Overview of Data Sources

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Contents

The goal of this consulting project is to develop a predictive model of trail use. The aim is to inform policy/methods adopted by land management agencies (Forest Service); also good for local decision makers.

For our analysis, we will use count data obtained from trail counters deployed at a subset (33) of all trails (35) in the Bridger Mountains outside of Bozeman, MT. These data will be used to create a predictive model for trail use over time for all trails in the Bridger Mountain range.

1 Sources of Data

1. Headwaters Economics Counter Data
2. Strava Data (aggregated)
3. Weather covariate
4. Trail characteristics

1.1 Counter Data

From Headwaters Economics website:

> These data were collected using infrared counters rotated across 20 trails throughout the Bridgers. The counters record a use each time the beam is broken and were installed to minimize inaccurate counts from dogs or vegetation. Because this method measures total traffic, on a trail where use predominately is out-and-back the number of users will be approixmately half of the total traffic. Counters were installed for anywhere from 13 to 61 days, with an average of 29 days at each site. To ensure sufficient data were collected, counters were installed longest on trails that were more remote or had relatively low use.

In Figure 1

See Figure 2 for locations of trail cameras.

Table 1: Total Number of Trail Camera Counts (2021)

counterid	trailname	subsectionname	count	start	end
1	Fairy Lakeshore	NA	3412	07-25	07-31
2	Fairy Creek	NA	376	08-05	09-07

counterid	trailname	subsectionname	count	start	end
3	College M	NA	4493	08-14	08-25
4	Bridger Ridge	Baldy to Bridger	1261	07-06	12-31
5	Bridger Ridge	Baldy to Bridger	1844	07-06	12-31
6	Bridger Ridge	Bridger	1689	07-06	12-31
7	Bridger Ridge	Bridger to Ross Pass	1582	07-06	12-31
8	Bridger Ridge	M to Baldy	2635	08-07	09-12
9	Bridger Ridge	Ross Pass to Sacagawea Peak	1508	07-06	12-31
10	Bridger Ridge	Ross Pass to Sacagawea Peak	310	07-12	12-31
11	Bridger Ridge	Steep Way	10122	08-27	09-26
12	Sacagawea Pass	NA	5192	08-05	09-09
13	Sacagawea Pass	NA	9485	07-12	12-31
14	Horsethief Mountain	NA	628	07-13	09-09
15	Carroll Creek	NA	757	08-07	09-09
16	Felix Canyon	NA	146	07-29	08-01
17	Raptor View	NA	158	07-13	08-09
18	Sypes Canyon	NA	3868	08-13	09-08
19	Bridger Foothills	College M to Sypes	834	08-14	08-25
20	Truman Gulch	NA	1585	08-12	08-28
21	East Bridger South	NA	321	07-13	08-09
22	East Bridger North	NA	780	07-13	08-09
23	Shafthouse Hill	Lower Shafthouse	687	07-03	09-09
24	Shafthouse Hill	Upper Shafthouse	303	07-03	07-05
25	South Fork Flathead Creek	NA	91	07-03	07-03
26	Corbly Gulch	NA	1766	06-27	07-26
27	Corbly Gulch	NA	165	07-13	12-31
28	North Cottonwood	North Cottonwood to Johnson Canyon	662	07-28	09-10
29	North Cottonwood Access	NA	2124	08-13	09-08
30	Ross Pass	NA	1246	07-13	08-09
31	Middle Cottonwood	NA	9060	06-27	08-16
32	Johnson Canyon Jeep Trail	NA	573	08-13	09-08
33	Benchmark Rd	NA	244	07-13	08-02

1.2 Strava Data

Strava count data are made available through Strava Metro. Data are binned (intervals of 5 with ceiling rounding) and aggregated on multiple scales (daily, monthly, annual). Counts are available as "total trips" and "total people". Total trips should always be larger than the total people count as people sometimes make multiple passes of a single trail (e.g. M laps). Strava trails are subdivided into "edges". Edge IDs (for the trailhead edge?) are available in the Counter data. Strava count data are available for the entire year of 2021 (not just summer monitoring as in the counter data). These data also include the overarching trail name and number (e.g. 511 - Bridger Foothills) that also correspond to the counter data provided by HE.

It is important to note that when considering Strava data at the Trail scale (rather than edge scale) you are propagating rounding errors for each segment forward (+_ 1-4 for each edge?). Similarly, aggregating the data in the daily dataframe to a monthly timescale will likely not match the information provided in the monthly dataframe.

1.2.1 Join IDs

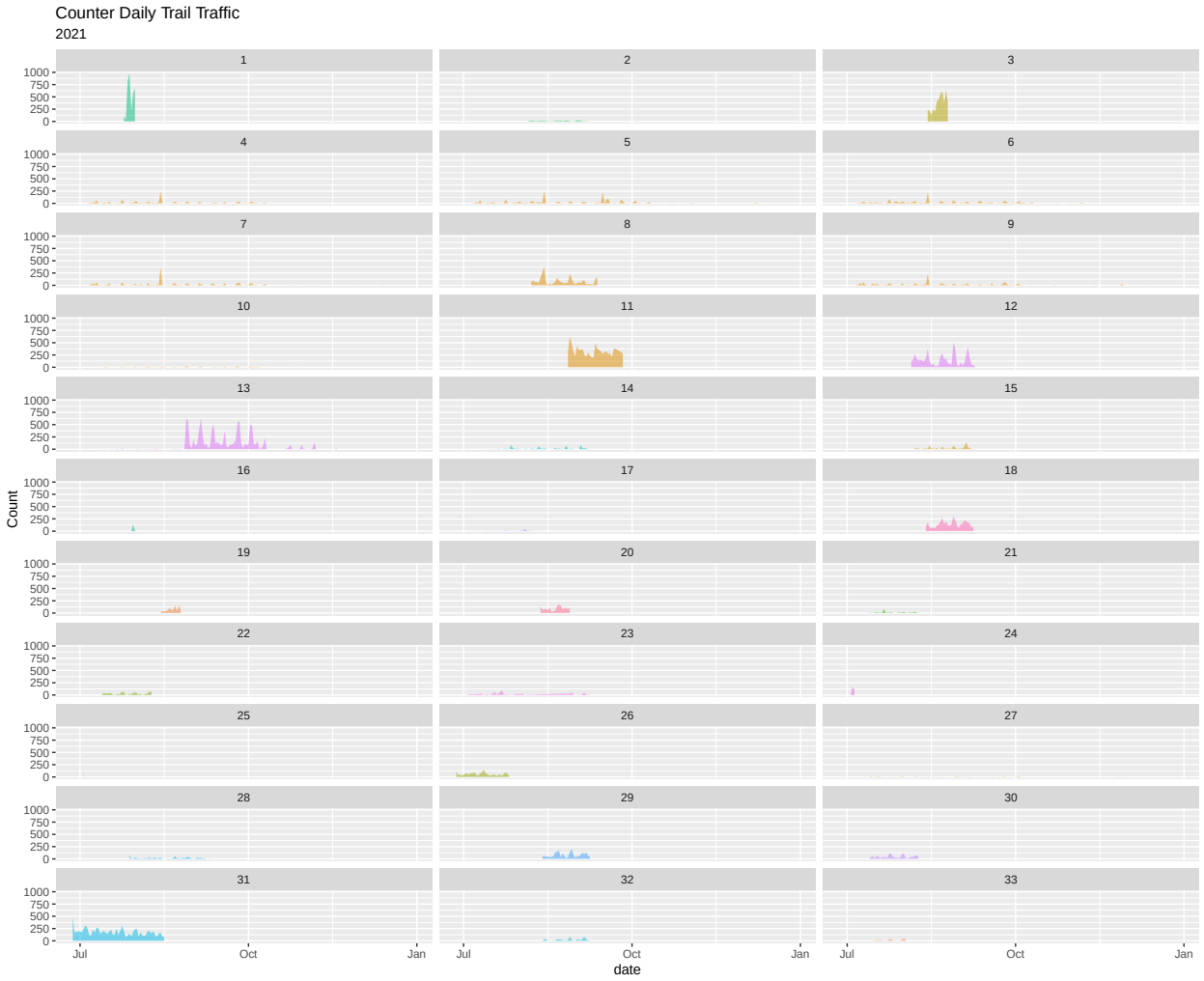


Figure 1: Timeseries plots of daily trail camera counts over time in the Bridger Mountains.

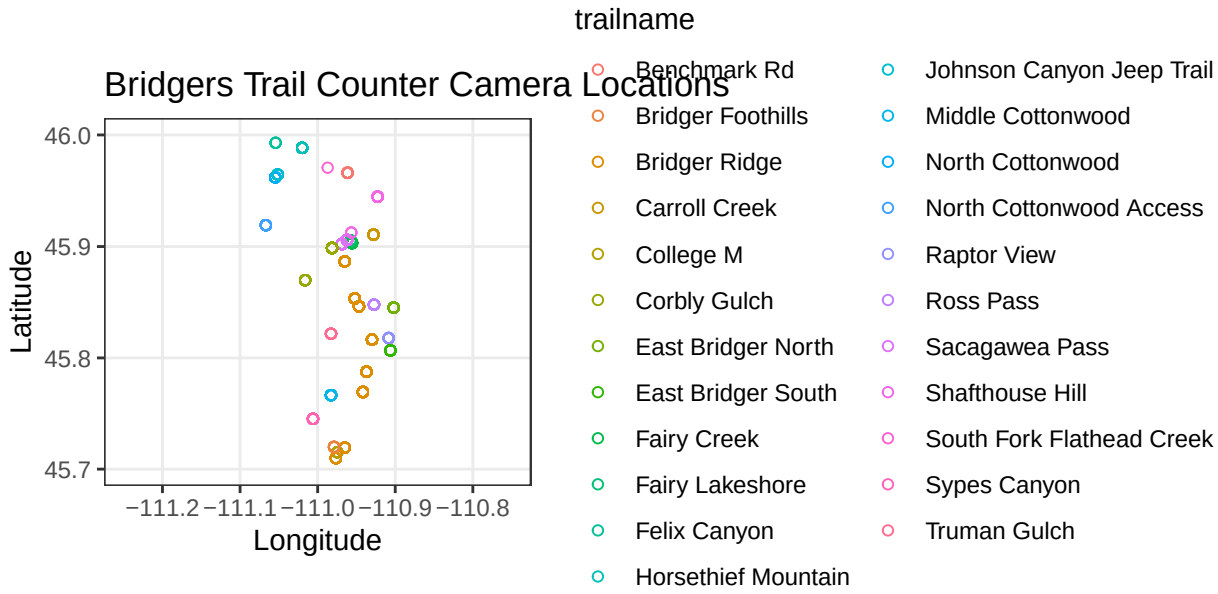


Figure 2: Trail Camera Locations in Bridgers

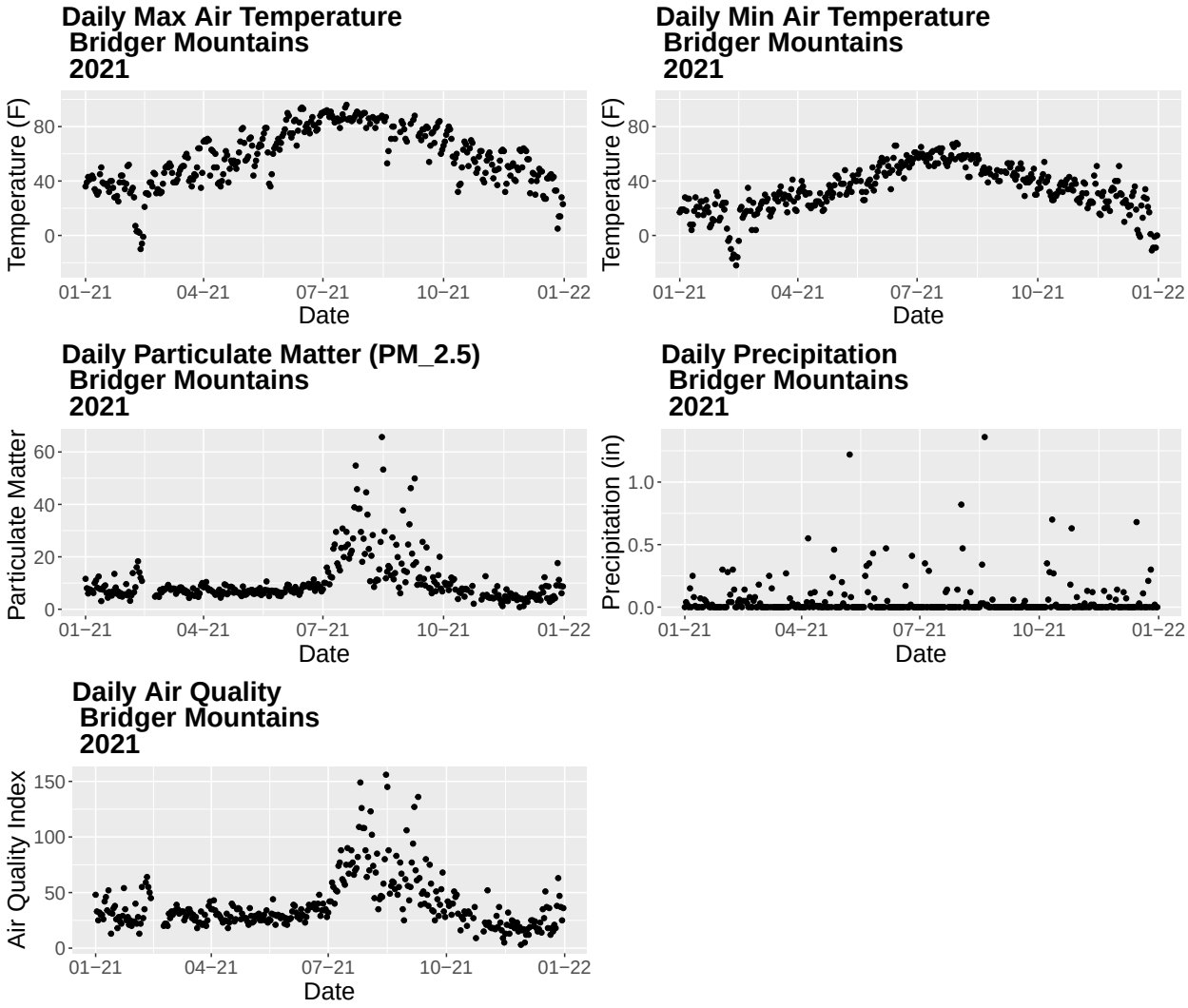
Table 2: Total Number of Strava Counts (2021)

trailname	count	start	end
Bridger Foothills	46750	01-01	12-02
Bridger Ridge	46280	01-01	09-30
Carrol Creek	360	06-19	09-05
College M	22030	01-01	09-30
Corbly Gulch	9870	03-28	12-04
E Bridger North	2495	01-09	10-10
E Bridger South	25	06-23	08-07
Fairy Creek	785	06-02	10-02
Fairy Lake Shortcut	140	06-11	09-25
Fairy Lakeshore	310	06-02	09-26
Felix Canyon Rd	600	04-17	12-03
Flathead Pass Rd	105	06-19	10-16
Johnson Canyon Jeep Trail	20	06-12	06-12
M shortcut	4015	01-01	09-30
Middle Cottonwood	12295	01-02	10-31
New World Gulch	1070	01-30	10-03
North Cottonwood	2180	02-20	11-06
North Cottonwood Access	1155	01-18	09-30
Raptor View	270	06-26	09-29
Ross Pass	765	06-06	10-02
S Fork Brackett Creek	55	06-22	10-02
Sacagawea Pass	2055	06-12	09-26
Shafthouse Hill	1035	06-12	10-10
Sypes Canyon	19005	01-01	11-21
Truman Gulch	5375	01-10	12-04
Upper Brackett Creek	105	06-27	10-02

1.3 Weather Covariates

The following weather covariates are available on a daily basis:

1. Precipitation (in.)
2. Temperature Max (degrees Fahrenheit)
3. Temperature Min (degrees Fahrenheit)
4. Mean Air Quality (AQI)



2 Questions

1. At what resolution is prediction desired? (e.g. at trail segment level or at entire trail level. The latter is more likely with available data.)
2. To confirm: some trail/subsections have multiple cameras deployed?
3. Have the count numbers for the deployed cameras already been halved for out-and-back trails? Are there any loop trails?
4. To confirm: no outlier counter data in this dataset have been altered?
5. Is there data for trail length (or trail segment/edge length for Strava)?
6. Is there hourly information for the trail counter data? Also information for total elevation change?
7. Do the edge IDs in trail_count correspond to the trailhead edge segments?
8. Shapefile with (coarse scale - full trail no edges) full trail location?
9. If a trail use camera was deployed through the end of 2021

Future: how many people double track hikes with Strava and AllTrails. (likely more often for long, technical trails that require navigation)