Data Visualizations and Analysis

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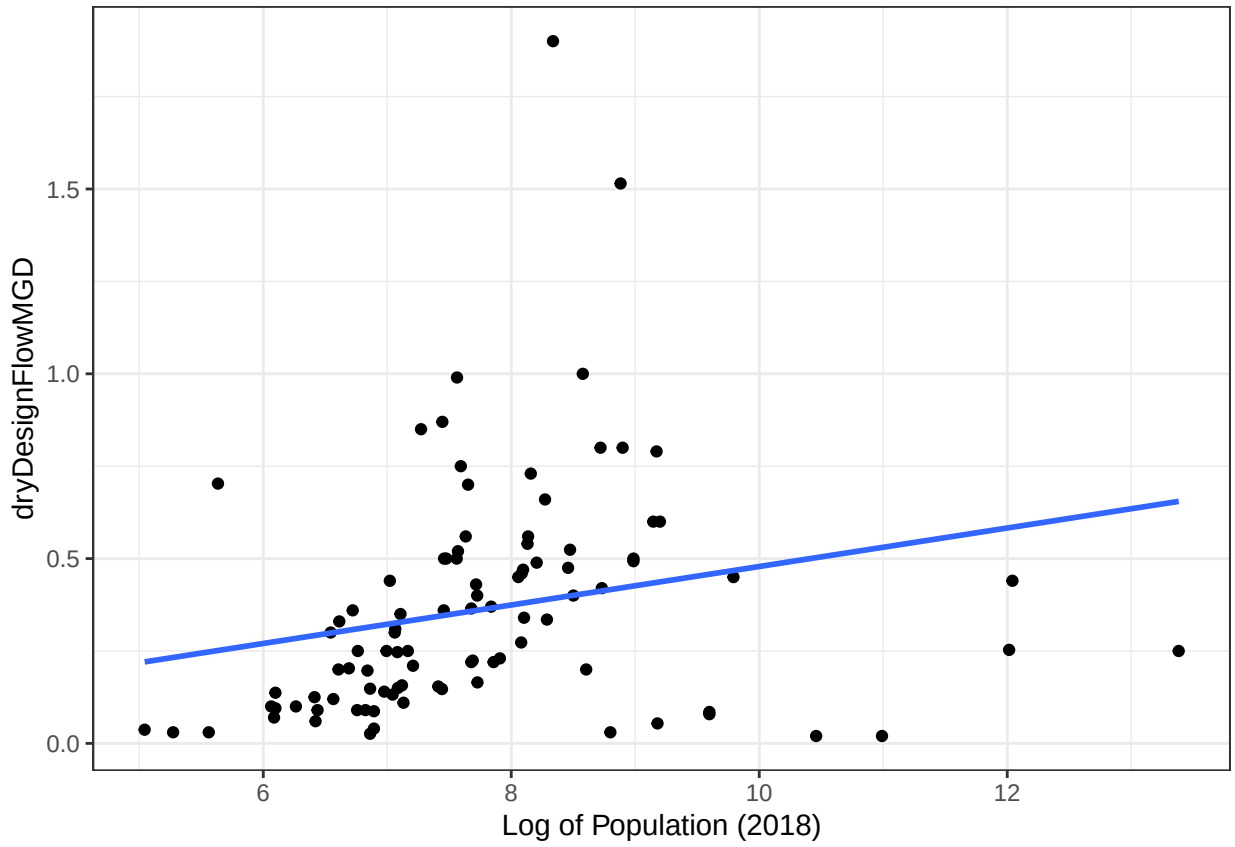
```
ggplot(working_df, aes(x = log(pop_2018), y = dryDesignFlowMGD)) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE) +
  theme_bw() +
  labs(x = "Log of Population (2018)")
```

```
## `geom_smooth()` using formula 'y ~ x'
```

```
## Warning: Removed 17 rows containing non-finite values (stat_smooth).
```

```
## Warning: Removed 17 rows containing missing values (geom_point).
```

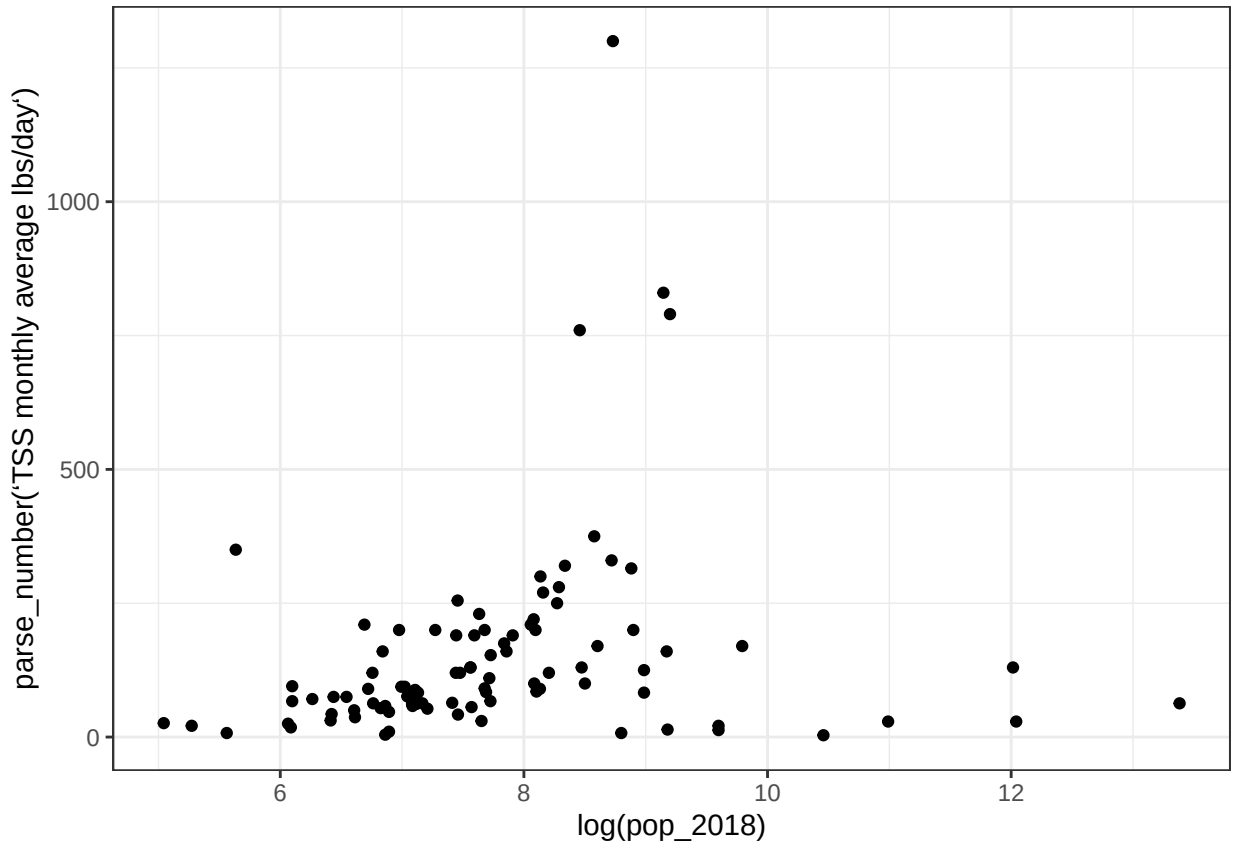


```
ggplot(working_df, aes(x = log(pop_2018),
                       y = parse_number(`TSS monthly average lbs/day`))) +
  geom_point() +
  theme_bw()
```

```
## Warning: 2 parsing failures.
## row col expected actual
##  13  -- a number     na
##  45  -- a number     na
```

```
## Warning: 2 parsing failures.
## row col expected actual
##  13  -- a number     na
##  45  -- a number     na
```

```
## Warning: Removed 19 rows containing missing values (geom_point).
```




```
working_df %>%
  filter(type1 %in% c("lagoons", "activated sludge")) %>%
  group_by(type1) %>%
  summarize(median = median(pop_2018, na.rm = TRUE))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
## # A tibble: 2 x 2
##   type1            median
##   <chr>             <dbl>
## 1 activated sludge  1962.
## 2 lagoons           1718.
```

```
library(viridis)
```

```
## Loading required package: viridisLite
```

```
library(plotly)
```

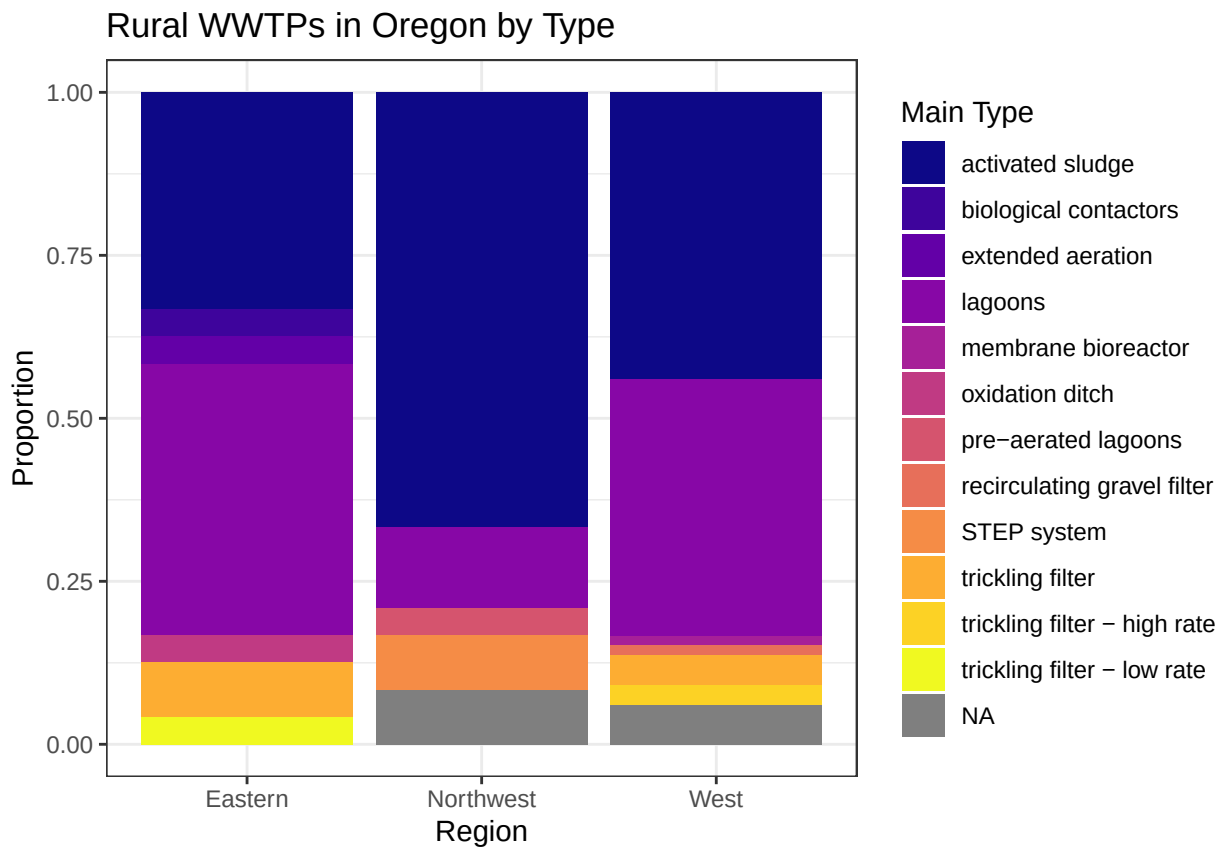
```
##
## Attaching package: 'plotly'
```

```
## The following object is masked from 'package:ggplot2':
##
##     last_plot
```

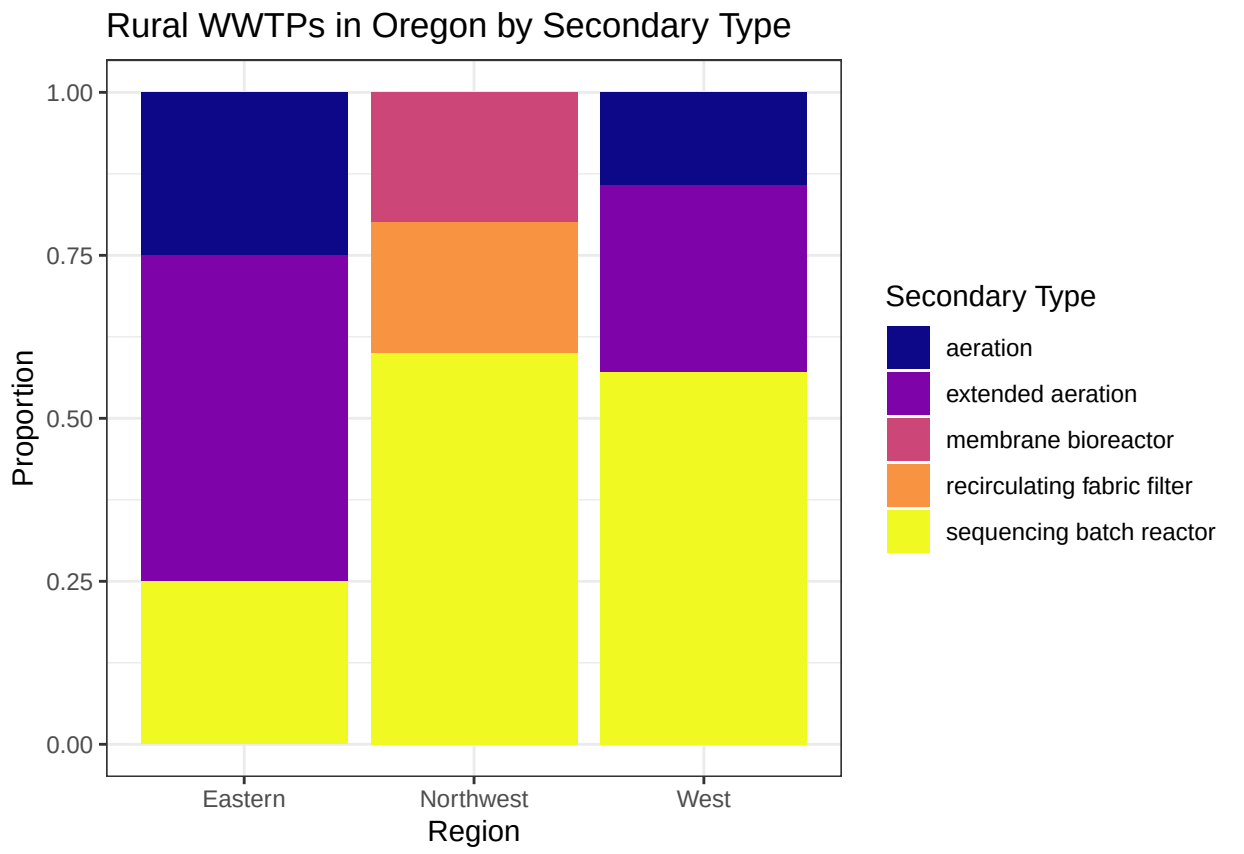
```
## The following object is masked from 'package:stats':
##
##     filter
```

```
## The following object is masked from 'package:graphics':
##
##     layout
```

```
p <- working_df %>%
  ggplot(aes(x = Region.x,
             fill = type1)) +
  geom_bar(position = "fill") +
  scale_fill_viridis_d(option = "C", na.value = "grey50") +
  scale_x_discrete(labels=c("Eastern", "Northwest", "West")) +
  theme_bw() +
  labs(x = "Region",
       fill = "Main Type",
       y = "Proportion",
       title = "Rural WWTPs in Oregon by Type")
p
```



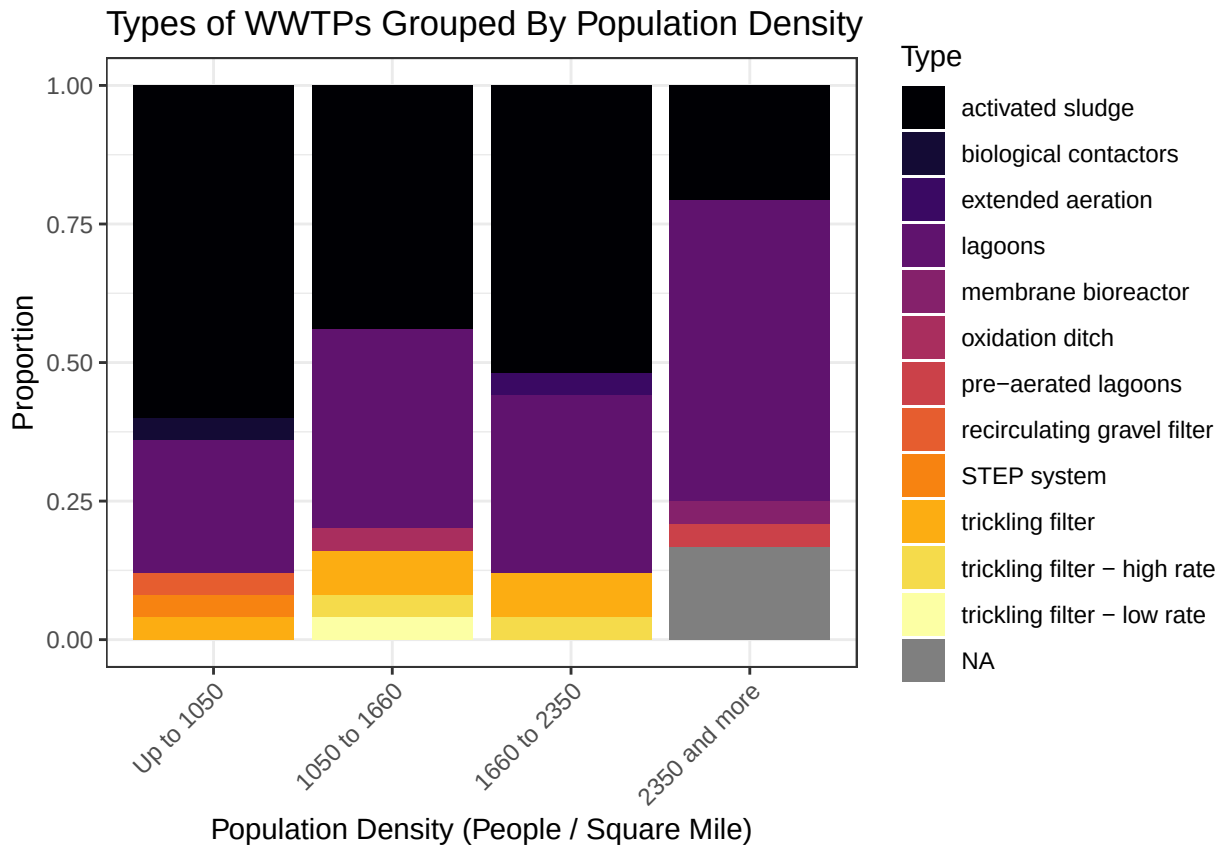

```
# ggplotly(p, tooltip = c("type1", "count"))

working_df %>%
  filter(type2 != c("na", NA)) %>%
  ggplot(aes(x = Region.x,
             fill = type2)) +
  geom_bar(position = "fill") +
  scale_fill_viridis_d(option = "C", na.value = "grey50") +
  scale_x_discrete(labels=c("Eastern", "Northwest", "West")) +
  theme_bw() +
  labs(x = "Region",
       fill = "Secondary Type",
       y = "Proportion",
       title = "Rural WWTPs in Oregon by Secondary Type")
```



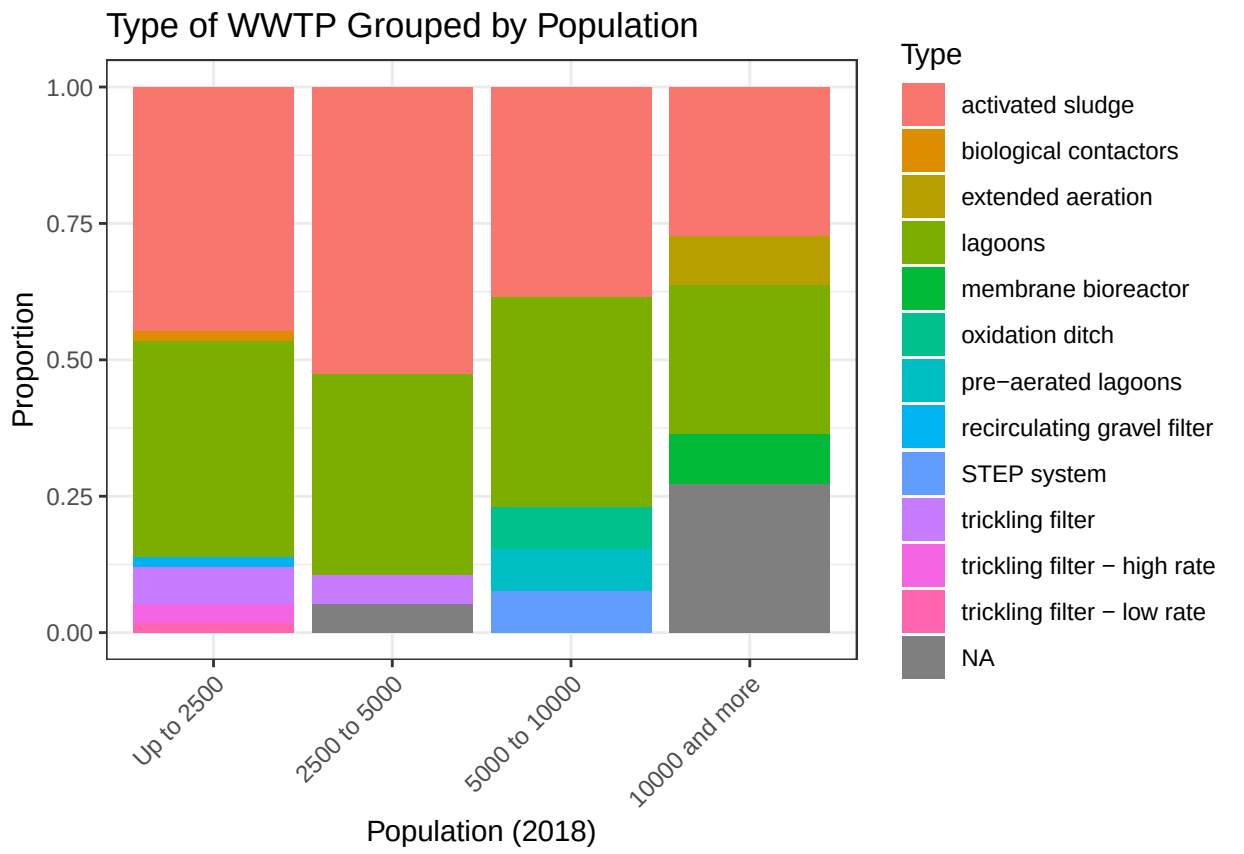

```
library(gtools)
```

```
## Warning: package 'gtools' was built under R version 4.0.1
```

```
working_df$quantile_density <- quantcut(working_df$pop_density_2018, q = 4)
ggplot(working_df[!is.na(working_df$quantile_density), ], aes(x = quantile_density,
                      fill = type1)) +
  geom_bar(position = "fill") +
  scale_x_discrete(labels=c("Up to 1050", "1050 to 1660", "1660 to 2350", "2350 and more")) +
  scale_fill_viridis_d(option = "B", na.value = "grey50") +
  theme_bw() +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1)) +
  labs(x = "Population Density (People / Square Mile)",
       y = "Proportion",
       fill = "Type",
       title = "Types of WWTPs Grouped By Population Density")
```




```
working_df$quantile_pop_2018 <- quantcut(working_df$pop_2018, q = 4)
working_df$cut_pop_2018 <- cut(working_df$pop_2018, breaks = c(0, 2500, 5000, 10000, 1e7))
p1 <- ggplot(working_df[!is.na(working_df$cut_pop_2018), ], aes(x = cut_pop_2018,
                        fill = type1)) +
  geom_bar(position = "fill") +
  scale_x_discrete(labels=c("Up to 2500", "2500 to 5000", "5000 to 10000", "10000 and more")) +
  theme_bw() +
  theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust=1)) +
  labs(x = "Population (2018)",
       y = "Proportion",
       title = "Type of WWTP Grouped by Population",
       fill = "Type")

p1
```



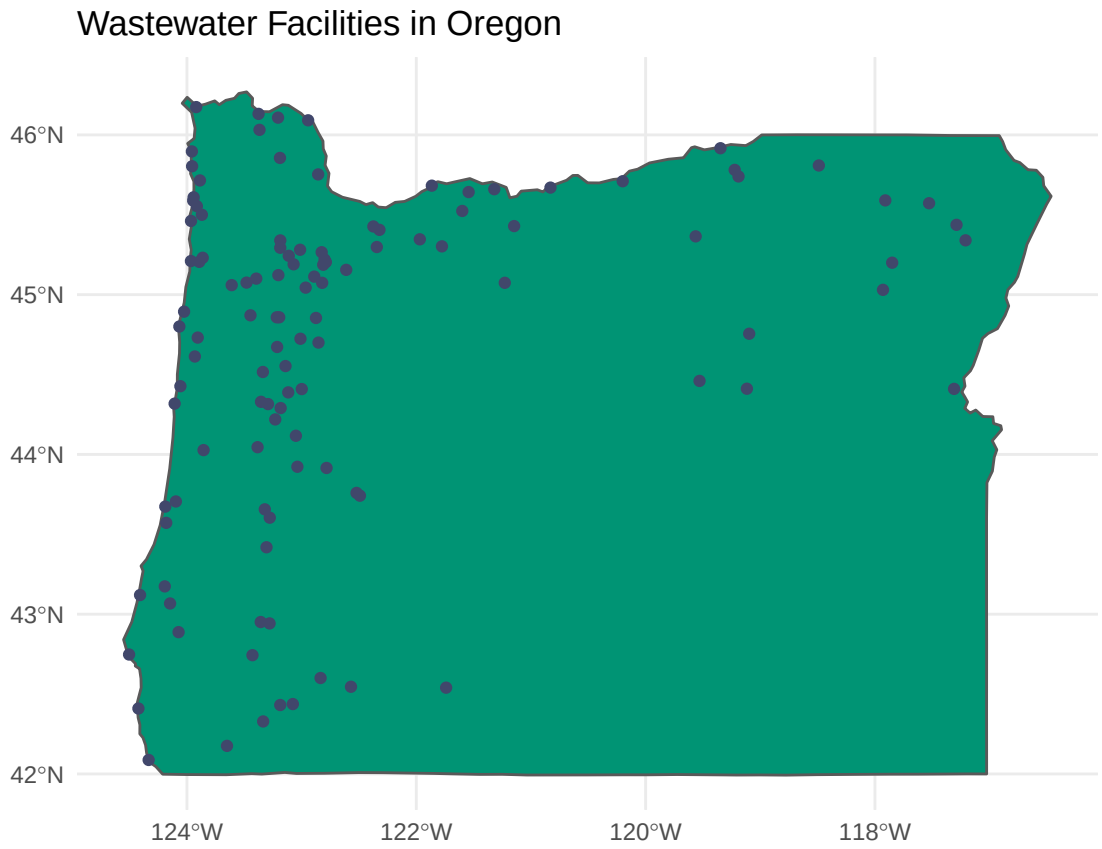

```
# ggplotly(p1)
```

Maps:

```
library(sf)
```

```
## Linking to GEOS 3.7.2, GDAL 2.4.2, PROJ 5.2.0
```

```
library(USAboundaries)
library(PNWColors)
df_sf <- st_as_sf(working_df, coords = c("Longitude", "Latitude"), crs = "+proj=longlat +datum=WGS84")
OR_sf <- us_boundaries(type = "state", states = "OR")

ggplot() +
  geom_sf(data = OR_sf, fill = "#009474") +
  geom_sf(data = df_sf, color = "#41476b") +
  coord_sf() +
  theme_minimal() +
  labs(title = "Wastewater Facilities in Oregon")
```


Wastewater Facilities in Oregon
46°N
45°N
44°N
43°N
42°N
124°W
122°W
120°W
118°W