Our Project: Environmental Analysis

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Contents

Summary

THE GOAL of this project is to identify the four Pokemon[1] that are polluting the local stream and causing it to glow purple on several occasions, documented on the following dates:

- `July 12, 2020`
- `July 18, 2020`
- `July 23, 2020`

[1] Pokemon are a new invasive species in MN. See Pokemen explosion in MN.

Project details

Where?

Who?

What is contributing most?

Data sources

All data were downloaded from the following online resources:

1. US EPA
2. Wikipedia
3. BBC.org

```
library(tidyverse)

# Download data
data <- read_csv("")
```

Facility IDs pulled from MPCA's local TEMPO database.

We used the `mpcadb` package to access TEMPO.

```
library(mpcadb)

## TEMPO AI's
# Complete list of the Agency Interest names from TEMPO with 'get_ai()'.
ai_names <- get_ai(ai = c(1:8, 56, 878), keep_alt_names = T)

knitr::kable(head(ai_names))
```

MASTER_AI_ID	INT_DOC_ID	MASTER_AI_NAME	AI_TYPE_CODE	START_DATE	END_DATE
6	0	CS McCrossan Construction Inc	MOB	1993-04-01 00:00:00	NA
56	0	Essentia Health Saint Joseph's Medical Center	CON	1995-12-13 13:59:07	NA
1	0	Crown Beverage Packaging - Mankato	CON	1987-01-01 00:00:00	NA
3	0	Crown Holdings	CON	1991-01-30 00:00:00	NA
4	0	Crystal Cabinet Works Inc - Component Center	CON	1995-07-03 13:40:52	NA
5	0	Crystal COOP - Lake Crystal	CON	1995-07-03 13:47:07	NA

(help!) Access data from MN's GIS Rest API

(help!) Read data from blackholes: PDF's, Excel, Access

Data dictionary

Column	Description	Example value
`geoid`	Unique ID assigned to each Pokemon.	*2430262*
`lat`	Latitude coordinate of object's center.	*-94.021*

Column	Description	Example value
`lon`	Longitude coordinate of object's center.	*44.521*

Data overview

To place figures in the margin you can use the **knitr** chunk option `fig.margin = TRUE`.

For example:

```
{r fig-margin, fig.margin=T, fig.cap="MPG vs Horsepower, colored by transmission."}
```

```
library(ggplot2)
library(mncolors)

mtcars <- mtcars

mtcars$Transmission <- factor(mtcars$am,
                              labels = c('automatic', 'manual'))

ggplot(mtcars, aes(hp, mpg, color = Transmission)) +
  geom_point() +
  geom_smooth() +
  scale_color_mn(palette = "accent", reverse = T) +
  theme(legend.position = 'top')
```

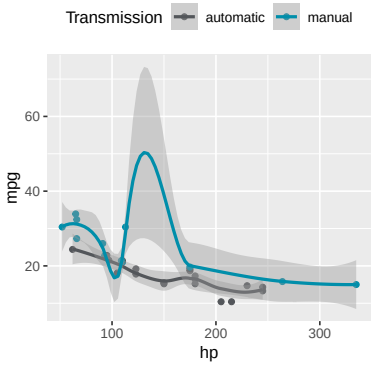


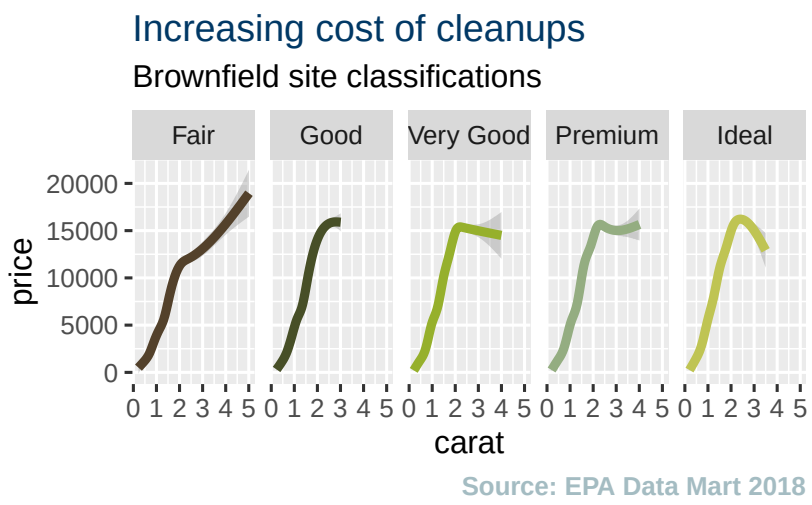
Figure 1: **FIG 1.** MPG vs horsepower, colored by transmission.

MN Colors

You can set the colors for your plots to align with the MN state brand:

```
library(mncolors) #remotes::install_github("MPCA-data/mncolors")
library(ggplot2)
#library(hrbrthemes)

mpca_theme <- function() {

  title_color   <- mncolors(5, "blue")[5]

  caption_color <- mncolors(5, "blue")[2]

  theme(plot.title   = element_text(color = title_color),
            plot.caption = element_text(color = caption_color, face  = 'bold'))

}
```

```
ggplot(diamonds, aes(carat, price)) +
  geom_smooth(aes(color = cut), size = 1.5, show.legend = F) +
  scale_color_mn(palette = "treefrog") +
  facet_wrap(vars(cut), nrow = 1) +
  labs(title    = "Increasing cost of cleanups",
       subtitle = "Brownfield site classifications",
       caption  = "Source: EPA Data Mart 2018") +
  #scale_y_comma() +
  mpca_theme()
```



Analysis

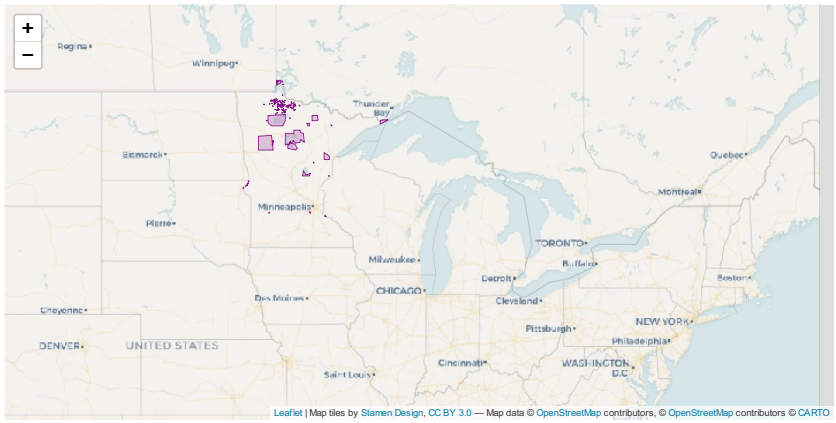
A map to guide you

We used the following equation to scale the Pokemon contribution to its relative size and spatial distribution in the watershed:
for x in $[a, b]$:

$$\frac{d}{dx}\left(\int_a^x f(u)\,du\right) = f(x)$$

```
library(mpcaej) #remotes::install_github("MPCA-data/mpcaej")
library(leaflet)
library(sf)
library(tidyverse)

ej_shapes    <- ej_shapes

tribal_areas <- tribe_shapes

#------ Map the polygons ---------#
leaflet(st_transform(tribal_areas, 4326)) %>%
  addProviderTiles(providers$Stamen.TonerLines,
                   options = providerTileOptions) %>%
```

```
  addProviderTiles(providers$CartoDB.Voyager,
                   options = providerTileOptions(opacity = 0.8)) %>%
  addPolygons(color        = "purple",
              weight       = 1,
              smoothFactor = 1.4,
              opacity      = 0.9,
              fillOpacity  = 0.2)
```



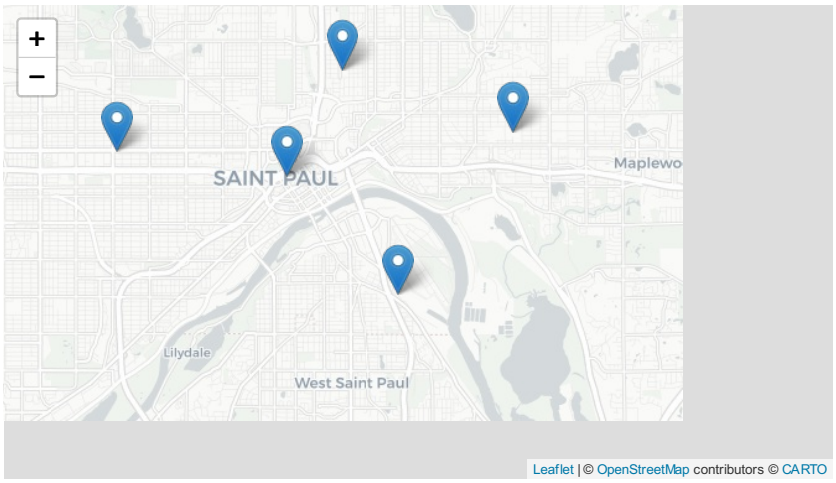
\begin{figure} *\caption[Federally recognized tribal areas in Minnesota]{Federally recognized tribal areas in Minnesota.* Ref. MPCA Geocommons. . . *} \end{figure}*

Tab menus

You can condense a group of related material into a tabbed menu the reader can select from. For example, several maps of your project. Add `{.tabset}` after the main header *(`# My tab menu {.tabset}`)* for the group, and then every sub-header *(`## The first tab`)* under it will be collapsed into a new tab.

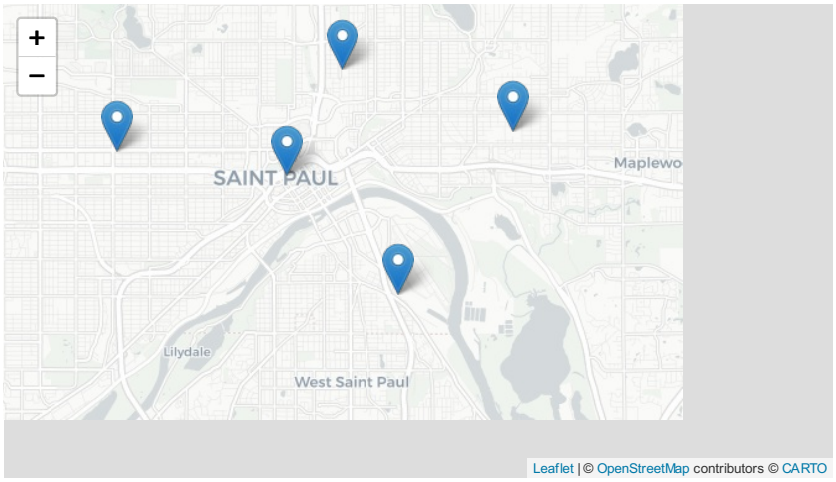
Map markers

```
sites <- read_csv('https://raw.githubusercontent.com/MPCA-air/aqi-watch/master/data-raw/locations.csv')

sites <- filter(sites, str_detect(`Site Name`, "Paul"))

# Add site markers
leaflet(sites) %>%
  addProviderTiles(providers$CartoDB) %>%
  addMarkers()
```



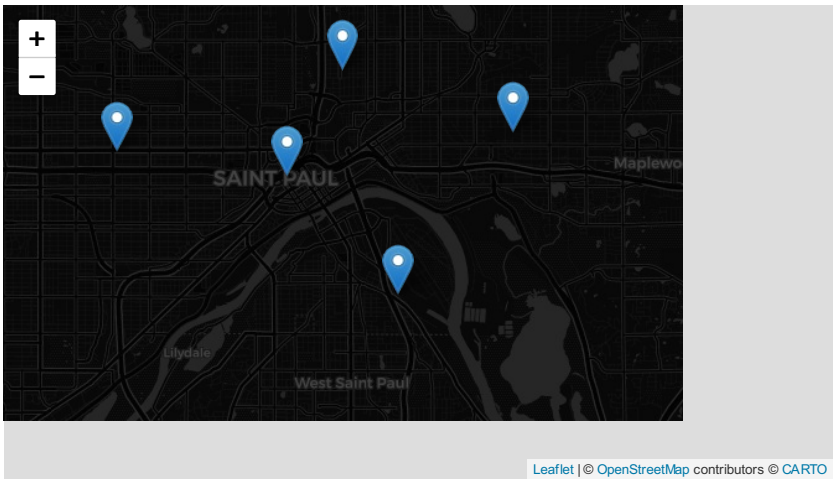
Add popups

```
# Add popup info & Darkness
leaflet(sites) %>%
  addProviderTiles(providers$CartoDB) %>%
  addMarkers(popup = ~`Site Name`)
```



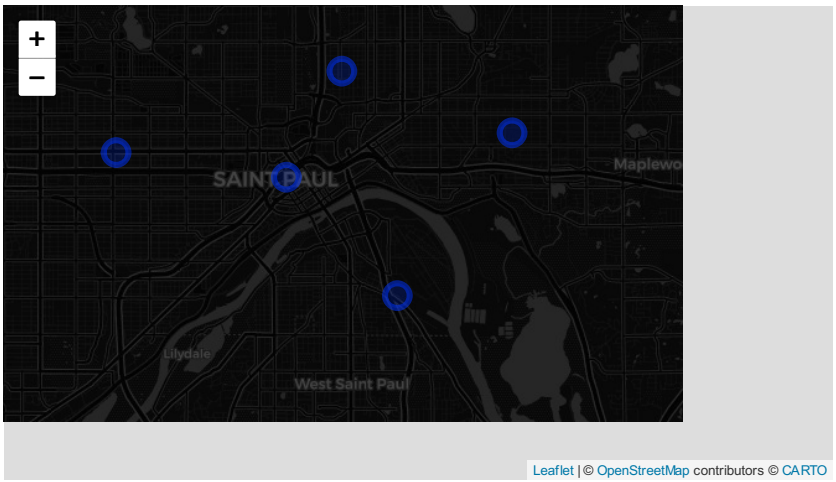
Dark basemap

```
# Add Darkness
leaflet(sites) %>%
  addProviderTiles(providers$CartoDB.DarkMatter) %>%
  addMarkers(popup = ~`Site Name`)
```



Circle markers

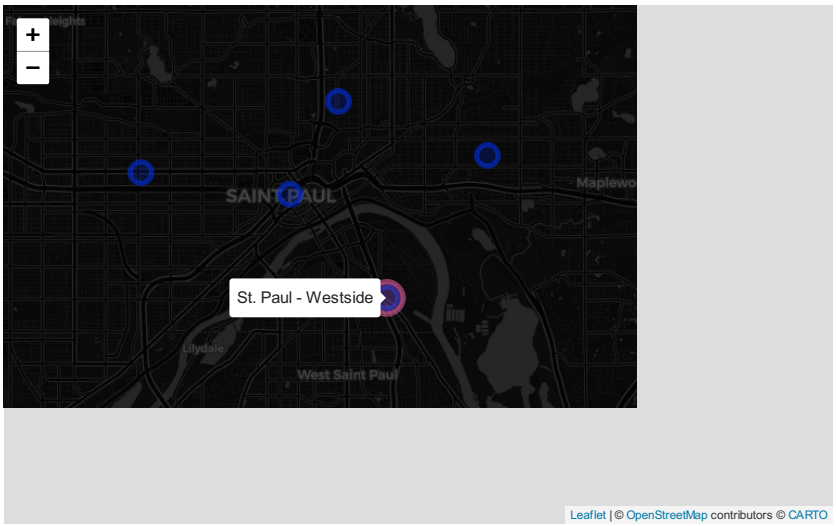
```
# Add Darkness
leaflet(sites) %>%
  addProviderTiles(providers$CartoDB.DarkMatter) %>%
  addCircleMarkers(label = ~`Site Name`)
```



Label a single site

```
# Add Darkness
leaflet(sites) %>%
  addProviderTiles(providers$CartoDB.DarkMatter) %>%
  addCircleMarkers(label = ~`Site Name`) %>%
  addCircleMarkers(data   = sites[4, ],
                   color  = "hotpink",
```

```
                    radius = 15,
                    label  = ~'Site Name',
                    labelOptions = labelOptions(noHide = T,
                                                textsize = "15px"))
```



Collapsible / Hidden content

Want to hide a long list or table until the reader chooses to look at it? You can use `<summary>` for that. Adding the following creates a drop-down window in your document that will start collapsed and expand when the reader clicks on it.

```
<details>
<summary> Click to see the Looooooong list </summary>

 ...this is hidden, collapsable content...

- fish
- bird
- toad
- stone

</details>
```

And here it is:

Click to see the Looooooong list

...this is hidden, collapsable content...

- fish
- bird
- toad
- stone

(help!) Non-detect and Censored data summaries

(help!) Multi-variate predictions

Conclusions

You can set figures to span the entire page by using the chunk option `fig.fullwidth = TRUE`.

```
ggplot(diamonds, aes(carat, price)) + geom_smooth() +
  facet_grid(~ cut)
```

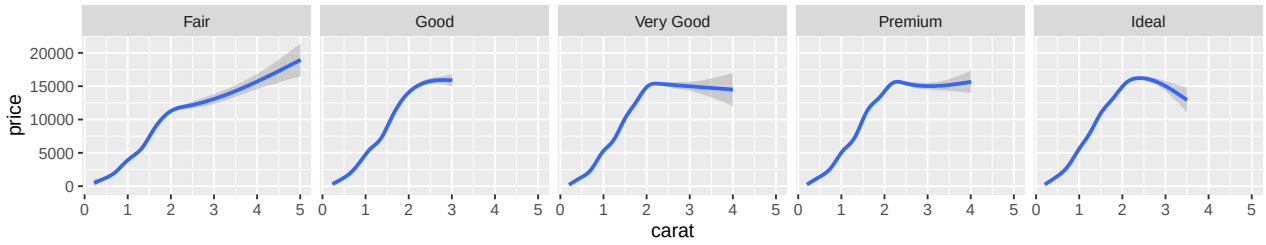


Figure 2: A full width figure.

This comment says it best:

> *I can win an argument on any topic, against any opponent. People know this, and steer clear of me at parties. Often, as a sign of their great respect, they don't even invite me.*
>
> — Dave Barry

References

1. 2012, A
2. 2015, B
3. 2018, C