

TNC Permits Data Exploration

Colorado

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1. Data Head

##	RX_ID	SOURCE_ID	STATE	YEAR	DATE	BURN_NAME
##	1	<NA>	CA	2020	2020-01-22	DRD
##	2	<NA>	CA	2020	2020-01-07	DRD
##	3	<NA>	CA	2021	2021-01-07	DRD
##	4	<NA>	CA	2020	2020-01-08	2019-Carveacre
##	5	<NA>	CA	2021	2021-01-08	SUID 56
##	6	<NA>	CA	2021	2021-11-01	Bear Basin Road Area 1(h)
##		BURNTYPE_REPORTED	BURNTYPE_CLASSIFIED	ACRES_PERMITTED	ACRES_REQUESTED	
##	1	Hand Pile	Pile	0	40	
##	2	Hand Pile	Pile	0	40	
##	3	Hand Pile	Pile	0	3	
##	4	UNK	Unknown	0	20	
##	5	Broadcast	Broadcast	0	10	
##	6	Landing Pile	Pile	0	5	
##		ACRES_COMPLETED	PILE_VOLUME	TONS	ENTITY_REQUESTING	NOBURNREASON_REPORTED
##	1		40	0	0 US Forest Service	<NA>
##	2		15	0	0 US Forest Service	<NA>
##	3		2	0	0 US Forest Service	<NA>

```

## 4          20      0      0 US Forest Service           <NA>
## 5          4       0      0 US Forest Service           <NA>
## 6          5       0      0 US Forest Service           <NA>
##   NOBURNREASON_CLASSIFIED IN_STATE LON_ADJUSTED LAT_ADJUSTED LON_PERMIT
## 1          <NA>    FALSE    -116.00     32.000   -116.00
## 2          <NA>    FALSE    -116.00     32.000   -116.00
## 3          <NA>    FALSE    -116.00     32.000   -116.00
## 4          <NA>    FALSE    -116.42     32.450   -116.42
## 5          <NA>    FALSE    -116.00     32.000   -116.00
## 6          <NA>    FALSE   -123.84     14.813  -123.84
##   LAT_PERMIT      RECORD_TYPE
## 1      32.000 planned_accomplished c(-1866995.89371405, 1188967.12481174)
## 2      32.000 planned_accomplished c(-1866995.89371405, 1188967.12481174)
## 3      32.000 planned_accomplished c(-1866995.89371405, 1188967.12481174)
## 4      32.450 planned_accomplished c(-1894909.1295238, 1246307.98405057)
## 5      32.000 planned_accomplished c(-1866995.89371405, 1188967.12481174)
## 6      14.813 planned_accomplished c(-3119799.25100242, -414244.135297648)
##   ha_permit ha_request ha_complete burned
## 1      0      16.19     16.19      1
## 2      0      16.19      6.07      1
## 3      0      1.21      0.81      1
## 4      0      8.09      8.09      1
## 5      0      4.05      1.62      1
## 6      0      2.02      2.02      1

```

To compare to the Colorado Forest Tracker database and due to my research interests, I am filtering to Colorado only.

2. Common Variables

In this section I will visualize columns that are comparable to the Forest Tracker database.

ENTITY_REQUESTING

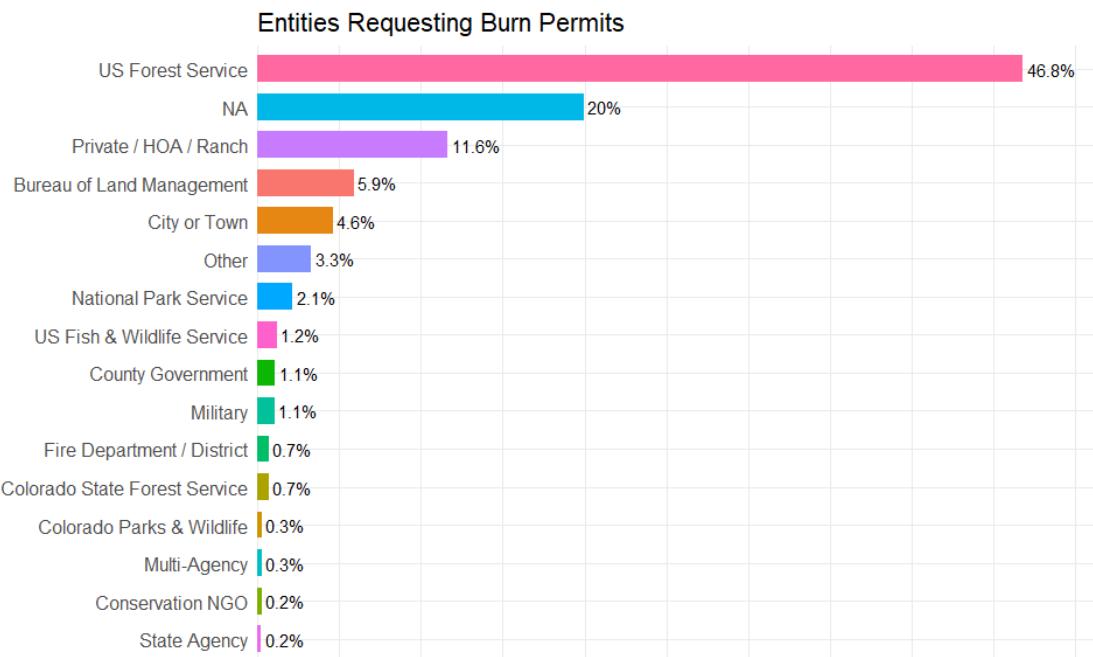
There are many unique entities, so first I created groups.

Field offices were added to the BLM group, though if this variable is used further then they should be individually evaluated.

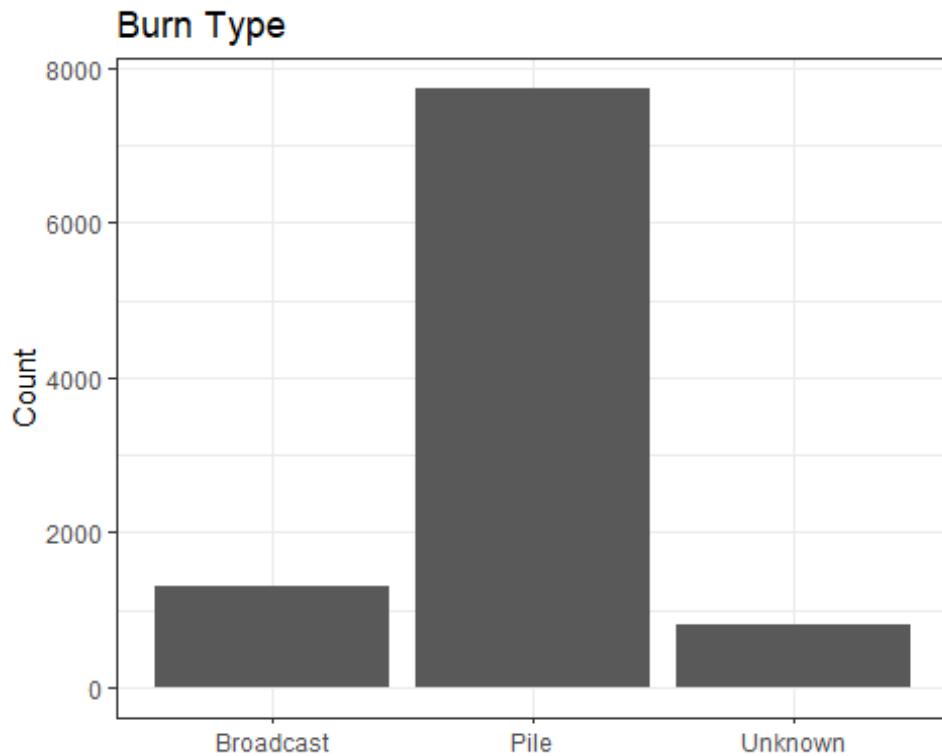
District offices without clear identifiers are added to “other”. This is because I think the Southwest District Office (which accounts for ~100 points) is the Colorado State Forest Service, but it could also be the BLM or someone else.

Some items described as areas (ex. “Gunnison Area”, “Monte Vista Area”) are, I believe, Colorado Parks & Wildlife, because some other entries from them are formatted like “Glenwood Springs Area, Colo Pks Wildlife”. However these have been left in “other” for now.

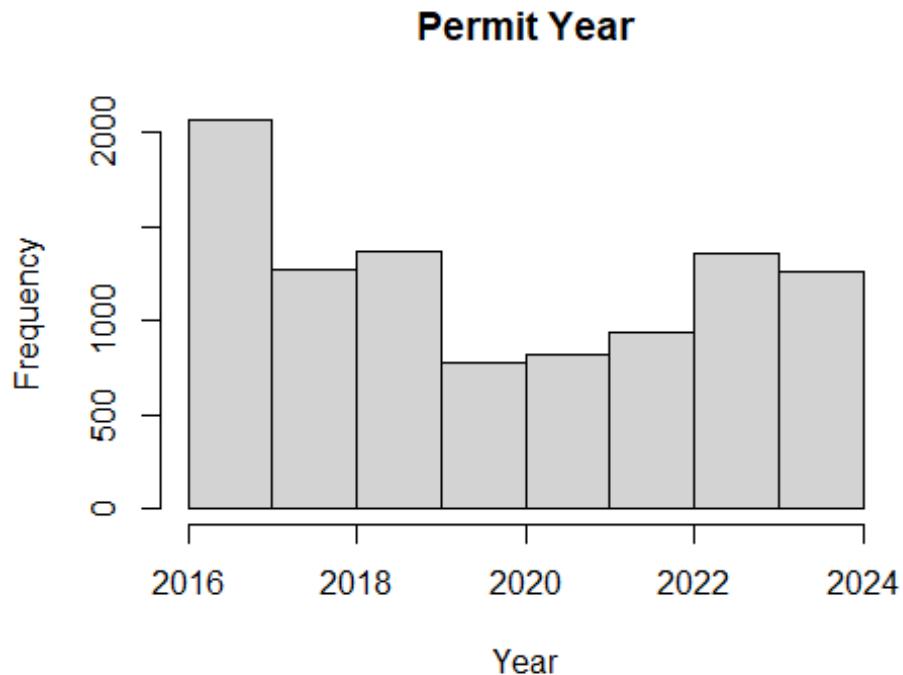
“Local Government Agency” was included in City or Town.



BURNTYPE_CLASSIFIED



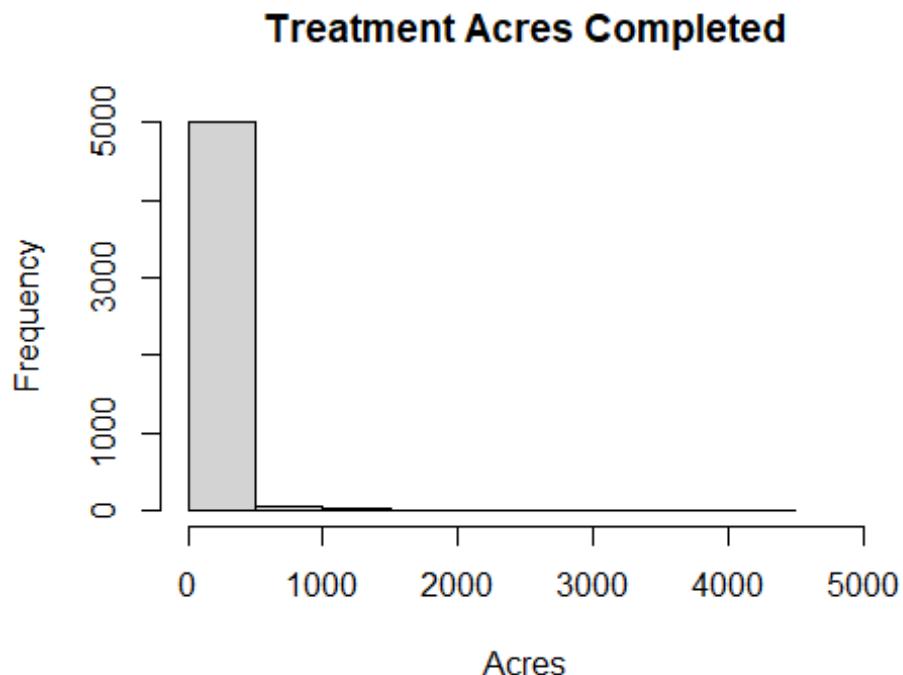
YEAR



Years Range:

```
## [1] 2016 2024
```

ACRES_COMPLETED

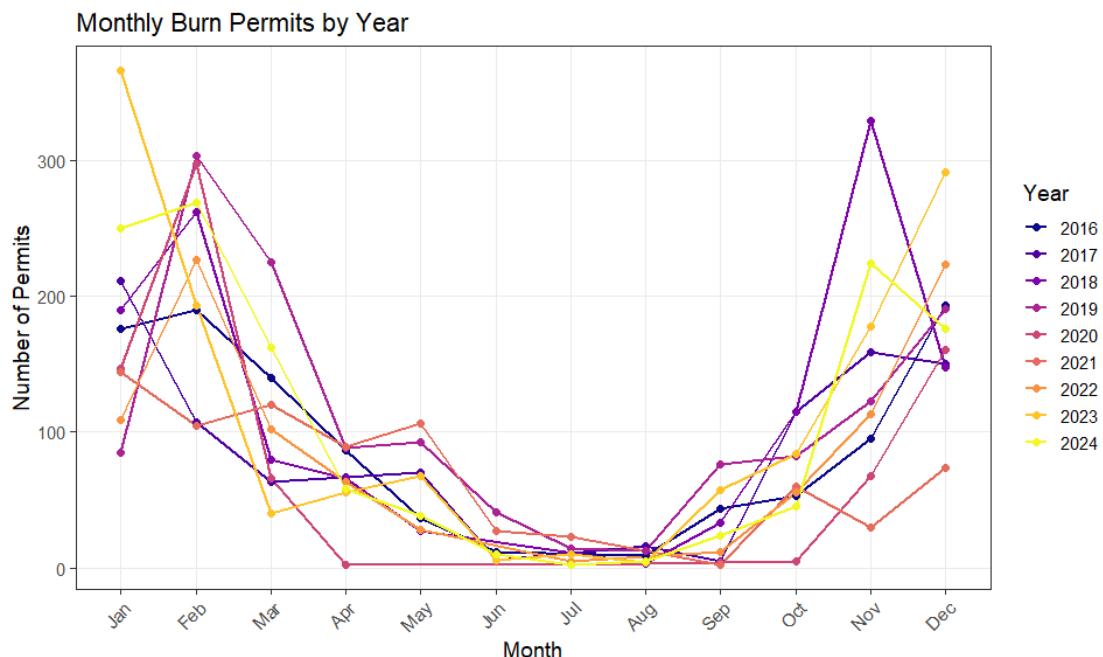


Mean Acres:

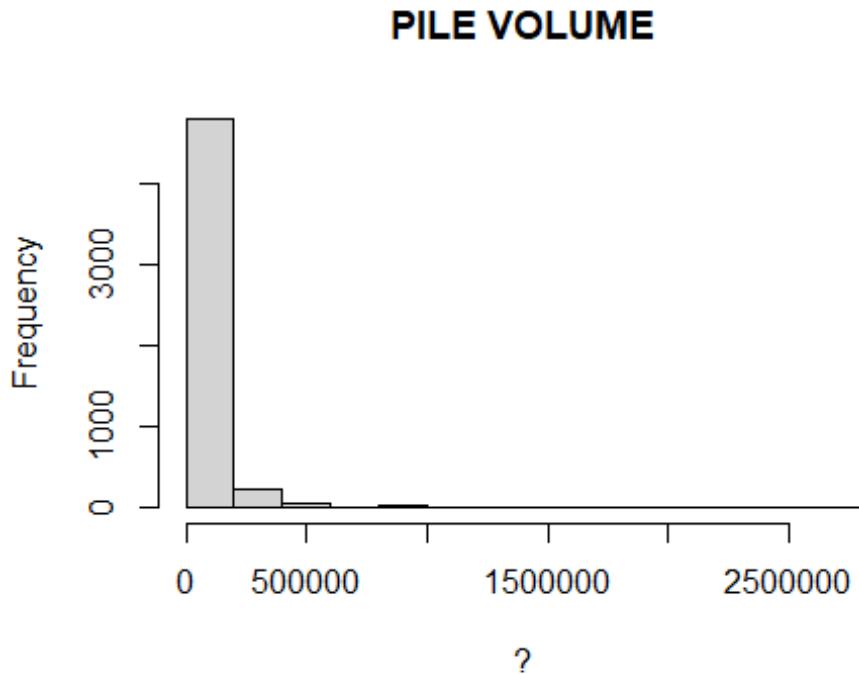
```
## [1] 35.1611
```

3. Unique Variables

DATE (Summarized)



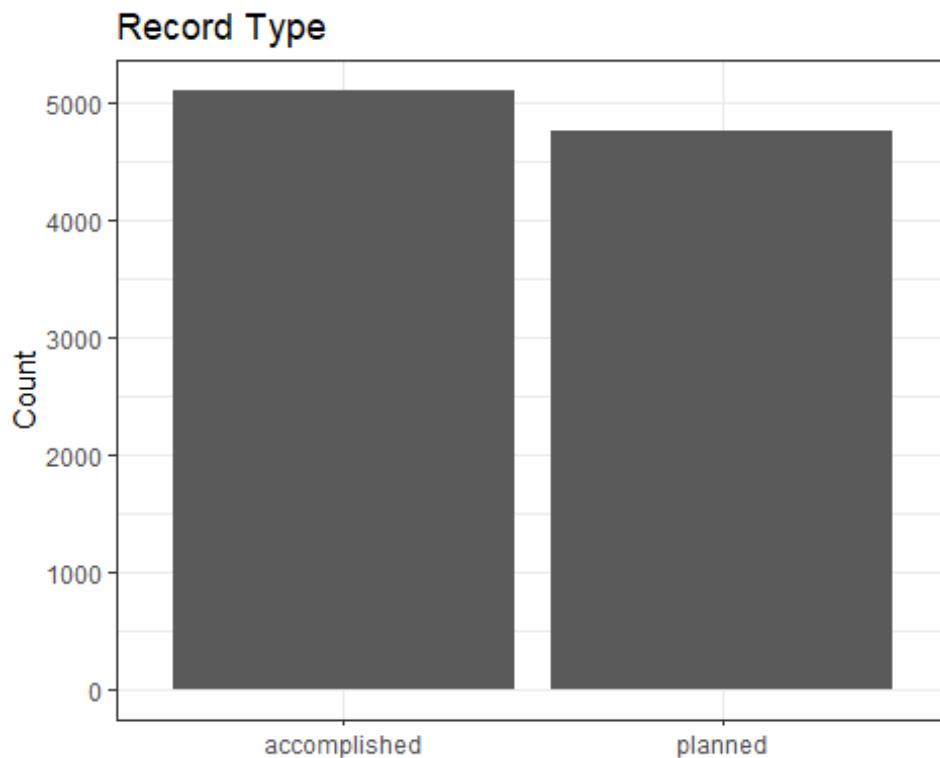
PILE_VOLUME



Mean:

```
## [1] 47485.12
```

RECORD_TYPE



Appendix

```
library(knitr)
knitr::opts_chunk$set(echo = FALSE)
knitr::opts_chunk$set(message = FALSE)
knitr::opts_chunk$set(root.dir = 'C:/Users/Elizabeth Buhr/Documents/fuels-
analysis/')
#Load packages
library(tidyverse)
library(ggplot2)
library(scales) #graphical scales in ggplot (entity plot)
#path to file (accessed 10/7/25)
permits <- read.csv("data/rx_permit_db_share/analysis_16Sept2025.csv")
  # 174122 observations

#check column names and values
head(permits)
permits <- filter(permits, STATE == "CO")
  #9863 observations for burns - about twice as much as forest tracker
df_entity <- permits %>%
```

```

mutate(
  ENTITY_GROUP = case_when(
    # Forest Service
    str_detect(ENTITY_REQUESTING, regex("National Forest|Natl Forest|Nat'l
Forest|Forest Service", ignore_case = TRUE)) ~ "US Forest Service",

    # Colorado State Forest Service
    str_detect(ENTITY_REQUESTING, regex("Colo State Forest Svc|Colorado
State Forest Svc|CSFS|Coo State Forest Svc", ignore_case = TRUE)) ~ "Colorado
State Forest Service",

    # BLM
    str_detect(ENTITY_REQUESTING, regex("BLM|Bureau of Land
Management|Field Office|Field Offfice|Field Office", ignore_case = TRUE)) ~
"Bureau of Land Management",

    # National Park Service
    str_detect(ENTITY_REQUESTING, regex("National Park|National
Monument|National Recreation Area", ignore_case = TRUE)) ~ "National Park
Service",

    # National Wildlife Refuge / USFWS
    str_detect(ENTITY_REQUESTING, regex("Wildlife Refuge|Fish and
Wildlife|USFWS", ignore_case = TRUE)) ~ "US Fish & Wildlife Service",

    # Colorado Parks & Wildlife
    str_detect(ENTITY_REQUESTING, regex("Colo Parks|Colorado Parks|CPW|Colo
Pk's Wildlife", ignore_case = TRUE)) ~ "Colorado Parks & Wildlife",

    # State Agencies (non-CSFS)
    str_detect(ENTITY_REQUESTING, regex("State Land Board|Colorado State
Parks|State Land", ignore_case = TRUE)) ~ "State Agency",

    # County Governments
    str_detect(ENTITY_REQUESTING, regex("County", ignore_case = TRUE)) ~
"County Government",

    # Cities and Towns
    str_detect(ENTITY_REQUESTING, regex("City of|Town
of|Metro|Metropolitan|Utilities|Local Government Agency", ignore_case =
TRUE)) ~ "City or Town",

    # Fire Departments / Districts
    str_detect(ENTITY_REQUESTING, regex("Fire|F.D.|Fire Dept|Fire
Protection|Fire District", ignore_case = TRUE)) ~ "Fire Department /
District",

    # Private / HOA / Ranch
  )
)

```

```

    str_detect(ENTITY_REQUESTING,
  regex("Ranch|Private|HOA|Association|Metro District|Resort|Assn", ignore_case = TRUE)) ~ "Private / HOA / Ranch",

    # Military
    str_detect(ENTITY_REQUESTING, regex("Army|Military|Air Force|SFS",
  ignore_case = TRUE)) ~ "Military",

    # Conservation NGOs
    str_detect(ENTITY_REQUESTING, regex("Conservancy|Trust|Foundation",
  ignore_case = TRUE)) ~ "Conservation NGO",

    # Multi-Agency / Other Labels
    str_detect(ENTITY_REQUESTING, regex("Multiple", ignore_case = TRUE)) ~
"Multi-Agency",

    # NA or blank
    is.na(ENTITY_REQUESTING) | ENTITY_REQUESTING == "" ~ "NA",

    # Catch-all
    TRUE ~ "Other"
  )
)

# df_entity %>%
#   filter(ENTITY_GROUP == "Other") %>%
#   count(ENTITY_REQUESTING, sort = TRUE)
# Summarize by ENTITY_REQUESTING
df_grouped <- df_entity %>%
  group_by(ENTITY_GROUP) %>%
  summarise(Count = n()) %>%
  mutate(
    Percent = Count / sum(Count),
    PercentRounded = round(100 * Percent, 1),
    Label = paste0(PercentRounded, "%")
  ) %>%
  filter(PercentRounded > 0) %>%           # Remove entities with 0.0%
  arrange(Percent)                         # Smallest to Largest

# Plot
ggplot(df_grouped, aes(x = reorder(ENTITY_GROUP, Percent), y = Percent, fill = ENTITY_GROUP)) +
  geom_bar(stat = "identity", width = 0.7, show.legend = FALSE) +
  geom_text(aes(label = Label), hjust = -0.1, size = 4) +
  scale_y_continuous(labels = percent_format(), expand = expansion(mult =
c(0, 0.1))) +
  labs(
    title = "Entities Requesting Burn Permits",
    x = NULL,

```

```

y = NULL
) +
coord_flip() +
theme_minimal(base_size = 14) +
theme(
  axis.text.x = element_blank(),
  axis.ticks.x = element_blank(),
  axis.text.y = element_text(size = 12)
)
#BURNTYPE_CLASSIFIED Bar Plot

ggplot(permits, aes(x = BURNTYPE_CLASSIFIED)) +
  geom_bar() +
  theme_bw() +
  labs(title = "Burn Type", x = NULL, y = "Count")
# YEAR_COMP histogram
hist(permits$YEAR, main = "Permit Year", xlab = "Year", xlim = c(2016,2024),
breaks = 8)
range(permits$YEAR)
#histogram of ACRES_MGT
hist(permits$ACRES_COMPLETED, main = "Treatment Acres Completed", xlab =
"Acres", xlim = c(0, 5000))
#Mean
mean(permits$ACRES_COMPLETED, na.rm = TRUE)
#Mean = 35.1611
# Create Date Summaries using package Lubridate
# Convert character to Date
permits$DATE <- ymd(permits$DATE)

# Extract features
permits$year <- year(permits$DATE)
permits$month <- month(permits$DATE, label = TRUE)
permits$day <- day(permits$DATE)

# Group by year-month
permits_summary <- permits %>%
  filter(!is.na(year), !is.na(month)) %>%    # drop NAs
  group_by(year, month) %>%
  summarise(n = n(), .groups = "keep")

#Dates Time Series (x = month, y = count, group = year)
ggplot(permits_summary, aes(x = month, y = n, group = year, color =
factor(year))) +
  geom_line(linewidth = 1) +
  geom_point(size = 2) +
  labs(
    title = "Monthly Burn Permits by Year",
    x = "Month",
    y = "Number of Permits",

```

```
    color = "Year"
) +
theme_bw(base_size = 14) +
theme(
  panel.grid.minor = element_blank(),
  axis.text.x = element_text(angle = 45, hjust = 1)
) +
scale_color_viridis_d(option = "C")
#PILE_VOLUME
hist(permits$PILE_VOLUME, main = "PILE VOLUME", xlab = "?")
mean(permits$PILE_VOLUME, na.rm = TRUE)
# RECORD_TYPE

ggplot(permits, aes(x = RECORD_TYPE)) +
  geom_bar() +
  theme_bw() +
  labs(title = "Record Type", x = NULL, y = "Count")
```