poor air quality from wildfires in the area. Canuck Peak is one of the sites that tends to be farther out of the way for users.

Figure 14.1 Canuck Peak Daily Trail Visit Counts and Air Quality



Note: Canuck Peak Trail, Libby Air Quality. AQI 0-50 Good, 51-100 Moderate, 101-150 Unhealthy for Sensitive Groups, 151+ Unhealthy.

Figure 14.2 shows the total weekly trail visits at the Canuck Peak Site. The week with the highest use was August 1st – 7th, with 40 trail visits, but this may be due to a camera error occurring after a visit to the site on August 5th. The three weeks in July are more typical of trail usage at Canuck Peak. A weekly average of 10.6 trail visits were recorded at the Canuck Peak site during the 2022 weeks monitored.

Figure 14.2 Canuck Peak Weekly Counts

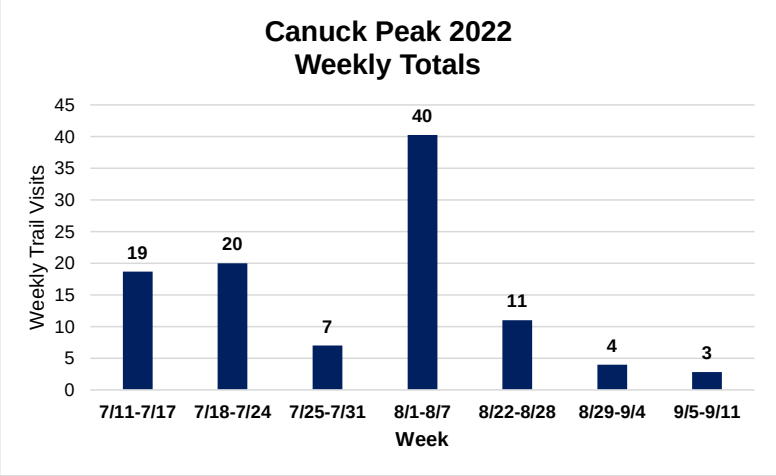


Figure 14.3 shows the parties per week that were observed at Canuck Peak. During 2021, the week with the largest number of parties at this site was July 18th-24th with 17, the week of July 11th -17th also observed 16 parties.

Figure 14.3 Canuck Peak Parties per Week

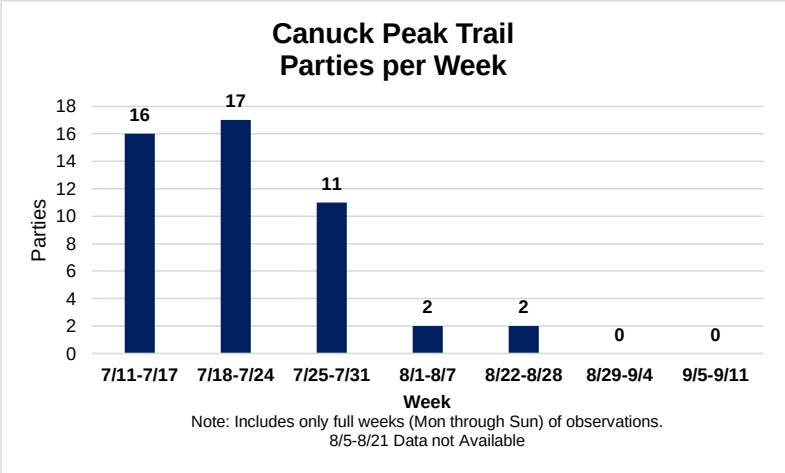


Figure 14.4 compares the average number of trail visits by the day of the week at the Canuck Peak site. During 2021 the highest use day was Wednesday, with an average of 3.6 daily visitors. This may be due to the gap in the data making the July trails visits outweigh the remaining weeks.

Figure 14.4 Canuck Peak Daily Averages by Day of the Week

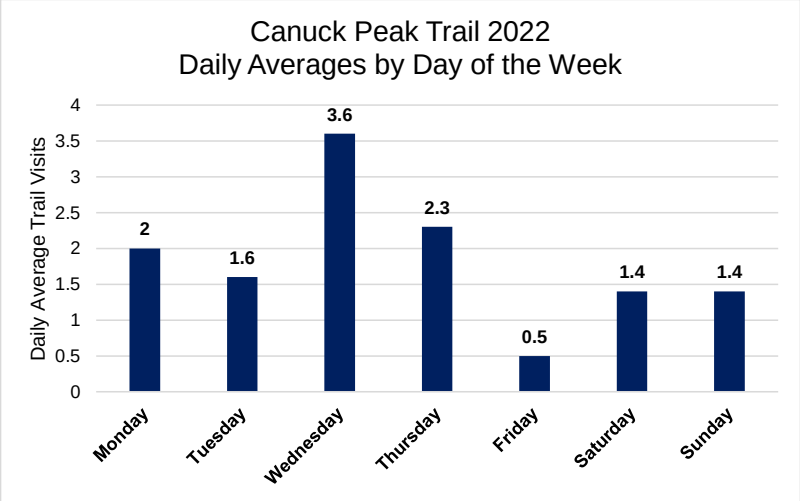


Figure 14.5 shows the percentage distribution of party sizes at the Canuck Peak monitoring site. Here, 64.6% of parties were composed of solo users, whereas the remaining 35.4% of parties were composed of pairs of individuals.

Figure 14.5 Canuck Peak Percentage Distribution of Party Size

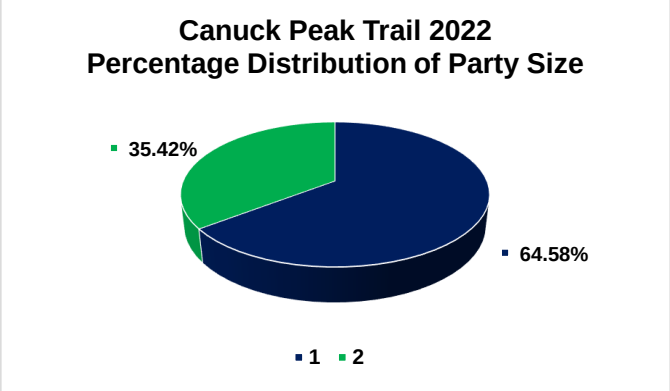


Figure 14.6 shows the distribution of user types observed at the party level for the Canuck Peak site. Canuck Peak mostly had hiker user types observed during the 2022 season. Overnight hikers were more common, with 80.4% of parties at this site, compared to 15.2% of parties being made of day hikers. This distribution may have been impacted by limited number of weeks, as thru-hikers may have been more motivated to pass through the area in the monitored weeks.

Figure 14.6 Canuck Peak Percentage Distribution of User Types

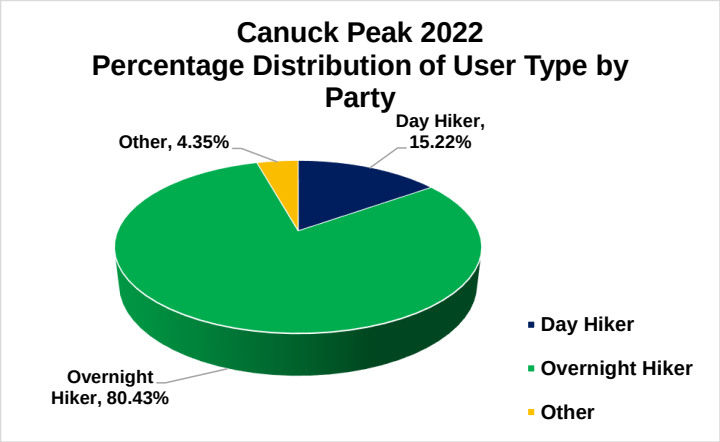
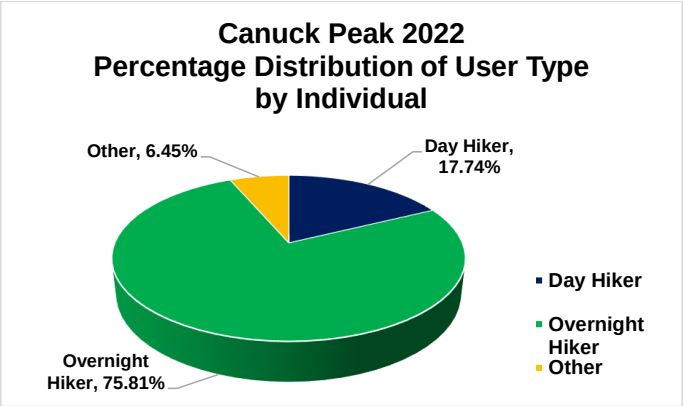


Figure 14.7 shows the distribution of user types at the individual level that were recorded at Canuck Peak during 2022. Similar to the percentage distribution by party, the percentage distribution of user type by individual showed that overnight hikers were more common than day hikers at Canuck Peak. Overnight hikers made up 75.8% of trail visits, compared to day hikers making up 17.7%.

Figure 14.7 Canuck Peak Percentage Distribution of User Types



Parker Ridge 2022

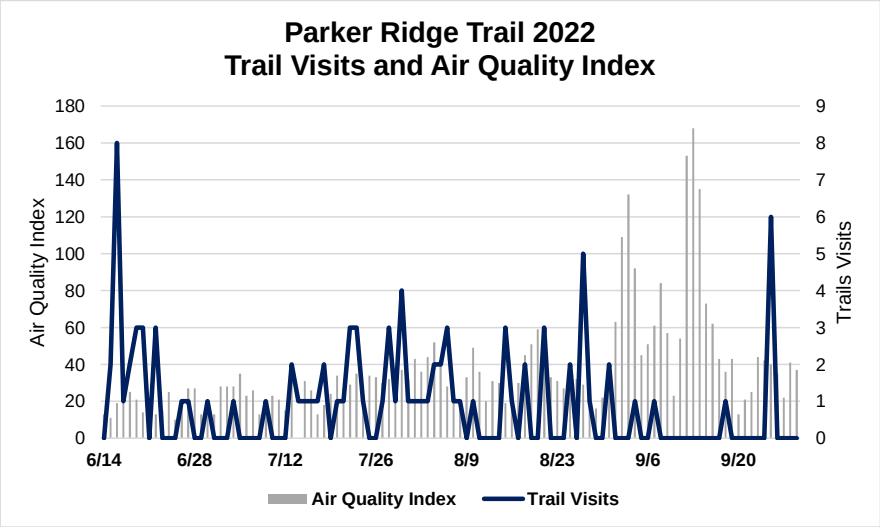
The Parker Ridge Trail (#221) is located off the Parker Ridge trailhead in Kaniksu National Forest and is one of the new PNNST monitoring sites added in the Idaho Panhandle. To get to this trailhead, turn west onto Copeland Rd from US-1 N and drive for about 4 miles, then merge onto Westside Rd #417 on the right and continue another 7 miles to a parking area on the left. The 2022 monitoring site was located about 0.5 miles from this trailhead.

2022 counter location.
Counter to climber's left.

2022 camera location.
Camera to climber's right.

From June 15, 2022, through September 30, 2022, an estimated 70 trail visits were recorded at the Parker Ridge monitoring site. Figure 16.1 displays the daily trail visit counts for this site as well as the corresponding air quality measured in Libby. Trail use may have been affected by lower air quality in August and September due to wildfires in the area. For example, trail visits peaked during a time when AQI lowered for a bit in early August, before AQI rose again during the month and trail visits lowered.

Figure 16.1 Parker Ridge Daily Counts and Air Quality



Note: Parker Ridge Trail, Libby Air Quality. AQI 0-50 Good, 51-100 Moderate, 101-150 Unhealthy for Sensitive Groups, 151+ Unhealthy.

Figure 16.2 shows the total weekly trail visits for the Parker Ridge monitoring site. The weeks with the highest use included June 13th-19th with 19 trail visits, followed by July 18th-14th and August 1st-7th with 11 trail visits. The average number of weekly trail visits for this site was 6.5 trail visits for the weeks monitored during 2022.

Figure 16.2 Parker Ridge Weekly Counts

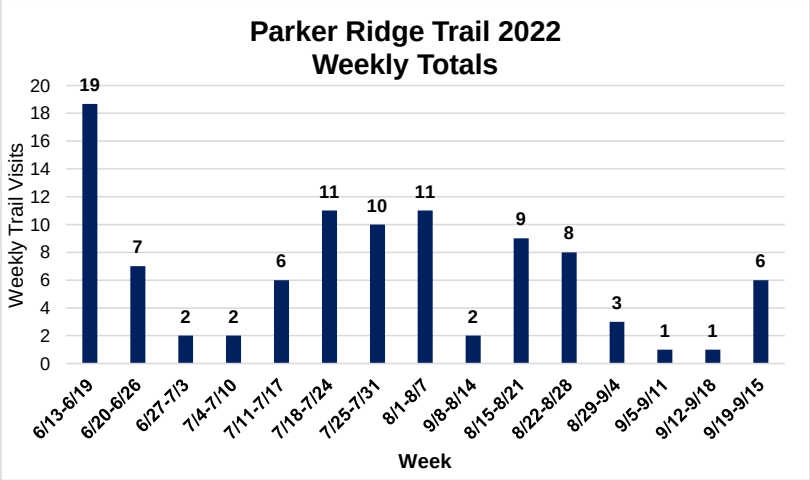


Figure 16.3 shows the parties per week that were observed at the Parker Ridge. The weeks of September 5th-15th are excluded due to a short-term fire closure. The week noted to have the greatest number of parties observed at Parker Ridge was June 13th-19th. During this week 15 parties passed by the monitoring site.

Figure 16.3 Parker Ridge Parties per Week

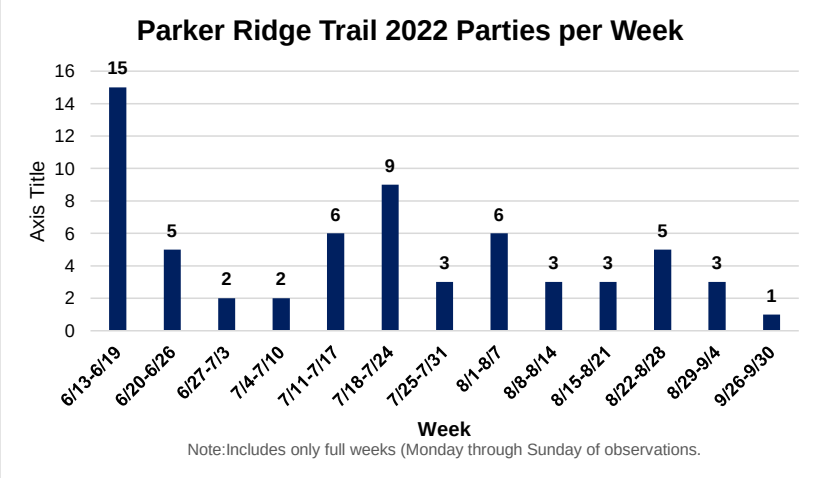


Figure 16.4 includes the daily average number of trail visits by the day of the week at the Parker Ridge site. The highest use day for this site was Thursday, Saturday, and Sunday, with an average of 1.3 visitors per day. Based on camera data, this trail was frequented by day hikers on the weekends, which could account for the higher weekend traffic, which is typical of day use patterns.

Figure 16.4 Parker Ridge Daily Averages by Day of the Week

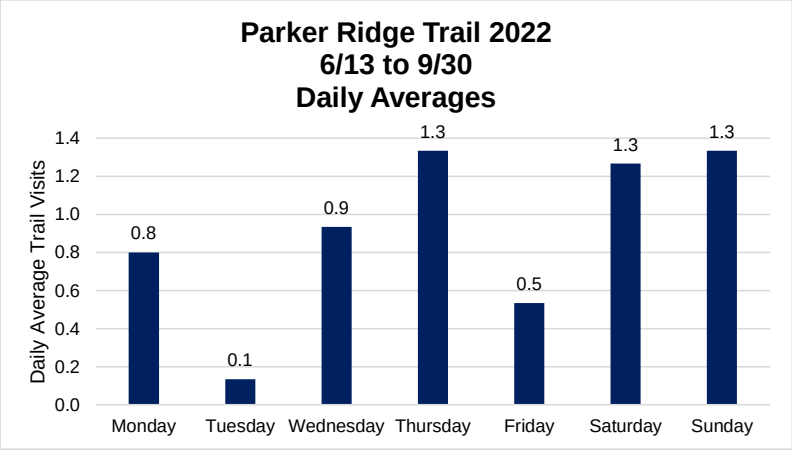


Figure 16.5 shows the percentage distribution of Parker Ridge party sizes. The most common party size at this site involved solo trail users, which composed 63.5% of parties, followed by pairs of users, which made up another 25.4% of parties. Most of the remaining parties were composed of three or four individuals.

Figure 16.5 Parker Ridge Percentage Distribution of Party Size

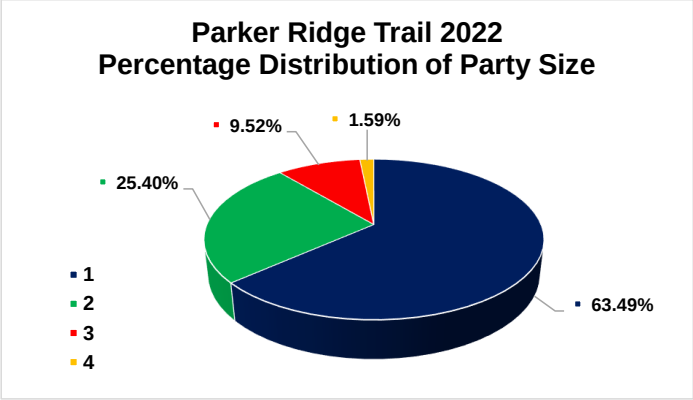


Figure 16.6 shows the distribution of user types observed at the party level for Parker Ridge. Most parties at this site were day hikers, which composed 61.3% of parties at this site. The next most common type of user included the 32.3% of parties that were overnight hikers. Additionally, a small 6.4% of parties at this site were other users such as trail crew.

Figure 16.6 Parker Ridge Percentage Distribution of User Types by Party

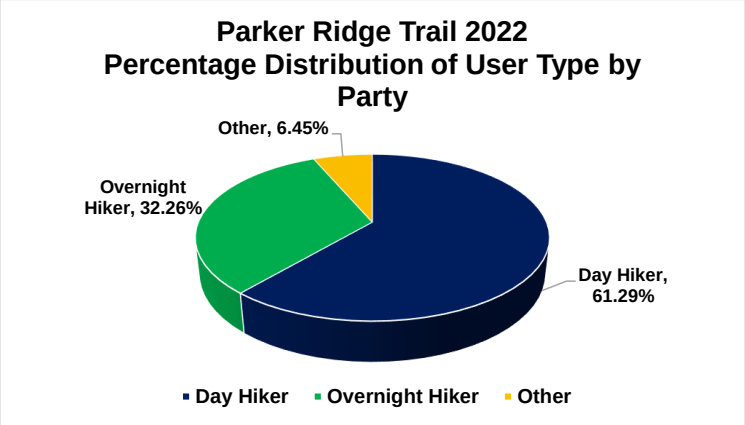
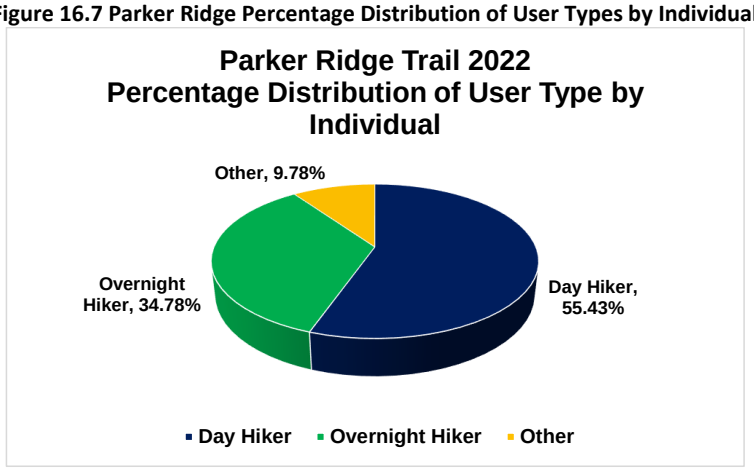


Figure 16.7 shows the distribution of user types at the individual level that were recorded at Parker Ridge during 2022. Day hikers made up 55.4% of trail visits, compared to overnight hikers making up 34.8.2%, and other users making up the other 9.8.6% of users.

Figure 16.7 Parker Ridge Percentage Distribution of User Types by Individual



Brush Lake 2022

The Brush Lake monitoring site is located off the Bethlehem trailhead in Kaniksu National Forest. This site is also one of the new PNNST monitoring sites added in the Idaho Panhandle during 2021. To get to this trailhead, turn east onto Fawn Lane from US-95 N, then turn north onto Camp 9 Rd, then follow Camp 9 Rd for about five miles until it turns into Camp Bethlehem Mine Rd, and continue for another 2 miles to where the Bethlehem trailhead intersects with the road on the right. The 2022 monitoring site was located about 0.8 miles from this intersection.

2022 counter location.
Counter to climber's right.

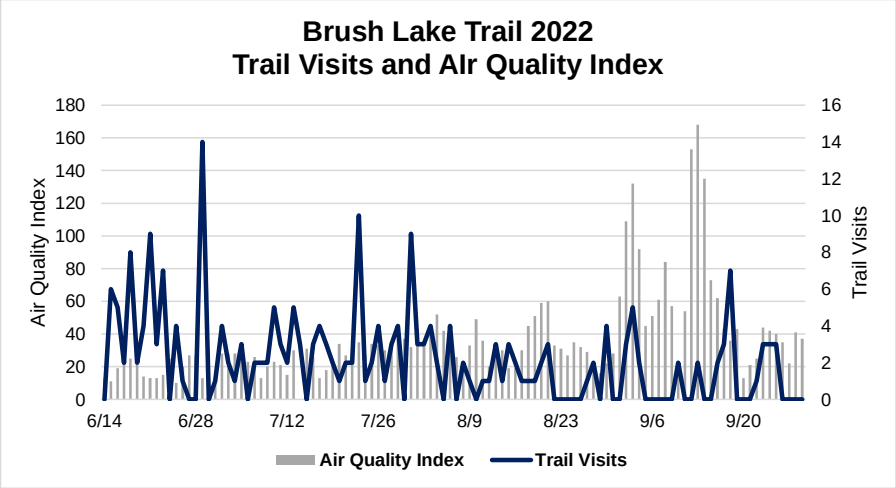
2022 camera location.
Camera to climber's left.

Commented [TJ8]: Comment from above- need to take out this hand written and use the same format as other images with typing and a circle graphic otherwise does not look professional

From June 14, 2022 through September 30, 2022, an estimated 230 trail visits were recorded at the Brush Lake monitoring site. Unlike any of the other monitored sites, Brush Lake is on a trail where some motorized uses are allowed, and so it had additional types of users observed. During 2022 numerous ATV parties, additionally, Brush Lake had approximately numerous parties of motor vehicles are a barrier at the trail head was removed. The number of individuals within these cars could not reliably be determined due to the interior cabin obstructing counts. Notably, this trail is only open to vehicles under 50" wide, so cars observed on this trail were entering illegally. Camera data showed that many of these car sightings appeared to be just a few of the same cars traveling up and down the trail for multiple days.

Figure 17.1 displays the daily trail visit counts for Brush Lake as well as the corresponding air quality measured in Libby. Trail use at Brush Lake may have been affected by lower air quality in September due to wildfires in the area, however, use did remain relatively high during one of the AQI peaks in late August.

Figure 17.1 Brush Lake Daily Counts and Air Quality



Note: Brush Lake Trail, Libby Air Quality. AQI: 0-50 Good, 51-100 Moderate, 101-150 Unhealthy for Sensitive Groups, +151 Unhealthy.

Figure 17.2 shows the total weekly trail visits for Brush Lake during 2022. The week with the highest use was June 20th-26th with 28 trail visits, with the week before recording a total one less. The average number of weekly trail visits for this site was 16.86 trail visits for the weeks monitored during 2022.

Figure 17.2 Brush Lake Weekly Counts

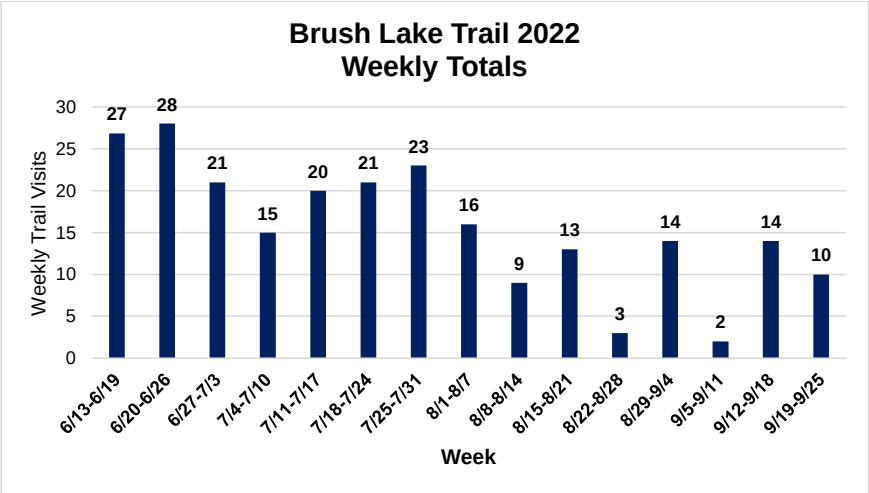


Figure 17.3 shows the parties per week at Brush Lake. The week with the most parties at Brush Lake was July 25th-31st. During this week 26 parties passed by the Brush Lake monitoring site.

Figure 17.3 Brush Lake Parties per Week

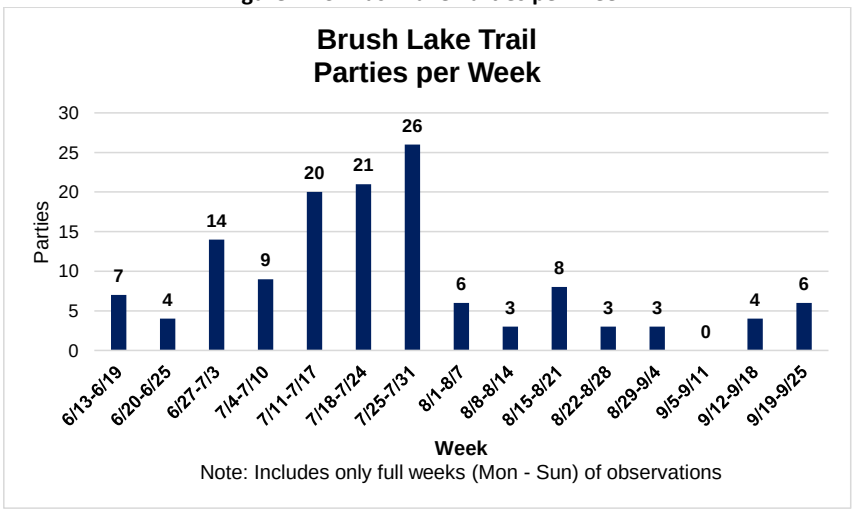


Figure 17.4 includes the average daily number of trail visits by the day of the week for Brush Lake. The highest use day for this site was Saturday, with an average of 3.6 visitors per day, followed by Sundays with 2.8 average visitors, and Wednesday with 2.3 average visitors.

Figure 17.4 Brush Lake Daily Averages by Day of the Week

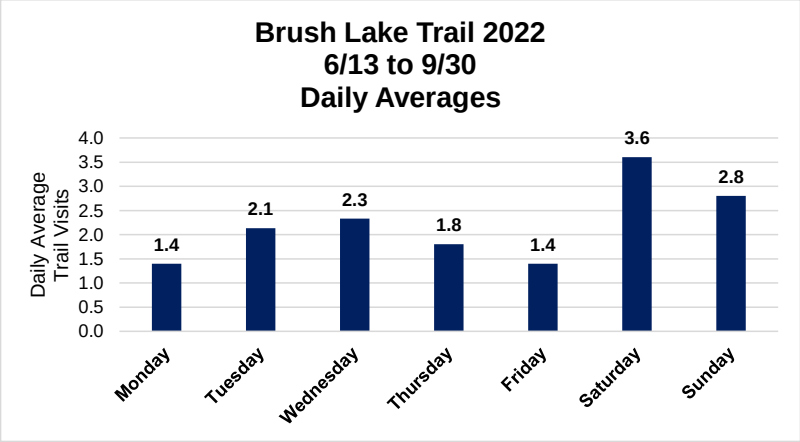


Figure 17.5 shows the percentage distribution of Parker Ridge party sizes. The most common party size at this site was made up of solo trail users, which composed 61.1% of parties, followed by pairs of users which made up 27.5% of parties. However, party sizes had a relatively wide range at this site, with parties of up to ten people observed.

Figure 17.5 Brush Lake Percentage Distribution of Party Size

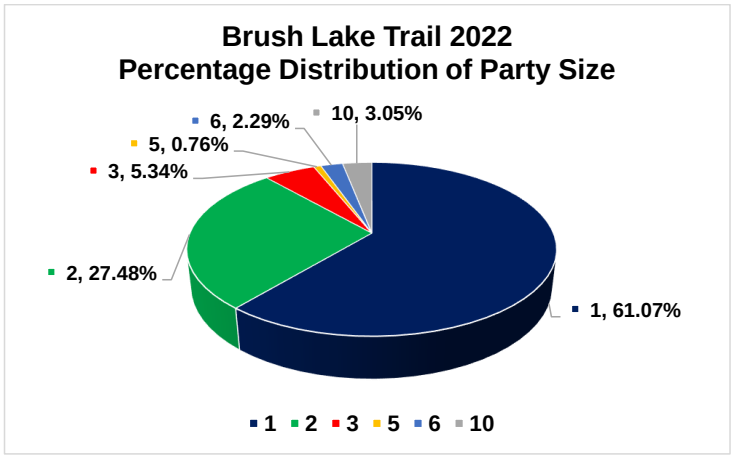


Figure 17.6 shows the distribution of user types observed at the party level for Brush Lake. Other users were the majority user type with 48.1%, and overnight hikers were the next most common, making up 39.5% of parties. Day hikers composed 12.4% of parties.

Figure 17.6 Brush Lake Percentage Distribution of User Types by Party

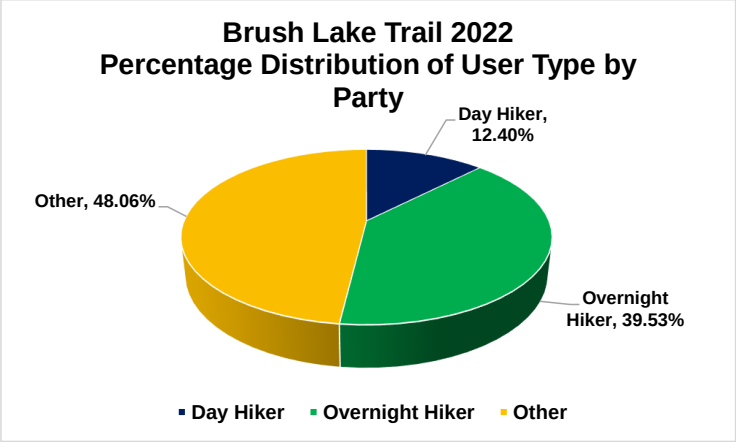
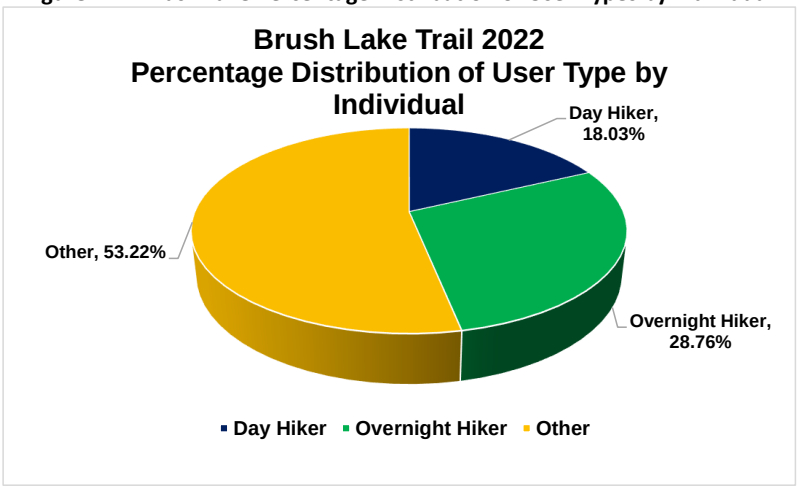


Figure 17.7 shows the distribution of user types at the individual level that were recorded at Brush Lake during 2021. Much like the percentage distribution of user type by party, individual showed that other users make up most trail visitors. Overnight hikers were more common than day hikers at Brush Lake, with 28.8% of users being overnight hikers compared to 18% being day hikers.

Figure 17.7 Brush Lake Percentage Distribution of User Types by Individual



Comparison of 2017 – 2022 Average Daily Trail Visits and Monthly Visits

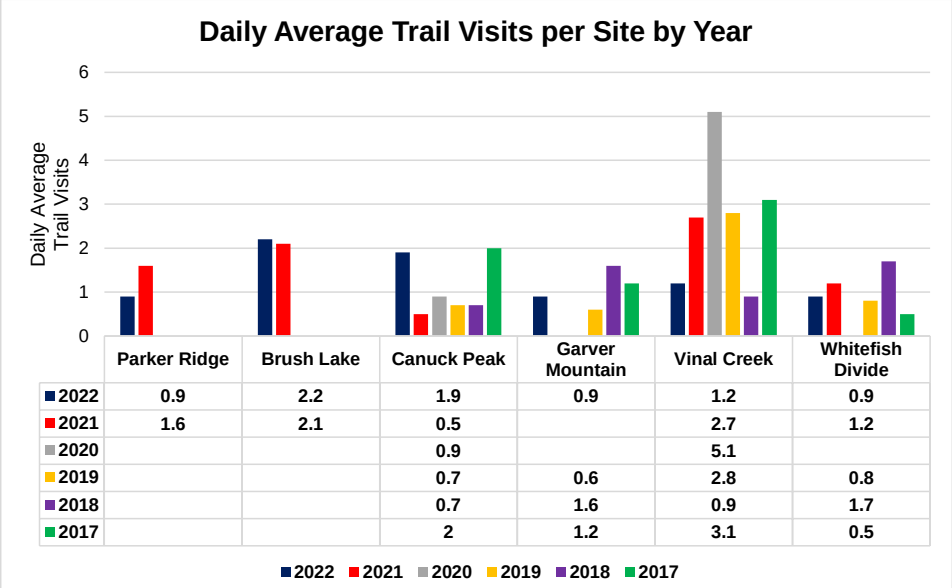
The following graphs compare use of trails between the past five monitoring seasons. The graphs separately depict the average daily trail visits for July, August, and September to allow for a more in-depth examination of use at each site per month, compared between the years. Average daily trail visits for each month were used instead of total counts per month to make better relative comparisons while considering that the different sites and years had different amounts of camera and counter data available. Daily averages were based on total monthly counts divided by observed days at each site for each year, with a minimum of ten days of observation needed for each daily average. Graphs with empty bars indicate when some years had insufficient data for certain sites. The three new Idaho sites (Pyramid-Ball Lakes, Parker Ridge, and Brush Lake) were not included in these graphs as this was the first year they were each monitored.

Because no calibration factors were available from 2017, the 2018 calibration factors have been applied to the 2017 data for when making calculations. New calibration factors were added to 2019, 2020, 2021, and 2022 data. Comparison of daily averages should be made with caution due to variations in the ability to determine accurate calibration factors for each year and individual sites. For example, the accuracy of these factors may be influenced by the number of days monitored, cameras' minimal time intervals, researcher errors, etc. However, it remains useful to compare these trends for overall patterns of use and changes over time, even if individual counts and daily averages are estimates.

Additionally, when making these comparisons it is important to note that the calibration factors for 2017, 2018, 2019, 2020, 2021, and 2022 were calculated in somewhat different ways. Calibration factors for 2019, 2020, and 2021 accounted for all trail users (including overnight hikers, day hikers, horse riders, bike riders, trail/administrative crew members, ATVs, motorized bike/motorcycle riders, and cars). In contrast, 2018 data was calibrated only for day and overnight hikers (excluding all other types of users). Therefore, while the percentage of trail users that were trail/administrative crew members, horse riders, bike riders, ATVs, motorized bike/motorcycle riders, and cars is relatively small, comparisons between 2017, 2018, 2019, 2020, and 2021 are not entirely equivalent. Trail user estimates for 2017 and 2018 would likely be at least slightly higher than the reported estimates.

Figures 18.1 compares average daily trail visits for each trail for July across 2017, 2018, 2019, 2020, 2021, and 2022. The number of average daily trail visits increased from 2017 to 2018, and at Whitefish Divide and Garver Mountain. Brush Lake and Parker Ridge were added in 2021, and are each showing steady usage. Canuck Peak has increased usage in 2022 when compared to 2019-2021. While Vinal Creek shows consistent usage over all years. Whitefish Divide also shows positive daily averages, but was unfortunately not included in the 2020 season.

Figure 18.1 Comparison of Average Daily Trail Visits Between Sites: 2017 – 2022[16][17]



	Parker Ridge	Brush Lake	Canuck Peak	Garver Mountain	Vinal Creek	Whitefish Divide
2022	0.9	2.2	1.9	0.9	1.2	0.9
2021	1.6	2.1	0.5		2.7	1.2
2020			0.9		5.1	
2019			0.7	0.6	2.8	0.8
2018			0.7	1.6	0.9	1.7
2017			2	1.2	3.1	0.5

[16] 2017 and 2018 calibration factors accounted for only hikers (including day and overnight), while 2019, 2020, and 2021 calibration factors accounted for all trail users.

[17] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

Table 3 compares average daily trail visits across each site for August during 2017, 2018, 2019, 2020, 2021, and 2022. Among these sites, July usage is the highest over the years, with mixed usage in August, and most years a steady drop off in trail visits beginning in September.

Table 3. Comparison of Average Monthly Trail Visits Between Sites: 2017 – 2022[18][19]

Month - Year	Parker Ridge	Brush Lake	Canuck Peak	Garver Mountain	Vinal Creek	Whitefish Divide
Jul-17			220.4	63.0	189.0	32.9
Aug-17			58.0	29.0	97.3	14.0
Sep-17			31.0	19.0	10.0	11.0
Jul-18			46.5	48.6	50.0	31.0
Aug-18			10.0	31.0	24.0	61.0
Sep-18			4.4		10.0	53.6
Jul-19			32.0	43.0	128.0	48.0
Aug-19			28.0	14.0	60.0	16.0
Sep-19			3.0	3.0	54.0	6.0
Jul-20			50.7		237.0	
Aug-20			25.0		125.0	
Sep-20			11.1		71.4	
Jul-21			22.0		136.8	50.6
Aug-21	31.0		13.3		68.2	10.0
Sep-21	46.7		3.0		39.0	65.5
Jul-22	29.0	86.0	63.8	62.0	78.1	34.4
Aug-22	32.0	45.0	79.7	12.0	19.1	38.0
Sep-22	3.9	39.1	13.3	7.8	13.0	11.7

[18] 2017 and 2018 calibration factors accounted for only hikers (including day and overnight), while 2019, 2020, and 2021 calibration factors accounted for all trail users.
[19] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

Comparison of 2021 and 2022 Party Sizes

Party size was determined for the 2021 and 2022 field seasons using camera data observations. During 2021 and 2022, party size was measured as the number of individuals that appeared to be traveling together (based on being the same user type and traveling in the same direction) that passed by the camera within two minutes of each other, such that there is at least 2 minutes between one party and the next. Whitefish Divide, Vinal Creek, Parker Ridge, and Brush Lake were the only complete data sets available for this analysis, Canuck Peak was omitted due to data deficiencies and Garver Mountain was not used in 2021.

Figure 19.1 shows the approximate percentage distribution of party sizes at Whitefish Divide Trail for overlapping dates observed between 2021 and 2022. For both years at this site the most common party involved solo users, which was then followed by pairs of users. A smaller percentage of groups of three were also observed both years.

Figure 19.1 Whitefish Divide Percentage Distribution of Party Size 2021 vs 2022

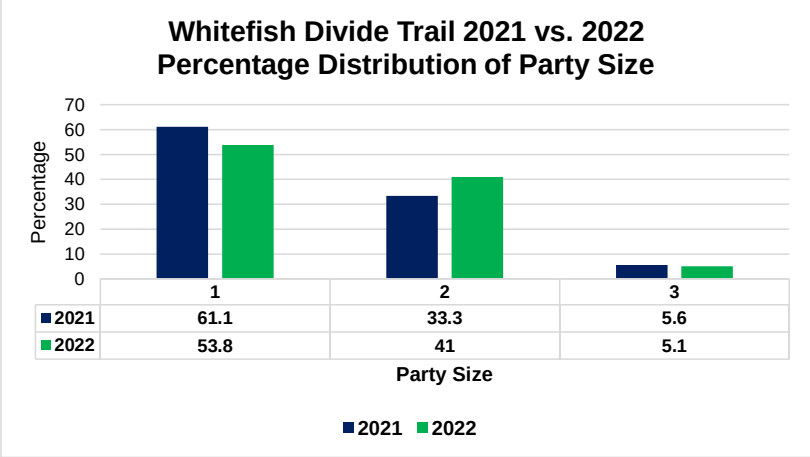


Figure 19.2 shows the approximate percentage distribution of party sizes at Vinal Creek[20] for overlapping dates observed during 2021 and 2022. The spread of party sizes at Vinal Creek[29] ranged for both 2021 and 2022. During 2021, solo of trail users composed the largest percentage of parties, followed by pairs of users, and a small percentage of parties ranging from 3 to 10 plus. In contrast, solo users were the most common party size at Vinal Creek[29] in 2022, then followed by pairs of users. Larger groups of individuals were noted at this site across 2021, with some parties in 2021 having over ten people.

[20] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

Figure 19.2 Vinal Creek Percentage Distribution of Party Size 2021 vs 2022

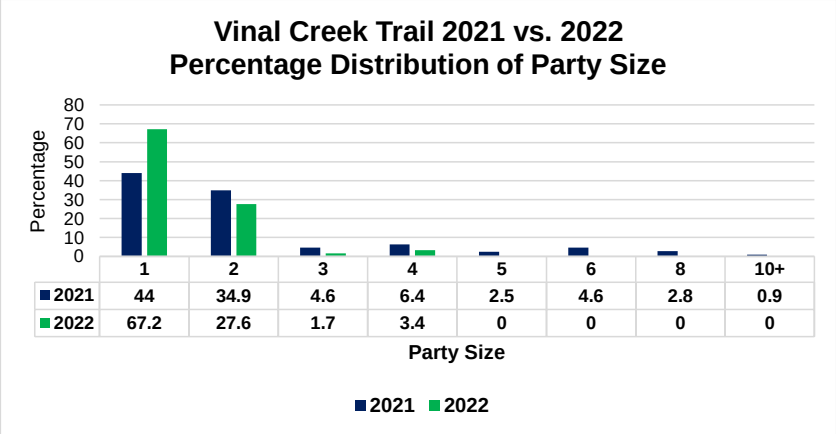


Figure 19.3 shows the approximate percentage distribution of party sizes at Parker Ridge for overlapping dates observed during 2021 and 2022. During both 2021 and 2022, the most common party observed at Parker Ridge involved solo users, which was then followed by pairs of users, and a mixture of three person to ten-plus person parties.

Figure 19.3 Parker Ridge Trail Percentage Distribution of Party Size 2021 vs. 2022

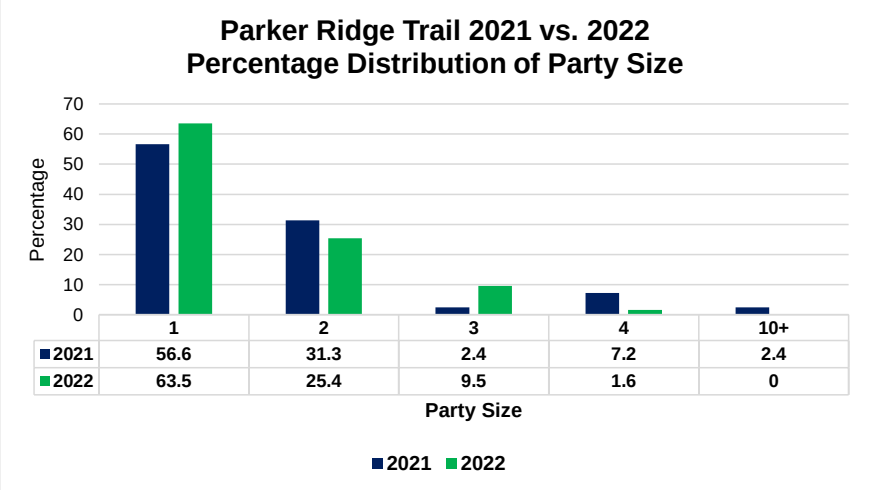
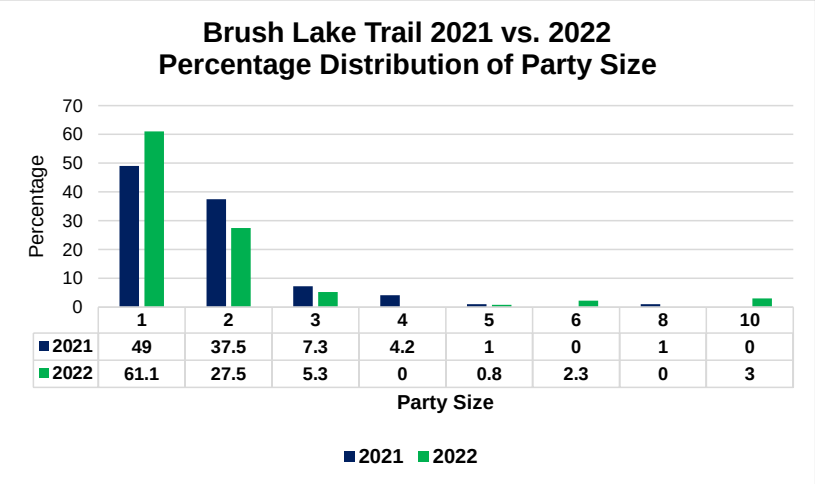


Figure 19.4 shows the approximate percentage distribution of party sizes at Brush Lake for overlapping dates observed during 2021 and 2022. During both 2021 and 2022, the most common party observed at Brush Lake involved solo users, which was then followed by pairs of users, and a mixture of three person to ten-plus person parties.

Figure 19.4 Brush Lake Trail Percentage Distribution of Party Size 2021 vs. 2022



	1	2	3	4	5	6	8	10
2021	49	37.5	7.3	4.2	1	0	1	0
2022	61.1	27.5	5.3	0	0.8	2.3	0	3

Comparison of 2021 and 2022 User Types

Figure 20.1 shows the distribution of user types by party at Whitefish Divide for overlapping dates observed over 2021 and 2022. During 2021 the most common types of party was composed of day hikers, followed by overnight hikers. In contrast, during 2022, the most common type of party was made of overnight hikers, then followed by day hikers. The percentage of parties of other users stayed relatively small across both years.

Figure 20.1 Whitefish Divide Percentage Distribution of User Types by Party

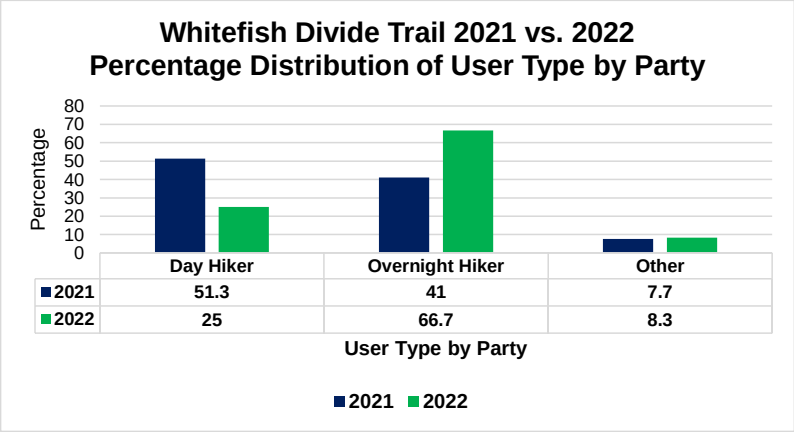


Figure 20.2 shows the distribution of user types observed at the individual level for Whitefish Divide across 2021 and 2022. Similar to the party analysis, the most common types of users during 2021 were day hikers followed by overnight hikers. Again, this was in contrast to how the most common users in 2022 were overnight hikers, followed by day hikers.

Figure 20.2 Whitefish Divide Percentage Distribution of User Types by Individual

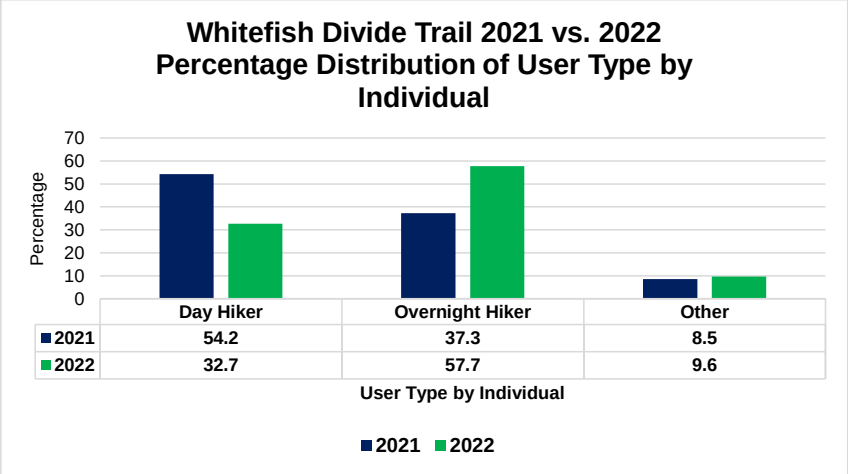
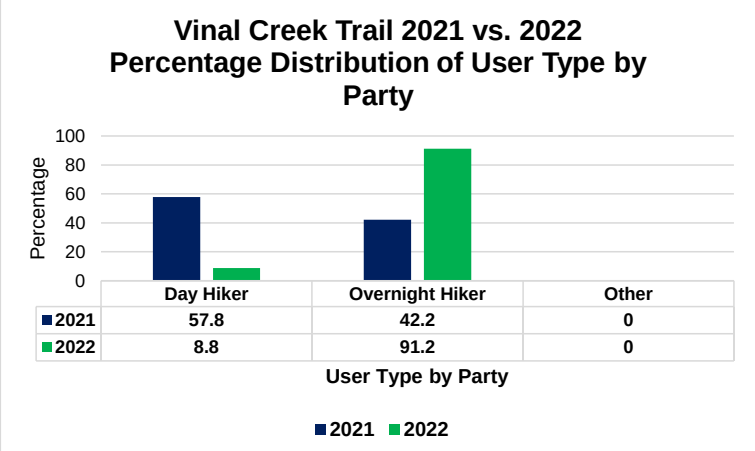


Figure 20.3 shows the distribution of user types by party at Vinal Creek[21] for overlapping dates observed during 2021 and 2022. Day hikers were the greatest percentage of type of user by party at Vinal Creek[30] during in 2021. Overnight hikers made up the next largest percentage of parties for 2021. In 2022, this trend reversed with overnight hikers becoming the majority of users, followed by day hikers.

Figure 20.3 Vinal Creek Percentage Distribution of User Types by Party[22]



[21] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.
[22] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

Figure 20.4 shows the distribution of user types observed at the individual level for Vinal Creek's[30] overlapping dates across 2021 and 2022. Similar to the analysis by party, most trail users at Vinal Creek[30] during 2021 users were day hikers, followed by overnight hikers, and in 2022 users were overnight hikers, followed by day hikers.

Figure 20.4 Vinal Creek Percentage Distribution of User Types by Individual

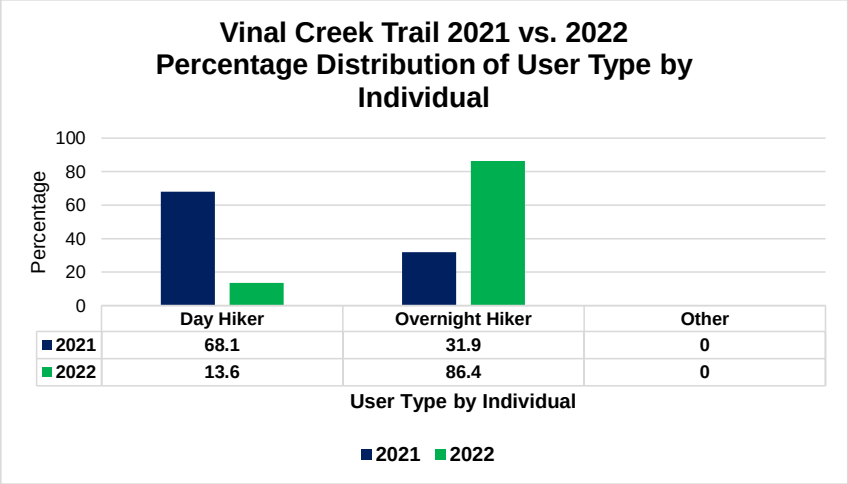


Figure 20.5 shows the distribution of user types by party at Parker Ridge for overlapping dates observed during 2021 and 2022. Day hikers made up the largest percentage of parties during 2021 and reduced in 2022. Overnight hikers composed the next percentage of parties at Parker Ridge for in 2022, and a large portion in 2021. A small percentage of other users and crew members were also observed at Parker Ridge during the observed days of 2021 and 2022.

Figure 20.5 Parker Ridge Percentage Distribution of User Types by Party

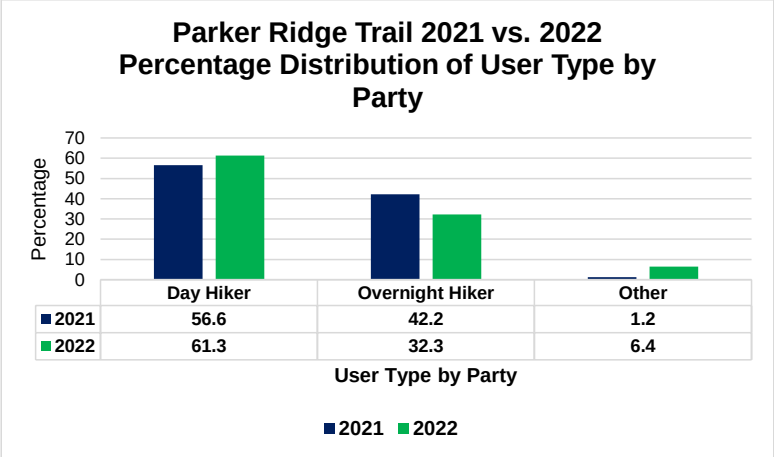


Figure 20.6 shows the distribution of user types observed at the individual level for Parker Ridge's overlapping dates across 2021 and 2022. Similar to the analysis by party, most trail users at Parker Ridge during 2021 were day hikers, followed by overnight hikers. However, measured by individuals, the number of overnight hikers was greater than that of day hikers in 2022. With the final small percentage consisting of bikers and crew, grouped together as "other" users.

Figure 20.6 Parker Ridge Percentage Distribution of User Types by Individual

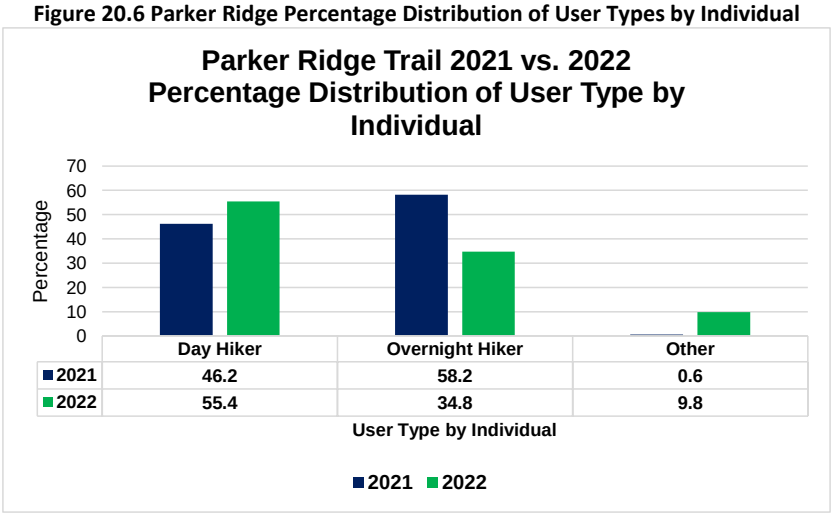


Figure 20.7 shows the distribution of user types by party at Brush Lake for overlapping dates observed during 2021 and 2022. Overnight hikers made up the largest percentage of parties during 2021 and other users made up the largest majority in 2022. In 2021, day hikers and other users composed the next greatest percentage of parties at Brush Lake, while in 2022 overnight hikers made up the second largest group. In the case of 2022, a vehicle barrier was removed from the Brush Lake Trail which allowed for significant vehicle usage by motorcycles, side-by side four-wheel drive vehicles, and numerous cars ferrying large groups.

Figure 20.7 Brush Lake Percentage Distribution of User Type by Party

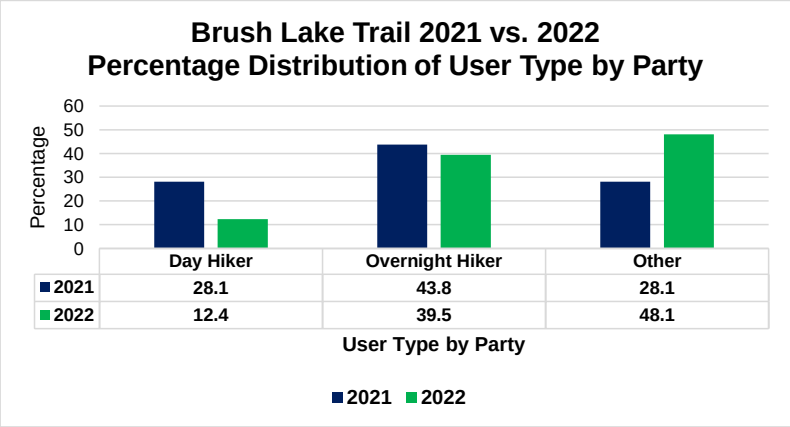
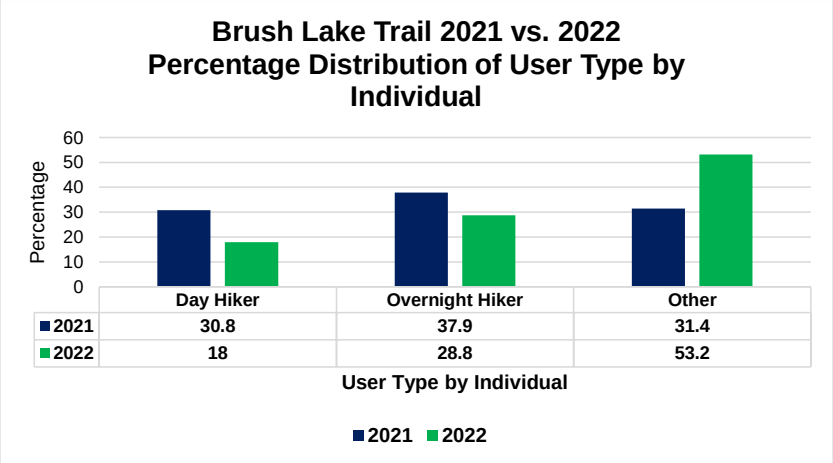


Figure 20.8 shows the distribution of user types observed at the individual level for Brush Lake for the overlapping dates across 2021 and 2022. Similar to the analysis by party, most trail users at Brush Lake during 2021 were overnight hikers, followed by day hikers and other users. While in 2022, other users made up the majority of users, followed by overnight hikers and then day hikers. However, measured by individuals, the number of overnight hikers and day hikers were much lower, and the other users accessing the trail with vehicles was higher. High vehicle usage on this trail may be a deterrent to overnight and day hikers.

Figure 20.8 Brush Lake Percentage Distribution of User Type by Individual



Recommendations and Reflections

Field Work

- The 2022 field season began for some sites in June and extend into the end of September. Start and end dates were influenced by trail conditions, with snow limiting access to some sites in the early season, and wildfires influencing air quality later in the season. Future monitoring site selections should, where possible, be optimized for early season access (e.g. confirming road conditions, prioritizing sites that are south-facing or on lower elevation slopes, etc.).
- Some counter data was lost for nearly every site, primarily during some middle sections of the 2022 season. While no cameras were stolen during 2022, some camera data was lost due to memory card issues, and the last memory card from Bluebird Lake was stolen. In addition to this, memory cards often filled during the two weeks in between site visits due to high winds causing the camera to capture branch movements.
- Losses in counter and camera data impacted calibration factors, as there were fewer dates with overlapping camera and counter data to use for calibration calculations. Additionally, like prior years, there continued to be quite a big difference between the counter data and camera data. The research team would like to continue improving on the precision of the study's calibration methods.
- During 2022, for dates without raw counter data, camera data was used to substitute trail visit estimates when possible. This mixture of data is not wholly equivalent, and thus must be interpreted with more caution.
- A loss of some camera data among sites may also make it more difficult to extrapolate some trends regarding specific types of visitor use (user type and party size) and their corresponding frequency at each site.
- During 2022, party size was measured as the number of individuals that appeared to be traveling together (based on being the same user type and traveling in the same direction) that passed by the camera within two minutes of each other, such that there is at least 2 minutes between one party and the next. These measures were used to calculate the number of parties using each trail per week in order to assess disturbance patterns.

Specific Sites

- Wildfires and lower air quality were more prevalent in 2021 than 2020, which likely has affected observed trends in visitor use for at least some PNNST trails monitored. These conditions may have impacted lower trail use among some users (for example, among sensitive health groups). 2022 did not experience low air quality during the peak usage of the PNNST, many of the sites proved valuable and should continue to me monitored.

Commented [TJ9]: Wasn't there also issues with cards filling to fast due to branch movements, etc?

Commented [WP10]: Bluebird?

- No cameras were stolen during the 2022 field season (though some were investigated by passersby). The research team continues to be concerned about the efficacy of the safety lock system in protecting the cameras from potential theft. As was experienced at Bluebird Lake during the fire closure. For sites that are more frequently used, manual calibration by a researcher may be a more appropriate option than a camera. If there are some sites that are particularly hard to hide a camera or appear more vulnerable to theft, the research team may have to forgo cameras at those sites or consider changing the sites for long-term monitoring.
- Newer cameras (those purchased for the 2020 field season) were particularly susceptible to motion-activated photo-capture in response to foliage movement. For sites like Parker Ridge, where the counter location is in a more open area with more wind movement, the camera regularly took thousands of photos in reaction to moving branches, even when moved around within the vicinity to have slightly different vantage points.

Future Research

- Some possible explanations for the difference in counter and camera data at some sites could be that the infrared cameras take photos every five seconds (the minimum setting), which is too long to capture quick hikers and thus, the cameras do not take these hikers into account. This year, some sites had newer cameras, which had a shorter interval of 0 seconds, which may have been able to better capture hikers that were moving quickly. Thus, these newer cameras may be able to provide more accurate camera data for comparison to counter data, which may yield more accurate calibration factors and trail use estimates for these monitoring sites. Furthermore, selecting sites on flat sections of trail (where users are more likely to be travelling at equivalent speeds in either direction) may reduce error for both cameras and counters. However, the significance of these potential differences is not known.
- To gain a better understanding of types of users, their travel patterns, and their experience, it is recommended that a short questionnaire be administered by part of the research team at select locations throughout the field season in 2022. This could also be administered using a QSR code that is posted at select trailheads and ranger stations.
- In order to better understand disturbance patterns related to trail use it is recommended that the research team could engage in systematic trail observations of characteristics like anthropogenic noise. Trail observations could be prioritized, and would be more feasible, for more high use sites such as Pyramid-Ball Lakes or Vinal Creek[23]. Wildlife moving across the camera should be captured in some format, as sites

[23] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46

such as Whitefish Divide saw bears, deer, elk, wolverine, bobcat, and lynx cross the camera.

Appendices

Appendix A. 2022 Missing Counter and Camera Data Summary

Due to technical issues during the 2022 field season, raw counter data was lost for a number of days at all of the monitoring sites except for Whitefish Divide. During analysis, counter data was prioritized when available in order to hopefully provide more accurate trail visit measurements once calibrated. However, for days where counter data was missing, trail visits were estimated using camera data as a substitute. Generally, camera data may be more likely to underestimate trail use compared to the calibrated counter data.

Table 4 shows the dates across each site for which calibrated counter data was used to calculate trail visits, dates for which camera data was substituted to estimate trail visits (when counter data was not available), and dates for which both counter and camera data was not available.

Table 4 Calibration Dates and Calculated Calibration Factors

Site	Counter Data Calibrated and Used	Camera Data Substituted	Both Data Missing
Whitefish Divide	7/20-9/30		
Vinal Creek[24]	7/5-7/25; 8/5-9/30	7/25-8/4	
Canuck Peak	7/14-8/4; 8/23-9/10	8/5-8/22	9/10-9/30
Garver Mountain	6/28-9/30		
Parker Ridge	6/15-9/30		
Brush Lake	6/15-9/30		

Commented [TJ11]: Why was this missing? Was it taken down earlier? Some equipment got pulled earlier right

Commented [SS12R11]: The camera angle was too high and did not capture any users.

[24] The Vinal Creek monitoring site is not located on the PNNST and data is not PNNST use. See pp. 41-46.

Appendix B. 2022 Wildlife Photos

Commented [TJ13]: Was wildlife recorded in the camera data analysis? USFS may be interested in that data

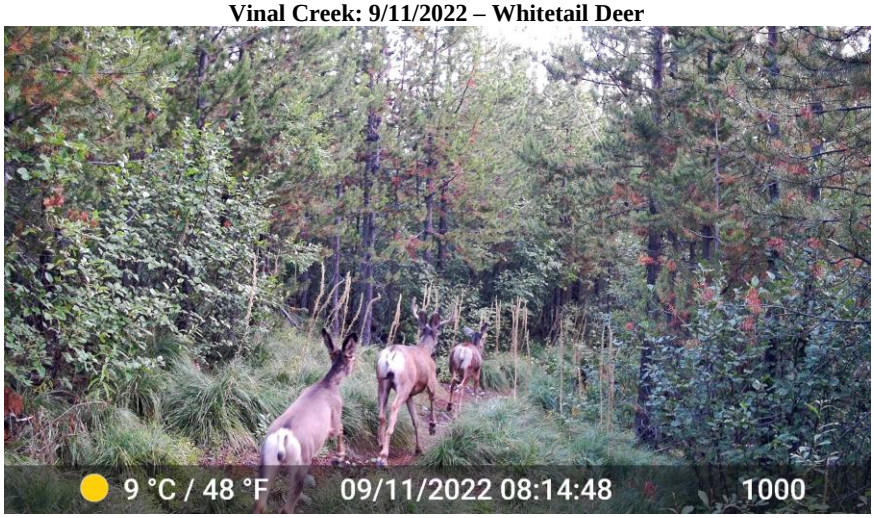
Commented [SS14R13]: I noted what I could of the wildlife. There maybe something to share with them.

Garver Mountain: 7/8/2022 – Bull Moose

Canuck Peak: 7/30/2022 - Elk

Parker Ridge: 8/5/2022 – Elk

Vinal Creek: 9/11/2022 – Whitetail Deer



Whitefish Divide: 9/16/2022 – Canada Lynx

Whitefish Divide: 9/21/2022 – Black Bear

Brush Lake: 9/25/2022 – Moose

Whitefish Divide: 9/27/2022 - Wolverine