Trail Usage Report

Winter 2017-18

Prepared by

United Riders of Crowsnest (UROC) Club

May 2018
www.uroc.ca

Introduction

This report covers trail traffic surveys on Pass Powderkeg trails for the period Nov 1, 2017 to April 30, 2018.

This is the fourth in a series of winter trail usage reports. A comprehensive description of the equipment and methodology is available in a previous report dated November 2014.

Equipment and Methodology

Pass Powderkeg

Six trail traffic counters were installed - referred to as PPTC01, PPTC02, PPTC03 etc. (Pass Powderkeg Traffic Counter 01 and so on). Trail counters were checked and data download approximately once a month.

PPTC01 was installed on the Double Dirt trail in the woods below the water tower;
PPTC02 was installed on the Double Dirt trail between the water tower and the Dale Strandquist trail;
PPTC03 was installed on the Chainsaw Massacre trail above the Dale Strandquist trail;
PPTC05 was installed around mid-hill on the Buck-50 trail;
PPTC06 was installed lower hill on the Buck-50 trail;
PPTC07 was installed mid-hill on the Spare Change trail.

For the first time, a trail camera was deployed with the intention of getting a better idea of the trail traffic mix. A Reconyx MS8 camera was rotated through three locations from late December until the end of April. The camera is used with a smartphone mobile app which can communicate with the camera within a useful range of around 10 m. The camera has day/night capability, a sensing range of about 15 m and 3MP image resolution. As a security camera, it can also communicate wirelessly with a LAN in real-time, but this had no practical use for our application.

Results from the trail camera are presented in Appendix B. The camera will continue to be deployed during the coming summer when there will be considerably more traffic, especially higher up the hill. We expect that the traffic mix will be quite different than during the winter when biking and trail running opportunities are quite limited.

Results

As usual, when discussing the results from IR counters, we refer to "counts" not "users". We cannot tell whether a single user passes a counter once going outbound and a second time on their return (i.e. counted twice) or whether that user returned by a different route (only counted once). Some assumptions are indicated in the Summary Table.

In general, the data has received a limited amount of verification and some processing to remove obvious errors. The verification was simply that of comparing counted traffic with known traffic i.e. when the number of participants and approximate time of passage was known. For the trail counter PPTC02, there were 40 days of comparative data from the trail cam and this is presented in Appendix B.

The IR counters will count people, large dogs, deer and other large animals i.e. any reasonably large warm body. It cannot indicate whether the user is ascending or descending the trail or whether a person is hiking, biking or using snow shoes.

In the histograms presented in the Appendix A, for "Day of the Week", Sunday is represented by "1", Monday by "2" etc. The histograms show normalized data where, for example, the count for a particular day of the week was divided by the total count i.e. its proportion of the total. The normalized data provides a better basis for comparing the distributions for the different locations.

For the "Time of Day" histograms, the first time period is from midnight to 02:59, the second from 03:00 to 05:59 etc. It is probably reasonable to assume that most counts after 10 pm and before 6 am are animal movements. The overnight counts have been typically 1% to 2% of the total for each data set (after eliminating probable animal movements).

Pass Powderkeg Summary

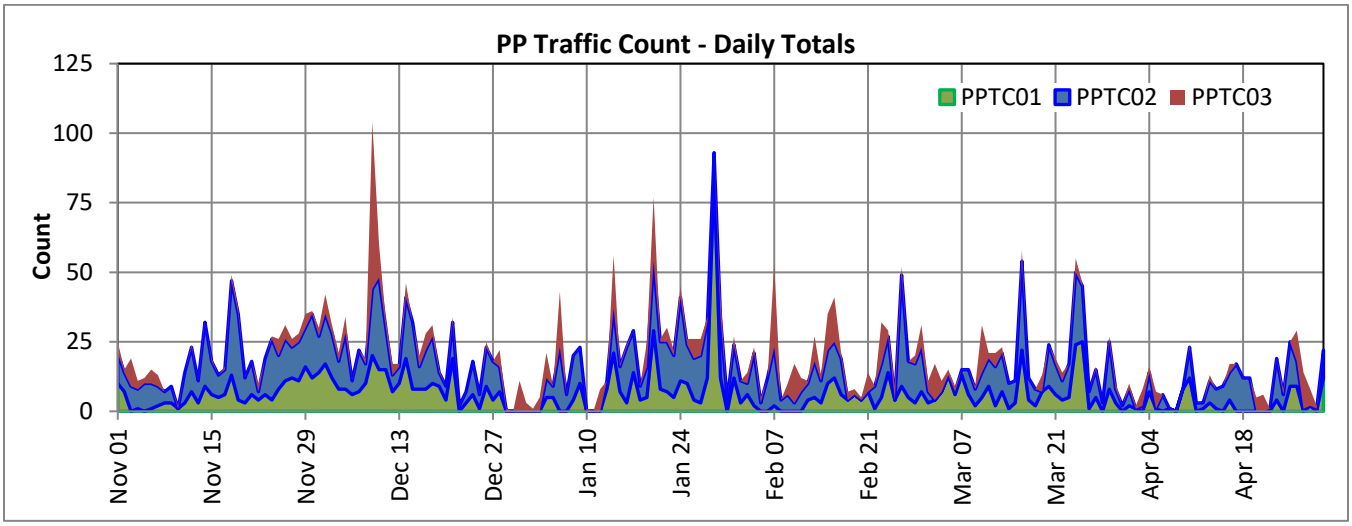

Figure 1 Traffic Count, Daily Totals SE Side

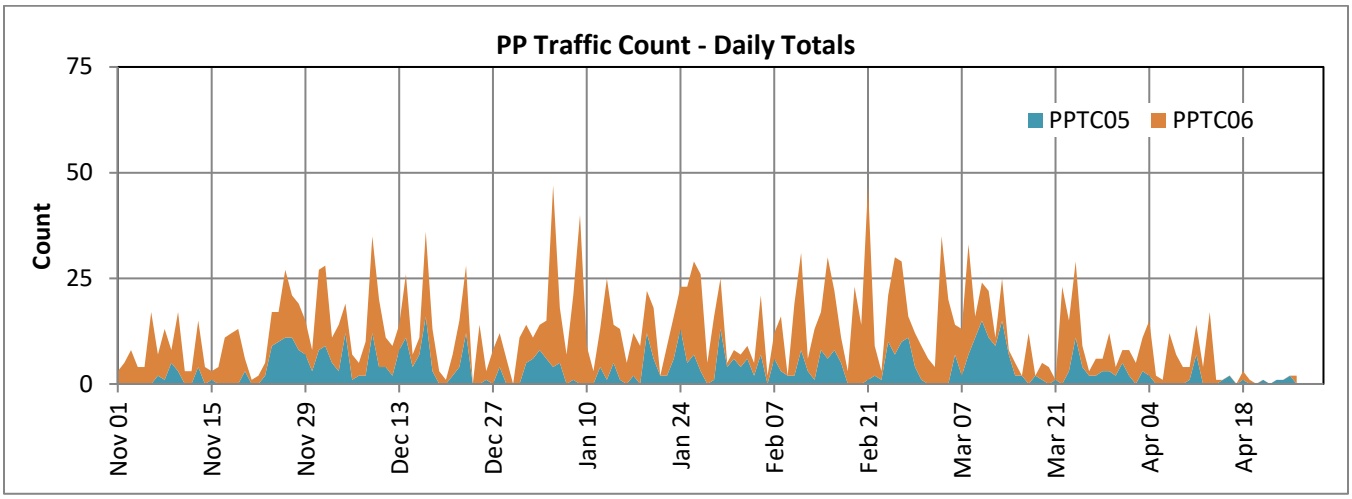

Figure 2 Traffic Count, Daily Totals N Side

The above **stacked area** graphs give a general idea of the trail usage pattern through the winter season.

Summary Table

					Counts				
Counter	Trail	Start Date	End Date	No. of Days	Total	Avg Daily	Max Daily	Traffic Type	Travel Direction
PPTC01	Double Dirt-spresso	Nov 01	Apr 30	169	1130	7	85	Mostly foot	Mixed
PPTC02	Double Dirt-spresso	Nov 01	Apr 30	170	1796	11	40	Foot, bike and snow shoe	Mostly out and back
PPTC03	Chainsaw Massacre	Nov 01	Apr 30	181	647	4	60		
PPTC04	Berma-Grin								
PPTC05	Buck-50	Nov 01	Apr 30	155	617	4	16	Ski/snowshoe	
PPTC06	Buck-50	Nov 01	Apr 30	181	1553	9	46	Mostly foot and snow shoe	
PPTC07	Spare Change	Nov 01	Apr 30	181	1286	7	70	Ski/snowboard	Predominantly downhill

Notes:

1. Start Date – start of reporting period or when counter was first installed; End Date – end of reporting period or when no further data was available.
2. No. of days – number of days between Start and End when valid data was available. During the winter, some counters get obscured by snow i.e. no data available for some periods.
3. The "Traffic Type" and "Travel Direction" are subjective assessments provided as a guide and partially based on observation of tracks. For PPTC02, trail cam data was available from a nearby location.
4. "Mixed" travel direction indicates that a trail user might include an alternative trail/road in a circuit i.e. could be only ascending, only descending or both ascending and descending past the counter.

Discussion of Results

The data provides a good general indication of the overall level of traffic and is useful for year to year comparisons. The IR counters provide no distinction between types of users and undoubtedly include some animal counts. From a trail manager's perspective, the data helps to show which trails are favoured by users and on what type of trail the club should focus its development activities.

Figure 1 and Figure 2 (stacked graphs) show the pattern of usage rather number of users since a user passing PPTC01 might also pass PPTC02 on the same trip; in fact, they might pass both counters going up and down. The best that can be said is that, on a particular day, most users on trails on the southeast side of the hill probably were not also using the trails on the north side.

The annual change in "Daily Average" count is shown in the following graph. The daily average count is the best, simple basis for comparison since there are periods of missing data for individual counters. The daily average counts for winter 2017-18 have been adjusted to reduce the number of days (used in averaging) when trail counters were obscured by snow.

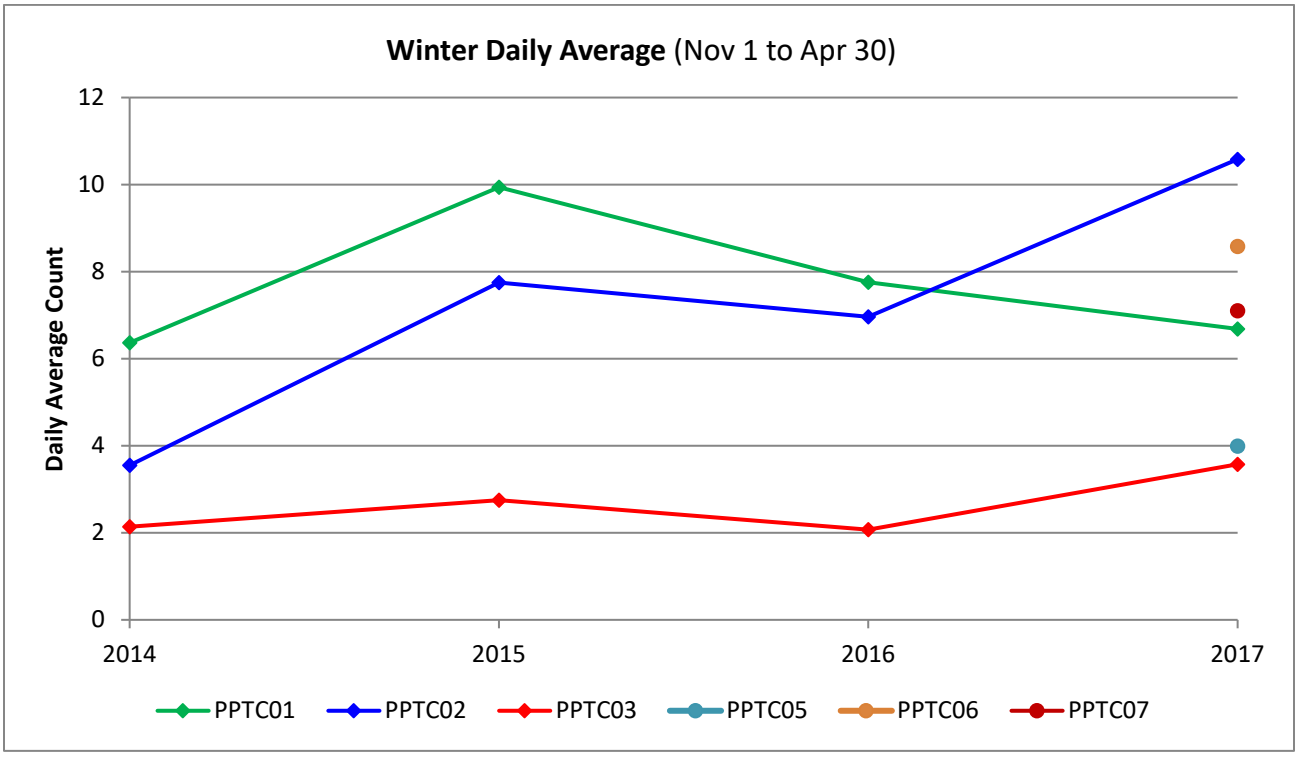

Figure 3 Daily Average Count (Adjusted)

First thing to note from Figure 3 is that this is the first winter for PPTC05, PPTC06 and PPTC07 so no comparative data is available.

Traffic on the Double Dirt (PPTC01) below the water tanks and Little Shred Ridinghood has shown a decline over the last few years. Much of Little Shred Ridinghood is in open terrain and accumulates more snow than adjacent areas in the trees. The snow becomes packed and icy and is not attractive to walkers or fatbikers unless

equipped with studded footwear/tires. The traffic spike on Jan 29 seems valid since a group of around 20 was detected repeatedly (group's purpose/mode of travel unknown).

On the other hand, traffic on Double Dirt above the water tank (PPTC02) shows a steady increase. Vehicles are frequently parked near the water tank so that trail users avoid the lower trail. The ski hill road used only to be open to the public during ski season (mid-December to end of March) but now are always open and consequently parking part way up the road is now an option. It is also reasonable to assume a fair number of people using the upper trail on foot are accessing it via the ski hill road. This section of trail above the water tank seems to be the most popular for a variety of trail users.

The count for PPTC03 is showing a modest uptrend in part due to one well attended snow shoe event on Dec 9. It is believed, from observation of tracks, that most of the traffic on this trail is snow shoers. The area receives more snow than lower down the hill, it is less packed and consequently less attractive to fatbikers (who have generally had enough if they get up as far as the Dale Strandquist trail). Skiers appear to prefer ascending the hill via Buck-50 (observation of tracks and some trail cam data).

The PPTC06 counter on lower Buck-50 catches some trail users who are making a lower hill traverse between Southmore and 113 St. areas. This part of the trail receives a fair amount of snow but with snow shoe packing it becomes quite accessible to people on foot except right after a heavy snow fall. This part of the trail is also used by skiers who continue up to the top of the hill to ski down one of the ski runs. There appears to be little fatbiking use (observation of tracks) which is a bit surprising since the trail is often at least as well packed as Double Dirt and the traverse between 113 St and Southmore (and on to the main trailhead) does not involve much elevation gain.

The Buck-50 mid-hill counter PPTC05 is located above the mid-hill access to Buck-50 so is catching traffic on the upper part of the hill (probably going to the top of the hill in the case of skiers). The trail shows ski and snow shoe tracks but next to no evidence of fatbiking.

The surprise trail traffic "winner" for January to March has been the PPTC07 counter installed at the bottom of Spare Change. This is capturing snow board and ski traffic going over the technical cliff drop and to a lesser extent the gap-jump. Both these features are a lot less intimidating once there are several feet of snow on the ground. The traffic pattern is clearly related to opening times at the ski hill. As for the rest of Spare Change, there is not much evidence of use except at the upper end by the entrance and at the rock drop onto the Bully road (all ski/snow board).

When considering weekday distributions, PPTC02 and PPTC06 show fairly even distributions suggestive of regular trail users. The higher trails (PTC03 and PPTC05) show proportionally more traffic at the weekends.

It is probably fair to say that the overall increase in trail traffic has been substantially due to the promotion of snow shoeing by the Pass Powderkeg Ski Operation and associated lessons and guiding. More snow shoers translates into better packed trails that then make it easier for other users such as dog walkers/hikers and fatbikers.

Despite some early season snow shoe packing, fatbiking continues to be a challenge at Pass Powderkeg. This is considered unlikely to change unless trail grooming occurs. The lower trails such as Little Shred Ridinghood and lower Double Dirt get hard packed and icy so unless the biker has studded tires, they are no fun; further up the hill the steeper trail, which is quite manageable in the summer, becomes a lot more challenging with snow cover.

Appendix A provides the detail for each counter; Appendix B has some interesting information about types of trail users and comparative statistics for IR counters and the trail cam.

Recommendations

Trail usage surveys will be continued this coming summer to further identify trends.

The use of the trail cam through the summer will allow for a much better understanding of traffic composition. Unlike the winter, when traffic is concentrated on a few lower and mid-hill trails, the whole trail network is more extensively used during the summer.

We would like to thank Alberta Environment and Parks, Blairmore office for their continued loan of the trail traffic monitoring equipment. The trail cam promises to provide some useful perspective into the IR counter data we have collected during the last four years.

Insert pdf trail map here

Appendix A: Additional Graphs for Pass Powderkeg Trail Traffic.

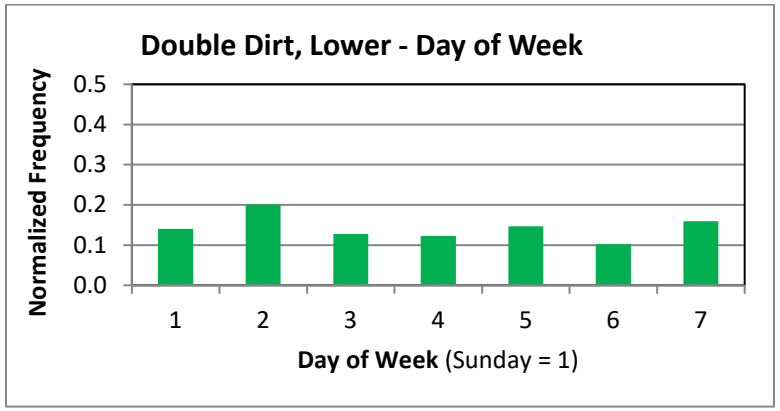

Figure 4

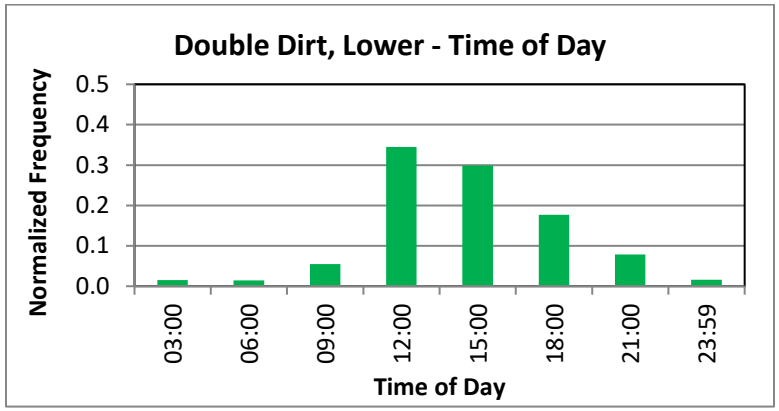

Figure 5

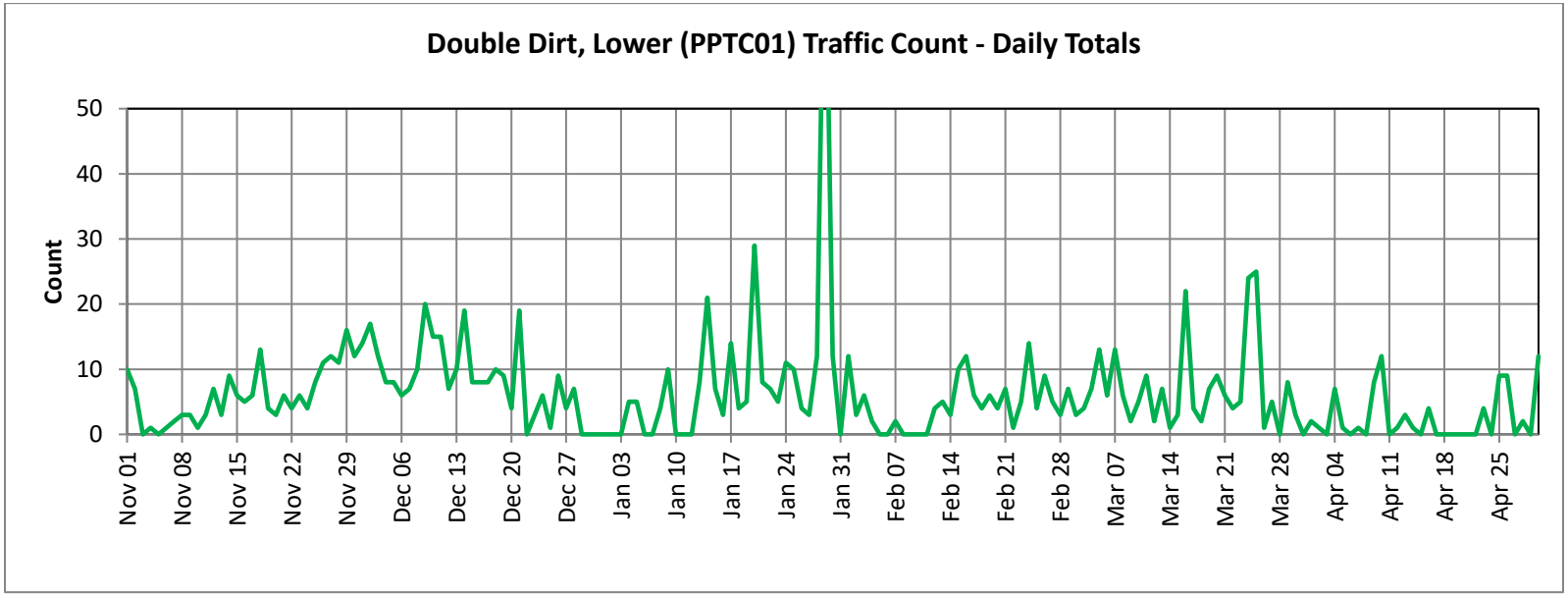

Figure 6

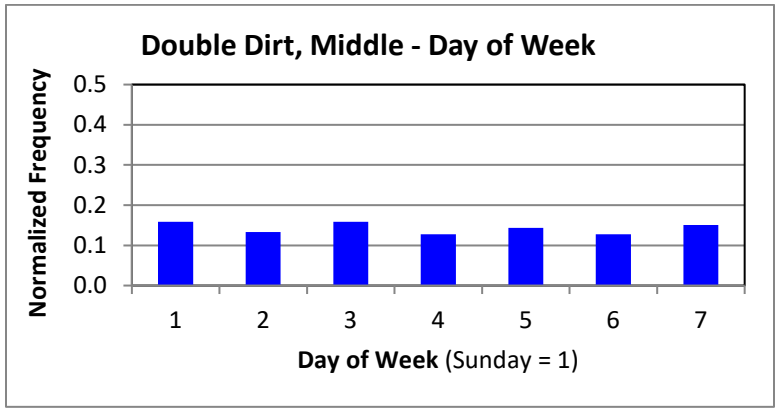

Figure 7

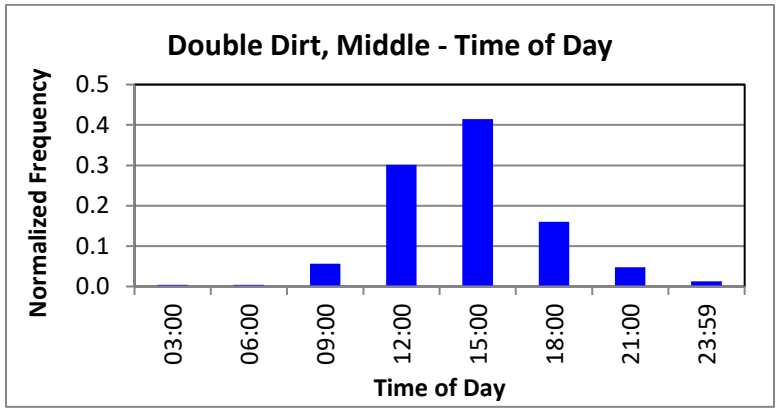

Figure 8

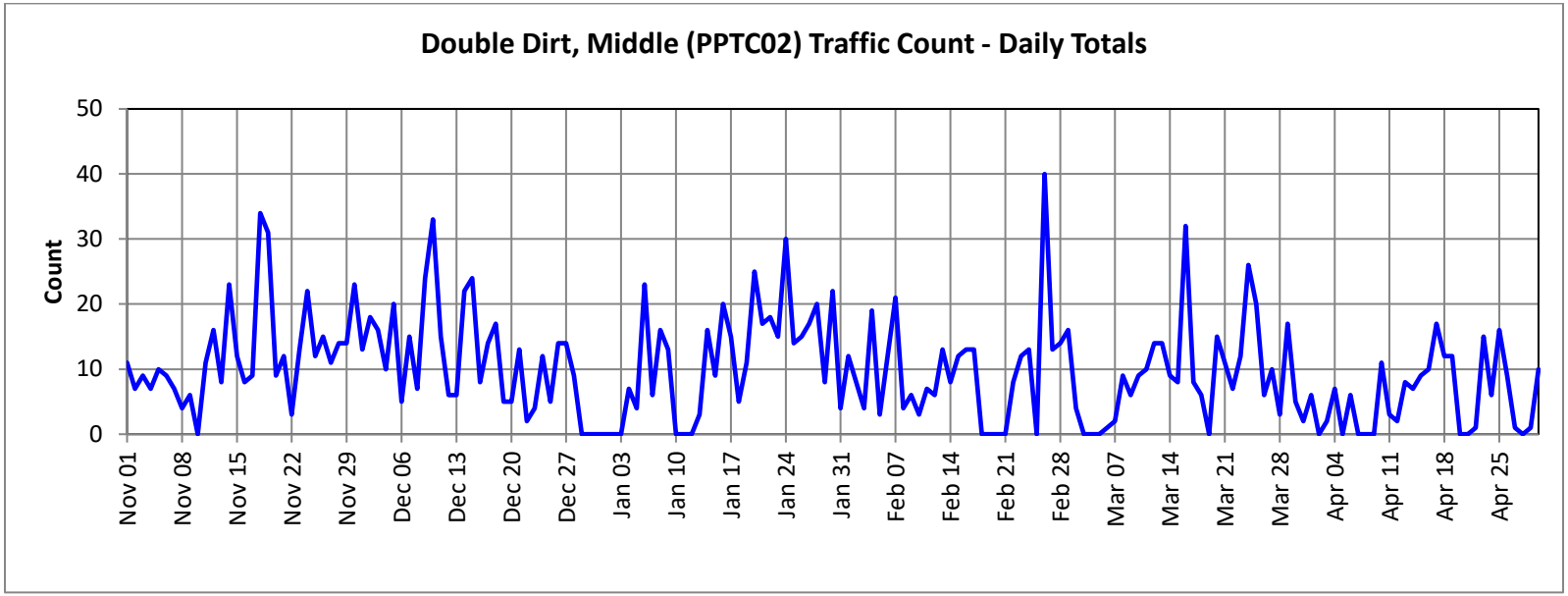

Figure 9

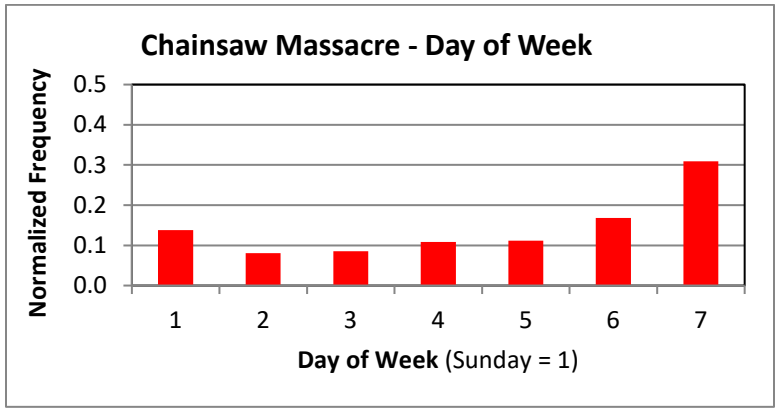

Figure 10

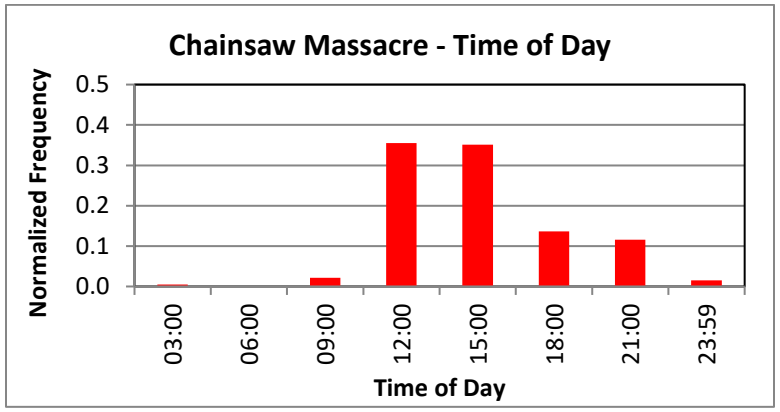

Figure 11

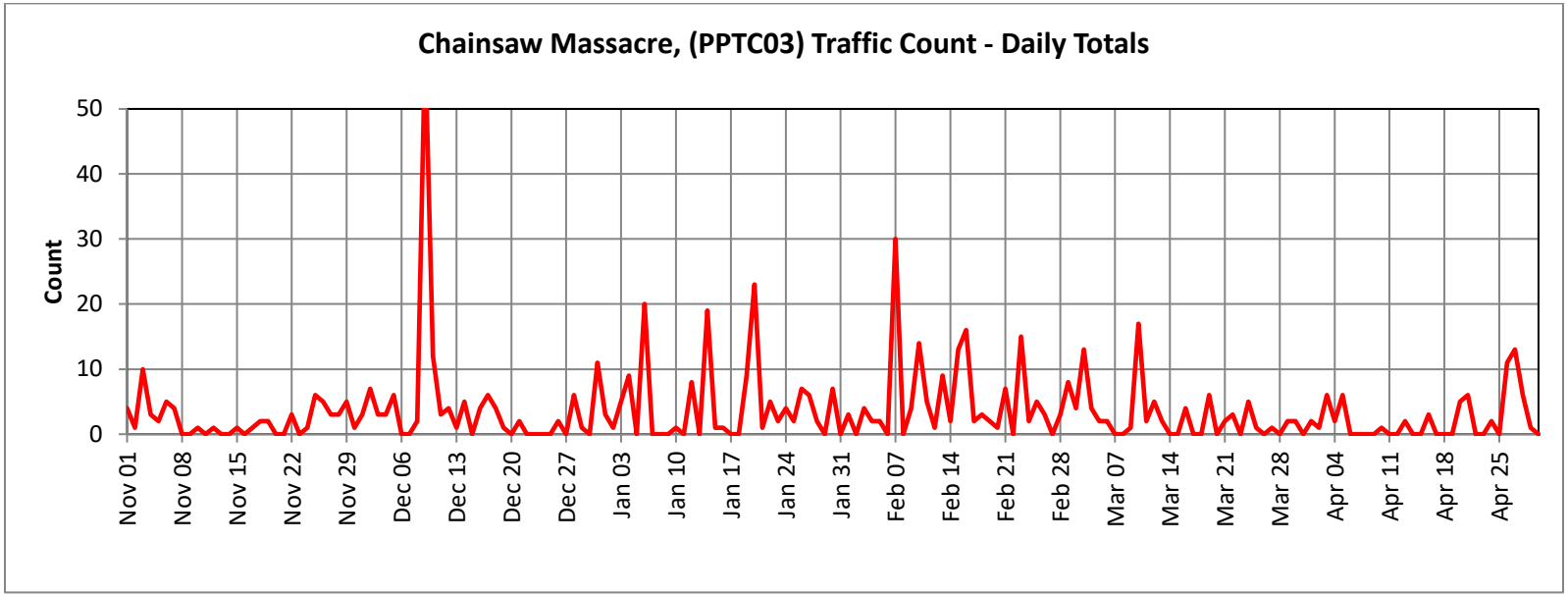

Figure 12

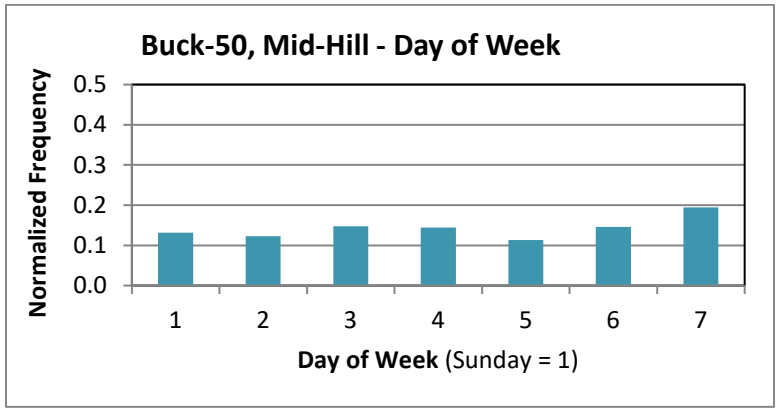

Figure 13

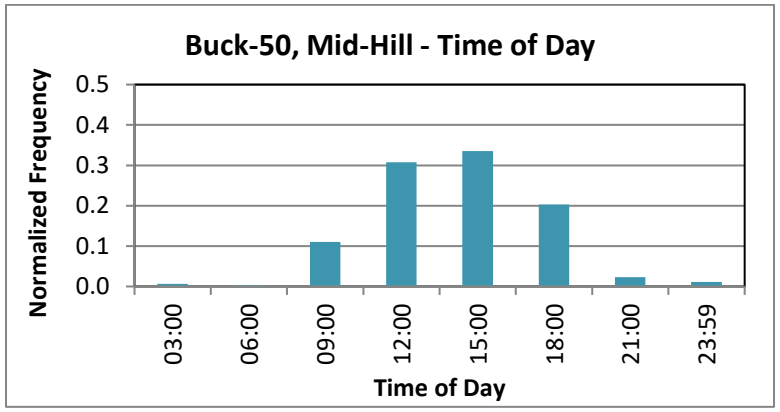

Figure 14

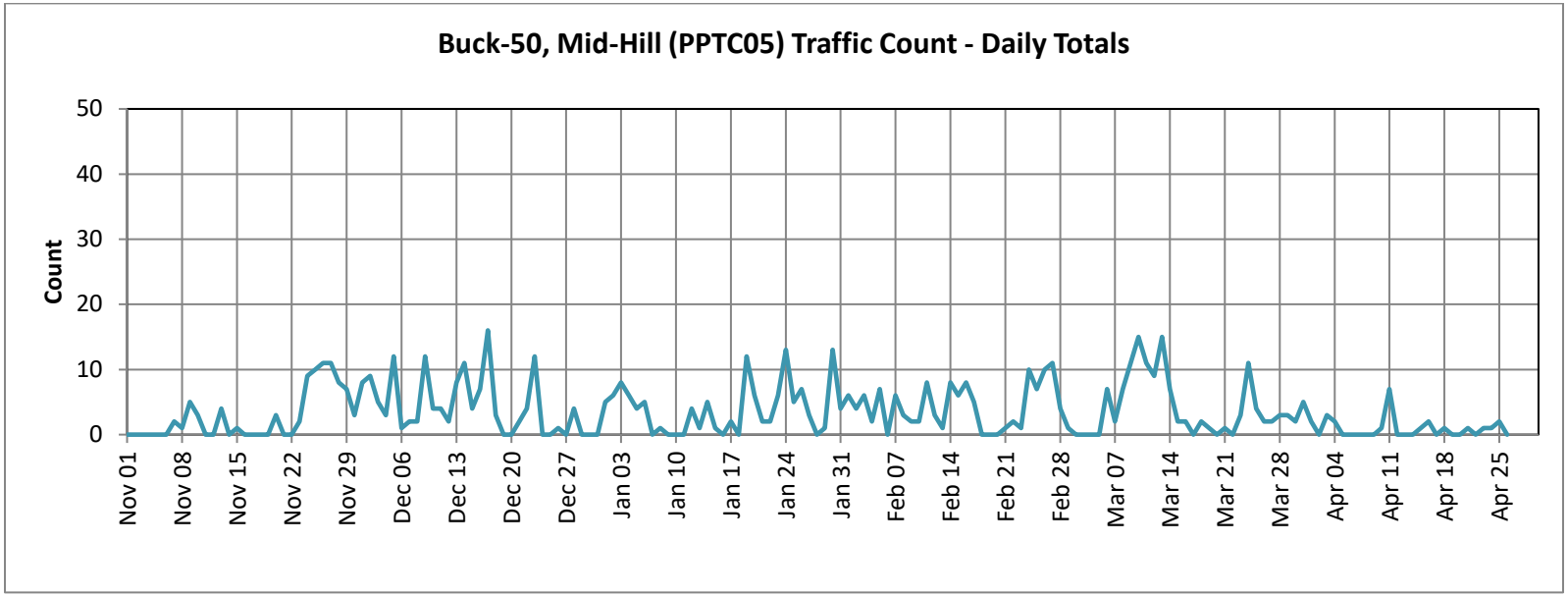

Figure 15

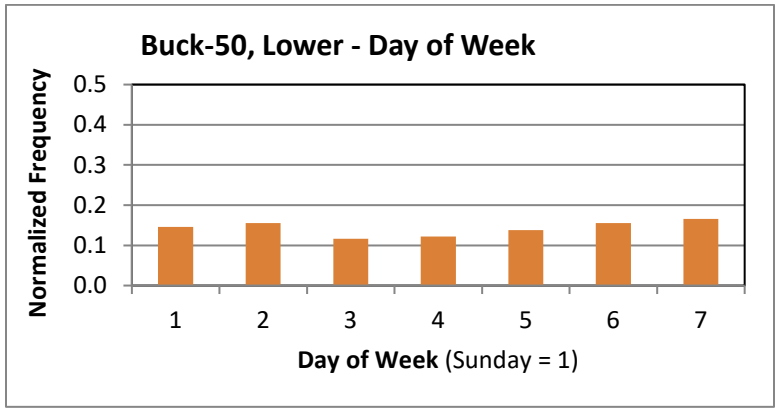

Figure 16

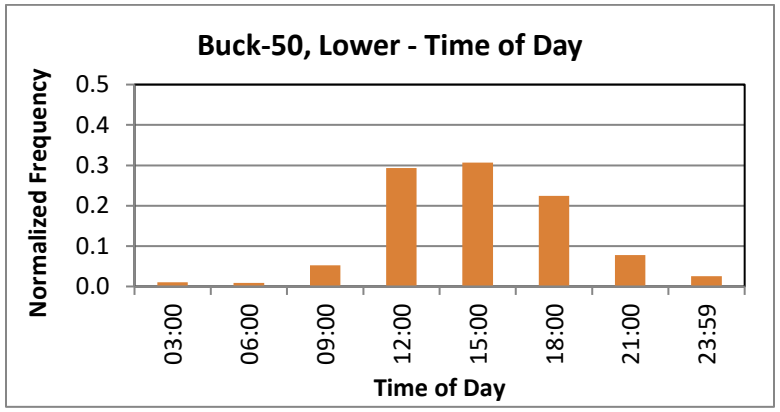

Figure 17

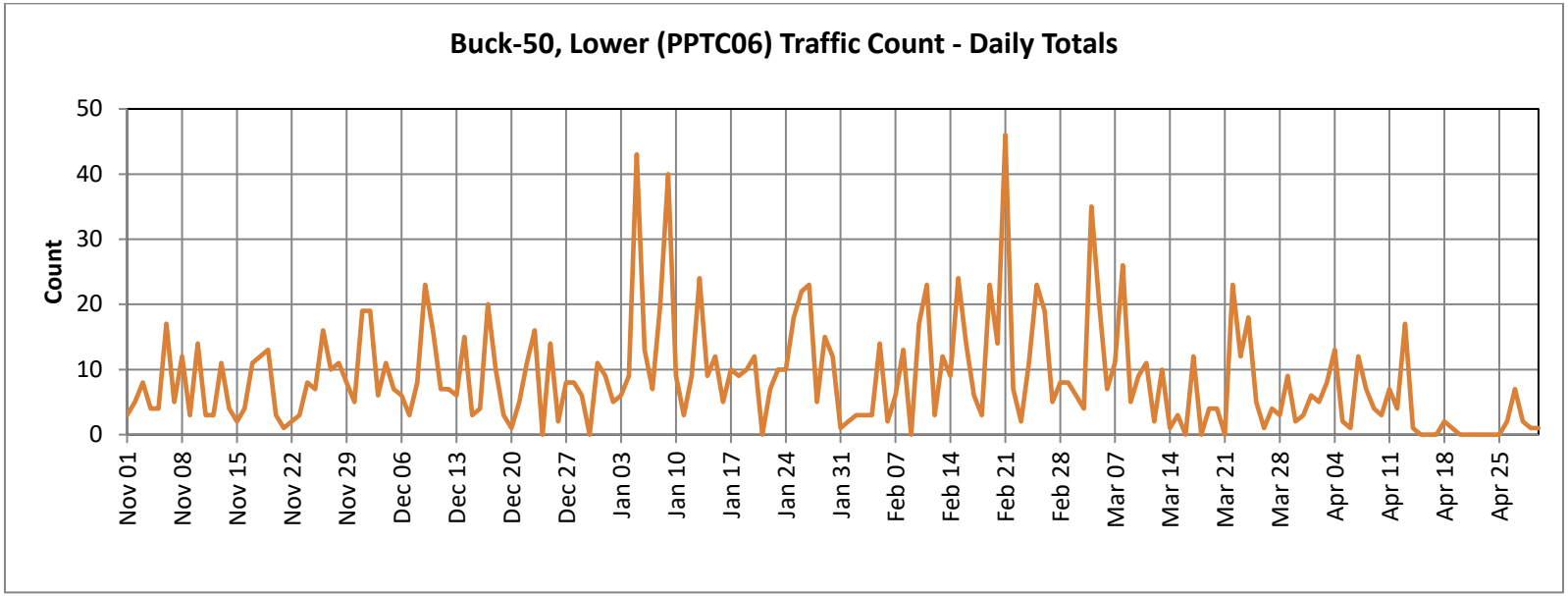

Figure 18

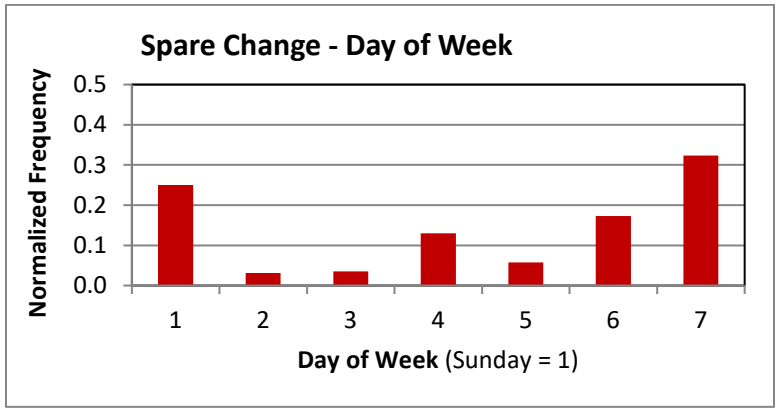

Figure 19

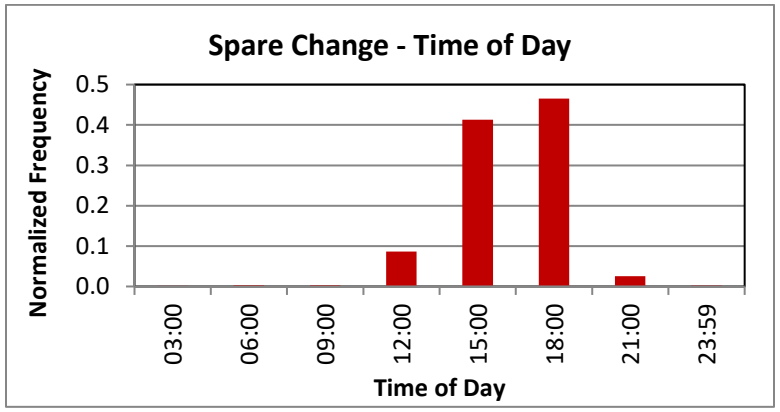

Figure 20

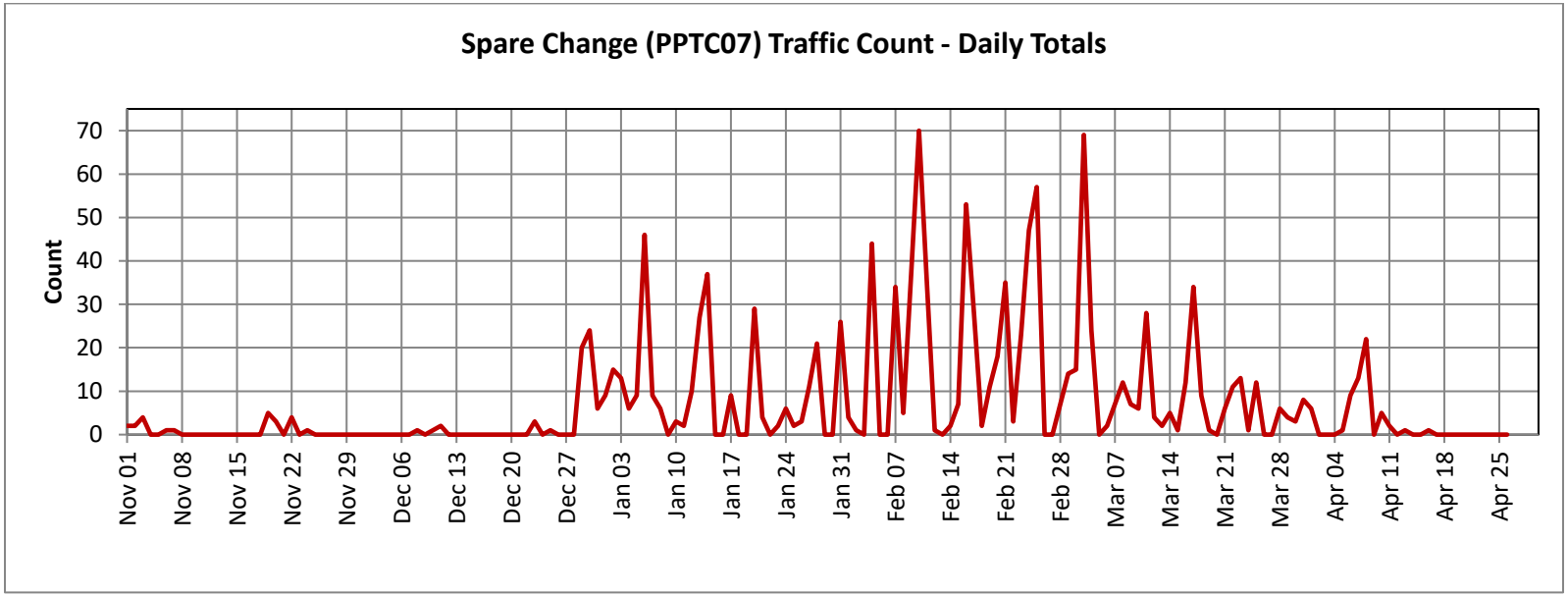

Figure 21

Appendix B: Trail Camera – Results and Discussion.

Introduction

A Reconyx MS8 has been loaned to UROC by Alberta Environment and Parks. For further details of the characteristics and specification of the camera, check the Reconyx website.

The trail cam has been installed at three different Pass Powderkeg trail locations from Dec 8 to the present. During this period, the camera was out of action for cold shutdown from Dec 23 to Jan 8 and was temporarily removed from service from Jan 9 to Jan 15.

The first location on the Double Dirt trail near the IR counter PPTC02 provided 40 days' worth of good data. The second location on the lower Buck-50 trail provided some additional useful images and the third location on the Chainsaw Massacre trail virtually nothing up until the end of April.

For the first location, as well as being able to clearly identify the traffic mix, it has been possible to make a reasonable comparison between the trail cam and IR counter performance.

For the summer season (May 1 to Oct 31), the camera will be moved back to its initial location then moved around to sample the traffic mix at various places including the top of the hill.

Summary Results

The intent of surveying traffic is primarily to determine the number of people using the trails and the type of activity in which they are engaging (hiking, biking, skiing etc.). It is also helpful to know the extent to which particular trails are being used and the traffic flow. It might, incidentally, be interesting to know how many dogs, deer and cougars are using the trails however this has the potential to turn into a major research project. Cost-benefit has to be considered and our approach thus far has been simply to get a general indication of trail usage trends and which trails are popular or less so. The trail cam usefully adds to our knowledge about the trail traffic mix.

The concept of known unknowns and unknown unknowns comes to mind when considering the data collected (or not) by the trail cam and IR counters. Short of having a 100% continuous observation by human or continually recording camera, it is not possible to be certain about the actual amount of trail use.

Most of the following discussion is based on 40 days of trail cam images as well as data from IR counter PPTC02. There was of the order of 30 m spacing along the trail between the two devices which was quite sufficient to add uncertainty to the comparison. The traffic mix for three data blocks are shown in Table 1.

Table 1 Traffic Mix from Trail Cam Images – Double Dirt Trail

	Biker	Hiker	Runner	Snow Shoer	Skier	Dog	Other Animals	Total (people)	Total (dogs, other)
Block 1 (Dec 08 to Dec 18)	20	30	16	0	0	60	0	66	60
Block 2 (Dec 18 to Dec 23)	2	15	3	1	0	14	0	21	14
Block 3 (Jan 15 to Feb 11)	53	102	26	40	1	136	12	222	148

To make some estimate of the "accuracy" of the two devices, an "expected group size" was used. The expected group size was estimated primarily from viewing images of a group passing the trail cam in one direction, then returning in the opposite but was also adjusted by a best guess of what was happening at the adjacent IR counter. The expected group size was used to estimate what was counted/missed for each device.

A point to note is that the camera can not overcount (more precisely that the person looking at the sequence of images of a group can generally be relied upon not to overcount the number of distinct people or animals). The IR counter can "overcount" in two distinct ways – a) the target moves slowly past the counter taking longer than the pre-set 1.5 second delay to pass through the sensing zone (more likely the further the sensor is from the trail), and b) a dog for example may run past the counter, turn around, run back to its owner (second count) then pass for a third time continuing along the trail. The latter overcount is not an error on the part of the IR counter but rather a behaviour pattern that will tend to inflate the count. This behaviour can be observed on the trail cam images and the dog will only be recorded as a single count. The IR counter will also undercount in two distinct ways- a) two targets moving closely together past the sensor may only generate a single count, and b) small to mid-sized dogs which can be observed in the imagery, may not be detected by the IR counters. On balance, the overcounting and undercounting of IR counters may about balance out for the main targets of interest - people.

The spatial separation of the two devices created anomalies that can not be explained with certainty. Wild animals, in particular (deer and cougar) may pass one device then leave the trail and be out of effective range of the second device. In many instances, a particular user passed one device then cut off on his own trail bypassing the second device. This may have encouraged other to do the same.

The three blocks of data were analysed for count. Results for each are shown in the tables below.

Table 2 Count Error Estimate

Trail cam:	Block 1 (Dec 08 to Dec 18)	Block 2 (Dec 18 to Dec 23)	Block 3 (Jan 15 to Feb 11)
Estimated undercount, people	10%	9%	0%
Estimated undercount, dogs	3%	18%	0%
IR Counter			
Estimated undercount, people	6%	0%	4%
Estimated undercount, dogs	37%	53%	11%

The trail cam images can be used to identify the male/female, adult/child mix with reasonable accuracy although in heavy winter clothing it is not always possible to be sure of gender. Similarly, it is possible to identify regular users from occasional users – both people and dogs – fatbikes and regular mountain bikes and so on.

A limited number of observations were obtained from the location on the Buck-50 trail.

Table 3 Traffic Mix from Trail Cam Images – Buck-50 Trail

	Biker	Hiker	Runner	Snow Shoer	Skier	Dog	Other Animals	Total (people)	Total (dogs, other)
Block 1 (Feb 26 to Mar 30)	0	17	2	15	9	16	0	43	16

There was no IR counter near by for comparison. This camera location was somewhat further from the trail than the first setup and more exposed to wind. It seems likely that it was missing some of the traffic when the results are compared with those from PPTC05 and PPTC06.

Nothing useful was obtained from the third location on the Chainsaw Massacre trail.

The work to install, collect imagery and perform analysis from one trail cam easily exceeds the work required for all the IR counters combined. The camera is a useful tool and used selectively, it can provide a sampling of the trail traffic mix which it is not possible to obtain with the IR counters. The IR counters are easier to install, and the data is only amenable to limited processing so does not take long. On balance, the IR counters seem a convenient way to get a general idea of traffic volumes and trends.

Further Reading

This has been a learning experience for installation, operation and data analysis and it is a good job that we just started with one unit.

The trail cam is a high-value target for mischief or theft and unlike the TRAFx IR counters, is not as easily concealed. A fair amount of effort was required to find suitable locations to install. Considerations included:

- Generally facing north to avoid direct sun on sensors
- High in a live tree with limbs that help conceal the camera (but not so much limb that the view is obstructed)
- Installation distance 8 m to 12 m from trail to capture around 10 m of trail length
- Not in the direct line of sight of a trail user i.e. perpendicular to a relatively straight section of trail.

In the winter, installation is further complicated by the need to avoid an obvious trail from the main trail to the camera location (some mis-direction and subterfuge required). However, once the camera is in place, communication can occur wirelessly to perform setup, arm the camera and download thumbnail images (subject to proviso noted below).

The camera is a high-power demand device and unlike the IR counters, alkaline batteries are inadequate in the cold. The ready choices are rechargeable NiMH or disposable Lithium. We opted for the rechargeables with the understanding that they would only work down to -30 C. What was not appreciated at first was that having shut down in the cold, the camera would not restart without physical intervention even if the batteries still had most of their charge. In late December 2017, the camera did shut down and was not restarted for over a week. This of course required climbing up a tree in very cold weather to physically reset the camera!

The camera has a published trigger time of 0.2 seconds. This does not seem to be the case because even at a moderate walking pace, a target might be halfway across the field of view before the first image is captured. This suggests that in the summer when travel speeds might be considerably higher, the selected installation location should be picked where there is some feature that slows travel.

The camera uses IR sensors to detect a target. It can be triggered by gusty wind and particularly moving vegetation. (IR counters are also susceptible to error caused by moving vegetation but since we try to install these counters much closer to the trail and they a have lower effective range, overall, they are probably less affected).

The smartphone mobile app can be used to configure, arm the camera and download thumbnail images. It can take 3MP still images and HD video. To retrieve the full-sized images and HD video it is not necessary to remove the microSD memory card from the camera but practically, unless there are only a few images to download, it is better to remove the card and insert into a computer/card reader. Downloading the higher resolution images and video takes a long time using the wireless capability and is a heavy drain on the batteries.

The camera has an option to capture stills, including time lapse, video or a combination of both. It also has a motion sensing test mode so that you can a) view the FOV on your phone and b) walk around in front of the trail cam and be notified when it senses the target (you).

Home-Based Evaluation

A week of home-based evaluation was performed before taking the camera to the field.

The evaluation of the camera and the camera-IR counter comparison should not be viewed as a rigorously controlled set of tests but rather as a best effort, field evaluation. The tests and field use did provide some insights on how best to install the camera and what we might be expected to learn.

The camera seemed to work best with the target at 8 – 12 m distance from the camera and moving perpendicular to the principal axis of the camera. The camera has a field of view (FOV) of 45 degrees measured along the long side of the rectangular FOV. For comparison the IR counters have a 10 degree conical FOV.

If the camera is mounted as close as 5 m to the target, then even at a moderately fast walking pace, the camera will trigger but not capture the subject in the images. The camera will capture images at 15 m distance but reliability decreases. The detection range is dependent on the temperature differential between the target and ambient, so it remains to be seen how this will work in the summer.

In an open area with gusty winds and an ambient temperature of 2 to 3 C, the detection reliability was about 65% between 2.5 m and 15 m. In the same area with light wind, detection rate was about 95%

<u>Comparative test between the Reconyx camera and two TRAFx IR counters.</u>

The test location was generally sheltered and the ground was snow covered. The camera was set perpendicular to the trail at a distance of 7.5 m. Two IR counters were set close by at a distance of 4 m from the trail. The camera and IR counters were all aimed at the same place on the trail. An event was defined as an instance where one or more targets passed the devices **as a group** and any of the three devices registered a count/image. The camera was configured to capture 3 images at 1 sec intervals each time it was triggered.

December 1-3

Total number of events	32	
1 person walking (slow, medium or fast pace)	22	events
1 person jogging	2	
2 persons at 5 m spacing	2	
2 persons at 2 m spacing	1	
Animal/unknown	5	
Events not detected by camera	1	
Events not detected by IR counter 1	4	See note 1
Events not detected by IR counter 2	7	See note 1
Camera triggered by event	96%	
Camera triggered but fails to capture target	3%	On any of the three images

December 3-6

Total number of events	19	
1 person walking (medium or fast pace)	12	events
1 person riding bike	4	
Animal/unknown	1	
Events not detected by camera	3	
Events not detected by IR counter 1	1	See note 2
Events not detected by IR counter 2	1	See note 2
Camera triggered by event	84%	
Camera triggered but fails to capture target	0%	On any of the three images

Notes:

1. Both IR counters failed to detect the same two passes by a pedestrian. A fox was present in the area (caught on camera) and may account for the remaining missed IR counts.
2. Not the same event for missed IR counts
3. Without human monitoring, there is no "absolute" benchmark to which the various sensors can be compared. Thus, when the camera is triggered, the failure to capture an image of the target could be due to several reasons:
    - Fast moving target
    - Moving vegetation or wind gust i.e. no legitimate target
    - Some unknown factor
4. The camera may fail to trigger even when a target is present due to several reasons:
    - Wind masking
    - Insufficient thermal mass and/or temperature differential between target and ambient
    - Some unknown factor
5. The IR sensor may fail to capture a target due to:
    - Multiple targets in close proximity – only one counted
    - Insufficient thermal mass and/or temperature differential between target and ambient e.g. a fox or small dog
    - Some unknown factor
6. The IR sensors are prone to double count when the target is moving slowly and/or sensor is located further than desirable from trail. The time the target is within the FOV exceeds the delay time set for the counter (default = 1.5 sec).